Grand Gulf Nuclear Station

Unit 3

Combined

License

Application

Part 2: Final Safety Analysis Report

Revision 0

February 2008

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ABBREVIATIONS AND ACRONYMS

Term	Definition
AE	Architect Engineer
ALARA	As Low As Reasonably Achievable
AREOR	Annual Radiological Environmental Operating Reports
ARERR	Annual Radioactive Effluent Release Reports
CD	Consolidated-Drained
CEO	Chief Executive Officer
COC	Chain of Custody
CRR	Cyclic Resistance Ratio
CSR	Cyclic Stress Ratios
DBA	Design Basis Accident
DF	Design Factor
E	Elasticity
EES	Entergy Electric System
EGSL	Entergy Gulf States Louisiana, LLC
ELL	Entergy Louisiana, LLC
EOF	Emergency Operations Facility
EOI	Entergy Operations Inc.
EMI	Entergy Mississippi, Inc.
EPA	Environmental Protection Agency
ETR	Energy Transfer Ratio
FFD	Fitness for Duty
FHA	Fuel Handling Accident
FIRS	Foundation Input Response Spectra
FWLB	Feedwater Line Break
GMRS	Ground Motion Response Spectra
GWG	Generic Writer's Guide
IDLH	Immediately Dangerous to Life Or Health

ABBREVIATIONS AND ACRONYMS (CONTINUED)

IE	Inspection and Enforcement
ISFSI	Independent Spent Fuel Storage Installation
JPM	Job Performance Measure
LER	Licensee Event Report
LLNL	Lawrence Livermore National Laboratory
MDCT	Mechanical Draft Cooling Tower
MEI	Maximally Exposed Individual
MP&C	Materials, Procurement, and Contracts
MR	Maintenance Rule
NACE	National Association of Corrosion Engineers
NAD	North American Datum
NMN	New Madrid North
NMS	New Madrid South
NPHS	Normal Power Heat Sink
NSA	Nuclear Safety Assurance
OJT	On-the-Job Training
OLNC	On-Line Noble Chem^{TM}
PGP	Procedures Generation Package
PS&O	Planning, Scheduling, and Outages
PSA	Probabilistic Safety Assessment
PSHA	Probabilistic Seismic Hazard Analyses
PWS	Potable Water System
RCTS	Resonant Column and Torsional Shear
Rd	Reduction Coefficient
RO	Reactor Operators
RP	Radiation Protection
RPT	Radiation Protection Technician
SASW	Spectral Analysis of Surface Waves

ABBREVIATIONS AND ACRONYMS (CONTINUED)

SERC	Southeastern Electric Reliability Council
STA	Shift Technical Advisor
SWDS	Sanitary Waste Discharge System
TLD	Thermoluminescent Dosimeter
TSO	Transmission System Operator
UCA	Upland Complex Alluvium
UCOA	Upland Complex Old Alluvium
UHRS	Uniform Hazard Response Spectrum
USACE	U.S. Army Corps of Engineers
USGS MODFLOW	United States Geologic Survey's Modular Groundwater Flow
UU	Unconsolidated-Undrained

CHAPTER 1 INTRODUCTION AND GENERAL DESCRIPTION OF THE PLANT

1.1 INTRODUCTION

This section of the ESBWR Design Control Document (DCD), i.e., the referenced DCD, is incorporated by reference with the following departures and/or supplements.

1.1.1 FORMAT AND CONTENT

1.1.1.1 10 CFR 52 AND REGULATORY GUIDE 1.206

GGNS SUP 1.1-1

This FSAR was developed to comply with the content requirements of 10 CFR 52.79, and to the extent feasible, the content and format guidance contained in Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)." See Table 1.9-203, Conformance With the FSAR Content Guidance in RG 1.206. If the information requested by RG 1.206 is not needed (e.g., because it is already provided in the DCD or is located elsewhere in the FSAR), the table specifies the location of the information.

Section C.III.6 of RG 1.206 addresses referencing a design certification (DC) application rather than a certified design. The existing DC rules (10 CFR 52 appendices) require that a Combined Operating License Application (COLA) that references a certified design include a plant-specific DCD containing the same type of information and using the same organization and numbering as the generic DCD for the ESBWR design, as modified and supplemented by the applicant's exemptions and departures. Consistent with this guidance and the expected approval of the ESBWR DCD, the organization and numbering of this FSAR follows the organization and numbering of the generic DCD for the ESBWR design as modified and supplemented by exemptions and departures. Where necessary to present additional information, new sections were added following the logical structure of the ESBWR generic DCD.

1.1.1.2 STANDARD REVIEW PLAN

As required by 10 CFR 52.79(a)(41), an evaluation of the facility for conformance with the acceptance criteria contained in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants LWR Edition," in effect six months prior to submittal of the COLA was performed. This evaluation determined that this FSAR contains no unacceptable deviations from the acceptance criteria given in the applicable portions of the SRP. Where necessary, Table 1.9-201, Conformance with Standard Review Plan, provides a summary of any differences from the SRP acceptance criteria, along with a justification for an exception to a criterion or a Branch Technical Position (BTP); or the table identifies the applicable FSAR section(s) that addresses a difference.

1.1.1.3 TABLES AND FIGURES

Tabulations of data are designated “tables.” Each is identified by the section number followed by a number. (for example, Table 1.9-204 would be an FSAR table in Section 1.9.) The use of the “200” series for FSAR table numbers distinguishes FSAR tables from DCD tables. If a table from the DCD is referenced in the FSAR text, it is denoted as such, for example “DCD Table 4.1-1.” If a table from the DCD or the ESP application (ESPA) was revised for use in the FSAR, the original DCD or ESPA table number was appended with an “R;” for example, if “DCD “Table 4.2-1” was revised, it would have become “Table 4.2-1R.” Tables are located at the end of the section immediately following the text.

Drawings, pictures, sketches, curves, graphs, and engineering diagrams identified as “figures” are numbered using the section number followed by a number. (for example, Figure 2.1-201 would be an FSAR figure in Section 2.1.) The use of the “200” series for FSAR figure numbers distinguishes FSAR figures from DCD or ESPA figures. If a figure from the DCD or ESPA is referenced in the FSAR text, it is denoted as such; for example “DCD Figure 4.1-1.” If a figure from the DCD or ESPA was revised for use in the FSAR, the original DCD or ESPA figure number was appended with an “R;” for example, if “DCD “Figure 4.2-1” was revised, it would have become “Figure 4.2-1R.” Figures are located at the end of the applicable section following the tables.

1.1.1.4 NUMBERING OF PAGES

Text pages are numbered sequentially within each chapter (for example, Page 1-4 is the fourth page of Chapter 1).

1.1.1.5 PROPRIETARY AND SECURITY-RELATED SENSITIVE UNCLASSIFIED NON-SAFEGUARDS INFORMATION (SUNSI)

GGNS SUP 1.1-2

Proprietary information and SUNSI covers a range of information for which the loss, misuse, modification, or unauthorized access can reasonably be foreseen to harm the public interest, the commercial or financial interests of an entity or individual to whom the information pertains, the conduct of NRC and Federal programs, or the personal privacy of individuals. This classification includes security-related information which, if released, could cause harm to the public interest as it could be useful, or could reasonably be expected to be useful, to a terrorist in a potential attack. To protect SUNSI, it is not included in the public version of the FSAR. SUNSI that was needed at the time of COL application/ approval was supplied in a separate part of the COL application. FSAR sections that rely on restricted information contain references to the appropriate location in the COL application. SUNSI included in the non-public version of the FSAR is appropriately indicated.

1.1.1.6 ACRONYMS

GGNS SUP 1.1-3

The FSAR frontmatter contains a supplemental list of acronyms used in the FSAR text for acronyms not identified in the DCD chapter acronym lists or in the ESPA Site Safety Analysis Report (SSAR) acronym list. In addition to the supplemental list of acronyms, acronyms are defined at their first occurrence in an FSAR chapter text.

1.1.1.7 INCORPORATION BY REFERENCE

GGNS SUP 1.1-4

10 CFR 52.79 states in part that, “The final safety analysis report need not contain information or analyses submitted to the Commission in connection with the design certification, provided, however, that the final safety analysis report must either include or incorporate by reference the standard design certification final safety analysis report and must contain, in addition to the information and analyses otherwise required, information sufficient to demonstrate that the site characteristics fall within the site parameters specified in the design certification.” Therefore, because this COLA references the ESBWR DC application, the FSAR incorporates by reference the ESBWR DCD with certain departures (see Section 1.1.1.8) and supplemental information (see Section 1.1.1.10). References in this FSAR to the DCD should be understood to mean the ESBWR DCD, Tier 2, submitted by GE-Hitachi Nuclear Energy Americas LLC (GEH), as Revision 4.

1.1.1.8 DEPARTURES FROM THE STANDARD DESIGN CERTIFICATION (OR APPLICATION)

GGNS SUP 1.1-5

A departure is a plant-specific “deviation” from design information in a standard DC rule or, consistent with Section C.III.6 of RG 1.206, from design information in a DC application.

10 CFR 52 clarifies that Tier 2 information in a standard DC rule does not include conceptual design information (CDI) and per Section C.III.6 of RG 1.206, Tier 2 information in a standard DC application does not include CDI. Therefore, replacement or revision of CDI does not constitute a departure. Additionally, information addressing combined licenses (COL) information/holder items and supplemental information (see Section 1.1.1.10) that does not change the intent or meaning of the ESBWR DCD text is not considered a departure from the ESBWR DCD.

1.1.1.9 INCORPORATION BY REFERENCE OF ESPA SSAR INFORMATION

GGNS SUP 1.1-4

10 CFR 52.79 states in part that, "The final safety analysis report need not contain information or analyses submitted to the Commission in connection with the early site permit, provided, however, that the final safety analysis report must either include or incorporate by reference the early site permit site safety analysis report and must contain, in addition to the information and analyses otherwise required, information sufficient to demonstrate that the design of the facility falls within the site characteristics and design parameters specified in the early site permit." Therefore, because this COLA references the GGNS ESP, the FSAR incorporates by reference the ESPA SSAR, with certain variances and supplemental information (see Section 1.1.1.10). A variance is a plant-specific deviation from one or more of the site characteristics, design parameters, or terms and conditions of an ESP or from the SSAR. Table 1.1-202, Cross Reference of SSAR Sections Incorporated by Reference into FSAR Sections, provides information on how the incorporation of SSAR information into the FSAR is accomplished. References in this FSAR to the SSAR should be understood to mean ESPA SSAR Revision 3 submitted by System Energy Resources Inc. (SERI) March 8, 2006 (ADAMS Accession No. ML060830203). Subsequent to the ESP Application, the NRC issued early site permit ESP-002 to SERI, the ESP holder (ADAMS Accession No. ML070780457).

1.1.1.10 SUPPLEMENTS

GGNS SUP 1.1-6

Supplements fall into one of the following categories (see Table 1.1-201 for definitions of categories unless noted otherwise):

- COL Item
- CDI
- ESP COL Action Item
- ESP Permit Condition
- ESPA SSAR Correction
- Supplemental Information (see definition below)

Supplemental information is FSAR information that includes information not related to COL Items, departures, variances, conceptual design, ESPA corrections, or permit conditions (see Table 1.1-201 for definition of terms); or is information to demonstrate that the design of the facility falls within the site characteristics and design parameters specified in the DCD.

1.1.1.11 LEFT MARGIN ANNOTATIONS

STD SUP 1.1-3

FSAR sections are annotated in the left margin with information that identifies 1) the reason the information is being provided and, as applicable, 2) whether the information is standard (identical) for any ESBWR application, or specific to the COLA for a particular plant.

The annotations and their definitions are listed in Table 1.1-201.

1.1.1.12 TENSE

Because this FSAR is a licensing basis document that will control plant design and operations after the COL is issued, the FSAR is generally written in the present tense. Thus, plant design and configuration are described in the present tense although the plant is not yet built. Similarly, programs, procedures, organizational matters are generally described in the present tense although such descriptions may not yet be implemented. Accordingly, the use of the present tense in this FSAR should be understood as describing the plant, programs and procedures, and organization as they will exist when in place, and not as a representation that they are already in place.

1.1.2 GENERAL DESCRIPTION

1.1.2.1 ESBWR STANDARD PLANT SCOPE

GGNS CDI

Replace the last sentence with the following.

The orientation of the principal plant structures for Unit 3 is shown in Figure 1.1-201.

GGNS SUP 1.1-7

The ESBWR standard plant scope is discussed in DCD Section 1.1.2.1. In addition to the buildings and structures within the scope of the ESBWR standard plant, the plant includes an intake structure for plant makeup water, a discharge canal for the normal power heat sink (circulating water system) cooling tower blowdown, normal power heat sink and auxiliary heat sink cooling towers, a sewage treatment plant, water treatment facilities, storage tanks for water and fuel oil, a switchyard and other site support systems and structures necessary to support the operation and maintenance of the facility.

1.1.2.2 TYPE OF LICENSE REQUEST

Add the following to the end of this section.

This application by Entergy Operations, Inc. (EOI) on behalf of itself; Entergy Mississippi, Inc. (EMI); Entergy Louisiana, LLC (ELL); Entergy Gulf States Louisiana, LLC (EGSL); and System Energy Resources, Inc. (SERI) is for a combined construction permit and operating license, i.e., COL under Section 103 of the Atomic Energy Act, for the second nuclear power plant to be located on the existing Grand Gulf Nuclear Station (GGNS) site near Port Gibson, Mississippi. This COLA references a DC application for an ESBWR (consistent with Section C.III.6 of RG 1.206) and the ESP for the GGNS site. The second unit is designated GGNS Unit 3.

1.1.2.4 DESCRIPTION OF LOCATION

GGNS SUP 1.1-8

Add the following to the end of this section.

SSAR Section 1.2 is incorporated by reference with no variances or supplements.

1.1.2.7 RATED CORE THERMAL POWER

GGNS COL 1.1-1-A

Replace the last three sentences of this section with the following.

GEH is responsible for the design of the Turbine Island for the ESBWR Standard Plant to be deployed at the GGNS site (Unit 3).

The design of the Unit 3 plant auxiliaries was not been finalized at the time of COLA submittal; therefore, confirmation of the net electrical output could not be made. This information will be supplied, as required, in an FSAR update following selection of the architect-engineer and completion of necessary plant design. However, Unit 3 will utilize a single ESBWR Standard Plant; therefore, no departures from the ESBWR Standard Plant’s estimated gross electrical output, estimated net electrical output or rated thermal power level is anticipated.

Unit 3 utilizes a single ESBWR Standard Plant and no site specific environmental parameter was identified that results in a deviation from the thermal output of the standard plant.

1.1.2.8 SCHEDULE

GGNS SUP 1.1-9 Construction and startup schedules will be provided after issuance of the COL.

1.1.3 COL UNIT-SPECIFIC INFORMATION

1.1-1-A Established Rated Electrical Output

GGNS COL 1.1-1-A This COL Item is addressed in Section 1.1.2.7.

TABLE 1.1-201 (Sheet 1 of 5)
LEFT MARGIN ANNOTATIONS

STD SUP 1.1-5

FSAR Component	Margin Annotation	Definition and Use
Standard Departure	STD DEP X.Y.Z -#	FSAR information that departs from the generic DCD and is common for all parallel applicants; i.e., the departure and discussion of the departure are identical for all applicants of the ESBWR technology. Each Standard Departure is numbered based on the applicable section down to the X.Y.Z level, e.g.: STD DEP 9.2-1, or STD DEP 9.2.1-1.
Plant-Specific Departure	(PLANT) DEP X.Y.Z-#	FSAR information that departs from the generic DCD and is plant-specific; i.e., the departure and discussion of the departure are not identical for all applicants of the ESBWR technology. Each Plant-Specific Departure is numbered based on the applicable section down to the X.Y.Z level, e.g.: NAPS DEP 9.2-1, or NAPS DEP 9.2.1-1.

TABLE 1.1-201 (Sheet 2 of 5)
LEFT MARGIN ANNOTATIONS

	FSAR Component	Margin Annotation	Definition and Use
STD SUP 1.1-5	Standard COL Item	STD COL X.Y-#-A or STD COL X.Y-#-H	FSAR information that addresses a DCD COL Item that is common for all parallel applicants; i.e., the response to and discussion of the DCD COL Item are identical for all applicants of the ESBWR technology. Each Standard COL Item is numbered as identified in ESBWR DCD Table 1.10-1. The -A refers to a COL Applicant item while the -H refers to a COL Holder item.
	Plant-Specific COL Item	(PLANT) COL X.Y-#-A or (PLANT) COL X.y-#-H	FSAR information that addresses a DCD COL Item that is plant-specific; i.e., the response to the COL Item is not a Standard COL Item for parallel applicants. Each Plant-Specific COL Item is numbered as identified in the ESBWR DCD (see STD COL above).
	Standard Conceptual Design Information	STD CDI	A CDI designation is used to identify FSAR information that replaces CDI in the DCD, in whole or in part. Replacement and supplemental CDI is generally plant-specific; however, for conceptual design that is generic for all applications the annotation for standard (STD) is used, STD CDI.

TABLE 1.1-201 (Sheet 3 of 5)
LEFT MARGIN ANNOTATIONS

STD SUP 1.1-3

FSAR Component	Margin Annotation	Definition and Use
Plant Specific Conceptual Design Information	(PLANT) CDI	A CDI designation is used to identify FSAR information that replaces CDI n in the DCD, in whole or in part. Plant specific replacement and supplemental CDI uses the annotation (PLANT) CDI, e.g., NAPS CDI.
Standard Supplemental Information	STD SUP X.Y-#	Supplemental FSAR information that is identical for all parallel applicants; i.e., the supplemental information is identical for all applicants of the ESBWR technology. Each Standard Supplemental Information designation is numbered based on applicable section down to the X.Y level, e.g., STD SUP 10.4-1.
Plant-Specific Supplemental Information	(PLANT) SUP X.Y-#	Supplemental FSAR information that is plant-specific (not standard). Each Plant Specific Supplemental Information designation is numbered based on applicable section down to the X.Y level, e.g., NAPS SUP 10.4-1.
Design Control Document	DCD	Information in the DCD that is provided in the FSAR as determined necessary to aid in FSAR contextual clarity.

TABLE 1.1-201 (Sheet 4 of 5)
LEFT MARGIN ANNOTATIONS

	FSAR Component	Margin Annotation	Definition and Use
GGNS SUP 1.1-10	ESP COL Item	(PLANT) ESP COL X.Y-#	ESP COL Action items identify matters that an applicant for a construction permit or operating license addresses in a COLA. An ESP COL Item designation is used to identify FSAR information that addresses an ESP COL Action Item. Responses to all ESP COL Action Items are assumed to be plant-specific. An ESP COL Action Item is numbered as identified in the applicable ESP; e.g.: GGNS ESP COL 2.4-2.
	ESP Permit Condition	(PLANT) ESP PC #	ESP Permit Conditions are requirements to take certain actions as specified in that permit. An ESP Permit Condition designation is used to identify FSAR information that addresses an ESP Permit Condition. Responses to all ESP Permit Conditions are assumed to be plant-specific. An ESP Permit Condition is numbered as identified in the applicable ESP; e.g.: GGNS ESP PC 3.E(1).

TABLE 1.1-201 (Sheet 5 of 5)
LEFT MARGIN ANNOTATIONS

	FSAR Component	Margin Annotation	Definition and Use
GGNS SUP 1.1-10	ESP Variance	(PLANT) ESP VAR X.Y.Z-#	A request for an ESP Variance is a request for deviation from one or more site characteristics, design parameters, or terms and conditions of the ESP. Each ESP Variance is numbered based on the applicable section down to the ESP Application X.Y.Z level, e.g.: GGNS ESP VAR 2.4-1.
	Early Site Permit	ESP	Assigned to a heading or subheading from the ESP safety analysis report, for clarity. Information in the ESP safety analysis report that is provided in the FSAR as determined necessary to aid in FSAR contextual clarity.
	Early Site Permit Safety Analysis Report Corrections	ESP COR	Corrections to the information provided in the ESP safety analysis report in order to ensure that the information is complete and accurate for FSAR.

TABLE 1.1-202 (Sheet 1 of 4)
CROSS REFERENCE OF SSAR SECTIONS INCORPORATED BY REFERENCE INTO FSAR SECTIONS

GGNS SUP 1.1-4

SSAR Section	SSAR Section Title	FSAR Section Incorporating SSAR Section By Reference / Comments
1.1	Introduction	Information in SSAR Section 1.1 is incorporated by reference into this table. That section provides general information related to the ESP proceeding, and is not applicable to any particular FSAR section.
1.1.1	Site Ownership	Section 2.1.2, Exclusion Area Authority And Control
1.1.2	The Applicant	Information in SSAR Section 1.1 is incorporated by reference into this table. That section provides information related to the ESP proceeding, and is not applicable to any particular FSAR section. COL application Part 1 defines the COL Applicant.
1.2	General Site Description	Section 1.1.2.4, Description of Location
1.3	Plant Parameters Envelope	Information in SSAR Section 1.3 is incorporated by reference into this Table. That section provides information regarding the PPE concept, its development, and use in the ESP application. That section is not applicable to any particular FSAR section. Demonstrations that the Unit 3 design characteristics fall within the PPE design parameters are provided in Section 3.0 of the Environmental Report, Part 3, of the COL application. PPE parameters of SSAR Tables 1.3-1 and 1.3-2 are included in ESP-002, Appendices B and D; COL application Part 1 incorporates the ESP into the application by reference.

TABLE 1.1-202 (Sheet 2 of 4)
CROSS REFERENCE OF SSAR SECTIONS INCORPORATED BY REFERENCE INTO FSAR SECTIONS

GGNS SUP 1.1-4

SSAR Section	SSAR Section Title	FSAR Section Incorporating SSAR Section By Reference / Comments
1.4	Conformance With Regulatory Requirements and Guidance	This section of the SSAR is incorporated by reference into the FSAR. FSAR Table 1.9-202 includes the Regulatory Guides listed in SSAR Table 1.4-1 applicable six months prior to submittal of the COL application.
2.1	Geography and Demography	Section 2.1, Geography and Demography
2.2	Nearby Industrial, Military and Transportation Facilities and Routes	Section 2.2, Nearby Industrial, Military, and Transportation Facilities and Routes
2.3	Meteorology	Section 2.3, Meteorology
2.4.1	Hydrologic Description	Section 2.4.1, Hydrologic Description
2.4.2	Floods	Section 2.4.2, Floods
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers	Section 2.4.3, Probable Maximum Flood on Streams and Rivers
2.4.4	Potential Dam Failures, Seismically Induced	Section 2.4.4, Potential Dam Failures
2.4.5	Probable Maximum Surge and Seiche Flooding	Section 2.4.5, Probable Maximum Surge and Seiche Flooding
2.4.6	Probable Maximum Tsunami Flooding	Section 2.4.6, Probable Maximum Tsunami Hazards
2.4.7	Ice Effects	Section 2.4.7, Ice Effects
2.4.8	Cooling Water Canals and Reservoirs	Section 2.4.8, Cooling Water Canals and Reservoirs
2.4.9	Channel Diversions	Section 2.4.9, Channel Diversions
2.4.10	Flooding Protection Requirements	Section 2.4.10, Flooding Protection Requirements

TABLE 1.1-202 (Sheet 3 of 4)
CROSS REFERENCE OF SSAR SECTIONS INCORPORATED BY REFERENCE INTO FSAR SECTIONS

GGNS SUP 1.1-4

SSAR Section	SSAR Section Title	FSAR Section Incorporating SSAR Section By Reference / Comments
2.4.11	Low Water Considerations	Section 2.4.11, Low Water Considerations
2.4.12	Ground Water	Section 2.4.12, Groundwater
2.4.13	Accidental Releases of Liquid Effluents in Ground and Surface Waters	Section 2.4.13, Accidental Releases of Liquid Effluents In Ground and Surface Waters
2.5	Geology, Seismology, and Geotechnical Engineering	Section 2.5, Geology, Seismology, and Geotechnical Engineering
2.5.1	Basic Data	Section 2.5.1, Basic Geologic And Seismic Information
2.5.2	Vibratory Ground Motion	Section 2.5.2, Vibratory Ground Motion
2.5.3	Surface Faulting	Section 2.5.3, Surface Faulting
2.5.4	Stability of Subsurface Materials and Foundations	Section 2.5.4, Stability of Subsurface Materials and Foundations
2.5.5	Stability of Slopes	Section 2.5.5, Stability of Slopes
2.5.6	Embankments and Dams	Section 2.5.5, Stability of Slopes
3.1.1	Exclusion Area and Low-Population Zone	Section 2.1, Geography and Demography
3.1.2	Population Center Distance	Section 2.1, Geography and Demography
3.1.3	Site Atmospheric Dispersion Characteristics and Dispersion Parameters	Section 2.3, Meteorology
3.1.4.1	Meteorology	Section 2.3, Meteorology
3.1.4.2	Geology	Section 2.5, Geology, Seismology, and Geotechnical Engineering

TABLE 1.1-202 (Sheet 4 of 4)
CROSS REFERENCE OF SSAR SECTIONS INCORPORATED BY REFERENCE INTO FSAR SECTIONS

GGNS SUP 1.1-4

SSAR Section	SSAR Section Title	FSAR Section Incorporating SSAR Section By Reference / Comments
3.1.4.3	Seismology	Section 2.5, Geology, Seismology, and Geotechnical Engineering
3.1.4.4	Hydrology	Section 2.4, Hydrologic Engineering
3.1.5	Potential Off-site Hazards	Section 2.2, Nearby Industrial, Military, and Transportation Facilities and Routes
3.1.6	Site Characteristics – Security Plan	Information in SSAR Section 3.1.6 is incorporated by reference into this Table. Complete Security Plans are provided as safeguards information in Part 8, Safeguards/ Security Plans, of the COL application.
3.1.7	Site Characteristics - Emergency Plans	Information in SSAR Section 3.1.7 is incorporated by reference into this Table. The complete Emergency Plan is provided in Part 5, Emergency Plan, of the COL application.
3.1.8	Population Density	Section 2.1, Geography and Demography
3.2	Gaseous Effluent Release Dose Consequences from Normal Operations	Section 12.2.2.2, Airborne Dose Evaluation Off-site
3.3	Postulated Accidents and Accident Dose Consequences	Information in Section 3.3 of the SSAR is superseded by information provided in DCD Section 15.4 as discussed in Table 2.0-201 and Table 2.0-203, and in variance GGNS ESP VAR 2.0-3 in Part 7 of the COL application.
3.4	Geologic and Seismic Siting Factors	Section 2.5, Geology, Seismology, and Geotechnical Engineering

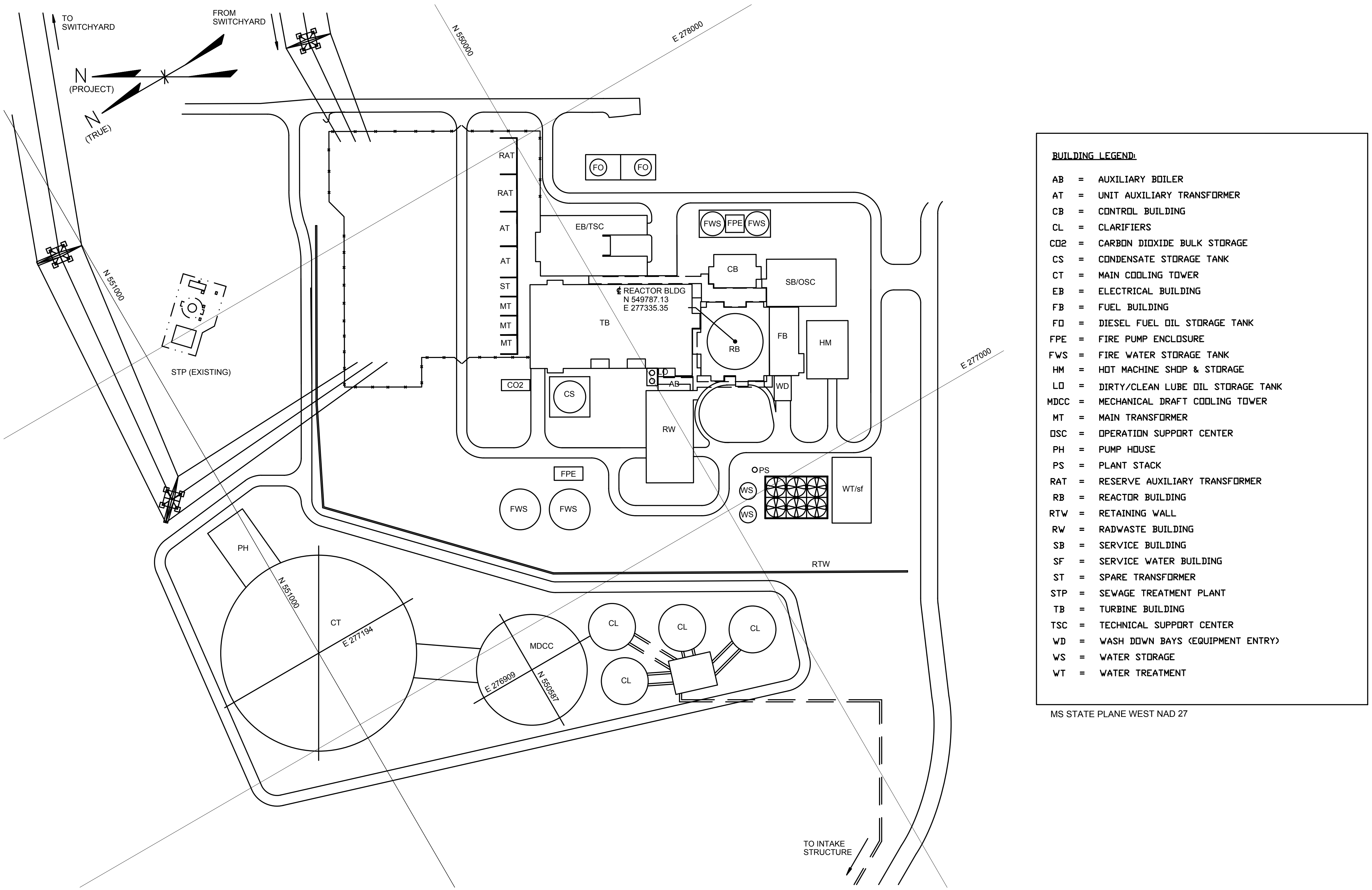

Figure 1.1-201. Unit 3 Site Plot Plan

1.2 GENERAL PLANT DESCRIPTION

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

1.2.2.11.4 Main Turbine

Delete the second sentence of the first paragraph and replace the first sentence of the first paragraph with the following.

STD CDI The main turbine has one high-pressure (HP) turbine and three low-pressure (LP) turbines.

1.2.2.11.7 Main Condenser

Delete the second sentence of the third paragraph and replace the first sentence of the third paragraph with the following.

STD CDI The main condenser is a multi-pressure, triple-shell unit.

1.2.2.12.1 Makeup Water System

Replace second paragraph with the following.

GGNS CDI Clarified, filtered river water is supplied to the MWS by the Station Water System. Prior to transfer to the demineralized water storage tank, the clarified water is processed through a vendor-supplied mobile water treatment system.

1.2.2.12.6 Oxygen Injection System

Replace the second sentence of the first paragraph with the following.

GGNS CDI Oxygen is supplied from the Unit 1 cryogenic skid.

1.2.2.12.13 Hydrogen Water Chemistry System

Replace the existing text with the following.

STD CDI

The HWC system consists of hydrogen and oxygen supply systems to inject hydrogen in the feedwater and oxygen in the offgas, plus monitoring systems to track the effectiveness of the system.

1.2.2.12.15 Zinc Injection System

Replace this section with the following.

STD CDI

The Zinc Injection System is not utilized.

1.2.2.12.16 Freeze Protection

Replace this section with the following.

STD CDI

Freeze protection is incorporated at the individual system level using insulation and heat tracing for all external tanks and piping that may freeze during winter weather.

1.2.2.16.10 Other Building Structures

Replace the third paragraph with the following.

GGNS CDI

Other facilities include the Service Building, the Water Treatment Building, Administration Building, Training Center, Sewage Treatment Plant, warehouse, and hot machine shop. These are all of conventional size and design, and in some cases may be shared with Unit 1.

1.2.2.19 MODULAR CONSTRUCTION TECHNIQUES AND PLANS

STD SUP 1.2-1

To the extent practical, modular construction techniques that have been applied during ABWR construction projects will be adapted and/or modified for use during ESBWR construction. Modularization reviews will be performed to develop a plan for bringing the ABWR experience into the ESBWR. Once completed, the results of the modularization reviews will be used as guidance to develop the detailed design of the areas affected by modularization.

1.3 COMPARISON TABLES

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

Add the following to the end of this section.

GGNS COL 1.3-1-A There are no updates to DCD Table 1.3-1 based on unit-specific information.

1.3.1 COL UNIT-SPECIFIC INFORMATION

1.3-1-A UPDATE TABLE 1.3-1

GGNS COL 1.3.1-A This COL item is addressed in Section 1.3.

1.4 IDENTIFICATION OF AGENTS AND CONTRACTORS

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

1.4.1 GGNS UNIT 3 PROJECT

GGNS SUP 1.4-1

Unit 3 is owned by Entergy Mississippi, Inc. (EMI); Entergy Louisiana, LLC (ELL); and Entergy Gulf States Louisiana, LLC (EGSL). Unit 3 is operated by Entergy Operations Inc. (EOI) (Entergy Operations). EMI, ELL, EGSL, EOI and SERI are wholly owned subsidiaries of Entergy Corporation. Entergy has over 30 years of experience in the design, construction, and operation of nuclear generating stations. Entergy operates 12 reactors in several states. Entergy has managed several major construction projects including steam generator replacements, pressurizer replacements, turbine upgrades, dry fuel storage projects, and major control systems upgrades in addition to the initial construction of Arkansas Nuclear One, Waterford 3 and Grand Gulf Unit 1.

In addition to operating the plant, Entergy Operations is responsible for the following coordination of the licensing activity:

- Assurance, through quality assurance audits, of the proper implementation and compliance of the quality program.
- Assurance of the proper implementation and execution of the supplier inspection program.

1.4.2 ARCHITECT-ENGINEER

GGNS SUP 1.4-2

The architect-engineer for the site specific systems and structures outside the scope of the reactor vendor, for the construction phase of the project had not been chosen at the time of COLA submittal; this information will be supplied in an FSAR update following selection of the architect-engineer.

1.4.3 NUCLEAR STEAM SUPPLY SYSTEM

GGNS SUP 1.4-3

GEH is responsible for developing the complete standard plant for the ESBWR necessary to obtain a DC from the NRC, supporting preparation of the COL application, and activities to support deployment of the ESBWR on the GGNS site. GEH, established in June 2007, is a business alliance of General Electric (GE) and Hitachi’s respective nuclear businesses, established to serve the global nuclear industry.

DCD Table 1.4-1 lists the commercial nuclear reactors that were completed by GE or are under construction by GEH. For 50 years, GE provided advanced technology for nuclear energy. GE developed breakthrough light water technology in the mid-1950s: the Boiling Water Reactor (BWR). Since then, GE developed nine evolutions of BWR technology, including the first operational advanced light water design in the world, the ABWR, and culminating in its latest generation of design, the ESBWR. All of GE's nuclear technology has been transferred to GEH. There are 67 plants operating worldwide utilizing GEH designs with an operating capacity of over 59 GW, including 36 BWR plants in North America.

Further information describing GEH's design scope is discussed in DCD Section 1.1.2.1.

1.4.4 CONSTRUCTION OF THE TURBINE ISLAND AND NUCLEAR ISLAND

The contractors for the construction of the turbine island and the nuclear island have not yet been selected. The turbine island and the nuclear island together represent the powerblock. The contractor for the construction of the turbine island will be responsible for the erection and delivery of the turbine building, the electric building, and the contents of each building. The contractor for the construction of the nuclear island will be responsible for the erection and delivery of the reactor and fuel building, the control building, the hot machine shop, the radwaste building, and the contents of each building. Each contractor will be selected based on their historical work in the nuclear industry, ongoing nuclear business, ability to deliver integrated engineering and construction services, and available resources.

1.4.4.1 TURBINE GENERATOR VENDOR

GEH has the overall responsibility for the design, fabrication, and delivery of the entire turbine island, including the turbine generator system, for the standard General Electric ESBWR single unit plant; Unit 3 is a standard ESBWR single unit plant. Any subcontractors utilized for the design, fabrication and delivery of the turbine generator is the responsibility of GEH.

1.4.5 CONSULTANTS

1.4.5.1 ENERCON SERVICES, INC.

GGNS SUP 1.4-4 Enercon under contract to NuStart, served as primary contractor for development of the COL application, supplying engineering support, conceptual design, environmental impact assessments and project management. Enercon Services Inc. based in Tulsa, Oklahoma is an engineering, environmental, technical and management services firm providing a broad range of professional services to private and government sector clients throughout the United States since 1983. In addition to Enercon's over 20 years of experience in supporting startup and operation of the current fleet of commercial nuclear power plants licensed under 10 CFR Part 50, Enercon is experienced in supporting new reactor activities including COL application preparation, under the 10 CFR Part 52 process for the Duke Energy Lee project, the TVA Bellefonte project, and the Texas Utilities Comanche Peak project as well as the Grand Gulf Unit 3 COL project. Enercon has been involved in projects implementing the 10 CFR Part 52 licensing process for over 5 years, including the preparation of the ESP application for Entergy's Grand Gulf Unit 3, support for the initial development of the industry's guidance document for preparing COL applications, NEI-04-01, "Industry Guideline for Combined License Applicants Under 10 CFR Part 52," and participation in the public interactions supporting development of NRC RG 1.206.

1.4.5.2 WILLIAM LETTIS AND ASSOCIATES INC. (WLA)

GGNS SUP 1.4-5 WLA performed geologic and geotechnical field investigations, geologic mapping and characterization of seismic sources, and seismic sensitivity analyses for the COLA. They also provided support for COL application preparation. WLA is a consulting firm based in Walnut Creek, California practicing in applied earth sciences. WLA provides a range of services to support clients in developing ESPAs and Construction and Operating Licenses (COL) applications including detailed site characterization, assessment of capable tectonic features and seismic source zones, Probabilistic Seismic Hazard Assessment (PSHA) studies during project design, and preparation of Safety Analysis Reports. WLA developed new regulatory guidelines for the U.S. NRC (NUREG/CR-5562 and NUREG/CR-5503), and has provided input and guidance for various international agencies to review or develop new regulatory criteria pertaining to seismic and geologic hazard studies. WLA has provided some or all of the above services for the following nuclear power plant sites: Diablo Canyon, North Anna, Duke Lee, Bellefonte, South Texas, Comanche Peak, Calvert Cliffs, Vogtle, Turkey Point, V.C. Summer, the Ulchin Nuclear Power Plant in South Korea, and the Shivta-Rogem Nuclear Power Plant in Israel.

1.4.5.3 MACTEC ENGINEERING AND CONSULTING, INC. (MACTEC E&C)

GGNS SUP 1.4-6 MACTEC E&C performed geotechnical field investigations and laboratory testing in support of Chapter 2. That effort included performing standard penetration tests; obtaining core samples; performing cone pentrometer tests, cross-hole seismic tests and laboratory test of soil samples; installing ground water observation wells; and preparing data reports. Headquartered in Atlanta, MACTEC E&C is a leading consulting firm providing engineering, environmental, and construction consulting services to public and private clients worldwide, operating with 3,000 employees in 100 U.S. offices. Uniting the strengths of the former Harding Environmental Science & Engineering, Pacific Environmental

Services, and Law Engineering and Environmental Services, MACTEC E&C provides a wide variety of services including site development, planning and engineering design, construction phase services, environmental services and facilities operations and maintenance services.

1.4.5.4 BURNS AND ROE

GGNS SUP 1.4-7 Burns and Roe developed conceptual design, provided scheduling support and engineering support for the COL application. Burns and Roe is an engineering, procurement, construction, operations and maintenance company, and has provided services to private and governmental clients worldwide since 1932. Burns and Roe is headquartered in Oradell, New Jersey. Burns and Roe has experience includes early pioneering work on light water reactor plants, and subsequently on liquid metal fast breeder reactor plants. Burns and Roe is also experienced in providing engineering and construction services for the decommissioning, dismantling, and decontamination of retired nuclear power plants. Specific past experience with the nuclear power industry includes: engineer of record for the nation's first commercially owned and operated nuclear power plant, Oyster Creek; executed recovery services associated with the United State's most significant nuclear incident at Three Mile Island; engineered and planned the first decommissioning of a commercially operated, government owned reactor at Shippingport; and performed the first decommissioning of a large-scale commercial reactor, utilizing a one-piece reactor removal at Trojan.

1.4.5.5 ADDITIONAL CONSULTANTS

GGNS SUP 1.4-8 Additional consultants may be utilized during the construction, startup and operational phases of the Unit 3 project, for activities not within the scope of the reactor vendor that had not been chosen at the time of COLA submittal; this information will be supplied in an FSAR update following selection of the architect-engineer.

1.5 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

1.6 MATERIAL INCORPORATED BY REFERENCE

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

Add the following paragraph to the end of this section.

GGNS SUP 1.6-1 Table 1.6-201 lists topical reports not included in DCD Section 1.6 that are incorporated in whole or in part by reference in the FSAR.

GGNS SUP 1.6-1

TABLE 1.6-201 (Sheet 1 of 2)
REFERENCED TOPICAL REPORTS

Report No.	Title	Section No.
NEI 03-12, Appendix F	Nuclear Energy Institute, “New Plant Security Program,” NEI 03-12, Appendix F, Revision 2, September 2007	13.6
NEI 06-06	Nuclear Energy Institute, “Fitness for Duty Program Guidance for New Nuclear Power Plant Construction Sites,” NEI 06-06, Revision 1, September 2007	13.7
NEI 06-13-A	Nuclear Energy Institute, “Technical Report on a Template for an Industry Training Program Description,” NEI 06-13-A, Revision 0, October 2006	13BB
NEI 06-14A	Nuclear Energy Institute, “Quality Assurance Program Description,” NEI 06-14A, Revision 4, July 2007	17.5
NEI 07-02	Nuclear Energy Institute, “Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed under 10 CFR Part 52,” NEI 07-02, Revision 3, September 2007	17.6
NEI 07-03	Nuclear Energy Institute, “Generic FSAR Template Guidance for Radiation Protection Program Description,” NEI 07-03, Revision 3, October 2007	12BB
NEI 07-08	Nuclear Energy Institute, “Generic FSAR Template Guidance for Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA),” NEI 07-08, Revision 0, September 2007	12AA

TABLE 1.6-201 (Sheet 2 of 2)
REFERENCED TOPICAL REPORTS

GGNS SUP 1.6-1

Report No.	Title	Section No.
NEI 07-09	Nuclear Energy Institute, "Generic FSAR Template Guidance for Off-site Dose Calculation Manual (ODCM) Program Description," NEI 07-09, Revision 0, September 2007	11.5
NEI 07-10	Nuclear Energy Institute, "Generic FSAR Template Guidance for Process Control Program (PCP) Description," NEI 07-10, Revision 1, October 2007	11.4
NEI 07-11	Nuclear Energy Institute, "Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," NEI 07-11, Revision 0, September 2007	11.2

1.7 DRAWINGS AND OTHER DETAILED INFORMATION

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

Add the following paragraph at the end of this section.

STD COL 1.7-1-H The final P&IDs used for construction will be available upon completion of the final design configuration. Design changes that result in revisions to the simplified diagrams will be incorporated in subsequent updates to the FSAR.

1.7.1 ELECTRICAL, INSTRUMENTATION AND CONTROL DRAWINGS

Replace the last sentence in this section with the following.

GGNS SUP 1.7-1 DCD Table 1.7-2 and Table 1.7-201 provide a summary of the electrical system configuration drawings found throughout the DCD and FSAR, respectively.

1.7.2 PIPING AND INSTRUMENTATION DIAGRAMS

Replace the last sentence of the first paragraph with the following.

GGNS SUP 1.7-2 DCD Table 1.7-3 and Table 1.7-202 provide a summary of the mechanical system configuration drawings found throughout the DCD and FSAR, respectively.

1.7.4 COL INFORMATION

1.7-1-H Final Design Configuration Confirmation

STD COL 1.7-1-H This COL item is addressed in Section 1.7.

GGNS SUP 1.7-1

TABLE 1.7-201
SUMMARY OF ELECTRICAL SYSTEM CONFIGURATION DRAWINGS

FSAR Figure No.	Title
8.2-201	Entergy Electrical System Map
8.2-202	Off-site Power System One-Line Diagram
8.2-203	Switchyard Plan

GGNS SUP 1.7-2

TABLE 1.7-202
SUMMARY OF MECHANICAL SYSTEM CONFIGURATION DRAWINGS

FSAR Figure No.	Title
9.2-201	Potable Water System Simplified Diagram
9.2-202	Sanitary Waste Discharge System Simplified Diagram
9.2-203	Station Water System Simplified Diagram
9.5-201	Fire Protection System Yard Main Loop
10.4-201	Circulating Water Pumps and Natural Draft Cooling Tower
10.4-202	Main Circulating Water Supply Lines with Tube Cleaning Components
10.4-203	Mechanical Draft Cooling Tower
10.4-204	Natural Draft Cooling Tower with Blowdown

1.8 INTERFACES FOR STANDARD DESIGNS

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

1.8.2 IDENTIFICATION OF BOP INTERFACES

Add the following paragraph after the first paragraph of this section.

STD CDI

The significant interface requirements for those systems that are beyond the scope of the DCD are identified in DCD Tier 1.

Delete the second sentence of the second paragraph of this section.

GGNS SUP 1.8-1

1.8.3 VERIFICATION OF SITE PARAMETERS

Chapter 2 provides information demonstrating that the site characteristics fall within the ESBWR site parameters specified in the referenced certified design.

Chapter 2 also provides information demonstrating that the design of the facility falls within the site characteristics and bounding design parameters for the ESP.

GGNS SUP 1.8-2

1.8.4 COL INFORMATION ITEMS AND PERMIT CONDITIONS

Section 1.10 identifies specific FSAR sections that address the COL information items from the referenced certified design, and COL Action Items and Permit Conditions from the ESP.

GGNS SUP 1.8-3

1.8.5 GENERIC CHANGES AND DEPARTURES FROM THE REFERENCED CERTIFIED DESIGN

Plant-specific departures from the referenced certified design are listed in Table 1.8-201, along with the section of the FSAR in which each is discussed. These departures are described and evaluated in Part 7 of the COLA. There are no generic changes from the referenced certified design.

GGNS SUP 1.8-4

1.8.6 VARIANCES FROM THE ESP AND ESPA SSAR

Requests for variances from the ESP and SSAR comply with the requirements of 10 CFR 52.39 and 10 CFR 52.93. Variances are listed in Table 1.8-202, along with the section of the FSAR in which each is discussed. These variances are described and evaluated in Part 7 of the COLA.

GGNS SUP 1.8-5

1.8.7 CONCEPTUAL DESIGN INFORMATION

The referenced DCD includes CDI for certain systems, or portions of systems, that are outside the scope of the standard plant design. Table 1.8-203 identifies systems for which either the CDI in the DCD is adopted as the actual system design information, or the CDI in the DCD is replaced with site-specific design information, along with cross references to FSAR sections where the CDI is treated. Where there are differences between the conceptual design and the actual design, these differences have been evaluated. The evaluations have concluded that there are no impacts on the safety evaluations provided in the referenced certified design.

GGNS SUP 1.8-6

1.8.8 PROBABILISTIC RISK ASSESSMENT (PRA)

Site- and plant-specific information, including site meteorological data and site-specific population distribution, plant-specific design information that replaced CDI described in the DCD, and the departures listed in Section 1.8.5, were reviewed with respect to the DC PRA. The conclusion, which is documented in Section 19.5, is that there is no significant change from the certified design PRA.

GGNS SUP 1.8-3

TABLE 1.8-201
DEPARTURES FROM THE REFERENCED CERTIFIED DESIGN

Number	Subject	FSAR Section
GGNS DEP 2.0-1	Seismic Spectra Exceedance	Table 2.0-201 Figure 2.0-201 Figure 2.0-202

GGNS SUP 1.8-4

TABLE 1.8-202
VARIANCES FROM THE ESP AND ESPA SSAR

Number	Subject	FSAR Section
GGNS ESP VAR 2.0-1	Design response spectra	Table 2.0-202
GGNS ESP VAR 2.0-2	Minimum shear wave velocity of soil at the proposed plant foundation level	Table 2.0-202
GGNS ESP VAR 2.0-3	Accident Analyses.	Table 2.0-203
GGNS ESP VAR 2.3-1	Determination of Roof Loads Due to Extreme Winter Precipitation	2.3.1.2.6
GGNS ESP VAR 2.4.1-1	Distance to closest surface water	2.4.1.2 Table 2.0-202
GGNS ESP VAR 2.4.12-1	Highest ground water elevation	2.4.12.2.3 Table 2.0-202

GGNS SUP 1.8-5

TABLE 1.8-203 (Sheet 1 of 5)
CONCEPTUAL DESIGN INFORMATION (CDI)

Item in DCD	CDI in DCD adopted as actual design	CDI in DCD replaced with actual design	Evaluation	FSAR Section
1.1.2.1 ESBWR Standard Plant Scope Figure 1.1-1 ESBWR Standard Plant General Site Plan		X	Site plan general site plan provided	1.1.2.1 Figure 1.1-201
1.2.2.11.4 Main Turbine	X		Conceptual turbine type selected as site specific design	1.2.2.11.4
1.2.2.11.7 Main Condenser	X		Conceptual condenser type selected as site specific design	1.2.2.11.7
1.2.2.12.1 Makeup Water System		X	Source of water is clarified, filtered river water; prior to transfer to demineralized water storage tank, clarified water is processed with vendor-supplied mobile water treatment system	1.2.2.12.1

TABLE 1.8-203 (Sheet 2 of 5)
CONCEPTUAL DESIGN INFORMATION (CDI)

GGNS SUP 1.8-5

Item in DCD	CDI in DCD adopted as actual design	CDI in DCD replaced with actual design	Evaluation	FSAR Section
1.2.2.12.6 Oxygen Injection System		X	Oxygen is supplied from the Unit 1 cryogenic skid.	1.2.2.12.6
1.2.2.12.13 Hydrogen Water Chemistry Table 3.2-1 P73 Note 9.3.9 Hydrogen Water Chemistry		X	Hydrogen water chemistry option utilized	1.2.2.12.13 Table 3.2-1 9.3.9
1.2.2.12.15 Zinc Injection System Table 3.2-1 P74 Note 9.3.11 Zinc Injection System		X	Zinc Injection System is not utilized.	1.2.2.12.15 Table 3.2-1 9.3.11
1.2.2.12.16 Freeze Protection		X	Freeze protection incorporated for external tanks and piping that may freeze during winter weather	1.2.2.12.16
1.2.2.16.10 Other Building Structures		X	Site-specific buildings specified	1.2.2.16.10

GGNS SUP 1.8-5

TABLE 1.8-203 (Sheet 3 of 5)
CONCEPTUAL DESIGN INFORMATION (CDI)

Item in DCD	CDI in DCD adopted as actual design	CDI in DCD replaced with actual design	Evaluation	FSAR Section
1.8.2 Identification of BOP Interfaces	X		Not applicable	1.8.2
Appendix 3A Seismic Soil-Structure Interaction Analysis		X	Site-specific geotechnical data described in Chapter 2	Appendix 3A Chapter 2
Appendix 3A.2 ESBWR Standard Site Plan		X	Site-specific general site plan provided	Section 3A.2 Figure 1.1-201
6.2.5.2 Containment Inerting System Figure 6.2-29		X	Location of Nitrogen Storage Tank Skid is included in Table 2.2-201	6.2.5.2 Table 2.2-201
9.2.1 Plant Service Water Table 9.2-2 Figure 9.2-1	Figure 9.2-1	X	Site-specific system description and design characteristics described	9.2.1 Table 9.2-201
9.2.3 Makeup Water System Table 9.2-9		X	Site-specific system description and design characteristics described	9.2.3 Table 9.2-202

GGNS SUP 1.8-5

TABLE 1.8-203 (Sheet 4 of 5)
CONCEPTUAL DESIGN INFORMATION (CDI)

Item in DCD	CDI in DCD adopted as actual design	CDI in DCD replaced with actual design	Evaluation	FSAR Section
9.2.4 Potable and Sanitary Water Systems		X	Site-specific system description and design characteristics described	9.2.4 Table 9.2-203 Figure 9.2-201 Figure 9.2-202
9.2.10 Station Water System		X	Site-specific system description and design characteristics described	9.2.10 Table 9.2-204 Figure 9.2-203
9.3.9 Hydrogen Water Chemistry System		X	Site-specific system description and design characteristics described	9.3.9

GGNS SUP 1.8-5

TABLE 1.8-203 (Sheet 5 of 5)
CONCEPTUAL DESIGN INFORMATION (CDI)

Item in DCD	CDI in DCD adopted as actual design	CDI in DCD replaced with actual design	Evaluation	FSAR Section
10.4.5 Circulating Water System		X	Site-specific system description and design characteristics described	10.4.5 Table 10.4-3R Table 10.4-201 Figure 10.4-201 Figure 10.4-202 Figure 10.4-203 Figure 10.4-204
11.2 Liquid Waste Management System	X		Conceptual design for liquid waste management selected as site specific design	11.2
11.4 Solid Waste Management System	X		Conceptual design for solid waste management selected as site specific design	11.4

1.9 CONFORMANCE WITH STANDARD REVIEW PLAN AND APPLICABILITY OF CODES AND STANDARDS

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

1.9.1 CONFORMANCE WITH STANDARD REVIEW PLAN

Add the following paragraph at the end of this section.

GGNS COL 1.9-3-A Table 1.9-201 evaluates conformance with the SRP sections and BTPs in effect six months prior to the submittal of the COLA. Table 1.9-201 does not re-address conformance with the SRP for those portions of the facility design included in the referenced certified design. Similarly, Table 1.9-201 does not re-address SSAR conformance with the applicable RS-002 sections.

In the table, the term “Conforms” means that no exception is being taken to the guidance in the SRP section/acceptance criteria as they apply to site-specific design information, operational aspects of the facility, or siting information in the FSAR that supplements the SSAR. The term “Not applicable” means that the SRP section/acceptance criteria do not apply to the ESBWR or Unit 3. Any differences with the SRP acceptance criteria are identified and justified, with references to the applicable FSAR section(s) that address the difference, as necessary.

1.9.2 APPLICABILITY TO REGULATORY CRITERIA

Add the following paragraphs at the end of this section.

GGNS COL 1.9-3-A **Division 1, 4, 5, and 8 Regulatory Guides**

Table 1.9-202 evaluates conformance with Division 1, 4, 5, and 8 Regulatory Guides in effect six months prior to the submittal of the COLA. Each issued Division 1 RG is evaluated. Issued Division 4, 5, and 8 Regulatory Guides identified in the SRP, RG 1.206, or DCD Table 1.9-21 as COL responsibility are also evaluated. (Conformance with Division 4 Regulatory Guides is also addressed in ER Chapter 1.) Table 1.9-202 does not re-address conformance with Regulatory Guides for those portions of the facility design included in the referenced certified design. Similarly, Table 1.9-202 does not re-address SSAR conformance with the applicable Regulatory Guides.

In the table, the term “Conforms” means that no exception is being taken to the guidance in the regulatory positions as they apply to site-specific design information, operational aspects of the facility, or siting information in the FSAR that supplements the SSAR. The term “Not applicable” means that the regulatory positions do not apply to the ESBWR or Unit 3.

RG 1.206

Table 1.9-203 evaluates conformance with the FSAR content guidance in RG 1.206. Where necessary, the table identifies the FSAR section where the required information is provided. In the table, the term “Conforms” means that the information called for in RG 1.206 is either: 1) already addressed in the DCD or SSAR; or 2) addressed by adding new information beyond that contained in the DCD or SSAR. The term “Not applicable” means that the information called for in RG 1.206 does not apply to the ESBWR or Unit 3.

Table 1.9-203 evaluates conformance with RG 1.206, Section C.III.2, “Information Needed for a Combined License Application Referencing a Certified Design and an Early Site Permit.” Section C.III.1, “Information Needed for a Combined License Application Referencing a Certified Design,” and Section C.I, “Standard Format and Content of Combined License Applications for Nuclear Power Plants-Light-Water Reactor Edition,” were also evaluated, as applicable, if portions of these sections were referenced or identified in RG 1.206, Section C.III.2, or Section C.III.1, respectively

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Industrial Codes and Standards

STD SUP 1.9-1 Table 1.9-204 identifies the Industrial Codes and Standards that are applicable to those portions of the Unit 3 design that are beyond the scope of the DCD or the SSAR, and to the operational aspects of the facility.

1.9.3 APPLICABILITY OF EXPERIENCE INFORMATION

Add the following after the first sentence of the section.

STD SUP 1.9-2 Table 1.9-205 lists NUREG and NUREG/CR reports cited in the FSAR.

Add the following paragraph at the end of this section.

Table 1.9-205 addresses operational experience information, as described in applicable NUREG reports, for those portions of the Unit 3 design and operation that are beyond the scope of the DCD. The comment column of Table 1.9-205 includes a reference to the applicable FSAR section that provides further discussion of the operational experience.

1.9.4 COL INFORMATION

1.9-3-A SRP AND REGULATORY GUIDE APPLICABILITY

GGNS COL 1.9-3-A This COL Item is addressed in Sections 1.9.1 and 1.9.2.

GGNS COL 1.9-3-A

TABLE 1.9-201 (Sheet 1 of 59)
CONFORMANCE WITH STANDARD REVIEW PLAN

SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
1	Introduction and Interfaces	Initial Issuance	Mar-07	No Specific Acceptance Criteria	Conforms
2.0	Site Characteristics and Site Parameters	Initial Issuance	Mar-07	II.2, II.3, II.5	Not applicable
				II.1, II.4	Conforms
2.1.1	Site Location and Description	Rev. 3	Mar-07	II.1, II.2	Conforms
2.1.2	Exclusion Area Authority and Control	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
2.1.3	Population Distribution	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms.
2.2.1 - 2.2.2	Identification of Potential Hazards in Site Vicinity	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
2.2.3	Evaluation of Potential Accidents	Rev. 3	Mar-07	II.1, II.2	Conforms
2.3.1	Regional Climatology	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9	Conforms
2.3.2	Local Meteorology	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
2.3.3	Onsite Meteorological Measurements Programs	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms

GGNS COL 1.9-3-A

TABLE 1.9-201 (Sheet 2 of 59)
CONFORMANCE WITH STANDARD REVIEW PLAN

SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
2.3.4	Short Term Atmospheric Dispersion Estimates for Accident Releases	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
2.3.5	Long-Term Atmospheric Dispersion Estimates for Routine Releases	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
2.4.1	Hydrologic Description	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
2.4.2	Floods	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10	Conforms
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers	Rev. 4	Mar-07	II.1, II.2, II.3	Conforms
2.4.4	Potential Dam Failures	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
2.4.5	Probable Maximum Surge and Seiche Flooding	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
2.4.6	Probable Maximum Tsunami Hazards	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
2.4.7	Ice Effects	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
2.4.8	Cooling Water Canals and Reservoirs	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
2.4.9	Channel Diversions	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
2.4.10	Flooding Protection Requirements	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
2.4.11	Low Water Considerations	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
2.4.12	Groundwater	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
2.4.13	Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms.
2.4.14	Technical Specifications and Emergency Operation Requirements	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
2.5.1	Basic Geologic and Seismic Information	Rev. 4	Mar-07	II.1, II.2	Conforms
2.5.2	Vibratory Ground Motion	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
2.5.3	Surface Faulting	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
2.5.4	Stability of Subsurface Materials and Foundations	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.6, II.7, II.8, II.9, II.10, II.11	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
				II.5	Exception. Backfill sources will be identified and backfill properties will be verified prior to construction.
				II.12	Exception. Evaluation of the effectiveness of foundation improvement measures will be performed prior to construction.
2.5.5	Stability of Slopes	Rev. 3	Mar-07	II. Section 2.5.5.1, II. Section 2.5.5.2, II. Section 2.5.5.3, II. Section 2.5.5.4	Conforms
3.2.1	Seismic Classification	Rev. 2	Mar-07	II.1	Conforms
3.2.2	System Quality Group Classification	Rev. 2	Mar-07	II.1	Conforms
3.3.1	Wind Loadings	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
3.3.2	Tornado Loadings	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
3.4.1	Internal Flood Protection for Onsite Equipment Failures	Rev. 3	Mar-07	II.1, II.2	Conforms
3.4.2	Analysis Procedures	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
3.5.1.1	Internally Generated Missiles (Outside Containment)	Rev. 3	Mar-07	II.1, II.2	Conforms
3.5.1.2	Internally-Generated Missiles (Inside Containment)	Rev. 3	Mar-07	II.1, II.2	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
3.5.1.3	Turbine Missiles	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
3.5.1.4	Missiles Generated by Tornadoes and Extreme Winds	Rev. 3	Mar-07	II.1, II.2	Conforms
3.5.1.5	Site Proximity Missiles (Except Aircraft)	Rev. 4	Mar-07	II.1, II.2	Conforms
3.5.1.6	Aircraft Hazards	Rev. 3	Mar-07	II.1, II.2	Conforms
3.5.2	Structures, Systems, and Components to be Protected from Externally-Generated Missiles	Rev. 3	Mar-07		Conforms
3.5.3	Barrier Design Procedures	Rev. 3	Mar-07	II.1, II.2	Conforms
3.6.1	Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
3.6.2	Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	Rev. 2	Mar-07	II.1, II.2, II.3	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
3.6.3	Leak-Before-Break Evaluation Procedures	Rev. 1	Mar-07	II.1, II.2	Not applicable. ESBWR design does not rely on a Leak Before Break Evaluation.
3.7.1	Seismic Design Parameters	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
3.7.2	Seismic System Analysis	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14	Conforms
3.7.3	Seismic Subsystem Analysis	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14	Conforms
3.7.4	Seismic Instrumentation	Rev. 2	Mar-07	II.1, II.2	Conforms
3.8.1	Concrete Containment	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
3.8.2	Steel Containment	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
3.8.4	Other Seismic Category I Structures	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
3.8.5	Foundations	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
3.9.1	Special Topics for Mechanical Components	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
3.9.2	Dynamic Testing and Analysis of Systems, Structures, and Components	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
3.9.3	ASME Code Class 1, 2, and 3 Components, and Component Supports, and Core Support Structures	Rev. 2	Mar-07	II.1, II.2, II.3	Conforms
3.9.4	Control Rod Drive Systems	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
3.9.5	Reactor Pressure Vessel Internals	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
3.9.6	Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints	Rev. 3	Mar-07	II.1, II.3, II.4, II.5, II.6	Conforms
				II.2	Not applicable. There are no safety related pumps.
3.9.7	Risk-Informed Inservice Testing	Rev. 0	Aug-98	II.A, II.B	Not applicable. Risk-informed inservice testing is not being used.
3.9.8	Risk-Informed Inservice Inspection of Piping	Rev. 0	Sep-03	II.1, II.2, II.3	Not applicable. Risk-informed inservice inspection of piping is not being used.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
3.10	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment	Rev. 3	Mar-07	II.1, II.2, II.3, II.5	Conforms.
				II.4, II.6	Conforms.
3.11	Environmental Qualification of Mechanical and Electrical Equipment	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14, II.15	Conforms
				II.16	Conforms
3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and their Associated Supports	Initial Issuance	Mar-07	II.A, II.B, II.C, II.D	Conforms
3.13	Threaded Fasteners - ASME Code Class 1, 2, and 3	Initial Issuance	Mar-07	II.1, II.2	Conforms
BTP 3-1	Classification of Main Steam Components Other than the Reactor Coolant Pressure Boundary for BWR Plants	Rev. 2	Mar-07		Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 3-2	Classification of BWR/6 Main Steam and Feedwater Components Other than the Reactor Coolant Pressure Boundary	Rev. 2	Mar-07		Conforms
BTP 3-3	Protection Against Postulated Piping Failures in Fluid Systems Outside Containment	Rev. 3	Mar-07		Conforms
BTP 3-4	Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment	Rev. 2	Mar-07		Conforms
4.2	Fuel System Design	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
4.3	Nuclear Design	Rev. 3	Mar-07	II.1, II.2, II.4	Conforms
				II.3	Conforms
4.4	Thermal and Hydraulic Design	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.8, II.9, II.10	Conforms
				II.7	Not applicable
4.5.1	Control Rod Drive Structural Materials	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
4.5.2	Reactor Internal and Core Support Structure Materials	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
4.6	Functional Design of Control Rod Drive System	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
BTP 4-1	Westinghouse Constant Axial Offset Control (CAOC)	Rev. 3	Mar-07		Not applicable to the ESBWR
5.2.1.1	Compliance with the Codes and Standards Rule, 10 CFR 50.55a	Rev. 3	Mar-07	RG 1.26	Conforms
5.2.1.2	Applicable Code Cases	Rev. 3	Mar-07	RG 1.84, RG 1.147, RG 1.192	Conforms
5.2.2	Overpressure Protection	Rev. 3	Mar-07	II.1, II.2, II.5, II.6, II.7	Conforms
				II.3, & II.4	Not applicable to the ESBWR
5.2.3	Reactor Coolant Pressure Boundary Materials	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms. Acceptance Criterion II.3 is addressed in DCD Section 3.9.3.9.
5.2.4	Reactor Coolant Pressure Boundary Inservice Inspection and Testing	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
5.2.5	Reactor Coolant Pressure Boundary Leakage Detection	Rev. 2	Mar-07	II.1, II.2	Conforms
5.3.1	Reactor Vessel Materials	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
5.3.2	Pressure-Temperature Limits, Upper-Shelf Energy, and Pressurized Thermal Shock	Rev. 2	Mar-07	II.1, II.2, II.3	Conforms
5.3.3	Reactor Vessel Integrity	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
5.4	Reactor Coolant System Component and Subsystem Design	Rev. 2	Mar-07		Conforms
5.4.1.1	Pump Flywheel Integrity (PWR)	Rev. 2	Mar-07		Not applicable to the ESBWR
5.4.2.1	Steam Generator Materials	Rev. 3	Mar-07		Not applicable to the ESBWR
5.4.2.2	Steam Generator Program	Rev. 2	Mar-07		Not applicable to the ESBWR
5.4.6	Reactor Core Isolation Cooling System (BWR)	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
5.4.7	Residual Heat Removal (RHR) System	Rev. 4	Mar-07	II.1, II.2, II.3, II.4	Conforms
5.4.8	Reactor Water Cleanup System (BWR)	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
5.4.11	Pressurizer Relief Tank	Rev. 3	Mar-07		Not applicable to the ESBWR
5.4.12	Reactor Coolant System High Point Vents	Rev. 1	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14	Conforms
5.4.13	Isolation Condenser System (BWR)	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12	Conforms
BTP 5-1	Monitoring of Secondary Side Water Chemistry in PWR Steam Generators	Rev. 3	Mar-07		Not applicable to the ESBWR
BTP 5-2	Overpressurization Protection of Pressurized-Water Reactors While Operating at Low Temperatures	Rev. 3	Mar-07		Not applicable to the ESBWR
BTP 5-3	Fracture Toughness Requirements	Rev. 3	Mar-07		Conforms
BTP 5-4	Design Requirements of the Residual Heat Removal System	Rev. 3	Mar-07		Not applicable to ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
6.1.1	Engineered Safety Features Materials	Rev. 2	Mar-07	II.1, II.2, II.3, II.4	Conforms
6.1.2	Protective Coating Systems (Paints) - Organic Materials	Rev. 3	Mar-07	II.1	Conforms
6.2.1	Containment Functional Design	Rev. 3	Mar-07		Conforms
6.2.1.1.A	PWR Dry Containments, Including Subatmospheric Containments	Rev. 3	Mar-07		Not applicable to the ESBWR
6.2.1.1.B	Ice Condenser Containments	Draft Rev. 3	Jun-96		Not applicable to the ESBWR
6.2.1.1.C	Pressure-Suppression Type BWR Containments	Rev. 7	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11	Conforms
6.2.1.2	Subcompartment Analysis	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
6.2.1.3	Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents (LOCAs)	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
6.2.1.4	Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures	Rev. 2	Mar-07		Not applicable to the ESBWR
6.2.1.5	Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies	Rev. 3	Mar-07		Not applicable to the ESBWR
6.2.2	Containment Heat Removal Systems	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8	Conforms
6.2.3	Secondary Containment Functional Design	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms. See DCD Table 1.9-20.
6.2.4	Containment Isolation System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14, II.15, II.16, II.17, II.18, II.19, II.20, II.21, II.22	Conforms
6.2.5	Combustible Gas Control in Containment	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9	Conforms
6.2.6	Containment Leakage Testing	Rev. 3	Mar-07		Conforms
6.2.7	Fracture Prevention of Containment Pressure Boundary	Rev. 1	Mar-07	II.1, II.2	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
6.3	Emergency Core Cooling System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.6, II.7, II.8, II.10	Conforms
				II.5, II.9	Not applicable
6.4	Control Room Habitability System	Rev. 3	Mar-07	II.1, II.2, II.4, II.5, II.6	Conforms
				II.3	Exception: For differential pressure testing of the control room, the periodic verification interval of every 18 months in Acceptance Criteria II.3.a through II.3.c is increased to every 24 months to accommodate the ESBWR's two year operating cycle. The frequencies for testing the CR HVAC system are defined by Technical Specifications 3.7.2 and 5.5.12 of the referenced certified design.
				II.7	Exception: SRP states that self-contained breathing apparatus for the control room personnel should be on hand. DCD 6.4.1.1 states that CRHA habitability requirements are satisfied without the need for individual breathing apparatus and/or special clothing.
6.5.1	ESF Atmosphere Cleanup Systems	Rev. 3	Mar-07		Conforms. Surveillances, testing, and maintenance guidelines for the CRHAVS are addressed in Technical Specifications 3.7.2, 5.5.12, and 5.5.13, Maintenance Rule requirements in Section 17.6, and procedure requirements in Section 13.5.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
6.5.2	Containment Spray as a Fission Product Cleanup System	Rev. 4	Mar-07		Not applicable. See DCD Table 1.9-20.
6.5.3	Fission Product Control Systems and Structures	Rev. 3	Mar-07	II.1, II.2, (there is no II.3)	Conforms
				II.4	Not applicable. Drywell spray function is not credited in DCD Chapter 15 dose analysis.
6.5.4	Ice Condenser as a Fission Product Cleanup System	Draft Rev. 4	Jun-96		Not applicable to the ESBWR
6.5.5	Pressure Suppression Pool as a Fission Product Cleanup System	Rev. 1	Mar-07	II.1, II.2	Conforms. Refer to DCD Table 1.9-20.
				II.3	Not applicable.
6.6	Inservice Inspection and Testing of Class 2 and 3 Components	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11	Conforms
6.7	Main Steam Isolation Valve Leakage Control System (BWR)	Draft Rev. 3	Jun-96		Not applicable
BTP 6-1	pH For Emergency Coolant Water for Pressurized Water Reactors	Initial Issuance	Mar-07		Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 6-2	Minimum Containment Pressure Model for PWR ECCS Performance Evaluation	Rev. 3	Mar-07		Not applicable to the ESBWR
BTP 6-3	Determination of Bypass Leakage Paths in Dual Containment Plants	Rev. 3	Mar-07		Conforms. Refer to DCD Table 1.9-20.
BTP 6-4	Containment Purging During Normal Plant Operations	Rev. 3	Mar-07		Conforms. Refer to TS SR 3.6.1.3.
BTP 6-5	Currently the Responsibility of Reactor Systems Piping From the RWST (or BWST) and Containment Sump(s) to the Safety Injection Pumps	Rev. 3	Mar-07		Not applicable
7.0	Instrumentation and Controls - Overview of Review Process	Rev. 5	Mar-07		Conforms
Appendix 7.0-A	Review Process for Digital Instrumentation and Control Systems	Rev. 5	Mar-07		Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
7.1	Instrumentation and Controls - Introduction	Rev. 5	Mar-07	II.1, II.2, II.3	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
7.1-T	Table 7-1 Regulatory Requirements, Acceptance Criteria, and Guidelines for Instrumentation and Control Systems Important to Safety	Rev. 5	Mar-07		Conforms
Appendix 7.1-A	Acceptance Criteria and Guidelines for Instrumentation and Controls Systems Important to Safety	Rev. 5	Mar-07	1, 2, 3, 4, 5	Conforms
Appendix 7.1-B	Guidance for Evaluation of Conformance to IEEE Std 279	Rev. 5	Mar-07		Conforms
Appendix 7.1-C	Guidance for Evaluation of Conformance to IEEE Std 603	Rev. 5	Mar-07		Conforms
Appendix 7.1-D	Guidance for Evaluation of the Application of IEEE Std 7-4.3.2	Initial Issuance	Mar-07	SRM to SECY 93-087 II.Q	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
7.2	Reactor Trip System	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, SRM to SECY 93-087 II.Q	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.3	Engineered Safety Features Systems	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, SRM to SECY 93-087 II.Q	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.4	Safe Shutdown Systems	Rev. 5	Mar-07	II.1, II.2, II.3	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.5	Information Systems Important to Safety	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, II.5, SRM to SECY 93-087 II.Q	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.6	Interlock Systems Important to Safety	Rev. 5	Mar-07	II.1, II.2, II.3	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.7	Control Systems	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, SRM to SECY 93-087 II.Q	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
7.8	Diverse Instrumentation and Control Systems	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, SRM to SECY 93-087 II.Q	Conforms. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
7.9	Data Communication Systems	Rev. 5	Mar-07	II.1, II.2, II.3	Conforms. Addressed in DCD Section 7.1. Procedures addressed in Section 13.5. Technical Specifications addressed in Chapter 16. ITAAC addressed in COLA Part 10.
Appendix 7-A	General Agenda, Station Site Visits (formerly Appendix 7-B)	Rev. 5	Mar-07		Not applicable. Provides guidance to the NRC to conduct site visits.
Appendix 7-B	Acronyms, Abbreviations, and Glossary (formerly Appendix 7-C)	Rev. 5	Mar-07		Conforms
BTP 7-1	Guidance on Isolation of Low-Pressure Systems from the High-Pressure Reactor Coolant System	Rev. 5	Mar-07		Conforms
BTP 7-2	Guidance on Requirements of Motor-Operated Valves in the Emergency Core Cooling System Accumulator Lines	Rev. 5	Mar-07		Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 7-3	Guidance on Protection System Trip Point Changes for Operation with Reactor Coolant Pumps Out of Service	Rev. 5	Mar-07		Not applicable to the ESBWR
BTP 7-4	Guidance on Design Criteria for Auxiliary Feedwater Systems	Rev. 5	Mar-07		Not applicable to the ESBWR
BTP 7-5	Guidance on Spurious Withdrawals of Single Control Rods in Pressurized Water Reactors	Rev. 5	Mar-07		Not applicable to the ESBWR
BTP 7-6	Guidance on Design of Instrumentation and Controls Provided to Accomplish Changeover from Injection to Recirculation Mode	Rev. 5	Mar-07		Not applicable. ESBWR does not use recirculation pumps or active ECCS pumps.
HICB-7	Not Used				Not used
BTP 7-8	Guidance for Application of Regulatory Guide 1.22	Rev. 5	Mar-07		Conforms. Chapter 16 addresses Technical Specifications.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 7-9	Guidance on Requirements for Reactor Protection System Anticipatory Trips	Rev. 5	Mar-07		Conforms
BTP 7-10	Guidance on Application of Regulatory Guide 1.97	Rev. 5	Mar-07		Conforms. Section 13.5 addresses procedures.
BTP 7-11	Guidance on Application and Qualification of Isolation Devices	Rev. 5	Mar-07		Conforms.
BTP 7-12	Guidance on Establishing and Maintaining Instrument Setpoints	Rev. 5	Mar-07		Conforms. Section 13.5 addresses procedures.
BTP 7-13	Guidance on Cross-Calibration of Protection System Resistance Temperature Detectors	Rev. 5	Mar-07		Not applicable. RTDs are not used in the ESBWR protection systems.
BTP 7-14	Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems	Rev. 5	Mar-07		Conforms
HCIB-15	Not Used				Not used

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 7-16	Withdrawn				Withdrawn
BTP 7-17	Guidance on Self-Test and Surveillance Test Provisions	Rev 5	Mar-07		Conforms. Section 13.5 addresses procedures. Chapter 16 addresses Technical Specifications.
BTP 7-18	Guidance on the Use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems	Rev. 5	Mar-07		Conforms. Section 13.5 addresses procedures.
BTP 7-19	Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems	Rev. 5	Mar-07		Conforms
HCIB-20	Not Used				Not used
BTP 7-21	Guidance on Digital Computer Real-Time Performance	Rev. 5	Mar-07		Conforms
8.1	Electric Power - Introduction	Rev. 3	Mar-07		Conforms
8.2	Offsite Power System	Rev. 4	Mar-07	II.4, II.5, II.8	Conforms
				II.1, II.2, II.3, II.6, II.7	Not applicable. ESBWR is a passive design and does not rely on offsite power.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
8.3.1	A-C Power Systems (Onsite)	Rev. 3	Mar-07	II.1, II.2, II.3, II.4.A, II.4.C, II.4.D, II.4.E, II.4.F, II.4.H, II.4.J, II.5, II.6, II.7, II.10	Conforms
				II.4.B, II.4.I	Not applicable. The ESBWR diesel generators are not safety-related.
				II.4.G, II.8	Not applicable. The ESBWR diesel generators are not safety-related, nor is AC power needed to achieve safe shutdown.
				II.9	Conforms. Addressed in DCD 17.4 and Section 17.6.
8.3.2	D-C Power Systems (Onsite)	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.7, II.8, II.9, II.10	Conforms
				II.5, II.6	Not applicable. Addressed in DCD Sections 8.3.2.1.1 and 8.3.2.2.2.
				II.11	Not applicable. The ESBWR is designed to shutdown safely without reliance on offsite or diesel-generator-derived AC power for 72 hours, which exceeds station blackout requirements.
				II.12	Conforms. Addressed in Section 17.6.
				II.13	Conforms. Addressed in Section 17.6.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
8.4	Station Blackout	Initial Issuance	Mar-07	II.1, II.2	Conforms. Addressed in DCD Section 15.5.5.
				II.3	Not applicable. Onsite Class 1E Emergency AC power sources are not required for ESBWR safe shutdown.
				II.4, II.5	Conforms. Addressed in Section 17.6.
Appendix 8-A	General Agenda, Station Site Visits	Rev. 1	Mar-07		Not applicable. Provides guidance to NRC to conduct site visits.
BTP 8-1	Requirements on Motor-Operated Valves in the ECCS Accumulator Lines	Rev. 3	Mar-07		Not applicable. The ESBWR does not have any safety-related motor-operated valves.
BTP 8-2	Use of Diesel-Generator Sets for Peaking	Rev. 3	Mar-07		Not applicable. The ESBWR will not use the non-safety related diesel generators as peaking units.
BTP 8-3	Stability of Offsite Power Systems	Rev. 3	Mar-07		Conforms - Stability studies investigating worst case loss of off-site generation were performed
BTP 8-4	Application of the Single Failure Criterion to Manually Controlled Electrically Operated Valves	Rev. 3	Mar-07		Not applicable. The ESBWR does not use any manually-operated valves to mitigate an accident.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 8-5	Supplemental Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems	Rev. 3	Mar-07		Not applicable. The ESBWR does not rely on safety-related AC power systems. However, refer to DCD Table 7.1-1 for conformance to RG 1.47 and BISI for all safety-related systems.
BTP 8-6	Adequacy of Station Electric Distribution System Voltages	Rev. 3	Mar-07		Not Applicable - The use of batteries/inverters in the supply arrangement of the ESBWR Class 1E busses results in independence from off-site power with respect to the voltage on the 1E busses.
BTP 8-7	Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status	Rev. 3	Mar-07		Not applicable. The ESBWR does not use safety-related diesel generators.
9.1.1	Criticality Safety of Fresh and Spent Fuel Storage and Handling	Rev. 3	Mar-07	II.1	Conforms
9.1.2	New and Spent Fuel Storage	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
9.1.3	Spent Fuel Pool Cooling and Cleanup System	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
				II.8	Conforms. EP-ITAAC are addressed in COLA Part 10.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
9.1.4	Light Load Handling System (Related to Refueling)	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
9.1.5	Overhead Heavy Load Handling Systems	Rev. 1	Mar-07	II.1, II.2, II.3, II.4	Conforms
9.2.1	Station Service Water System	Rev. 5	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
9.2.2	Reactor Auxiliary Cooling Water Systems	Rev. 4	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
9.2.3	Demineralized Water Makeup System				SRP withdrawn
9.2.4	Potable and Sanitary Water Systems	Rev. 3	Mar-07	II.1.A, II.1.B, II.1.C	Conforms
9.2.5	Ultimate Heat Sink	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
9.2.6	Condensate Storage Facilities	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
9.3.1	Compressed Air System	Rev. 2	Mar-07	II.1, II.2, II.3, II.4	Conforms. Instrument Air is addressed in DCD Section 9.3.6, Service Air is addressed in DCD Section 9.3.7, and High Pressure Nitrogen Supply System is addressed in DCD Section 9.3.8.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
9.3.2	Process and Post-accident Sampling Systems	Rev. 3	Mar-07	II.1, II.3, II.4	Conforms
				II.2	Exception. Technical Specifications do not require analyses. Section 9.3.2 addresses actions required to qualify process sampling for taking radioactive samples without having a specific post-accident sampling system. Analyses and frequencies of process systems are addressed in plant operating procedures.
9.3.3	Equipment and Floor Drainage System	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
9.3.4	Chemical and Volume Control System (PWR) (Including Boron Recovery System)	Rev. 3	Mar-07		Not applicable to the ESBWR
9.3.5	Standby Liquid Control System (BWR)	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
9.4.1	Control Room Area Ventilation System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms. Section 9.4 was evaluated against these criteria.
9.4.2	Spent Fuel Pool Area Ventilation System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
9.4.3	Auxiliary and Radwaste Area Ventilation System	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms. Section 9.4 was evaluated against these criteria.
9.4.4	Turbine Area Ventilation System	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
9.4.5	Engineered Safety Feature Ventilation System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
9.5.1	Fire Protection Program	Rev. 5	Mar-07	II.1, II.2, II.4	Not applicable. See DCD Table 1.9-21.
				II.3, II.5, II.6	Conforms
				II.7	Exception: The elements of the Fire Protection Program required to be operational prior to receipt of new fuel are those elements necessary to protect buildings storing new fuel and adjacent fire areas that could affect the fuel storage area. Other required elements of the Fire Protection Program will be fully operational prior to initial fuel loading. Refer to Section 13.4.
9.5.2	Communications Systems	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.14	Conforms
9.5.3	Lighting Systems	Rev. 3	Mar-07	II.1, II.2, II.3, II.4	Conforms
9.5.4	Emergency Diesel Engine Fuel Oil Storage and Transfer System	Rev. 3	Mar-07		Not applicable to the ESBWR
9.5.5	Emergency Diesel Engine Cooling Water System	Rev. 3	Mar-07		Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
9.5.6	Emergency Diesel Engine Starting System	Rev. 3	Mar-07		Not applicable to the ESBWR
9.5.7	Emergency Diesel Engine Lubrication System	Rev. 3	Mar-07		Not applicable to the ESBWR
9.5.8	Emergency Diesel Engine Combustion Air Intake and Exhaust System	Rev. 3	Mar-07		Not applicable to the ESBWR
10.2	Turbine Generator	Rev. 3	Mar-07	II.1.A, II.1.B	Conforms
				II.1.C	Exception—The TGS has the capability to permit periodic testing of all components important to safety while the unit is at or above rated speed. In DCD Section 10.2.2.7, a list of components that may be tested with the unit at load is provided. However, some load reduction may be necessary before testing main stop and control valves, and intermediate stop and intercept valves (see DCD Section 10.2.3.7). Overspeed trip testing is performed at speed levels greater than or equal to rated speed with no electrical load. Thus, not all components are capable of being tested at rated load as required in the corresponding Acceptance Criterion. (continued)

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
10.2	Turbine Generator (continued)				
				II.1.C (continued)	Load reduction for turbine valve testing is common in the existing fleet of power reactors and is considered acceptable. Testing at turbine loads below the rated load condition is considered an acceptable means of confirming that equipment relied on to prevent turbine overspeed related failures is available and capable of providing required functions. Further, component redundancies, as described in DCD Section 10.2.2.4, ensure that a single failure of any of the above valves important to safety will not disable the function of the overspeed protection system.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
10.2	Turbine Generator (continued)			II.2.A	Exception—Inservice inspection of main steam and reheat valves is discussed in DCD Sections 10.2.2.7 and 10.2.3.7. The first disassembly and visual inspection of all main stop valves, main control valves, intermediate stop, and intercept valves are performed within the first three refueling shutdowns. However, the interval for subsequent inspections may be extended beyond the SRP interval of 3-1/3 years to an interval consistent with applicable industry guidance, subject to the requirements of the turbine missile probability analysis. The inspection interval may not exceed the requirements or assumptions in the turbine missile probability analysis. Further, inspection intervals are only extended if there are no significant findings in the initial (baseline) inspections. Thus, with the above provisions, extending the inspection interval beyond the SRP interval is considered acceptable.
				II.2.B, II.3	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
10.2.3	Turbine Rotor Integrity	Rev. 2	Mar-07	II.1, II.2	Conforms
				II.3.A	Exception - DCD Section 10.2.3.5 states that, “Forgings are rough-machined with minimum stock allowance prior to heat treatment.” This statement meets the intent of the corresponding SRP Acceptance Criterion. The exception to the Acceptance Criterion is introduced with the reference to welded rotors. The GE N1R steam turbine selected for this site utilizes integral forgings in the rotor design and fabrication. Although other manufacturers produce welded rotors, the GE N1R rotor is not a welded rotor design and does not utilize welding to construct the base rotor. Flaws in the forging may be repaired by welding and other means, but only after heat treatment. Thus, the intent of this Acceptance Criterion is met.
				II.3.B, II.3.C, II.3.D, II.4, II.5	Conforms
10.3	Main Steam Supply System	Rev. 4	Mar-07	II.1, II.2, II.3, II.5, II.6, II.7, II.8	Conforms
				II.4	Not applicable to the ESBWR
10.3.6	Steam and Feedwater System Materials	Rev. 3	Mar-07	II.1, II.2	Conforms
10.4.1	Main Condensers	Rev. 3	Mar-07	II.1	Conforms
10.4.2	Main Condenser Evacuation System	Rev. 3	Mar-07	II.1	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
10.4.3	Turbine Gland Sealing System	Rev. 3	Mar-07		Conforms
10.4.4	Turbine Bypass System	Rev. 3	Mar-07	II.1, II.2, II.3	Conforms
10.4.5	Circulating Water System	Rev. 3	Mar-07	II.1	Conforms
10.4.6	Condensate Cleanup System	Rev. 3	Mar-07	II.1	Conforms
				II.2	Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
10.4.7	Condensate and Feedwater System	Rev. 4	Mar-07	II.1, II.2.B, II.3, II.4, II.5, II.6	Conforms
				II.2.A	Not applicable to the ESBWR
				II.7	Exception: This SRP acceptance criterion states that guidance for acceptable FAC inspection programs “is found in (NRC) Generic Letter 89-08 and in EPRI NP-3944.” EPRI document NSAC-202L, Rev. 2, supersedes EPRI NP-3944 and is therefore referenced in place of EPRI NP-3944 in DCD Section 6.6.7, for guidance regarding FAC (erosion corrosion) monitoring and related inspection programs. The more recent document, EPRI NSAC-202L, utilizes more extensive industry experience and improved inspection methods and modeling. The substitution of EPRI NSAC-202L, Rev. 2, in place of EPRI NP-3944 is therefore acceptable.
				II.8	Conforms. Addressed in DCD Sections 3.9.3, 5.2.4, and 10.4.7, and DCD Tables 1.9-22 and 1.11-1.
10.4.8	Steam Generator Blowdown System (PWR)	Rev. 3	Mar-07		Not applicable to the ESBWR
10.4.9	Auxiliary Feedwater System (PWR)	Rev. 3	Mar-07		Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 10-1	Design Guidelines for Auxiliary Feedwater System Pump Drive and Power Supply Diversity for Pressurized Water Reactor Plants	Rev. 3	Mar-07		Not applicable to the ESBWR
BTP 10-2	Design Guidelines for Avoiding Water Hammers in Steam Generators	Rev. 4	Mar-07		Not applicable to the ESBWR
11.1	Source Terms	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.6, II.7, II.8, II.9	Conforms. Addressed in DCD Section 12.2 and in FSAR Section 12.2.
				II.5	Conforms. Addressed in Sections 11.2 and 11.3.
11.2	Liquid Waste Management System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms. Addressed in DCD Sections 11.2 and 12.2, and in FSAR Sections 11.2 and 12.2.
				II.6	Not applicable. Applies to ESP applications.
11.3	Gaseous Waste Management System	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms. Addressed in DCD Sections 11.3 and 12.2, and in FSAR Sections 11.2 and 12.2.
				II.8	Not applicable. Applies to ESP applications.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
11.4	Solid Waste Management System	Rev. 3	Mar-07	II.1, II.2, II.5, II.7, II.8, II.9, II.14	Conforms.
				II.3, II.4, II.6, II.11. II.12, II.13	Conforms (addressed in DCD Section 11.4 and in FSAR Section 11.4; for Acceptance Criterion II.13, this is also addressed in Section 11.5) with the following exception: RG 1.206, Section 13.4 includes the PCP as an operational program, and only requires a program description in the COLA and a milestone for full program implementation. The FSAR provides a description of the PCP, along with the implementation milestone. Procedures for handling waste will be developed once the PCP is implemented.
				II.10	Not applicable. There is no temporary onsite storage facility.
11.5	Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems	Rev. 4	Mar-07	II.1, II.2	Addressed in DCD Section 11.5.2.
				II.3, II.4, II.5	Conforms (addressed in DCD Sections 11.5.2 and 11.5.3, and in Section 11.5) with the following exception: RG 1.206, Section 13.4 includes the ODCM (including the SREC) and PCP as operational programs, and only requires program descriptions in the COLA and milestones for full program implementation. The FSAR provides descriptions of the PCP and ODCM along with implementation milestones.
				II.6	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
BTP 11-3	Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Plants	Rev. 3	Mar-07	B.1,B.3, B.5	Conforms
				B.2, B.4	Conforms (addressed in DCD Section 11.4 and in FSAR Section 11.4; for Acceptance Criterion II.13, this is also addressed in Section 11.5) with the following exception: RG 1.206, Section 13.4 includes the PCP as an operational program, and only requires a program description in the COLA and a milestone for full program implementation. The FSAR provides a description of the PCP, along with the implementation milestone. Procedures for handling waste will be developed once the PCP is implemented.
BTP 11-5	Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure	Rev. 3	Mar-07		Conforms. Addressed in DCD Section 11.3.
BTP 11-6	Postulated Radioactive Releases Due to Liquid-containing Tank Failures	Rev. 3	Mar-07		Conforms. Addressed in DCD Section 15.3.16 and in FSAR Section 2.4.13.
12.1	Assuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable	Rev. 3	Mar-07	II.1, II.2. II.3, II.4	Conforms. Addressed in Section 13.2, and Appendices 12AA and 12BB.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
12.2	Radiation Sources	Rev. 3	Mar-07	II.1	Not applicable. Acceptance criterion cites RG 1.3. SRP states RG 1.3 is applicable to license holders issued prior to January 10, 1997. COL applicant is not a license holder.
				II.2	Not applicable to the ESBWR
				II.3	Conforms. Addressed in DCD Sections 12.3 and 15.4 and in FSAR Section 6.4.
				II.4	Conforms. Addressed in DCD Section 12.3.
				II.5	Conforms
				II.6	Conforms. Addressed in DCD Sections 1A and 12.2.
				II.7	Conforms. Addressed in DCD Section 12.2.
12.3–12.4	Radiation Protection Design Features	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
12.5	Operational Radiation Protection Program	Rev. 3	Mar-07	II.1	Conforms with the following exceptions: 1) NUREG-0731 is not active, and is not utilized; 2) RG 8.8 specifies the use of RG 1.16. Reporting per C.1.b(2) and C.1.b(3) of RG 1.16 is no longer required.
				II.2.A, II.2.B, II.2.C, II.2.D, II.2.E.i, II.2.E.ii, II.2.E.iii, II.2.E.iv, II.2.F, II.2.G, II.2.H, II.4	Conforms
				II.2.E.v	Conforms with the following exception: NUREG-1736 states that RGs 8.20, 8.26, and 8.32 are outdated and recommends use of the methods in RG 8.9, Rev. 1. Therefore, the methods identified in RG 8.9, Rev. 1 will be used in place of those in RGs 8.20, 8.26, and 8.32.
				II.3	Conforms with the following exceptions: 1) RG 8.25 is not applicable to power stations; and 2) NUREG-1736 states that RGs 8.20, 8.26, and 8.32 are outdated and recommends use of the methods in RG 8.9, Rev. 1

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.1.1	Management and Technical Support Organization	Rev. 5	Mar-07	II.1.A, B, D, II.2.A.i through II.2.A.v	Conforms. Addressed in Section 13.1 and 14.2.
				II.1.C	Exception: Design and construction responsibilities are not defined in numbers. The experience requirements of corporate staff are set by corporate policy and not provided in detail; however, the experience level of Entergy, as discussed in Section 13.1 and Appendix 13AA, in the area of nuclear plant development, construction, and management establishes that Entergy has the necessary capability and staff to ensure that design and construction of the facility will be performed in an acceptable manner.
				II.2.A.vi, II.2.A.vii	Conforms. Addressed in Sections 13.1 and 14.2.
				II.2.A.viii	Not applicable. Only applies to applicants whose applications were pending as of February 16, 1982.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.1.2–13.1.3	Operating Organization	Rev. 6	Mar-07	General 1	Exception: SRP requires operational, on-site technical support, and maintenance groups to be under the direction and supervision of a plant manager. Entergy has organized much of its technical support with direct reporting to off-site/corporate organizations and dotted line reporting to the site executive in charge of plant management. This applies to such groups as training, security, emergency preparedness, QA, licensing, and projects.
				General 2, General 3	Conforms
				General 4	Not applicable. There are no requests for exemptions from the requirements of 10 CFR 50.54(m).
				II.1.A, II.1.B	Conforms with the following exception: Quality assurance is in accordance with the QAPD. QA requirements as they apply to the operating organization and on-site review are described in the QAPD. Responsibilities and authorities of operating personnel conform to the guidance of ANSI/ANS-3.2-1994 (R1999). Rules of practice, fire protection, RG 1.8 and TMI item I.C.3 are addressed in Section 13.1.
				II.1.A.i through II.1.A.v, II.1.C, II.1.E, II.1.F, II.1.G	Conforms
				II.1.D	Not applicable

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
				II.1.H	Conforms. Addressed in Section 13.2.
13.2.1	Reactor Operator Requalification Program: Reactor Operator Training	Rev. 3	Mar-07	II.1.A.i	Conforms. Addressed in Section 13.1.
				II.1.A.ii, II.1.A.iii, II.1.A.v, II.1.B, II.1.D, II.1.E	Conforms
				II.1.A.iv	Conforms. Addressed in Sections 13.1, 13.2, and 17.5.
				II.1.A.vi	Conforms. Addressed in DCD Chapter 18.
				II.1.A.vii	Exception: The COLA incorporates by reference approved industry template NEI 06-13, which does not address compliance with NUREG-1021.
				II.1.C	Exception: This item states that “formal segments of the initial licensed operator training program should be substantially complete when the pre-operational program test begins.” Appendix 13BB (via NEI 06-13) commits to a similar state of readiness: (continued)
13.2.1 (cont’d)					“Before initial fuel loading, the number of persons trained in preparation for RO and SRO licensing examinations will be sufficient to meet regulatory requirements, with allowances for examination contingencies and without the need for planned overtime.”

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.2.2	Non-Licensed Plant Staff Training	Rev. 3	Mar-07	II.1, II.2, II.3, II.4, II.5, II.7, II.8, II.9	Conforms.
				II.6	Exception. This item states that “formal segments of the initial training program should be substantially complete when the pre-operational test program begins.” Appendix 13BB (via NEI 06-13) commits to a similar state of readiness: “Before initial fuel loading, sufficient plant staff will be trained to provide for safe plant operations.”
				II.10	Conforms. Addressed in DCD Section 9.5.1.
				II.11	Conforms. Addressed in Sections 13.2 and 13.4.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.3	Emergency Planning	Rev. 3	Mar-07	II.1, II.2,	Conforms. Addressed in Section 13.4, COLA Part 5, and COLA Part 10.
				II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II.11, II.12, II.13, II.17, II.18, II.27, II.28, II.29, II.30	Conforms. Addressed in COLA Part 5.
				II.14	Not applicable. Allows NRC to issue a license when applicant asserts that noncompliance with offsite EP requirements is because state or local government has declined to participate in emergency planning.
				II.15, II.16, II.19, II.20, II.21	Not applicable. Only applies to ESP applications.
				II.22	Not applicable. Only applies to design certification applications.
				II.23	Conforms. Addressed in COLA Part 10.
				II.24	Conforms: Emergency Planning ITAAC were developed using SECY 05-0197 and were tailored to the specific reactor design and emergency planning program requirements.
				II.25	Conforms. Addressed in DCD Section 13.3 and COLA Part 5. The EOF will be used for Unit 3.
				II.26	Conforms. Reviewed under SRPs 7.5 and 18.2.
				II.31	Conforms. Addressed in Section 13.4.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.4	Operational Programs	Rev. 3	Mar-07		Conforms
13.5.1.1	Administrative Procedures - General	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.6, II.7	Conforms
				II.5	Conforms with the following exception: Section 13.5 conforms to the updated version of ANSI/ANS-3.2-1994 (R1999).
				II.8	Section 13.5 and DCD Section 18.9 discuss conformance with NUREG- 0711
				II.9, II.10, II.12, II.13, II.14, II.15, II.16, II.17, II.18, II.19, II.20	Conforms
				II.11	Conforms with the following exception: Section 13.5 conforms to the updated version of ANSI/ANS-3.2-1994 (R1999).
13.5.2.1	Operating and Emergency Operating Procedures	Rev. 2	Mar-07	II.1	Conforms
				II.2.A, II.2.B	Conforms
				II.2.C	Section 13.5 and DCD Section 18.9 discuss conformance with NUREG- 0711
				II.2.D, II.2.E, II.2.H, II.2.I	Conforms.
				II.2.F, II.2.G	Conforms with the following exception: Section 13.5 conforms to the updated version of ANSI/ANS-3.2-1994 (R1999).
13.6	Physical Security	Rev. 3	Mar-07		Addressed in COLA Part 8.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
13.6.1	Physical Security - Combined License Review Responsibilities	Initial Issuance	Mar-07		Addressed in COLA Part 8.
13.6.2	Physical Security - Design Certification	Initial Issuance	Mar-07		Not applicable. Applies to design certification applications.
13.6.3	Physical Security - Early Site Permit	Initial Issuance	Mar-07		Not applicable. Applies to ESP applications.
14.2	Initial Plant Test Program - Design Certification and New License Applicants	Rev. 3	Mar-07	1A, 1B, 1C, 2A, COL/OL Applicants: 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 4A, 4B, 5A, 5B, 6A, 6C	Conforms
				5C	Not applicable. No first-of-a-kind features utilized in the facility.
				5D	Not applicable. No test exceptions have been identified.
				6B	Not applicable. FSAR references a certified design.
				DC Applicants: 3A, 3B, 3C, 3D, 4A, 6A, 6B, 6C	Not applicable. Applies to DC applicants.
14.2.1	Generic Guidelines for Extended Power Uprate Testing Programs	Initial Issuance	Aug-06		Not applicable. Applies to power uprates.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
14.3	Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2	Conforms
14.3.1	[Reserved]	[Reserved]	Mar-07		Not used
14.3.2	Structural and Systems Engineering - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II.9, II.10, II. 11	Conforms
14.3.3	Piping Systems and Components - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2.A, II.2.B, II.2.C, II.2.D, II.2.E	Conforms
14.3.4	Reactor Systems - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms
14.3.5	Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
14.3.6	Electrical Systems - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	Class 1E Equipment: II.1, II.2, II.3, II.4, II.5 Other Electrical Equipment Important to Safety: II.1, II.2, II.3, II.4, II.5	Conforms
14.3.7	Plant Systems - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7, II.8, II. 9	Conforms
14.3.8	Radiation Protection - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3	Conforms
14.3.9	Human Factors Engineering - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
14.3.10	Emergency Planning - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2	Conforms
14.3.11	Containment Systems - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1, II.2, II.3, II.4, II.5	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
14.3.12	Physical Security Hardware - Inspections, Tests, Analyses, and Acceptance Criteria	Initial Issuance	Mar-07	II.1	Conforms. The security ITAAC are generic and included in the referenced certified design. No site-specific security ITAAC are required.
15	Introduction - Transient and Accident Analyses	Rev. 3	Mar-07	I.1, I.2, 1.3, I.4, I.5, I.6	Conforms
15.0.1	Radiological Consequence Analyses Using Alternative Source Terms	Rev. 0	Jul-00	V	Conforms
15.0.2	Review of Transient and Accident Analysis Method	Rev. 0	Dec-05	II.1, II.2, II.3, II.4, II.5, II.6	Conforms
15.0.3	Design Basis Accident Radiological Consequences of Analyses for Advanced Light Water Reactors	Initial Issuance	Mar-07		Not applicable to the ESBWR. For radiological analysis, the DCD utilized previously issued SRPs. This SRP was not issued at the time of DCD submittal.
15.1.1–15.1.4	Decrease in Feedwater Temperature, Increase in Feedwater Flow, Increase in Steam Flow, and Inadvertent Opening of a Steam Generator Relief or Safety Valve	Rev. 2	Mar-07	II.1, II.2, II.3, II.4, II.5, 1, 2, 3, 4	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.1.5	Steam System Piping Failures Inside and Outside of Containment (PWR)	Rev. 3	Mar-07		Not applicable to the ESBWR
15.1.5.A	Radiological Consequences of Main Steam Line Failures Outside Containment of a PWR				Not applicable to the ESBWR
15.2.1–15.2.5	Loss of External Load; Turbine Trip; Loss of Condenser Vacuum; Closure of Main Steam Isolation Valve (BWR); and Steam Pressure Regulator Failure (Closed)	Rev. 2	Mar-07	1A, 1B, 1C, 1D, 2A, 2B, 2D, 2E, 2F, 3A, 3B, 3C, 3D	Conforms
				2C	Not applicable. This is not an event of moderate frequency.
15.2.6	Loss of Nonemergency AC Power to the Station Auxiliaries	Rev. 2	Mar-07	II.1, II.2, II.4, II.5, II.5B, II.5C, II.5D	Conforms
				II.3	Not applicable. This is not an event of moderate frequency.
				II.5A	Not applicable. There are no RCS loops in the ESBWR.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.2.7	Loss of Normal Feedwater Flow	Rev. 2	Mar-07	1A, 1B, 1C, 1D, 2A, 2B, 2D, 2E, 2F, 3A, 3B, 3C, 3D	Conforms
				2C	Not applicable. This is not an event of moderate frequency.
15.2.8	Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	Rev. 2	Mar-07		Not applicable to the ESBWR
15.3.1–15.3.2	Loss of Forced Reactor Coolant Flow Including Trip of Pump Motor and Flow Controller Malfunctions	Rev. 2	Mar-07		Not applicable to the ESBWR
15.3.3–15.3.4	Reactor Coolant Pump Rotor Seizure and Reactor Coolant Pump Shaft Break	Rev. 3	Mar-07		Not applicable to the ESBWR
15.4.1	Uncontrolled Control Rod Assembly Withdrawal from a Subcritical or Low Power Startup Condition	Rev. 3	Mar-07	1A, 1C	Conforms
				1B	Not applicable to the ESBWR
15.4.2	Uncontrolled Control Rod Assembly Withdrawal at Power	Rev. 3	Mar-07	1A, 1C	Conforms
				1B	Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.4.3	Control Rod Misoperation (System Malfunction or Operator Error)	Rev. 3	Mar-07	1, 2, 3	Conforms
15.4.4 - 15.4.5	Startup of an Inactive Loop or Recirculation Loop at an Incorrect Temperature, and Flow Controller Malfunction Causing an Increase in BWR Core Flow Rate	Rev. 2	Mar-07	A, B, D, E, F, 1, 2, 3, 4	Conforms
				C	Not applicable. This is not an event of moderate frequency.
15.4.6	Inadvertent Decrease in Boron Concentration in the Reactor Coolant System (PWR)	Rev. 2	Mar-07		Not applicable to the ESBWR
15.4.7	Inadvertent Loading and Operation of a Fuel Assembly in an Improper Position	Rev. 2	Mar-07	1, 2	Conforms
15.4.8	Spectrum of Rod Ejection Accidents (PWR)	Rev. 3	Mar-07		Not applicable to the ESBWR
15.4.8.A	Radiological Consequences of a Control Rod Ejection Accident (PWR)				Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.4.9	Spectrum of Rod Drop Accidents (BWR)	Rev. 3	Mar-07	1, 2, 3	Conforms. Postulated events are not applicable to the ESBWR.
15.4.9.A	Radiological Consequences of Control Rod Drop Accident (BWR)	Rev 2	July 81		Conforms. Postulated control rod drop events are not applicable to the ESBWR.
15.5.1–15.5.2	Inadvertent Operation of ECCS and Chemical and Volume Control System Malfunction that Increases Reactor Coolant Inventory	Rev. 2	Mar-07	1, 2, 3	Conforms
15.6.1	Inadvertent Opening of a PWR Pressurizer Pressure Relief Valve or a BWR Pressure Relief Valve	Rev. 2	Mar-07	1, 2, 3, A, B, C, D	Conforms
15.6.2	Radiological Consequences of the Failure of Small Lines Carrying Primary Coolant Outside Containment	Rev. 2	Jul-81	II.1, II.2	Conforms
15.6.3	Radiological Consequences of Steam Generator Tube Failure				Not applicable to the ESBWR

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.6.4	Radiological Consequences of Main Steam Line Failure Outside Containment (BWR)	Rev. 2	Jul-81	II.1, II.2, II.3	Conforms
				II.4	Conforms. Addressed in TS 3.4.3.
15.6.5	Loss-of-Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary	Rev. 3	Mar-07	II.1A, II.1B, II.1C, II.1D, II.1.E, II.2, II.3	Conforms.
15.6.5.A	Radiological Consequences of a Design Basis Loss-of-Coolant Accident Including Containment Leakage Contribution	Rev 1	July 81		Not Applicable. Reference DCD Table 1.9-20.
15.6.5.B	Radiological Consequences of a Design Basis Loss-of-Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Rev 1	July 81		Not Applicable. Reference DCD Table 1.9-20.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.6.5.D	Radiological Consequences of a Design Basis Loss-of-Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)	Rev 1	July 81		Not Applicable. Reference DCD Table 1.9-20.
15.7.3	Postulated Radioactive Releases Due to Liquid-Containing Tank Failures			1, 2	Conforms
15.7.4	Radiological Consequences of Fuel Handling Accidents	Rev. 2	Jul-81	II.1, II.2, II.3, II.4, II.5	Conforms. Radiological assumptions superseded by SRP 15.0.1.
15.7.5	Spent Fuel Cask Drop Accidents	Rev. 2	July 81	II.1, II.2, II.3, II.4, II.5	Conforms. Because a spent fuel cask drop exceeding 9.2 m (30 ft) is not postulated (DCD Section 15.4.10.1), per SRP 15.7.5 a design basis radiological analysis is not required. Therefore, the acceptance criteria do not apply even though the SRP does.
15.8	Anticipated Transients Without Scram	Rev. 2	Mar-07	1A	Not applicable. ESBWR does not have recirculation pumps.
				1B, 1C, 1D, 1E	Conforms
				1F	Conforms

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
15.9	Boiling Water Reactor Stability	Initial Issuance	Mar-07	1, 2, 3, 4A, 4B, 5, 6, 7, 9A, 9B, 9C, 10, 11	Conforms
				8, 9D	Conforms
16	Technical Specifications	Rev. 2	Mar-07		Conforms
16.1	Risk-informed Decision Making: Technical Specifications	Rev. 1	Mar-07		Not applicable
17.1	Quality Assurance During the Design and Construction Phases	Rev. 2	Jul-81		Not applicable. RG 1.206 refers the COL applicant to Section 17.5 for the format and content of a QA Program for design and construction of new plants.
17.2	Quality Assurance During the Operations Phase	Rev. 2	Jul-81		Not applicable. RG 1.206 refers the COL applicant to Section 17.5 for the format and content of a QA Program for design and construction of new plants.
17.3	Quality Assurance Program Description	Rev. 0	Aug-90		Not applicable. RG 1.206 refers the COL applicant to Section 17.5 for the format and content of a QA Program for design and construction of new plants.
17.4	Reliability Assurance Program (RAP)	Initial Issuance	Mar-07	II.B.1, II.B.2, II.B.3, II.B.4, II.B.5, II.B.6, II.B.7, II.B.8, II.B.9	Conforms. Addressed in DCD Section 17.4 and FSAR Sections 17.5 and 17.6.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
17.5	Quality Assurance Program Description - Design Certification, Early Site Permit and New License Applicants	Initial Issuance	Mar-07	II.A, II.B, II.C, II.D., II.E, II.F, II.G, II.H, II.I, II.J, II.K, II.L, II.M, II.N, II.O, II.P, II.Q, II.R, II.S, II.T, II.U, II.V,	Conforms
				II.W Option II	Conforms Option II chosen. IRC is discussed in QAPD.
17.6	Maintenance Rule	Initial Issuance	Mar-07	II.1, II.2	Conforms
18	Human Factors Engineering	Rev. 2	Mar-07	II.A	Conforms
				II.B, II.C	Not applicable. These acceptance criteria apply to changes to existing plants.
19.0	Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors	Rev. 2	Jun-07	II.1, II.2, II.3, II.4, II.5, II.6, II.7	Conforms
				II.8, II.9	Not applicable. Only applies to Westinghouse AP 600 design.
19.1	Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities	Rev. 2	Jun-07		Not applicable. There are no plans for risk-informed activities.

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SRP Section	Title	Rev	Date	Specific Acceptance Criteria	Evaluation
19.2	Review of Risk Information Used to Support Permanent Plant Specific Changes to the Licensing Basis: General Guidelines	Rev. 0	Jun-07		Not applicable. There are no plans for risk-informed applications.

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CONFORMANCE WITH REGULATORY GUIDES

RG Number	Title	Revision	Date	RG Position	Evaluation
1.1	Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps	Rev. 0	Nov-70	General	Not applicable
1.3	Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors	Rev. 2	Jun-74	General	Not applicable. RG 1.183 is used.
1.4	Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors	Rev. 2	Jun-74	General	Not applicable
1.5	Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors	Rev. 0	Mar-71	General	Not applicable. RG 1.183 is used.
1.6	Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems	Rev. 0	Mar-71	General	Not applicable
1.7	Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident	Rev. 3	Mar-07	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.8	Qualification and Training of Personnel for Nuclear Power Plants	Rev. 3	May-00	C.1	Conforms.
				C.2	Conforms, except experience requirements cannot be met prior to operations as described in Appendix 13BB (Section 1.1.3).
1.9	Application and Testing of Safety-Related Diesel Generators in Nuclear Power Plants	Rev. 4	Mar-07	General	Not applicable
1.11	Instrument Lines Penetrating Primary Reactor Containment (Safety Guide 11) Supplement to Safety Guide 11, Backfitting Considerations	Rev. 0	Feb-72	C.1, C.2, E	Conforms
1.12	Nuclear Power Plant Instrumentation for Earthquakes	Rev. 2	Mar-97	C.1, C.2, C.4 – C.7	Conforms
				C.3, C.8	Conforms. The seismic monitoring program, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site.
1.13	Spent Fuel Storage Facility Design Basis	Rev. 2	Mar-07	General	Conforms
1.14	Reactor Coolant Pump Flywheel Integrity	Rev. 1	Aug-75	General	Not applicable
1.16	Reporting of Operating Information– Appendix A Technical Specifications	Rev. 4	Aug-75	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.20	Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing	Rev. 3	Mar-07	C.1	Conforms.
				C.2	Not applicable. Unit 3 does not have prototype reactor internals.
				C.3	Conforms. Section 3.9.2.4 describes that the vibration assessment program will be completed one year after the time of application.
1.21	Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants	Rev. 1	Jun-74	General	Conforms. Sections 11.4.2.3 (NEI 07-10) and 11.5.4.5 (NEI 07-09) provide descriptions of the PCP and ODCM, respectively. Implementation milestones are provided in Section 13.4.
1.22	Periodic Testing of Protection System Actuation Functions	Rev. 0	Feb-72	General	Conforms. Operational program implementation is described in Section 13.4.
1.23	Meteorological Monitoring Programs For Nuclear Power Plants	Rev. 1	Mar-07	General	Exception: The RG in part requires that sensors should be located … at a distance of at least 10 times the height of any nearby obstruction if the height of the obstruction exceeds one-half the height of the wind measurement. This criterion is met for all structures except the natural draft cooling tower. An alternative method for evaluating the wake effects for a hyperbolically-shaped structure is provided in Section 2.3.2 and it is demonstrated that the natural draft cooling tower will not adversely affect measurements made at the primary meteorological tower.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.24	Assumptions Used for Evaluating the Potential Radiological Consequences of a Pressurized Water Reactor Radioactive Gas Storage Tank Failure	Rev. 0	Mar-72	All	Not applicable
1.25	Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors	Rev. 0	Mar-72	General	Not applicable. RG 1.183 is used.
1.26	Quality Group Classifications and Standards or Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants	Rev. 4	Mar-07	All	Exception. The QAPD is based on NEI 06-14A which invokes Revision 3 of RG 1.26 (the same revision utilized by the DCD).
		Rev. 3	Feb 76	All	Conforms with the following exception: The QAPD incorporates the exception taken to RG 1.26 in the ESBWR DCD Table 1.9-21b.
1.27	Ultimate Heat Sink for Nuclear Power Plants	Rev. 2	Jan-76	General	The UHS is within the scope of the referenced certified design and is addressed in DCD Section 9.2.5.
1.28	Quality Assurance Program Requirements (Design and Construction)	Rev. 3	Aug-85	General	Exception: The QAPD identified in Section 17.5 addresses a QA program based on the newer NQA-1-1994, as provided for in SRP 17.5.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.29	Seismic Design Classification	Rev. 4	Mar-07	General	Exception. The QAPD is based on NEI 06-14A which invokes Revision 3 of RG 1.29 (the same revision utilized by the DCD).
		Rev. 3	Sept 78	All	Conforms with the following exception: The QAPD incorporates the exception taken to RG 1.29 in the ESBWR DCD Table 1.9-21b.
1.30	Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment	Rev. 0	Aug-72	General	Exception: The QAPD identified in Section 17.5 addresses a QA program based on a newer NQA-1-1994, as discussed in SRP 17.5.
1.31	Control of Ferrite Content in Stainless Steel Weld Metal	Rev. 3	Apr-78	General	Conforms. Operational program implementation is described in Section 13.4.
1.32	Criteria for Power Systems for Nuclear Power Plants	Rev. 3	Mar-04	General	Exception - The design of off-site power meets the intent of RG1.32 with respect to separation and redundancy, but is neither safety-related nor provided with safety-related power supplies. The design is described in Sections 8.2.1.1, 8.2.1.2.1.1, and 8.2.1.2.1.2
1.33	Quality Assurance Program Requirements (Operation)	Rev. 2	Feb-78	C.1	Conforms with the following exception: For procedures, RG 1.33 is utilized, however, ANSI/ANS-3.2-1994 (R1999) is used as guidance instead of the 1976 version endorsed by RG 1.33.
				C.2, C.3, C.4, C.5	Not applicable. The QAPD identified in Section 17.5 follows NQA-1 rather than the older standards referenced in RG 1.33.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.34	Control of Electroslag Weld Properties	Rev. 0	Dec-72	General	Conforms. Operational program implementation is described in Section 13.4.
1.35	Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments	Rev. 3	Jul-90	General	Not applicable
1.35.1	Determining Prestressing for Inspection of Prestressed Concrete Containments	Rev. 0	Jul-90	General	Not applicable
1.36	Nonmetalic Thermal Insulation for Austenitic Stainless Steel	Rev. 0	Feb-73	General	Conforms. Operational program implementation is described in Section 13.4.
1.37	Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-cooled Nuclear Power Plants	Rev. 1	Mar-07	General	Conforms
1.38	Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants	Rev. 2	May-77	General	Exception. Section 17.5 identifies equivalent quality assurance standards.
1.39	Housekeeping Requirements for Water-Cooled Nuclear Power Plants	Rev. 2	Sep-77	General	Exception. Section 17.5 identifies equivalent quality assurance standards.
1.40	Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants	Rev. 0	Mar-73	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.41	Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments	Rev. 0	Mar-73	General	Conforms with the following exception: There are no safety-related DGs for ESBWR.
1.43	Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components	Rev. 0	May-73	General	Conforms
1.44	Control of the Use of Sensitized Stainless Steel	Rev. 0	May-73	General	Conforms. Operational program implementation is described in Section 13.4.
1.45	Reactor Coolant Pressure Boundary Leakage Detection Systems	Rev. 0	May-73	General	Conforms. Operational program implementation is described in Section 13.4.
1.47	Bypassed and Inoperable status Indication for Nuclear Power Plant Safety Systems	Rev. 0	May-73	General	Conforms. Operational program implementation is described in Section 13.4.
1.50	Control of Preheat Temperature for Welding of Low-Alloy Steel	Rev. 0	May-73	General	Conforms. Operational program implementation is described in Section 13.4.
1.52	Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants	Rev. 3	Jun-01	General	Conforms
1.53	Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems	Rev. 2	Nov-03	General	Conforms
1.54	Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants	Rev. 1	Jul-00	General	Conforms with the following exceptions: Not applicable to small size equipment as described in DCD Section 6.1.2.1.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.56	Maintenance of Water Purity in Boiling Water Reactors	Rev. 1	Jul-78	General	Conforms.
1.57	Design Limits and Loading Combinations for Metal Primary Reactor Containment System Components	Rev. 1	Mar-07	General	Conforms
1.59	Design Basis Floods for Nuclear Power Plant (Errata Published 7/30/80)	Rev. 2	Aug-77	General	Conforms
1.60	Design Response for Seismic Design of Nuclear Power Plants	Rev. 1	Dec-73	General	Conforms
1.61	Damping Values for Seismic Design of Nuclear Power Plants	Rev. 1	Mar-07	General	Conforms
1.62	Manual Initiation of Protective Actions	Rev. 0	Oct-73	General	Conforms
1.63	Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants	Rev. 3	Feb-87	General	Conforms
1.65	Materials and Inspections for Reactor Vessel Closure Studs	Rev. 0	Oct-73	General	Conforms
1.68	Initial Test Programs for Water-Cooled Nuclear Power Plants	Rev. 2	Aug-78	General	Conforms
1.68.1	Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants	Rev. 1	Jan-77	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.68.2	Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants	Rev. 1	Jul-78	General	Conforms
1.68.3	Preoperational Testing of Instrument and Control Air Systems	Rev. 0	Apr-82	General	Conforms
1.69	Concrete Radiation Shields for Nuclear Power Plants	Rev. 0	Dec-73	General	Conforms
1.70	Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants LWR Edition	Rev. 3	Nov-78	--	Not applicable. RG 1.206 is used. Table 1.9-203.
1.71	Welder Qualification for Areas of Limited Accessibility	Rev. 1	Mar-07	General	Conforms. Operational program implementation is described in Section 13.4.
1.72	Spray Pond Piping Made from Fiberglass-Reinforced Thermosetting Resin	Rev. 2	Nov-78	General	Not applicable
1.73	Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants	Rev. 0	Jan-74	General	Conforms
1.75	Criteria for Independence of Electrical Safety Systems	Rev. 3	Feb-05	General	Conforms
1.76	Design Basis Tornado for Nuclear Power Plants	Rev. 1	Mar-07	General	Conforms
1.77	Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized Water Reactors	Rev. 0	May-74	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.78	Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release	Rev. 1	Dec-01	General	Conforms
1.79	Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors	Rev. 1	Sep-75	General	Not applicable
1.81	Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants	Rev. 1	Jan-75	General	Not applicable
1.82	Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident	Rev. 3	Nov-03	General	Conforms
1.83	Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes	Rev. 1	Jul-75	General	Not applicable
1.84	Design, Fabrication, and Materials Code Case Acceptability, ASME Section III	Rev. 33	Aug-05	General	Conforms
1.86	Termination of Operating Licenses for Nuclear Reactors	Rev. 0	Jun-74	General	This RG is outside the scope of the FSAR.
1.87	Guidance for Construction of Class 1 Components in Elevated-Temperature Reactors (Supplement to ASME Section III Code Cases 1592, 1593, 1594, 1595, and 1596)	Rev. 1	Jun-75	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.89	Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants	Rev. 1	Jun-84	General	Conforms. Source terms from RG 1.183 used.
1.90	Inservice Inspection of Prestressed Concrete Containment Structures with Grouted Tendons	Rev. 1	Aug-77	General	Not applicable
1.91	Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants	Rev. 1	Feb-78	General	Conforms
1.92	Combining Modal Responses and Spatial Components in Seismic Response Analysis	Rev. 2	Jul-06	General	Conforms
1.93	Availability of Electric Power Sources	Rev. 0	Dec-74	General	Conforms. Operational program implementation is described in Section 13.4.
1.94	Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants	Rev. 1	Apr-76	General	Exception. Section 17.5 identifies equivalent QA standards in NQA-1, Subpart 2.5.
1.96	Design of Main Steam Isolation Valve Leakage Control Systems for Boiling Water Reactor Nuclear Power Plants	Rev. 1	Jun-76	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.97	Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants	Rev. 4	Jun-06	General	Conforms. Operational program implementation is described in Section 13.4.
1.98	Assumptions Used for Evaluating the Potential Radiological Consequences of a Radioactive Offgas System Failure in a Boiling Water Reactor	Rev. 0	Mar-76	General	Not applicable. Superseded by BTP 11-5.
1.99	Radiation Embrittlement of Reactor Vessel Materials	Rev. 2	May-88	General	Conforms. Operational program implementation is described in Section 13.4.
1.100	Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants	Rev. 2	Jun-88	General	Conforms
1.101	Emergency Response Planning and Preparedness for Nuclear Power Reactors	Rev. 5	Jun-05	General	Not applicable (See Rev. 3 discussion)

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.101		Rev. 3	Aug-05	General	Conforms with the following exception: The EP for Unit 3 utilizes Rev 3 of RG 1.101 which endorses Rev 1 of NUREG-0654/FEMA-REP-1, however, the EP utilizes NEI 07-01, Rev. 0 for EALs instead of Appendix 1 of NUREG-0654/FEMA-REP-1 (NEI 07-01 has not been endorsed by the NRC via revision to RG 1.101 at this time). RG 1.101 Rev 4 is not used because it endorses NEI 99-01 as an alternative to Appendix 1 of NUREG 0654/FEMA-REP-1 regarding EALs; the EP utilizes NEI 07-01. RG 1.101 Rev 5 is not applicable since it addresses co-located licensees.
1.102	Flood Protection for Nuclear Power Plants	Rev. 1	Sep-76	General	Conforms
1.105	Setpoints For Safety-Related Instrumentation	Rev. 3	Dec-99	General	Conforms. Operational program implementation is described in Section 13.4.
1.106	Thermal Overload Protection for Electric Motors on Motor-Operated Valves	Rev. 1	Feb-77	General	Not applicable
1.107	Qualifications for Cement Grouting for Prestressing Tendons in Containment Structures	Rev. 1	Feb-77	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.109	Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I	Rev. 1	Oct-77	General	Conforms
1.110	Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors	Rev. 0	Mar-76	General	Conforms
1.111	Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors	Rev. 1	Jul-77	General	Conforms
1.112	Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Nuclear Power Reactors	Rev. 1	Mar-07	General	Not Applicable. BWR-GALE code is used in DCD Section 12.2.2.1 for gaseous releases (NUREG-0016), and in DCD Section 12.2.2.3 for liquid releases. SSAR Section 3.2 uses the PPE gaseous source term which is a composite from a number of reactor types.
1.113	Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I	Rev. 1	Apr-77	General	Conforms with the following exception: Methodology for liquid release, utilized in Section 12.2.2.4, Liquid Doses Off-Site, is based on RG 1.109.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.114	Guidance to Operators at the Controls and to Senior Operators in the Control Room of a Nuclear Power Unit	Rev. 2	May-89	General	Conforms
1.115	Protection Against Low-Trajectory Turbine Missiles	Rev. 1	Jul-77	General	Conforms
1.116	Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems	Rev. 0	May-77	General	Exception: Section 17.5 identifies equivalent QA standards in NQA-1, Subpart 2.8.
1.117	Tornado Design Classification	Rev. 1	Apr-78	General	Conforms
1.118	Periodic Testing of Electric Power and Protection Systems	Rev. 3	Apr-95	General	Conforms. Operational program implementation is described in Section 13.4.
1.121	Bases for Plugging Degraded PWR Steam Generator Tubes	Rev. 0	Aug-76	General	Not applicable
1.122	Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components	Rev. 1	Feb-78	General	Conforms
1.124	Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports	Rev. 2	Feb-07	General	Conforms
1.125	Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants	Rev. 1	Oct-78	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.126	An Acceptable Model and Related Statistical Methods for the Analysis of Fuel Densification	Rev. 1	Mar-78	General	Conforms
1.127	Inspection of Water-Control Structures Associated with Nuclear Power Plants	Rev. 1	Mar-78	General	Conforms
1.128	Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants	Rev. 2	Feb-07	General	Not applicable. Does not apply to ESBWR VRLA Batteries.
1.129	Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants	Rev. 2	Feb-07	General	Not applicable. Does not apply to ESBWR VRLA Batteries.
1.130	Service Limits and Loading Combinations for Class 1 Plate-and-Shell-Type Component Supports	Rev. 2	Mar-07	General	Conforms
1.131	Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants	Rev. 0	Aug-77	General	Conforms
1.132	Site Investigations for Foundations of Nuclear Power Plan	Rev. 2	Oct-03	General	Conforms.
1.133	Loose-Part Detection Program for the Primary System of Light Water Cooled Reactors	Rev. 1	May-81	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.134	Medical Evaluation of Licensed Personnel for Nuclear Power Plants	Rev. 3	Mar-98	General	Conforms. Although RG 1.134 is not specifically identified in the FSAR, equivalent requirements for medical evaluations for licensed personnel are embedded in policies and procedures of operations and training departments.
1.135	Normal Water Level and Discharge at Nuclear Power Plants	Rev. 0	Sep-77	General	Not applicable. Water levels and discharges were evaluated in the SSAR and ESP-ER.
1.136	Design Limits, Combinations, Materials, Construction, and Testing of Concrete Containments	Rev. 3	Mar-07	General	Conforms
1.137	Fuel-Oil Systems for Standby Diesel Generators	Rev. 1	Oct-79	General	Not applicable
1.138	Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants	Rev. 2	Dec-03	C.1.1 - C.1.2.3, C.2.1 - C.2.3, C.3, C.4.1, C.4.2, C.4.5, C.5.1 - C.5.3	Conforms
				C.4.3	Not applicable. No testing was conducted on reconstituted or remolded samples.
				C.4.4	Not applicable. All particles in the recovered samples tested were included in the testing.

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RG Number	Title	Revision	Date	RG Position	Evaluation
				C.6.1, C.6.2	Exception. Cyclic Triaxial Tests were not performed. Torsional shear testing was performed instead as part of a combined resonant column/torsional shear test. Special procedures were used for dynamic soil property testing that combines laboratory resonant column/torsional shear tests because no published standard methods exist.
				C.6.3	Exception. Resonant column tests were performed as part of a combined resonant column/torsional shear test. Special procedures were used for dynamic soil property testing that combines laboratory resonant column/torsional shear tests because no published standard methods exist.
				C.7	Not applicable. Grand Gulf is considered a soft soil site.
1.139	Guidance for Residual Heat Removal	Rev. 0	May-78	General	Conforms
1.140	Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants	Rev. 2	Jun-01	General	Conforms. Operational program implementation is described in Section 13.4.
1.141	Containment Isolation Provisions for Fluid Systems	Rev. 0	Apr-78	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.142	Safety-Related Concrete Structures for Nuclear Power Plants (Other Than Reactor Vessels and Containments)	Rev. 2	Nov-01	General	Conforms
1.143	Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light Water Cooled Nuclear Power Plants	Rev. 2	Nov-01	General	Conforms. Operational program implementation is described in Section 13.4.
1.145	Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants	Rev. 1	Nov-82	General	Conforms
1.147	Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1	Rev. 14	Aug-05	General	Conforms. Operational program implementation is described in Section 13.4.
1.148	Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants	Rev. 0	Mar-81	General	Conforms
1.149	Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations	Rev. 3	Oct-01	General	Conforms
1.150	Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations	Rev. 1	Feb-83	General	Conforms. Operational program implementation is described in Section 13.4.
1.151	Instrument Sensing Lines	Rev. 0	Jul-83	General	Conforms. Operational program implementation is described in Section 13.4.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.152	Criteria for Use of Computers in Safety Systems of Nuclear Power Plants	Rev. 2	Jan-06	General	Conforms. Operational program implementation is described in Section 13.4.
1.153	Criteria for Safety Systems	Rev. 1	Jun-96	General	Conforms
1.154	Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors	Rev. 0	Jan-87	General	Not applicable
1.155	Station Blackout	Rev. 0	Aug-88	General	Conforms, except no emergency AC power is required for the ESBWR. Only the coping analysis is applicable. Operational program implementation is described in Section 13.4.
1.156	Environmental Qualification of Connection Assemblies for Nuclear Power Plants	Rev. 0	Nov-87	General	Conforms
1.157	Best-Estimate Calculations of Emergency Core Cooling System Performance	Rev. 0	May-89	General	Conforms
1.158	Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants	Rev. 0	Feb-89	General	Conforms
1.159	Assuring the Availability of Funds for Decommissioning Nuclear Reactors	Rev. 1	Oct-03	General	Conforms. The amount of funds for decommissioning and the method of financial assurance is described in COLA Part 1.
1.160	Monitoring the Effectiveness of Maintenance at Nuclear Power Plants	Rev. 2	Mar-97	General	Conforms. Operational program implementation is described in Section 13.4. Maintenance Rule activities are addressed in Section 17.6.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.161	Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft.-Lb.	Rev. 0	Jun-95	General	Not applicable.
1.162	Format and Content of Report for Thermal Annealing of Reactor Pressure Vessels	Rev. 0	Feb-96	General	This RG is outside the scope of the FSAR.
1.163	Performance-Based Containment Leak-Test Program	Rev. 0	Sep-95	General	Conforms
1.165	Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion	Rev. 0	Mar-97	General	Conforms.
1.166	Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions	Rev. 0	Mar-97	General	Conforms. The seismic monitoring program, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site.
1.167	Restart of a Nuclear Power Plant Shut Down by a Seismic Event	Rev. 0	Mar-97	General	Not applicable.
1.168	Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 1	Feb-04	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
1.169	Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 0	Sep-87	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.170	Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 0	Sep-97	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
1.171	Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 0	Sep-97	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
1.172	Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 0	Sep-97	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
1.173	Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	Rev. 0	Sep-97	General	Conforms. Procedures addressed in Section 13.5. ITAAC addressed in COLA Part 10.
1.174	An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis	Rev. 1	Nov-02	General	Not applicable. The approach described in this RG is not being used.
1.175	An Approach for Plant-Specific, Risk-Informed Decisionmaking: Inservice Testing	Rev. 0	Aug-98	General	Not applicable. Risk informed inservice testing is not being used.
1.176	An Approach for Plant-Specific, Risk-Informed Decisionmaking: Graded Quality Assurance	Rev. 0	Aug-98	General	Not applicable. A risk-based graded QA program is not being used.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.177	An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications	Rev. 0	Aug-98	General	Not applicable. Risk informed Technical Specifications are not being used.
1.178	An Approach For Plant-Specific Risk-informed Decisionmaking Inservice Inspection of Piping	Rev. 0	Sep-98	General	Not applicable. Risk informed inservice inspection is not being used.
1.179	Standard Format and Content of License Termination Plans for Nuclear Power Reactors	Rev. 0	Jan-99	General	This RG is outside the scope of the FSAR.
1.180	Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems	Rev. 1	Oct-03	General	Conforms. Operational program implementation is described in Section 13.4.
1.181	Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)	Rev. 0	Sep-99	General	Conforms
1.182	Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants	Rev. 0	May-00	General	Conforms
1.183	Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors	Rev. 0	Jul-00	General	Conforms
1.184	Decommissioning of Nuclear Power Reactors	Rev. 0	Jul-00	General	Not applicable. The RG provides guidance on how to conduct decommissioning activities.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.185	Standard Format and Content for Post-Shutdown Decommissioning Activities Report	Rev. 0	Jul-00	General	This RG is outside the scope of the FSAR.
1.186	Guidance and Examples for Identifying 10 CFR 50.2 Design Bases	Rev. 0	Oct-00	General	This RG is outside the scope of the FSAR.
1.187	Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments	Rev. 0	Nov-00	General	Conforms.
1.188	Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses	Rev. 1	Sep-05	General	Not applicable. This RG is outside the scope of the FSAR.
1.189	Fire Protection for Nuclear Power Plants	Rev. 1	Mar-07	General	Conforms with the following exception. Section C.1.1 of the RG states, in part, that the licensee should assign overall responsibility for the FPP to a person who has management control over all organizations involved in fire protection activities. The organization described in Section 13.1 shows separate reporting chains for the fire protection staff and the fire brigade (operations department) up to the level of the CNO.
1.190	Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence	Rev. 0	Mar-01	General	Conforms. The reactor vessel material surveillance program is described in Section 5.3.1.8. Implementation of the program is described in Section 13.4.

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.191	Fire Protection Program for Nuclear Power Plants During Decommissioning and Permanent Shutdown	Rev. 0	May-01	General	Not applicable. This RG is outside the scope of the FSAR.
1.192	Operation and Maintenance Code Case Acceptability, ASME OM Code	Rev. 0	Jun-03	General	Conforms. Operational program implementation is described in Section 13.4.
1.193	ASME Code Cases Not Approved for Use	Rev. 1	Aug-05	General	Conforms
1.194	Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants	Rev. 0	Jun-03	General	Conforms
1.195	Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors	Rev. 0	May-03	General	Not applicable. RG 1.183 is used.
1.196	Control Room Habitability at Light-Water Nuclear Power Reactors	Rev. 1	Jan-07	General	Conforms
1.197	Demonstrating Control Room Envelope Integrity at Nuclear Power Plant Reactors	Rev. 0	May-03	General	Conforms
1.198	Procedures and Criteria for Assessing Seismic Soil Liquefaction At Nuclear Power Plant Sites	Rev. 0	Nov-03	General	Conforms

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RG Number	Title	Revision	Date	RG Position	Evaluation
1.199	Anchoring Components and Structural Supports in Concrete	Rev. 0	Nov-03	General	Conforms
1.200	An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities	Rev. 1	Jan-07	General	Not applicable
1.201	Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance	Rev. 1	May-06	General	Not applicable
1.202	Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors	Rev. 0	Feb-05	General	Not applicable. The RG provides guidance for submitting decommissioning cost estimates to NRC prior to license termination.
1.203	Transient and Accident Analysis Methods	Rev. 0	Dec-05	General	Conforms
1.204	Guidelines for Lightning Protection of Nuclear Power Plants	Rev. 0	Nov-05	General	Conforms. Operational program implementation is described in Section 13.4.
1.205	Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants	Rev. 0	May-06	General	Not applicable. Risk-informed, performance-based fire protection is not used.
1.206	Combined License Applications for Nuclear Power Plants (LWR Edition)	Rev. 0	Jun-07	General	See Table 1.9-203.

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CONFORMANCE WITH REGULATORY GUIDES

RG Number	Title	Revision	Date	RG Position	Evaluation
1.207	Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors	Rev. 0	Mar-07	General	Conforms
1.208	A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion	Rev. 0	Mar-07	C.1.1, C.1.1.1 - C.1.1.4, C.1.2, C.1.4, C.1.5, C.2.1 - C.2.3, C.2.3.1, C.3, C.3.1 - C.3.5, C.4.0 - C.4.3, C.5.1 - C.5.4	Conforms
				C.1.3	Not applicable. Construction not yet in progress.
				C.2.3.2	Not applicable. Site not in Western US.
				C.2.3.3	Not applicable. No subduction zones in region.
1.209	Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants	Rev. 0	Mar-07	General	Conforms. Operational program implementation is described in Section 13.4.
4.7	General Site Suitability Criteria for Nuclear Power Stations	Rev. 2	Apr-98	General	Conforms.

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RG Number	Title	Revision	Date	RG Position	Evaluation
4.15	Quality Assurance for Radiological Monitoring Programs (Inception Through Normal Operations to License Termination) – Effluent Streams and the Environment	Rev. 1	Feb-79	General	Conforms. Section 11.5.4.5 (NEI 07-09) provides a description of the ODCM. The implementation milestone is provided in Section 13.4.
5.44	Perimeter Intrusion Alarm Systems	Rev. 3	Oct-97	General	Conforms to one test option as discussed in the RG defined by a plant station procedure.
5.62	Reporting of Safeguards Events	Rev. 1	Nov-87	General	Not applicable. Reportability of Safeguards Events is in accordance with 10 CFR 73 Appendix G.
5.66	Access Authorization Program for Nuclear Power Plants	Rev. 0	Jun-91	General	Not applicable. NEI 03-01, Revision 1, April 2004 is used.
8.1	Radiation Symbol	Rev. 0	Feb-73	General	Conforms. The facility utilizes standard radiation symbols.
8.2	Guide for Administrative Practices in Radiation Monitoring	Rev. 0	Feb-73	General	Conforms. Operational program implementation is described in Section 13.4.
8.4	Direct-Reading and Indirect-Reading Pocket Dosimeters	Rev. 0	Feb-73	General	Conforms. Operational program implementation is described in Section 13.4.
8.5	Criticality and Other Interior Evacuation Signals	Rev. 1	Mar-81	General	Conforms. Operational program implementation is described in Section 13.4.
8.6	Standard Test Procedure for Geiger-Muller Counters	Rev. 0	May-73	General	Conforms. Operational program implementation is described in Section 13.4.
8.7	Instructions for Recording and Reporting Occupational Radiation Exposure Data	Rev. 2	Nov-05	General	Conforms. Operational program implementation is described in Section 13.4.

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CONFORMANCE WITH REGULATORY GUIDES

RG Number	Title	Revision	Date	RG Position	Evaluation
8.8	Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable	Rev. 3	Jun-78	General	Conforms. Operational program implementation is described in Section 13.4.
8.9	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program	Rev. 1	Jul-93	General	Conforms. Operational program implementation is described in Section 13.4.
8.10	Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable	Rev. 1-R	May-77	General	Conforms. Operational program implementation is described in Section 13.4.
8.11	Applications of Bioassay for Uranium	Rev. 0	Jun-74	General	Not applicable. RG 8.11 has been superseded by RG 8.9, Rev 1.
8.13	Instruction Concerning Prenatal Radiation Exposure	Rev. 3	Jun-99	General	Conforms. Operational program implementation is described in Section 13.4.
8.15	Acceptable Programs for Respiratory Protection	Rev. 1	Oct-99	General	Conforms. Operational program implementation is described in Section 13.4.
8.19	Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants – Design Stage Man-Rem Estimates	Rev. 1	Jun-79	General	Conforms
8.20	Applications of Bioassay for I-125 and I-131	Rev. 1	Sep-79	General	Exception. Per NUREG-1736, RG 8.20 is outdated. RG 8.9 is used. Operational program implementation is described in Section 13.4.
8.25	Air Sampling in the Workplace	Rev. 1	Jun-92	General	Not applicable

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RG Number	Title	Revision	Date	RG Position	Evaluation
8.26	Applications of Bioassay for Fission and Activation Products	Rev. 0	Sep-80	General	Exception. Per NUREG-1736, RG 8.20 is outdated. RG 8.9 is used. Operational program implementation is described in Section 13.4.
8.27	Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants	Rev. 0	Mar-81	General	Conforms. Operational program implementation is described in Section 13.4.
8.28	Audible-Alarm Dosimeters	Rev. 0	Jul-81	General	Conforms. Operational program implementation is described in Section 13.4.
8.29	Instruction Concerning Risks from Occupational Radiation Exposure	Rev. 1	Feb-96	General	Conforms. Operational program implementation is described in Section 13.4.
8.32	Criteria for Establishing a Tritium Bioassay Program	Rev. 0	Jul-88	General	Exception. Per NUREG-1736, RG 8.20 is outdated. RG 8.9 is used. Operational program implementation is described in Section 13.4.
8.33	Quality Management Program	Rev. 0	Oct-91	General	Not applicable to nuclear power plants. RG 8.33 applies to nuclear medicine.
8.34	Monitoring Criteria and Methods To Calculate Occupational Radiation Doses	Rev. 0	Jul-92	General	Conforms. Operational program implementation is described in Section 13.4.
8.35	Planned Special Exposures	Rev. 0	Jun-92	General	Conforms. Operational program implementation is described in Section 13.4.
8.36	Radiation Dose to the Embryo/Fetus	Rev. 0	Jul-92	General	Conforms. Operational program implementation is described in Section 13.4.
8.38	Control of Access to High and Very High Radiation Areas of Nuclear Plants	Rev. 1	May-06	General	Conforms. Operational program implementation is described in Section 13.4.

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TABLE 1.9-203 (Sheet 1 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.2 1	Introduction and General Description of the Plant	Conforms
C.III.2 1.1	Introduction	Conforms with the following exception: the design of the plant auxiliaries had not been finalized at the time of COLA submittal, therefore, confirmation of net electrical output could not be made.
C.III.2 1.2	General Plant Description	Conforms. Addressed in Sections 1.2.2.19 and 2.0, Figure 1.1-201, and DCD Figures 1.2-1 through 1.2-33.
C.III.2 1.3	Comparisons with Other Facilities	Conforms
C.III.2 1.4	Identification of Agents and Contractors	Conforms with the following exceptions: the architect-engineer and consultants to be utilized during construction, startup and operation had not been chosen at the time of COLA submittal.
C.III.2 1.5	Requirements for Further Technical Information	Conforms
C.III.2 1.6	Material Referenced	Conforms
C.III.2 1.7	Drawings and Other Detailed Information	Conforms
C.III.2 1.8	Site and Plant Design Interfaces and Conceptual Design Information	Conforms. There are no generic changes from the DCD, however, there is one departure from the DCD as discussed in COLA Part 7.
C. III.2 1.9	Conformance with Regulatory Criteria	Conforms

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TABLE 1.9-203 (Sheet 2 of 61) CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.2 2.1.1	Site Location and Description	Conforms
C.III.2 2.1.2.1	Authority	Conforms
C.III.2 2.1.2.2	Control of Activities Unrelated to Plant Operation	Conforms.
C.III.2 2.1.2.3	Arrangements for Traffic Control	Conforms.
C.III.2 2.1.2.4	Abandonment or Relocation of Roads	Conforms.
C.III.2 2.1.3	Population Distribution	Conforms
C.III.2 2.2	Nearby Industrial, Transportation, and Military Facilities	Conforms
C.III.2 2.3.1	Regional Climatology	Conforms
C.III.2 2.3.2	Local Meteorology	Conforms
C.III.2 2.3.3	Onsite Meteorological Measurements Program	Conforms.
C.III.2 2.3.4	Short-Term Atmospheric Dispersion Estimates for Accident Releases	Conforms
C.III.2 2.3.5	Long-Term Atmospheric Dispersion Estimates for Routine Releases	Conforms
C.III.2 2.4.1	Hydrologic Description	Conforms

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TABLE 1.9-203 (Sheet 3 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.2 2.4.2	Floods	Conforms
C.III.2 2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers	Conforms
C.III.2 2.4.4	Potential Dam Failures	Conforms
C.III.2 2.4.5	Probable Maximum Surge and Seiche Flooding	Conforms
C.III.2 2.4.6	Probable Maximum Tsunami Hazards	Conforms
C.III.2 2.4.7	Ice Effects	Conforms.
C.III.2 2.4.8	Cooling Water Canals and Reservoirs	Conforms
C.III.2 2.4.9	Channel Diversions	Conforms
C.III.2 2.4.10	Flooding Protection Requirements	Conforms. There are no safety-related SSCs that are not part of the DC facility.
C.III.2 2.4.11	Low Water Considerations	Conforms
C.III.1 2.4.12.1	Description and Onsite Use	Conforms
C.III.1 2.4.12.2	Sources	Conforms

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TABLE 1.9-203 (Sheet 4 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 2.4.12.3	Subsurface Pathways	Exception. The liquid pathway is not considered because of the mitigation capabilities of the Radwaste Building, tanks, and associated components containing radioactive liquids outside containment.
C.III.1 2.4.12.4	Monitoring or Safeguard Requirements	Not applicable. An operational monitoring program is not required.
C.III.1 2.4.12.5	Site Characteristics for Subsurface Hydrostatic Loading	Conforms
C.III.1 2.4.13	Accidental Release of Radioactive Liquid Effluent in Ground and Surface Waters	Conforms
C.III.2 2.4.14	Technical Specifications and Emergency Operation Requirements	Conforms
C.III.2 2.5.1	Basic Geologic and Seismic Information	Conforms
C.III.1 2.5.2	Vibratory Ground Motion	Conforms
C.III.2 2.5.3	Surface Faulting	Conforms
C.III.1 2.5.4.1	Geologic Features	Conforms
C.III.1 2.5.4.2	Properties of Subsurface Materials	Conforms
C.III.1 2.5.4.3	Foundation Interfaces	Conforms
C.III.1 2.5.4.4	Geophysical Surveys	Conforms

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TABLE 1.9-203 (Sheet 5 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 2.5.4.5	Excavations and Backfill	Conforms with the following exception: Sources of backfill have not been identified. Backfill properties will be verified prior to construction.
C.III.1 2.5.4.6	Ground Water Conditions	Conforms
C.III.1 2.5.4.7	Response of Soil and Rock to Dynamic Loading	Conforms
C.III.1 2.5.4.8	Liquefaction Potential	Conforms
C.III.1 2.5.4.9	Earthquake Site Characteristics	Conforms
C.III.1 2.5.4.10	Static Stability	Conforms
C.III.1 2.5.4.11	Design Criteria	Conforms
C.III.1 2.5.4.12	Techniques to Improve Subsurface Conditions	Conforms
C.III.2 2.5.5	Stability of Slopes	Conforms
C.III.1 3.1	Conformance with NRC General Design Criteria	Conforms. Conformance with the NRC's criteria to 10 CFR 50, Appendix A, is described in DCD Section 3.1 and the applicable DCD system sections.

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**TABLE 1.9-203 (Sheet 6 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN
RG 1.206**

Section	Section Title	Conformance Evaluation
C.III.1 3.2.1	Seismic Classification	Conforms. There are no additional safety-related or RTNSS SSCs subject to seismic classification beyond those addressed in the DCD. There are no SSCs outside the referenced certified design that are required to be designed for an OBE.
C.III.1 3.2.2	System Quality Group Classification	Conforms. There are no additional safety-related or RTNSS SSCs subject to system quality group classification beyond those addressed in the DCD.
C.III.1 3.3.1 (1)	Wind Loadings	Conforms. There are no safety-related SSCs outside the scope of the certified design. Nonsafety-related facility SSCs that are not included in the referenced certified design meet the requirements of DCD Sections 3.3.1.3 and 3.3.2.3.
C.III.1 3.3.1 (2)	Wind Loadings	Conforms
C.III.1 3.3.2	Tornado Loadings	Conforms. There are no safety-related SSCs outside the scope of the certified design. Nonsafety-related facility SSCs that are not included in the referenced certified design meet the requirements of DCD Sections 3.3.1.3 and 3.3.2.3.
C.III.1 3.4.1	Internal Flood Protection	Conforms. There are no SSCs outside the scope of the referenced certified design that require internal flood protection whose failure could prevent a safe shutdown of the plant or result in the uncontrolled release of significant radioactivity.
C.III.1 3.4.2	Analysis Procedures	Conforms. There are no Seismic Category I structures outside the scope of the referenced certified design.

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TABLE 1.9-203 (Sheet 7 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.5.1.1	Internally Generated Missiles (Outside Containment)	Conforms. There are no SSCs outside the scope of the referenced certified design that are required to be protected against damage from internally generated missiles.
C.III.1 3.5.1.2	Internally Generated Missiles (Inside Containment)	Conforms.
C.III.1 3.5.1.3	Turbine Missiles	Conforms. Addressed in DCD Section 10.2.3.8 and FSAR Section 10.2.3.8.
C.III.1 3.5.1.4	Missiles Generated by Tornadoes and Extreme Winds	Conforms. Table 2.0-201 demonstrates that the site-specific tornado characteristics are bounded by the parameters assumed in the DCD. DCD Section 3.5.1.4 indicates that resistance to missiles is independent of site topography.
C.III.1 3.5.1.5	Site Proximity Missiles (Except Aircraft)	Conforms
C.III.2 3.5.1.6	Aircraft Hazards	Conforms
C.III.1 3.5.2	Structures, Systems, and Components To Be Protected from Externally Generated Missiles	Conforms. There are no SSCs outside the scope of the referenced certified design that are required to be protected from externally generated missiles.
C.III.1 3.5.3	Barrier Design Procedures	Conforms. There are no SSCs that require reanalysis for tornado, extreme wind, or site proximity missile impact or for aircraft impact.
C.III.1 3.6	Protection against Dynamic Effects Associated with the Postulated Rupture of Piping	Conforms
C.III.1 3.6.1	Plant Design for Protection against Postulated Piping Failures in Fluid systems Outside of Containment	Conforms

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TABLE 1.9-203 (Sheet 8 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.6.2	Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	Conforms
C.III.1 3.6.3	Leak-Before-Break Evaluation Procedures	Not Applicable. ESBWR design does not rely on a Leak Before Break Evaluation.
C.III.1 3.7.1	Seismic Design Parameters	Conforms. Addressed in DCD Sections 3.7 and 3.7.1.
C.III.1 3.7.1.1	Design Ground Motion	Conforms. Addressed in DCD Section 3.7.1.1 and FSAR Section 2.5.2.
C.III.1 3.7.1.1.1	Design Ground Motion Response Spectra	Conforms with the following exception: there is a departure for an exceedance below 0.2 Hz which is evaluated in Section 3.7.1.1.4 and COLA Part 7.
C.III.1 3.7.1.1.2	Design Ground Motion Time History	Exception. The site-specific earthquake ground motion time history is not developed to match the GMRS/FIRS because the CSDRS are confirmed adequate (Section 3.7.1.1.4). Also Approach 3 of NUREG/CR-6728 was used to develop FIRS at the various foundation levels and did not require the use of acceleration time history.
C.III.1 3.7.1.2	Percentage of Critical Damping Values	Conforms
C.III.1 3.7.1.3	Supporting Media for Seismic Category I Structures	Conforms. Addressed in DCD Section 3.7.1.3 and FSAR Section 2.5.4.
C.III.1 3.7.2	Seismic System Analysis	Conforms. Addressed in DCD Section 3.7.2.
C.III.1 3.7.2.1	Seismic Analysis Methods	Conforms
C.III.1 3.7.2.2	Natural Frequencies and Responses	Conforms. Addressed in DCD Section 3.7.2.2.
C.III.1 3.7.2.3	Procedures Used for Analytical Modeling	Conforms

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**TABLE 1.9-203 (Sheet 9 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206**

Section	Section Title	Conformance Evaluation
C.III.1 3.7.2.4	Soil/Structure Interaction	Conforms. Addressed in DCD Section 3.7.2.4 and Appendix 3A and FSAR Section 2.5.4.
C.III.1 3.7.2.5	Development of Floor Response Spectra	Conforms. Addressed in DCD Section 3.7.2.5.
C.III.1 3.7.2.6	Three Components of Earthquake Motion	Conforms
C.III.1 3.7.2.7	Combination of Modal Responses	Conforms
C.III.1 3.7.2.8	Interaction of Nonseismic Category I Structures with Seismic Category I Structures	Conforms. There are no Seismic Category I structures outside the scope of the referenced certified design. In lieu of providing the plant-specific distances between structures and the heights of structures, the distance and height requirements for Non-Seismic Category I structures are addressed in DCD Section 3.7.2.8.
C.III.1 3.7.2.9	Effects of Parameter Variations on Floor Response Spectra	Conforms. Addressed in DCD Section 3.7.2.9.
C.III.1 3.7.2.10	Use of Constant Vertical Static Factors	Conforms
C.III.1 3.7.2.11	Method Used to Account for Torsional Effects	Conforms
C.III.1 3.7.2.12	Comparison of Responses	Conforms. Addressed in DCD Section 3.7.2.12.
C.III.1 3.7.2.13	Methods for Seismic Analysis of Dams	Not applicable. There are no Seismic Category I dams in the ESBWR design per DCD Section 3.7.3.14.
C.III.1 3.7.2.14	Determination of Dynamic Stability of Seismic Category I Structures	Conforms. Addressed in DCD Sections 3.7.2.14 and 3.8.5.5.
C.III.1 3.7.2.15	Analysis Procedure for Damping	Conforms
C.III.1 3.7.3.1	Seismic Analysis Methods	Conforms
C.III.1 3.7.3.2	Procedures Used for Analytical Modeling	Conforms
C.III.1 3.7.3.3	Analysis Procedure for Damping	Conforms

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CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.7.3.4	Three Components of Earthquake Motion	Conforms
C.III.1 3.7.3.5	Combination of Modal Responses	Conforms. Addressed in DCD Section 3.7.3.7.
C.III.1 3.7.3.6	Use of Constant Vertical Static Factors	Conforms
C.III.1 3.7.3.7	Buried Seismic Category I Piping, Conduits, and Tunnels	Conforms. Addressed in DCD Section 3.7.3.13.
C.III.1 3.7.3.8	Methods for Seismic Analysis of Seismic Category I Concrete Dams	Not applicable. There are no Seismic Category I dams for Unit 3.
C.III.1 3.7.3.9	Methods for Seismic Analysis of Above-Ground Tanks	Conforms. Addressed in DCD Section 3.7.3.15.
C.III.1 3.7.4	Seismic Instrumentation	Conforms
C.III.1 3.8.1	Concrete Containment	Conforms
C.III.1 3.8.2	Steel Containment	Conforms
C.III.1 3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	Conforms
C.III.1 3.8.4	Other Seismic Category I Structures	Conforms. There are no Seismic Category I structures that are outside the scope of the DCD.
C.III.1 3.8.5	Foundations	Conforms
C.III.1 3.9.1	Special Topics for Mechanical Components	Conforms. There are no Seismic Category I components or supports beyond those evaluated in the reference certified design.
C.III.1 3.9.1.1	Design Transients	Conforms. There are no Seismic Category I components or supports beyond those evaluated in the reference certified design.

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TABLE 1.9-203 (Sheet 11 of 61) CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.9.1.2	Computer Programs Used in Analysis	Conforms. There are no Seismic Category I components or supports beyond those evaluated in the reference certified design.
C.III.1 3.9.1.3	Experimental Stress Analysis	Conforms. There are no Seismic Category I components or supports beyond those evaluated in the reference certified design.
C.III.1 3.9.1.4	Considerations for the Evaluation of the Faulted Condition	Conforms. There are no Seismic Category I components or supports beyond those evaluated in the reference certified design.
C.III.1 3.9.2	Dynamic Testing and Analysis of Systems, Components, and Equipment	Conforms. There are no systems outside the scope of the referenced certified design that require dynamic testing and analysis.
C.III.1 3.9.2.1	Piping Vibration, Thermal Expansion, and Dynamic Effects	Conforms. There are no ASME Code Class 1, 2, and 3 systems; other high-energy piping systems inside seismic Category I structures; high-energy portions of systems for which failure could reduce the functioning of any seismic Category I plant feature to an unacceptable level; or seismic Category I portions of moderate-energy piping systems located outside containment outside the scope of the referenced certified design.
C.III.1 3.9.2.2	Seismic Analysis and Qualification of Seismic Category I Mechanical Equipment	Conforms
C.III.1 3.9.2.3	Dynamic Response Analysis of Reactor Internals Under Operational Flow Transients and Steady-State Conditions	Conforms. There are no ESBWR pressure vessel internals that the referenced certified design does not cover.

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**TABLE 1.9-203 (Sheet 12 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206**

Section	Section Title	Conformance Evaluation
C.III.1 3.9.2.4	Pre-Operational Flow-Induced Vibration Testing of Reactor Internals	Conforms. There are no BWR pressure vessel internals that the referenced certified design does not cover. DCD Sections 3.9.2.3 and 3.9.2.4 adequately cover the analysis of potential adverse flow effects that could impact BWR vessel internals.
C.III.1 3.9.2.5	Dynamic System Analysis of the Reactor Internals Under Faulted Condition	Conforms. Addressed in DCD Section 3.9.3.1 and Table 3.9-2.
C.III.1 3.9.2.6	Correlations of Reactor Internals Vibration Tests with the Analytical Results	Conforms. Addressed in DCD Section 3.9.2.6.
C.III.1 3.9.3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures	Conforms. There are no pressure-retaining components or component supports designed or constructed in accordance with ASME Code Class 1, 2, or 3, or GDC 1,2,4,14, or 15, beyond those evaluated in the referenced certified design.
C.III.1 3.9.4	Control Rod Drive Systems	Conforms
C.III.1 3.9.5.1	Design Arrangements	Conforms
C.III.1 3.9.5.2	Loading Conditions	Conforms
C.III.1 3.9.5.3	Design Bases	Conforms
C.III.1 3.9.5.4	BWR Reactor Pressure Vessel Internals Including Steam Dryer	Conforms. There are no reactor pressure vessel internals (including the steam dryer) or other main steam system components that are not covered by the referenced certified design. The reactor is classified as non-prototype.
C.III.1 3.9.6.1	Functional Design and Qualification of Pumps, Valves, and Dynamic Restraints	Conforms. There is no safety-related equipment beyond the scope of the referenced certified design.
C.III.1 3.9.6.2	Inservice Testing Program for Pumps	Not applicable. There are no safety-related pumps.

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TABLE 1.9-203 (Sheet 13 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.9.6.3	Inservice Testing Program for Valves	Conforms. Addressed in DCD Section 3.9.6; the list of valves included in the IST program is provided in Table 3.9-8. IST Program test procedures and schedules are addressed in Technical Specifications 5.5.5. Justification for cold shutdown and refueling outage test schedules is addressed in DCD Section 3.9.6 and Table 3.9-8. The implementation milestones for the IST and MOV Programs are addressed in Section 13.4.
C.III.1 3.9.6.3.1	Inservice Testing Program for Motor-Operated Valves (MOVs)	Conforms. Addressed in DCD Section 3.9.6.
C.III.1 3.9.6.3.2	Inservice Testing Program for Power-Operated Valves (POVs) Other Than MOVs	Conforms. Addressed in DCD Section 3.9.6.
C.III.1 3.9.6.3.3	Inservice Testing Program for Check Valves	Conforms. Addressed in DCD Section 3.9.6.
C.III.1 3.9.6.3.4	Pressure Isolation Valve (PIV) Leak Testing	Not applicable. The ESBWR plant does not have any PIVs.
C.III.1 3.9.6.3.5	Containment Isolation Valve (CIV) Leak Testing	Conforms
C.III.1 3.9.6.3.6	Inservice Testing Program for Safety and Relief Valves	Conforms. Addressed in DCD Table 3.9-8.
C.III.1 3.9.6.3.7	Inservice Testing Program for Manually Operated Valves	Conforms. Addressed in DCD Table 3.9-8.
C.III.1 3.9.6.3.8	Inservice Testing Program for Explosively Activated Valves	Conforms. Addressed in DCD Table 3.9-8.
C.III.1 3.9.6.4	Inservice Testing Program for Dynamic Restraints	Conforms with the following exception: A plant specific snubber table will be prepared in conjunction with closure of ITAAC Table 3.1-1.
C.III.1 3.9.6.5	Relief Requests and Alternative Authorizations to ASME OM Code	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 3.10.1	Seismic Qualification Criteria	Conforms. There is no seismic or dynamic qualification required for equipment that is outside the scope of the referenced certified design.
C.III.1 3.10.2	Methods and Procedures for Qualifying Mechanical and Electrical Equipment and Instrumentation	Conforms
C.III.1 3.10.3	Methods and Procedures of Analysis or Testing of Supports of Mechanical and Electrical Equipment and Instrumentation	Conforms
C.III.1 3.10.4	Test and Analyses Results and Experience Database	Conforms
C.III.1 3.11	Environmental Qualification of Mechanical and Electrical Equipment	Conforms. There is no other equipment beyond that which has been evaluated in the referenced certified design.
C.III.1 3.11.1	Equipment Location and Environmental Conditions	Conforms
C.III.1 3.11.2	Qualification Tests and Analysis	Conforms
C.III.1 3.11.3	Qualification Test Results	Conforms
C.III.1 3.11.4	Loss of Ventilation	Conforms
C.III.1 3.11.5	Estimated Chemical and Radiation Environment	Conforms
C.III.1 3.11.6	Qualification of Mechanical Equipment	Conforms
C.III.1 3.12.1	Introduction	Conforms
C.III.1 3.12.2	Codes and Standards	Conforms. Addressed in DCD Sections 3.2, 3.6, 3.7, and Chapters 5 and 14.
C.III.1 3.12.3	Piping Analysis Methods	Conforms. Addressed in DCD Sections 3.7.2.2 and 3.7.3.9.
C.III.1 3.12.3.1	Experimental Stress Analyses	Conforms. Addressed in DCD Section 3.9.1.3.
C.III.1 3.12.3.2	Modal Response Spectrum Method	Conforms. Addressed in DCD Section 3.7.2.1.

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Section	Section Title	Conformance Evaluation
C.III.1 3.12.3.3	Response Spectra Method (or Independent Support Motion Method)	Conforms. Addressed in DCD Section 3.7.2.1.2.
C.III.1 3.12.3.4	Time History Method	Conforms. Addressed in DCD Section 3.7.2.1.1.
C.III.1 3.12.3.5	Inelastic Analyses Method	Not Applicable. Per DCD Section 3.9.1.4 (Inelastic Analyses Methods), except for pipe whip restraints, inelastic analyses methods are not used in the ESBWR piping design and analysis.
C.III.1 3.12.3.6	Small-Bore Piping Method	Conforms. Addressed in DCD Section 3.7.3.16.
C.III.1 3.12.3.7	Nonseismic/Seismic Interaction (II/I)	Conforms with the following exception: The location and distance between piping systems will be established as part of the completion of ITAAC Table 3.1-1.
C.III.1 3.12.3.8	Seismic Category I Buried Piping	Not Applicable. Per DCD Section 3.7.3.13, there is no buried Seismic Category I piping.
C.III.1 3.12.4	Piping Modeling Technique	Conforms. Addressed in DCD Section 3.7.3.3.1 and Appendix 3D for the PISYS computer code.
C.III.1 3.12.4.1	Computer Codes	Conforms. Addressed in DCD Appendix 3D.
C.III.1 3.12.4.2	Dynamic Piping Model	Conforms. Addressed in DCD Section 3.7.3.3.1.
C.III.1 3.12.4.3	Piping Benchmark Program	Conforms. Addressed in DCD Appendix 3D.
C.III.1 3.12.4.4	Decoupling Criteria	Conforms. Addressed in DCD Sections 3.7.2.3 and 3.7.3.16.
C.III.1 3.12.5.1	Seismic Input Envelope vs. Site-Specific Spectra	Conforms. Addressed in DCD Section 3.7.1.
C.III.1 3.12.5.2	Design Transients	Conforms. Addressed in DCD Section 3.9.1.1 and DCD Table 3.9-1.

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TABLE 1.9-203 (Sheet 16 of 61) CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 3.12.5.3	Loadings and Load Combination	Conforms. Addressed in DCD Section 3.9.1.1 and DCD Table 3.9-8.
C.III.1 3.12.5.4	Damping Values	Conforms. Addressed in DCD Section 3.7.1.2 and DCD Table 3.7-1.
C.III.1 3.12.5.5	Combination of Modal Responses	Conforms. Addressed in DCD Section 3.7.3.7.
C.III.1 3.12.5.6	High-Frequency Modes	Conforms. Addressed in DCD Sections 3.7.1.1 and 3.7.1.2.
C.III.1 3.12.5.7	Fatigue Evaluation of ASME Code Class 1 Piping	Conforms. Addressed in DCD Section 3.9.3.4 and DCD Table 3.9-8.
C.III.1 3.12.5.8	Fatigue Evaluation of ASME Code Class 2 and 3 Piping	Conforms. Addressed in DCD Section 3.9.
C.III.1 3.12.5.9	Thermal Oscillations in Piping Connected to the Reactor Coolant System	Conforms
C.III.1 3.12.5.10	Thermal Stratification	Conforms. Addressed in DCD Section 3.9.2.1.2.
C.III.1 3.12.5.11	Safety Relief Valve Design, Installation, and Testing	Conforms. Addressed in DCD Figures 5.2-3 and 5.4-3, and DCD Table 3.9-8.
C.III.1 3.12.5.12	Functional Capability	Conforms. Addressed in DCD Table 3.9-2, Note 13, and DCD Chapters 5 and 6.
C.III.1 3.12.5.13	Combination of Inertial and Seismic Anchor Motion Effects	Conforms. Addressed in DCD Section 3.7.3.9.
C.III.1 3.12.5.14	Operating-Basis Earthquake as a Design Load	Not applicable. The SSE establishes the design load for the ESBWR.
C.III.1 3.12.5.15	Welded Attachments	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.5.16	Modal Damping for Composite Structures	Conforms. Addressed in DCD Section 3.7.2.13.
C.III.1 3.12.5.17	Minimum Temperature for Thermal Analyses	Conforms. Addressed in DCD Sections 3.9.1.1 and 3.9.3.1.

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Section	Section Title	Conformance Evaluation
C.III.1 3.12.5.18	Intersystem Loss-of-Coolant Accident	Conforms. Addressed in DCD Appendix 3K.
C.III.1 3.12.5.19	Effects of Environment on Fatigue Design	Conforms. Addressed in DCD Section 3.9.3.4. The reference in RG 1.206 to 1.76 appears to be in error, and should have referenced 1.207.
C.III.1 3.12.6.1	Applicable Codes	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.2	Jurisdictional Boundaries	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.3	Loads and Load Combinations	Conforms. Addressed in DCD Section 3.9 and DCD Appendix 3B.
C.III.1 3.12.6.4	Pipe Support Baseplate and Anchor Bolt Design	Conforms. Addressed in DCD Section 3.9.3.7.
C.III.1 3.12.6.5	Use of Energy Absorbers and Limit Stops	Conforms. Addressed in DCD Section 3.9.3.7.
C.III.1 3.12.6.6	Use of Snubbers	Conforms. Addressed in DCD Section 3.9.3.7.1(3).
C.III.1 3.12.6.7	Pipe Support Stiffnesses	Conforms. Addressed in DCD Section 3.7.3.3.1.
C.III.1 3.12.6.8	Seismic Self-Weight Excitation	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.9	Design of Supplementary Steel	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.10	Consideration of Friction Forces	Conforms. Addressed in DCD Section 3.9.3.7.1(5).
C.III.1 3.12.6.11	Pipe Support Gaps and Clearances	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.12	Instrumentation Line Support Criteria	Conforms. Addressed in DCD Section 3.9.3.7.1.
C.III.1 3.12.6.13	Pipe Deflection Limits	Conforms. Addressed in DCD Section 3.9.2.1.1 and Chapter 14.
C.III.1 3.13	Threaded Fasteners – ASME code Class 1, 2, and 3	Conforms
C.III.1 3.13.1.1	Materials Selection	Conforms
C.III.1 3.13.1.2	Special Materials fabrication Processes and Special Controls	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 3.13.1.3	Fracture Toughness Requirements for Threaded Fasteners Made of Ferritic Materials	Conforms
C.III.1 3.13.1.5	Certified Material Test Reports	Conforms
C.III.1 3.13.2	Inservice Inspection Requirements	Conforms
C.III.1 4.1	Reactor: Summary Description	Conforms
C.III.1 4.2	Fuel System Design	Conforms
C.III.1 4.3	Nuclear Design	Conforms
C.III.1 4.4	Thermal and Hydraulic Design	Conforms
C.III.1 4.5.1	Control Rod Drive Structural Materials	Conforms
C.III.1 4.5.2	Reactor Internal and Core Support Materials	Conforms
C.III.1 4.6	Functional Design of Reactivity Control System	Conforms
C.III.1 5.1	Reactor Coolant and Connecting Systems: Summary Description	Conforms
C.III.1 5.2.1	Compliance with ASME Codes and Code Cases	Conforms
C.III.1 5.2.2.1	Design Bases	Conforms
C.III.1 5.2.2.2	Design Evaluation	Conforms
C.III.1 5.2.2.3	Piping and Instrumentation Diagrams	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 5.2.2.4	Equipment and Component Description	Conforms
C.III.1 5.2.2.5	Mounting of Pressure-Relief Devices	Conforms
C.III.1 5.2.2.6	Applicable Codes and Classification	Conforms
C.III.1 5.2.2.7	Material Specification	Conforms
C.III.1 5.2.2.8	Process Instrumentation	Conforms
C.III.1 5.2.2.9	System Reliability	Conforms
C.III.1 5.2.2.10	Testing and Inspection	Conforms. Addressed in DCD Section 5.2.2.4, and in Section 3.9 and Chapter 14.
C.III.1 5.2.3.1	Material Specifications	Conforms
C.III.1 5.2.3.2	Compatibility with Reactor Coolant	Conforms. Addressed in DCD Section 5.2.3.
C.III.1 5.2.3.3	Fabrication and Processing of Ferritic Materials	Conforms
C.III.1 5.2.3.4	Fabrication and Processing of Austenitic Stainless Steels	Conforms
C.III.1 5.2.3.5	Prevention of Primary Water Stress-Corrosion Cracking for Nickel-Based Alloys (PWRs only)	Not applicable. Applies only to PWRs.
C.III.1 5.2.3.6	Threaded Fasteners	Conforms. Addressed in DCD Section 3.9.3.9.

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Section	Section Title	Conformance Evaluation
C.III.1 5.2.4.1	Inservice Inspection and Testing Program	Conforms. Addressed in DCD Section 5.2.4 and in FSAR Section 5.2.4.
C.III.1 5.2.4.2	Preservice Inspection and Testing Program	Conforms. Addressed in DCD Section 5.2.4.
C.III.1 5.2.5	Reactor Coolant Pressure Boundary Leakage Detection	Conforms
C.III.1 5.3.1.1	Material Specifications	Conforms
C.III.1 5.3.1.2	Special Processes Used for Manufacturing and Fabrication	Conforms
C.III.1 5.3.1.3	Special Methods for Nondestructive Examination	Conforms
C.III.1 5.3.1.4	Special Controls for Ferritic and Austenitic Stainless Steels	Conforms
C.III.1 5.3.1.5	Fracture Toughness	Conforms
C.III.1 5.3.1.6	Material Surveillance	Conforms. Addressed in DCD Section 5.3.1.6 and FSAR Section 5.3.1.8.
C.I.1 5.3.1.7	Reactor Vessel Fasteners	Although Regulatory Position C.III.1 provides a Section Number 5.3.1.7; there is no specific direction provided for COL applicants. A review of Regulatory Position C.I Section 5.3.17 was performed and the information requested is provided in the DCD Section 5.3.1.7.
C.III.1 5.3.2.1	Limit Curves	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 5.3.2.2	Operating Procedures	Conforms. Addressed in DCD Sections 5.3.2.1, 5.3.2.2, and 5.3.3.6, and FSAR Section 5.3.3.6.
C.III.1 5.3.2.3	Pressurized Thermal Shock (PWRs only)	Not applicable. Applies only to PWRs.
C.III.1 5.3.2.4	Upper-Shelf Energy	Conforms
C.III.1 5.3.3	Reactor Vessel Integrity	Conforms. Identification of a specific manufacturer is not required.
C.III.1 5.3.3.1	Design	Conforms
C.III.1 5.3.3.2	Materials of Construction	Conforms
C.III.1 5.3.3.3	Fabrication Methods	Conforms
C.III.1 5.3.3.4	Inspection Requirements	Conforms. Addressed in DCD Section 5.3.3.4.
C.III.1 5.3.3.5	Shipment and Installation	Conforms. Addressed in DCD Section 5.3.3.5.
C.III.1 5.3.3.6	Operating Conditions	Conforms. Addressed in DCD Section 5.3.3.6 and FSAR Section 5.3.3.6.
C.III.1 5.3.3.7	Inservice Surveillance	Conforms. Addressed in DCD Section 5.3.3.7.
C.III.1 5.3.3.8	Threaded Fasteners	Conforms. Addressed in DCD Section 3.9.3.9 and FSAR Section 3.13.
C.III.1 5.4.1	Reactor Coolant Pumps or Circulation Pumps (BWR)	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 5.4.1.1	Pump Flywheel Integrity (PWR)	Not applicable. Applies only to PWRs.
C.III.1 5.4.2	Steam Generators (PWR)	Not applicable. Applies only to PWRs.
C.III.1 5.4.3	Reactor Coolant System Piping and Valves	Conforms
C.III.1 5.4.4	Main Steamline Flow Restrictions	Conforms
C.III.1 5.4.5	Pressurizer	Not applicable. Applies only to PWRs.
C.III.1 5.4.6	Reactor Core Isolation Cooling System (BWRs)/Isolation Condenser System (Economic Simplified BWR)	Conforms
C.III.1 5.4.7	Residual Heat Removal System/ Passive Residual Heat Removal System (Advanced Light-Water Reactor/Shutdown Cooling Mode of the Reactor Water Cleanup System (Economic Simplified BWR)	Conforms
C.III.1 5.4.8	Reactor Water Cleanup System (BWR)/Reactor Water Cleanup/ Shutdown Cooling System (Economic Simplified BWR)	Conforms
C.III.1 5.4.9	Reactor Coolant System Pressure Relief Devices/Reactor Coolant Depressurization Systems	Conforms
C.III.1 5.4.10	Reactor Coolant System Component Supports	Conforms
C.III.1 5.4.11	Pressurizer Relief Discharge System (PWRs only)	Not applicable. Applies only to PWRs.
C.III.1 5.4.12	Reactor Coolant System High-Point Vents	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 5.4.13	Main Steamline, Feedwater, and Auxiliary Feedwater Piping	Conforms
C.III.1 6.1	Engineered Safety Features: Engineered Safety Feature Materials	Conforms. Addressed in DCD Section 6.1.
C.III.1 6.1.1.1	Materials Selection and Fabrication	Conforms
C.III.1 6.1.1.2	Composition and Compatibility of Core Cooling Coolants and Containment Sprays	Conforms. Addressed in DCD Sections 5.2.3.2, 5.4.8, 9.3.10, 5.2.3.4.1, 6.1.1.3.4, 9.1.3, 6.1.1.4, and 6.1.2.
C.III.1 6.1.2	Organic Materials	Exception. The information requested by the RG is not available at this time, but commitments and a milestone for completing COL Item 6.1.3-1-A, which pertains to this guidance, are addressed in Section 6.1.2.3.
C.III.1 6.2	Containment Systems	Conforms
C.III.1 6.2.1	Containment Functional Design	Conforms
C.III.1 6.2.2	Containment Heat Removal Systems	Conforms
C.III.1 6.2.3	Secondary Containment Functional Design	Not Applicable. The ESBWR plant does not have a secondary containment.
C.III.1 6.2.4	Containment Isolation System	Conforms.
C.III.1 6.2.5	Combustible Gas Control in Containment	Conforms.

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Section	Section Title	Conformance Evaluation
C.III.1 6.2.6	Containment Leakage Testing	Conforms. Addressed in DCD Sections 6.2.6.1 through 6.2.6.5, and in FSAR Section 13.4. Special testing requirements in RG 1.206, Section C.III.1, Section 6.2.6.5 are not applicable to the ESBWR.
C.III.1 6.2.7	Fracture Prevention of Containment Pressure Vessel	Conforms
C.III 6.3	Emergency Core Cooling System	Conforms. There are no aspects of the site-specific design that affect the LOCA analyses in the DCD.
C.III.1 6.4	Habitability Systems	Conforms
C.III.1 6.5	Fission Product Removal and Control Systems	Conforms
C.III.1 6.6	Inservice Inspection of Class 2 and 3 Components	Conforms. Addressed in DCD Section 6.6 and in FSAR Section 6.6.10.3.
C.III.1 6.6.1	Components Subject to Examination	Conforms
C.III.1 6.6.2	Accessibility	Conforms
C.III.1 6.6.3	Examination Techniques and Procedures	Conforms. Addressed in DCD Section 6.6.3.2. There are no special examination techniques required to meet the ASME Code.
C.III.1 6.6.4	Inspection Intervals	Conforms. Addressed in DCD Section 6.6.4.
C.III.1 6.6.5	Examination Categories and Requirements	Conforms. Addressed in DCD Section 6.6.3.1.

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Section	Section Title	Conformance Evaluation
C.III.1 6.6.6	Evaluation of Examination Results	Conforms (addressed in DCD Section 6.6.5), except that RG 1.206 references ASME Code Sections IWC-4000 and IWD-4000 for Class 2 and Class 3, respectively, whereas DCD Section 6.6.5 references IWA-4000. Later editions of ASME Code Section XI do not contain Sections IWC-4000 and IWD-4000, only IWA-4000. Therefore, the intent of the RG is met.
C.III.1 6.6.7	System Pressure Tests	Conforms. Addressed in DCD Section 6.6.6.
C.III.1 6.6.8	Augmented Inservice Inspection to Protect against Postulated Piping Failures	Conforms. Addressed in DCD Section 6.6.7.
C.III.1 6.7	Main Steamline Isolation Valve Leakage Control Steam (BWRs)	Not applicable to the ESBWR.
C.III.1 7	Instrumentation and Controls	Conforms. Addressed in DCD Chapter 7, Tier 1, and design-related ITAAC (DAC). There are no departures from the referenced certified design.
C.III.1 7.1	Introduction	Conforms. There is no safety-related instrumentation, control, or supporting system that has not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.2	Reactor Trip System	Conforms. There is no reactor trip system instrumentation, control, or supporting system that has not been addressed in the referenced certified design or other parts of the COL application.

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Section	Section Title	Conformance Evaluation
C.III.1 7.3	Engineered Safety Features Systems	Conforms. There are no ESF systems I&C or supporting systems that have not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.4	Systems Required for safe Shutdown	Conforms. There are no safe-shutdown systems I&C or supporting systems that have not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.5	Information Systems Important to Safety	Conforms. There are no information systems important to safety that have not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.6	Interlock Systems Important to Safety	Conforms. There are no interlock systems important to safety that have not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.7	Control Systems Not Required for Safety	Conforms. There is no control system instrumentation or supporting system that has not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.8	Diverse Instrumentation and Control Systems	Conforms. There is no diverse I&C system that has not been addressed in the referenced certified design or other parts of the COL application.
C.III.1 7.9	Data Communication Systems	Conforms. There are no data communication systems that have not been addressed in the referenced certified design or other parts of the COL application.

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Section	Section Title	Conformance Evaluation
C.III.1 8	Electrical Power	Conforms
C.III.1 8.1	Introduction	Conforms. There are no safety-related or RTNSS onsite AC or DC loads that are added to the referenced certified design. There are no safety-related or RTNSS electrical systems that are beyond the scope of the referenced certified design.
C.III.1 8.2.1	Description	Conforms (as it relates to passive designs). Addressed in Sections 8.2.1, 8.2.2 and 8.2.3, Table 8.2-201, Figures 8.2-202, 8.2-203, and 8.2-204 and DCD Section 8.2.3.
C.III.1 8.2.2	Analysis	Conforms (as it relates to BWRs and passive designs). Addressed in Section 8.2.2.
C.III.1 8.3.1.1	AC Power Systems: Description	Conforms. Addressed in DCD Section 8.3.1 and in FSAR Section 8.3.1.1.
C.III.1 8.3.1.2	Analysis	Not applicable. Does not request information for passive designs.
C.III.1 8.3.1.3	Electrical Power System Calculations and Distribution System Studies for AC Systems	Conforms
C.III.1 8.3.2.1	DC Power Systems: Description	Not applicable. Does not request information for passive designs.
C.III.1 8.3.2.2	Analysis	Not applicable. Does not request information for passive designs.
C.III.1 8.3.2.3	Electrical Power System Calculations and Distribution System Studies for DC Systems	Conforms
C.III.1 8.4.1(1)	Station Blackout: Description	Not applicable. Does not request information for passive designs.

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Section	Section Title	Conformance Evaluation
C.III.1 8.4.1(2)		Not applicable. Does not request information for passive designs.
C.III.1 8.4.1(3)		Conforms. Addressed in Section 8.3.2.1.1.
C.III.1 8.4.1(4)		Conforms. Addressed in Section 8.3.2.1.1.
C.III.1 8.4.2	Analysis	Not applicable. Does not request information for passive designs.
C.III 9.1.1	Fuel Storage and Handling: Criticality Safety of Fresh and Spent Fuel Storage and Handling	Conforms. Addressed in DCD Sections 9.1.1 and 9.1.2.
C.III 9.1.2	New and Spent Fuel Storage	Conforms. Addressed in DCD Section 9.1.2.
C.III 9.1.3	Spent Fuel Pool Cooling and Cleanup System	Conforms. Addressed in DCD Section 9.1.3.
C.III 9.1.4	Light Load Handling System (Related to Refueling)	Conforms
C.III.1 9.1.5	Overhead Heavy Load Handling System	Conforms. Addressed in DCD Section 9.1.5.5 and in Sections 9.1.4 and 9.1.5.
C.III.1 9.2.1	Station Service Water System (Open, Raw Water Cooling Systems):	Conforms. Addressed in DCD Section 9.2.1 and FSAR Section 9.2.1. FSAR Section 9.2.1.2 supplies information on the site-specific PSWS heat sink and provisions to preclude corrosion and fouling.
C.III.1 9.2.2	Cooling System for Reactor Auxiliaries (Closed Cooling Water Systems)	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 9.2 (for DCD Section 9.2.3)	Makeup Water System	Conforms. Design Bases, Safety Evaluation, Inspection and Testing Requirements, and Instrumentation are addressed in DCD Section 9.2.3. System Description is addressed in Section 9.2.3.
C.III.1 9.2.4	Potable and Sanitary Water Systems	Conforms
C.III.1 9.2.5	Ultimate Heat Sink	The design of the UHS is within the scope of the referenced certified design, and inspection and testing requirements are addressed in DCD Section 9.2.5.
C.III.1 9.2.6	Condensate Storage Facilities	Conforms. There are no safety-related or RTNSS condensate storage facilities outside the scope of the referenced certified design that are sources of water for residual heat removal or sources of coolant inventory makeup for safety-related systems.
C.III.1 9.2 (for DCD Section 9.2.7)	Chilled Water System	Conforms. Addressed in DCD Section 9.2.7.
C.III.1 9.2 (for DCD Section 9.2.8)	Turbine Component Cooling Water System	Conforms. Addressed in DCD Section 9.2.8.
C.III.1 9.2 (for DCD Section 9.2.10)	Station Water System	Conforms. Design Bases, Safety Evaluation, Inspection and Testing Requirements, and Instrumentation are addressed in DCD Section 9.2.10. System Description is addressed in Section 9.2.10.

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Section	Section Title	Conformance Evaluation
C.III.1 9.3	Process Auxiliaries	Conforms. Hydrogen Water Chemistry is addressed in Section 9.3.9, Oxygen Injection System is addressed in Section 9.3.10, Zinc Injection System is addressed in Section 9.3.11, and Auxiliary Boiler System is addressed in DCD Section 9.3.12.
C.III.1 9.3 1	Compressed Air Systems	Conforms. Instrument Air is addressed in DCD Section 9.3.6, Service Air is addressed in DCD Section 9.3.7, and High Pressure Nitrogen Supply System is addressed in DCD Section 9.3.8.
C.III.1 9.3.2	Process and Postaccident Sampling Systems	Conforms
C.III.1 9.3.3	Equipment and Floor Drain System	Conforms. Addressed in DCD Section 9.3.3.
C.III.1 9.3.4	Chemical and Volume Control System (PWRs) (Including Boron Recovery System)	Not applicable. Applies only to PWRs.
C.III.1 9.3.5	Standby Liquid Control System	Conforms
C.III.1 9.4	Air Conditioning, Heating, Cooling, and Ventilation Systems	Conforms. Reactor Building HVAC System is addressed in DCD Section 9.4.6, Electric Building Heating, Ventilation, and Air Conditioning System is addressed in DCD Section 9.4.7, and Drywell Cooling System is addressed in DCD Section 9.4.8.
C.III.1 9.4.1	Control Room Area Ventilation System	Conforms

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RG 1.206**

Section	Section Title	Conformance Evaluation
C.III.1 9.4.2	Spent Fuel Pool Area Ventilation Systems	Conforms
C.III.1 9.4.3	Auxiliary and Radwaste Area Ventilation System	Conforms
C.III.1 9.4.4	Turbine Building Area Ventilation System	Conforms
C.III.1 9.4.5	Engineered Safety Feature Ventilation System	Conforms
C.III.I 9.5.1	Fire Protection Program	Conforms
C.III.1 9.5.1.1(1)		Conforms
C.III.1 9.5.1.1(2)		Conforms
C.III.1 9.5.1.1(3)		Conforms. Addressed in Section 1.7.
C.III.1 9.5.1.1(4)		Conforms. Will be completed in accordance with the milestones in Section 13.4.
C.III.1 9.5.1.1(5)		Conforms. Will be completed in accordance with the milestones in Section 13.4.
C.III.1 9.5.1.1(6)		Conforms
C.III.1 9.5.1.1(7)		Conforms. Will be completed in accordance with the milestones in Section 13.4.
C.III.1 9.5.1.1(8)		Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 9.5.1.1(9)		Conforms. Addressed in DCD Sections 9.5.1.15 and 14.3, and in FSAR Section 13.4.
C.III.1 9.5.2	Communication System	Conforms. Addressed in DCD Section 9.5.2 and in FSAR Section 9.5.2.
C.III.1 9.5.3	Lighting System	Conforms. Addressed in DCD Section 9.5.3.
C.III.1 9.5.4	Diesel Generator Fuel Oil Storage and Transfer Systems	Conforms. Addressed in DCD Section 9.5.4 and in FSAR Section 9.5.4.
C.III.1 9.5.5	Diesel Generator Cooling Water Systems	Conforms. Addressed in DCD Section 9.5.5.
C.III.1 9.5.6	Diesel Generator Starting Systems	Conforms. Addressed in DCD Section 9.5.6.
C.III.1 9.5.7	Diesel Generator Lubrication Systems	Conforms. Addressed in DCD Section 9.5.7.
C.III.1 9.5.8	Diesel Generator Combustion Air Intake and Exhaust System	Conforms. Addressed in DCD Section 9.5.8.
C.III.1 10.1	Steam and Power Conversion: Introduction	Conforms. There are no principal design features of the steam and power conversion system that are outside the scope of the referenced certified design.
C.III.1 10.2.1 (1)	Design Bases	Conforms. Addressed in DCD Section 10.2.1.
C.III.1 10.2.1 (2)	Design Bases	Conforms. Addressed in DCD Section 10.2.2.
C.III.1 10.2.1 (3)	Design Bases	Conforms. Addressed in DCD Sections 3.5.1, 3.5.3, 3.6, and 10.2.4, and DCD Figure 3.5-2.
C.III.1 10.2.2 (1)	Description	Conforms. Addressed in DCD Sections 10.2.2, 10.2.3, and DCD Figures 1.2-12 to 1.2-20, 3.5-2, and 10.1-1.

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Section	Section Title	Conformance Evaluation
C.III.1 10.2.2 (2)	Description	Conforms. Addressed in DCD Sections 10.2.2 and 10.2.3.
C.III.1 10.2.2 (3)	Description	Conforms. Addressed in DCD Section 10.2.2 and DCD Figures 10.2-1, 10.2-2, and 10.2-3.
C.III.1 10.2.2 (4)	Description	Conforms. Addressed in DCD Sections 10.2.3 and 14.2.8.
C.III.1 10.2.2 (5)	Description	Conforms. Addressed in DCD Sections 12.2.1, 12.2.3, 12.4.4, Table 12.2-23 and DCD Figures 12.3-12 to 12.3-18 and 12.3-32 to 12.3-38.
C.III.1 10.2.2 (6)	Description	Conforms. Addressed in DCD Sections 3.6, 10.2.2, and 10.2.4.
C.III.1 10.2.3 (1)	Turbine Rotor Integrity	Conforms. Addressed in DCD Section 10.2.3 and FSAR Section 10.2.3.
C.III.1 10.2.3 (2)	Turbine Rotor Integrity	Conforms. Addressed in DCD Section 10.2.3 and FSAR Section 10.2.3.
C.III.1 10.2.3 (3)	Turbine Rotor Integrity	Conforms. Addressed in DCD Section 10.2.3 and FSAR Section 10.2.3.
C.III.1 10.2.3 (4)	Turbine Rotor Integrity	Conforms. Addressed in DCD Section 10.2.3 and FSAR Section 10.2.3.
C.III.1 10.2.3 (5)	Turbine Rotor Integrity	Conforms. Addressed in DCD Sections 10.2.2 and 10.2.3, and FSAR Section 10.2.3.
C.III.1 10.3	Main Steam Supply System	Conforms. Addressed in DCD Section 10.3.
C.III.1 10.3.1 (1)	Design Bases	Conforms. Addressed in DCD Section 10.3.1.
C.III.1 10.3.1 (2)	Design Bases	Conforms. Addressed in DCD Section 10.3.
C.III.1 10.3.1 (3)	Design Bases	Conforms. Addressed in DCD Sections 10.3.2 and 10.3.3.
C.III.1 10.3.1 (4)	Design Bases	Conforms. Addressed in DCD Section 10.3.

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Section	Section Title	Conformance Evaluation
C.III.1 10.3.1 (5)	Design Bases	Conforms. Addressed in DCD Section 10.3.3.
C.III.1 10.3.1 (6)	Design Bases	Conforms. Addressed in DCD Section 10.3.
C.III.1 10.3.2	Description	Conforms. Addressed in DCD Section 10.3.3.
C.III.1 10.3.3	Evaluation	Conforms. Addressed in DCD Section 10.3.
C.III.1 10.3.4	Inspection and Testing Requirements	Conforms. Addressed in DCD Section 10.3.4.
C.III.1 10.3.5	Water Chemistry (PWR Only)	Not applicable. Only applies to PWRs.
C.III.1 10.3.6 (1)	Steam and Feedwater System Materials	Conforms. Addressed in DCD Section 10.3.6.
C.III.1 10.3.6 (2)	Steam and Feedwater System Materials	Conforms. Addressed in DCD Sections 6.6 and 10.3.4.
C.III.1 10.3.6 (3)	Steam and Feedwater System Materials	Not applicable. DCD Section 10.3.6 states that there are no austenitic stainless steels in the steam and feedwater system piping.
C.III.1 10.3.6 (4)	Steam and Feedwater System Materials	Not Applicable. DCD Section 10.3.6 states that there are no austenitic stainless steels in the ASME Code Section III Class 1 and 2 portions of steam and feedwater piping.
C.III.1 10.3.6 (5)	Steam and Feedwater System Materials	Conforms. Addressed in DCD Section 10.3.
C.III.1 10.3.6 (6)	Steam and Feedwater System Materials	Not applicable. Additional information is not required.
C.III.1 10.4	Other Features of the Steam and Power Conversion System	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 10.4.1	Main Condensers	Conforms. Sampling points for detection are discussed in DCD Section 10.4.1.5.4. Although sodium content and sampling for sodium content is not specifically mentioned in DCD Section 10.4.1, monitoring condensate for an increase in conductivity is considered an acceptable means to detect condenser tube leakage. A table of key parameters and associated action levels is provided as Table 10.4-201. Alarm setpoints are established to provide an indication of abnormal chemistry conditions prior to reaching a recommended action level.
C.III.1 10.4.2	Main Condenser Evacuation System	Conforms. There are no design features of the main condenser evacuation system that are outside the scope of the referenced certified design.
C.III.1 10.4.3 (1)	Turbine Gland Sealing System	Conforms. Addressed in DCD Section 10.4.3.
C.III.1 10.4.3 (2)		Conforms with the following exception: For the operational phase, the QA Program is described in Chapter 17, and is based on NQA-1, rather than RG 1.33.
C.III.1 10.4.4 (1)	Turbine Bypass System	Conforms. The Turbine Bypass System is consistent with the referenced certified design.
C.III.1 10.4.5 (1)	Circulating Water System	Conforms
C.III.1 10.4.5 (2)		Not applicable. The circulating water system does not interface with the UHS.
C.III.1 10.4.6 (1)	Condensate Cleanup System	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 10.4.6 (2)		Conforms. Addressed in DCD Sections 10.4.1, 10.4.6, and 5.2.3, DCD Table 5.2-5, and in Table 10.4-201.
C.III.1 10.4.6 (3)		Conforms.
C.III.1 10.4.6 (4)		Not applicable. Only applies to PWRs.
C.III.1 10.4.7 (1)	Condensate and Feedwater Systems	Not applicable. Only applies to PWRs.
C.III.1 10.4.7 (2)		Conforms. Addressed in DCD Sections 1.2.2 and 5.2.4, and DCD Tables 1.9-22 and 1.11-1.
C.III.1 10.4.7 (3)		Not applicable. The condensate and feedwater systems are consistent with the referenced certified design.
C.III.1 10.4.8	Steam Generator Blowdown System (PWR)	Not applicable. Only applies to PWRs.
C.III.1 10.4.9	Auxiliary Feedwater System (PWR)	Not applicable. Only applies to PWRs.
C,III.1 11.1	Source Terms	Conforms
C.III.1 11.2.1(1)	Liquid Waste Management Systems: Design Bases	Conforms. Addressed in DCD Section 11.2 and in FSAR Section 11.2.
C.III.1 11.2.1(2)	Design Bases	Conforms. Addressed in DCD Section 11.2.
C.III.1 11.2.1(3)	Design Bases	Conforms. Addressed in DCD Section 11.2.1 and DCD Table 11.2-3. Conformance with RG 1.140 is addressed in DCD Section 9.4.3.
C.III.1 11.2.1(4)	Design Bases	Conforms. Addressed in DCD Section 9.4.3.

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Section	Section Title	Conformance Evaluation
C.III.1 11.2.1(5)	Design Bases	Conforms. Addressed in DCD Sections 11.2.3 and 15.3.16 and in FSAR Section 2.4.13.
C.III.1 11.2.1(6)	Design Bases	Conforms. Quality Assurance Program requirements are addressed in Chapter 17.
C.III.1 11.2.1(7)	Design Bases	Conforms. Addressed in DCD Section 11.2.4.
C.III.1 11.2.1(8)	Design Bases	Conforms
C.III.1 11.2.1(9)	Design Bases	Conforms. Addressed in DCD Section 11.2.2 and in FSAR Section 11.2.
C.III.1 11.2.2(1)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(2)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(3)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(4)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.3(1)	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 11.2 and 12.2, and in FSAR Section 12.2.
C.III.1 11.2.3(2)	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 11.2 and 12.2, and in FSAR Section 12.2.
C.III.1 11.3.1(1)	Gaseous Waste Management Systems: Design Bases	Addressed in DCD Section 11.3. Conforms with the following exception: No discussion is provided regarding the capability of and requirements for using portable processing equipment for refueling outages.

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Section	Section Title	Conformance Evaluation
C.III.1 11.3.1(2)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.1(3)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.1(4)	Design Bases	Conforms. Quality Assurance Program requirements are addressed in Chapter 17.
C.III.1 11.3.1(5)	Design Bases	Conforms. Addressed in DCD Section 11.3.5.
C.III.1 11.3.1(6)	Design Bases	Conforms. Addressed in DCD Section 12.6 and in FSAR Section 12.6.
C.III.1 11.3.1(7)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.2(1)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(2)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(3)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(4)	System Description	Conforms. Addressed in DCD Sections 11.3.2, 11.3.3, and 9.4.
C.III.1 11.3.3	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 11.3 and 12.2, and in FSAR Section 12.2.
C.III.1 11.4.1(1)	Solid Waste Management System: Design Bases	Conforms. Addressed in DCD Section 11.4 and in FSAR Section 11.4.
C.III.1 11.4.1(2)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in FSAR Section 11.4.

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Section	Section Title	Conformance Evaluation
C.III.1 11.4.1(3)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in FSAR Section 11.4.
C.III.1 11.4.1(4)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in FSAR Sections 11.4, 13.5, and 17.5.
C.III.1 11.4.1(5)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in FSAR Section 11.4.
C.III.1 11.4.1(6)	Design Bases	Conforms.
C.III.1 11.4.1(7)	Design Bases	Conforms. Addressed in DCD Section 11.4.
C.III.1 11.4.2(1)	System Description	Addressed in DCD Section 11.4 and in FSAR Section 11.4. Conforms with the following exception: The FSAR provides a description of the PCP. Detailed waste packaging methodologies will be provided in the PCP. The implementation milestone is provided in Section 13.4.
C.III.1 11.4.2(2)	System Description	Addressed in DCD Section 11.4 and FSAR Section 11.4. Conforms with the following exception: The FSAR provides a description of the PCP. Detailed waste packaging methodologies will be provided in the PCP. The implementation milestone is provided in Section 13.4.
C.III.1 11.4.2(3)	System Description	Addressed in DCD Section 11.4 and in FSAR Section 11.4. Conforms with the following exception: The FSAR provides a description of the PCP. Detailed waste packaging methodologies will be provided in the PCP. The implementation milestone is provided in Section 13.4. There are no temporary onsite storage facilities.

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Section	Section Title	Conformance Evaluation
C.III.1 11.4.2 (4)	System Description	Conforms. Addressed in DCD Section 11.4.
C.III.1 11.4.3 (1)	Radioactive Effluent Releases	Addressed in DCD Section 11.4 and in FSAR Section 11.4. Conforms with the following exception: The FSAR provides a description of the PCP. Detailed waste packaging methodologies will be provided in the PCP. The implementation milestone is provided in Section 13.4.
C.III.1 11.4.3 (2)	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 3.1 and 11.4.
C.III.1 11.4.3 (3)	Radioactive Effluent Releases	Conforms. Addressed in DCD Section 12.2.
C.III.1 11.5.1	Process and Effluent Radiological Monitoring and Sampling Systems: Design Bases	Conforms
C.III.1 11.5.2(1)	System Description	Conforms. Addressed in DCD Section 11.5.
C.III.1 11.5.2 (2)	System Description	Conforms with the following exception: Section 11.5 provides a description of the ODCM. The implementation milestone is provided in Section 13.4.
C.III.1 11.5.2 (3)	System Description	Conforms with the following exception: Section 11.5 and TS Chapter 5 provide a description of the radiological effluent controls. The implementation milestone is provided in Section 13.4.
C.III.1 11.5.2 (4)	System Description	Conforms with the following exception: FSAR Section 11.5 and TS Chapter 5 provide a description of the REMP. The implementation milestone is provided in Section 13.4.

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Section	Section Title	Conformance Evaluation
C.III.1 11.5.2 (5)	System Description	Conforms. Addressed in DCD Sections 3.1 and 11.5.
C.III.1 11.5.2 (6)	System Description	Conforms
C.III.1 11.5.2 (7)	System Description	Conforms
C.III.1 11.5.3	Effluent Monitoring and Sampling	Conforms
C.III.1 11.5.4	Process Monitoring and Sampling	Conforms
C.III.1 12.1.1	Policy Considerations	Conforms. Addressed in Sections 12.1 and 12.5.
C.III.1 12.1.2	Design Considerations	Conforms. Addressed in Section 12.5.
C.III.1 12.1.3	Operational Considerations	Conforms. Addressed in Sections 12.1 and 12.5.
C.III.1 12.2.1	Contained Sources	Conforms
C.III.1 12.2.2	Airborne Radioactive Material Sources	Conforms
C.III.1 12.3.1	Facility Design Features	Conforms
C.III.1 12.3.2	Shielding	Conforms
C.III.1 12.3.3	Ventilation	Conforms. Addressed in DCD Sections 9.4.1 and 12.3.

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Section	Section Title	Conformance Evaluation
C.III.1 12.3.4	Area Radiation and Airborne Radioactivity Monitoring Instrumentation	Conforms
C.III.1 12.3.5	Dose Assessment	Conforms. Addressed in DCD Section 12.4 and in FSAR Section 12.4.
C.III.1 12.4	Dose Assessment	Conforms
C.III.1 12.5 (1) (a)	Operational Radiation Protection Program: Organization	Conforms. Addressed in Sections 12.5 and 13.1.
C.III.1 12.5 (1) (b)	Facilities	Conforms
C.III.1 12.5 (1) (c)	Instrumentation and Equipment	Conforms
C.III.1 12.5 (1) (d)	Procedures	Conforms
C.III.1 12.5 (1) (e)	Training	Conforms. Addressed in Sections 12.5 and 13.2.
C.III.1 12.5 (2)		Conforms. Addressed in DCD Section 12.3.
C.III.1 12.5 (3)		Conforms. Addressed in Sections 12.5, 13.1, and 13.4.
C.III.1 12.5 (4)		Conforms. Addressed in Section 13.4.
C.III.1 12.5, last paragraph		Conforms. Addressed in Sections 12.5, 13.1, 13.2, and 13.5.
C.III.1 12.5.1	Organization	Conforms. Addressed in Sections 12.5 and 13.1.

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Section	Section Title	Conformance Evaluation
C.III.1 12.5.2	Equipment, Instrumentation, and Facilities	Conforms
C.III.1 12.5.3	Procedures	Conforms. Addressed in Sections 12.5, 13.2, 13.5, and 17.5.
C.III.1 13.1.1(1)	Organizational Structure of Applicant: Management and Technical Support Organization	Conforms. Addressed in Sections 13.1 and 14.2.
C.III.1 13.1.1(2)		Conforms
C.III.1 13.1.1(3)		Conforms
C.III.1 13.1.1(4)		Conforms
C.III.1 13.1.1(5)		Conforms
C.III.1 13.1.1(6)		Conforms
C.III.1 13.1.1(7)		Conforms. Addressed in Sections 13.1 and 14.2.
C.III.1 13.1.1.1	Design, Construction, and Operating Responsibilities	Conforms
C.III.1 13.1.1.2	Organizational Arrangement	Conforms. (Unit 3 is not a new, multi-unit plant site.)
C.III.1 13.1.1.3	Qualifications	Conforms. Addressed in Sections 13.1 and 17.5.
C.III.1 13.1.2(1)		Exception. The guidelines of RG 1.33 for operating organization are met through equivalent administrative controls described in Chapter 17.

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Section	Section Title	Conformance Evaluation
C.III.1 13.1.2(2)		Exception. The guidelines of RG 1.33 for onsite review and rules of practice are met through equivalent administrative controls described in Chapter 17.
C.III.1 13.1.2(3)		Conforms. Addressed in Sections 9.5.1 and 13.1.
C.III.1 13.1.2(4)		Conforms with the following exception: experience requirements cannot be met prior to operations as described in Appendix 13BB.
C.III.1 13.1.2(5)		Conforms
C.III.1 13.1.2(6)		Conforms
C.III.1 13.1.2(7)		Conforms. Addressed in Appendix 13AA.
C.III.1 13.1.2(8)		Conforms. Addressed in Appendix 13AA.
C.III.1 13.1.2.1	Plant Organization	Conforms.
C.III.1 13.1.2.2(1)	Plant Personnel Responsibilities and Authorities	Conforms. Addressed in Sections 13.1 and 17.5.
C.III.1 13.1.2.2(2)		Conforms
C.III.1 13.1.2.2(3)		Conforms
C.III.1 13.1.2.3	Operating Shift Crews	Conforms

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Section	Section Title	Conformance Evaluation
C.III.1 13.1.3.1	Qualification Requirements	Conforms with the following exception: experience requirements cannot be met prior to operations as described in Appendix 13BB.
C.III.1 13.1.3.2	Qualifications of Plant Personnel	Exception. Resumes will not be included in the application, but will be available for inspection upon request.
C.III.1 13.2.1	Plant Staff Training Program	Conforms with the following exception: experience requirements of RG 1.8 cannot be met prior to operations as described in Appendix 13BB. The Commission’s regulations, guides, and reports pertaining to training are listed in section 1.6 of NEI 06-13.
C.III.1 13.2.1.1 Licensed Staff (1)		Conforms with the following exceptions: 1) this item discusses inclusion of details of the licensed training program. As noted in NEI 06-13, which is incorporated by reference, the systematic approach to training (SAT) process is used to establish and maintain training programs. Course duration and content are determined by the SAT process and by administrative procedure and are not included in the FSAR section; 2) the requirement for a “contingency plan…in the event fuel loading is subsequently delayed”’ is met by the operator re-qualification program; and 3) the industry standard content for this section does not include a discussion of proposed schedule for licensed personnel.

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TABLE 1.9-203 (Sheet 46 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.2.1.1 Licensed Staff (2)		Conforms
C.III.1 13.2.1.1 Licensed Staff (3)		Conforms
C.III.1 13.2.1.1 Licensed Staff (4)		Conforms
C.III.1 13.2.1.1 Licensed Staff (5)		Conforms
C.III.1 13.2.1.1 Licensed Staff (6)		Conforms Section 13.4 contains milestones for implementation of operational programs.
C.III.1 13.2.1.1 Non-licensed Staff (1)		Conforms
C.III.1 13.2.1.1 Non-licensed Staff (2)		Conforms

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TABLE 1.9-203 (Sheet 47 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.2.1.1 Non-licensed Staff (3)		Exception – This item discusses programs not covered under 10 CFR 50.120. As noted in NEI 06-13, which is incorporated by reference, the systematic approach to training (SAT) process is used to establish and maintain training programs. Course duration and content are determined by the SAT process and by administrative procedure and are not included in the FSAR section.
C.III.1 13.2.1.1 Non-licensed Staff (4)		Conforms. Addressed in Section 9.5.1.
C.III.1 13.2.1.1 Non-licensed Staff (5)		Conforms
C.III.1 13.2.1.1 Non-licensed Staff (6)		Conforms with the following exception: The first part of this item discusses detailed course descriptions. As noted in NEI 06-13, which is incorporated by reference, the systematic approach to training (SAT) process is used to establish and maintain training programs. Course duration and content are determined by the SAT process and by administrative procedure and are not included in the FSAR section. The implementation milestone is addressed in Section 13.4.
C.III.1 13.2.1.1 Non-licensed Staff (7)		Conforms

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TABLE 1.9-203 (Sheet 48 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.2.1.2	Coordination with Preoperational Tests and Fuel Loading	Conforms with the following exception: Rather than providing contingency plans for training in the event of significantly delayed fuel loading the retraining programs are utilized, as described in NEI 06-13. Figure 13AA-202 shows the training schedule relative to fuel loading.
C.III.1 13.2.2(1)	Applicable NRC Documents: 10 CFR 19	Conforms
C.III.1 13.2.2(2)	10 CFR 26	Conforms
C.III.1 13.2.2(3)	10 CFR 50	Conforms
C.III.1 13.2.2(4)	10 CFR 50 Appendix E	Conforms
C.III.1 13.2.2(5)	10 CFR 52	Conforms
C.III.1 13.2.2(6)	10 CFR 55	Conforms
C.III.1 13.2.2(7)	RG 1.8	Addressed in Table 1.9-202.
C.III.1 13.2.2(8)	RG 1.149	Addressed in Table 1.9-202.
C.III.1 13.2.2(9)	NUREG-0711	Conforms. HFE addressed in DCD Chapter 18.

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TABLE 1.9-203 (Sheet 49 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.2.2(10)	NUREG-1021	Exception: Industry standard content for this section does not explicitly include discussion of compliance with NUREG-1021, Operator Licensing Examination Standards for Power Reactors.
C.III.1 13.2.2(11)	NUREG-1220	Not applicable. NUREG provides instructions for NRC inspectors.
C.III.1 13.2.2(12)	GL 86-04	Conforms
C.III.1 13.2.2(13)	RG 1.134	Exception. Industry standard content for this section does not explicitly include a discussion of compliance with RG 1.134, Medical Evaluations.
C.III.1 13.3(1)	Emergency Planning	Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3(2)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3(3)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3(4)		Conforms. Addressed in Chapter 2, and the Emergency Plan and Evacuation Time Estimate in COLA Part 5.
C.III.1 13.3(5)		Conforms. Addressed in COLA Part 5.
C.III.1 13.3(6)		Not applicable. Applies when state and/or local governments decline to participate in emergency planning and preparedness.
C.III.1 13.3(7)		Conforms

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TABLE 1.9-203 (Sheet 50 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.3.1 (1)	Combined License Application and Emergency Plan Content	Conforms. Addressed in COLA Part 5.
C.III.1 13.3.1 (2)		Conforms. Addressed in COLA Parts 5 and 10.
C.III.1 13.3.1 (3)		Conforms. Addressed in Chapter 1 and the Emergency Plan in COLA Part 5.
C.III.1 13.3.1 (4)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.1 (5)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.1 (6)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.1 (7)		Conforms. Addressed in Chapter 1.
C.III.1 13.3.1 (8)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.1 (9)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.2 (1)	Emergency Plan Considerations for Multiunit Sites	Conforms. The Unit 3 EP is a stand-alone plan and does not rely upon the EP for Unit 1.
C.III.1 13.3.2 (2)		Not applicable. The Unit 3 EP is a stand-alone plan and does not rely upon the EP for Unit 1.
C.III.1 13.3.2 (3)		Conforms. Addressed in the Emergency Plan in COLA Part 5 and 10.
C.III.1 13.3.2 (4)		Conforms. Addressed in COLA Part 5.

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TABLE 1.9-203 (Sheet 51 of 61) CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 13.3.2 (5)		Conforms. Addressed in the Emergency Plan in COLA Part 5.
C.III.1 13.3.2 (6)		Conforms. Addressed in the Emergency Plan and the Evacuation Time Estimate in COLA Part 5.
C.III.1 13.3.2 (7)		Not applicable. Provisions for co-located licensees do not apply.
C.III.1 13.3.2 (8)		Conforms. Addressed in COLA Part 10.
C.III.1 13.3.2 (9)		Not applicable. There are no adjacent sites.
C.III.1 13.3.3	Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria	Conforms. Addressed in COLA Part 10.
C.III.1 13.4	Operational Program Implementation	Conforms
C.III.1 13.5.1	Administrative Procedures	Conforms with the following exception: ANSI/ANS-3.2-1994 (R1999) is used as guidance instead of the 1976 version endorsed by RG 1.33.
C.III.1 13.5.2.1	Operating and Emergency Operating Procedures	Conforms with the following exception: Section 13.5.1 identifies classes of procedures by topic or type in lieu of the specific title. Operating procedures will be developed after activities such as job and task analyses have been completed.
C.III.1 13.5.2.2	Maintenance and Other Operating Procedures	Conforms
C.III.1 13.6	Security	Conforms. Addressed in Sections 13.4 and 13.6, and COLA Part 8.

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TABLE 1.9-203 (Sheet 52 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.I 13.7	FFD	Conforms
C.III.1 14.1	Verification Program: Specific Information to be Addressed for the Initial Plant Test Program	Conforms. Addressed in Sections 14.2 and 14.3.
C.III.1 14.2	Initial Plant Test Program	Conforms
C.III.1 14.2.1	Summary of Test Program and Objectives	Conforms
C.III.1 14.2.2	Organization and Staffing	Conforms. Addressed in DCD Section 14.2 and in FSAR Section 13.1, Appendix 13AA and Section 14.2.
C.III.1 14.2.3	Test Procedures	Conforms. Addressed in DCD Section 14.2. and FSAR Section 14.2.
C.III.1 14.2.4	Conduct of Test Program	Conforms. Addressed in DCD Section 14.2.
C.III.1 14.2.5	Review, Evaluation, and Approval of Test Results	Conforms. Addressed in DCD Section 14.2.
C.III.1 14.2.6	Test Records	Conforms
C.III.1 14.2.7	Conformance of tests programs with Regulatory Guides	Conforms. Addressed in DCD Section 14.2.3.
C.III.1 14.2.8	Utilization of Reactor Operating and Testing Experiences in Development of Test Program	Conforms. Addressed in DCD Section 14.2 and in FSAR Section 14.2.
C.III.1 14.2.9	Trial Use of Plant Operating and Emergency Procedures	Conforms. Addressed in DCD Section 14.2.5 and in FSAR Section 13.2.
C.III.1 14.2.10	Initial Fuel Loading and Initial Criticality	Conforms. Addressed in DCD Section 14.2.6.

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**TABLE 1.9-203 (Sheet 53 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN
RG 1.206**

Section	Section Title	Conformance Evaluation
C.III.1 14.2.11	Test Program Schedule	Conforms. Addressed in DCD Section 14.2.7 and in FSAR Section 14.2.7.
C.III.1 14.2.12	Individual Test Descriptions	Conforms. Addressed in DCD Section 14.2.8 and in FSAR Section 14.2.9.
C.III.1 14.3	Inspections, Tests, Analyses, and Acceptance Criteria	Conforms. Addressed in COLA Part 10.
C.III.1 15.1	Transient and Accident Analyses: Transient and Accident Classification	Conforms. There are no aspects of the site-specific design that affect the transient and accident analyses in the DCD.
C.III.1 15.2	Frequency of Occurrence	Conforms
C.III.1 15.3	Plant Characteristics Considered in the Safety Evaluation	Conforms
C.III.1 15.4	Assumed Protection System Actions	Conforms
C.III.1 15.5	Evaluation of Individual Initiating Events	Conforms.
C.III.1 15.6.1	Identification of Causes and Frequency Classification	Conforms
C.III.1 15.6.2	Sequence of Events and Systems Operation	Conforms
C.III.1 15.6.3	Core and System Performance	Conforms
C.III.1 15.6.4	Barrier Performance	Conforms
C.III.1 15.6.5	Radiological Consequences	Conforms. Table 2.0-201 compares the site-specific short-term χ/Qs for the EAB, LPZ, and control room to the χ/Qs assumed in the DCD.

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TABLE 1.9-203 (Sheet 54 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 16.1	Technical Specifications and Bases	Conforms. Addressed in COLA Part 4. There are no deviations from the generic TS bases.
C.III.1 16.2	Content and Format of Technical Specifications and Bases	Conforms. Addressed in COLA Part 4. No plant-specific deviations from the referenced certified generic Technical Specifications or Bases are required and none are being requested (e.g., incorporation of TSTF travelers).
C.III.1 17.1	Quality Assurance and Reliability Assurance: Quality Assurance During the Design and Construction Phase	Conforms
C.III.1 17.2	Quality Assurance During the Operations Phase	Conforms
C.III.1 17.3	Quality Assurance Program Description	Conforms
C.III.1 17.4.1	New Section 17.4 in the Standard Review Plan	Conforms
C.III.1 17.4.2	Reliability Assurance Program Scope, Stages, and Goals	Not applicable. This RG section does not request information from the COL applicant.
C.III.1 17.4.3	Reliability Assurance Program Implementation	Conforms. Addressed in Sections 17.4, 17.5 (QAPD), and 17.6.
C.III.1 17.4.4	Reliability Assurance Program Information Needed in a COL Application	Conforms. Addressed in DCD Section 17.4 and in FSAR Sections 17.4, 17.5, and 17.6.
C.III.1 17.5.1	COL Applicant QA Program Responsibilities	Conforms
C.III.1 17.5.2	Updated SRP Section 17.5 and the QA Program Description	Conforms. Section 17.5 references the QAPD which is based on NEI 06-14A which complies with SRP Section 17.5.

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TABLE 1.9-203 (Sheet 55 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.III.1 17.5.3	Evaluation of the QAPD Against the SRP and QAPD Submittal Guidance	Conforms
C.III.1 17.6	Description of the Applicant's Program for Implementation of 10 CFR 50.65, the Maintenance Rule	Conforms
C.III.1 17.6.1	Scoping per 10 CFR 50.65(b)	Conforms
C.III.1 17.6.2	Monitoring per 10 CFR 50.65(a)	Conforms
C.III.1 17.6.3	Periodic Evaluation per 10 CFR 50.65(a)(3)	Conforms
C.III.1 17.6.4	Risk Assessment and Management per 10 CFR 50.65(a)(4)	Conforms
C.III.1 17.6.5	Maintenance Rule Training and Qualification	Conforms
C.III.1 17.6.6	Maintenance Rule Program Role in Implementation of Reliability Assurance Program (RAP) in the Operations Phase	Conforms
C.III.1 17.6.7	Maintenance Rule Program Implementation	Conforms
C.III.1 Chapter 18	Human Factors Engineering	Conforms
	HFE principles incorporated into:	
	(1) Planning and management	Conforms. Addressed in DCD Section 18.2.
	(2) Plant design processes not closed with design certification	Conforms. Addressed in DCD Tier 1 ITAAC Table 3.3-1.
	(3) HSI, procedures, and training	Conforms. Addressed in DCD Tier 1 ITAAC Table 3.3-1, Items 6, 7, and 8.

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TABLE 1.9-203 (Sheet 56 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
	(4) implementation of the design	Conforms. Addressed in DCD Tier 1 ITAAC Table 3.3-1, Item 10.
	(5) monitoring of performance at the site	Conforms. Addressed in DCD Tier 1 ITAAC Table 3.3-1, Item 11.
	Applicant program addresses normal and emergency, maintenance, test, inspection and surveillance activities	Conforms. Addressed in DCD Section 18.1.
	FSAR/DCD describe objectives and scope of the applicant's activities related to element, methodology, and results for (12 HFE elements)	Conforms. Addressed in DCD Sections 18.3 through 18.13.
	Applicant should reference detailed implementation plan reviewed and approved as part of design certification	Conforms. Addressed in DCD Section 18.2.1.
C.I 18.1	HFE Program Management	Conforms. Addressed in DCD Sections 18.2.2 and 18.2.3.
C.I 18.1.1	General HFE Program and Scope	Conforms. Addressed in DCD Sections 18.2.1 and 18.2.2.
C.I 18.1.2	HFE Team and Organization	Conforms. Addressed in DCD Section 18.2.3.
C.I 18.1.3	HFE Process and Procedures	Conforms. Addressed in DCD Sections 18.2.1 and 18.2.2.
C.I 18.1.4	HFE Issues Tracking	Conforms. Addressed in DCD Section 18.2.2.
C.I 18.1.5	HFE Technical Program	Conforms. Addressed in DCD Sections 18.3 through 18.13.
C.I 18.2.1	Objectives and scope	Conforms. Addressed in DCD Section 18.3.1.
C.I 18.2.2.1	OER Process	Conforms. Addressed in DCD Section 18.3.2.

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**TABLE 1.9-203 (Sheet 57 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206**

Section	Section Title	Conformance Evaluation
C.I 18.2.2.2	Predecessor plants and systems	Conforms. Addressed in DCD Section 18.3.2.1.
C.I 18.2.2.3	Risk-important human actions	Conforms. Addressed in DCD Section 18.3.2.2.
C.I 18.2.2.4	HFE technology	Conforms. Addressed in DCD Section 18.3.2.3.
C.I 18.2.2.5	Recognized industry issues	Conforms. Addressed in DCD Section 18.3.2.4.
C.I 18.2.2.6	Issued Identified by plant personnel	Conforms. Addressed in DCD Section 18.3.2.5.
C.I 18.2.2.7	Issue Analysis, Tracking, and Review	Conforms. Addressed in DCD Section 18.3.2.6.
C.I 18.2.3	Results	Conforms. Addressed in DCD Section 18.3.3.
C.I 18.3.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.4.2.
C.I 18.3.1.1	Functional Requirements Analysis	Conforms. Addressed in DCD Section 18.4.1.
C.I 18.3.1.2	Function Allocation Analysis	Conforms. Addressed in DCD Section 18.4.2.
C.I 18.3.2.1	Methodology for Functional Requirements Analysis	Conforms. Addressed in DCD Section 18.4.1.
C.I 18.3.2.2	Methodology for Function Allocation Analysis	Conforms. Addressed in DCD Section 18.4.2.
C.I 18.3.3	Results	Conforms. Addressed in DCD Sections 18.4.1 and 18.4.2.

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TABLE 1.9-203 (Sheet 58 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.I 18.4.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.5.1.
C.I 18.4.2	Methodology	Conforms. Addressed in DCD Section 18.5.1.
C.I 18.4.3	Results	Conforms. Addressed in DCD Section 18.5.1.
C.I 18.5.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.6.2. Training is addressed in Section 13.2 and Appendix 13BB.
C.I 18.5.2	Methodology	Conforms. Addressed in DCD Sections 18.6.4 and 18.6.5. Training is addressed in Section 13.2 and Appendix 13BB.
C.I 18.5.3	Results	Conforms. Addressed in DCD Section 18.6.6. Training is addressed in Section 13.2 and Appendix 13BB.
C.I 18.6.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.7.1.
C.I 18.6.2	Methodology	Conforms. Addressed in DCD Section 18.7.2.
C.I 18.6.3	Results	Conforms. Addressed in DCD Section 18.7.3.
C.I 6.3.2.8	Manual Actions	Conforms. Addressed in DCD Section 18.7.2.
C.I 18.7.1	Objectives and scope	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.2.1	HSI Design Inputs	Conforms. Addressed in DCD Section 18.8.1.

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TABLE 1.9-203 (Sheet 59 of 61) CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.I 18.7.2.2	Concept of operations	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.2.3	Functional Requirements Specification	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.2.4	HSI Concept Design	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.2.5	HSI Detailed Design and Integration	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.2.6	HSI Tests and Evaluations	Conforms. Addressed in DCD Section 18.8.1.
C.I 18.7.3.1	Overview of HSI Design and Its Key Features	Conforms. Addressed in DCD Section 18.8.1(3).
C.I 18.7.3.2	Safety Aspects of the HSI	Conforms. Addressed in DCD Section 18.8.1(3).
C.I 18.7.3.3	HSI Change Process	Conforms. Addressed in DCD Section 18.8.1(4).
C.I 18.8.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.9.1. Procedure development is discussed in Section 13.5.
C.I 18.8.2	Methodology	Conforms. Addressed in DCD Section 18.9.2. Procedure development is discussed in Section 13.5.
C.I 18.8.3	Results	Conforms. Addressed in DCD Section 18.9.3. Procedure development is discussed in Section 13.5.
C.I 18.9.1	Objectives and Scope	Conforms. Addressed in DCD Sections 18.10.1 and 18.10.2. The training program is described in Section 13.2 and Appendix 13BB.

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TABLE 1.9-203 (Sheet 60 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.I 18.9.2	Methodology	Conforms. Addressed in DCD Sections 18.10.3 and 18.10.4. The training program is described in Section 13.2 and Appendix 13BB.
C.I 18.9.3	Results	Conforms. Addressed in DCD Section 18.10.5. The training program is described in Section 13.2 and Appendix 13BB.
C.I 18.10.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.11 and 18.11.1.
C.I 18.10.2	Methodology	Conforms. Addressed in DCD Section 18.11.
C.I 18.10.2.1	Operational Conditions Sampling	Conforms. Addressed in DCD Section 18.11.
C.I 18.10.2.2	Design Verification	Conforms. Addressed in DCD Section 18.11.
C.I 18.10.2.3	Integrated system validation	Conforms. Addressed in DCD Section 18.11.
C.I 18.10.2.4	Human engineering discrepancy resolution	Conforms. Addressed in DCD Section 18.11.
C.I 18.10.3	Results	Conforms. Addressed in DCD Section 18.11.2.
C.I 18.11.1	Objectives and Scope	Conforms. Addressed in DCD Section 18.12.1.
C.I 18.11.2	Methodology	Conforms. Addressed in DCD Section 18.12.2.
C.I 18.11.3	Results	Conforms. Addressed in DCD Section 18.12.3.

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TABLE 1.9-203 (Sheet 61 of 61)
CONFORMANCE WITH THE FSAR CONTENT GUIDANCE IN RG 1.206

Section	Section Title	Conformance Evaluation
C.I 18.12.1	Objectives and Scope	Conforms. Addressed in DCD Sections 18.13.1 and 18.13.2.
C.I 18.12.2	Methodology	Conforms. Addressed in DCD Sections 18.13.2 and 18.13.3.
C.I 18.12.3	Results	Conforms. Addressed in DCD Section 18.13.4.
C.III.1 Chapter 19	Probabilistic Risk Assessment and Severe Accident Evaluation	Conforms. As discussed in RG 1.206, Section C.III.1.10, the FSAR follows the organization and numbering of the referenced certified design.

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TABLE 1.9-204 (Sheet 1 of 5)
INDUSTRIAL CODES AND STANDARDS

Code or Standard Number	Year	Title
American Nuclear Society (ANS)		
3.1	1993	Selection, Qualification, and Training of Personnel for Nuclear Power Plants
American Society of Civil Engineers (ASCE)		
ASCE 43-05	2005	Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities
American Society of Mechanical Engineers (ASME)		
A 17.1	2007	Safety Code for Elevators and Escalators
B31.1	2007	Power Piping
NQA-1	2004	Quality Assurance Programs Requirements for Nuclear Facilities
Boiler and Pressure Vessel Code, Section IX	2007	Qualification Standard for Welding and Brazing Procedures, Welder, Brazers and Welding and Brazing Operators
American Society for Testing and Materials (ASTM)		
D422-63(2002)e1	2002	Standard Test Method for Particle-Size Analysis of Soils
D698-00e1	2000	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D854-06	2006	Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
D1452-80	2000	Standard Practice for Soil Investigation and Sampling by Auger Borings
D1557-02e1	2002	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
D1586-99	1999	Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils

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TABLE 1.9-204 (Sheet 2 of 5)
INDUSTRIAL CODES AND STANDARDS

Code or Standard Number	Year	Title
D1587-00	2000	Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
E2105-00	2005	Standard Practice for General Techniques of Thermogravimetric Analysis (TGA) Coupled With Infrared Analysis (TGA/IR)
D2113-99	1999	Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation
D2216-05	2005	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2435-04	2004	Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
D2487-06	2006	Standard Practice for Classification of Soils for Engineering Purposes
D2488-06	2006	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
D2850-03a	2003	Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils
D4220-95	2000	Standard Practices for Preserving and Transporting Soil Samples
D4318-05	2005	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D4633-05	2005	Standard Test Method for Energy Measurement for Dynamic Penetrometers
D4767-04	2004	Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
D5079-02	2006	Standard Practices for Preserving and Transporting Rock Core Samples

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TABLE 1.9-204 (Sheet 3 of 5)
INDUSTRIAL CODES AND STANDARDS

Code or Standard Number	Year	Title
D5084-03	2003	Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
D-5333-03	2003	Standard Test Method for Measurement of Collapse Potential of Soils
D5778-95	2000	Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils
D5783-95	2006	Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices
ASTM E-84	2007	Method of Test of Surface Burning Characteristics of Building Materials
ASTM E-119	2007	Fire Test of Building Construction Materials
ASTM E-814	2006	Standard Test Method for Fire Tests for Through-Penetration Fire Stops
Applicable Building Codes		
Standard Southern Building Code	1997	Standard Southern Building Code
Uniform Building Code	1997	Uniform Building Code
28 CFR 36		American Disability Act (ADA) Accessibility Guidelines
Factory Mutual		
Data Sheet 7-42	2006	Guidelines for Evaluating the Effects of Vapor Cloud Explosions Using a TNT Equivalency Method
	2007	Approval Guide
Institute of Electrical and Electronics Engineers (IEEE)		
C2	2007	National Electric Safety Code

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TABLE 1.9-204 (Sheet 4 of 5)
INDUSTRIAL CODES AND STANDARDS

Code or Standard Number	Year	Title
National Fire Protection Association (NFPA)		
NFPA 10	2007	Standard for Portable Fire Extinguishers
NFPA 11	2005	Standard for Low-, Medium-, and High-Expansion Foam Systems
NFPA 13	2007	Standard for the Installation of Sprinkler Systems
NFPA 14	2007	Standard for the Installation of Sandpipe and Hose Systems
NFPA 15	2007	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 16	2007	Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 20	2007	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	2007	Standard for the Installation of Private Fire Service Mains and their Appurtenances
NFPA 25	2008	Recommended Practices for Inspection, Testing, and Maintenance of Standpipes and Hose Systems
NFPA 30	2008	Flammable and Combustible Liquids Code
NFPA 37	2006	Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 55	2005	Standard for Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks
NFPA 70	2008	National Electric Code
NFPA 72	2007	National Fire Alarm Code
NFPA 80	2007	Standard for Fire Doors and Windows

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TABLE 1.9-204 (Sheet 5 of 5)
INDUSTRIAL CODES AND STANDARDS

Code or Standard Number	Year	Title
NFPA 80A	2007	Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 101	2006	Life Safety Code
NFPA 204	2007	Standard for Smoke and Heat Venting
NFPA 214	2005	Standard on Water-Cooling Towers
NFPA 241	2004	Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 252	2008	Standard Methods of Fire Tests of Door Assemblies
NFPA 255	2006	Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 780	2008	Standard for the Installation of Lightning Protection Systems
Occupational Safety and Health Act (OSHA)		
29 CFR 1910	2006	Occupational Safety and Health Standards
29 CFR 1926	2006	Safety and Health Regulations for Construction
Underwriters Laboratories (UL)		
	2007	Fire Protection Equipment Directory
United States Army Corps of Engineers (USACE)		
EM 1110-2-1906	1986	Laboratory Soils Testing, U.S. Army Corps of Engineers
Environmental Protection Agency (EPA)		
40 CFR 60	2006	EPA Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
SW-846 9045d	2004	Test Methods for Evaluating Solid Waste
MCAWW 300.0A	1983	Methods for the Chemical Analysis of Water and Wastes

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TABLE 1.9-205 (Sheet 1 of 2)
NUREG REPORTS CITED

NUREG No.	Issue Date	Title	Comment/Section Where Discussed
0570	06/1979	Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release	6.4
0612	07/1980	Control of Heavy Loads at Nuclear Power Plants	13.5
0737	11/1980	Clarification of TMI Action Plan Requirements	13.1, 13.5
0800	03/2007	Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants	1.1, 2.0, 9.3, 11.5
1488	04/1994	Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains	2.5
1736	10/2001	Consolidated Guidance: 10 CFR Part 20 – Standards for Protection Against Radiation	1.9
1817	4/2006	Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site	Table 1.11-201
1840	04/2006	Safety Evaluation Report for an Early Site Permit (ESP) at the Grand Gulf Site	12.2

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TABLE 1.9-205 (Sheet 2 of 2)
NUREG REPORTS CITED

NUREG No.	Issue Date	Title	Comment/Section Where Discussed
CR-2650	10/1982	Allowable Shipment Frequencies for the Transport of Toxic Gases Near Nuclear Power Plants	2.2
CR-4013	04/1986	LADTAP II Technical Reference and User Guide	12.2
CR-6331	05/1997	Atmospheric Relative Concentrations in Building Wakes	2.3
CR-6728	10/2001	Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-consistent Ground Motion Spectra Guidelines	2.5, 3.7.1.1.5
CR-6769	04/2002	Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Development of Hazard- & Risk-Consistent Seismic Spectra for Two Sites	2.5
CR-6937	06/2007	User's Manual for RESRAD-OFFSITE Version 2	2.4

1.10 SUMMARY OF COL ITEMS

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

Add the following at the end of this section.

GGNS SUP 1.10-1 Table 1.10-201 lists the FSAR location(s) where the individual COL items from the DCD are addressed. Table 1.10-202 lists the FSAR location(s) where the individual COL Action Items and Permit Conditions from the ESP are addressed.

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TABLE 1.10-201 (Sheet 1 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
1.1-1-A	Establish Rated Electrical Output	1.1.2.7
1.3-1-A	Update Table 1.3-1	1.3
1.7-1-H	Final Design Configuration Confirmation	1.7
1.9-3-A	SRP and Regulatory Guide Applicability	SRP: 1.9.1 and Table 1.9-201 RGs: 1.9.2 and Table 1.9-202 RG 1.206: 1.9.2 and Table 1.9-203
1.11-1-A	Address Table 1.11-1 Items That Refer to Notes (2) and (7)	1.11.1 and Table 1.11-201
1C.1-1-A	Handling of Safeguards Information	1C.1, Table 1C-201
1C.1-2-A	Emergency Preparedness and Response Actions	1C.1, Table 1C-202
2.0-1-A	Site Characteristics Demonstration	2.0 and Table 2.0-201
2.0-2-A	Site Location and Description Information in Accordance with SRP 2.1.1	2.0, 2.1
2.0-3-A	Site-Specific Exclusion Area Authority and Control Information in Accordance with SRP 2.1.2.	2.0 and 2.1
2.0-4-A	Describe the Population Distribution in Accordance with SRP 2.1.3	2.0 and 2.1
2.0-5-A	Identify Potential Hazards in the Site Vicinity, in Accordance with SRP 2.2.1 - 2.2.2	2.0 and 2.2

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TABLE 1.10-201 (Sheet 2 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
2.0-6-A	Evaluation of Potential Accidents in Accordance with SRP 2.2.3	2.0 and 2.2
2.0-7-A	Regional Climatology in Accordance with SRP 2.3.1	2.0 and 2.3
2.0-8-A	Local Meteorology in Accordance with SRP 2.3.2	2.0 and 2.3
2.0-9-A	Onsite Meteorological Measurement Programs in Accordance with SRP 2.3.3	2.0 and 2.3
2.0-10-A	Short-Term Diffusion Estimates for Accidental Atmospheric Releases in Accordance with SRP 2.3.4	2.0 and 2.3
2.0-11-A	Long-Term Diffusion Estimates in Accordance with SRP 2.3.5	2.0 and 2.3
2.0-12-A	Hydraulic Description Maximum Ground Water Level in Accordance with SRP 2.4.1	2.0 and 2.4.1
2.0-13-A	Protection of Below-Grade Penetrations and Access Openings from Floods in Accordance with SRP 2.4.2	2.0 and 2.4.2
2.0-14-A	Probable Maximum Flood on Streams and Rivers in Accordance with SRP 2.4.3	2.0 and 2.4.3
2.0-15-A	Potential Dam Failures Seismically Induced in Accordance with SRP 2.4.4	2.0 and 2.4.4
2.0-16-A	Probable Maximum Surge and Seiche Flooding in Accordance with SRP 2.4.5	2.0and 2.4.5
2.0-17-A	Probable Maximum Tsunami in Accordance with SRP 2.4.6	2.0 and 2.4.6
2.0-18-A	Ice Effects in Accordance with SRP 2.4.7	2.0 and 2.4.7

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**TABLE 1.10-201 (Sheet 3 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED**

Item No.	Subject/Description of Item	Section
2.0-19-A	Cooling Water Canals and Reservoirs in Accordance with SRP 2.4.8	2.0 and 2.4.8
2.0-20-A	Channel Diversion in Accordance with SRP 2.4.9	2.0 and 2.4.9
2.0-21-A	Flooding Protection Requirements in Accordance with SRP 2.4.10	2.0 and 2.4.10
2.0-22-A	Cooling Water Supply in Accordance with SRP 2.4.11	2.0 and 2.4.11
2.0-23-A	Groundwater in Accordance with SRP 2.4.12	2.0 and 2.4.12
2.0-24-A	Accidental Releases of Liquid Effluents in Ground and Surface Waters in Accordance with SRP 2.4.13	2.0and 2.4.13
2.0-25-A	Technical Specifications and Emergency Operation Requirements in Accordance with SRP 2.4.14	2.0 and 2.4.14
2.0-26-A	Basic Geologic and Seismic Information in Accordance with SRP 2.5.1	2.0 and 2.5.1
2.0-27-A	Vibratory Ground Motion in Accordance with SRP 2.5.2	2.0 and 2.5.2
2.0-28-A	Surface Faulting in Accordance with SRP 2.5.3	2.0 and 2.5.3
2.0-29-A	Stability of Subsurface Materials and Foundations in Accordance with SRP 2.5.4	2.0 and 2.5.4
2.0-30-A	Stability of Slopes in Accordance with SRP 2.5.5	2.0, 2.5.5 and Appendix 2AA
3.6.5-1-A	Pipe Break Analysis Results and Protection Methods	3.6.2.5

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TABLE 1.10-201 (Sheet 4 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
3.9.9-1-H	Reactor Internals Vibration Analysis, Measurement and Inspection Program	3.9.2.4
3.9.9-2-H	ASME Class 2 or 3 or Quality Group D Components with 60-Year Design Life	3.9.3.1
3.9.9-3-A	Inservice Testing Programs	3.9.6
3.9.9-4-A	Snubber Inspection and Test Program	3.9.3.7.1(3)e and 3.9.3.7.1(3)f
3.10.4-1-A	Dynamic Qualification Report	3.10.1.4
3.11-1-A	Environmental Qualification Document (EQD)	3.11.2.2
4.3-1-A	Variances from Certified Design	4.3
4A-1-A	Variances from Certified Design	4A
5.2-1-H	Preservice and Inservice Inspection Program Plan	5.2.4 and 5.2.4.11
5.2-2-H	Leak Detection Monitoring	5.2.5.9
5.3-2-A	Materials and Surveillance Capsule	5.3.1.8
6.1.3-1-A	Protective Coatings and Organic Materials	6.1.2.3
6.2-1-H	Information indicated in Tables 6.2-16 through 6.2-42	6.2.4.2
6.4-1-A	Control Room Habitability Area (CRHA) Procedures and Training	6.4.4
6.4-2-A	Toxic Gas Analysis	6.4.5 and Table 2.2-201
6.6-1-A	Preservice Inspection (PSI) and Inservice Inspection (ISI) Program Description	6.6

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TABLE 1.10-201 (Sheet 5 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
8.2.4-1-A	Transmission System Description	8.2.1.1, Table 8.2-201, and Figure 8.2-201
8.2.4-2-A	Switchyard Description	8.2.1.2.1.1, 8.2.1.2.1.2, and Figures 8.2-202 and 8.2-203
8.2.4-3-A	Normal Preferred Power	8.2.1.2.1.2 and Figure 8.2-204
8.2.4-4-A	Alternate Preferred Power	8.2.1.2.1.2
8.2.4-5-A	Protective Relaying	8.2.1.2.1.1
8.2.4-6-A	Switchyard DC Power	8.2.1.2.1.1
8.2.4-7-A	Switchyard AC Power	8.2.1.2.1.1
8.2.4-8-A	Switchyard Transformer Protection	8.2.4
8.2.4-9-A	Stability and Reliability of the Offsite Transmission Power Systems	8.2.2.1 and 8.2.3
8.2.4-10-A	Interface Requirements	8.2.2.1and 8.2.1.2.1.1
8A.2.3-1-A	Cathodic Protection System	8A.2.1
9.1.6-4-A	Fuel Handing Operations	9.1.4.13 and 9.1.4.19
9.1.6-5-A	Handling of Heavy Loads	9.1.5.6, 9.1.5.8, and 9.1.5.9
9.2.1-1-A	Material Selection	9.2.1.2
9.2.5-1-A	Post 7-Day Makeup to Ultimate Heat Sink (UHS)	9.2.5
9.3.2-1-A	Post-Accident Sampling Program	9.3.2.2
9.3.9-1-A	Implementation of Hydrogen Water Chemistry	9.3.9
9.3.9-2-A	Hydrogen and Oxygen Storage and Supply	9.3.9.2 and 9.3.9.2.1
9.3.10-1-A	Oxygen Storage Facility	9.3.10.2
9.3.11-1-A	Determine Need for Zinc Injection System	9.3.11.2
9.3.11-2-A	Provide System Description for Zinc Injection System	9.3.11.4

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**TABLE 1.10-201 (Sheet 6 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED**

Item No.	Subject/Description of Item	Section
9.5.1-1-A	Secondary Firewater Storage Source	9.5.1.2 and 9.5.1.4
9.5.1-2-A	Secondary Firewater Capacity	9.5.1.2 and 9.5.1.4
9.5.1-4-A	Piping and Instrument Diagrams	9.5.1.2, 9.5.1.4, 9.5.1.5, and Figure 9.5-201
9.5.1-5-A	Fire Barriers	9.5.1.10
9.5.1-6-H	Smoke Control	9.5.1.11
9.5.1-7-H	Fire Hazards Analysis (FHA) Compliance Review	9.5.1.12
9.5.1-8-A	Fire Protection (FP) Program Description	9.5.1.15
9.5.1-9-A	FP Licensing Changes	9.5.1.15.2
9.5.1-10-H	Fire Brigade	9.5.1.15.4, 13.1.2.1.5
9.5.1-11-A	Quality Assurance	9.5.1.15.9
9.5.2.5-1-A	Offsite Interfaces	9.5.2.2
9.5.2.5-2-A	Grid Transmission Operator	9.5.2.2
9.5.4-1-A	Fuel Oil Capacity	9.5.4.2
9.5.4-2-A	Protection of Underground Piping	9.5.4.2
9A.7-1-A	Yard Fire Zone Drawings	9A.4.7
9A.7-2-A	Fire Hazards Analysis for Site Specific Areas	9A.4.7, 9A.5.7, 9A.5.8, and 9A.5.9
10.2-1-H	Turbine Missile Probability Analysis	10.2.3.8
10.4-1-A	Leakage (of Circulating Water Into the Condenser)	10.4.6.3 and Table 10.4-201
11.2-1-A	Implementation of IE Bulletin 80-10	11.2.2.3
11.2-2-A	Implementation of Part 20.1406	11.2.2.3
11.4-1-A	Mobile System Regulatory Guide Compliance	11.4.2.3

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TABLE 1.10-201 (Sheet 7 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
11.4-2-A	Compliance with IE Bulletin 80-10	11.4.2.3
11.4-3-A	Process Control Program	11.4.2.3
11.4-4-A	Temporary Storage Facility	11.4.1
11.4-5-A	Compliance with Part 20.1406	11.4.1
11.5-1-A	Subsystem Lower Limit of Detection	11.5.4.7
11.5-2-A	Offsite Dose Calculation Manual	11.5.4.4, 11.5.4.5, 11.5.5.8, and 12.2
11.5-3-A	Process and Effluent Monitoring Program	11.5 and 11.5.4.6 and Table 11.5-201
11.5-4-A	Site Specific Offsite Dose Calculation	11.5.4.8
11.5-5-A	Instrument Sensitivities	11.5.4.9
12.1-1-A	Regulatory Guide 8.10	12BB
12.1-2-A	Regulatory Guide 1.8	12BB
12.1-3-A	Operational Considerations	12BB
12.1-4-A	Regulatory Guide 8.8	12BB
12.2-2-A	Airborne Effluents and Doses	12.2.2.2 and 11.3.2
12.2-3-A	Liquid Effluents and Doses	12.2.2.4
12.3-2-A	Operational Considerations	12.3.4
12.3-3-A	Controlled Access	12.3.1.3
12.5-1-A	Equipment, Instrumentation, and Facilities	12BB
12.5-2-A	Compliance with Paragraph 50.34 (f)(2)(xxvii) of 10 CFR 50 and NUREG-0737 Item III.D.3.3	12BB
12.5-3-A	Radiation Protection Program	12BB
13.1-1-A	Organizational Structure	13.1.1 through 13.1.3 and Appendix 13AA

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TABLE 1.10-201 (Sheet 8 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
13.2-1-A	Reactor Operator Training	13.2.1 and 13BB
13.2-2-A	Training for Non-Licensed Plant Staff	13.2.2 and 13BB
13.3-1-A	Identification of OSC and Communication Interfaces with Control Room and TSC	13.3 and COLA Part 5 (EP), Sections II.F and II.H
13.3-2-A	Identification of EOF and Communication Interfaces with Control Room and TSC	13.3 and COLA Part 5 (EP), Sections II.F and II.H
13.3-3-A	Decontamination Facilities	13.3 and COLA Part 5 (EP), Section II.J
13.4-1-A	Operation Programs	13.4
13.4-2-A	Implementation Milestones	13.4
13.5-1-A	Administrative Procedures Development Plan	13.5.1
13.5-2-A	Plant Operating Procedures Development Plan	13.5.2
13.5-3-A	Emergency Procedures Development	13.5.2
13.5-4-A	Implementation of the Plant Procedures Plan	13.5, 13.5.2
13.5-5-A	Procedures Included in Scope of Plan	13.5.2
13.5-6-H	Procedures for Calibration, Inspection and Testing	13.5.2
14.2-1-H	Startup Administration Manual	14.2.2.1
14.2-2-H	Approved Plant Pre-Operational and Startup Test Procedure	14.2.2.2
14.2-3-H	Detailed Testing Schedule	14.2.7
14.2-4-H	Approved Test Procedures for Site-Specific System	14.2.9

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TABLE 1.10-201 (Sheet 9 of 9)
SUMMARY OF FSAR SECTIONS WHERE DCD COL ITEMS ARE ADDRESSED

Item No.	Subject/Description of Item	Section
14.3-1-A	Emergency Planning Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)	14.3.8
14.3-2-A	Site-Specific ITAAC	14.3.9
16.0-1	Replace Tech Spec Information in Brackets with Plant-Specific Information	COLA Part 4 (TS and TS Bases)
17.2-1-A	QA Program for the Construction and Operations Phases	17.2 and 17.5
17.2-2-A	QA Program for Design Activities	17.1 and 17.5
17.3-1-A	Quality Assurance Program Document	17.3 and 17.5
17.4-1-A	Operation Reliability Assurance Activities	17.4.1, 17.4.6, 17.4.9, 17.4.10, and 17.6
19.2.6-1-H	Seismic High Confidence Low Probability of Failure Margins	19.2.3.2.4

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TABLE 1.10-202 (Sheet 1 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP COL 2.2-1	Perform an evaluation of industrial hazards associated with the site, and should assess design-specific interactions between the existing and new unit(s) and, if necessary, propose measures to account for such interactions.	2.2, 6.4
ESP COL 2.3-1	Evaluate interaction between the existing meteorological tower and the proposed facility's cooling towers.	2.3
ESP COL 2.3-2	Evaluate dispersion of airborne radioactive materials to the control room.	2.3
ESP COL 2.3-3	Confirm specific release point characteristics and locations of potential receptors for routine release dose computations.	2.3
ESP COL 2.4-1	Demonstrate that sufficient separation between the new ESP intake and the combined effluent outfall is provided so that the effluent recirculating back to the new ESP intake will not adversely affect the intake.	2.4.1
ESP COL 2.4-2	Demonstrate that if dewatering is necessary for the operation of the ESP facility, it will be considered a safety-related facility and must be designed, operated, and maintained as such.	2.4.12

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TABLE 1.10-202 (Sheet 2 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP COL 2.4-3	Design the site grading to provide flooding protection to safety-related structures at the ESP site based on a comprehensive flood water routing analysis for a local probable maximum precipitation (PMP) event on the ESP site.	2.4.1, 2.4.2, 2.4.3, 2.4.10
ESP COL 2.4-4	Design the ESP facility with a maximum withdrawal of 85,000 gpm from the Mississippi River for the makeup water requirement for the ESP facility.	2.4.1
ESP COL 2.4-5	Demonstrate that the ESP plant grade is safe from the flooding effects of maximum water surface elevation during local intense precipitation without relying on any active surface drainage systems that may be blocked during this event.	2.4.2, 2.4.3, 2.4.10
ESP COL 2.4-6	Demonstrate that 30-day cooling water supply for the ESP facility UHS will be available as liquid water in any dedicated water storage basin(s) accounting for any losses including, but not limited to, those resulting from evaporation, seepage, icing, and a margin of safety.	2.4.1, 2.4.11
ESP COL 2.4-7	Demonstrate that the ESP facility UHS will not be used frequently for non emergency operation of the ESP facility.	2.4.11

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TABLE 1.10-202 (Sheet 3 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP COL 2.4-8	Demonstrate that an adequately designed ground water well system capable of withdrawing a maximum of 3570 gpm is provided for the ESP facility.	2.4.1, 2.4.12
ESP COL 2.4-9	Provide detailed ground water information including location and depth of perched aquifers.	2.4.12
ESP COL 2.5-1	Use excavation walls (or a combination of ground improvement with tied-back walls) and control the ground water during the excavations at the COL or CP stage.	2.5.4
ESP COL 2.5-2	Conduct detailed studies on the fill material and the required treatment to the fill material.	2.5.4, 2.5.5
ESP COL 2.5-3	Perform additional borings, laboratory testing, and a geophysical survey to confirm the current base case material properties and their variabilities throughout the site during the COL or CP stage. If the investigations to be performed during the COL or CP stage indicate differences in material properties which may have significantly impact to design ground motions, the applicant should evaluate the need to perform additional site response analyses with the updated properties to develop updated design ground motions.	2.5.2, 2.5.4, 2.5.5, 2AA

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TABLE 1.10-202 (Sheet 4 of 8) SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP COL 2.5-4	Perform geotechnical investigations during the COL or CP stage to provide additional verification regarding the soil properties of the zone with rise and fall of P-wave velocity, indicated in the SSAR.	2.5.4
ESP COL 2.5-5	Provide information to correlate plot plans and profiles of each seismic Category I facility with subsurface profiles and material properties to ascertain the sufficiency of selected borings to represent soil variations under each structure.	2.5.4
ESP COL 2.5-6	Evaluate potential excavation procedures that may be used, as well as the impact of the adjacent bluff on temporary support conditions and on standoff distance in the ESP area.	2.5.4
ESP COL 2.5-7	Provide a detailed dewatering plan for evaluating the ground water conditions (procedure for dewatering during construction, and ground water control throughout the life of the plant) regarding their effects on the foundation stability.	2.5.4
ESP COL 2.5-8	Perform additional site investigations during the COL or CP stage, including deep borings in the footprint of the powerblock structures to evaluate the potential for karst formation.	2.5.4

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TABLE 1.10-202 (Sheet 5 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP COL 2.5-9	Develop specific design criteria (such as potential wall rotations, facility sliding, and overturning) during the COL or CP stage when the specific characteristics of the operating system are known.	2.5.4
ESP COL 2.5-10	Incorporate the effects resulting from the local topography or possible changes in topography in the future soil-structure interface (SSI) analyses.	2.5.5
ESP COL 2.5-11	Evaluate the effect of potential flooding of the Mississippi River and possible future erosion of the bluff, including their impacts on SSI effects of the plant.	2.5.5
ESP COL 11.1-1	Verify that the calculated radiological doses to members of the public from radioactive gaseous and liquid effluents for any facility to be built on the Grand Gulf site are bounded by the radiological doses included in the ESP application and reviewed by the NRC.	12.2.2.2
ESP COL 13.6-1	Provide specific designs for protected area barriers.	13.6
ESP PC 3.A	The characteristics of the Grand Gulf ESP Site set forth in Appendix A to this ESP are hereby incorporated into this ESP.	2.0

GGNS SUP 1.10-1

TABLE 1.10-202 (Sheet 6 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP PC 3.B	The controlling values of parameters set forth in Appendix B to this ESP are hereby incorporated into this ESP.	2.0
ESP PC 3.C	The combined license (COL) action items set forth in Appendix C to this ESP are hereby incorporated into this ESP. These COL action items identify certain matters that an applicant who submits an application referencing this ESP shall address in the final safety analysis report (FSAR). These items constitute information requirements but are not the only acceptable set of information in the FSAR. An applicant may depart from or omit these items, provided that it identifies and justifies the departure or omission in the FSAR. In addition, these items do not relieve an applicant from any requirement in 10 C.F.R. Chapter I that governs the application. After issuance of a construction permit (CP) or COL, these items are not requirements for the permit holder or licensee unless such items are included in a permit or license condition.	1.10
ESP PC 3.D	The values of plant parameters considered in the environmental review of the application and set forth in Appendix D to this ESP are hereby incorporated into this ESP.	COLA Part 3, Environmental Report, Section 3.0, includes the parameters of ESP Appendix D, and provides the demonstration required by 10 CFR 51.50 (c)(1)

GGNS SUP 1.10-1

**TABLE 1.10-202 (Sheet 7 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED**

Item No.	Subject / Description of Item	FSAR Section
ESP PC 3.E(1)	An applicant for a CP or COL referencing this ESP shall demonstrate that they have been granted the right to exercise sufficient control within the exclusion area identified in the ESP including authority to maintain ingress to and egress from the exclusion area and to evacuate individuals from the exclusion area in the event of an emergency. Such an applicant shall also secure any necessary arrangements to provide, in the event of a declared emergency, for the control of traffic on county roads and the evacuation of individuals within the ESP exclusion area. These arrangements shall be obtained and executed before the construction of a nuclear plant begins under a CP or COL referencing the ESP.	2.1
ESP PC 3.E(2)	An applicant for a CP or COL referencing this ESP shall ensure that any new unit's radioactive waste management systems, structures, and components, as defined in Regulatory Guide 1.143, for a future reactor include features to preclude accidental releases of radionuclides into potential liquid pathways.	2.4.13

GGNS SUP 1.10-1

TABLE 1.10-202 (Sheet 8 of 8)
SUMMARY OF FSAR SECTIONS WHERE ESP COL ACTION ITEMS AND PERMIT CONDITIONS ARE ADDRESSED

Item No.	Subject / Description of Item	FSAR Section
ESP PC 3.E(3)	An applicant for a CP or COL referencing this ESP shall perform geologic mapping of future excavations for safety-related structures and shall evaluate any unforseen geologic features that are encountered. Such an applicant shall notify the NRC no later than 30 days before any excavations for safety-related structures are open in order to allow for NRC's examination and evaluation.	2.5.4
ESP PC 3.F	An applicant for a CP or COL referencing this ESP shall develop an Environmental Protection Plan (EPP) for construction and operation of the proposed reactor and include the EPP in the application. The portion of the EPP directed to operation shall include any environmental conditions derived in accordance with 10C.F.R. § 50.36b.	COLA Part 11

1.11 TECHNICAL RESOLUTIONS OF TASK ACTION PLAN ITEMS, NEW GENERIC ISSUES, NEW GENERIC SAFETY ISSUES AND CHERNOBYL ISSUES

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

1.11.1 APPROACH

Add the following to the end of the section.

GGNS COL 1.11-1-A FSAR Table 1.11-201 supplements DCD Table 1.11-1 to address the site-specific aspects of items that refer to Notes (2) and (7).

GGNS SUP 1.11-1 FSAR Table 1.11-202 supplements DCD Table 1.11-1 to provide references to FSAR locations that provide additional information on specific issues.

1.11.2 COL INFORMATION

1.11-1-A Address Table 1.11-1 Items that refer to Notes (2) and (7)

GGNS COL 1.11-1-A This COL item is addressed in Section 1.11 and Table 1.11-201.

1.11.3 REFERENCES

1.11-201 U.S. Nuclear Regulatory Commission, “Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site,” NUREG 1817, Final Report, April 2006.

GGNS COL 1.11-1-A

TABLE 1.11-201 (Sheet 1 of 3)
COL ITEM RESOLUTIONS RELATED TO NUREG-0933 TABLE II TASK ACTION PLAN ITEMS AND NEW GENERIC ISSUES

Action Plan Item/ Issue Number	Description	Associated Location(s) Where Discussed and/or Technical Resolution
TASK ACTION PLAN ITEMS		
A-33	NEPA Review of Accident Risks	This environmental issue involves consideration of accidents on a risk specific basis. This subject is addressed in COLA Part 3 Chapter 7 and in Section 5.10 and Chapter 7 of Reference 1.11-201.
B-1	Environmental Technical Specifications	Issue is addressed in COLA Part 4, Sections 5.5.1 and 5.5.3, which address the ODCM and Radioactive Effluent Controls Program. See also Sections 11.5.4.5 and 11.5.4.6.
B-28	Radionuclide / Sediment Transport Program	Issue is addressed in COLA Part 4, Sections 5.5.1 and 5.5.3, which address the ODCM and Radioactive Effluent Controls Program. See also Sections 2.4.13, 11.5.4.5 and 11.5.4.6. This issue is also addressed in COLA Part 3 Sections 5.4 and 6.2 and in Sections 5.9 and 5.10.2 of Reference 1.11-201.
B-37	Chemical Discharges to Receiving Waters	Issue is addressed in COLA Part 3 Sections 3.6, 4.2 and 5.2 and in Sections 4.3.3 and 5.3.3 of Reference 1.11-201.
B-38	Reconnaissance Level Investigations	Issue is addressed in COLA Part 3 Sections 2.4 and 4.3.

GGNS COL 1.11-1-A

**TABLE 1.11-201 (Sheet 2 of 3)
COL ITEM RESOLUTIONS RELATED TO NUREG-0933 TABLE II TASK ACTION PLAN ITEMS AND NEW GENERIC ISSUES**

Action Plan Item/ Issue Number	Description	Associated Location(s) Where Discussed and/or Technical Resolution
B-39	Transmission Lines	Issue is addressed in COLA Part 3, Sections 2.2, 3.7, 4.1, 4.3 and 5.6.
B-40	Effects of Power Plant Entrainment on Plankton	Issue is addressed in COLA Part 3, Section 5.3 and in Section 5.4.2 of Reference 1.11-201.
B-41	Impacts on Fisheries	Impact of power plant operation on fishery resources is addressed in COLA Part 3, Section 5.3 and in Section 5.4.2 of Reference 1.11-201.
B-42	Socioeconomic Environmental Impacts	Issue is addressed in COLA Part 3, Sections 2.5, 4.4 and 5.8 and in Sections 2.8, 4.5 and 5.5 of Reference 1.11-201.
B-43	Value of Aerial Photographs for Site Evaluation	Work completed to date on this issue is published in NUREG/CR-2861. The use of aerial photography is addressed in Section 2.5.5.
C-16	Assessment of Agricultural Land in Relation to Power Plant Siting and Cooling System Selection	The impact of construction and power plant operation on agricultural land use is addressed in COLA Part 3, Sections 2.2, 4.1, 5.1 and 9.4 and in Sections 8.3 and 8.5 of Reference 1.11-201.

GGNS COL 1.11-1-A

TABLE 1.11-201 (Sheet 3 of 3)
COL ITEM RESOLUTIONS RELATED TO NUREG-0933 TABLE II TASK ACTION PLAN ITEMS AND NEW GENERIC ISSUES

Action Plan Item/ Issue Number	Description	Associated Location(s) Where Discussed and/or Technical Resolution
NEW GENERIC ISSUES		
184	Endangered Species	Issue is addressed in COLA Part 3 Sections 2.4, 4.3 and 5.3 and in Sections 2.7, 4.4 and 5.4 of Reference 1.11-201.

GGNS SUP 1.11-1

TABLE 1.11-202 (Sheet 1 of 2)
SUPPLEMENTARY RESOLUTIONS RELATED TO NUREG-0933 TABLE II TMI ACTION PLAN ITEMS AND HUMAN FACTORS ISSUES

Action Plan Item/ Issue Number	Description	Associated Location(s) Where Discussed and/or Technical Resolution
TMI ACTION PLAN ITEMS		
1.A.1.1	Shift Technical Advisor	Section 13.1.2.1.2.8 and DCD Section 18.6
1.A.1.2	Shift Supervisor Administrative Duties	Sections 13.1.2.1.2.4 and 13.1.2.1.2.5
1.A.1.3	Shift Manning	Section 13.1.2.1.4, Table 13.1-202, Figure 13.1-202, and DCD Section 18.6
1.A.2.1(1)	Qualifications – Experience	Section 13.1.3.1, Table 13.1-201, and DCD Section 18.6
1.C.3	Shift Supervisor Responsibilities	Sections 13.1.2.1.2.4 and 13.1.2.1.2.5
1.F.2(6)	Increase the Size of Licensees’ QA Staff	Section 13.1.1.2.3, Table 13.1-201, and Section 17.5
1.F.2(9)	Clarify Organizational Reporting Levels for the QA Organization	Section 13.1.1.2.3, Figure 13.1-201, and Section 17.5
II.B.3	Post Accident Sampling	Appendix 12BB
III.D.3.3	In-Plant Radiation Monitoring	Appendix 12BB

GGNS SUP 1.11-1

TABLE 1.11-202 (Sheet 2 of 2)
SUPPLEMENTARY RESOLUTIONS RELATED TO NUREG-0933 TABLE II TMI ACTION PLAN ITEMS AND HUMAN FACTORS ISSUES

Action Plan Item/ Issue Number	Description	Associated Location(s) Where Discussed and/or Technical Resolution
HUMAN FACTORS ISSUES		
HF1.1	Shift Staffing	Table 13.1-201, Table 13.1-202, Section 13.1.2.1.4
HF4.1	Inspection Procedure for Upgraded Emergency Operating Procedures	This item relates to Inspection results indicating that licensees were not appropriately developing and implementing their Emergency Operating Procedures in accordance with their Procedure Generation Packages. Section 13.5.2.1.4 requires implementation of the Procedure Generation Packages.

1.12 IMPACT OF CONSTRUCTION ACTIVITIES ON UNIT 1

GGNS SUP 1.12-1

1.12.1 INTRODUCTION

Paragraph 10 CFR 52.79(a)(31) requires that the FSAR include the following information:

> For nuclear power plants to be operated on multi-unit sites, an evaluation of the potential hazards to the structures, systems and components (SSCs) important to safety of operating units resulting from construction activities, as well as a description of the managerial and administrative controls to be used to provide assurance that the limiting conditions for operation (LCO) are not exceeded as a result of construction activities at the multi-unit sites.

Accordingly, the evaluation of the potential impact of the construction of Unit 3 on Unit 1 SSCs important to safety is summarized below, along with a description of the managerial and administrative controls used to provide assurance that Unit 1 LCO are not exceeded as a result of Unit 3 construction activities. This evaluation involves several sequential steps:

- Identification of potential construction activity hazards
- Identification of SSCs important to safety
- Identification of LCOs
- Identification of Impacted SSCs and LCOs
- Identification of applicable managerial and administrative controls

1.12.2 POTENTIAL CONSTRUCTION ACTIVITY HAZARDS

Unit 3 is located on the existing GGNS site on a parcel of land adjacent to and generally west of the operating unit, Unit 1, as shown in Figure 2.1-201.

Based on experience from similar construction projects, the scope of work necessary to construct Unit 3 is well understood. In general, it includes, but not necessarily limited to, activities such as site exploration, grading, clearing and installation of drainage and erosion control measures; boring, drilling, dredging, demolition and excavating; storage and warehousing of equipment, and construction, erection and fabrication of new facilities. These activities involve major ESBWR standard plant structures such as the Reactor Building, Control Building, Fuel Building, Turbine Building, Radwaste Building, Electrical Building, and plant stack; as well as related support facilities such as transformers, switchyard(s), transmission lines, cooling water structures and systems, water treatment facilities, storage tanks, cooling towers, etc.

The applicable time period for such activities starts when work is first performed under the COL for Unit 3 and ends for each Unit 3 SSC when responsibility for that SSC is transferred to the accountable operating organization.

Each of the types of construction activities necessary to build a new unit was examined to identify the potential hazards to the existing unit. The resulting list of construction activities and potential hazards is shown in Table 1.12-201.

1.12.3 STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY

Consistent with 10 CFR 50.34 and 10 CFR 50, Appendix A, Unit 1 SSCs important to safety were identified from Chapter 3 of the Unit 1 Updated Final Safety Analysis Report (UFSAR) (Reference 1.12-201); additionally, information in Chapters 4, 5, 6, 7, 8 and 9 of the Unit 1 GGNS UFSAR was utilized.

1.12.4 LIMITING CONDITIONS FOR OPERATION

Pursuant to 10 CFR 50.36, LCOs are the lowest functional capability or performance levels of equipment required for safe operation of a facility and are established in operating unit Technical Specifications for each item meeting one or more of the following criteria:

- Criterion 1 - Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
- Criterion 2 - A process variable, design feature, or operating restriction that is an initial condition of a DBA or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 3 - A SSC that is part of the primary success path and which functions or actuates to mitigate a DBA or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 4 - A SSC which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The applicable LCOs are found in the Unit 1 Technical Specifications (Reference 1.12-202).

1.12.5 IMPACTED STRUCTURES, SYSTEMS AND COMPONENTS AND LIMITING CONDITIONS FOR OPERATION

The information described in Sections 1.12.2 - 1.12.4 was evaluated to identify Unit 1 SSCs and LCOs that might be impacted by Unit 3 construction activities. This evaluation focused on Seismic Category 1 structures and components and/or systems outside of Seismic Category 1 structures to ensure that they were capable of withstanding any construction impacts without loss of safety function. SSCs that are within Seismic Category 1 structures and that are specific to Unit 1 are not affected because they are protected against construction activities as long as the Seismic Category 1 structure in which they are housed is protected. These SSCs include items such as the ADS Accumulators, Fuel Storage Racks and Control Rod Drive Assemblies. Additionally, Unit 1 LCO parameters such as “Control Rod OPERABILITY,” “Shutdown Margin” and “RCS Specific Activity” are eliminated from consideration because they are related to specific parameters rather than physical equipment.

For each of the potential hazards listed in Table 1.12-201, Table 1.12-202 presents the potential consequences to the SSCs of the existing unit that were identified in the above process.

1.12.6 MANAGERIAL AND ADMINISTRATIVE CONTROLS

Managerial and administrative controls are utilized to identify preventive and mitigative measures and provide notification of hazard activity initiation in order to prevent or minimize exposure of SSCs to the identified hazards. Applicable managerial and administrative controls are listed in Table 1.12-203.

Specific hazards, impacted SSCs, and managerial and administrative controls are developed and implemented as work progresses on site. For example, prior to construction activities which involve the use of large construction equipment such as cranes, managerial and administrative procedures will be in place to prevent adverse impacts on Unit 1 overhead power lines, switchyard, security boundary, etc., by providing the necessary restrictions on their use.

1.12.7 REFERENCES

1.12-201 Grand Gulf Unit 1 UFSAR

1.12-202 Grand Gulf Unit 1 Technical Specifications

GGNS SUP 1.12-1

TABLE 1.12-201 (Sheet 1 of 3)
POTENTIAL HAZARDS TO UNIT 1
FROM UNIT 3 CONSTRUCTION ACTIVITIES

ACTIVITY	REPRESENTATIVE HAZARDS
Site Exploration, Grading, Clearing, Installation of Drainage and Erosion Control Measures, Etc.	Impact on Overhead Power Lines Impact on Transmission Towers Impact on Underground Conduits, Piping, Tunnels, Etc. Impact on Site Access and Egress Impact on Drainage Facilities and Structures Impact on On-site Transportation Routes Impact on Slope Stability Impact of Increased Soil Erosion and Local Flooding Impact of Construction-Generated Dust and Equipment Exhausts Impact of Encroachment on Protected Or Vital Areas Impact of Encroachment on Structures and Facilities
Boring, Drilling, Pile Driving, Dredging, Demolition, Excavation, Etc.	Impact on Underground Conduits, Piping, Tunnels, Etc. Impact on Foundation Integrity Impact on Structural Integrity Impact on Slope Stability Impact of Ground Vibration Impact Of Overpressure Due To Use Of Explosives

GGNS SUP 1.12-1

TABLE 1.12-201 (Sheet 2 of 3)
POTENTIAL HAZARDS TO UNIT 1
FROM UNIT 3 CONSTRUCTION ACTIVITIES

ACTIVITY	REPRESENTATIVE HAZARDS
Equipment Movement, Material Delivery, Vehicle Traffic. Etc.	Impact on Overhead Power Lines
	Impact on Transmission Towers
	Impact on Underground Conduits, Piping, Tunnels, Etc.
	Impact of Crane Load Drops
	Impact of Crane or Crane Boom Failures
	Impact of Vehicle Accidents
	Impact of Vehicle Runaways
Equipment and Material Laydown, Storage, Warehousing, Etc.	Impact of Releases of Stored Flammable, Hazardous or Toxic Materials
	Impact of Wind-Generated, Construction-Related Debris and Missiles
	Impact of Increased Local Flooding
General Construction, Erection, Fabrication, Etc.	Impact on Instrumentation and Control Systems and Components
	Impact on Electrical Systems and Components
	Impact on Cooling Water Systems and Components
	Impact on Radioactive Waste Release Points and Parameters
	Impact of Abandonment of SSCs
	Impact of Relocation of SSCs

GGNS SUP 1.12-1

TABLE 1.12-201 (Sheet 3 of 3)
POTENTIAL HAZARDS TO UNIT 1
FROM UNIT 3 CONSTRUCTION ACTIVITIES

ACTIVITY	REPRESENTATIVE HAZARDS
Connection, Integration, Tie-In, Testing, Etc.	Impact on Instrumentation and Control Systems and Components
	Impact on Electrical and Power Systems and Components
	Impact on Cooling Water Systems and Components
General Site Construction Activities	Impact on Site Security Systems

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 1 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
CONTAINMENT STRUCTURE	
Impact of Crane or Crane Boom Failures	Building Degradation Due to Crane Boom Failure
Impact of Wind-Generated Construction-Related Debris and Missiles	Effects of Construction-Related Debris or Missiles
Impact On Foundation Integrity	Building Degradation Due To Foundation Undermining As A Result Of Demolition, Excavation, Etc.
Impact On Structural Integrity	Building Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Building Degradation Due To Structural Damage As A Result Of Explosion
CONTROL ROOM EMERGENCY HVAC SYSTEMS	
Impact of Construction-Generated Dust and Equipment Exhausts	Effects of Construction-Generated Dust and Equipment Exhausts on Control Room Habitability Systems Air Intakes
Impact of Releases of Flammable, Hazardous or Toxic Materials	Effects of Releases of Flammable, Hazardous or Toxic Materials on Control Room Habitability Systems Design Basis
Impact Of Vehicle Accidents	Effects Of Releases Of Flammable, Hazardous Or Toxic Materials And/Or Smoke On Control Room Habitability Systems Design Basis

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 2 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
DIESEL GENERATOR BUILDING	
Impact of Crane or Crane Boom Failures	Building Degradation Due to Crane Boom Failure
Impact Of Wind-Generated Construction-Related Debris And Missiles	Effects Of Construction-Related Debris Or Missiles
Impact On Drainage Facilities And Structures	Design Basis Flood Elevation Exceeded
Impact Of Increased Soil Erosion And Local Flooding	Design Basis Flood Elevation Exceeded
Impact Of Increased And Local Flooding	Design Basis Flood Elevation Exceeded
Impact On Slope Stability	Drainage Degradation Due To Damming Effect Resulting In Exceedence Of Design Basis Flood Elevation
Impact On Foundation Integrity	Building Degradation Due To Foundation Undermining As A Result Of Demolition, Excavation, Etc.
Impact On Structural Integrity	Building Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Building Degradation Due To Structural Damage As A Result Of Explosion

GGNS SUP 1.12-1

**TABLE 1.12-202 (Sheet 3 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES**

Potential Hazard	Potential Consequences
DIESEL GENERATORS	
Impact of Construction-Generated Dust and Equipment Exhausts	Effects of Construction-Generated Dust and Equipment Exhausts on Emergency Diesel Generator Combustion Air Intakes
Impact On Site Access And Egress	Prevention Of Diesel Fuel Oil Delivery
Impact On On-site Transportation Routes	Prevention Of Diesel Fuel Oil Delivery
FIRE PROTECTION SYSTEM	
Impact on Underground Conduits, Piping, Tunnels, Etc.	Degradation of Fire Protection System Availability or Capacity
Impact of the Relocation of SSCs	Degradation of Fire Protection System Availability or Capacity
Impact On On-site Transportation Routes	Degradation Of Fire Fighting Capabilities
AUXILIARY BUILDING	
Impact of Crane or Crane Boom Failures	Building Degradation Due to Crane Boom Failure
Impact of Wind-Generated Construction-Related Debris and Missiles	Effects of Construction-Related Debris or Missiles
Impact On Drainage Facilities And Structures	Design Basis Flood Elevation Exceeded
Impact Of Increased Soil Erosion And Local Flooding	Design Basis Flood Elevation Exceeded
Impact Of Increased And Local Flooding	Design Basis Flood Elevation Exceeded

GGNS SUP 1.12-1

**TABLE 1.12-202 (Sheet 4 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES**

Potential Hazard	Potential Consequences
AUXILIARY BUILDING (CONTINUED)	
Impact On Slope Stability	Drainage Degradation Due To Damming Effect Resulting In Exceedence Of Design Basis Flood Elevation
Impact On Foundation Integrity	Building Degradation Due To Foundation Undermining As A Result Of Demolition, Excavation, Etc.
Impact On Structural Integrity	Building Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Building Degradation Due To Structural Damage As A Result Of Explosion
GASEOUS RADIOACTIVE WASTE MANAGEMENT SYSTEM	
Impact on Radioactive Waste Release Points and Parameters	Building and Facility Effects on Gaseous Release χ/Q and D/Q Assumptions
OFF-SITE POWER SYSTEM	
Impact on Overhead Power Lines	Transmission Line Disruptions Due to Grading or Clearing, Equipment Movement, Crane Boom Failures, Etc.
Impact on Transmission Towers	Transmission Line Disruptions Due to Grading or Clearing, Equipment Movement, Crane Boom Failures, Etc.
Impact Of Crane Or Crane Boom Failures	Transmission Line Disruptions Or Tower Degradation Due To Crane Boom Failure

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 5 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
OFF-SITE POWER SYSTEM (CONTINUED)	
Impact Of Encroachment On Structures And Facilities	Transmission Line Disruptions Due To Construction Activities
Impact Of Vehicle Runaways	Transmission Line Disruptions Or Tower Degradation Due To Vehicle Impact
Impact On On-site Transportation Routes	Impede Identification And Restoration Of Switchyard Equipment Malfunctions
Impact of Ground Vibration	Operability Disruptions Due to Vibration Induced Spurious Trips
Impact On Foundation Integrity	Transmission Tower Degradation Due To Foundation Undermining As A Result Of Demolition, Excavation, Etc.
Impact On Structural Integrity	Transmission Tower Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Transmission Tower Degradation Due To Structural Damage As A Result Of Explosion
Impact on Electrical Systems and Components	Operability Disruptions Due to Equipment Movement, System Interconnections, Etc.
Impact on Instrumentation and Control Systems and Components	Operability Disruptions Due to Connection, Integration, Tie-In, Testing, Etc.

GGNS SUP 1.12-1

**TABLE 1.12-202 (Sheet 6 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES**

Potential Hazard	Potential Consequences
ON-SITE POWER SYSTEMS	
Impact of Ground Vibration	Operability Disruptions Due to Vibration Induced Spurious Trips
Impact on Electrical Systems and Components	Operability Disruptions Due to Vibration Induced Spurious Trips, System Interconnections, Etc.
Impact on Instrumentation and Control Systems and Components	Operability Disruptions Due to Connection, Integration, Tie-In, Testing, Etc.
CONTROL BUILDING	
Impact of Crane or Crane Boom Failures	Building Degradation Due to Crane Boom Failure
Impact of Wind-Generated Construction-Related Debris and Missiles	Effects of Construction-Related Debris or Missiles
Impact On Drainage Facilities And Structures	Design Basis Flood Elevation Exceeded
Impact Of Increased Soil Erosion And Local Flooding	Design Basis Flood Elevation Exceeded
Impact Of Increased And Local Flooding	Design Basis Flood Elevation Exceeded
Impact On Slope Stability	Drainage Degradation Due To Damming Effect Resulting In Exceedence Of Design Basis Flood Elevation
Impact On Foundation Integrity	Building Degradation Due To Foundation Undermining As A Result Of Demolition, Excavation, Etc.

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 7 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
CONTROL BUILDING (CONTINUED)	
Impact On Structural Integrity	Building Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Building Degradation Due To Structural Damage As A Result Of Explosion
PLANT SERVICE WATER (PSW) SYSTEM	
Impact on Underground Conduits, Piping, Tunnels, Etc.	Degradation of PSW System Availability or Capacity
Impact on Cooling Water Systems and Structures	Degradation of PSW System Availability or Capacity
Impact of the Relocation of SSCs	Degradation of PSW System Availability or Capacity
Impact Of Encroachment On Structures And Facilities	Degradation Of PSW System Availability Or Capacity
Impact Of Crane Load Drops	Degradation Of PSW System Availability Or Capacity
Impact On On-site Transportation Routes	Degradation Of Ability To Access PSW Pump And Switchgear Houses
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Degradation Of PSW System Due To Structural Damage As A Result Of Explosion

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 8 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
ULTIMATE HEAT SINK (UHS)	
Impact on Underground Conduits, Piping, Tunnels, Etc.	Degradation of UHS Availability or Capacity
Impact on Cooling Water Systems and Components	Degradation of UHS Availability or Capacity
Impact Of Wind-Generated Construction-Related Debris And Missiles	Effects Of Construction-Related Debris Or Missiles
Impact On Drainage Facilities And Structures	Design Basis Flood Elevation Exceeded
Impact Of Increased Soil Erosion And Local Flooding	Design Basis Flood Elevation Exceeded
Impact Of Increased And Local Flooding	Design Basis Flood Elevation Exceeded
Impact On Slope Stability	Drainage Degradation Due To Damming Effect Resulting In Exceedence Of Design Basis Flood Elevation
Impact On Structural Integrity	UHS Basin Degradation Due To Structural Damage As A Result Of Demolition, Excavation, Etc.
Impact Of Overpressure Due To Inadvertent Explosives Detonation	UHS Basin Degradation Due To Structural Damage As A Result Of Explosion

GGNS SUP 1.12-1

TABLE 1.12-202 (Sheet 9 of 9)
POTENTIAL CONSEQUENCES TO UNIT 1 DUE TO POTENTIAL HAZARDS RESULTING FROM UNIT 3 CONSTRUCTION ACTIVITIES

Potential Hazard	Potential Consequences
SITE	
Impact on Site Security Systems	Security Threat to Operating Unit Could Impact SSCs
Impact On Site Access And Egress	Emergency Plan Impact
Impact On Drainage Facilities And Structures	Design Basis Flood Elevation Exceeded
Impact Of Increased Soil Erosion And Local Flooding	Design Basis Flood Elevation Exceeded
Impact Of Increased And Local Flooding	Design Basis Flood Elevation Exceeded
Impact On Slope Stability	Drainage Degradation Due To Damming Effect Resulting In Exceedence Of Design Basis Flood Elevation
Impact On On-site Transportation Routes	Emergency Plan, Fire Fighting Capabilities, And Security Impacts
Impact Of Encroachment On Plant Protected Or Vital Areas	Security Impacts
Impact Of Vehicle Runaways	Security Impacts
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Security Impacts
Impact Of Abandonment Of SSCs	Security Impacts

GGNS SUP 1.12-1

TABLE 1.12-203 (Page 1 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact on Overhead Power Lines	Administrative Controls for Appropriate Standoff and/or Installation of Temporary Support Towers
Impact on Transmission Towers	Administrative Controls for Appropriate Standoff and/or Installation of Temporary Support Towers
Impact on Underground Conduits, Piping, Tunnels, Etc.	Administrative Controls to Identify Potentially Affected Structures, Systems and Components, Evaluation To Ensure Their Structural Integrity During Construction, and/or Measures to Mitigate Impacts
Impact On Site Access And Egress	Administrative Controls To Ensure Adequate Site Access And Egress Is Maintained (For Example, Additional Access Road During Construction)
Impact On Drainage Facilities And Structures	Administrative Controls To Ensure That Drainage Capability Is Maintained (For Example, Addition Of Temporary Drainage Culverts During Construction)
Impact On Onsite Transportation Routes	Administrative Controls To Ensure Adequate Onsite Transportation Routes (For Example Segregation of Construction Traffic Routes From Operating Plant Routes)
Impact On Slope Stability	Administrative Controls To Ensure Adequate Controls On Grading And Excavation To Maintain Slope Stability (For Example, Construction Control Plans, Temporary Barriers To Mitigate Inadvertent Earth Movement, Etc.)

GGNS SUP 1.12-1

TABLE 1.12-203 (Page 2 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact Of Increased Soil Erosion And Local Flooding	Administrative Controls To Ensure That Drainage Capability Is Maintained To Prevent Soil Erosion Or Local Flooding (For Example, Addition Of Temporary Drainage Culverts Or Temporary Construction Barriers)
Impact Of Increased And Local Flooding	Administrative Controls To Ensure That Drainage Capability Is Maintained To Prevent Increased Or Local Flooding (For Example, Addition Of Temporary Drainage Structures And/Or Temporary Barriers, Design Of Laydown And Storage Areas To Divert Runoff To Drainage Structures, Etc.)
Impact of Construction-Generated Dust and Equipment Exhausts	Administrative Controls to Avoid or Minimize Construction Dust (For Example Use Of Water Spray Trucks) and/or Enhanced Monitoring of Potentially Affected System Intakes, Filters, Etc.
Impact Of Encroachment On Structures And Facilities	Administrative Controls To Avoid Encroachment (For Example, Temporary Barriers Erected, Additional Security Personnel, Etc.)
Impact On Foundation Integrity	Administrative Controls To Identify Potentially Affected Structures, Systems And Components And To Provide Adequate Controls On Construction Activities (For Example, Construction Control Plans, Pre-Activity Planning, Etc.)

GGNS SUP 1.12-1

TABLE 1.12-203 (Page 3 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact On Structural Integrity	Administrative Controls To Identify Potentially Affected Structures, Systems And Components And To Provide Adequate Controls On Construction Activities (For Example, Construction Control Plans, Pre-Activity Planning, Etc.)
Impact Of Overpressure Due To Inadvertent Explosives Detonation	Administrative Controls To Coordinate Transport Onsite, Onsite Use And Onsite Storage Of Explosive Materials With Security And Safety Departments In Accordance With Unit 1 And/Or 3 Security Plan(s)
Impact Of Vehicle Accidents	Administrative Controls To Respond To Site Accidents (For Example Construction Control Plans For Construction Fire Brigade, Hazardous Materials Response Team, Etc.)
Impact Of Vehicle Runaways	Administrative Controls To Limit Access Of Construction Vehicles To Defined Areas Of The Site To Minimize Impact Of A Runaway Vehicle
Impact Of Abandonment Of Structures, Systems Or Components	Administrative Controls For Post-Construction Disposition Of Construction Related Structures (For Example, Disposition Of Abandoned Structures To Ensure Structures Do Not Impede Security's Line Of Sight)

GGNS SUP 1.12-1

TABLE 1.12-203 (Page 4 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact of Ground Vibration	Administrative Controls to Identify Potentially Affected Structures, Systems and Components And To Evaluate Nature Of Activity And Limit The Possible Impact On SSCs (For Example, Case By Case Evaluations Or Generic Evaluations of Specific Activities To Determine Possible Adverse Impacts
Impact of Crane or Crane Boom Failures	Administrative Controls for Appropriate Standoff and/or Load Limits (For Example, Controls To Limit Cranes To Defined Areas That Maintain Safe Distance From SSCs And Establishment of Programs Requiring Adherence To Equipment Load Limitations)
Impact Of Crane Load Drops	Administrative Controls For Appropriate Rigging, Load Limits And Standoff (For Example, Construction Plan Defines Acceptable Paths And Locations For Transporting And/Or Lifting Large Loads)
Impact of Releases of Flammable, Hazardous or Toxic Materials	Administrative Controls on Quantities and Types of Flammable, Hazardous or Toxic Materials
Impact of Wind-Generated, Construction-Related Debris and Missiles	Administrative Controls on Equipment and Material Storage and Transport, and for Reducing Power or Shutting Down Unit 1 During High Winds or High Wind Warnings

GGNS SUP
1.12-1

TABLE 1.12-203 (Page 5 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact on Electrical Systems and Components	Administrative Controls to Identify Potentially Affected Structures, Systems and Components, Evaluation To Ensure Their Electrical Integrity During Construction, and/or Measures to Mitigate Impacts (For Example, Performance Of Construction Activities When Systems And/Or Components Are Not Required To Be Operable)
Impact on Instrumentation and Control Systems and Components	Administrative Controls to Identify Potentially Affected Structures, Systems and Components, Evaluation To Ensure Their Electrical Integrity During Construction, and/or Measures to Mitigate Impacts (For Example, Performance Of Construction Activities When Systems And/Or Components Are Not Required To Be Operable)
Impact on Cooling Water Systems and Components	Administrative Controls to Identify Potentially Affected Structures, Systems and Components, Evaluation To Ensure Their Electrical Integrity During Construction, and/or Measures to Mitigate Impacts (For Example, Performance Of Construction Activities When Systems And/Or Components Are Not Required To Be Operable)
Impact on Radioactive Waste Release Points and Parameters	Enhanced Monitoring and Control to Assure Releases Are Within Limits

GGNS SUP 1.12-1

TABLE 1.12-203 (Page 6 of 6)
MANAGERIAL AND ADMINISTRATIVE CONTROLS FOR UNIT 3 CONSTRUCTION ACTIVITY HAZARDS

HAZARD	CONTROL
Impact of Relocation of Structures, Systems or Components	Administrative Controls to Identify Potentially Affected Structures, Systems and Components, Evaluation To Ensure Their Integrity During Construction, and/or Measures to Mitigate Impacts (For Example, Provisions For Supplemental Fire Protection Equipment)
Impact on Site Security Systems	Security Plan Controls Site Activities, Reference Security Plan (For Example Maintaining Adequate Separation Distances, Controlling Vehicles and Personnel Access, Increased Security Personnel During Construction, Etc.).
Impact Of Encroachment On Plant Protected Or Vital Areas	Security Plan Controls Site Activities, Reference Security Plan (For Example, Maintaining Adequate Separation Distances)

APPENDIX 1A RESPONSE TO TMI RELATED MATTERS

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

Table 1A-1, 10 CFR 50.34(f)(3)(i), TMI Item I.C.5

Add the following to the end of the ESBWR Resolution statement.

STD SUP 1A.1-1 ESBWR construction and operations engineers are also continually involved in reviewing industry experience from these same sources in accordance with the administrative procedures described in DCD Section 18.3.2.

Table 1A-1, 10 CFR 50.34(f)(3)(iii), TMI Item I.F.2

Add the following to the end of the ESBWR Resolution statement.

STD SUP 1A.1-1 The Quality Assurance Program described in Chapter 17 also meets the requirements of issue I.F.2 as they apply to the construction and operation of the ESBWR.

Table 1A-1, 10 CFR 50.34(f)(3)(vii), TMI Item II.J.3.1

Add “13.1” as an “Associated Location(s)” and add the following to the end of the ESBWR Resolution statement.

STD SUP 1A.1-1 The ESBWR construction and operations teams have also developed a management plan for the ESBWR project that consists of a properly structured organization with open lines of communication, clearly defined responsibilities, well-coordinated technical efforts, and appropriate control channels.

The organizational structure is discussed in Section 13.1.

APPENDIX 1B PLANT SHIELDING TO PROVIDE ACCESS TO AREAS AND PROTECT SAFETY EQUIPMENT FOR POST-ACCIDENT OPERATION [II.B.2]

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 1C INDUSTRY OPERATING EXPERIENCE

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

APPENDIX 1C.1 EVALUATION

Replace the last paragraph with the following.

STD COL 1C.1-1-A
STD COL 1C.1-2-A
STD SUP 1C-1

Tables 1C-201 and 1C-202. These tables address Generic Letters and Bulletins that have been in effect/issued up to six months before the COL application submittal date, and after the SRP revisions that are applicable to this FSAR. They also address Generic Letter 82-39 and IE Bulletin 2005-02, which were identified in the DCD as the responsibility of the COL applicant.

APPENDIX 1C.2 COL INFORMATION

1C.1-1-A Handling of Safeguards Information

STD COL 1C.1-1-A

This COL item is addressed in Section 1C.1 and the Table 1C-201 entry for Generic Letter 82-39.

1C.1-2-A Emergency Preparedness and Response Actions

STD COL 1C.1-2-A

This COL item is addressed in Section 1C.1 and the Table 1C-202 entry for IE Bulletin 2005-02.

STD COL 1C.1-1-A

TABLE 1C-201
OPERATING EXPERIENCE REVIEW RESULTS SUMMARY—GENERIC LETTERS

No.	Issue Date	Title	Evaluation Result or Location(s) Where Discussed
82-39	12/22/82	Problems with the Submittals of 10 CFR 73.21 Safeguards Information Licensing Review	Not Applicable. Is an administrative communication. The site has an approved procedure for handling Safeguards Information including how to mail such information to authorized recipients.

STD COL 1C.1-2-A

TABLE 1C-202
OPERATING EXPERIENCE REVIEW RESULTS SUMMARY — IE BULLETINS

No.	Issue Date	Title	Evaluation Result or Location(s) Where Discussed
2005-02	7/18/05	Emergency Preparedness and Response Actions for Security-Based Events	COLA Part 5, Emergency Plan

CHAPTER 2 SITE CHARACTERISTICS

2.0 INTRODUCTION

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

Replace the last two paragraphs of DCD Section 2.0 with the following.

Comparison of Site Characteristics and ESBWR Site Parameters

GGNS COL 2.0-1-A

The site parameters[1] for the ESBWR standard plant are identified in Table 2.0-1 of the referenced DCD. Table 2.0-201, Comparison of ESBWR DCD Site Parameters with Unit 3 Site Characteristics, lists the ESBWR site parameters and the corresponding Unit 3 site characteristics[2], and provides the comparison showing that either the Unit 3 site characteristic falls within the ESBWR DCD site parameter, or identifies a departure.

Comparison of Unit 3 Site Characteristics and ESP Site Characteristics and Design Parameters

GGNS SUP 2.0-1

The ESP site characteristics for the Grand Gulf ESP Site are identified in ESP-002 (Reference 2.0-201) Appendix A, Characteristics of the Grand Gulf ESP Site, and controlling parameters and design basis accident (DBA) source terms are in ESP-002 Appendix B, Controlling Values of Parameters and Design Basis Accident Source Term Plant Parameters.

GGNS ESP PC 3.A

Table 2.0-202, Comparison of Unit 3 Site Characteristics to the Grand Gulf ESP Site Characteristics, lists the ESP site characteristics and the corresponding site characteristics for Unit 3. The table provides the comparison showing that either each Unit 3 value falls within the site characteristic specified in the ESP, or identifies a variance.

GGNS ESP PC 3.B

Table 2.0-203, Comparison of Unit 3 Design Characteristics with Grand Gulf ESP Controlling Values of Parameters and DBA Source Term Plant Parameters, lists the ESP parameters and the corresponding design values for Unit 3. The table provides the comparison showing that each Unit 3 value falls within the bounding design parameter specified in the ESP, or identifies a variance.

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[1] 10 CFR 52.1 defines site parameters as the postulated physical, environmental and demographic features of an assumed site.

[2] 10 CFR 52.1 defines site characteristics as the actual physical, environmental and demographic features of a site.

GGNS COL 2.0-2-A through 2.0-30-A

Information on Unit 3 site characteristics is provided in Sections 2.1 through 2.5 of this chapter, which incorporate by reference sections from the SSAR with appropriate supplements and/or variances. The information addresses the Standard Review Plan (SRP), NUREG-0800 information requirements of the DCD for a COL application, as identified in Table 2.0-2R. In the column identified as "COL Information," the COL Item from the ESBWR DCD is replaced with a sentence identifying the FSAR section which addresses the corresponding COL item.

2.0.1 COL UNIT-SPECIFIC INFORMATION

2.0-1-A Site Characteristics Demonstration

GGNS COL 2.0-1-A

This COL Item is addressed in Section 2.0 and Table 2.0-201.

2.0-2-A through 2.0-30-A Standard Review Plan Conformance

GGNS COL 2.0-2-A through 2.0-30-A

These COL Items are addressed in Section 2.0 and Table 2.0-2R.

2.0.2 REFERENCES

2.0-201 System Energy Resources Inc., Grand Gulf ESP Site, Docket No. 52-009, Early Site Permit No. ESP-002, April 5, 2007 (ADAMS Accession No. ML070780457).

GGNS COL 2.0-2-A through 2.0-30-A

TABLE 2.0-2R (Sheet 1 of 4)
LIMITS IMPOSED ON ACCEPTANCE CRITERIA IN SECTION II OF SRP BY ESBWR DESIGN

Section	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.1.1	Site Location and Description	None.	COL Item 2.0-2-A is addressed in Section 2.1.
2.1.2	Exclusion Area Authority and Control	None.	COL Item 2.0-3-A is addressed in Section 2.1.
2.1.3	Population Distribution	ESBWR PRA off-site consequence analysis in DCD Reference 2.0-1 is based on a population density of 305 people per square kilometer (790 per square mile) from DCD Table 2.0-2.	COL Item 2.0-4-A is addressed in Section 2.1.
2.2.1 – 2.2.2	Identification of Potential Hazards in Site Vicinity	Per DCD Table 2.0-1.	COL Item 2.0-5-A is addressed in Section 2.2.
2.2.3	Evaluation of Potential Accidents	None considered in vicinity of plant.	COL Item 2.0-6-A is addressed in Section 2.2.
2.3.1	Regional Climatology	Per DCD Table 2.0-1.	COL Item 2.0-7-A is addressed in Section 2.3.
2.3.2	Local Meteorology	None.	COL Item 2.0-8-A is addressed in Section 2.3.

GGNS COL 2.0-2-A through 2.0-30-A

TABLE 2.0-2R (Sheet 2 of 4)
LIMITS IMPOSED ON ACCEPTANCE CRITERIA IN SECTION II OF SRP BY ESBWR DESIGN

Section	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.3.3	On-site Meteorological Measurements Programs	None.	COL Item 2.0-9-A is addressed in Section 2.3.
2.3.4	Short-Term Dispersion Estimates for Accidental Atmospheric Releases	Per DCD Table 2.0-1. See also DCD Chapter 15.	COL Item 2.0-10-A is addressed in Section 2.3.
2.3.5	Long-Term Diffusion Estimates	Per DCD Table 2.0-1. See DCD Section 12.2.2.1 for a discussion of the generation of these values.	COL Item 2.0-11-A is addressed in Section 2.3.
2.4.1	Hydraulic Description Maximum Ground Water Level	Per DCD Table 2.0-1.	COL Item 2.0-12-A is addressed in Section 2.4.1.
2.4.2	Floods	Per DCD Table 2.0-1.	COL Item 2.0-13-A is addressed in Section 2.4.2.
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers	Probable maximum flooding level on streams and rivers does not exceed the maximum flood level defined in DCD Table 2.0-1.	COL Item 2.0-14-A is addressed in Section 2.4.3.
2.4.4	Potential Dam Failures Seismically Induced	Potential seismically induced dam failures do not cause flooding to exceed the maximum flood level defined in DCD Table 2.0-1.	COL Item 2.0-15-A is addressed in Section 2.4.4.

GGNS COL 2.0-2-A through 2.0-30-A

TABLE 2.0-2R (Sheet 3 of 4)
LIMITS IMPOSED ON ACCEPTANCE CRITERIA IN SECTION II OF SRP BY ESBWR DESIGN

Section	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.5	Probable Maximum Surge and Seiche Flooding	Probable maximum surge and seiche flooding level does not exceed the maximum flood level defined in DCD Table 2.0-1.	COL Item 2.0-16-A is addressed in Section 2.4.5.
2.4.6	Probable Maximum Tsunami Flooding	Probable maximum tsunami flooding level does not exceed the maximum flood defined in DCD Table 2.0-1.	COL Item 2.0-17-A is addressed in Section 2.4.6.
2.4.7	Ice Effects	None.	COL Item 2.0-18-A is addressed in Section 2.4.7.
2.4.8	Cooling Water Canals and Reservoirs	None.	COL Item 2.0-19-A is addressed in Section 2.4.8.
2.4.9	Channel Diversions	None.	COL Item 2.0-20-A is addressed in Section 2.4.9.
2.4.10	Flooding Protection Requirements	None.	COL Item 2.0-21-A is addressed in Section 2.4.10.
2.4.11	Cooling Water Supply	None.	COL Item 2.0-22-A is addressed in Section 2.4.11.
2.4.12	Groundwater	Per DCD Table 2.0-1.	COL Item 2.0-23-A is addressed in Section 2.4.12.

GGNS COL 2.0-2-A through 2.0-30-A

TABLE 2.0-2R (Sheet 4 of 4)
LIMITS IMPOSED ON ACCEPTANCE CRITERIA IN SECTION II OF SRP BY ESBWR DESIGN

Section	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.13	Accidental Releases of Liquid Effluents in Ground and Surface Waters	The source term provided in DCD Table 12.2-13a, “Liquid Waste Management System Equipment Drain Collection Tank Activity,” is used in the effects analysis.	COL Item 2.0-24-A is addressed in Section 2.4.13.
2.4.14	Technical Specifications and Emergency Operation Requirements	None.	COL Item 2.0-25-A is addressed in Section 2.4.14.
2.5.1	Basic Geologic and Seismic Information	None.	COL Item 2.0-26-A is addressed in Section 2.5.1.
2.5.2	Vibratory Ground Motion	Per DCD Table 2.0-1 (and DCD Figures 2.0-1 and 2.0-2).	COL Item 2.0-27-A is addressed in Section 2.5.2.
2.5.3	Surface Faulting	ESBWR design assumes no permanent ground deformation from tectonic or non-tectonic faulting.	COL Item 2.0-28-A is addressed in Section 2.5.3.
2.5.4	Stability of Subsurface Materials and Foundations	Per DCD Table 2.0-1.	COL Item 2.0-29-A is addressed in Section 2.5.4.
2.5.5	Stability of Slopes	Per DCD Table 2.0-1.	COL Item 2.0-30-A is addressed in Section 2.5.5.

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 1 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Maximum Ground Water Level:	0.61 m (2 ft.) below plant grade	Approximately 58 ft. below plant grade	Yes	FSAR 2.4.12 provides a maximum measured groundwater elevation of 75.8 ft. msl. FSAR 2.4.1 provides the plant (site) grade elevation of 133.5 ft. msl. Therefore, the maximum ground water level is about 58 ft. below plant (site) grade (133.5-75.8=57.7, rounded to 58). Therefore, the Unit 3 site characteristic value for maximum ground water level falls within the value established by the ESBWR site parameter.
Extreme Wind:				
Seismic Category I and II Structures				
100-year Wind Speed (3-sec gust):(12)	67.1 m/s (150 mph)	96 mph	Yes	SSAR 2.3.1.5 provides a 100-year wind speed lower than that in the DCD. Therefore, the Unit 3 site characteristic value for 100-year wind speed falls within the value established by the ESBWR site parameter.
Exposure Category:	D	See comment	Yes	An extreme wind exposure category was not specified as a site characteristic in the SSAR. The ESBWR site parameter of exposure category is determined using ASCE 7 (DCD Ref. 2.0-2). Exposure category is determined by a number of variables including wind speed, building shape and location, and surface roughness. An ESBWR site parameter of Exposure Category D results in the most severe design wind pressures. Therefore, because the design parameter of Exposure Category D cannot be exceeded at any site, the Unit 3 site characteristic, defined as that required by the DCD, falls within (is the same as) the ESBWR site parameter value for extreme wind exposure category.

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 2 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Non-Seismic Standard Plant Structures				
50-year Wind Speed (3-sec gust):	58.1 m/s (130 mph)	90 mph (3-second gust)	Yes	SSAR 2.3.1.5 provides a 50-year wind speed lower than that in the DCD. Therefore, the Unit 3 site characteristic value for 50-year wind speed falls within the value established by the ESBWR site parameter.
Maximum Flood (or Tsunami) Level: [2]	0.3 m (1 ft.) below plant grade	More than 1 ft. below plant grade	Yes	FSAR 2.4.2.3 provides the maximum flood level of more than 1 ft. below plant (site) grade. Therefore, the Unit 3 site characteristic value for maximum flood level falls within the value established by the ESBWR site parameter.
Tornado:				
Maximum Tornado Wind Speed: [3]	147.5 m/s (330 mph)	300 mph	Yes	SSAR 2.3.1.4 provides a maximum tornado wind speed lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum tornado wind speed falls within the value established by the ESBWR site parameter.
Maximum Rotational Speed:	116.2 m/s (260 mph)	240 mph	Yes	SSAR 2.3.1.4 provides a tornado maximum rotational speed lower than that in the DCD. Therefore, the Unit 3 site characteristic value for tornado maximum rotational speed falls within the value established by the ESBWR site parameter.
Translational Speed:	31.3 m/s (70 mph)	60 mph	Yes	SSAR 2.3.1.4 provides a tornado translational speed lower than that in the DCD. Therefore, the Unit 3 site characteristic value for tornado translational speed falls within the value established by the ESBWR site parameter.
Radius:	45.7 m (150 ft.)	150 ft.	Yes	SSAR 2.3.1.4 provides a tornado radius equal to that in the DCD. Therefore, the Unit 3 site characteristic value for tornado radius falls within the value established by the ESBWR site parameter.

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 3 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Pressure Drop:	16.6 kPa (2.4 psi)	2.0 psi	Yes	SSAR 2.3.1.4 provides a tornado pressure drop lower than that in the DCD. Therefore, the Unit 3 site characteristic value for tornado pressure drop falls within the value established by the ESBWR site parameter.
Rate of Pressure Drop:	11.7 kPa/s (1.7 psi/s)	1.2 psi/s	Yes	SSAR 2.3.1.4 provides a tornado rate of pressure drop lower than that in the DCD. Therefore, the Unit 3 site characteristic value for tornado rate of pressure drop falls within the value established by the ESBWR site parameter.
Missile Spectrum: (3)	Spectra I of SRP 3.5.1.4, Rev 2 applied to full building height.	See comment	Yes	A site characteristic for tornado missile spectrum was not provided in the SSAR. DCD Section 3.5.1.4 specifies that Seismic Category I buildings are designed to resist tornado generated missiles per DCD Table 2.0-1 and their resistance to missiles is independent of site topography. Therefore, the Unit 3 site characteristic for tornado missile spectrum, defined as that required by the DCD, falls within (is the same as) the ESBWR site parameter value.
Precipitation (for Roof Design):				
Maximum Rainfall Rate: (4)	49.3 cm/hr (19.4 in/hr)	19.2 in/hr	Yes	FSAR 2.4.2.3 provides a maximum rainfall rate lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum rainfall rate falls within the value established by the ESBWR site parameter.
Maximum Short Term Rate:	15.7 cm (6.2 in.) in 5 minutes	6.2 in. in 5 minutes	Yes	FSAR 2.4.2.3 provides a maximum short term rainfall rate equal to that in the DCD. Therefore, the Unit 3 site characteristic value for maximum short term rainfall rate falls within the value established by the ESBWR site parameter.
Maximum Roof Load: (5)	2873 Pa (60 lbf/ft^2)	29.5 lbf/ft^2	Yes	FSAR 2.3.1.2.6 provides a maximum roof load for extreme winter precipitation lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum roof load falls within the ESBWR site parameter value.

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 4 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Maximum Ground Snow Load [5] (100-year recurrence interval):	2394 Pa (50 lbf/ft^2)	6.1 lbf/ft^2	Yes	SSAR 2.3.1.4 provides a maximum ground snow load lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum ground snow load within the value established by the ESBWR site parameter.
Maximum 48-hr Winter Rainfall: [5]	91.4 cm (36 in.)	35 in.	Yes	SSAR 2.3.1.2.5 provides a maximum 48-hr winter rainfall lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum 48-hr winter rainfall falls within the value established by the ESBWR site parameter.
Ambient Design Temperature:[6]				
2% Exceedance Values				
Maximum:	35.6°C (96°F) dry bulb	92°F dry bulb	Yes	SSAR Table 2.3-3 provides a maximum 2% exceedance dry bulb temperature lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum 2% exceedance dry bulb temperature falls within the value established by the ESBWR site parameter.
	26.1°C (79°F) wet bulb (coincident)	78°F wet bulb (coincident)	Yes	SSAR Table 2.3-3 provides a maximum 2% exceedance coincident wet bulb temperature lower than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum 2% exceedance coincident wet bulb temperature falls within the value established by the ESBWR site parameter.

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 5 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Maximum:	27.2°C (81°F) wet bulb (non-coincident)	80°F wet bulb (non-coincident) (0.4% exceedance value) See Comment	Yes	The site characteristic 2% annual exceedance value for the maximum wet bulb temperature (non-coincident) was not provided in the SSAR. However, the value would be lower than the site 0.4% annual exceedance value of 80°F shown, which is from SSAR Table 2.3-3. Therefore, the Unit 3 site characteristic value for maximum 2% exceedance non-coincident wet bulb temperature falls within the value established by the ESBWR site parameter.
Minimum:	-23.3°C (-10°F)	25°F (1% exceedance value) See Comment	Yes	The site characteristic 2% annual exceedance value for minimum temperature was not provided in the SSAR. However, the value would be greater than the site 1% exceedance value of 25°F shown, which is from SSAR Table 2.3-3. Therefore, the Unit 3 site characteristic value for minimum 2% exceedance temperature falls within the value established by the ESBWR site parameter.
1% Exceedance Values				
Maximum:	37.8°C (100°F) dry bulb	95°F dry bulb (0.4% exceedance value) See comment	Yes	The site characteristic 1% annual exceedance value for the maximum dry bulb temperature was not provided in the SSAR. However, the value would be lower than the site 0.4% annual exceedance value of 95°F shown, which is from SSAR Table 2.3-3. Therefore, the Unit 3 site characteristic value for maximum 1% exceedance dry bulb temperature falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 6 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Maximum:	26.1°C (79°F) wet bulb (coincident)	80°F wet bulb (coincident) (0.4% exceedance value) See comment	Yes	The site characteristic 1% annual exceedance value for the maximum wet bulb temperature (coincident) was not provided in the SSAR. The value of 80°F provided is the site 0.4% exceedance value from SSAR Table 2.3-3 (referenced to the 2001 ASHRAE Fundamentals Handbook for Jackson, MS). This site characteristic exceeds the site parameter given in the DCD. However, the HVAC design is based on the combination of maximum dry bulb and maximum coincident wet bulb temperature. Therefore, a site characteristic of coincident wet bulb temperature greater than the site parameter is acceptable, given that the maximum dry bulb site characteristic is bounded by the ESBWR dry bulb site parameter.
	27.8°C (82°F) wet bulb (non-coincident)	80.4°F(non-coincident) (0.4% exceedance value) See comment	Yes	The site characteristic 1% annual exceedance value for the maximum wet bulb temperature (non-coincident) was not provided in the SSAR. However, the value would be lower than the site 0.4% annual exceedance value of 80.4°F shown, which is from SSAR Table 2.3-3 Therefore, the Unit 3 site characteristic value for maximum 1% exceedance non-coincident wet bulb temperature falls within the value established by the ESBWR site parameter.
Minimum:	-23.3°C (-10°F)	25°F	Yes	SSAR Table 2.3-3 provides a minimum 1% exceedance temperature greater than that in the DCD. Therefore, the Unit 3 site characteristic value for minimum 1% exceedance temperature falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 7 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
0% Exceedance Values				
Maximum:	47.2°C (117°F) dry bulb	108°F dry bulb (100-year return period) See comment	Yes	The site characteristic 0% annual exceedance value for maximum temperature was not provided in the SSAR. However, the value would not exceed the site 100-year return period value of 108°F shown, which is from SSAR 2.3.2.1.2. Therefore, the Unit 3 site characteristic value for maximum 0% exceedance dry bulb temperature falls within the value established by the ESBWR site parameter.
	26.7°C (80°F) wet bulb (coincident)	81°F wet bulb (average for worst 1 day) See comment	Yes	The site characteristic 0% annual exceedance value for maximum (coincident) wet bulb temperature was not provided in the SSAR. The value of 81°F provided is the worst single day average temperature from SSAR Table 2.3-16. This site characteristic exceeds the site parameter given in the DCD. However, the HVAC design is based on the combination of maximum dry bulb and maximum coincident wet bulb temperature. Therefore, a site characteristic of coincident wet bulb temperature greater than the site parameter is acceptable, given that the maximum dry bulb site characteristic is bounded by the ESBWR dry bulb site parameter.
Maximum:	31.1°C (88°F) wet bulb (non-coincident)	81°F wet bulb (average for worst 1 day) See comment	Yes	The site characteristic 0% annual exceedance value for maximum (non-coincident) wet bulb temperature was not provided in the SSAR. However, the value would not exceed the average temperature for the worst single day value of 81°F shown, which is from SSAR Table 2.3-16. Therefore, the Unit 3 site characteristic value for maximum 0% exceedance non-coincident wet bulb temperature falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 8 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Minimum:	-40°C (-40°F)	-6°F (100-year return period) See comment	Yes	The site characteristic 0% annual exceedance value for minimum temperature was not provided in the SSAR. However, the value would not be lower than the site 100-year return period value of -6°F shown, which is from SSAR 2.3.2.1.2. Therefore, the Unit 3 site characteristic value for minimum 0% exceedance temperature falls within the value established by the ESBWR site parameter.
Soil Properties:				
Minimum Static Bearing Capacity: [7]				
Reactor/Fuel Building:	699 kPa (14,600 lbf/ft^2)	261,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a Reactor/Fuel Building static bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for Reactor/Fuel Building minimum static bearing capacity falls within the value established by the ESBWR site parameter.
Control Building:	292 kPa (6100 lbf/ft^2)	270,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a Control Building static bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for Control Building minimum static bearing capacity falls within the value established by the ESBWR site parameter.
Fire Water Service Complex (FWSC):	165 kPa (3450 lbf/ft^2)	193,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a FWSC static bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for FWSC minimum static bearing capacity falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 9 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Minimum Dynamic Bearing Capacity: (7)				
Reactor/Fuel Building:	2700 kPa (56,400 lbf/ft^2)	261,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a Reactor/Fuel Building dynamic bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for Reactor/Fuel Building minimum dynamic bearing capacity falls within the value established by the ESBWR site parameter.
Control Building:	2800 kPa (58,500 lbf/ft^2)	270,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a Control Building dynamic bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for Control Building minimum dynamic bearing capacity falls within the value established by the ESBWR site parameter.
Fire Water Service Complex:	440 kPa (9200 lbf/ft^2)	193,000 lbf/ft^2	Yes	FSAR 2.5.4.10.2 provides a FWSC dynamic bearing capacity greater than that in the DCD. Therefore, the Unit 3 site characteristic value for FWSC minimum dynamic bearing capacity falls within the value established by the ESBWR site parameter.
Minimum Shear Wave Velocity:(8)	300 m/s (1000 ft/s)	1331 ft/s minimum	Yes	FSAR Table 2.5.2-206 provides a minimum equivalent uniform shear wave velocity (V_{eq}) greater than that in the DCD. Therefore, the Unit 3 site characteristic value for minimum equivalent uniform shear wave velocity falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 10 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Liquefaction Potential:				
Seismic Category I Structures	None under footprint of Seismic Category I structures resulting from site-specific SSE.	None under footprint of Seismic Category I structures resulting from site-specific SSE.	Yes	FSAR 2.5.4.8 provides evidence of no liquefaction potential under the footprint of Seismic Category I structures resulting from site-specific SSE. Therefore, the Unit 3 site characteristic value for liquefaction potential under Seismic Category I structures falls within the value established by the ESBWR site parameter.
Other than Seismic Category I Structures	See Note (13)	None under footprint of other than Seismic Category I structures.	Yes	FSAR 2.5.4.8.2 provides geologic evidence of no liquefaction potential under the footprint of the Unit 3 powerblock and adjacent ground. Therefore, the Unit 3 site characteristic value for liquefaction potential under other than Seismic Category I structures falls within the value established by the ESBWR site parameter.
Angle of Internal Friction	≥ 30 degrees	> 30 degrees See comment	Yes	With the exception of the Lower loess, angle of internal friction is greater than 30 degrees for stratigraphic units under the Unit 3 powerblock excavation. As discussed in FSAR 2.5.4.5.1.2, the Lower loess will be completely excavated below the Reactor/Fuel Building, with the basemat resting on Upland Complex Alluvium, which had measured angles of internal friction of 36 and 39 degrees (FSAR 2.5.4.2.2.1.4). In the case of the Control Building, removal and replacement of loess below the minimum mat bearing level will be required to provide foundation stability. As stated in FSAR 2.5.4.5.3.2, the minimum angle of internal friction for backfill is 35 degrees. Therefore, the Unit 3 site characteristic value for angle of internal friction falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 11 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Seismology:				
SSE Horizontal Ground Response Spectra: (9)	See DCD Figure 2.0-1	See Figure 2.0-201	No	FSAR Figure 2.0-201 (taken from FSAR Figure 2.5.2-233) provides the site-specific horizontal ground response spectrum, which is bounded by the ESBWR horizontal ground response spectrum except for frequencies below 0.2 Hz.
GGNS DEP 2.0-1 SSE Vertical Ground Response Spectra:(9)	See DCD Figure 2.0-2	See Figure 2.0-202	No	FSAR Figure 2.0-202 (taken from FSAR Figure 2.5.2-234) provides the site-specific vertical ground response spectrum, which is bounded by the ESBWR vertical ground response spectrum except for frequencies below approximately 0.15 Hz. This low frequency exceedance is a departure from the DCD. This is departure GGNS DEP 2.0-1. See Section 3.7.1.1.4.
Hazards in Site Vicinity:				
Site Proximity Missiles and Aircraft:	< about 10^{-7} per year	Less than 10^{-7} per year	Yes	SSAR 2.2.3.1.6 provides the probability of aircraft accidents having the potential for radiological consequences greater than 10 CFR Part 100 exposure guidelines is less than that in the DCD. Therefore, the Unit 3 site characteristic value for site proximity missiles and aircraft falls within the value established by the ESBWR site parameter.
Volcanic Activity:	None	None	Yes	SSAR 2.5.1.1.5.10.1 and 2.5.3.7 provide that there is no volcanic risk to the Grand Gulf Site. Therefore, the Unit 3 site characteristic value for volcanic activity falls within the value established by the ESBWR site parameter.
Toxic Gases:	None *	< toxicity limits	Yes	SSAR 2.2.3.1.2, FSAR 2.2.3 and 6.4 indicate that the quantity stored on the site for toxic gases is not a hazard for Unit 3. Therefore, the Unit 3 site characteristic value for toxic gases falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 12 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
* Maximum toxic gas concentrations at the Main Control Room (MCR) HVAC intakes:	< toxicity limits	< toxicity limits	Yes	FSAR 6.4 indicates that maximum toxic gas concentrations at the MCR HVAC intakes are less than toxicity limits. Therefore, the Unit 3 site characteristic value for maximum toxic gas concentrations at the MCR HVAC intakes falls within the value established by the ESBWR site parameter.
Required Stability of Slopes: (10)				
Factor of safety (FOS) for static (non-seismic) loading	1.5	Minimum FOS of 1.5	Yes	FSAR 2.5.5.2.1 and 2.5.5.2.2 provide static factors of safety in excess of 1.5. Therefore, the Unit 3 site characteristic value for static FOS falls within the value established by the ESBWR site parameter.
FOS for dynamic (seismic) loading due to site-specific SSE	1.1	Minimum FOS of 1.1	Yes	FSAR 2.5.5.2.1 and 2.5.5.2.2 provide static factors of safety in excess of 1.1. Therefore, the Unit 3 site characteristic value for dynamic FOS falls within the value established by the ESBWR site parameter.
Maximum Settlement Values for Seismic Category I Buildings(14)**:**				
Maximum Settlement at any Corner of Basemat				
Under Reactor/ Fuel Building	103 mm (4.0 inches)	1 inch	Yes	FSAR Table 2.5.4-219 provides basemat maximum corner settlement under the Reactor/Fuel Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Reactor/ Fuel Building basemat maximum corner settlement falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 13 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Under Control Building	18 mm (0.7 inches)	0.375 inches	Yes	FSAR Table 2.5.4-219 provides basemat maximum corner settlement under the Control Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Control Building basemat maximum corner settlement falls within the value established by the ESBWR site parameter.
Under FWSC Structure	17 mm (0.7 inches)	<0.25 inches	Yes	FSAR Table 2.5.4-219 provides basemat maximum corner settlement under the FWSC structure less than that in the DCD. Therefore, the Unit 3 site characteristic value for FWSC structure basemat maximum corner settlement falls within the value established by the ESBWR site parameter.
Average Settlement at Four Corners of Basemat				
Under Reactor/ Fuel Building	65 mm (2.6 inches)	<1 inch	Yes	FSAR Table 2.5.4-219 provides basemat average corner settlement under the Reactor/Fuel Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Reactor/ Fuel Building basemat average corner settlement falls within the value established by the ESBWR site parameter.
Under Control Building	12 mm (0.5 inches)	0.375 inches	Yes	FSAR Table 2.5.4-219 provides basemat average corner settlement under the Control Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Control Building basemat average corner settlement falls within the value established by the ESBWR site parameter.
Under FWSC Structure	10 mm (0.4 inches)	<0.25 inches	Yes	FSAR Table 2.5.4-219 provides basemat average corner settlement under the FWSC structure less than that in the DCD. Therefore, the Unit 3 site characteristic value for FWSC structure basemat average corner settlement falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 14 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Maximum Differential Settlement Along the Longest Mat Foundation Dimension				
Within Reactor/ Fuel Building	77 mm (3.0 inches)	<0.5 inches	Yes	FSAR Table 2.5.4-219 provides maximum differential settlement under the Reactor/Fuel Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Reactor/ Fuel Building basemat maximum differential settlement falls within the value established by the ESBWR site parameter.
Within Control Building	14 mm (0.6 inches)	0.3 inches	Yes	FSAR Table 2.5.4-219 provides maximum differential settlement under the Control Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for Control Building maximum differential settlement falls within the value established by the ESBWR site parameter.
Under FWSC Structure	12 mm (0.5 inches)	0.41 inches	Yes	FSAR Table 2.5.4-219 provides maximum differential settlement under the FWSC structure less than that in the DCD. Therefore, the Unit 3 site characteristic value for FWSC structure maximum differential settlement falls within the value established by the ESBWR site parameter.
Maximum Differential Displacement between Reactor/ Fuel Buildings and Control Building	85 mm (3.3 inches)	0.75 inches	Yes	FSAR Table 2.5.4-219 provides maximum differential displacement between the Reactor/Fuel Buildings and the Control Building less than that in the DCD. Therefore, the Unit 3 site characteristic value for maximum differential displacement between the Reactor/Fuel Buildings and Control Building falls within the value established by the ESBWR site parameter.

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TABLE 2.0-201 (Sheet 15 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Meteorological Dispersion (χ/Q):[11]				
EAB χ/Q:				
0-2 hours:	2.00E-03 s/m^3	5.95 E-4 s/m^3	Yes	SSAR 2.3.4.2 provides EAB and LPZ χ/Q values less than those in the DCD. Therefore, the Unit 3 site characteristic values for EAB and LPZ χ/Q fall within the values established by the ESBWR site parameters.
LPZ χ/Q:				
0-8 hours:	1.90E-04 s/m^3	8.83 E-5 s/m^3	Yes	
8-24 hours:	1.40E-04 s/m^3	6.16 E-5 s/m^3	Yes	
1-4 days:	7.50E-05 s/m^3	2.82 E-5 s/m^3	Yes	
4-30 days:	3.00E-05 s/m^3	9.15 E-6 s/m^3	Yes	
Control Room χ/Q: Reactor Building Unfiltered inleakage				
0-2 hours:	1.90E-03 s/m^3	1.33E-03 s/m^3	Yes	FSAR Table 2.3-204 provides Control Room χ/Q values for Reactor Building unfiltered inleakage less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Reactor Building unfiltered inleakage fall within the values established by the ESBWR site parameters.
2-8 hours:	1.30E-03 s/m^3	6.56E-04 s/m^3	Yes	
8-24 hours:	5.90E-04 s/m^3	2.79E-04 s/m^3	Yes	
1-4 days:	5.00E-04 s/m^3	1.84E-04 s/m^3	Yes	
4-30 days	4.40E-04 s/m^3	1.38E-04 s/m^3	Yes	

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TABLE 2.0-201 (Sheet 16 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Control Room χ/Q: Reactor Building Filtered air intake (emergency and normal)				
0-2 hours:	1.50E-03 s/m^3	1.06E-03 s/m^3 (Normal)	Yes	Normal intake χ/Q values bound emergency intake χ/Q values. FSAR Table 2.3-204 provides Control Room χ/Q values for Reactor Building filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Reactor Building filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	1.10E-03 s/m^3	6.18E-04 s/m^3 (Normal)	Yes	
8-24 hours:	5.00E-04 s/m^3	2.90E-04 s/m^3 (Normal)	Yes	
1-4 days:	4.20E-04 s/m^3	1.73E-04 s/m^3 (Normal)	Yes	
4-30 days	3.80E-04 s/m^3	1.52E-04 s/m^3 (Normal)	Yes	
Control Room χ/Q: Passive Containment Cooling System (PCCS) / Reactor Building Roof Unfiltered inleakage				
0-2 hours:	3.40E-03 s/m^3	2.33E-03 s/m^3	Yes	FSAR Table 2.3-206 provides Control Room χ/Q values for PCCS/Reactor Building Roof unfiltered inleakage less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for PCCS/Reactor Building Roof unfiltered inleakage fall within the values established by the ESBWR site parameters.
2-8 hours:	2.70E-03 s/m^3	1.28E-03 s/m^3	Yes	
8-24 hours:	1.40E-03 s/m^3	4.51E-04 s/m^3	Yes	
1-4 days:	1.10E-03 s/m^3	4.19E-04 s/m^3	Yes	
4-30 days	7.90E-04 s/m^3	3.56E-04 s/m^3	Yes	

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TABLE 2.0-201 (Sheet 17 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Control Room χ/Q: Passive Containment Cooling System / Reactor Building Roof Filtered air intake (emergency and normal)				
0-2 hours:	3.00E-03 s/m^3	1.98E-03 s/m^3 (Normal)	Yes	Normal intake χ/Q values bound emergency intake χ/Q values. FSAR Table 2.3-206 provides Control Room χ/Q values for PCCS/Reactor Building Roof filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for PCCS/Reactor Building Roof filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	2.50E-03 s/m^3	1.31E-03 s/m^3 (Normal)	Yes	
8-24 hours:	1.20E-03 s/m^3	4.88E-04 s/m^3 (Normal)	Yes	
1-4 days:	9.00E-04 s/m^3	4.50E-04 s/m^3 (Normal)	Yes	
4-30 days	7.00E-04 s/m^3	3.96E-04 s/m^3 (Normal)	Yes	
Control Room χ/Q: Turbine Building Unfiltered inleakage				
0-2 hours:	1.20E-03 s/m^3	1.07E-03 s/m^3	Yes	FSAR Table 2.3-205 provides Control Room χ/Q values for Turbine Building unfiltered inleakage less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Turbine Building unfiltered inleakage fall within the values established by the ESBWR site parameters.
2-8 hours:	9.80E-04 s/m^3	8.10E-04 s/m^3	Yes	
8-24 hours:	3.90E-04 s/m^3	3.62E-04 s/m^3	Yes	
1-4 days:	3.80E-04 s/m^3	3.43E-04 s/m^3	Yes	
4-30 days	3.20E-04 s/m^3	2.75E-04 s/m^3	Yes	

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TABLE 2.0-201 (Sheet 18 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Control Room χ/Q: Turbine Building Filtered air intake (emergency and normal)				
0-2 hours:	1.20E-03 s/m^3	7.13E-04 s/m^3 (Normal)	Yes	Normal intake χ/Q values bound emergency intake χ/Q values. FSAR Table 2.3-205 provides Control Room χ/Q values for Turbine Building filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Turbine Building filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	9.80E-04 s/m^3	5.21E-04 s/m^3 (Normal)	Yes	
8-24 hours:	3.90E-04 s/m^3	2.75E-04 s/m^3 (Normal)	Yes	
1-4 days:	3.80E-04 s/m^3	2.04E-04 s/m^3 (Normal)	Yes	
4-30 days	3.20E-04 s/m^3	1.47E-04 s/m^3 (Normal)	Yes	
Control Room χ/Q: Fuel Building – Diffuse Source Filtered air intake (emergency and normal)				
0-2 hours:	2.80E-03 s/m^3	2.24E-03 s/m^3	Yes	FSAR Table 2.3-207 provides Control Room χ/Q values for Fuel Building-Diffuse Source filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Fuel Building-Diffuse Source filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	2.50E-03 s/m^3	1.16E-03 s/m^3	Yes	
8-24 hours:	3.90E-03 s/m^3	3.99E-04 s/m^3	Yes	
1-4 days:	3.80E-03 s/m^3	3.19E-04 s/m^3	Yes	
4-30 days	3.20E-03 s/m^3	2.71E-04 s/m^3	Yes	

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TABLE 2.0-201 (Sheet 19 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [(1)] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Control Room χ/Q: Fuel Building Cask Doors Filtered air intake (emergency and normal)				
0-2 hours:	1.50E-03 s/m^3	8.61E-04 s/m^3	Yes	FSAR Table 2.3-207 provides Control Room χ/Q values for Fuel Building Cask Doors filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Fuel Building Cask Doors filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	1.30E-03 s/m^3	4.63E-04 s/m^3	Yes	
8-24 hours:	6.80E-04 s/m^3	1.95E-04 s/m^3	Yes	
1-4 days:	5.60E-04 s/m^3	1.40E-04 s/m^3	Yes	
4-30 days	4.30E-04 s/m^3	1.21E-04 s/m^3	Yes	
Control Room χ/Q: Radwaste Building Filtered air intake (emergency and normal)				
0-2 hours:	1.50E-03 s/m^3	1.11E-03 s/m^3	Yes	FSAR Table 2.3-207 provides Control Room χ/Q values for Radwaste Building filtered air intake less than those in the DCD. Therefore, the Unit 3 site characteristic values for Control Room χ/Q for Radwaste Building filtered air intake fall within the values established by the ESBWR site parameters.
2-8 hours:	1.30E-03 s/m^3	7.93E-04 s/m^3	Yes	
8-24 hours:	6.80E-04 s/m^3	3.18E-04 s/m^3	Yes	
1-4 days:	5.60E-04 s/m^3	1.96E-04 s/m^3	Yes	
4-30 days	4.30E-04 s/m^3	1.64E-04 s/m^3	Yes	

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TABLE 2.0-201 (Sheet 20 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
Long Term Dispersion Estimates:				
χ/Q:	2.0E-06 s/m^3	8.8 E-6 sec/m^3 (Undepleted / No Decay χ/Q Value at Site Boundary, 0.85 mile)	No	SSAR Table 2.3-143 provides long term dispersion estimate χ/Q values that are greater than the DCD ESBWR site parameter value. Per Note (12) of DCD Table 2.0-1, if a selected site has a χ/Q value that exceeds the ESBWR reference site value, the release concentrations in DCD Table 12.2-17 would be adjusted proportionate to the change in χ/Q to show the 10 CFR 20 limits are met. In addition, for a site selected that exceeds the bounding χ/Q values, the resulting annual average doses must be addressed to demonstrate that the doses continue to meet the dose reference values provided in 10 CFR 50 Appendix I, using site-specific χ/Q values. Per DCD COL Item 12.2-2-A, Section 12.2.2.2 demonstrates that site-specific doses and gaseous effluent isotopic concentrations and off-site doses are well within allowable limits using the higher χ/Q site characteristic and the bounding ESP composite gaseous release source term.
		7.8 E-6 sec/m^3 (Depleted / No Decay χ/Q Value at Site Boundary, 0.85 mile)	No	
		2.2 E-6 sec/m^3 (Undepleted / No Decay χ/Q Value at Nearest Home, 0.81 mile)	No	

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 21 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
χ/Q:	2.0E-06 s/m^3	1.9 E-6 sec/m^3 (Depleted / No Decay χ/Q Value at Nearest Home, 0.81 miles)	Yes	SSAR Table 2.3-143 provides long term dispersion estimate χ/Q values less than or equal to those in the DCD. Therefore, the Unit 3 site characteristic values for long term dispersion estimate χ/Q fall within the values established by the ESBWR site parameters.
		2.0 E-6 sec/m^3 (Undepleted / No Decay χ/Q Value at Nearest Garden, 1.05 miles)	Yes	
		1.7 E-6 sec/m^3 (Depleted / No Decay χ/Q Value at Nearest Garden, 1.05 miles)	Yes	
		4.7 E-8 sec/m^3 (Undepleted / No Decay χ/Q Value at Nearest Milk Cow, 10 miles)	Yes	

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 22 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

GGNS COL 12.2-2-A

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
χ/Q:	2.0E-06 s/m^3	4.7 E-8 sec/m^3 (Depleted / No Decay χ/Q Value at Nearest Milk Cow, 10 miles)	Yes	SSAR Table 2.3-143 provides long term dispersion estimate χ/Q values less than or equal to those in the DCD. Therefore, the Unit 3 site characteristic values for long term dispersion estimate χ/Q fall within the values established by the ESBWR site parameters.
		1.1 E-7 sec/m^3 (Undepleted / No Decay χ/Q Value at Nearest Meat Cow, 4 miles)	Yes	
		1.1 E-7 sec/m^3 (Depleted / No Decay χ/Q Value at Nearest Meat Cow, 4 miles)	Yes	
D/Q:	4.0E-09 m^{-2}	1.2 E-8 m^{-2} (Site Boundary, 0.58 miles)	No	SSAR Table 2.3-143 provides long term dispersion estimate D/Q values greater than the DCD ESBWR site parameter value. Per Note (12) of DCD Table 2.0-1, if a selected site has a D/Q value that exceeds the ESBWR reference site value, the release concentrations in DCD Table 12.2-17 would be adjusted proportionate to the change in D/Q to show the 10 CFR 20 limits are met. In addition, for a site selected that exceeds the bounding D/Q values, the resulting annual average doses must be addressed to demonstrate that the doses continue to meet the dose reference values provided in 10 CFR 50 Appendix I, using site-specific D/Q values. Per DCD COL Item 12.2-2-A, Section 12.2.2.2 demonstrates that site-specific doses are well within allowable limits using the higher D/Q site characteristic and the bounding ESP composite gaseous release source term.
		7.0 E-9 m^{-2} (Nearest Home, 0.64 mile)	No	
		5.4 E-9 m^{-2} (Nearest Garden, 0.63 mile)	No	

GGNS COL 2.0-1-A

TABLE 2.0-201 (Sheet 23 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

Parameter	ESBWR Site Parameter	Unit 3 Site Characteristic	Bounding Yes/No	Comments
		8.7 E-11 m^{-2} (Nearest Milk Cow, 10 miles)	Yes	SSAR Table 2.3-143 provides long term dispersion estimate D/Q values less than those in the DCD. Therefore, the Unit 3 site characteristic values for long term dispersion estimate D/Q fall within the values established by the ESBWR site parameters.
		4.0 E-10 m^{-2} (Nearest Meat Cow, 4 miles)	Yes	

Notes for Table 2.0-201:

(1) The design of the Radwaste Building uses a set of design parameters that are specified in RG 1.143, Table 2, Class RW IIa instead of the corresponding values given in this table.

(2) PMF, as defined in Table 1.2-6 of Volume III of DCD Reference 2.0-4.

(3) Maximum speed selected is based on Attachment 1 of DCD Reference 2.0-5, which summarizes the NRC Interim Position on RG 1.76. Concrete structures designed to resist Spectrum I missiles of SRP 3.5.1.4, Rev. 2, will also resist missiles postulated in RG 1.76, Revision 1.

(4) Based on probable maximum precipitation (PMP) for one hour over 2.6 km^2 (one square mile) with a ratio of 5 minutes to one hour PMP of 0.32 as found in DCD Reference 2.0-3. Roof scuppers and drains are designed independently to limit water accumulation on the roof to no more than 100 mm (4 in) during PMP conditions. See also DCD Table 3G.1-2.

(5) Maximum design roof load accommodates snow load and 48-hour probable maximum winter precipitation (PMWP) in DCD References 2.0-2 and 2.0-6. Roof scuppers and drains are designed independently to limit water accumulation on the roof to no more than 100 mm (4 in) during PMWP conditions. See also DCD Table 3G.1-2.

(6) Zero percent exceedance values are based on conservative estimates of historical high and low values for potential sites. One and two percent exceedance values were selected in order to bound the values presented in DCD Reference 2.0-4 and available Early Site Permit applications.

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TABLE 2.0-201 (Sheet 24 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS (1) WITH UNIT 3 SITE CHARACTERISTICS

(7) At foundation level of Seismic Category I structures. For minimum dynamic bearing capacity site-specific application, use the larger value or a linearly interpolated value of the applicable range of shear wave velocities at the foundation level. Grand Gulf is considered a soft soil site; the corresponding shear wave velocity is 1000 ft/sec.

(8) This is the equivalent uniform shear wave velocity (V_{eq}) over the entire soil column at seismic strain, which is a lower bound value after taking into account uncertainties. V_{eq} is calculated to achieve the same wave traveling time over the depth equal to the embedment depth plus 2 times the largest foundation plan dimension below the foundation as follows:

$$V_{eq} = \frac{\sum d_i}{\sum \frac{d_i}{V_i}}$$

where d_i and V_i are the depth and shear wave velocity, respectively, of the i^{th} layer. Per Section 2.5.4.7.1, the ratio of the largest to the smallest shear wave velocity over the mat foundation width at the foundation level does not exceed 1.7.

(9) Safe Shutdown Earthquake (SSE) design ground response spectra of 5% damping, also termed Certified Seismic Design Response Spectra (CSDRS), are defined as free-field outcrop spectra at the foundation level (bottom of the base slab) of the Reactor/Fuel and Control Building structures. For ground surface founded FWSC structures, the CSDRS is 1.35 times the values shown in DCD Figures 2.0-1 and 2.0-2.

TABLE 2.0-201 (Sheet 25 of 25)
COMPARISON OF ESBWR DCD SITE PARAMETERS [1] WITH UNIT 3 SITE CHARACTERISTICS

GGNS COL 2.0-1-A

(10) Values reported here are actually design criteria rather than site design parameters. They are included here because they do not appear elsewhere in the DCD.

(11) Unit 3 χ/Q values fall within the ESBWR reference site values. Therefore, the radiological consequences associated with the controlling DBA meet the dose reference values provided in 10 CFR 50.34(a) and control room operator dose limits provided in General Design Criterion 19.

(12) Value was selected to comply with expected requirements of southeastern coastal locations.

(13) Localized liquefaction potential under other than Seismic Category I structures is addressed per SRP 2.5.4 in Table 2.0-2R.

(14) Settlement values are long-term (post-construction) values except for differential settlement within the foundation mat. The design of the foundation mat accommodates immediate and long-term (post-construction) differential settlements after the installation of the basemat.

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ESP PC 3.A

TABLE 2.0-202 (Sheet 1 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
		2.1 - Introduction		
Exclusion Area Boundary (EAB)	The perimeter of a 2760 ft. radius circle from the circumference of a 630 ft. circle encompassing the proposed powerblock housing the reactor containment structure for new unit	The perimeter of a 2760 ft. radius circle from the circumference of a 630 ft. circle encompassing the proposed powerblock housing the reactor containment structure for new unit	SSAR Figure 2.1-2 SSAR 2.1.2	Yes The EAB site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.
Low Population Zone	2 mile radius circle from the circumference of a 630 ft. circle encompassing the proposed powerblock housing the reactor containment structure for new unit	2 mile radius circle from the circumference of a 630 ft. circle encompassing the proposed powerblock housing the reactor containment structure for new unit	SSAR 2.1.3.4	Yes The Low Population Zone site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.
Population Center Distance	2.7 miles	25 miles	SSAR 2.1.3.5	Yes The Population Center Distance site characteristic is greater than the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.

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ESP PC 3.A

TABLE 2.0-202 (Sheet 2 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic		ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
2.2 - Nearby Industrial, Transportation, and Military Facilities					
Minimum separation distance from GGNS on-site storage of liquid hydrogen.		737 ft.	>737 ft.	SSAR 2.2.3.1.1	Yes The minimum separation distance site characteristic is greater than the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.
2.3 - Meteorology					
Ambient Air Temperature and Humidity					
Maximum Dry-Bulb Temperature	2% annual exceedance	92°F	92°F	SSAR Table 2.3-3	Yes The maximum dry bulb temperature site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
	0.4% annual exceedance	95°F	95°F	SSAR Table 2.3-3	
	average annual highest	98°F	98°F	SSAR Table 2.3-3	
	100-year return period	108°F	108°F	SSAR Table 2.3-3	

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ESP PC 3.A

TABLE 2.0-202 (Sheet 3 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic		ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Ambient Air Temperature and Humidity (cont.)					
Minimum Dry-Bulb Temperature	99% annual exceedance	25°F	25°F	SSAR Table 2.3-3	Yes The minimum dry bulb temperature site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
	99.6% annual exceedance	21°F	21°F	SSAR Table 2.3-3	
	average annual lowest	14°F	14°F	SSAR Table 2.3-3	
	100-year return period	-6°F	-6°F	SSAR 2.3.2.1.2	
Maximum Wet-Bulb Temperature	2% annual exceedance	78°F	78°F	SSAR Table 2.3-3	Yes The maximum wet bulb temperature site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
	0.4% annual exceedance	80°F	80°F	SSAR Table 2.3-3	

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ESP PC 3.A

TABLE 2.0-202 (Sheet 4 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Basic Wind Speed				
Fastest-mile	83 mi/h	83 mi/h	SSAR 2.3.1.5	Yes
3-Second Gust	96 mi/h	96 mi/h	SSAR 2.3.1.5	The basic wind speed site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Tornado				
Maximum Wind Speed	300 mi/h	300 mi/h	SSAR 2.3.1.4	Yes
Translational Speed	60 mi/h	60 mi/h	SSAR 2.3.1.4	The tornado site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Maximum Rotational Speed	240 mi/h	240 mi/h	SSAR 2.3.1.4	
Radius of Maximum Rotational Speed	150 ft.	150 ft.	SSAR 2.3.1.4	
Pressure Drop	2.0 lbf/in^2	2.0 lbf/in^2	SSAR 2.3.1.4	
Rate of Pressure Drop	1.2 $lbf/in^2/s$	1.2 $lbf/in^2/s$	SSAR 2.3.1.4	
Winter Precipitation				
100-Year Snowpack	6.1 lbf/ft^2	6.1 lbf/ft^2	SSAR 2.3.1.2.6	Yes
48-Hour Probable Maximum Winter Precipitation	35 inches of water	35 inches of water	SSAR 2.3.1.2.6	The winter precipitation site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.

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ESP PC 3.A

TABLE 2.0-202 (Sheet 5 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Ultimate Heat Sink (UHS)				
Meteorological Conditions Resulting in the Minimum Water Cooling during Any 1 Day	81.0°F wet-bulb temperature with coincident 86.3°F dry-bulb temperature	81.0°F wet-bulb temperature with coincident 86.3°F dry-bulb temperature	SSAR Table 2.3-16	Yes The UHS site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Meteorological Conditions Resulting in the Minimum Water Cooling during Any Consecutive 5 Days	80.2°F wet-bulb temperature with coincident 86.2°F dry-bulb temperature	80.2°F wet-bulb temperature with coincident 86.2°F dry-bulb temperature	SSAR Table 2.3-17	
Meteorological Conditions Resulting in the Maximum Evaporation and Drift Loss during Any Consecutive 30 Days	78.5°F wet-bulb temperature with coincident 83.1°F dry-bulb temperature	78.5°F wet-bulb temperature with coincident 83.1°F dry-bulb temperature	SSAR Table 2.3-18	
Meteorological Conditions Resulting in Maximum Water Freezing in the UHS Water Storage Facility	98 °F degree days below freezing	98 °F degree days below freezing	SSAR 2.3.1.3.3	Yes The UHS site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.

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ESP PC 3.A

TABLE 2.0-202 (Sheet 6 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Short-Term (Accident Release) Atmospheric Dispersion				
0–2-H χ/Q Value @ EAB	5.95×10^{-4} s/m^3	5.95×10^{-4} s/m^3	SSAR 2.3.4.2	Yes
0–8-H χ/Q Value @ LPZ	8.83×10^{-5} s/m^3	8.83×10^{-5} s/m^3	SSAR 2.3.4.2	The short-term (accident release) atmospheric dispersion site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
8–24-H χ/Q Value @ LPZ	6.16×10^{-5} s/m^3	6.16×10^{-5} s/m^3	SSAR 2.3.4.2	
1–4-Day χ/Q Value @ LPZ	2.82×10^{-5} s/m^3	2.82×10^{-5} s/m^3	SSAR 2.3.4.2	
4–30-Day χ/Q Value @ LPZ	9.15×10^{-6} s/m^3	9.15×10^{-6} s/m^3	SSAR 2.3.4.2	

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ESP PC 3.A

TABLE 2.0-202 (Sheet 7 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Long-Term (Routine Release) Atmospheric Dispersion				
Annual Average Undepleted/No Decay χ/Q Value @ Site Boundary	8.8×10^{-6} s/m^3	8.8×10^{-6} s/m^3	SSAR Table 2.3-143	Yes The long-term (routine release) atmospheric dispersion site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Annual Average Depleted/ No Decay χ/Q Value @ Site Boundary	7.8×10^{-6} s/m^3	7.8×10^{-6} s/m^3	SSAR Table 2.3-143	
Annual Average D/Q Value @ Site Boundary	1.2×10^{-8} 1/m^2	1.2×10^{-8} 1/m^2	SSAR Table 2.3-143	
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Home	2.2×10^{-6} s/m^3	2.2×10^{-6} s/m^3	SSAR Table 2.3-143	
Annual Average Depleted/ No Decay χ/Q Value @ Nearest Home	1.9×10^{-6} s/m^3	1.9×10^{-6} s/m^3	SSAR Table 2.3-143	
Annual Average D/Q Value @ Nearest Home	7.0×10^{-9} 1/m^2	7.0×10^{-9} 1/m^2	SSAR Table 2.3-143	

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ESP PC 3.A

TABLE 2.0-202 (Sheet 8 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Long-Term (Routine Release) Atmospheric Dispersion (cont.)				
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Garden	2.0×10^{-6} s/m^3	2.0×10^{-6} s/m^3	SSAR Table 2.3-143	Yes The long-term (routine release) atmospheric dispersion site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Annual Average Depleted/ No Decay χ/Q Value @ Nearest Garden	1.7×10^{-6} s/m^3	1.7×10^{-6} s/m^3	SSAR Table 2.3-143	
Annual Average D/Q Value @ Nearest Garden	5.4×10^{-9} 1/m^2	5.4×10^{-9} 1/m^2	SSAR Table 2.3-143	
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Milk Cow	7.0×10^{-8} s/m^3	7.0×10^{-8} s/m^3	SSAR Table 2.3-143	
Annual Average Depleted/ No Decay χ/Q Value @ Nearest Milk Cow	4.7×10^{-8} s/m^3	4.7×10^{-8} s/m^3	SSAR Table 2.3-143	
Annual Average D/Q Value @ Nearest Milk Cow	8.7×10^{-11} 1/m^2	8.7×10^{-11} 1/m^2	SSAR Table 2.3-143	
Annual Average Undepleted/No Decay χ/Q Value @ Nearest Meat Cow	1.4×10^{-7} s/m^3	1.4×10^{-7} s/m^3	SSAR Table 2.3-143	

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 9 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Long-Term (Routine Release) Atmospheric Dispersion (cont.)				
Annual Average Depleted/ No Decay χ/Q Value @ Nearest Meat Cow	1.1×10^{-7} s/m^3	1.1×10^{-7} s/m^3	SSAR Table 2.3-143	Yes The long-term (routine release) atmospheric dispersion site characteristics are identical to the ESP site characteristics. Therefore, the Unit 3 site characteristics fall within the ESP site characteristics.
Annual Average D/Q Value @ Nearest Meat Cow	4.0×10^{-10} 1/m^2	4.0×10^{-10} 1/m^2	SSAR Table 2.3-143	
2.4 - Hydrology				
Hydrology				
Proposed Facility Boundaries	SSAR Figure 2.4-1 shows the areal extent of proposed facility boundaries. This figure is reproduced below as Figure 1, bounding coordinates of the ESP site are a site characteristic. During construction, the ESP site could be disturbed up to a depth ranging from 35 to 140 feet plus some additional excavation.	FSAR Figure 2.4.1-201 Excavation depth is approximately 70 ft.	FSAR Figure 2.4.1-201 FSAR 2.5.4.5.1.2	Yes The site boundary site characteristic is identical to the ESP site characteristic. The excavation depth site characteristic is within the range of the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 10 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Hydrology (cont.)				
Site Grade	132.5 feet above msl	133.5 feet above msl	FSAR 2.4.1	Yes The site characteristic for finished ground level grade immediately adjacent to Unit 3 buildings is greater than the ESP site characteristic. Since the design parameter is related to flooding of safety-related structures and the PMF is less than the DCD criteria, the site characteristic falls within the ESP site characteristic.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 11 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

	Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
	Hydrology (cont.)				
GGNS ESP VAR 2.4.12-1	Highest Ground Water Elevation	70 feet below grade; 62.5 feet above msl; perched water may be present between the site grade at 132.5 feet above msl and the water table at 62.5 feet above msl.	Approximately 58 ft. below grade; 75.8 ft. above msl	FSAR 2.4.12	No Some of the groundwater elevations measured in wells near the center of the power block during the Unit 3 investigations are higher than 62.5 ft. above msl; as noted in Section 2.4.12 the highest measured in the Upland Complex is 75.8 ft. msl. FSAR 2.4.1 provides the site grade elevation of 133.5 ft. msl. Therefore, the maximum ground water level is about 58 ft. below site grade (133.5-75.8=57.7, rounded to 58). However, there is substantial margin to the design maximum groundwater level requirement of 2 ft. below site grade. All measured groundwater elevations are well below the DCD site parameter for groundwater. See GGNS ESP VAR 2.4.12-1.

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ESP PC 3.A

TABLE 2.0-202 (Sheet 12 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Hydrology (cont.)				
Flood Elevation	Flood water elevation at the ESP site caused by local intense precipitation will be established by the COL applicant using local intense precipitation values established in Section 2.4.2.3 of the SER. Local intense precipitation itself is a site characteristic, listed below.	PMF at 132.94 ft. above msl	FSAR 2.4.2.3	N/A Flooding from local intense precipitation is established using values of local intense precipitation as described.
Local Intense Precipitation	19.2 in/h, of which 6.2 in. falls during the first 5 minutes.	19.2 in/h, of which 6.2 in. falls during the first 5 minutes.	FSAR 2.4.2.3	Yes The local intense precipitation site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 13 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Hydrology (cont.)				
Frazil and Anchor Ice	The ESP site does not have the potential for the formation of frazil and anchor ice.	The Unit 3 site does not have the potential for the formation of frazil and anchor ice.	SSAR 2.4.7	Yes The frazil and anchor ice site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.
Maximum Cumulative Degree Days Below Freezing	98 °F	98 °F	SSAR 2.3.1.3.3	Yes The maximum cumulative degree days below freezing site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 14 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

GGNS ESP VAR 2.4.1-1

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Hydrology (cont.)				
Distance to the Closest Surface Water	Stream B is the closest surface water feature; 1017 ft.	The distance from the center of the Unit 3 powerblock (reactor containment building) to the closest approach of Stream B and Sedimentation Basin B is approximately 680 ft.	FSAR 2.4.1 FSAR 2.4.13	No Stream B drains Basin B (SSAR Figure 2.4-10) and flows into Sedimentation Basin B, which then flows to Hamilton Lake and on to the Mississippi River. Neither Stream B nor Hamilton Lake are a source of water for any use or application for Unit 3. The nearest potable water supply using water from the Mississippi River is located over 100 miles downstream. Groundwater on the site generally flows from east to west, towards the Mississippi River as discussed in Section 2.4.12. The general flow of groundwater is to the west of the plant, and Stream B and Sedimentation Basin B are to the south of the powerblock, the relative distance of approximately 680 ft. between the Unit 3 powerblock on Stream B and Sedimentation Basin B is acceptable. See GGNS ESP VAR 2.4.1-1.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 15 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Hydrology (cont.)				
Location of Aquifers Used by Large Population for Domestic, Municipal, Industrial, or Irrigation Water Supplies	2760 ft.	2760 ft.	FSAR 2.4.1	Yes The location of aquifers site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.
2.5 - Geology, Seismology, and Geotechnical Engineering				
Basic Geologic and Seismic Information				
Capable Tectonic Structures	No fault displacement potential within the Site Area	No fault displacement potential within the Site Area	SSAR 2.5.3	Yes The capable tectonic structures site characteristic is identical to the ESP site characteristic. Therefore, the Unit 3 site characteristic falls within the ESP site characteristic.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 16 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

GGNS ESP
VAR 2.0-1

Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
Vibratory Ground Motion				
Design Response Spectra	Appendix A. Figure 2	FSAR Figures 2.0-201 and 2.0-202	FSAR Figures 2.0-201 and 2.0-202	ESP site characteristic superseded. This is variance GGNS ESP VAR 2.0-1; see Section 2.5.2. Additional COL site investigations and analysis developed supplemental design response spectra. These design response spectra are specific to the Unit 3 footprint and therefore represent a site characteristic specific to Unit 3. Since these spectra are bounded by the DCD design spectra, the spectral acceleration at Unit 3 is acceptable.

GGNS
ESP PC 3.A

TABLE 2.0-202 (Sheet 17 of 17)
COMPARISON OF UNIT 3 SITE CHARACTERISTICS TO THE GRAND GULF ESP SITE CHARACTERISTICS

	Site Characteristic	ESP-002 Site Characteristic	Unit 3 Site Characteristic	Unit 3 Site Characteristic Reference	Bounded Yes/No
	Stability of Subsurface Materials and Foundations				
GGNS ESP VAR 2.0-2	Minimum shear wave velocity of soil at the proposed plant foundation Level	1000 feet per second (fps)	Equivalent uniform shear wave velocity (V_{eq} per Note (8) of Table 2.0-201) is a minimum of 1331 feet per second (fps)	FSAR Table 2.5.2-207	ESP site characteristic superseded. This is variance GGNS ESP VAR 2.0-2. The criterion indicated in the ESP is consistent with the value established in SSAR Section 2.5.4.6, which is minimum shear wave velocity for material underlying Seismic Category I foundations. GEH has redefined the criterion for this site characteristic in the DCD to be an equivalent uniform shear wave velocity (V_{eq}) over an entire soil column at seismic strain and provided the methodology for determining V_{eq} from site data. The value for V_{eq} established in the DCD (Table 2.0-1) is 1000 ft/s uniform shear wave velocity; the Unit 3 site characteristic value for V_{eq} (1331 fps) bounds the DCD value.

GGNS
ESP PC 3.B

TABLE 2.0-203 (Sheet 1 of 3)
COMPARISON OF UNIT 3 DESIGN CHARACTERISTICS WITH GRAND GULF ESP CONTROLLING VALUES OF PARAMETERS AND DBA SOURCE TERM PLANT PARAMETERS

Subject	ESP Appendix B Controlling Parameter Value	Unit 3 Design Characteristic	Unit 3 Design Characteristic Reference	Bounded Yes/No
		2.4 - Hydrology		
Makeup water flow	78,000 gpm	28,800 gpm	FSAR 2.4.1	Yes The makeup water flow design characteristic is less than the ESP (design) controlling parameter. Therefore, the Unit 3 design characteristic falls within the ESP (design) controlling parameter.
Potable Water/ Sanitary Waste System (max)	240 gpm	200 gpm	FSAR 2.4.1	Yes The potable water/sanitary waste system design characteristic is less than the ESP (design) controlling parameter. Therefore, the Unit 3 design characteristic falls within the ESP (design) controlling parameter.

GGNS
ESP PC 3.B

TABLE 2.0-203 (Sheet 2 of 3)
COMPARISON OF UNIT 3 DESIGN CHARACTERISTICS WITH GRAND GULF ESP CONTROLLING VALUES OF PARAMETERS AND DBA SOURCE TERM PLANT PARAMETERS

Subject	ESP Appendix B Controlling Parameter Value	Unit 3 Design Characteristic	Unit 3 Design Characteristic Reference	Bounded Yes/No
Demineralized Water System (max)	1440 gpm	554 gpm	FSAR 2.4.1	Yes The demineralized water system design characteristic is less than the ESP (design) controlling parameter. Therefore, the Unit 3 design characteristic falls within the ESP (design) controlling parameter.
Fire Protection System (FPS) (max)	1890 gpm	1075 gpm	FSAR 2.4.1	Yes The FPS design characteristic is less than the ESP (design) controlling parameter. Therefore, the Unit 3 design characteristic falls within the ESP (design) controlling parameter.

GGNS
ESP PC 3.B

TABLE 2.0-203 (Sheet 3 of 3)
COMPARISON OF UNIT 3 DESIGN CHARACTERISTICS WITH GRAND GULF ESP CONTROLLING VALUES OF PARAMETERS AND DBA SOURCE TERM PLANT PARAMETERS

GGNS ESP
VAR 2.0-3

Subject	ESP Appendix B Controlling Parameter Value	Unit 3 Design Characteristic	Unit 3 Design Characteristic Reference	Bounded Yes/No
DBA Source Term Parameters	ESP Appendix B, pages B-2 through B-11	DCD Section 15.4	DCD Section 15.4	ESP (design) controlling parameter superseded. Accident analyses evaluated in the SSAR were based on accidents and associated source terms for the ABWR, surrogate AP1000, and the ACR-700 plant designs. The source terms for the DBAs evaluated for the ESBWR in DCD Section 15.4 are not bounded by the ESP source terms (included in ESP-002 Appendix B) in all cases. This is variance GGNS ESP VAR 2.0-3. Calculated doses are shown in DCD Section 15.4 to be within limits set by regulatory guidance documents and applicable regulations. Unit 3 site-specific short term (accident) meteorological dispersion parameters (χ/Q) are demonstrated in Table 2.0-201 to fall within the associated DCD parameters. Therefore, the doses for the accidents evaluated in DCD Section 15.4 are bounding for Unit 3, and are within limits set by regulatory guidance documents and applicable regulations.

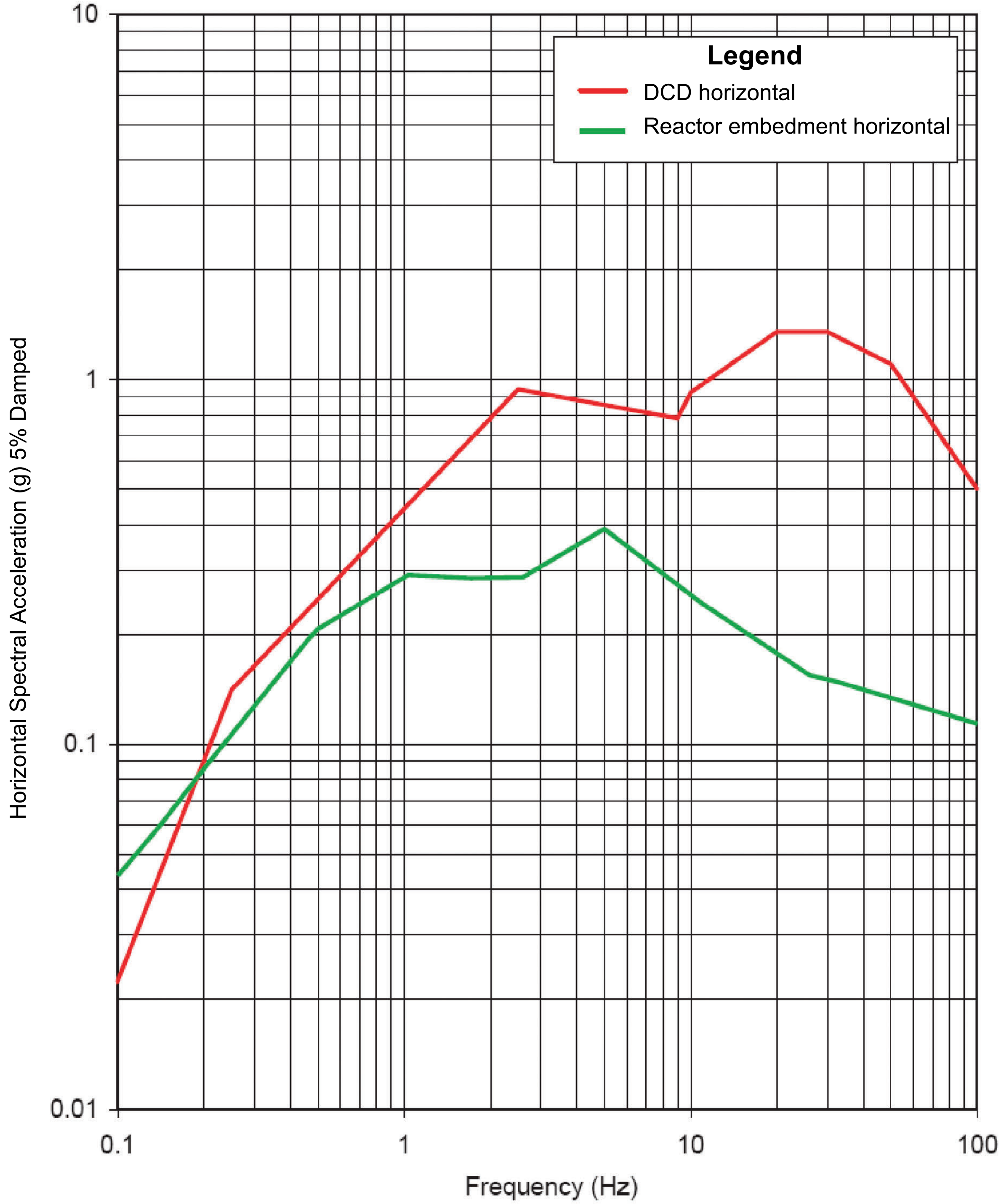


Figure 2.0-201. Unit 3 ESBWR Horizontal Design Ground Motion Response Spectra Comparison at Reactor Building Foundation Level

GGNS COL 2.0-1-A
GGNS DEP 2.0-1
GGNS ESP VAR 2.0-1

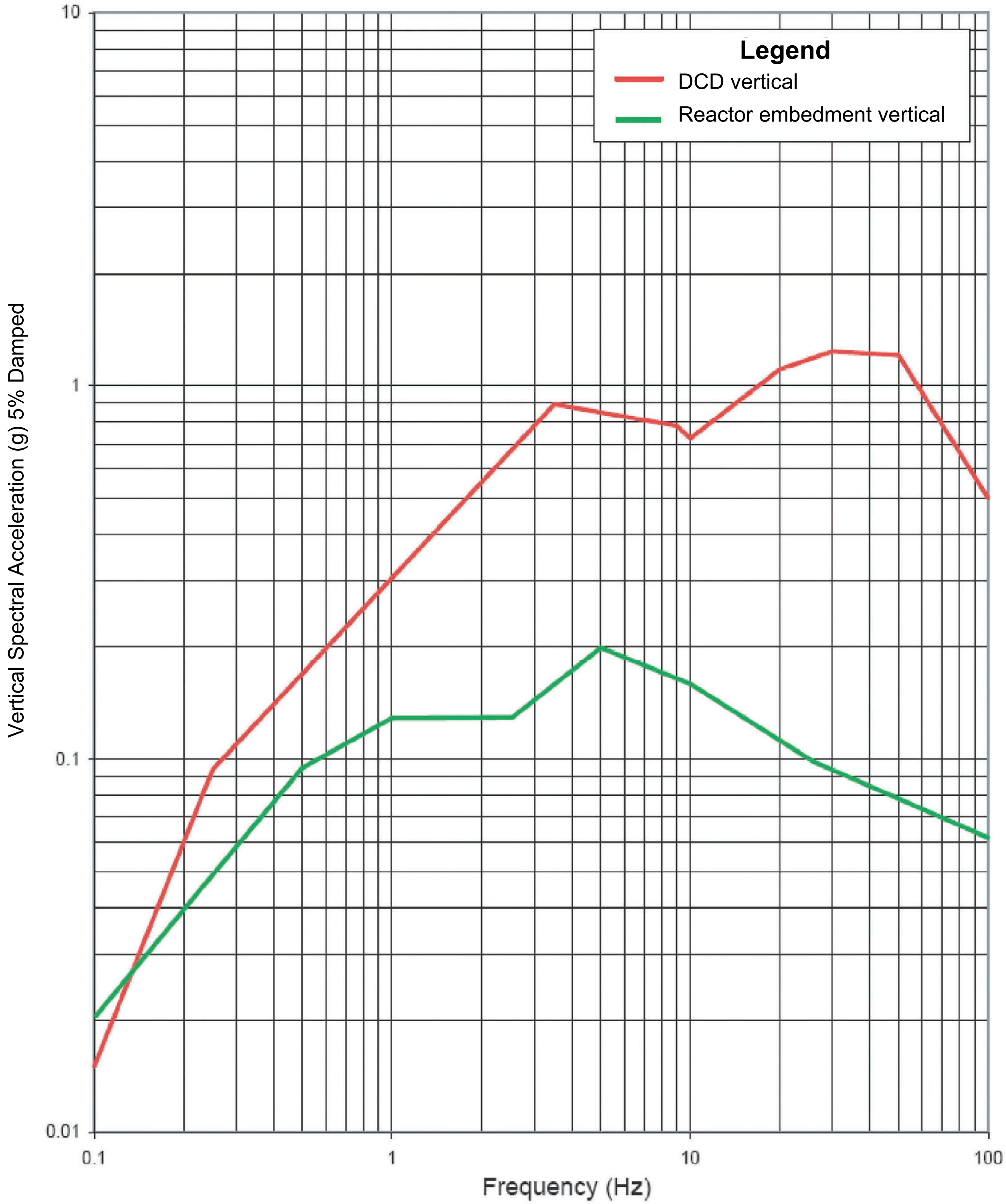


Figure 2.0-202. Unit 3 ESBWR Vertical Design Ground Motion Response Spectra Comparison at Reactor Building Foundation Level

2.1 GEOGRAPHY AND DEMOGRAPHY

GGNS COL 2.0-2-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Sections 3.1.1, 3.1.2, and 3.1.8 of the referenced ESP safety analysis report are incorporated by reference with no variances or supplements.

2.1.1.1 SITE LOCATION

GGNS COL 2.0-2-A

Add the following paragraph to the end of SSAR Section 2.1.1.1.

The Universal Transverse Mercator (UTM) grid coordinates for the center of the location of the power block of Unit 3 are N3543166 meters and E684017 meters in North American Datum (NAD) 1983, Zone 15 North. These coordinates correlate to the NAD 27 Mississippi State Plane West coordinates (in feet) of N549787 and E277335.

Add the following section and text after Section 2.1.1.2.1.

2.1.1.2.2 General Arrangement of Structures and Equipment - Unit 3

GGNS SUP 2.1-1

Figure 2.1-201 shows the location of Unit 3 significant plant facilities with respect to the Unit 3 EAB. Figure 2.1-202 provides a detailed site plan with Unit 1 and Unit 3 structures shown.

2.1.2 EXCLUSION AREA AUTHORITY AND CONTROL

Add the following at the end of Section 2.1.2.

GGNS ESP PC-3.E (1)

The EAB for Unit 3, which is within the existing site property boundary for Unit 1, is under the control of Entergy Operations Inc. (EOI).

Section 1.1.1, Site Ownership, of the ESP safety analysis report is incorporated by reference with no variances or supplements.

2.1.2.1 AUTHORITY

GGNS COL 2.0-3-A

As is true for Unit 1, the exclusion area for Unit 3 is wholly contained within the site property boundary for which EOI maintains control of ingress to and egress from and provides for evacuation of individuals from the area in the event of an emergency.

2.1.3 POPULATION DISTRIBUTION

GGNS COL 2.0-4-A

The ESBWR standard plant probabilistic risk assessment (PRA) off-site consequence analysis is based on a population density of 305 people per square kilometer (790 per square mile) per DCD Table 2.0-2. In the year 2070, the projected population density within 48-km (30-mi.) of the Unit 3 site is 20 people per square kilometer (52 per square mile); therefore, the assumptions utilized in the ESBWR PRA off-site consequences analysis are bounding.

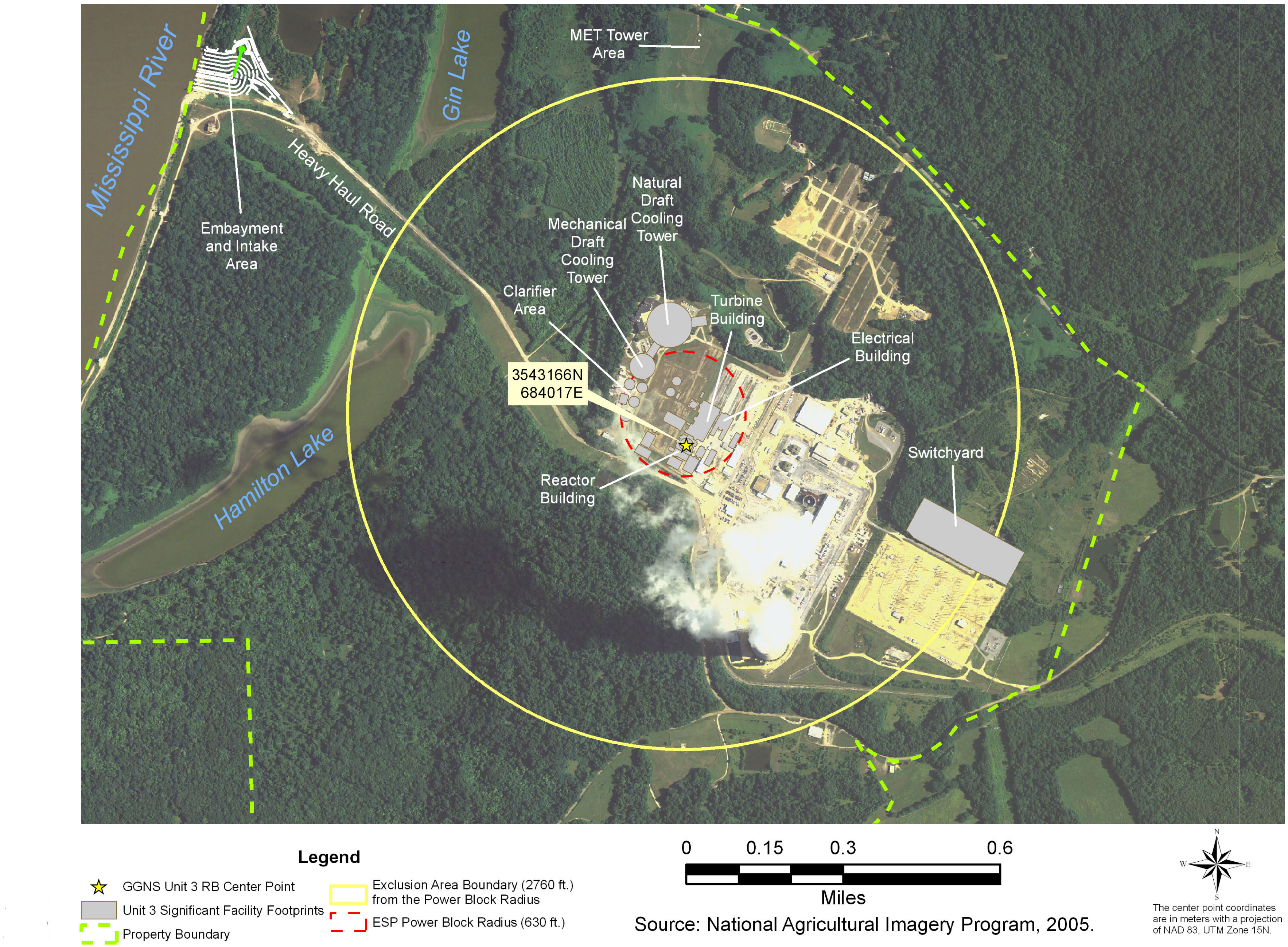
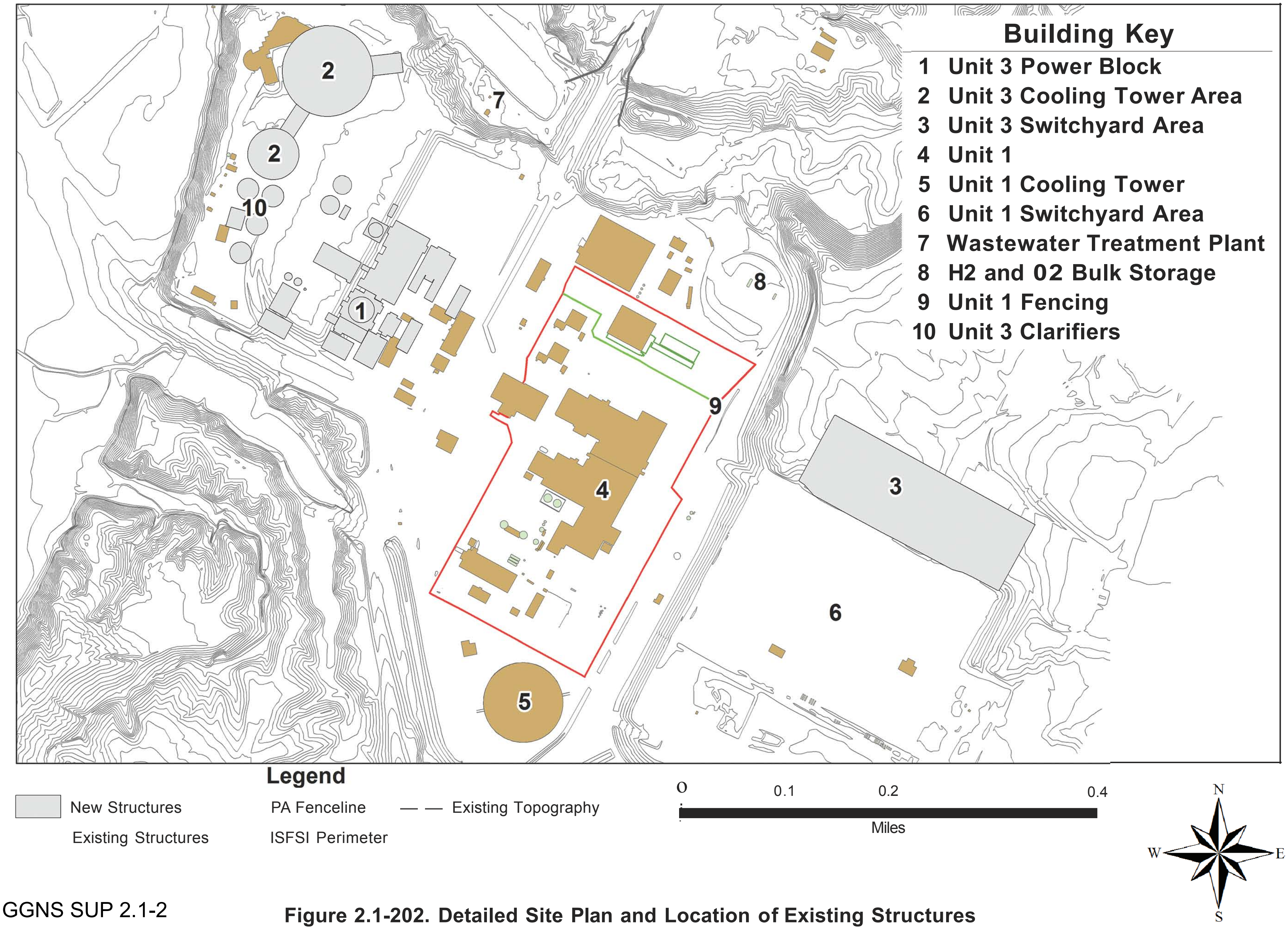


Figure 2.1-201. GGNS Site Layout



GGNS SUP 2.1-2

Figure 2.1-202. Detailed Site Plan and Location of Existing Structures

2.2 NEARBY INDUSTRIAL, MILITARY, AND TRANSPORTATION FACILITIES AND ROUTES

GGNS COL 2.0-5-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Section 3.1.5 of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

2.2.3.1.2 Toxic Chemicals

Add the following text after the last paragraph of this section.

ESP COL Action Item 2.2-1 states that a COL applicant should perform an evaluation of industrial hazards associated with the site and should assess design-specific interactions between the existing and new unit(s) and, if necessary, propose measures to account for such interactions. Based on the NRC FSER, Section 2.2.3.3 (NUREG-1840), this action item is understood to pertain to the analysis of control room habitability in the event of a toxic chemical accident at the GGNS site or in its vicinity.

GGNS ESP COL 2.2-1

GGNS COL 2.0-6-A

A probabilistic risk assessment was performed for Mississippi River barge shipments of chlorine and ammonia within five miles of the GGNS site, in accordance with RG 1.78. (See SSAR Section 2.2.3.) The risk level associated with these shipments was conservatively determined to be below 1x10-6 using the methodology provided by NUREG/CR-2650. Additionally, there are no shipping hazards within the vicinity of the GGNS site that are typically associated with barge accidents, such as unusual currents and blind bends. In addition, the nearest bridge or loading/unloading facility (at which accidents tend to cluster) is over 25 miles away in Vicksburg, Mississippi. This probabilistic risk assessment conforms with SRP 2.2.3, Acceptance Criteria No. 1. The actual design of the Unit 3 Control Room is not an input to the probability analysis. Therefore, there is no undue risk associated with chlorine and ammonia shipments on the Mississippi River for Unit 3.

Chemicals utilized in Unit 1 are identified in SSAR Table 2.2-5; SSAR Section 2.2.3 provides the analysis of these chemicals with regard to hazards to Unit 3.

The chemical materials stored on-site at Unit 3 are identified in Table 2.2-201. This table also identifies storage locations and the quantity of each chemical/ material. Properties relative to the hazards of each chemical and the results of a screening analysis based on these hazardous properties are provided in Table 2.2-202. The on-site chemicals with the potential to be flammable or explosive hazards are evaluated for possible effects on Unit 3 safety-related SSCs.

Table 2.2-202 shows that many of the chemicals are not toxic. For chemicals with immediately dangerous to life or health (IDLH) values listed in this table, the effects of toxic vapors or gases and their potential for incapacitating Unit 3 control room operators are evaluated and the results presented in Section 6.4. Table 2.2-202 also shows that except for hydrogen, the chemicals listed do not present a flammability or explosive hazard. As shown by the table column labeled “Flammable/Explosive?,” hydrogen has flammability and explosive properties that required analysis; this analysis was completed as described in SSAR Section 2.2.3.

Add the following section to the end of SSAR Section 2.2.3.1.

2.2.3.1.7 Unit 1 Turbine Missile Impact on Unit 3

GGNS ESP COL 2.2-1

GGNS COL 2.0-6-A

The Unit 1 turbine generator is located in the north-south direction, parallel to Unit 3, and to the east of the Unit 1 reactor auxiliary building (see Reference 2.2-201, Figures 3.5-1 and 3.5-2). The Unit 3 Control Building (CB) is located approximately 1300 ft. to the west of the Unit 1 turbine building, with the Unit 3 reactor and fuel buildings approximately 1400 ft. from the Unit 1 turbine building (Figures 1.1-201 and 2.4.1-201).

As discussed in Section 3.5.1.3 of Reference 2.2-201, low trajectory missiles are contained by shield walls located adjacent to the turbines. The probability analysis for high trajectory missiles of Reference 2.2-201 concludes that the probability of significant damage to a Unit 1 Category I SSCs is well within the annual upper limit of probability for a postulated missile of $1x10^{-7}$, and no specific protection measures against high trajectory missiles are required.

The Unit 1 turbine is provided with a highly reliable and redundant control system to trip the turbine in an overspeed condition (Reference 2.2-201, Section 10.2.2). The Unit 1 turbine disk integrity is addressed by the use of suitable materials, adequate design, and inservice inspections to minimize the probability of failure (Reference 2.2-201, Section 10.2.3).

Reference 2.2-201 concludes that turbine missiles are not a concern for Unit 1 safety-related SSCs due to the low probability of significant damage to Category I SSCs due to a postulated missile, redundant design features, and periodic inspection and testing. Therefore, when collectively considering these items, the additional shielding provided by other Unit 1 structures, and the separation distance between Units 1 and 3, Unit 1 turbine missiles are not a concern for Unit 3 operation.

2.2.4 REFERENCES

2.2-201 Grand Gulf Unit 1 Updated Final Safety Analysis Report (UFSAR), June 2007.

2.2-202 Physical Properties: A Guide to the Physical, Thermodynamic and Transport Property Data of Industrially Important Chemical Compounds by Carl L. Yaws, 1977.

2.2-203 NTIS Publication No. PB-94-195047: Documentation for Immediately Dangerous to Life or Health Concentrations (IDLH): NIOSH Chemical Listing and Documentation of Revised IDLH Values (as of 3/1/95) accessed via Center for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), website http://cdc.gov/niosh/idlh/intridl4.html, December 7, 2007.

2.2-204 NALCO Material Safety Data Sheet, Product TRC-233®.

2.2-205 Vermont Safety Information Resources, Inc. (SIRI) Material Safety Data Sheets, accessed via website http://siri.org/msds/ accessed December 7, 2007.

2.2-206 National Oceanic and Atmospheric Administration, Areal Locations of Hazardous Atmospheres (ALOHA®), Version 5.4.1, February 2007.

2.2-207 NFPA 422, Guide for Aircraft Accident/Incident Response Assessment, B6.3 and B6.4, 2004 Edition.

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

TABLE 2.2-201 (Sheet 1 of 2)

Unit 3 On-site Chemical Storage Locations and Quantities

Chemical/Material (Formula/Trade/State)	Location	No. x Quantity
Chlorine Gas	Potable Wells Area Sanitary Waste Treatment Facility	10 x 150-lb Bottles (6 bottles PWS, 4 bottles SW)
Sodium Hydroxide NaOH 60% Solution	Service Water / Water Treatment Building (Inside)	1 x 200 gallon Tank
Sodium Hypochlorite 12.5% Solution	Cooling Tower (Adjacent) Potable Wells Area	1 x 4000 gallon Tank 1 x 500 gallon Tank
Hydrochloric Acid	Service Water / Water Treatment Building (Inside)	1 x 180 gallon Tank
Hach SiO_2 Alazyer Reagents	Service Water / Water Treatment Building (Inside)	24 x 2.9L Bottles
Sulfuric Acid	Cooling Tower (Adjacent)	1 x 12,000 gallon Tank
Corrosion Inhibitor (Nalco 7384/Zinc)	Cooling Tower (Adjacent)	1 x 180 gallon Tank
Scale Inhibitor SURE-COOL 1393 (50% organic phosphate)	Cooling Tower (Adjacent)	1 x 280 gallon Tank
Dispersant PCL-401/28% TRC-233	Cooling Tower (Adjacent)	1 x 6000 gallon Tank
Hydrogen Peroxide	Service Water / Water Treatment Building (Inside)	1 x 180 gallon
Carbon Dioxide	CO2 Storage Area-Outside the Turbine Building (West side)	1 x 800 gallon (Cryogenic Storage Tank)

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

TABLE 2.2-201 (Sheet 2 of 2)
Unit 3 On-site Chemical Storage Locations and Quantities

Chemical/Material (Formula/Trade/State)	Location	No. x Quantity
Hydrogen	Unit 2 Cooling Tower Basin Area	1 x 18,000 gallon (Cryogenic Storage Tank)
Nitrogen	Unit 2 Cooling Tower Basin Area	1 x 25,000 gallon (Cryogenic Storage Tank)
Trisodium Phosphate (0.72% Solution)	Auxiliary Boiler Building	1 x 555 gallon Tank
Sodium Sulfite (2.2% Solution)	Auxiliary Boiler Building	1 × 555 gallon Tank
Disodium Phosphate (0.18% Solution)	Auxiliary Boiler Building	1 x 555 gallon Tank
Oxygen, Liquid	Unit 2 Cooling Tower Basin Area	1 x 9000 gallon (Cryogenic Storage Tank)
Diesel Fuel	East of Electrical Building / Technical Support Center	2 x 210,500 gallon Tank

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

TABLE 2.2-202 (Sheet 1 of 3)
UNIT 3 ON-SITE CHEMICALS EVALUATION

Chemical / Chemical Product[1]	Toxicity Limit (IDLH)/ TLV	Flammable/ Explosive?	Vapor Pressure	Disposition
Chlorine Gas	10 ppm (IDLH)	No / No	5168 mmHg @ 70°F	Toxicity analysis in Section 6.4. No other analysis required.
Sodium Hydroxide NaOH 60% Solution	10 mg/m^3 (IDLH)	No / No	14 mmHg @ 140°F	Hazardous liquid at ambient conditions. No further analysis required
Sodium Hypochlorite 12.5% Solution	0.5 ppm for Chlorine (TLV)	No / No	17.5 mmHg @ 68°F	Toxicity analysis in Section 6.4. No other analysis required.
Hydrochloric Acid 35.2% Solution	50 ppm (IDLH)	No/ No	190 mmHg @ 77°F	Hazardous liquid at ambient conditions. No further analysis required.
Hach SiO_2 Analyzer Reagents	0.025 mg/m^3 respirable dust (TLV)	No/ No	10 mmHg @ 3150°F	Silicosis Hazard. No further analysis required
Sulfuric Acid	15 mg/m^3 (IDLH)	No/ No	1 mmHg @ 295°F	Toxicity analysis in Section 6.4. No other analysis required.
Corrosion Inhibitor (Nalco 7384/Zinc)	50 mg/m^3 for zinc chloride (IDLH)	No/ No	1 mmHg @ 802.4°F	Liquid at ambient conditions. No further analysis required.

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

TABLE 2.2-202 (Sheet 2 of 3)
UNIT 3 ON-SITE CHEMICALS EVALUATION

Chemical / Chemical Product[1]	Toxicity Limit (IDLH)/ TLV	Flammable/ Explosive?	Vapor Pressure	Disposition
Scale Inhibitor SURE-COOL 1393 (50% organic phosphate)	None Established	No/ No	Not Required	No further analysis required
Dispersant PCL-401/ 28% TRC-233	None Established	No / No	760 mmHg at 212°F	No further analysis required
Hydrogen Peroxide	75 ppm (IDLH)	No / No	23 mmHg at 68°F	Toxicity analysis in Section 6.4. No other analysis required.
Carbon Dioxide	40,000 ppm (IDLH)	No / No	830 psi at 68°F	Toxicity (asphyxiation) analysis in Section 6.4. No other analysis required.
Hydrogen	None established; asphyxiant	Yes (4 to 75%) / Yes	29.030 psi at –418°F	Toxicity (asphyxiation) analysis in Section 6.4. Explosion analyses safe separation distances are provided in SSAR Section 2.2.3.
Nitrogen	None established; asphyxiant	No / No	65.820 psi at –294°F	Toxicity (asphyxiation) analysis in Section 6.4. No other analysis required.
Trisodium Phosphate (0.72% Solution)	None established	No / No	Not required	No further analysis required.

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

TABLE 2.2-202 (Sheet 3 of 3)
UNIT 3 ON-SITE CHEMICALS EVALUATION

Chemical / Chemical Product[1]	Toxicity Limit (IDLH)/ TLV	Flammable/ Explosive?	Vapor Pressure	Disposition
Sodium Sulfite (2.2% Solution)	None Established	No / No	17.535 mm Hg at 93.6°F	No further analysis required.
Disodium Phosphate (0.18% Solution)	None established	No / No	Not required	No further analysis required.
Oxygen	None established	No / No	36.260 psi at –280°F	Toxicity analysis in Section 6.4. No other analysis required.
Diesel Fuel	None established	Yes (Varies) / No	< 0.100 mmHg	No further analysis is required.[2]

1. Properties confirmed by Material Safety Data Sheets (Reference 2.2-202, 2.2-203, 2.2-204, and 2.2-205).

2. A fluid with an extremely low vapor pressure will not explode per NFPA 422 (Reference 2.2-207) which states that the vapor space in tanks storing low vapor pressure liquids is normally too lean to burn. The vapor pressure of diesel fuel is low enough such that the vapor concentration above the liquid (0.36%) is significantly lower than the LFL (1.3%). As a result the air-gas mixture is expected to be too lean to ignite and/or explode.

2.3 METEOROLOGY

GGNS COL 2.0-7-A through 2.0-11-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Sections 3.1.3 and 3.1.4.1 of the referenced ESP safety analysis report are incorporated by reference with no variances or supplements.

2.3.1 REGIONAL CLIMATOLOGY

2.3.1.2 REGIONAL METEOROLOGICAL CONDITIONS FOR DESIGN AND OPERATING BASES

2.3.1.2.5 Estimated Weight of the 48 Hour Probable Maximum Winter Precipitation (PMWP)

GGNS ESP VAR 2.3-1

Replace the last sentence of the second paragraph of this section with the following.

Frozen precipitation at a depth of 1.9 in. (of ice) creates a roof load of 9.9 lbf/ft^2 (1.9 in. *144 in^2/ft^2 * 0.0361 lbf/in^3 of water = 9.9 lbf/ft^2). However, the 11-year period of record used to derive the 48-hour frozen precipitation value of 9.9 $lbf/ft.^2$ is too short, resulting in large uncertainty in the resulting value; therefore, this value is not used in determination of roof loads.

2.3.1.2.6 Weight of Snow and Ice on Safety-Related Structures

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GGNS ESP VAR 2.3-1

The following supplemental information is included in Section 2.3.1.2.6 to provide an alternative method for defining the extreme winter precipitation roof loads as discussed in NUREG-1840, Section 2.3.1.3.

Replace the information in SSAR Section 2.3.1.2.6 with the following.

NRC RG 1.70 specifies that the combination of extreme live loads to be considered in the design of a nuclear power plant structures should include the weight of the 100-year snowpack at ground level plus the weight of the 48-hour PMWP at ground level for the month corresponding to the selected snowpack. The winter PMP calculated using the methodology of HMR 53 is 35 in. (SSAR Section 2.3.1.2.5); however, the winter PMP for the Grand Gulf area refers only to rainfall. DCD Table 2.0-1 indicates in Note 5 that the ESBWR structures roof scuppers and drains are designed independently to limit water accumulation on the roof to no more than 100 mm (4 in.) during PMWP conditions. Therefore, rain water will not remain on the roofs in amounts greater than 4 inches.

Based on the roof drainage system design capability to limit rainfall accumulation to a maximum of 4 inches water, the equivalent pressure loading from the PMWP event is 20.8 lbf/ft2. The maximum ground snow load is 6.1 lbf/ft^2 as reported in SSAR Section 2.3.1.2.4. The roof design live load from antecedent snowpack represents a 100-year return ground snow load that on the roof of each safety-related building is taken as 60% of that value, based on exposure and thermal conditions, per the ASCE 7 Commentary in DCD Reference 2.0-2. Therefore, the roof snow load from the antecedent snowpack is no more than 3.7 lbf/ft^2 for any Unit 3 safety-related building. Because precipitation during a PMWP event is liquid at the Grand Gulf site, the total roof loading includes an additional rain-on-snow surcharge to account for liquid flowing through the 100-year snowpack. Per Section 7.10 of ASCE 7, 5 lbf/ft^2 accounts for the rain-on-snow surcharge. Therefore, the maximum total load (snowpack plus rain) to be used for the extreme winter precipitation load for roof structural design purposes on a Unit 3 safety-related building is: (3.7 + 20.8 + 5) or 29.5 lbf/ft^2.

2.3.2 LOCAL METEOROLOGY

GGNS ESP COL 2.3-1

GGNS COL 2.0-8-A

ESP COL Action Item 2.3-1 states that a COL or CP applicant should evaluate interaction between the existing meteorological tower and the proposed facility's cooling towers. The following supplements to Section 2.3.2.2 provide the results of this COL Action Item 2.3-1 evaluation.

Add the following subheading after Section 2.3.2.2 heading:

General

Add the following subheading after the second and before the third paragraph:

Facility Construction and Structure Influences

Add the following text after the third paragraph:

The main 50 meter meteorological tower base is approximately 156 ft. msl as indicated in SSAR Section 2.3.3.2. The major Unit 3 structures in the vicinity of the meteorological tower are the Unit 3 turbine and reactor buildings, the offgas stack and the natural draft cooling tower (NDCT). The 550 ft. tall NDCT is located approximately 2600 ft. south of the meteorological tower with its base at elevation 157 ft. msl (Figure 2.4.1-201). The Unit 3 turbine and reactor buildings and the plant stack are sited on a grade of 133.5 ft. msl south-southeast of the meteorological tower at a distance of approximately 3200 ft. from the meteorological tower (Figure 2.4.1-201).

RG 1.23, Revision 1, indicates that a meteorological tower located at 10-building-heights horizontal distance downwind will not have adverse building wake effects exerted by the structure. The height of the turbine building is approximately 162 ft. above grade (DCD Figure 1.2-19) and the reactor building is approximately 157 ft. above grade (DCD Figure 1.2-11). Site grade at the location of these structures is 133.5 ft. msl. Therefore, the zone of turbulent flow created by the turbine building will be limited to approximately 1620 ft. (10 building heights) downwind. Thus, the Unit 3 turbine building or reactor building will not adversely affect the measurements taken at the primary tower. The plant stack is a narrow cylindrical structure located also approximately 3200 ft. from the meteorological tower; its height is approximately 164 ft. above grade. Therefore, it will not adversely affect the meteorological tower instrument measurements.

The 10-building-height distance of separation guidance is usually applied to square- or rectangular-shaped structures or objects. A round structure will produce a downwind wake zone that is shorter than a square or rectangular structure or object. The downwind region of adverse influence of a hyperbolically-shaped, natural-draft cooling tower is estimated to be approximately five times the width of the tower at the top of the structure (Reference 2.3-201).

The NDCT is approximately 550 ft. high, with a diameter of 262 ft. at the top. Based on the EPA guidance for this type of structure and the diameter at its top, the outermost boundary of influence that will be exerted by the NDCT is estimated to be approximately 1315 ft. This distance is much shorter than the physical separation of the cooling tower from the meteorological tower (i.e., approximately 2600 ft.). Therefore, the natural-draft cooling towers will not adversely affect measurements made at the primary meteorological tower. Similarly, other structures in the vicinity of the primary meteorological tower have been evaluated as having no adverse effect on the measurements taken at the tower.

Winds blow predominantly from the north-northeast at the site; winds at the 33 ft. elevation blow from the south an average of approximately 7.6 percent of the time, from the south-southeast an average of approximately 7.4 percent of the time, and from the south-southwest approximately 5.1 percent of the time (see SSAR Tables 2.3-32 through 2.3-43). Wake effects from the cooling tower and powerblock structures will have some influence on the local air flow immediately downwind of the structures. However, considering the frequency of winds blowing toward the meteorological tower, the distance of the plant structures from the meteorological tower and the shape of the plant structures, the effect on the meteorological measurements would be minimal and the data taken at the meteorological tower will be representative of the site.

Other Potential Influences

Add the following section.

2.3.2.2.4 Cooling Tower Plume Effects on On-site Meteorological Measurements

The circulating water cooling system includes one (1) hyperbolic NDCT and one (1) auxiliary mechanical draft cooling tower (MDCT) (see Section 10.4.5.2.1). The meteorological tower is located approximately 2600 ft. north of the NDCT. Due to the predominant northeast winds at the site, the cooling towers' plumes are directed away from the meteorological tower and toward the Mississippi River. In addition, the direction of the wind and location of the meteorological tower relative to the cooling tower make fogging near the tower as a result of cooling tower operation unlikely.

The prediction of the cooling tower plume behavior was performed using the Seasonal and Annual Cooling Tower Impact (SACTI) computer code (Reference 2.3-202). Grand Gulf site and Vicksburg meteorology data for the period 1997 through 2001 was used in the model. The heat load used is a bounding value and is the primary conservatism in the study. The cooling tower dimensions, layout, and airflow rates are based on the final facility design.

Table 2.3-209 describes the expected plume lengths by season and direction for the NDCT. Table 2.3-210 presents the plume lengths by season and direction for the MDCT. These MDCT plume lengths are typically shorter, but the plumes would be closer to the ground. This increases salt deposition and the possibility of fogging. Table 2.3-211 compares the plume lengths by frequency for the NDCT and MDCT.

The frequency of a cooling tower plume reaching the meteorological tower was determined to be 3.37 percent in the winter, 4.26 percent in the spring, 3.66 percent in the summer, and 1.89 percent in the fall. The average percentage of time that the cooling tower plume is predicted to reach the meteorological tower is 3.30 percent annually. This evaluation does not consider plume height at the meteorological tower which would reduce any potential effects on the meteorological tower. Due to the NDCT height (approximately 550 feet) and the expected plume rise, the effect of the cooling tower plume on the meteorological tower should be minimal even when the wind is blowing toward the meteorological tower. Plume lengths for the MDCT are significantly shorter; in summer when the MDCT operation is most prevalent, the predicted plume does not reach the meteorological tower location. In winter, plume lengths for the MDCT in the northerly direction are predicted to be approximately 0.6 miles, just reaching the meteorological tower location, but due to plume rise would not directly impact the meteorological tower. The NDCT does not result in fogging or icing. NDCTs are typically so high that these effects do not occur. The MDCT estimates of fogging are less than two hours per year in any location (up to 1.5 hours per year is predicted within about 660 ft. in the north-northwest direction). This would have no adverse impact on the meteorological tower measurements.

2.3.4 SHORT TERM DIFFUSION ESTIMATES

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

ESP COL Action Item 2.3-2 states that a COL or CP applicant should evaluate dispersion of radioactive materials to the control room. The following information is provided to address the relative concentration estimates at the control room intakes and replaces Sections 2.3.4.3 and 2.3.4.4 of the SSAR in their entirety.

2.3.4.3 RELATIVE CONCENTRATION ESTIMATES AT THE CONTROL ROOM EMERGENCY INTAKE

The atmospheric dispersion estimates (c/Q) for the various control room intake locations were calculated based on the guidance provided in RG 1.194, June 2003. The control room c/Qs were calculated for all probable release points to the control room emergency and normal air intakes using the ARCON96 computer code (NUREG/CR-6331) and hourly GGNS meteorological data from 2002 and 2003.

Four air intake locations were considered in the dispersion evaluations. These are the two redundant control room habitability area HVAC subsystem emergency filter unit (EFU) air intakes, the control room normal air intake, and an assumed control room inleakage location. The CRHAVS is provided with two safety-related charcoal filter trains (EFUs); and c/Q values were determined for each of the EFU charcoal filter train intake locations. These locations are presented as “EN” (Emergency Intake North) and “ES” (Emergency Intake South) in Figure 2.3-201. For most cases, only the closest emergency air intake is evaluated. Figure 2.3-201 also shows the location of the normal air intake (Point “N”).

The assumed location for unfiltered inleakage is a louver located on the CB west wall (shown as Point “A” in Figure 2.3-202) intended to provide cooling through natural circulation for the nonsafety-related equipment located at design grade elevation in the CB. The control room habitability area (CRHA) is located entirely below plant grade and the inleakage locations represent inleakage into the CB rather than the control room itself, thus, this assumed inleakage location is extremely conservative. Control Room habitability for toxic gas releases is discussed in FSAR Section 6.4.

2.3.4.3.1 Release and Receptor Locations

The release location depends on the event, the release pathway, and the event scenario. Release locations were evaluated for various design basis events.

Loss of Coolant Accident (LOCA) - The LOCA dose calculation credits operation of the EFU charcoal filter trains, therefore the assumed receptor locations are the emergency air intakes. The CB louvers are conservatively assumed as the unfiltered inleakage term. The release points associated with the design basis LOCA are:

1. Containment leakage to the reactor building was assumed to be a diffuse source released through the east face of the building. The reactor building face was projected to the east side of the stairwell in accordance with RG 1.194 guidance. The area was conservatively assumed to be 2000 m2. See Figure 2.3-203.

2. Containment leakage though the PCCS was assumed to be released through the moisture separators located on the 27,500 mm elevation. The leakage is routed through Seismic Category I ductwork to the reactor building roof. See Figure 2.3-204.

3. MSIV leakage is released via the main condenser, which is located in the turbine building. The turbine building is designed to Seismic Category II standards, therefore it is expected to remain intact following a SSE. This scenario evaluates a diffuse source over the entire area of the turbine building (conservatively assumed to be 2000 m2), with the source/receptor reduced as appropriate. See Figure 2.3-205.

Fuel Handling Accident (FHA) - No credit is taken for the control room EFU charcoal filter trains in the FHA dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake.

1. One potential release location for a FHA is the reactor building, which was previously discussed for the LOCA.

2. The other postulated release location for a FHA is the fuel building. Two release scenarios were evaluated:

   a. Equipment (cask) doors located on the west side of the fuel building. The cask doors are modeled as a point. The release height is assumed to be one (1) m above design plant grade.

   b. The east side of the fuel building is significantly closer to the CB; however, a release from the west side of the building is modeled as a diffuse release.

Main Steam Line Break (MSLB) - No credit is taken for the EFU charcoal filter trains in the MSLB dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. The MSLB release location is assumed to be the turbine building (diffuse release). See Figure 2.3-205.

Liquid Radwaste Tank Failure - No credit is taken for the EFU charcoal filter trains in the liquid radwaste tank failure dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. The release point assumed for this event is the radwaste building, which is west of the turbine building. The release is assumed to be a point source. The distance used is assumed to be the same as the fuel building cask doors, which is conservative due to geometric symmetry.

Instrument Line Break - No credit is taken for the EFU charcoal filter trains in the instrument line break dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. The instrument line break release location is assumed to be the reactor building (diffuse release).

Feedwater Line Break (FWLB) - No credit is taken for the EFU charcoal filter trains in the FWLB dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. The FWLB release location is assumed to be the turbine building (diffuse release).

Reactor Water Cleanup (RWCU) Line Break - No credit is taken for the EFU charcoal filter trains in the RWCU dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. The RWCU line break is assumed to occur in the reactor building (diffuse release).

1000 Failed Fuel Rods Analysis - No credit is taken for the EFU charcoal filter trains in the 1000 rods dose consequence analysis; therefore, the only receptor location evaluated is the control room normal air intake. There are two release locations for this event. One is the main condenser/turbine building (diffuse release) and the other is the off-gas system that vents through the main plant stack. Dispersion factors are only calculated for the turbine building; therefore, those values are used in the analysis.

Atmospheric dispersion is also evaluated for the TSC. The TSC intake is located north of line E6 and east of column ED of the electrical building as indicated on DCD Figure 1.2-26. Distances to the TSC are based on the shortest linear distance from the reactor building, turbine building, and PCCS vent duct to line E6, column ED, as appropriate.

2.3.4.3.2 Methodology

A diffuse release is assumed to occur over the area of the reactor building facing the CB. The reactor building roof elevation is 52.7 m (see DCD Figure 3G.1-6) and the design plant grade elevation of 4.65 m (el. 134 ft.) which gives a building height above design plant grade of 48.05 m. The width of the building is 47 m. Thus, the total surface area of the building above design plant grade is approximately 2280 m2. This analysis conservatively uses a value of 2000 m2 for the building area. Review of the turbine building general arrangement drawings confirms that the cross-sectional area of the turbine building is significantly greater than that of the reactor building. An area of 2000 m2 will be conservatively assumed to apply to the turbine building as well.

For the reactor building releases the release height is assumed to be at the center of the reactor building, or roughly 24 m above ground elevation. The release height for the turbine building is assumed to be half of the total building height. The turbine building roof elevation is 54 m; therefore, the release height is assumed to be 24.5 m. The PCCS release is a point source assumed to occur at the reactor building roofline (48.05 m).

The CB air intakes are assumed to be ~1m below the building roof elevation of 13,500 mm, or a “height” of 8 m. The height of the CB louvers (and the HVAC/ electrical/piping chase) is assumed to be 1 m. The intake for the TSC is assumed to be located at elevation 27.0 m, or a height of approximately 22.0 m.

Releases from the fuel building are assumed to occur either as a diffuse release on the east side of the building, or through the spent fuel cask equipment doors located on the west side of the building. For the diffuse release, the assumed fuel building width and height are based on the east/west cross-section of the building, which is conservative for all other locations. As such, the assumed width is 21.0 m and the height is 22.5 m based on DCD Figure 1.2-10. The release height for the diffuse source is then 11.25 m.

A release height of 5.0 m is assumed for the fuel building cask door release point. A release height of 8.0 m is assumed for the radwaste building. This value minimizes the slant path for releases from the radwaste building.

The distances and directions from the assumed release points to the control room HVAC Intake are shown on Table 2.3-201. In all cases, the intervening structures between the release point and the control room intake were ignored for calculational simplicity, thereby underestimating the true distance to the control room intakes.

Atmospheric stability was determined by the vertical temperature difference (ÄT) measured over the difference in measurement height and the stability classes given in RG 1.23. All releases were assumed to be point ground level releases. For each of the source-to-receptor combinations, the c/Q value that is not exceeded more than 5.0 percent of the total hours in the meteorological data set (e.g., 95-percentile c/Q) was determined.

The ARCON96 code requires values for a number of additional parameters. RG 1.194, Table A-2, provides useful guidance in determining reasonable values for a number of them. The remaining parameters are discussed below.

In ARCON96, the value of the “vertical velocity” is used only in vent and stack release models. Since these models are not used in this analysis the vertical velocity is set to 0 m/sec. Similarly, the “stack flow” value is set to 0 m/s as well.

Since the “stack flow” is 0, the stack radius is set to 0 m in accordance with RG 1.194 recommendations.

ARCON96 uses the “surface roughness length” parameter to adjust wind speeds to account for differences in meteorological instrumentation height and release height. This analysis will utilize the value of 0.2 m recommended by RG 1.194. The default value of 90 degrees will be assumed for the wind direction window. The default value for minimum wind speed (0.5 m/s) is assumed. A value of 4.3 is used for the “averaging sector width” in accordance with RG 1.194.

Initial diffusion coefficients are used in modeling a diffuse source. For the point source evaluations the values will be set to 0 m. RG 1.194, Section 3.2.4.4 states that for diffuse sources the two initial diffusion coefficients should be modified as follows (in the absence of site-specific empirical data)

$$\sigma_{Y_0} = \frac{Width}{6}$$

$$\sigma_{Z_0} = \frac{Height}{6}$$

Finally, the ARCON96 code default values are used for the “hours in averages” and “minimum number of hours” parameters in accordance with RG 1.194, Table A-2. The ARCON96 parameters are summarized in Tables 2.3-202 and 2.3-203.

2.3.4.3.3 Results

The c/Q values for each source-receptor pair are shown in Tables 2.3-204 through 2.3-207. The site-specific c/Qs are less than the corresponding DCD values (see Table 2.0-201).

Dispersion factors are required so that the doses from a Unit 1 accident on Unit 3 operators may be calculated. The cross-unit χ/Q values are conservatively based on a simple point source model. A distance of 350 m between Unit 1 and Unit 3 is conservatively assumed (actual distance is approximately 400 m). The release height and receptor height are both assumed to be 10 m. The results are presented in Table 2.3-208. The calculated results, as well as the results with a “safety factor” of 1.5, are presented. The “safety factor” is used to account for any variations in release locations.

2.3.4.4 INGRESS/EGRESS DIFFUSION ESTIMATES

For the purposes of evaluating dose to personnel for control room ingress and egress, the atmospheric dispersion coefficients calculated at the unfiltered CB louver intake are used.

2.3.5 LONG TERM DIFFUSION ESTIMATES

GGNS ESP COL 2.3-3

ESP COL Action Item 2.3-3 states that a COL or CP applicant should confirm specific release point characteristics and locations of potential receptors for routine release dose computations. This action item requires verification that the specific release point characteristics (e.g., release height and building wake dimensions) and specific locations of receptors of interest (e.g., distance and direction to nearest home, garden, meat animal, and milk animal) used to generate the SSAR long-term (routine release) atmospheric dispersion site characteristics bound the actual values provided at the COL or CP stage. The following information added to SSAR Section 2.3.5 addresses the action item.

Because the SSAR c/Q calculations utilized ground level releases and did not consider building wake effects, the release point characteristics used in the SSAR analyses supporting this section are bounding for Unit 3. The specific locations of receptors of interest (e.g., distance and direction to nearest home, garden, meat animal, and milk animal) used to generate the SSAR long-term (routine release) atmospheric dispersion site characteristics were compared with values from the latest Unit 1 land use census data (Reference 2.3-203). In all cases, the distances to the limiting locations used in the ESP SSAR analyses are smaller than the distances given in the current land use census. Therefore, the c/Qs provided in the SSAR remain valid for Unit 3.

2.3.6 REFERENCES

2.3-201 Guideline for Determination of Good Engineering Practice Stack Height, Technical Support Document for the Stack Height Regulations, U.S. Environmental Protection Agency (EPA), EPA-450/4-80-023, July 1981.

2.3-202 SACTI User's Manual: Cooling-Tower-Plume Prediction Code, EPRI CS-3403-CCM, April 1984.

2.3-203 Entergy Operations Inc., Annual Radiological Environmental Operating Report, April 30, 2007, ADAMS Accession No. ML071200209.

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

TABLE 2.3-201
RELEASE LOCATION DISTANCE AND DIRECTION DATA

Description	Distance (m)	Unit 1 Direction (deg)
Reactor Building Diffuse		
Reactor Building to Control Building Louvers	10.0	300
Reactor Building to Emergency Intake North (EN)	30.0	282
Reactor Building to Emergency Intake South (ES)	30.0	318
Reactor Building to Normal Air Intake (N)	30.0	328
Reactor Building to TSC	80.0	269
Turbine Building Diffuse		
Turbine Building to Control Building Louvers	30.0	30
Turbine Building to Emergency Intake North (EN)	30.0	350
Turbine Building to Emergency Intake South (ES)	50.0	356
Turbine Building to Normal CR Air Intake (N)	50.0	3
Turbine Building to TSC	20.0	300
PCCS Stack Point		
PCCS to Control Building Louvers	32.5	338
PCCS to Emergency Intake North (EN)	40.0	318
PCCS to Emergency Intake South (ES)	50.0	340
PCCS to Normal CR Air Intake (N)	50.0	346
PCCS to TSC	80.0	269
Fuel Building Cask Doors		
Fuel Building Cask Door to Normal CR Air Intake (N)	70.0	286
Fuel Building Diffuse Source		
Fuel Building Diffuse Source to Normal CR Air Intake (N)	30.0	283
Radwaste Building		
Radwaste Building to Normal CR Air Intake (N)	70.0	330
Cross Unit Impacts		
Unit 1 to Unit 3	350.0	135

GGNS ESP
COL 2.3-2

GGNS COL
2.0-10-A

TABLE 2.3-202
RELEASE LOCATION PARAMETERS

Parameter	Reactor Building	Turbine Building	RB Roof/ PCCS	Fuel Building	FB Cask Door	Radwaste Building
Release Height (m)	24.00	24.50	48.05[2]	5.00	5.00	8.00
Total Width (m)[1]	47.00	59.00	N/A	22.5	N/A	N/A
Total Height (m)[1]	48.05	49.00	N/A	22.0	N/A	N/A
Building Area (m2)	2000	2000	0.01	472.5	0.01	0.01
Initial Diffusion Coefficients (m)						
σ_{Yo}	7.83	9.83	N/A	3.75	N/A	N/A
σ_{Zo}	7.96	8.17	N/A	3.50	N/A	N/A
Release Type	Diffuse	Diffuse	Point	Diffuse	Point	Point

Notes:

1. Building height and width are not directly used by ARCON96. They are used to calculate óYo and óZo as well as to determine the diffuse source area, release heights, and release directions.

2. The release height for the PCCS/TSC evaluation was assumed to be 24.0 m (same elevation as the TSC air intake to minimize the “slant path”).

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

TABLE 2.3-203
ARCON96 INPUT PARAMETERS

Parameter	Value
Lower Instrument Height (m)	10.0
Upper Instrument Height (m)	50.0
Release Type (Point/Diffuse/Stack)	Table 2.3-202
Release Height (m)	Table 2.3-202
Diffuse Source Area (m^2)	Table 2.3-202
Vertical Velocity (m/s)	0.0
Stack Flow (m/s)	0.0
Stack Radius (m)	0.0
Direction - Receptor to Source	Table 2.3-201
Wind Direction Window (degrees)	90.0
Distance to Receptor (m)	Table 2.3-201
Intake Height (m)	
Control Building Louvers	1.0
Control Room Air Intakes	8.0
TSC Air Intake	22.0
Elevation Difference (m)	0.0
Surface Roughness Length (m)	0.2
σ_{yo}	Table 2.3-202
σ_{zo}	Table 2.3-202
Hours in Averages (hr)	ARCON96 Default
Minimum Number of Hours (hr)	ARCON96 Default

Notes:

1. All information was normalized to the design plant grade elevation; therefore no adjustments for elevation differences are required for ARCON96

GGNS ESP
COL 2.3-2

GGNS COL
2.0-10-A

TABLE 2.3-204
REACTOR BUILDING (DIFFUSE SOURCE) RELEASE
χ/Q RESULTS (S/M^3)

Description	Direction	Time Interval				
		0 - 2 hrs	2 - 8 hrs	8 - 24 hrs	1 - 4 days	4 - 30 days
CB Louvers	300º	1.33E-03	6.56E-04	2.79E-04	1.84E-04	1.38E-04
Control Room Emergency North Intake	282º	1.03E-03	5.01E-04	1.83E-04	1.36E-04	1.13E-04
Control Room Emergency South Intake	318º	1.04E-03	5.60E-04	2.65E-04	1.51E-04	1.32E-04
Control Room Normal Intake	328º	1.06E-03	6.18E-04	2.90E-04	1.73E-04	1.52E-04
TSC	269º	3.98E-04	2.12E-04	6.92E-05	5.70E-05	4.84E-05

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

TABLE 2.3-205
TURBINE BUILDING RELEASE
χ/Q RESULTS (S/M^3)

Description	Direction	Time Interval 0 - 2 hrs	2 - 8 hrs	8 - 24 hrs	1 - 4 days	4 - 30 days
CB Louvers	30º	1.07E-03	8.10E-04	3.62E-04	3.43E-04	2.75E-04
Control Room Emergency North Intake	350º	1.04E-03	6.60E-04	3.28E-04	2.26E-04	1.87E-04
Control Room Emergency South Intake	356º	6.90E-04	5.05E-04	2.57E-04	1.77E-04	1.38E-04
Control Room Normal Intake	3º	7.13E-04	5.21E-04	2.75E-04	2.04E-04	1.47E-04
TSC	300º	1.35E-03	6.79E-04	2.83E-04	1.96E-04	1.39E-04

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

TABLE 2.3-206
REACTOR BUILDING ROOF/PCCS VENT RELEASE
χ/Q RESULTS (S/M^3)

Description	Direction	Time Interval 0 - 2 hrs	2 - 8 hrs	8 - 24 hrs	1 - 4 days	4 - 30 days
CB Louvers	338º	2.33E-03	1.28E-03	4.51E-04	4.19E-04	3.56E-04
Control Room Emergency North Intake	318º	7.78E-04	2.15E-04	1.03E-04	7.36E-05	6.19E-05
Control Room Emergency South Intake	340º	1.90E-03	1.11E-03	3.88E-04	3.67E-04	3.05E-04
Control Room Normal Intake	349º	1.98E-03	1.31E-03	4.88E-04	4.50E-04	3.96E-04
TSC	269º	7.83E-04	4.02E-04	1.57E-04	1.33E-04	1.01E-04

GGNS ESP COL 2.3-2

GGNS COL 2.0-10-A

TABLE 2.3-207
FUEL BUILDING AND RADWASTE BUILDING RELEASE
χ/Q RESULTS (S/M^3)

Description	Direction	Time Interval 0 - 2 hrs	2 - 8 hrs	8 - 24 hrs	1 - 4 days	4 - 30 days
FB Cask Door to Normal Intake	286º	8.61E-04	4.63E-04	1.95E-04	1.40E-04	1.21E-04
FB Diffuse Source to Normal Intake	286º	2.24E-03	1.16E-03	3.99E-04	3.19E-04	2.71E-04
Radwaste to Normal Intake	330º	1.11E-03	7.93E-04	3.18E-04	1.96E-04	1.64E-04

GGNS ESP
COL 2.3-2

GGNS COL
2.0-10-A

TABLE 2.3-208
CROSS-UNIT RESULTS
χ/Q RESULTS (SEC/M^3)

Description	Direction	Time Interval 0 - 2 hrs	2 - 8 hrs	8 - 24 hrs	1 - 4 days	4 - 30 days
Unit 1 to Unit 3	135º	6.85E-05	5.96E-05	2.28E-05	1.82E-05	1.35E-05
w/ Safety Factor = 1.5	n/a	1.03E-04	8.94E-05	3.42E-05	2.73E-05	2.03E-05

Notes:

1. The Safety Factor is applied to account for any variations in the release locations.

GGNS ESP COL 2.3-1

GGNS COL 2.0-8-A

TABLE 2.3-209
NDCT PLUME LENGTHS BY SEASON

Average Plume Lengths in Miles

	Winter	Spring	Summer	Fall	Annual
Plume from NDCT moving in the indicated direction					
S	2.13	1	0.59	0.8	1.16
SSW	1.79	0.94	0.74	0.88	1.04
SW	1.88	0.96	0.71	1.1	1.11
WSW	2.37	1.46	1.12	1.25	1.48
W	2.93	2.2	1.34	1.61	2.24
WNW	2.16	2.04	1.09	2.15	1.91
NW	1.68	1.18	1.4	1.34	1.4
NNW	1.41	0.99	1.05	0.71	1.1
N	1.44	0.91	0.93	0.8	1.01
NNE	1.55	0.96	0.59	0.63	0.85
NE	1.28	0.76	0.5	0.78	0.78
ENE	1.35	0.84	0.62	0.75	0.89
E	1.24	0.87	0.62	0.62	0.81
ESE	1.01	0.79	0.62	0.75	0.78
SE	1.9	0.94	0.59	0.84	1.08
SSE	1.99	1	0.76	0.83	1.25
All	1.73	1	0.72	0.89	1.08

GGNS ESP COL 2.3-1

GGNS COL 2.0-8-A

TABLE 2.3-210
MDCT PLUME LENGTHS BY SEASON

Average Plume Lengths in Miles

	Winter	Spring	Summer	Fall	Annual
Plume from MDCTs moving in the indicated direction					
S	1.17	0.52	0.27	0.33	0.58
SSW	0.9	0.37	0.31	0.41	0.48
SW	0.92	0.4	0.3	0.44	0.48
WSW	0.92	0.54	0.56	0.52	0.61
W	1.16	0.95	0.58	0.63	0.91
WNW	0.85	0.97	0.55	0.86	0.81
NW	0.65	0.54	0.51	0.48	0.55
NNW	0.68	0.56	0.42	0.32	0.54
N	0.66	0.42	0.33	0.36	0.44
NNE	0.7	0.46	0.22	0.27	0.37
NE	0.63	0.35	0.18	0.32	0.35
ENE	0.7	0.38	0.26	0.32	0.42
E	0.63	0.39	0.28	0.24	0.37
ESE	0.48	0.34	0.25	0.25	0.32
SE	1.04	0.45	0.26	0.29	0.52
SSE	1.08	0.47	0.34	0.35	0.63
All	0.86	0.46	0.3	0.37	0.49

GGNS ESP COL 2.3-1

GGNS COL 2.0-8-A

TABLE 2.3-211
PLUME LENGTH FREQUENCY

	Winter	Spring	Summer	Fall
Most Frequent Plume Heading Directions	S,N,SSE	N,S	N,NNE,NE	S,SSW,SW
Percent of Plumes < 1/3 miles	MDCT: 60.4 NDCT: 23.7	MDCT: 80.0 NDCT: 48.4	MDCT: 88.4 NDCT: 62.0	MDCT: 82.3 NDCT: 50.1
Percent of Plumes >1/3 to 2/3 mile	MDCT: 21.7 NDCT: 31.6	MDCT: 10.6 NDCT: 26.2	MDCT: 4.2 NDCT: 20.8	MDCT: 10.2 NDCT: 26.0
Percent of Plumes >2/3 to 5 miles	MDCT: 13.1 NDCT: 21.1	MDCT: 7.3 NDCT: 13.5	MDCT: 7.2 NDCT: 9.2	MDCT: 6.8 NDCT: 13.8
Percent of Plumes >5 Miles	MDCT: 4.8 NDCT: 23.6	MDCT: 2.1 NDCT: 12.0	MDCT: 0.2 NDCT: 8.0	MDCT: 0.7 NDCT: 10.1

{{{Security-Related Information - Withheld Under 10 CFR 2.390(d)(1)}}}
(See COL Application - Part 9)

Figure 2.3-201. Control Room Air Intake Locations

{{{Security-Related Information - Withheld Under 10 CFR 2.390(d)(1)}}}
(See COL Application - Part 9)

Figure 2.3-202. Control Building Unfiltered Inleakage Location

{{{Security-Related Information - Withheld Under 10 CFR 2.390(d)(1)}}}
(See COL Application - Part 9)

Figure 2.3-203. Reactor Building Diffuse Source (Release Ducted Vertically to Reactor Building Roof)

{{{Security-Related Information - Withheld Under 10 CFR 2.390(d)(1)}}}
(See COL Application - Part 9)

Figure 2.3-204. PCCS Duct Location (Release Ducted Vertically to Reactor Building Roof)

{{{Security-Related Information - Withheld Under 10 CFR 2.390(d)(1)}}}
(See COL Application - Part 9)

Figure 2.3-205. Turbine Building Release Points

2.4 HYDROLOGIC ENGINEERING

Section 3.1.4.4 of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.1 HYDROLOGIC DESCRIPTION

GGNS COL 2.0-12-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

2.4.1.1 SITE AND FACILITIES

SSAR Section 2.4.1.1 identifies the center coordinates of the ESP powerblock area, which is not reactor design specific. Add the following supplemental information regarding the location of the Unit 3 powerblock.

GGNS SUP 2.4.1-1

The UTM coordinates of the center of the Unit 3 powerblock are indicated in Figure 2.1-201. The UTM grid coordinates for the center of the location of the power block of Unit 3 are N3543166 meters and E684017 meters in North American Datum (NAD) 1983, Zone 15 North. These coordinates correlate to the NAD 27 Mississippi State Plane West coordinates (in feet) of N549787 and E277335.

GGNS ESP COL 2.4-3

Figure 2.4.1-201 illustrates the site grading for Unit 3; the finished ground level grade immediately adjacent to Unit 3 buildings is at elevation 133.5 ft. msl. Design plant grade is six inches above finished ground level grade (DCD Table 3.4-1). Design flood considerations based on final grade, local drainage, local intense precipitation, and potential maximum flood for Unit 3 are discussed in Sections 2.4.2 and 2.4.3.

GGNS ESP COL 2.4-4

Demineralized water system (554 gpm maximum) and fire protection system (FPS) (1075 gpm maximum, short term) makeup water requirements are supplied by surface water intake from the Mississippi River, along with cooling tower makeup of 28,800 gpm. The total normal makeup water requirement from the Mississippi River is approximately 29,200 gpm; this value falls within the ESP bounding parameter of 85,000 gpm.

GGNS ESP COL 2.4-8

Groundwater withdrawal requirements for station operation are for potable and sanitary waste water needs. Peak groundwater demand for potable and sanitary waste water is 200 gpm and average demand is 35 gpm. Construction activities require a maximum of approximately 115 gpm of groundwater to supply concrete batch plant operation, dust suppression, initial makeup to fire protection tanks, and sanitary needs. The peak groundwater demand for construction and operation is 200 gpm, which is within the bounding value of 3570 gpm from ESP-

002. Additional information regarding groundwater usage for construction and operation is provided in Section 2.4.12.1.3.1.

GGNS ESP COL 2.4-1

Effluents from Unit 3 and Unit 1 are combined and discharged into the river downstream of the Unit 3 station service water intake. The intake lines are located approximately 365 ft. inside the mouth of the intake embayment. The common outfall diffuser is located approximately 310 ft. downstream of the mouth of the intake embayment. Therefore, recirculation of the combined effluent from the outfall to the embayment area and intake is precluded. The relative locations of the intake and the combined effluent outfall structures are illustrated in Figure 2.4.1-202. As discussed in Section 2.4.11, Unit 3 does not utilize water from the Mississippi River to support safety-related functions (i.e., UHS).

Revise the ninth paragraph of Section 2.4.1.1 as follows.

GGNS ES COL 2.4-6

Emergency cooling water (i.e., the ultimate heat sink - UHS) is not reliant on the river water intake, as discussed in Section 2.4.11.

2.4.1.2 HYDROSPHERE

Appendix A, Part 2.4 of ESP-002 provides site characteristics related to hydrology. The distance to the closest surface water body (1017 ft.) and the distance to the nearest public water supply well (2760 ft.) located just outside the EAB are specified, relative to the center of the ESP powerblock area shown in Figure 2.1-201. The following supplemental information provides these characteristics for the Unit 3 powerblock location.

GGNS ESP VAR 2.4.1-1

GGNS SUP 2.4.1-2

The distance from the center of the Unit 3 powerblock to Stream B/Sedimentation Basin B is approximately 680 ft. The distance from the center of the Unit 3 powerblock to Stream A/Sedimentation Basin A is approximately 1350 ft. See Table 2.0-202, Distance to Closest Surface Water, and Section 2.4.13. The nearest public supply wells outside the EAB are the Port Gibson municipal supply wells, as stated in SSAR Section 2.4.12.2.1. The Port Gibson municipal wells are over five miles from the EAB boundary.

2.4.1.3 REFERENCES

2.4.1-201 System Energy Resources Inc., Grand Gulf ESP Site, Docket No. 52-009, Early Site Permit No. ESP-002, April 5, 2007 (ADAMS Accession No. ML070780457).

2.4.1-202 GGNS Unit 1 Updated Final Safety Analysis Report (UFSAR), June 2007.

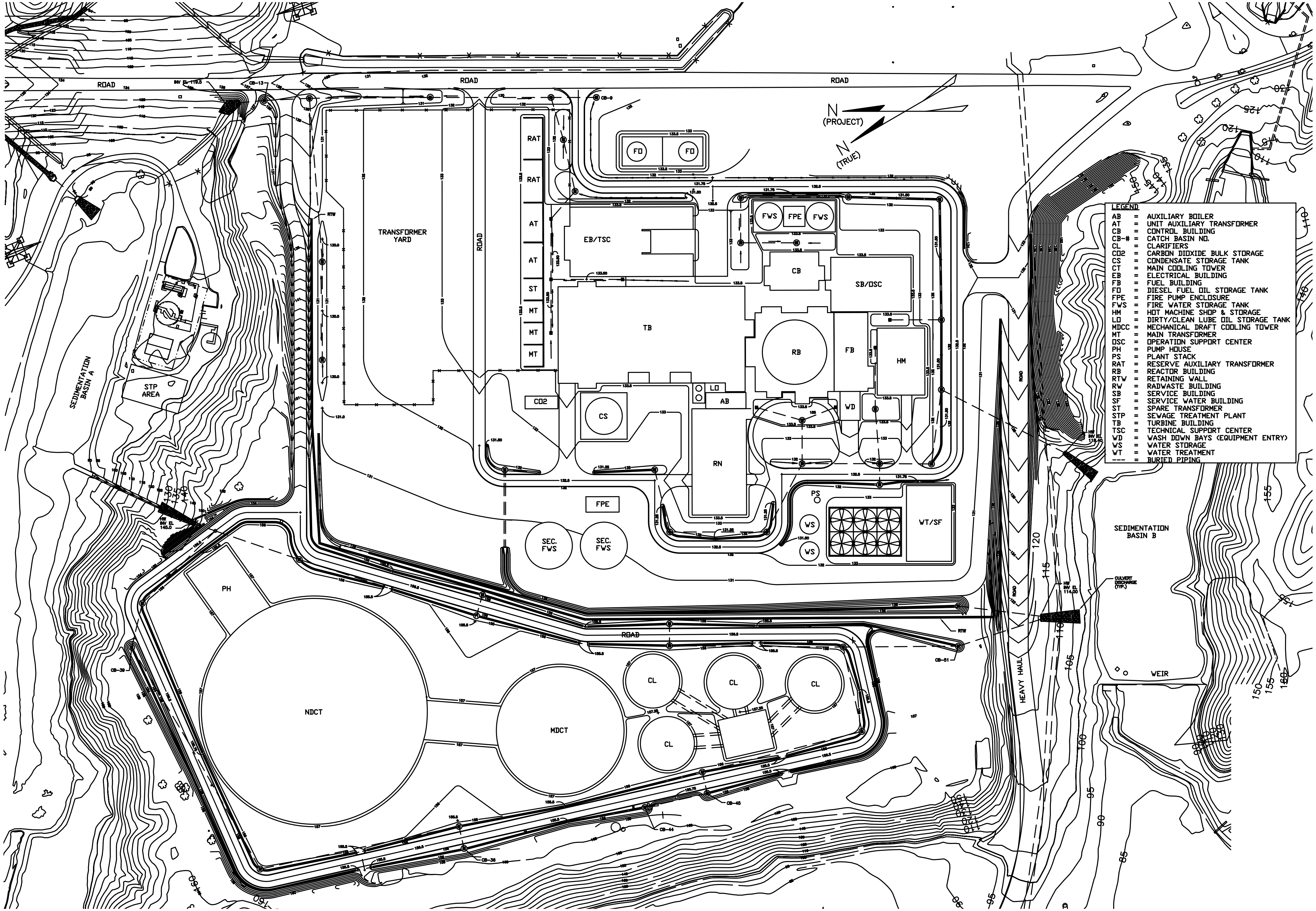


Figure 2.4.1-201. Unit 3 Drainage Plan (Sheet 1 of 2)

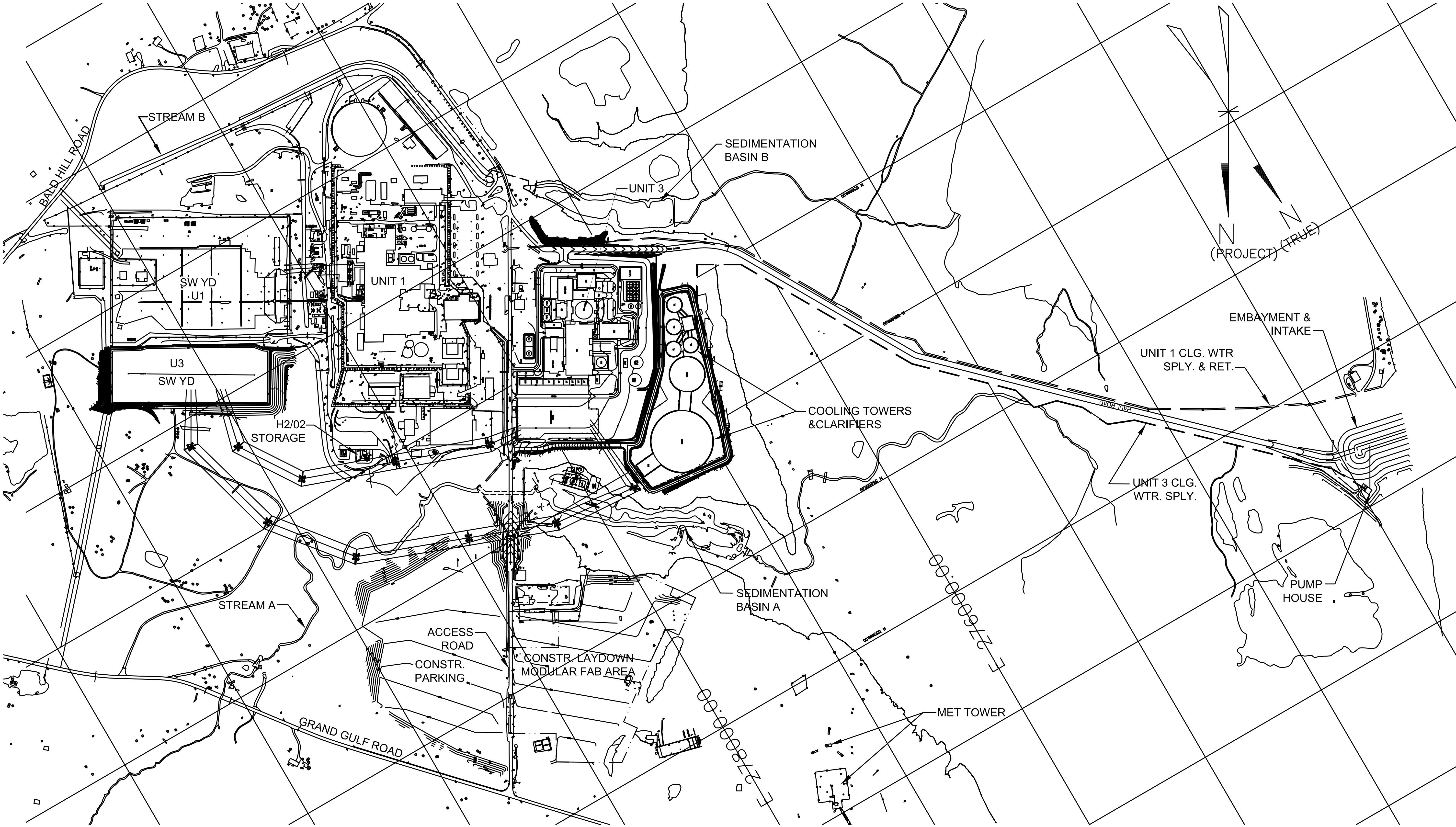


Figure 2.4.1-201. Unit 3 Drainage Plan (Sheet 2 of 2)

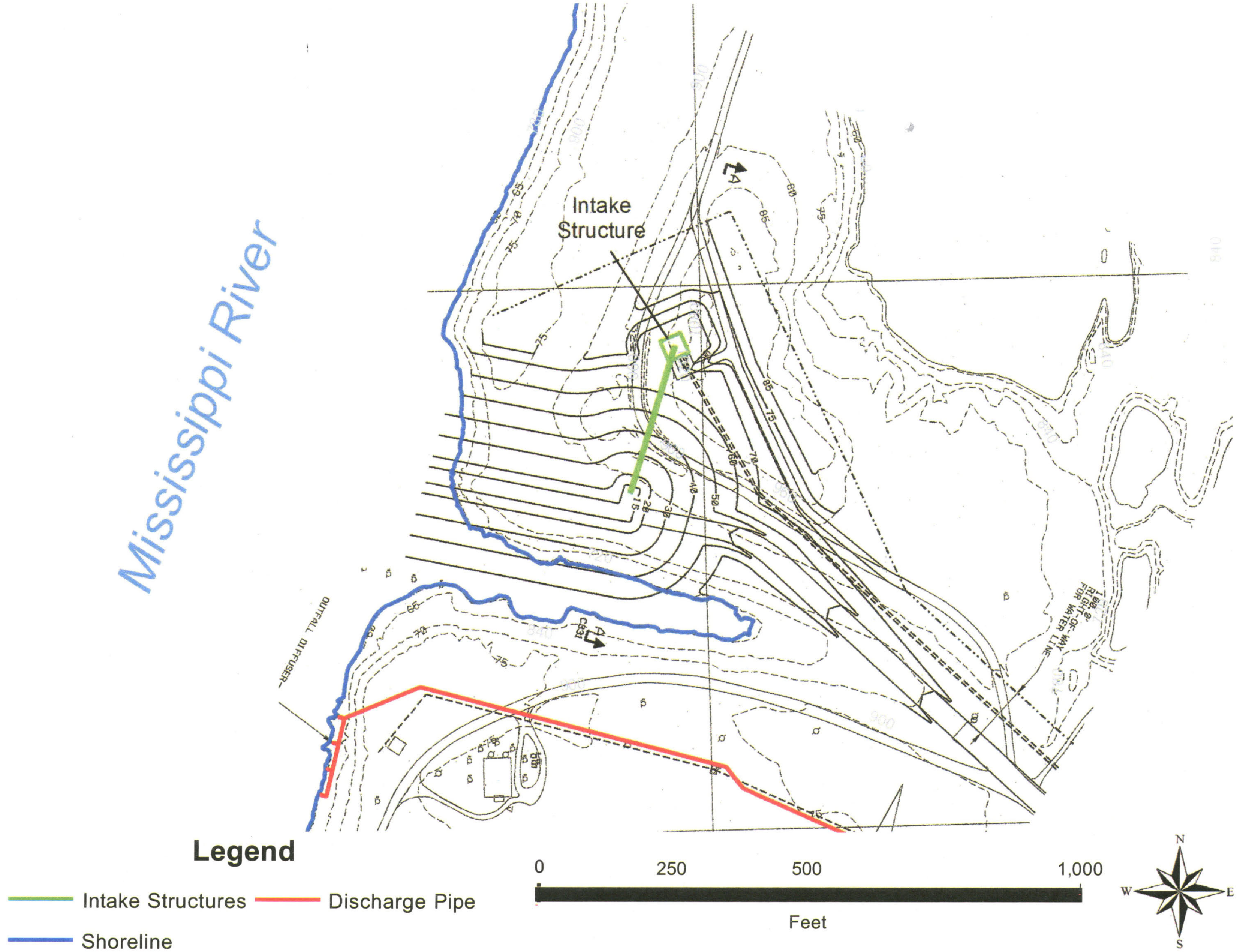


Figure 2.4.1-202. Location of Unit 3 Intake and Outfall Structures

2.4.2 FLOODS

GGNS COL 2.0-13-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

2.4.2.2 FLOOD DESIGN CONSIDERATIONS

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Replace the third and fourth paragraphs in this section with the following information.

The design flood considerations for Unit 3 are based on the local drainage areas shown in Figure 2.4.1-202, and the grading design shown in Figure 2.4.1-201.

2.4.2.3 EFFECTS OF LOCAL INTENSE PRECIPITATION

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Replace the contents of SSAR Section 2.4.2.3 and its subsections with the following information. SSAR Tables 2.4-7, 2.4-8, and 2.4-9 and SSAR Figures 2.4-10, 2.4-12, and 2.4-13 represent input parameters and outputs relevant to the Unit 1 flooding analysis, and support the development of the runoff model used in the Unit 3 analysis in Section 2.4.2.3.2 below.

The PMF for the two local streams close to the plant site (Section 2.4.3) is estimated based on the unit hydrograph method in accordance with RG 1.59. The effects of a local probable maximum precipitation (PMP) event on the adjacent drainage areas and site drainage systems for Unit 3 are discussed below.

The estimated local PMP and the resulting maximum floodwater elevation for the Unit 3 site configuration were calculated for the drainage areas, Basins A and B (Figure 2.4.2-201). The configuration of the principal structures on the Unit 3 site and the surrounding finished grade are shown in Figure 2.4.1-201.

The runoff model in the analysis uses a highly conservative assumption, in that the runoff coefficient (i.e., the percentage of rain that appears as direct runoff) was set at a maximum value of 1.0 (see Section 2.4.2.3.3.2.3, Peak Discharges). This assumption essentially models the drainage basins as if they were covered, such that all rainwater is allowed to run off without benefit of soil infiltration. In the analysis, no credit is taken for the storm drainage system shown in Figure 2.4.1-201, to neither support conveyance of the rainfall from the site nor to store the water in drainage channels, catch basins, and subsurface piping.

2.4.2.3.1 Precipitation Distribution

Local intense PMP depth for Unit 3 and the site area has been computed using the guidelines of Hydrometeorological Report (HMR) Nos. 51 and 52 (References 2.4.2-201 and 2.4.2-202). The location-specific PMP depths derived from HMR 51 and 52 are as follows:

Duration, Area	Multiplier to 1 hr, 1 mi2 PMP	Source	PMP Depth (in.)	Comments
5 min, 1 mi2	0.325	HMR 52, Fig. 36	6.2	multiplier*1 hr PMP
15 min, 1 mi2	0.51	HMR 52, Fig. 37	9.8	multiplier*1 hr PMP
30 min, 1 mi2	0.735	HMR 52, Fig. 38	14.1	multiplier*1 hr PMP
1 hr, 1 mi2	NA	HMR 51, Fig. 24	19.2	
1 hr, 10 mi2	NA	HMR 51, Fig. 29	15.8	
6 hr, 10 mi2	NA	HMR 51, Fig. 18	31.5	

Note: HMR 52 does not provide guidance for any precipitation duration beyond 1 hour for a 1 mi^2 area.

General Unit 3 site drainage characteristics are illustrated in Figures 2.4.1-201 and 2.4.1-202. To the north of the Unit 3 site, the topography drops off to Sedimentation Basin A (downstream of the discharge of Stream A from Culvert 9 located at the north access road crossing - see SSAR Figure 2.4-10). To the south of the Unit 3 site, the topography drops off toward Sedimentation Basin B (downstream of the discharge of Stream B from Culvert 1 located at the south access road crossing - see SSAR Figure 2.4-10). The ultimate discharge point for storm water from the site is the Mississippi River, which is generally unaffected by local intense rainfall events.

2.4.2.3.2 Runoff Model

Following *italics* text is taken from the SSAR, Section 2.4.2.3.2.

The model adopted for determination of the peak discharge for Basins A and B is based on the unit hydrograph concept. The approach consists of estimating basin lag, developing a representative dimensionless hydrograph (Reference 2.4.2-203)*, and synthesizing a unit hydrograph for any selected rainfall duration.*

The lag in hours is based on the curves given by Chow (Reference 2.4.2-204). From these curves, it is possible to estimate basin lag based on length and slope of the channel.

The dimensionless hydrograph adopted is based on observed data and upon curves developed by Hudlow (Reference 2.4.2-203) and Feddes (Reference 2.4.2-205) for small drainage basins varying in size from 0.5 square miles to 75 square miles. Mean dimensionless hydrographs developed by Hudlow (Reference 2.4.2-203) for a stream in east central Texas with a drainage area of 0.48 to 9.2 square miles, and by Feddes (Reference 2.4.2-205) for a two square mile basin near Bryan, Texas.

The watershed characteristics of Basin J (Reference 2.4.2-203) and Hudson Creek near Bryan, Texas (Reference 2.4.2-205) are similar to those of Basins A and B as discussed below.

The pertinent data for different parameters for Basins A and B at Unit 3, along with the characteristics of Basin J and Hudson Creek are as follows:

Basin	*Drainage Area (sq mi)*	*L (mi)*	*Lca (mi)*	*S (ft./mi)*	*Lag (hr)*
A	*2.8*	*3.4*	*1.9*	*48.53*	*1.60*
B	*0.6*	*1.52*	*0.53*	*64.14*	*0.65*
J	*0.48*	*0.96*	*0.33*	*62.80*	
Hudson Creek	*1.98*	*2.18*	*1.15*	*34.32*	

Where:

L = *Length of the longest watercourse from point of interest to the watershed divide*

Lca = *Length of water course from point of interest to the intersection of a line perpendicular to the stream alignment passing through the centroid of basin*

S = *Overall slope of longest watercourse from point of interest to divide*

An average graph as shown in SSAR Figure 2.4-11 has been used as being representative for the site region. On the dimensionless hydrograph, the ordinate is the discharge multiplied by the lag plus one-half the rainfall duration divided by the volume of runoff. The abscissa is time expressed as a percent of lag plus half the duration.

The lag times obtained above were applied to the dimensionless hydrograph (SSAR Figure 2.4-11) to produce the unit hydrograph given in SSAR Table 2.4-8 and SSAR Figure 2.4-12. The unit durations of the unit hydrographs used are 0.5 hr and 0.25 hr for basins A and B, respectively. The precipitation increments used for both basins are given in SSAR Table 2.4-9. The flood hydrographs obtained for the two basins along with the unit hydrograph and precipitation distribution are shown in SSAR Figure 2.4-12.

For the Unit 3 analysis, the area of Basins A and B were re-evaluated based on the topography shown in Figures 2.4.1-201 and 2.4.2-201; slightly revised area acreages are indicated in the table below.

Location Description	Unit 1 Analysis Basin A (sq. mi.)	Unit 3 Analysis Basin A (sq. mi.)	Unit 1 Analysis Basin B (sq. mi.)	Unit 3 Analysis Basin B (sq. mi.)
Access Road Culvert (1 & 9)	2.7	2.71	0.35	0.36
At the Outfall	2.8	2.86	0.6	0.50

Lag time is dependent on the parameters L, Lca, and S. The values for L, Lca, and S for this investigation were measured and calculated from the mapping supporting Figure 2.4.2-201. The values for L, Lca and S between the Unit 1 analysis and this investigation correlate well. The lag time is calculated using the equation below from Chow (Reference 2.4.2-209).

Lag Time = $C_t \{(L \times Lca)/S^{1/2}\}^n$

Where:

C_t is determined using the Unit 1 lag time and parameters. The resulting C_t for Basin A is 1.646 and for Basin B is 1.556.

L = Length of the longest watercourse from point of interest to the watershed divide (miles).

Lca = length of the longest watercourse from the point of interest to the intersection of a line perpendicular to the stream alignment passing through the centroid of the basin (miles).

S = overall slope of the longest watercourse from the point of interest to the divide (ft./mile).

n = 0.38.

Calculated lag time values are indicated in Table 2.4.2-201. However, to simplify the computations in the Unit 3 flooding analysis, the same lag time used in the

Unit 1 analysis were used to determine the peak flow at the culvert and at the outfalls, omitting the travel time from the culvert to the outfall. This is a conservative approach in determining the peak flow at the outfall since the shorter lag time would produce a larger peak. Therefore, lag times adopted for use in this investigation are 1.60 for Basin A, and 0.65 for Basin B.

Because the lag times are the same as those for the Unit 1 analysis, the unit hydrographs developed for the Unit 1 analysis (SSAR Table 2.4-8) were used to develop unit hydrographs, based on the revised basin areas, for the Unit 3 analysis. The ordinates of the unit hydrographs (SSAR Figure 2.4-10) for Basin A and Basin B (at each time step given in SSAR Table 2.4-8) were adjusted by multiplying the ordinates (discharge rate) by the ratio of the respective drainage areas. The resulting values for the corresponding time steps for the unit hydrographs for the Unit 3 analysis are given in Table 2.4.2-202.

The Basin A area is between 1 and 10 square miles, therefore, a 1-hour PMP depth must be determined for that area to develop the precipitation distribution for the basin. Using the charts from HMR 52 for drainage areas larger than 1 square mile, a graph of drainage area vs. PMP depth was developed. From that graph, for a drainage area of approximately 2.8 square miles, a 1-hour PMP of 18 inches is defined. No adjustment is required for Basin B PMP depth for the 1-hour event, because the drainage areas to the culvert and to the outfall are less than 1 square mile (i.e., the 1 square mile rainfall of 19.2 inches is used directly). Using the PMP depths provided in Section 2.4.2.3.1 for durations less than one hour, a graph of PMP rainfall depth vs. storm duration, from time zero to 6 hours duration, is developed. Using this rainfall versus storm duration graph, the precipitation depth for the 0.5- and 0.25-hr storm duration intervals for Basins A and B, respectively, are found (Table 2.4.2-203). The precipitation increments used for determination of the peak discharges from both basins are given in Table 2.4.2-204.

Assuming that 100 percent of the precipitation is runoff (assuming no losses in the basin), the peak flow in Streams A and B, at the location of the respective culvert and the outfall, is determined using the unit hydrographs and an incremental distribution designed to produce the highest runoff. The peak discharge values are shown in Table 2.4.2-205, and in the flood hydrographs of Figures 2.4.2-202 and 2.4.2-203 for Basin A and Basin B, respectively.

2.4.2.3.3 Site Drainage System

The powerblock area and surrounding area are divided into several drainage subbasins shown on Figure 2.4.2-204, based upon the site grading and drainage plan shown in Figure 2.4.1-201. For this analysis, Subbasins 5 through 11 and 13 are combined to one point of interest[1] (Point 2 on Figure 2.4.2-204) and Subbasin 12 is another point of interest (Point 3 on Figure 2.4.2-204).

1 Point of interest and point of discharge are used synonymously in discussions of the Unit 3 powerblock area flood analysis.

Subbasins 2 through 4 flow to a point adjacent to Subbasins 5 through 11 and 13 (Point 1 on Figure 2.4.2-204). The remaining subbasin (Subbasin 1) flows to a separate control point and does not contain safety-related structures. All of the subbasins draining areas with safety-related structures drain to Sedimentation Basin B which flows into Stream B and on to Hamilton Lake.

2.4.2.3.3.1 Basic Design

As shown in Figure 2.4.1-201, Unit 3 site grading is sloped away from all buildings. The storm drainage system for Unit 3 is designed to carry the 100-year return rainfall identified in SSAR Table 2.3-74 (rainfall in in/hr based on 30 minute duration storm data). Storm runoff for Unit 3 is carried away from the powerblock area by a storm drainage system consisting of a combination of swales, open channels, a subsurface system of catch basins and pipes, and culverts. Runoff is routed to Streams A and B, and subsequently drains to Lake Hamilton and thence to the Mississippi River. As indicated above, the flooding analysis of the local PMP event does not credit the storm drainage system for any reduction in flood levels.

2.4.2.3.3.2 Drainage of Local Intense Precipitation

2.4.2.3.3.2.1 Time of Concentration

The time of concentration, Tc, for the various subbasins and corresponding points of discharge (points of interest) is calculated using the SCS segmental approach as described in TR 55 (Reference 2.4.2-206). Tc is the sum of the time for water to flow from the upper part of the subbasin to the point of concentration. Flow conditions could be a combination of sheet flow, shallow flow, and/or channel flow. The flow paths from and between the various subbasins are indicated by the arrows shown in Figure 2.4.2-204.

Tc is calculated using the following equations:

Sheet Flow = $0.007(nL)^{0.8}/(P_2^{0.5}\ S^{0.4})$

Where:

n = Manning's roughness coefficient, 0.011 for smooth paved area

P_2 = the rainfall depth of the 2-year 24-hour event is 4.5 inches from Figure B-3 in Reference 2.4.2-206

L = flow length, which is not greater than 300 ft. (ft.)

S= slope of the travel path as measured from the site plan (Figure 2.4.2-204)

Shallow Concentrated Flow = L/3600V

Where:

L = flow length (ft.)

V = flow velocity (fps) which is dependent on slope from Figure 3-1 of Reference 2.4.2-206 and the type of surface (assumed as paved)

Channel Flow = Manning's Equation = $V = 1.49R^{2/3} S^{1/2}/n$

Tc = L/3600V

Where:

n = Manning's roughness coefficient, 0.030 for grass-lined area

R = hydraulic radius (the hydraulic area, A, divided by the hydraulic perimeter, P)

S = slope of the travel path as measured from the site grading plan (Figure 2.4.1-201)

Results of the time of concentration computations are shown in Table 2.4.2-206. The calculated time of concentration for the three subbasins ranges from approximately 5 to 8 minutes.

2.4.2.3.3.2.2 Rainfall Intensity

Rainfall intensity is the PMP for the drainage basin at a specific duration multiplied by the ratio of 60 minutes per hour and the storm duration in minutes. These specific duration PMP values are determined by interpolation of a curve of storm duration vs. PMP rainfall based on the data given in Section 2.4.2.3.1. The rainfall intensity values corresponding to times of concentration (storm duration) of 5 and 8 minutes are 74.4 and 56.2 inches per hour, respectively.

2.4.2.3.3.2.3 Peak Discharge and Maximum Flood Elevation

The peak discharge for each subbasin is calculated using the rational equation:

$$Q = CIA$$

Where:

Q = peak discharge from the area (cubic feet per second - cfs) due to the assumed storm condition

C = coefficient of runoff

I = intensity of precipitation in in/hr corresponding to the time of concentration (Tc)

A = drainage area in acres

Peak discharges from the various points of interest were calculated using the rational formula with rainfall intensities from Section 2.4.2.3.3.2.2 and a runoff coefficient of 1.0. Therefore, the peak discharge for each point of interest is estimated as its rainfall intensity multiplied by its area in acres. Results are shown in Table 2.4.2-207 for each of the three points of discharge.

Figure 2.4.1-201 shows the layout of the powerblock area, which includes a roadway around the perimeter. The roadway effectively acts as a dike or weir for water flow away from the powerblock structures. Runoff that cannot be stored in the subbasin or handled by the catch basins and storm pipes in the subbasin would overtop the roadway around the Unit 3 powerblock. As previously indicated, for this analysis, no credit is taken for catch basins or storm pipes in reducing the flood elevation. Weir equations from the Federal Highway Administration (Reference 2.4.2-207) are used to determine the head on the roadway if the PMF is to overtop the roadway. The weir equations used are:

$$Q = C_r\ L\ HW_r^{1.5}$$

For a suppressed weir for Subbasins 5 through 11 and 13, and Subbasins 2 to 4, since the access road does not have any constrictions, the flow over the access road from the adjacent subbasins acts as a side wall, and the downstream area is a steep downhill.

$$Q = k_t\ C_r\ L\ HW_r^{1.5}$$

For a submerged weir for Subbasin 12 since the tailwater elevation is the flood elevation of Basin B in this area.

Where:

k_t = submergence factor found using Graph C in Figure III-11 from Reference 2.4.2-207

C_r = overtopping discharge coefficient found using Graph B in Figure III-11 from Reference 2.4.2-207

L = estimated crest length of overflow section which is the length of the outermost boundary of the subbasin where weir flow would occur (ft.)

HW_r = head of flow on the weir (ft.)

Computation results are provided in Table 2.4.2-208. The resulting maximum PMF elevation as a result of a local intense PMP event is 132.94 ft. at Point 2 on Figure 2.4.2-204.

This maximum flood elevation is less than the ESBWR Standard Plant Site Parameter for maximum flood level, specified in FSAR Table 2.0-201 as required to be 1 ft. below design plant grade; design plant grade is 134 ft. msl, as discussed in FSAR Section 2.4.1.

2.4.2.3.3.2.4 Ice and Snow

Snowfall in the GGNS site area occurs about once a year with an average depth of 2 inches (Reference 2.4.2-208, Appendix C). The site is not subject to heavy snow accumulations.

The maximum depth of precipitation during the winter PMP is smaller than that of the all-season PMP considered in Section 2.4.2.3.1. Thus, the flood elevation at the site during this condition will be lower than that occurring during the all-season PMP.

2.4.2.4 REFERENCES

2.4.2-201 NOAA Hydrometeorological Report No. 51 (HMR 51), Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, June 1978.

2.4.2-202 NOAA Hydrometeorological Report No. 52 (HMR 52), Application of Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, August 1982.

2.4.2-203 Hudlow, M.D., “Techniques for Hydrograph Synthesis Based on Analysis of Data from Small Drainage Basins in Texas,” Technical

Report 3, Water Resources Institute, Texas A&M University, College Station, Texas, 1966.

2.4.2-204 Chow, Ven Te, “Hydrologic Determination of Waterway Areas for the Design of Drainage Structures in Small Drainage Basins,” Univ. of Illinois, Experimental Station, Bulletin No. 462, 1962, p. 58.

2.4.2-205 Feddes, R.G., Clark, R. A., and Runnels, R. C., “A Hydrometeorological Study Related to the Distribution of Precipitation and Runoff over Small Drainage Basins - Urban Versus Rural Areas,” Technical Report 28, Water Resources Institute, Texas A&M University, College Station, Texas, 1970.

2.4.2-206 TR 55, Urban Hydrology for Small Watersheds, Natural Resources Conservation Service, Conservation Engineering Division, June 1986.

2.4.2-207 Federal Highway Administration, Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, September 1985.

2.4.2-208 Mississippi River Commission, “Lower Mississippi Region Comprehensive Study, Appendices A through U,” Vicksburg, Mississippi, 1974.

2.4.2-209 Chow, V. T. (ed.), Handbook of Applied Hydrology, McGraw-Hill Book Company, NY, 1964.

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-201
CALCULATED BASIN LAG TIME PARAMETERS

Basin	L (mi)	Lca (mi)	S (ft./mi)	Lag (hr)
A (ESP)	3.4	1.9	48.53	1.6
A at Culvert #9	3.48	1.64	50.66	1.5
A at Outfall	3.89	2.09	46.50	1.8
B (ESP)	1.52	0.53	64.14	0.65
B at Culvert #1	1.59	0.47	49.18	0.66
B at Outfall	1.70	0.74	61.00	0.78

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-202
UNIT HYDROGRAPHS FOR UNIT 3 DRAINAGE AREAS

Basin A			Basin B		
Time (hour)	at Culvert #9 (cfs/in)	at Outfall (cfs/in)	Time (hour)	at Culvert #1 (cfs/in)	at Outfall (cfs/in)
0.00	0	0	0.00	0	0
0.50	68	71	0.25	40	55
1.00	375	395	0.50	186	257
1.50	730	768	0.75	286	395
2.00	832	875	1.00	199	276
2.50	589	619	1.25	103	142
3.00	360	378	1.50	56	78
3.50	213	224	1.75	32	45
4.00	135	142	2.00	18	25
4.50	82	87	2.25	11	15
5.00	53	56	2.50	7	9
5.50	34	36	2.75	0	0
6.00	21	22	3.00	0	0

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-203
PROBABLE MAXIMUM PRECIPITATION

Basin A		Basin B	
Duration (hour)	Depth (inches)	Duration (hour)	Depth (inches)
0.00	0.0	0.00	0.0
0.50	13.2	0.25	9.8
1.00	18.0	0.50	14.1
1.50	21.2	0.75	17.0
2.00	23.5	1.00	19.2
2.50	25.3	1.25	20.8
3.00	26.6	1.50	22.3
3.50	27.8	1.75	23.5
4.00	28.9	2.00	24.5
4.50	29.7	2.25	25.4
5.00	30.5	2.50	26.2
5.50	31.0	2.75	26.9
6.00	31.5	3.00	27.5

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-204
PRECIPITATION DISTRIBUTION FOR PMF PEAK DISCHARGE DETERMINATION

Basin A		Basin B	
Time (hr)	Incremental Precipitation (inch)	Time (hr)	Incremental Precipitation (inch)
0	0.5	0.00	0.0
0.50	0.5	0.25	0.6
1.00	0.8	0.50	0.8
1.50	1.1	0.75	0.9
2.00	1.2	1.00	1.0
2.50	1.3	1.25	1.2
3.00	1.8	1.50	1.6
3.50	3.2	1.75	2.2
4.00	13.2	2.00	4.3
4.50	4.8	2.25	9.8
5.00	2.3	2.50	2.9
5.50	0.8	2.75	1.5
6.00	0	3.00	0.7

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-205
PEAK DISCHARGE FLOWS FOR BASIN A AND B

Basin	Location	Peak Flow (cfs)
A	At Culvert #9	18,535
A	At Outfall	19,494
B	At Culvert #1	4646
B	At Outfall	6422

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-206
TIME OF CONCENTRATION FOR SUBBASINS

Flow Path	Parameter	Areas 2-4 (Point 1)	Areas 5-11 and 13 (Point 2)	Area 12 (Point 3)
Sheet Flow	n	0.011	0.011	0.011
	P_2	4.5	4.5	4.5
	L	300	300	300
	S	0.007	0.013	0.008
	T1 (hr)	0.062	0.049	0.059
	T1 (min)	3.7	2.94	3.54
Shallow Flow	S	0.01	0.01	0.01
	V	2.0	2.0	2.0
	L	137	33.0	83.0
	T2 (hr)	0.019	0.005	0.012
	T2 (min)	1.14	0.275	0.692
Channel Flow	n	0.030	0.030	0.030
	R	3.31	2.22	1.44
	S	0.004	0.006	0.009
	V	6.98	6.55	6.00
	L	1217	487	309
	T3 (hr)	0.048	0.021	0.014
	T3 (min)	2.91	1.24	0.84
Total	Tc (min)	7.7	4.5	5.1

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

TABLE 2.4.2-207
PEAK RUNOFF FLOW FOR SUBBASINS

Point of Discharge (See Figure 2.4.2-204)	Subbasins To Point	Drainage Area (acre)	Time of Concentration (min)	Adopted Storm Duration (min)	PMP Rainfall (inches)	Rainfall Intensity (in/hr)	Peak Discharge Flow (cfs)
1	2-4	18.27	7.7	8.0	7.5	56.2	1035
2	5-11 & 13	5.65	4.5	5.0	6.2	74.4	424
3	12	2.20	5.1	5.0	6.2	74.4	165

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

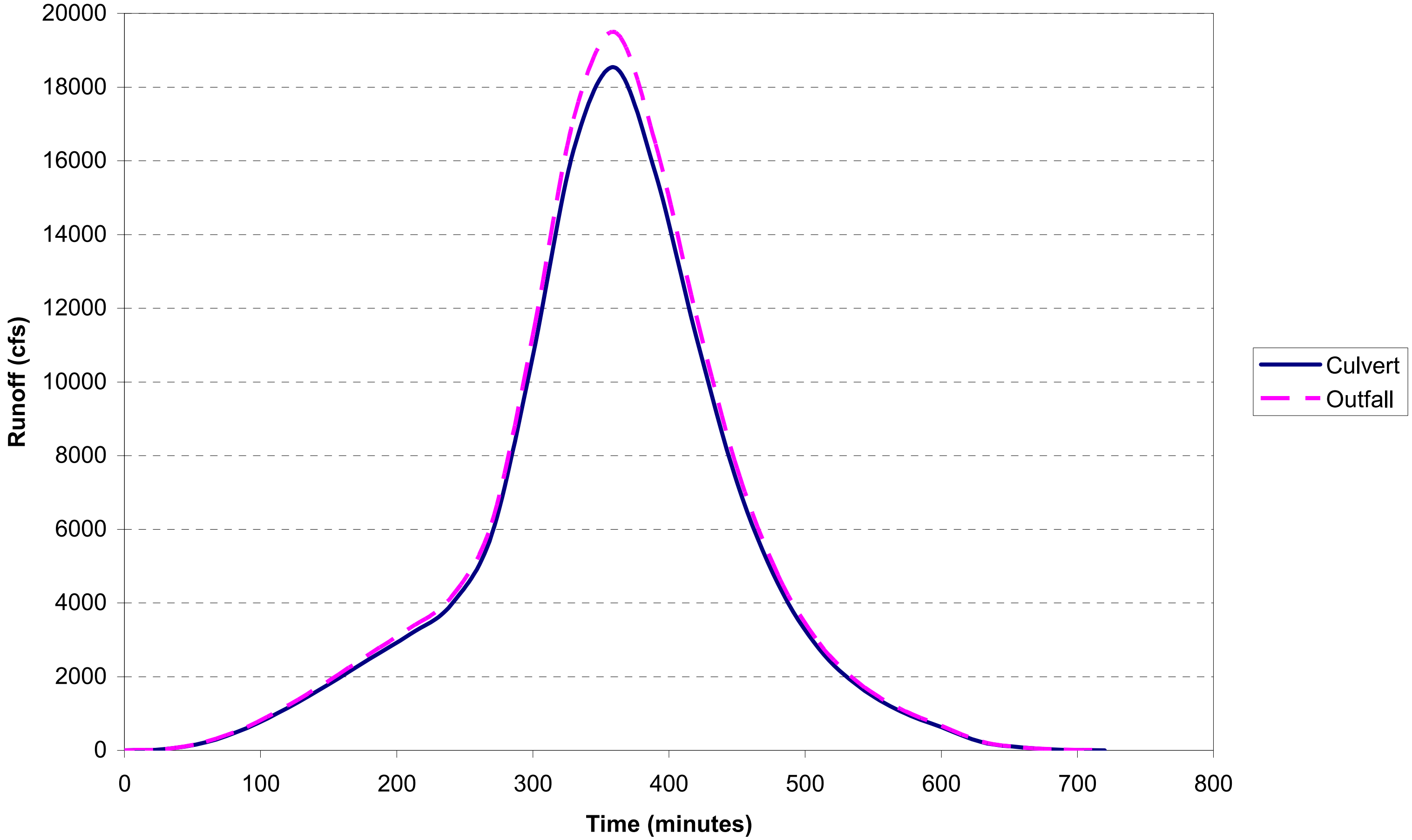
TABLE 2.4.2-208
MAXIMUM SUBBASIN FLOOD ELEVATION

Point of Discharge (See Figure 2.4.2-204)	Peak Flow (cfs)	L^1 (ft.)	C_r	HW_r (ft.)	k_t	Water Level (ft.)
1	1035	70	3.03	2.87	--	132.87
2	424	550	2.65	0.44	--	132.94
3	165	314	2.60	0.35	0.98	132.85

Notes:

1. The width of the roadway is 25 feet and the roadway is modeled as gravel, which is less effective for drainage.

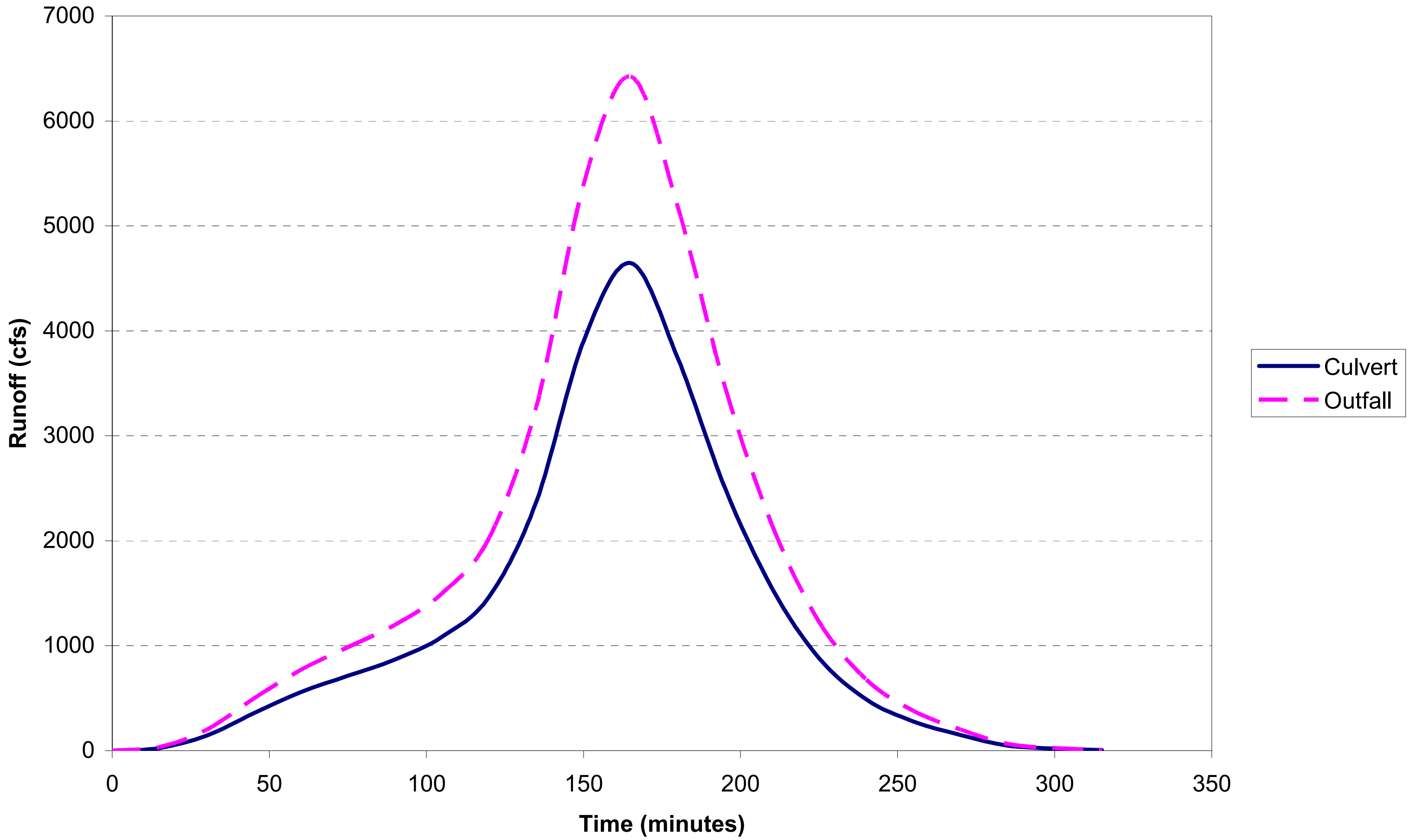
Figure 2.4.2-201. Local Drainage Basins



Notes: Basin A culvert #9 peak flow is 18,535 cfs. Basin A outfall peak flow is 19,494 cfs.

Figure 2.4.2-202. Basin A Flood Hydrographs

GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5



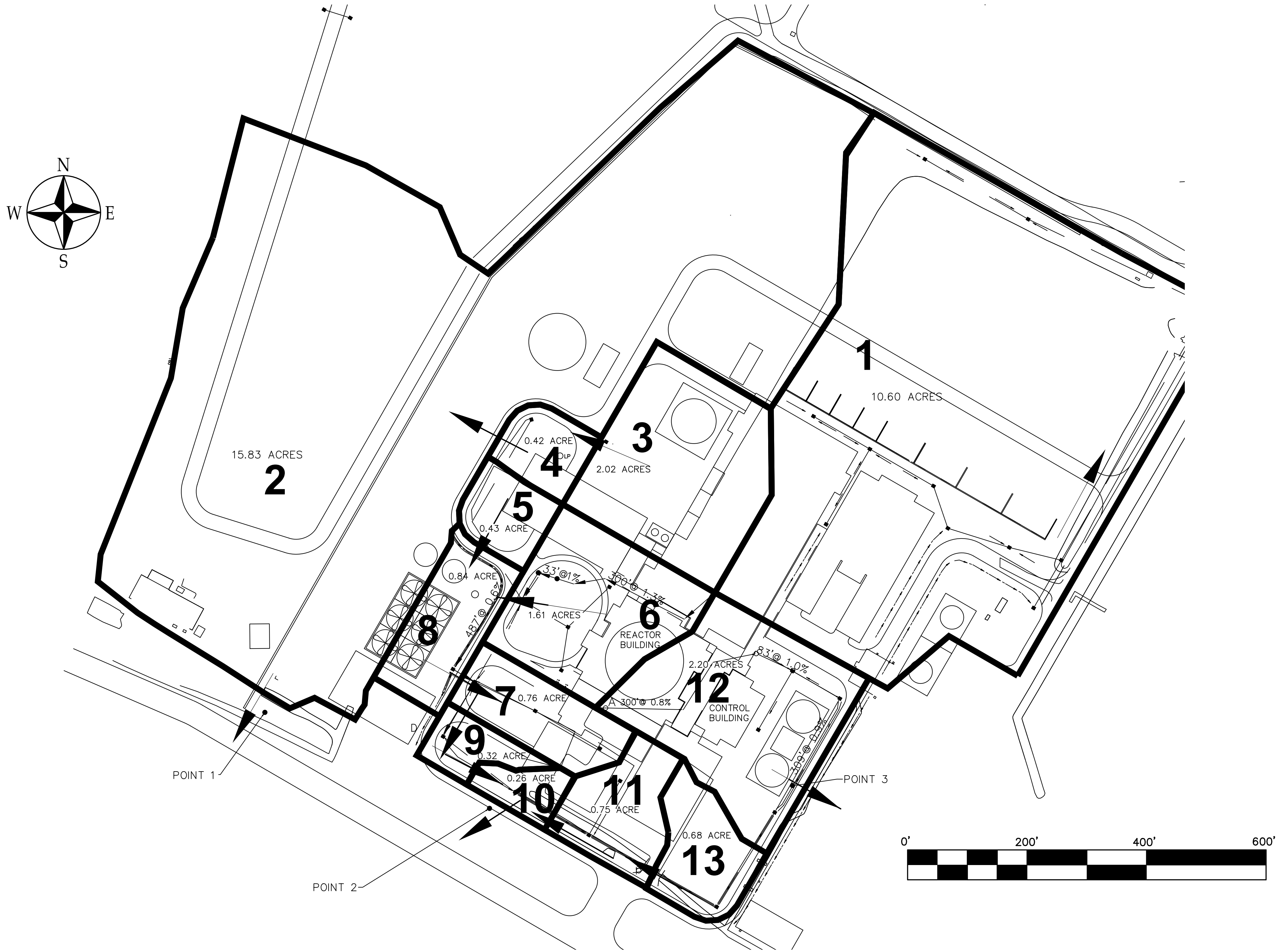
Notes: Basin B culvert #1 peak flow is 4646 cfs. Basin B outfall peak flow is 6422 cfs.

GGNS COL 2.0-13-A

GGNS ESP COL 2.4-3

GGNS ESP COL 2.4-5

Figure 2.4.2-203. Basin B Flood Hydrographs



GGNS COL 2.0-13-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Figure 2.4.2-204. Unit 3 Plant Drainage Areas

2.4.3 PROBABLE MAXIMUM FLOOD ON STREAMS AND RIVERS

GGNS COL 2.0-14-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

2.4.3.3.2 Local Streams

Replace the contents of SSAR Section 2.4.3.3.2 with the following information.

GGNS COL 2.0-14-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Runoff models for Streams A and B, and for the Unit 3 plant drainage areas, are discussed in Section 2.4.2.3.2. A description of the stream course model is contained in Section 2.4.2.3.3.2.

In assessing the effect of local PMP of the plant area, the following conservative assumptions have been made:

a. The storm drains are assumed to be blocked and do not hold up or carry any runoff.

b. The runoff coefficient for peak discharges from areas around the plant is C = 1.0, and no loss due to infiltration or retention occurs.

c. It is conservatively assumed that Culvert #1 is 50 percent blocked, and that Culvert #9 is completely blocked.

2.4.3.4.2 Local Streams

Replace the contents of SSAR Section 2.4.3.4.2 with the following information.

GGNS COL 2.0-14-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

The maximum discharges during probable maximum flood for Basins A and B are 19,494 cfs and 6422 cfs, respectively (Figures 2.4.2-202 and 2.4.2-203) at the basin outfalls (Figure 2.4.2-201). For Basin A, the peak flow of 19,494 cfs is equal to a PMF discharge of 6816 cfs/mi^2 and for Basin B a PMF discharge of 6422 cfs corresponds to a discharge of 12,844 cfs/mi^2. Examination of the data in SSAR Table 2.4-6 for observed Mississippi River basin floods indicates that PMF flood discharges of 6816 cfs/mi^2 and 12,844 cfs/mi^2 for Basins A and B, respectively, are several times higher than those observed in basins of these sizes on the east bank of the Mississippi River.

Due to site grading, about 0.36 square miles of the drainage area of Basin B drains to Culvert 1 (Section 2.4.2.3.2). The corresponding PMF discharge in the outlet channel for Basin B at the 15 ft. diameter corrugated metal Culvert 1 (drainage area of 0.36 square miles) is 4646 cfs (Table 2.4.2-204). This value corresponds to the discharge that will be flowing through the Basin B outlet channel during the PMF. The corresponding flow for Culvert 9 (from Basin A) is 18,535 cfs (Table 2.4.2-204) based on a drainage area of 2.71 square miles (Section 2.4.2.3.2).

2.4.3.5.2 Local Streams

Replace the contents of SSAR Section 2.4.3.5.2 with the following information.

STREAM A

GGNS COL 2.0-14-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

A 12 ft. diameter corrugated metal culvert (Culvert 9) is provided where the stream draining Basin A crosses under the access road. The drainage area up to Culvert 9 is about 2.71 square miles and has a peak discharge of 18,535 cfs (Table 2.4.2-204). The top of the access road has a minimum elevation of 124 ft. The locally depressed road at this location acts as a broad crested weir during high flows. Water level resulting from the discharge over the access road is calculated using a weir discharge coefficient of 2.6 and an average weir length of 510 ft. It is conservatively assumed that Culvert 9 is completely blocked causing the entire PMF flow to overtop the access road. The resulting water surface elevation at the road (upstream face of Culvert 9) is 130.80 ft., and 104.66 ft. at the downstream face of the culvert. Computations were performed using the HECRAS River Analysis System (Reference 2.4.3-201).

STREAM B

A 12 ft. diameter corrugated metal culvert (Culvert 1) is provided where the stream draining Basin B crosses under the access road. The drainage area up to Culvert 1 is about 0.36 square miles, and has a peak discharge of 4646 cfs (Table 2.4.2-204). The top of the access road has a minimum elevation of 132.3 ft. There are no constrictions over the road, so it is modeled as a free outfall weir. Water level resulting from the discharge over the access road is calculated using a weir discharge coefficient of 2.6 and an average weir length of 980 ft. It is conservatively assumed that Culvert 1 is 50 percent blocked. The resulting water surface elevation at the road (upstream face of Culvert 1) is 132.78 ft., and 116.43 ft. at the downstream face of the culvert. Computations were performed using the HECRAS River Analysis System (Reference 2.4.3-201).

The maximum PMF flood elevation on the Unit 3 site in the area of the powerblock is driven by the local PMP event flooding around the powerblock structures as discussed in Section 2.4.2.3.2. The resulting maximum flood elevation is 132.94 ft., which is below the design requirement of 1 ft. below the design plant grade of 134 ft.

2.4.3.6 COINCIDENT WIND WAVE ACTIVITY

GGNS COL 2.0-14-A
GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Delete the third sentence of the sixth paragraph of SSAR Section 2.4.3.6.

2.4.3.7 REFERENCES

2.4.3-201 HECRAS River Analysis System, Version 3.1.3; US Army Corps of Engineers, Hydrologic Engineering Center, CA., May 2005, www.hec.usace.army.mil

2.4.4 POTENTIAL DAM FAILURES

GGNS COL 2.0-15-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.5 PROBABLE MAXIMUM SURGE AND SEICHE FLOODING

GGNS COL 2.0-16-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.6 PROBABLE MAXIMUM TSUNAMI HAZARDS

GGNS COL 2.0-17-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.7 ICE EFFECTS

GGNS COL 2.0-18-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.8 COOLING WATER CANALS AND RESERVOIRS

GGNS COL 2.0-19-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.9 CHANNEL DIVERSIONS

GGNS COL 2.0-20-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.4.10 FLOODING PROTECTION REQUIREMENTS

GGNS COL 2.0-21-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Add the following text to the end of SSAR Section 2.4.10:

GGNS ESP COL 2.4-3
GGNS ESP COL 2.4-5

Safety-related systems and components are located in the Seismic Category I structures that provide protection against external flood and groundwater damage. As described in FSAR Section 2.4.1, design plant grade is 134 ft. msl and finished ground grade is 133.5 ft. msl. As described in FSAR Table 2.0-201, the limiting characteristic for maximum flood level is one foot below design plant grade. The PMF flood elevation for the Unit 3 site, as a result of flooding induced by local intense precipitation described in FSAR Section 2.4.2, is below the maximum allowed flood elevation. Other flood elevations evaluated in FSAR Section 2.4.3 through 2.4.9 are less; therefore, the requirements of GDC-2 and 10 CFR 100 are met.

Regulatory Treatment of Non-Safety Systems (RTNSS) is discussed in DCD Appendix 19A and RTNSS systems are summarized in DCD Table 19A-2. SSCs which have been identified as having RTNSS functions are protected from the adverse affects of flooding and, therefore, meet the applicable flooding requirements of GDC-2 and 10 CFR 100.

2.4.11 LOW WATER CONSIDERATIONS

GGNS COL 2.0-22-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Replace the last paragraph of SSAR Section 2.4.11.2 with the following.

GGNS ESP COL 2.4-6
GGNS ESP COL 2.4-7

Unit 3 is the ESBWR standard plant design which does not utilize surface water reservoirs for any safety-related function. As described in DCD Section 9.2.5, the ESBWR ultimate heat sink (UHS) is provided by the Isolation Condenser / Passive Containment Cooling (IC/PCC) pools which are not reliant on the river intake for cooling capability. The post-accident makeup to the UHS is provided by the fire protection system (FPS) through safety-related fuel and auxiliary pool cooling system (FAPCS) piping.

Revise the fourth paragraph of SSAR Section 2.4.11.4 as follows.

GGNS ESP COL 2.4-6
GGNS ESP COL 2.4-7

As described in DCD Section 9.2.5, the ESBWR ultimate heat sink (UHS) is provided by the Isolation Condenser / Passive Containment Cooling (IC/PCC) pools which are not reliant on the river intake for cooling capability. Therefore, low river water conditions do not impact the ability of the UHS to provide the required cooling for normal operations, anticipated operational occurrences and emergency conditions.

Revise the second paragraph of SSAR Section 2.4.11.5 as follows.

GGNS ESP COL 2.4-6
GGNS ESP COL 2.4-7

As described in DCD Section 9.2.5, the ESBWR ultimate heat sink (UHS) is provided by the Isolation Condenser / Passive Containment Cooling (IC/PCC) pools which are not reliant on the river intake for cooling capability. Since the UHS is not reliant on the river water intake to perform its emergency cooling functions, no warning of impending low flow from the river water makeup system is required.

2.4.12 GROUNDWATER

GGNS COL 2.0-23-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following corrections, variances and/or supplements.

2.4.12.1.3 On-site Use

2.4.12.1.3.1 Plant Operating Requirements

GGNS Unit 1 Facility Requirements

Correct the following text in the fourth paragraph of SSAR Section 2.4.12.1.3.1.

ESP COR

Three wells completed within the ~~Catahoula formation~~ Upland Complex are currently used to supply water for general site purposes including potable, sanitary, air conditioning and landscape maintenance.

Replace the New Facility Requirements header and subsequent paragraph from SSAR Section 2.4.12.1.3.1 with the following.

GGNS ESP COL 2.4-8

Unit 3 Requirements

Demineralized water system (1440 gpm) and FPS (1890 gpm) water supply requirements were assumed to be supplied by groundwater at the ESP application stage; however, based on the design of Unit 3 they are supplied by surface water intake from the Mississippi River. This is a reduction of 3370 gpm from the maximum groundwater supply requirements of 3570 gpm estimated at the ESP application stage. Unit 3 groundwater withdrawal requirements for station operation are for potable and sanitary waste water needs. The Potable Water System (PWS) is designed to supply up to 200 gpm of potable water during peak demand periods (Section 9.2.4). The average demand is 35 gpm.

The installation of one or two additional wells in the Upland Complex is necessary to meet the demand requirements of the PWS. Construction requires a lesser groundwater withdrawal (see Section 2.4.12.1.3.2). Therefore the wells installed to meet the PWS requirements satisfy the requirements for construction. Placement of new groundwater wells is anticipated to be along the bluff area, similar to existing wells, and plans are to screen wells in the Upland Complex. The Upland Complex deposits are heterogeneous with varying thicknesses of sand and gravel. There is a potential that adequate well spacing cannot be achieved for all the required wells needed during Unit 3 construction and operation due to this depositional heterogeneity. As a result, actual well installation and placement is dependent upon confirmation that the thickness and aquifer characteristics of the Upland Complex at the sites selected for new water well installation are appropriate to supply adequate volumes of water for construction and operation of Unit 3. If the Upland Complex cannot meet the demand, additional wells in the Mississippi River Alluvium can adequately meet the groundwater demand.

The upper portion of the Catahoula Formation is impermeable and acts as a confining unit; however, thin sand lenses are encountered in the upper portion in some of the Unit 3 borings. Groundwater levels in wells screened in the Catahoula Formation have a higher potentiometric head than the level of the formation itself, indicating the water is under confined conditions. At well MW1009C (Figure 2.4.12-201), the water-bearing sand lens within the Catahoula Formation is separated from the Upland Complex by approximately 50 ft. of less permeable Catahoula Formation deposits. Pump tests in the Upland Complex did not result in impacts to water level changes in the well screened within the Catahoula Formation when the well in the Upland Complex was being pumped.

2.4.12.1.3.2 Construction Requirements

GGNS ESP COL 2.4-8

Replace the information in SSAR Section 2.4.12.1.3.2 with the following.

Construction activities require a maximum of 115 gpm of water to supply concrete batch plant operation, dust suppression, makeup to fire protection tanks, and sanitary needs.

2.4.12.2.3 Groundwater Levels and Movement

GGNS ESP COL 2.4-9

Add the following information to the end of SSAR Section 2.4.12.2.3.

During the Unit 3 site characterization investigation, 97 soil borings were drilled to characterize subsurface geologic conditions and to obtain laboratory geotechnical test samples. Details of the geologic investigation, including cross sections, are provided in FSAR Section 2.5.4 and FSAR Figures 2.5.4-217 through 2.5.4-228.

A total of 44 groundwater monitoring wells were installed in 23 locations selected to further characterize the Unit 3 area (Figure 2.4.12-201) with locations indicated below. Unit 3 wells have a 4-digit numerical designation. Wells were installed in all 23 of the selected boring locations in the Upland Complex or Mississippi River Alluvium.

- 12 screened in the lower portion of the Loess (a well was installed only if moisture was encountered in the lower portion of the formation), designated with suffix “A.”

- 19 screened in the Upland Complex or Mississippi River Alluvium, designated with suffix “B.”

- 9 screened in thin sand lenses encountered in the upper portion of the Catahoula Formation, designated with suffix “C.”

- 4 screened in the Upland Complex to provide water levels during pump tests, designated with prefix “OW” and a 4-digit numerical designation.

Figure 2.4.12-201 provides the locations of the monitoring wells (with 2-digit numerical designations), drinking water wells, and other Unit 1 wells monitored during the Unit 3 site investigations. Table 2.4.12-201 summarizes installation information for the Unit 3 investigations.

Table 2.4.12-202 provides a summary of the water level data collected over a period of one year. Figure 2.4.12-202 provides hydrographs of selected wells. Figures 2.4.12-203 and 2.4.12-204 provide groundwater gradient maps for the Upland Complex groundwater monitoring program for the months with the lowest and highest groundwater elevations (i.e., December 2006 and May 2007, respectively). A groundwater gradient for the Loess was not determined due to the discontinuous nature of the water-bearing layers.

The monitoring data reported in Tables 2.4.12-202 how three distinct formations in which groundwater occurs in the vicinity of the Unit 3 powerblock. Table 2.4.12-202 and the water level hydrographs in Figure 2.4.12-202 illustrate these distinct formations. These measured water levels indicate the hydraulic separation between perched groundwater, encountered in some locations, and the water table in the Upland Complex and the Catahoula Formation.

The perched layers were generally encountered at elevations between approximately 70 to 90 ft. msl, or approximately 40 to 60 ft. below the Unit 3 site grade. Eight of the 12 wells installed in the Loess (“A” wells) were dry at every gauging event (Table 2.4.12-202). Monitoring wells screened in the Loess identified only small localized areas of perched groundwater. Lithologic description of continuous core samples collected during site characterization indicated moist or wet soils were encountered in soil borings in many areas within the Loess. CPT soundings also recorded a thin layer within the Loess with higher pore water content in many locations. However, based on groundwater in monitoring wells during the monitoring period, this zone within the Loess did not yield enough water in most areas to be measurable in a well. Those wells with measurable perched groundwater are illustrated in Figure 2.4.12-205. As indicated in Figure 2.4.12-205, groundwater perched above the site water table was localized, and of very limited extent. Water content indicated in boring logs and CPT soundings is discussed in detail in Section 2.5.4.1.2.3.2 and is modeled as shown in Figure 2.5.4-239.

While the water levels in the monitored wells generally increase or decline together, careful review of this data reveals occasional lag or differential movement of water levels between wells in the Upland Complex and those in the upper portion of the Catahoula Formation. The measured water level increase or decline also differs between the formations. Water levels in some of the upper layers of the Catahoula Formation show greater seasonal variation than the water levels monitored in the Upland Complex. For example, the seasonal variation in levels measured in well MW1007C varied by 4.3 ft., while the variation in well MW1007B varied by 3.3 ft. In February 2007, water level measurements in wells MW1007B and MW1007C revealed a potentiometric hydraulic head differential of 5.4 ft. (75.6 ft. above msl for well MW1007B versus 70.2 ft. above msl for well MW1007C). These data are consistent with data reported for previous Unit 1 investigations, in that the water levels generally tend to increase or decline together, but show distinct hydraulic separation between the formations.

The Unit 3 reactor building embedment is about 70 ft. beneath site grade, with its base at approximately 60 ft. above msl. This embedment depth is located within the Upland Complex, above the Catahoula Formation as illustrated in Figure 2.5.4-218.

As indicated in Table 2.4.12-202, the potentiometric surface of the water table aquifer in the Upland Complex during the monitoring period was approximately 72 to 76 ft. above msl. The potentiometric surface of water in the upper portion of the Catahoula Formation during the monitoring period was between 68 to 72 ft. above msl. Approximately 3 ft. of hydraulic separation exist between the Upland Complex potentiometric surface and the potentiometric surface of groundwater in the Catahoula Formation; however, the actual water-bearing zone in the Catahoula Formation is typically 85 ft. beneath the measured water level of wells screened in the Catahoula Formation. This separation indicates the groundwater in the Catahoula Formation near the Unit 3 powerblock is locally confined or semi-confined. Further, these data indicate that there is limited communication locally between the Upland Complex and the Catahoula Formation groundwater.

Data in Table 2.4.12-202 for wells near the center of the powerblock for Unit 3 (OW1008, MW1009B, MW1009C, MW1012B, MW1012C, and OW1013) indicate the highest and lowest groundwater elevations measured (data reproduced below).

Well Screened In	Highest Elevation Measured		Lowest Elevation Measured	
	Ft. Msl	Ft. Below TOC*	Ft. Msl	Ft. Below TOC*
Catahoula Formation	72.98	61.13	68.00	66.29
Upland Complex	75.80	58.15	71.79	62.45

*TOC - top of casing

The groundwater gradient observed in the Upland Complex is generally to the west toward the Mississippi River, as indicated in Figures 2.4.12-203 and 2.4.12-204. These figures are representative of seasonal fluctuations, and include the groundwater gradients for the highest and lowest water table levels during the period from July 2006 through June 2007. The gradient is consistent with the historical gradient reported for the Unit 1 investigations. The Unit 1 UFSAR provides groundwater gradient maps for measurements in May 1973, October 1973, August 1979, November 1979, and December 1979 (Reference 2.4.12-201, Figures 2.4-27, 2.4-34, 2.4-38-39, and 2.4-40). The May 1973 measurements were conducted when the Mississippi River was under flood conditions, and the 1973 flood had the highest discharge in the last 70 years. The December 1979 measurement was also conducted when the river was under flood conditions. With the exception of the May 1973 map, all the Unit 1 UFSAR maps show a groundwater gradient to the west with water level contours indicating an approximate water level of 65 to 75 ft. msl in the Unit 3 area. The May 1973 map shows an eastward groundwater gradient in the Unit 3 area, with a water level of 84 ft. msl. Measurements during Unit 3 investigations did not show a groundwater gradient reversal; however, reversal is possible when the Mississippi River is in extreme flood stage conditions as also discussed in the SSAR Section 2.4.12.2.3.

GGNS ESP VAR 2.4.12-1

ESP-002 Appendix A indicates the ESP site characteristic for the highest groundwater elevation is 70 ft. below site grade, 62.5 ft. above msl, and perched water may be present between the ESP site characteristic grade of 132.5 ft. above msl and the water table at 62.5 ft. above msl. Unit 3 site grade is established at elevation 133.5 ft. (Figure 2.4.1-201). Some of the groundwater elevations measured in wells near the center of the power block during the Unit 3 investigations are higher than 62.5 ft. above msl; as noted above the highest measured in the Upland Complex is 75.8 ft. msl. However, there is substantial margin to the design maximum groundwater level requirement of 2 ft. below plant (site) grade (Table 2.0-201).

GGNS COL 2.0-23-A

2.4.12.2.4 Hydrogeologic Properties of Subsurface Materials

GGNS ESP COL 2.4-9

Replace the information in SSAR Section 2.4.12.2.4 with the following.

Pump tests were completed to define hydrogeologic characteristics of the various aquifers to support the Unit 1 construction. Aquifer tests were completed to design the Unit 1 Ranney well system and the Unit 1 potable water wells. This information is included in the Unit 1 UFSAR (Reference 2.4.12-201). Additional pump tests were completed to support the Unit 3 site characterization to confirm the hydrogeologic characteristics of select water-bearing strata or aquifers to compare to the Unit 1 data. Pump tests were not completed in the Loess strata with perched groundwater because of the limited extent and indicated saturated thickness. Pump test results are described below.

Mississippi River Alluvium

Well MW1042B was screened within a sand and gravel layer in the Mississippi River Alluvium aquifer west of the Loess bluff upon which GGNS is located (Figure 2.4.12-201). Data from a step test conducted on monitoring well MW1042B, screened in the Mississippi River Alluvium, indicate a hydraulic conductivity of 1.7 x 10-2 centimeters per second (cm/s) and an intrinsic permeability of 1.7 x 10-7 cm2. The aquifer transmissivity developed from this test is approximately 12,900 gpd/ft. (1,700 ft^2/day). This transmissivity is lower than previous estimates of transmissivity developed from past pumping tests, but previous tests were conducted near the Mississippi River in coarser alluvium deposits. Mississippi River Alluvium aquifer test transmissivity results cited in Table 2.4B-1 of the Unit 1 UFSAR (Reference 2.4.12-201) range from 21,500 to 163,500 gpd/ft.

Laboratory tests conducted during the Unit 1 investigations of two samples from the Mississippi River Alluvium indicate hydraulic conductivities of 7.8 x 10^{-8} cm/s and 5.9 x 10^{-8} cm/s (Reference 2.4.12-201). These tests were conducted on silty clay and clayey silt samples.

Although the transmissivities from the Unit 3 investigations are somewhat lower than previous Unit 1 test results, these results of the aquifer test for Unit 3 are generally consistent with previous estimates developed during Unit 1 site characterization. As indicated from Unit 1 aquifer tests in the Mississippi River Alluvium, aquifer results may vary dependent upon location of the well, test method utilized, and well penetration of the total aquifer thickness.

Upland Complex

A 72-hour pumping test was conducted on monitoring well MW1009B, and seven monitoring wells (MW1012B, OW1013, OW1008, OW1068, OW1108, MW1009C, and MW1012C) were gauged during the test. The drawdown measured in observation wells screened in the same zone as the pumping well at the end of the test ranged from 0.6 ft. to 0.8 ft. Measurements continued after pumping ceased until groundwater levels in the wells recovered to static levels. Aquifer characteristics were calculated for each monitoring well surrounding the pumping well, and the results were averaged. Based on these test data, the average aquifer hydraulic conductivity determined from this test is 1.1 x 10^{-1} cm/s and the average aquifer intrinsic permeability is 1.2 x 10-6 cm^2. The aquifer transmissivity developed from this test is approximately 92,000 gpd/ft. (12,300 ft.2/day). This transmissivity is similar to the transmissivity developed from the distance-drawdown estimate of the pump test of TW-1 (120,300 gpd/ft.) cited in Table 2.4B-1 of the Unit 1 UFSAR (Reference 2.4.12-201).

Field tests were conducted during the Unit 1 investigations at multiple locations within the Upland Complex. The tests indicated hydraulic conductivities ranging from 1.1 x 10^{-1} cm/s to 2.6 x 10^{-4} cm/s (Reference 2.4.12-201, Tables 2.4-26 and 2.4-26a). The results from the Unit 3 tests are within the ranges of values determined from the Unit 1 tests.

Monitoring wells MW1009C and MW1012C were screened in the upper portion of the Catahoula Formation. Drawdown measurements were recorded in these wells during the pump test of well MW1009B. No drawdown was detected in either of these two Catahoula Formation monitoring wells during the performance of the pump test. These data further support the conclusion of limited hydraulic communication between the Upland Complex and the Catahoula Formation in the powerblock area of Unit 3.

Catahoula Formation

A 5-hour pumping test was conducted on monitoring well MW1009C, screened in a sand unit within the upper portion of the Catahoula Formation. Two monitoring wells (MW1012B and MW1012C) were gauged to detect changes in water levels during the test. The drawdown measured in observation well MW1012C (completed in the same zone as the pumping well) at the end of the test was 21.5 ft. Measurements continued after pumping ceased until groundwater levels in the wells recovered to static levels. Aquifer characteristics were calculated for each monitoring well surrounding the pumping well, and the results were averaged. Based on these test data, the average aquifer hydraulic conductivity is 6.6 x 10^{-4} cm/s and the average aquifer intrinsic permeability is 6.8 x 10-9 cm^2. The calculated transmissivity estimate for these upper portions of the Catahoula Formation water-bearing strata is approximately 300 gpd/ft. The hydraulic conductivity and transmissivity indicate the limited permeability of the water-bearing strata in the upper portion of the Catahoula Formation.

Laboratory hydraulic conductivity tests were conducted on samples from three Unit 3 borings (B1010, B1014, and two samples from P1109). These samples were collected from finer materials than the materials the pump tests wells were screened in. The hydraulic conductivities ranged from 1.5 x 10^{-8} cm/s to 1.3 x 10^{-7} cm/s.

Field and laboratory tests were conducted during the Unit 1 investigations at three locations within the Catahoula Formation. The tests indicated hydraulic conductivities ranging from 2.2 x 10^{-8} cm/s to 6.3 x 10^{-9} cm/s (Reference 2.4.12-201,Tables 2.4-26 and 2.4-26a). The laboratory tests were conducted on samples of fine indurated sand and hard silty clay. The piezometer was screened in clayey sand and sandy silty clay. The hydraulic conductivity results from the Unit 3 laboratory tests are similar to the values determined from the Unit 1 tests that were conducted on similar materials.

Monitoring wells MW1009C and MW1012C were screened in the upper portion of the Catahoula Formation. Drawdown measurements recorded in well MW1012B during the pump test of well MW1009C indicate no drawdown in that Upland Complex monitoring well during the performance of the upper portion of the Catahoula Formation pump test. These data also support the conclusion of limited hydraulic communication between the Upland Complex and the Catahoula Formation in the powerblock area of Unit 3.

2.4.12.3 MONITORING OR SAFEGUARD REQUIREMENTS

GGNS COL 2.0-23-A

Replace the information in SSAR Section 2.4.12.3 with the following.

Pre-construction groundwater monitoring will be conducted prior to initial construction in order to reaffirm baseline groundwater level data that have been established since the early 1970s and continued through the Unit 3 investigations.

The monitoring program will include collecting groundwater level measurements quarterly from selected monitoring wells. Unit 3 monitoring wells MW1025, MW1026, MW1027, MW1033, MW1040, MW1042, MW1043, MW1045, MW1082, and MW1134 will not be destroyed by construction activities. Data collected from these wells will be compared to existing information to evaluate potential impacts during construction and associated dewatering activities. During periods of excavation dewatering, the measurement frequency will vary as required to ensure that there are no unexpected impacts from the dewatering program.

An operational hydrological monitoring program is not required for the following reasons: (1) groundwater elevations in the Unit 3 powerblock area are well below the design requirement of 2 ft. below site grade, and operational dewatering is not required (see Section 2.4.12.4); (2) groundwater is not withdrawn from the

Catahoula Formation Sole Source Aquifer; and (3) the maximum operational groundwater withdrawal requirement is 200 gpm.

2.4.12.4 DESIGN BASIS FOR SUBSURFACE HYDROSTATIC LOADINGS

GGNS ESP COL 2.4-2

Replace the information in SSAR Section 2.4.12.4 with the following.

GGNS COL 2.0-23-A

Some of the groundwater elevations measured in wells near the center of the power block during the Unit 3 investigations are higher than 62.5 ft. above msl; as noted in FSAR Section 2.4.12.2.3 the highest measured groundwater in the Upland Complex is 75.8 ft. msl. However, there is substantial margin to the design maximum groundwater level requirement of 2 ft. below plant (site) grade, as defined in Table 2.0-201.

Because the maximum groundwater elevation at the Unit 3 site is less than the design requirement of 2 ft. below site grade elevation for safety-related structures, a permanent dewatering system is not required.

2.4.12.5 REFERENCES

2.4.12-201 GGNS Unit 1 Updated Final Safety Analysis Report (UFSAR), June 2007.

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 1 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1007A	133.32	133.36	50.1	83.26	2	Loess
			64.5	68.86		
MW1007B	133.57	133.36	77.6	55.76	2	Upland Complex
			92.0	41.36		
MW1007C	133.16	133.36	148.5	-15.14	4	Catahoula
			162.9	-29.54		
OW1008	134.20	134.34	75.1	59.24	2	Upland Complex
			94.5	39.84		
MW1009B	134.09	134.38	74.75	59.63	6	Upland Complex
			99.15	35.23		
MW1009C	134.11	134.38	148.25	-13.87	4	Catahoula
			167.65	-33.27		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 2 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1012B	134.24	134.14	74.25	59.89	6	Upland Complex
			98.65	35.49		
MW1012C	134.29	134.14	149.75	-15.61	4	Catahoula
			169.15	-35.01		
OW1013	133.95	134.18	75.25	58.93	2	Upland Complex
			94.65	39.53		
MW1016A	158.16	155.57	65.1	90.47	2	Loess
			74.5	81.07		
MW1016B	158.40	155.57	95.1	60.47	4	Upland Complex
			114.5	41.07		
MW1019A	133.79	133.78	41.75	92.03	2	Loess
			51.15	82.63		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 3 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1019B	133.52	133.78	88.75	45.03	2	Upland Complex
			108.15	25.63		
MW1020B	132.52	132.20	60.1	72.10	2	Upland Complex
			79.5	52.70		
MW1020C	132.60	132.20	120.1	12.10	4	Catahoula
			139.5	-7.30		
MW1022B	133.56	133.72	89.75	43.97	2	Upland Complex
			109.15	24.57		
MW1023A	157.69	155.33	65.1	90.23	2	Loess
			74.5	80.83		
MW1023B	157.78	155.33	80.1	75.23	2	Upland Complex
			99.5	55.83		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 4 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1024A	158.22	155.88	50.1	105.78	2	Loess
			69.5	86.38		
MW1024B	158.41	155.88	90.1	65.78	2	Upland Complex
			109.5	46.38		
MW1024C	158.41	155.88	154.9	0.98	4	Catahoula
			174.3	-18.42		
MW1025A	147.83	147.61	55.1	92.51	2	Loess
			69.5	78.11		
MW1025B	147.18	147.61	90.1	57.51	2	Upland Complex
			109.5	38.11		
MW1026A	131.68	131.66	30.1	101.56	2	Loess
			39.5	92.16		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 5 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1026B	131.81	131.66	80.1	51.56	2	Upland Complex
			99.5	32.16		
MW1027A	133.14	133.31	35.1	98.21	2	Loess
			49.5	83.81		
MW1027B	132.89	133.31	84.1	49.21	2	Upland Complex
			98.5	34.81		
MW1027C	133.24	133.31	158.1	-24.79	4	Catahoula
			167.5	-34.19		
MW1033A	158.24	155.45	55.1	100.35	2	Loess
			69.5	85.95		
MW1033B	158.54	155.45	85.1	70.35	2	Upland Complex
			89.5	65.95		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 6 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1040A	161.36	158.88	69.75	89.13	2	Loess
			79.15	79.73		
MW1040B	161.47	158.88	94.75	64.13	4	Upland Complex
			114.15	44.73		
MW1042B	87.09	84.57	32.75	51.82	2	Mississippi River
			47.15	37.42		Alluvium
MW1042C	86.53	84.56	83.75	0.81	2	Catahoula
			98.15	-13.59		
MW1043A	121.45	121.61	30.1	91.51	2	Loess
			44.5	77.11		
MW1043B	121.84	121.61	60.1	61.51	2	Upland Complex
			74.5	47.11		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 7 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1045B	100.24	99.60	70.25	29.35	2	Mississippi River
			84.65	14.95		Alluvium
OW1068	158.19	155.81	90.25	65.56	2	Upland Complex
			109.65	46.16		
MW1082B	199.18	196.14	77.6	118.54	2	Upland Complex
			97.0	99.14		
MW1082C	199.18	196.14	149.1	47.04	4	Catahoula
			168.5	27.64		
OW1108	134.01	134.26	75.25	59.01	2	Upland Complex
			94.65	39.61		
MW1134A	136.25	133.39	44.75	88.64	2	Loess
			54.15	79.24		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-201 (Page 8 of 8)
WELL INSTALLATION INFORMATION

Well ID	Top of Casing Elevation (ft. msl)	Ground Surface Elevation (ft. msl)	Screened Interval (depth below ground surface (bgs))	Screened Interval (ft. msl)	Casing Diameter (in.)	Formation
MW1134B	136.45	133.77	69.75	64.02	2	Upland Complex
			84.15	49.62		
MW1134C	136.91	133.97	153.75	-19.78	4	Catahoula
			163.15	-29.18		

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 1 of 8)
GGNS GROUNDWATER LEVEL DATA

Well ID / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		July 2006		August 2006		September 2006		October 2006		November 2006		December 2006	
MW1007A	133.32	56.88	76.44	57.26	76.06	57.44	75.88	57.63	75.69	57.78	75.54	57.87	75.45
MW1007B	133.57	58.78	74.79	59.53	74.04	60.60	72.97	61.16	72.41	61.08	72.49	61.24	72.33
MW1007C	133.16	64.56	68.60	65.52	67.64	66.73	66.43	67.24	65.92	67.24	65.92	67.07	66.09
OW1008	134.20	59.73	74.47	60.49	73.71	61.58	72.62	62.10	72.10	62.02	72.18	62.20	72.00
MW1009B	134.09	59.74	74.35	60.51	73.58	61.54	72.55	62.15	71.94	62.05	72.04	62.25	71.84
MW1009C	134.11	63.38	70.73	64.36	69.75	65.43	68.68	66.00	68.11	66.06	68.05	66.05	68.06
MW1012B	134.24	59.97	74.27	60.73	73.51	61.74	72.50	62.35	71.89	62.27	71.97	62.45	71.79
MW1012C	134.29	63.71	70.58	64.52	69.77	65.70	68.59	66.08	68.21	66.29	68.00	66.24	68.05
OW1013	133.95	59.50	74.45	NM*		61.28	72.67	61.88	72.07	61.78	72.17	62.00	71.95
MW1016A	158.16	Dry	Dry	78.44	79.72	78.44	79.72	78.46	79.70	78.45	79.71	78.45	79.71
MW1016B	158.40	84.28	74.12	84.92	73.48	85.96	72.44	86.54	71.86	86.55	71.85	86.70	71.70
MW1019A	133.79	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1019B	133.52	59.26	74.26	59.98	73.54	60.95	72.57	61.53	71.99	61.47	72.05	61.64	71.88

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 2 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		July 2006		August 2006		September 2006		October 2006		November 2006		December 2006	
MW1020B	132.52	57.14	75.38	57.82	74.70	58.75	73.77	59.37	73.15	59.40	73.12	59.50	73.02
MW1020C	132.60	58.13	74.47	58.80	73.80	59.70	72.90	60.26	72.34	60.24	72.36	60.39	72.21
MW1022B	133.56	59.19	74.37	59.84	73.72	60.78	72.78	61.08	72.48	61.33	72.23	61.47	72.09
MW1023A	157.69	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1023B	157.78	84.27	73.51	84.93	72.85	86.03	71.75	86.55	71.23	86.56	71.22	86.75	71.03
MW1024A	158.22	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1024B	158.41	84.60	73.81	85.24	73.17	86.25	72.16	86.76	71.65	86.82	71.59	86.99	71.42
MW1024C	158.41	84.56	73.85	85.22	73.19	86.18	72.23	86.73	71.68	86.84	71.57	86.90	71.51
MW1025A	147.83	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1025B	147.18	72.61	74.57	73.24	73.94	74.13	73.05	73.63	73.55	74.75	72.43	74.86	72.32
MW1026A	131.68	39.42	92.26	39.44	92.24	39.21	92.47	39.44	92.24	39.44	92.24	39.43	92.25
MW1026B	131.81	55.58	76.23	56.26	75.55	56.93	74.88	57.54	74.27	57.60	74.21	57.74	74.07
MW1027A	133.14	44.59	88.55	44.79	88.35	45.11	88.03	45.14	88.00	45.10	88.04	45.12	88.02

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 3 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		July 2006		August 2006		September 2006		October 2006		November 2006		December 2006	
MW1027B	132.89	57.30	75.59	58.08	74.81	59.11	73.78	59.73	73.16	59.59	73.30	59.76	73.13
MW1027C	133.24	65.41	67.83	66.36	66.88	67.66	65.58	68.19	65.05	68.03	65.21	67.88	65.36
MW1033A	158.24	64.71	93.53	64.95	93.29	65.52	92.72	65.44	92.80	65.70	92.54	65.84	92.40
MW1033B	158.54	66.58	91.96	66.89	91.65	67.18	91.36	67.45	91.09	67.16	91.38	67.82	90.72
MW1040A	161.36	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1040B	161.47	85.00	76.47	85.76	75.71	86.70	74.77	87.28	74.19	87.13	74.34	87.12	74.35
MW1042B	87.09	14.19	72.90	14.82	72.27	15.75	71.34	16.24	70.85	16.23	70.86	16.32	70.77
MW1042C	86.53	13.92	72.61	14.61	71.92	15.53	71.00	15.94	70.59	15.91	70.62	15.88	70.65
MW1043A	121.45	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1043B	121.84	48.54	73.30	49.23	72.61	50.36	71.48	50.91	70.93	50.84	71.00	51.02	70.82
MW1045B	100.24	27.57	72.67	28.27	71.97	29.44	70.80	29.93	70.31	29.83	70.41	29.96	70.28
OW1068	158.19	84.07	74.12	84.79	73.40	85.82	72.37	86.42	71.77	86.38	71.81	86.54	71.65
MW1082B	199.18	89.54	109.64	89.55	109.63	88.61	110.57	89.76	109.42	89.86	109.32	89.88	109.30

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 4 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		July 2006		August 2006		September 2006		October 2006		November 2006		December 2006	
MW1082C	199.18	90.01	109.17	90.05	109.13	91.16	108.02	91.33	107.85	91.50	107.68	91.52	107.66
OW1108	134.01	59.70	74.31	60.45	73.56	61.48	72.53	62.08	71.93	62.00	72.01	62.18	71.83
MW1134A	136.25	57.73	78.52	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1134B	136.45	60.08	76.37	60.85	75.60	61.89	74.56	62.52	73.93	62.34	74.11	62.50	73.95
MW1134C	136.91	70.41	66.50	71.40	65.51	72.73	64.18	73.25	63.66	73.17	63.74	72.84	64.07

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 5 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		January 2007		February 2007		March 2007		April 2007		May 2007		June 2007	
MW1007A	133.32	57.91	75.41	57.27	76.05	57.27	76.05	57.43	75.89	57.02	76.30	57.19	76.13
MW1007B	133.57	60.09	73.48	57.97	75.60	58.66	74.91	58.89	74.68	57.52	76.05	58.91	74.66
MW1007C	133.16	66.08	67.08	62.95	70.21	63.34	69.82	62.67	70.49	61.65	71.51	63.23	69.93
OW1008	134.20	61.02	73.18	58.90	75.30	59.60	74.60	NM	NM	58.36	75.84	59.80	74.40
MW1009B	134.09	61.08	73.01	58.94	75.15	59.62	74.47	59.85	74.24	58.39	75.70	59.82	74.27
MW1009C	134.11	65.00	69.11	62.24	71.87	62.69	71.42	62.32	71.79	61.13	72.98	62.67	71.44
MW1012B	134.24	61.28	72.96	59.15	75.09	59.80	74.44	60.05	74.19	58.59	75.65	60.01	74.23
MW1012C	134.29	65.22	69.07	62.41	71.88	62.87	71.42	62.54	71.75	61.32	72.97	62.86	71.43
OW1013	133.95	60.79	73.16	58.68	75.27	59.35	74.60	59.60	74.35	58.15	75.80	59.58	74.37
MW1016A	158.16	78.44	79.72	78.44	79.72	78.44	79.72	78.42	79.74	78.44	79.72	78.44	79.72
MW1016B	158.40	85.60	72.80	83.50	74.90	84.10	74.30	84.29	74.11	82.90	75.50	84.30	74.10
MW1019A	133.79	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1019B	133.52	60.56	72.96	58.56	74.96	59.10	74.42	59.36	74.16	57.98	75.54	59.31	74.21

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 6 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		January 2007		February 2007		March 2007		April 2007		May 2007		June 2007	
MW1020B	132.52	58.60	73.92	56.55	75.97	57.06	75.46	57.41	75.11	56.14	76.38	57.33	75.19
MW1020C	132.60	59.36	73.24	57.47	75.13	57.95	74.65	58.20	74.40	56.93	75.67	58.22	74.38
MW1022B	133.56	60.42	73.14	58.47	75.09	58.99	74.57	59.27	74.29	57.97	75.59	59.25	74.31
MW1023A	157.69	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1023B	157.78	85.58	72.20	83.32	74.46	84.10	73.68	84.16	73.62	82.68	75.10	84.20	73.58
MW1024A	158.22	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1024B	158.41	85.92	72.49	83.83	74.58	84.40	74.01	84.62	73.79	83.66	74.75	84.58	73.83
MW1024C	158.41	85.76	72.65	83.93	74.48	84.33	74.08	84.52	73.89	83.22	75.19	85.58	73.83
MW1025A	147.83	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1025B	147.18	73.90	73.28	71.95	75.23	72.41	74.77	72.61	74.57	71.45	75.73	72.69	74.49
MW1026A	131.68	39.46	92.22	39.43	92.25	39.43	92.25	39.44	92.24	39.43	92.25	39.44	92.24
MW1026B	131.81	56.94	74.87	55.03	76.78	55.41	76.40	55.72	76.09	54.78	77.03	55.81	76.00
MW1027A	133.14	45.23	87.91	45.16	87.98	45.26	87.88	45.36	87.78	45.56	87.58	45.74	87.40

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 7 of 8)
GGNS GROUNDWATER LEVEL DATA

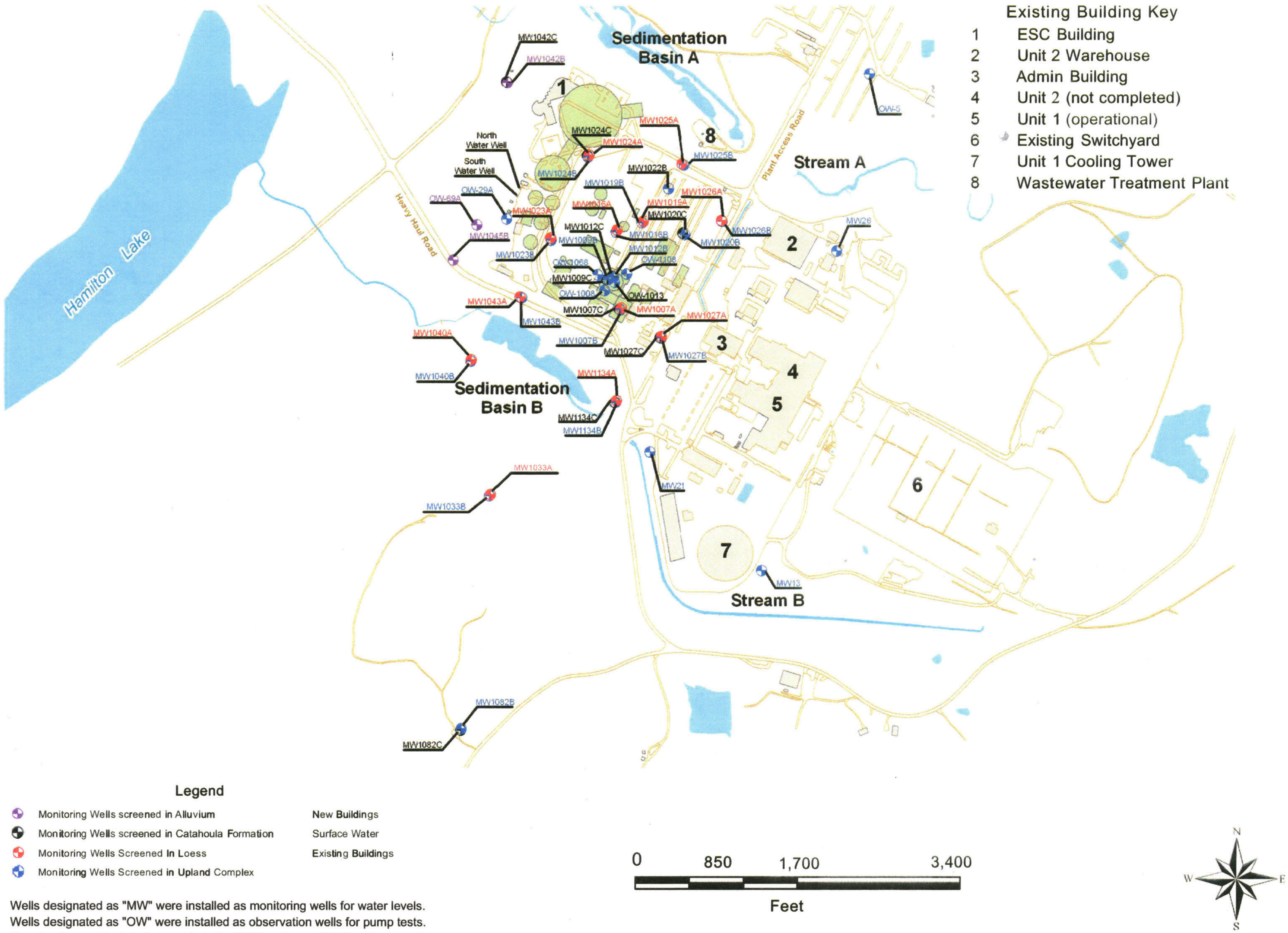
Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		January 2007		February 2007		March 2007		April 2007		May 2007		June 2007	
MW1027B	132.89	58.58	74.31	56.55	76.34	57.23	75.66	57.51	75.38	56.22	76.67	57.55	75.34
MW1027C	133.24	66.99	66.25	63.65	69.59	64.03	69.21	63.22	70.02	62.21	71.03	63.88	69.36
MW1033A	158.24	66.06	92.18	66.20	92.04	66.35	91.89	66.48	91.76	66.63	91.61	66.77	91.47
MW1033B	158.54	67.91	90.63	67.79	90.75	68.00	90.54	68.23	90.31	68.26	90.28	68.51	90.03
MW1040A	161.36	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1040B	161.47	87.83	73.64	84.13	77.34	84.57	76.90	85.12	76.35	84.61	76.86	85.68	75.79
MW1042B	87.09	14.74	72.35	13.09	74.00	13.62	73.47	13.88	73.21	12.64	74.45	14.10	72.99
MW1042C	86.53	14.13	72.40	13.42	73.11	13.07	73.46	13.23	73.30	12.06	74.47	13.78	72.75
MW1043A	121.45	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1043B	121.84	49.75	72.09	47.49	74.35	48.29	73.55	48.37	73.47	46.84	75.00	48.44	73.40
MW1045B	100.24	28.53	71.71	26.37	73.87	27.08	73.16	27.04	73.20	25.47	74.77	27.30	72.94
OW1068	158.19	85.38	72.81	83.19	75.00	83.89	74.30	84.05	74.14	82.60	75.59	84.08	74.11
MW1082B	199.18	89.91	109.27	89.93	109.25	90.15	109.03	90.13	109.05	90.24	108.94	90.36	108.82

GGNS ESP
COL 2.4-9

TABLE 2.4.12-202 (Sheet 8 of 8)
GGNS GROUNDWATER LEVEL DATA

Well Id / Month	Top Of Casing Elevation (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)	Depth To Water (ft.)	Water Elev. (ft. msl)
		January 2007		February 2007		March 2007		April 2007		May 2007		June 2007	
MW1082C	199.18	91.54	107.64	91.82	107.36	92.02	107.16	92.12	107.06	92.25	106.93	92.48	106.70
OW1108	134.01	61.01	73.00	58.90	75.11	59.55	74.46	59.81	74.20	58.36	75.65	59.77	74.24
MW1134A	136.25	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW1134B	136.45	61.34	75.11	59.37	77.08	60.00	76.45	60.33	76.12	59.15	77.30	60.42	76.03
MW1134C	136.91	71.86	65.05	68.32	68.59	68.70	68.21	67.68	69.23	67.72	69.19	68.55	68.36

NM - not measured, well inaccessible



Wells designated as "MW" were installed as monitoring wells for water levels.
Wells designated as "OW" were installed as observation wells for pump tests.
Construction and installation mehtods for "MW" wells and "OW" wells were the same.

Figure 2.4.12-201. Well Location Map

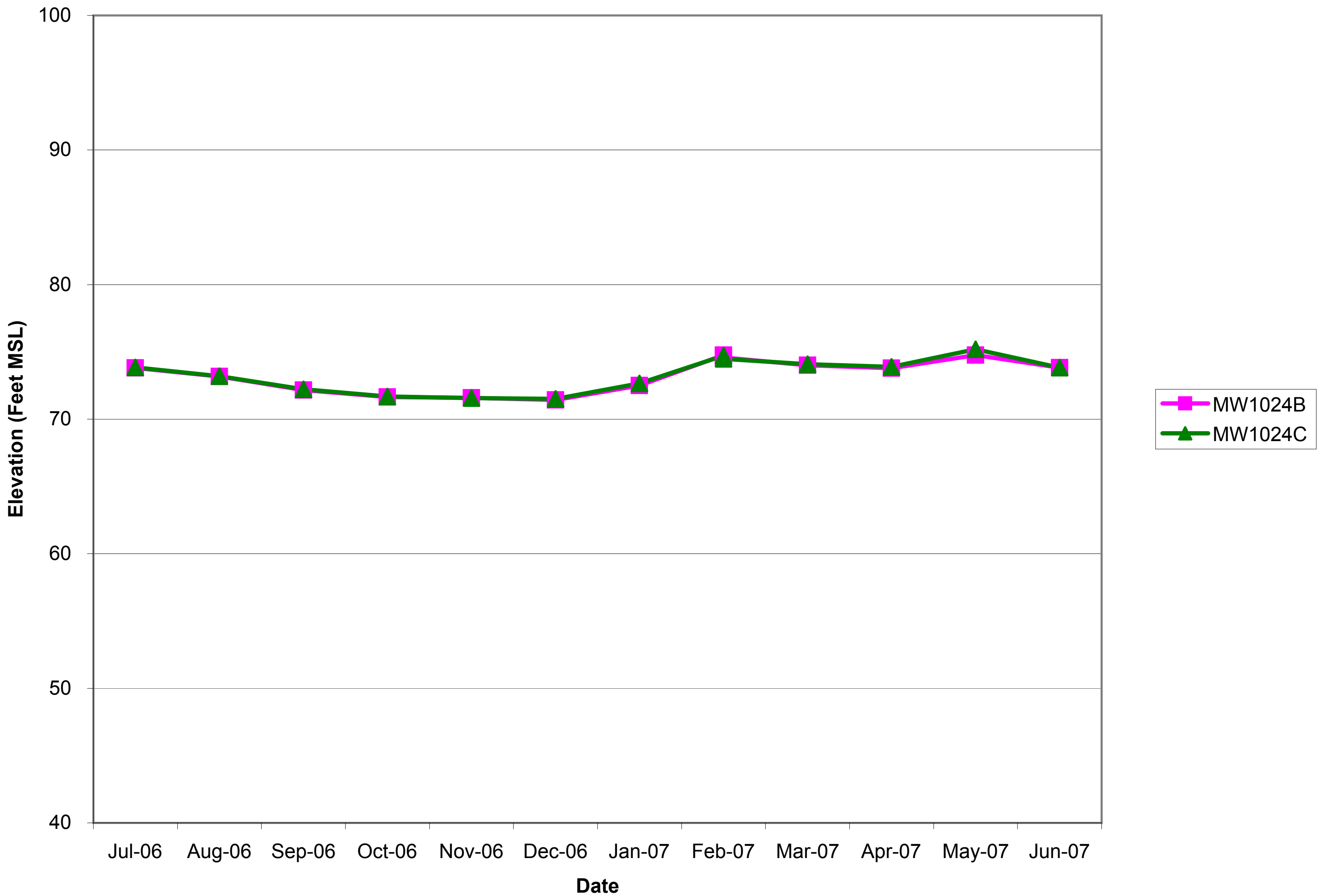


Figure 2.4.12-202. Groundwater Well Hydrograph - MW1024

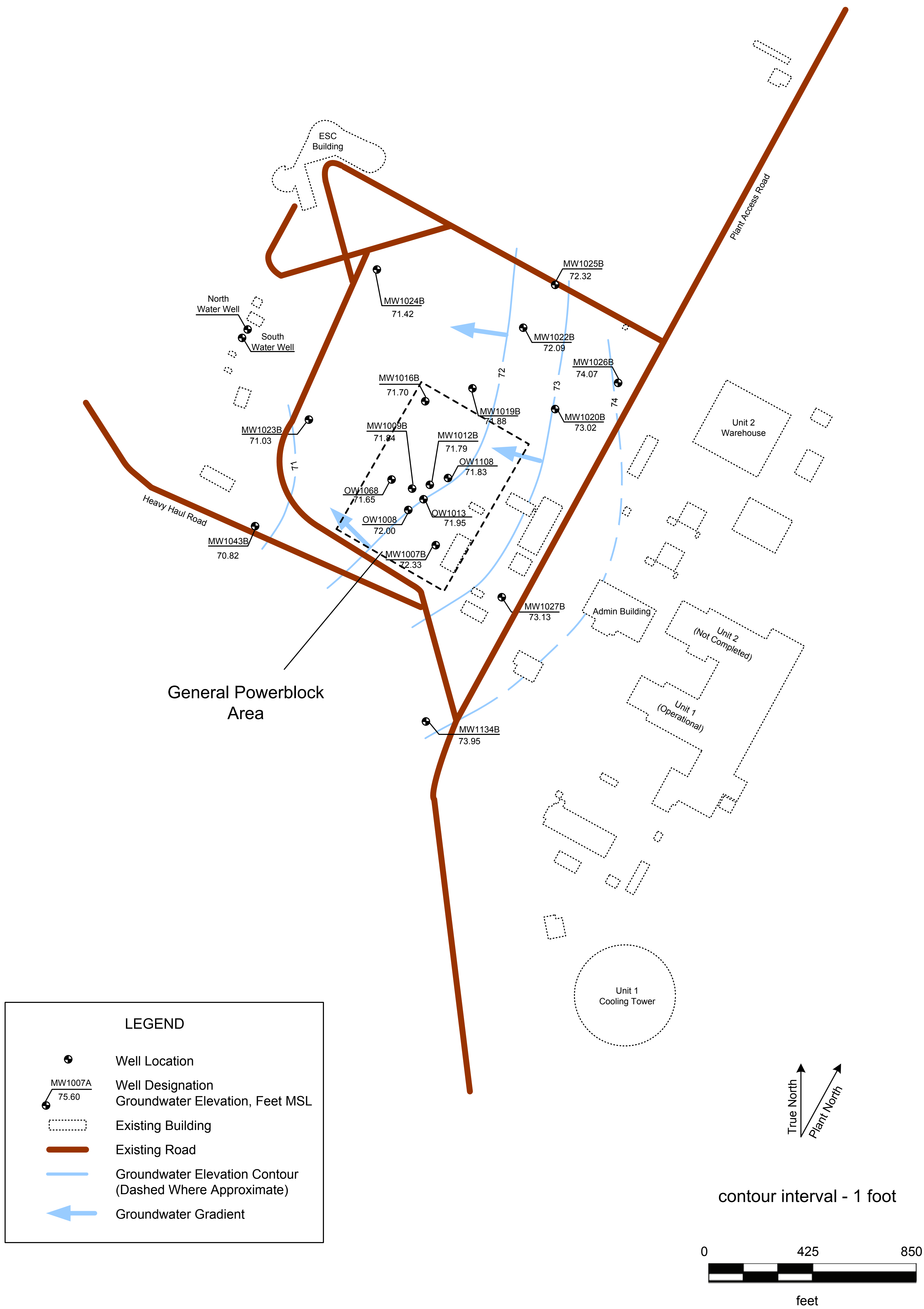


Figure 2.4-12-203. December 2006 Groundwater Gradient Map, Wells Screened in the Upland Complex

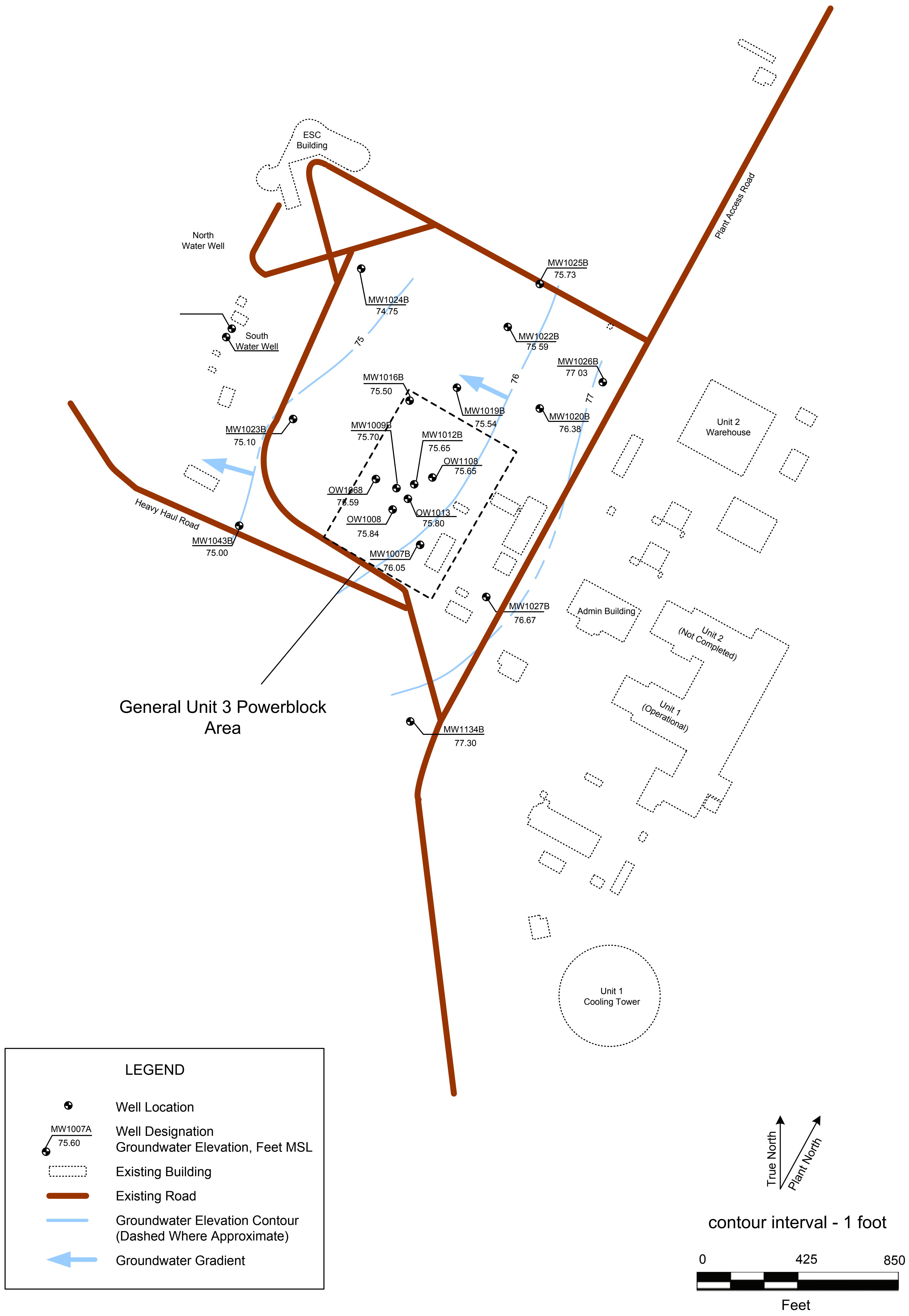


Figure 2.4.12-204. May 2007 Groundwater Gradient Map, Wells Screened in the Upland Complex

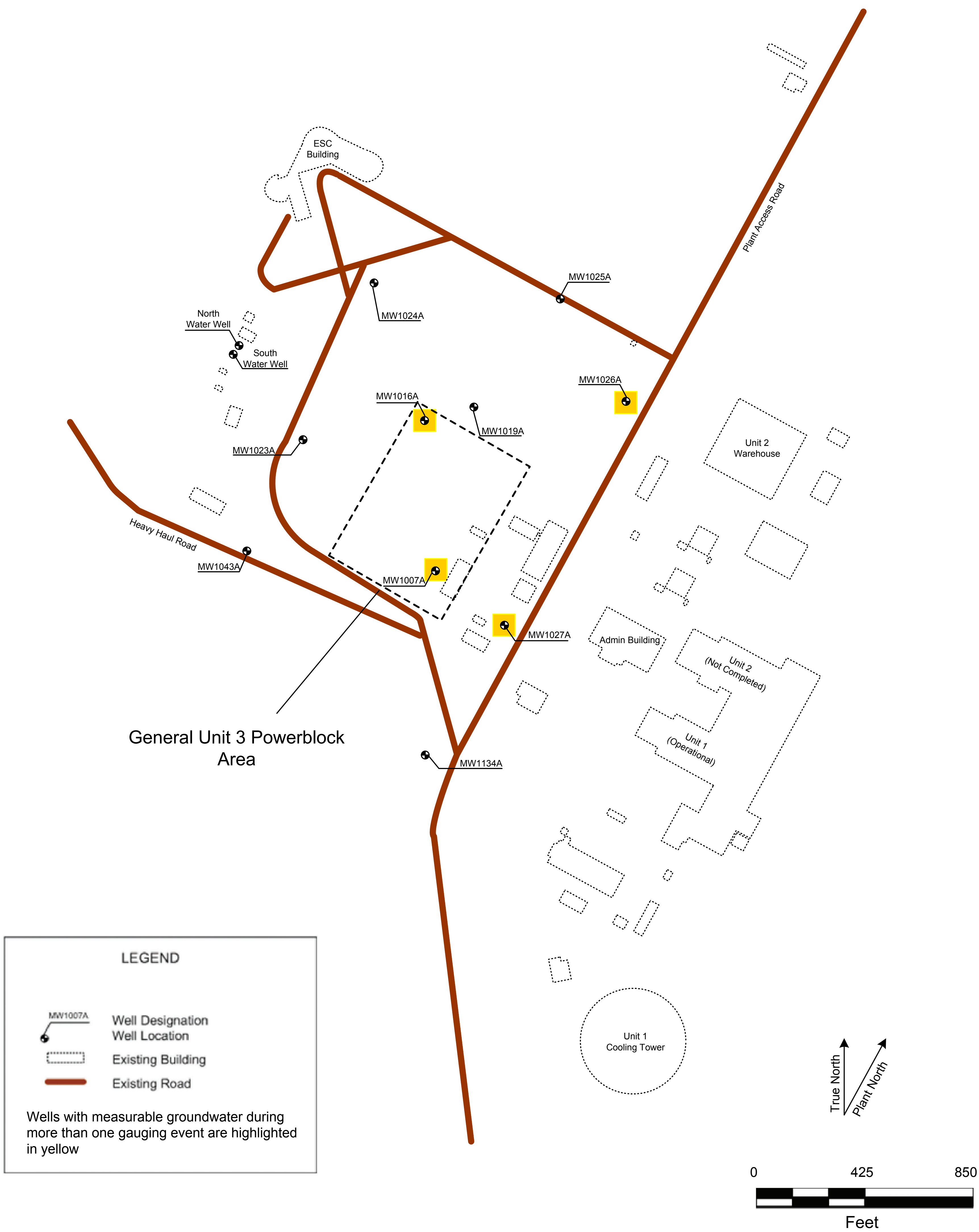


Figure 2.4.12-205. "A" Wells With Measurable Perched Groundwater

2.4.13 ACCIDENTAL RELEASES OF RADIOACTIVE LIQUID EFFLUENTS IN GROUND AND SURFACE WATERS

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Replace the text in SSAR Section 2.4.13 with the following.

GGNS ESP PC 3.E(2)

ESP-002 contains the following safety condition, permit condition no. 3.E(2):

> *An applicant for a CP or COL referencing this ESP shall ensure that any new unit's radioactive waste management systems, structures, and components, as defined in Regulatory Guide 1.143, for a future reactor include features to preclude accidental releases of radionuclides into potential liquid pathways.*

2.4.13.1 MITIGATING DESIGN FEATURES

As described in DCD Sections 1.2, 3.8.4, and 11.2, mitigating design features of the liquid waste management system and the radwaste building considered acceptable by NRC Branch Technical Position (BTP) 11-6 are incorporated into the Unit 3 design to preclude accidental release of liquid effluents. DCD Section 11.2.1 defines compliance with RG 1.143, Rev. 2 for permanent plant systems, structures, and components (SSCs), and mobile liquid radioactive waste systems. This includes (see RG 1.143, Section B, Paragraph 3) piping that begins at the interface valves in each line from other systems provided for collecting waste that may contain radioactive materials and to include related instrumentation and control systems. The radwaste system terminates at the point of controlled discharge to the environment, at that point of recycle to the primary or secondary water system storage tanks, or at the point of storage of packaged wastes. This includes the condensate storage tank (CST) and the liquid radioactive waste management system (LWMS) piping from the first interface valve of the CST to the radwaste system, and LWMS discharge effluent piping. As described in Section 9.2.6, the condensate storage and transfer system (CS&TS) which includes the condensate storage tank, meets GDC 60 by compliance with RG 1.143 Position C.1.2 for provisions to prevent uncontrolled releases of radioactive material.

The mobile system tanks mounted on skids hold very small volumes of liquid radwaste during volume reduction activities and processing. Radwaste volume reduction and processing activities are manual operations closely monitored and supervised by plant radwaste personnel. Therefore, any accidental releases or leaks would be small in comparison to a permanent plant LWMS tank rupture and quickly remediated, thus posing no adverse effects to the groundwater or surface water environment.

Furthermore, failure or rupture of pipes and other components within the LWMS or the CST have been designed with isolation features such that they can be quickly isolated if a spill event occurs or leaks develop. Again, the release would be quickly detected by plant personnel and remediated accordingly.

All below-grade tanks containing radioactivity are located on levels B1F and B2F of the radwaste building (see DCD Figure 1.2-25). The Radwaste Building is designed to seismic requirements as specified in DCD Section 3.8.4. In addition, all compartments containing high level liquid radwaste tanks are steel lined up to a height capable of containing the release of all liquid radwaste in the compartment. Releases as a result of tank failure or leakage result in the release of the liquid radwaste to the compartment and then to the building sump system for containment in other tanks or emergency tanks.

The CST is the only at- or above-grade tank that contains radioactivity outside of containment. The basin surrounding the tank is designed to prevent uncontrolled runoff in the event of a tank failure. The enclosed space is sized to contain the total tank capacity. Tank overflow is also collected in this space. A sump located inside the retention area has provisions for sampling collected liquids prior to their discharge.

The mitigating design features described above demonstrate compliance with ESP Permit Condition 3.E(2), which requires that the radioactive waste management systems, structures, and components as defined in RG 1.143, include features to preclude accidental releases of radionuclides into potential liquid pathways.

2.4.13.2 LIQUID EFFLUENT RELEASE EVALUATION

GGNS COL 2.0-24-A

Section 2.4.13.1 demonstrates that the ESP permit condition is satisfied by the Unit 3 LWMS design, and the design will preclude accidental release of radioactive liquid effluents to the environment. Nevertheless, in accordance with SRP 11.2, an analysis of the bounding release of radioactive liquid effluents to the groundwater and consequently to the surface water environment is performed.

This section provides a conservative and bounding analysis of a postulated, accidental release of radioactive liquid effluents to the groundwater. The accident scenario is described, and the model used to evaluate radionuclide transport is presented, along with potential pathways of contamination to water users. The radionuclide transport analysis is described, and the results are summarized. The radionuclide concentrations are compared against the regulatory limits.

As discussed below, there is no direct surface water pathway to the Mississippi River for the bounding release scenario considered.

2.4.13.2.1 Release Scenario

A liquid radwaste tank outside of containment is postulated to fail, coincident with the non-mechanistic failure of the above described mitigation design features, thus allowing the tank contents to be released to groundwater. The volume of the liquid assumed released and the associated radionuclide concentrations were selected to produce an accident scenario that leads to the most adverse contamination of groundwater.

Radwaste tanks outside of containment are located on levels B1F and B2F of the radwaste building as shown on DCD Figure 1.2-25. The radwaste tanks having the largest volumes include the three equipment drain collection tanks and the two equipment drain sample tanks, all in the lowest level, B2F. Each of these tanks has a volume of approximately 37,000 gallons (140 m^3) per DCD Table 11.2-2a.

Activity concentrations in various liquid radwaste tanks are provided in DCD Tables 12.2-13a through 12.2-13g. Of these tanks, the limiting tank in terms of radionuclide activity is the equipment drain collection tank; its activity is provided in DCD Table 12.2-13a (see DCD Table 2.0-2, for Section 2.4.13).

The scenario assumes that one of the equipment drain collection tanks fails and its contents are released directly to the groundwater. Note that this accident scenario is extremely conservative because the radwaste building is seismically designed in accordance with RG 1.143, Class RW-IIa, as described in DCD Section 12.2.1.4. Also, each tank cubicle is provided with a steel liner, as described in DCD Section 11.2.2.3, to preclude any potential liquid releases to the environment.

2.4.13.2.2 Transport Model and Pathway

Based on the COL stage investigations of the Unit 3 power block and surrounding areas documented in Section 2.4.12, specific Unit 3 site characteristics related to groundwater and transport pathway soils were developed.

Figure 2.4.13-201 illustrates the model used to evaluate an accidental release of radioactive liquid effluent to groundwater. The key elements and assumptions of the model are described and discussed below.

As indicated above, the worst-case scenario assumes one of the equipment drain collection tanks is the source of the release, with each tank having a capacity of 37,000 gallons and radionuclide concentrations as given in DCD Table 12.2-13a. These tanks are located on the lowest level of the radwaste building (level B2F), which has a bottom floor elevation 52 ft. below finished ground level grade of 133.5 ft. msl. One of the tanks is postulated to non-mechanistically fail, and 80 percent of the liquid volume (29,600 gallons) is released, following the guidance provided in BTP 11-6. It is further assumed that the entire 29,600 gallons immediately enters the groundwater in the surrounding soils.

The assumption of instantaneous release to the surrounding groundwater following tank failure is highly conservative because it requires failure of the floor drain system, and it ignores the barriers presented by the steel liners incorporated into the tank cubicles, and the radwaste building structure and basemat, which are seismically designed. Additionally, the highest groundwater level reported in Section 2.4.12.2.3 is slightly below the radwaste building basemat; therefore, some time would normally be required to reach the groundwater saturated zone.

In the worst-case accidental release scenario, radionuclides are released directly to the groundwater and then transported by groundwater to the nearest surface water body. The nearest surface water that is used as a drinking water source is the Mississippi River. The nearest potable water intake from the Mississippi River is more than 100 miles downstream. Refer also to SSAR Section 2.4.12.2 for a discussion of the locations and users of surface waters in close proximity to Unit 3.

Groundwater flow evaluation shows that with the exception of some flow direction changes when the Mississippi River is in extreme flood stages, the dominant direction of groundwater flow is westerly toward the Mississippi River (see Section 2.4.12.2.3). Although seasonal high groundwater levels may discharge to Hamilton Lake, the groundwater elevation in the vicinity of the lake during lower river stages is generally below El. 55 ft. msl. Groundwater flow is, therefore, generally beneath Hamilton Lake, and discharges directly to the Mississippi River. During flood conditions, the groundwater flow direction is temporarily reversed at the site. An accidental release during flood conditions would result in a temporary movement of contaminants away from the Mississippi River. However, the groundwater flow direction would return to normal after flood conditions wane, and the contaminants would move toward the river.

Hamilton Lake is in the westerly pathway of groundwater flow, approximately 2400 ft. from the radwaste building. However, radionuclides introduced into Hamilton Lake would require either re-infiltration into the Mississippi River Alluvium for continuing transport to the Mississippi River, or transport via the surface flow path at the lake outlet to the Mississippi River during high river stages. Both pathways would result in dilution by Hamilton Lake during transport to the Mississippi River.

The Grand Gulf early site permit, ESP-002, Appendix A indicates a site characteristic for distance to the nearest surface water body as 1017 ft. to Stream B. The radwaste building is located such that the distance from it to Sedimentation Basin B (which is fed by Stream B), directly to the south, is approximately 700 ft. Consideration of a groundwater release to Stream B or Sedimentation Basin B is highly conservative as the elevation at the western and lowest end of Sedimentation Basin B is above El. 85 ft. msl, and groundwater elevation is below this level in all but the most extreme river flood stage conditions. Additionally, Stream B and Sedimentation Basin B are not in a direct pathway of a release from a radwaste tank failure. And, while closer to the location of the radwaste building release point than the Mississippi River, neither Stream B nor Hamilton Lake is a source of drinking water. However, for added conservatism, this analysis was done to determine the concentrations of radionuclides in the groundwater at a distance of 600 ft. from the radwaste building release point.

The radwaste building basemat elevation is approximately the elevation of the top of the Upland Complex (Figure 2.4.13-201). Thus, the release pathway is westerly through the Upland Complex, and toward the Mississippi River alluvium in the floodplain. Groundwater flow is modeled to follow a straight line from the radwaste building toward the Mississippi River to the west.

The analysis allows for radionuclide decay during transport by groundwater, and considers this decay in the analysis. Radionuclide transport by groundwater is affected by adsorption by the surrounding soils. The Grand Gulf site is assumed to continually receive the average annual precipitation; precipitation that does not runoff or is not lost to evapotranspiration infiltrates through the unsaturated zone and into the groundwater.

Site-specific parameters such as distribution coefficients, hydraulic conductivity, porosity, and hydraulic gradient used in the analysis are provided in Table 2.4.13-201. Dilution of the radionuclide source term is not modeled in the analysis. Additionally, no screening of the radionuclide source term was performed (i.e., all radioisotope constituents of the source term in DCD Table 12.2-13a were included in the analysis).

Distribution (adsorption) coefficients (K_d values) were determined by analysis of soil samples from the Upland Complex, Catahoula Formation, and the loess. Measurements were obtained for cobalt, cesium, iron, iodine, nickel, plutonium, strontium, technetium, and uranium. Selection of radionuclides for determination of distribution coefficients was based on the activity of the equipment drain collection tank source term. Radionuclides with long half-lives, daughter products with significant potential exposure risk, and mobility in soil/groundwater were selected. In general, the Upland Complex provided the lowest distribution coefficient values for each element. In the analysis, the minimum values were used irrespective of their stratigraphic origin. Distribution coefficients for other elements in the analysis were assigned a value of zero, which is conservative since it assumes no retardation during transport.

Aquifer parameters were established for the Upland Complex, and the near bluff clay-silt portion of the Mississippi River Alluvium (see Section 2.4.12.2.4). Aquifer hydraulic conductivity was determined to be greater in the Upland Complex than in the Mississippi River Alluvium, based on the results of pump tests in MW1009B and 1042B, respectively. For this accidental release groundwater transport model, the highest hydraulic conductivity and hydraulic gradient measured at the site in the Upland Complex are used for conservatism. Total porosity values were obtained for the Upland Complex by laboratory tests using sample weight, moisture content, and specific gravity. Effective porosity values specific to Unit 3 were not developed during the COL site investigation; therefore, values were obtained from the Unit 1 UFSAR (Reference 2.4.13-201). This is appropriate due to the similarity between the total porosity values of the various soil formations listed in Table 2.4-27 of the Unit 1 UFSAR and the total porosity values obtained during the Unit 3 site investigation. Hydraulic gradient values were obtained from groundwater elevation measurements for wells screened in the Upland Complex in the vicinity of the powerblock, presented in Table 2.4.12-202. The maximum hydraulic gradient was derived from the July 2006 groundwater measurements.

The travel time of the groundwater movement from the radwaste building to the Mississippi River was computed from a variation of Darcy's Law:

$$t = \frac{x}{V} = \frac{x}{KI/\theta}$$

Where: t = time to move distance x (yr)

x = distance of contaminant movement (m)

V = average interstitial groundwater velocity (m/yr)

K = hydraulic conductivity (m/yr)

I = hydraulic gradient

θ = effective porosity

The values of parameters used are shown in Table 2.4.13-201. The computed travel time to the river is approximately 4.2 years.

This travel time is approximately one-third of the travel time estimated in the Unit 1 UFSAR analysis (Reference 2.4.13-201). This Unit 3 computation is conservative, considering key modeling assumptions, such as transport only in the Upland Complex geologic unit, which takes no credit for transport through the clay/silt material of the Mississippi River Alluvium (Figure 2.4.13-201 and Figure 2.5.4-224). As indicated in Figure 2.4.13-201, the Mississippi River Alluvium comprises a large portion of the transport path, and this material exhibits much lower hydraulic conductivity and ground water velocity parameters (thus the resultant Unit 1 higher travel time to the river).

2.4.13.2.3 Radionuclide Transport Analysis

Radionuclide concentrations in groundwater along the westerly transport pathway toward the Mississippi River as a result of an accidental release of an equipment drain collection tank contents directly to the groundwater were modeled using RESRAD-OFFSITE (NUREG/CR-6937). The RESRAD-OFFSITE computer code evaluates the radiological dose and excess cancer risk to an individual who is exposed while located outside the area of initial (primary) contamination. The primary contamination, which is the source of all the releases modeled by the code, is a layer of soil below the radwaste building. The code models the movement of the contaminants from the primary contamination to user-defined points along the transport pathway.

The groundwater pathway mechanism is a first-order release model that considers the effects of different transport rates for radionuclides and progeny nuclides, while allowing decay during the transport process. Concentrations of each radionuclide transmitted to the assumed drinking water source (conservatively modeled as 600 ft. from the radwaste building) are determined by the transport through the groundwater system, dilution by groundwater and infiltrating surface water from the overburden soils, adsorption, and decay.

Any radionuclides at the point of analysis are assumed to remain at the analysis point for a period of one year.

2.4.13.2.4 Compliance with 10 CFR Part 20

Table 2.4.13-202 lists the radionuclides detected at a distance of 600 ft. from the radwaste building and compares their concentrations to 10 CFR 20 Appendix B Table 2 Column limits. All radionuclide concentrations are well under limits. The bounding activity, for zinc-65, is more than a factor of ten under 10 CFR 20 limits. Meeting 10 CFR 20 limits at 600 ft. demonstrates that the radiological consequences of a postulated failure of the equipment drain collection tank are also acceptable for larger distances from the radwaste building (i.e., Hamilton Lake and the Mississippi River).

10 CFR 20 Appendix B states, 'The columns in Table 2 of this appendix captioned “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 or 0.5 millisieverts).' Thus, meeting the concentration limits of 10 CFR 20 Appendix B, Table 2 Column 2 results in a dose of less than 0.05 rem and therefore demonstrates that the requirements of 10 CFR 20.1301 and 10 CFR 20.1302 are met.

2.4.13.3 REFERENCES

2.4.13-201 Grand Gulf Unit 1 Updated Final Safety Analysis Report (UFSAR), June 2007.

GGNS COL
2.0-24-A

TABLE 2.4.13-201
SITE-SPECIFIC RESRAD-OFFSITE INPUTS

Parameter	Description	Value
Cobalt K_d (cm^3/g)	Radionuclide-specific distribution coefficient	214
Cesium K_d (cm^3/g)	Radionuclide-specific distribution coefficient	12.9
Iron K_d (cm^3/g)	Radionuclide-specific distribution coefficient	1552
Iodine K_d (cm^3/g)	Radionuclide-specific distribution coefficient	0.86
Nickel K_d (cm^3/g)	Radionuclide-specific distribution coefficient	48.1
Plutonium K_d (cm^3/g)	Radionuclide-specific distribution coefficient	236
Strontium K_d (cm^3/g)	Radionuclide-specific distribution coefficient	3.5
Technetium K_d (cm^3/g)	Radionuclide-specific distribution coefficient	0.18
Uranium K_d (cm^3/g)	Radionuclide-specific distribution coefficient	0.42
Total porosity (unitless)	Total soil porosity, which is the ratio of the soil pore volume to the total volume	0.4
Effective porosity (unitless)	Effective porosity of a porous medium, which is the ratio of the part of the pore volume where water can circulate to the total volume of a representative sample	0.25
Hydraulic conductivity (ft./yr (m/yr))	Flow velocity of groundwater under a hydraulic gradient	1.14E+05 (3.47E+04)
Hydraulic gradient to surface water body (unitless)	Change in groundwater elevation per unit of distance in the direction of groundwater flow to a surface water body.	0.0030
Distance to the nearest surface water body (ft. (m))	Distance to the nearest off-site surface water body that contributes to a potable drinking water source	5780 (1760)

GGNS COL
2.0-24-A

TABLE 2.4.13-202 (Sheet 1 of 2)
COMPARISON OF LIQUID RELEASE CONCENTRATIONS WITH 10 CFR 20 CONCENTRATIONS

Nuclide	Maximum Concentration[1] (μCi/ml)	10 CFR 20 Concentration (μCi/ml)
Ac-227	2.64E-25	5.E-09
Ag-110m	4.16E-10	6.E-06
Ba-140	1.13E-34	8.E-06
Ce-141	6.61E-20	3.E-05
Ce-144	2.09E-09	3.E-06
Cr-51	7.32E-20	5.E-04
Fr-223	3.64E-27	8.E-06
H-3	1.32E-06	1.E-03
I-129	3.31E-15	2.E-07
La-140	1.30E-34	9.E-06
Mn-54	3.74E-08	3.E-05
Nb-93m	2.32E-16	2.E-04
Nb-95	3.66E-14	6.E-09
Nb-95m	1.22E-16	3.E-05
Pa-231	2.49E-24	6.E-09
Pb-211	2.57E-25	2.E-04
Pr-144	2.09E-09	2.E-05
Ra-223	2.57E-25	1.E-07
Re-187	1.40E-20	8.E-03
Rh-103m	4.45E-18	6.E-03
Ru-103	4.46E-18	3.E-05
Ru-106	5.46E-09	3.E-06
Tc-99	1.02E-13	6.E-05
Te-129	1.42E-19	4.E-04
Te-129m	2.18E-19	7.E-06
Th-227	2.56E-25	2.E-06

GGNS COL
2.0-24-A

TABLE 2.4.13-202 (Sheet 2 of 2)
COMPARISON OF LIQUID RELEASE CONCENTRATIONS WITH 10 CFR 20 CONCENTRATIONS

Nuclide	Maximum Concentration[1] (μCi/ml)	10 CFR 20 Concentration (μCi/ml)
Th-231	3.52E-20	5.E-05
U-235	3.53E-20	3.E-07
Y-90	2.24E-19	7.E-06
Y-91	2.02E-14	8.E-06
Zn-65	3.70E-07	5.E-06
Zr-93	1.01E-15	4.E-05
Zr-95	1.65E-14	2.E-05

1. Concentrations evaluated at a point 600 ft. from the defined release location.

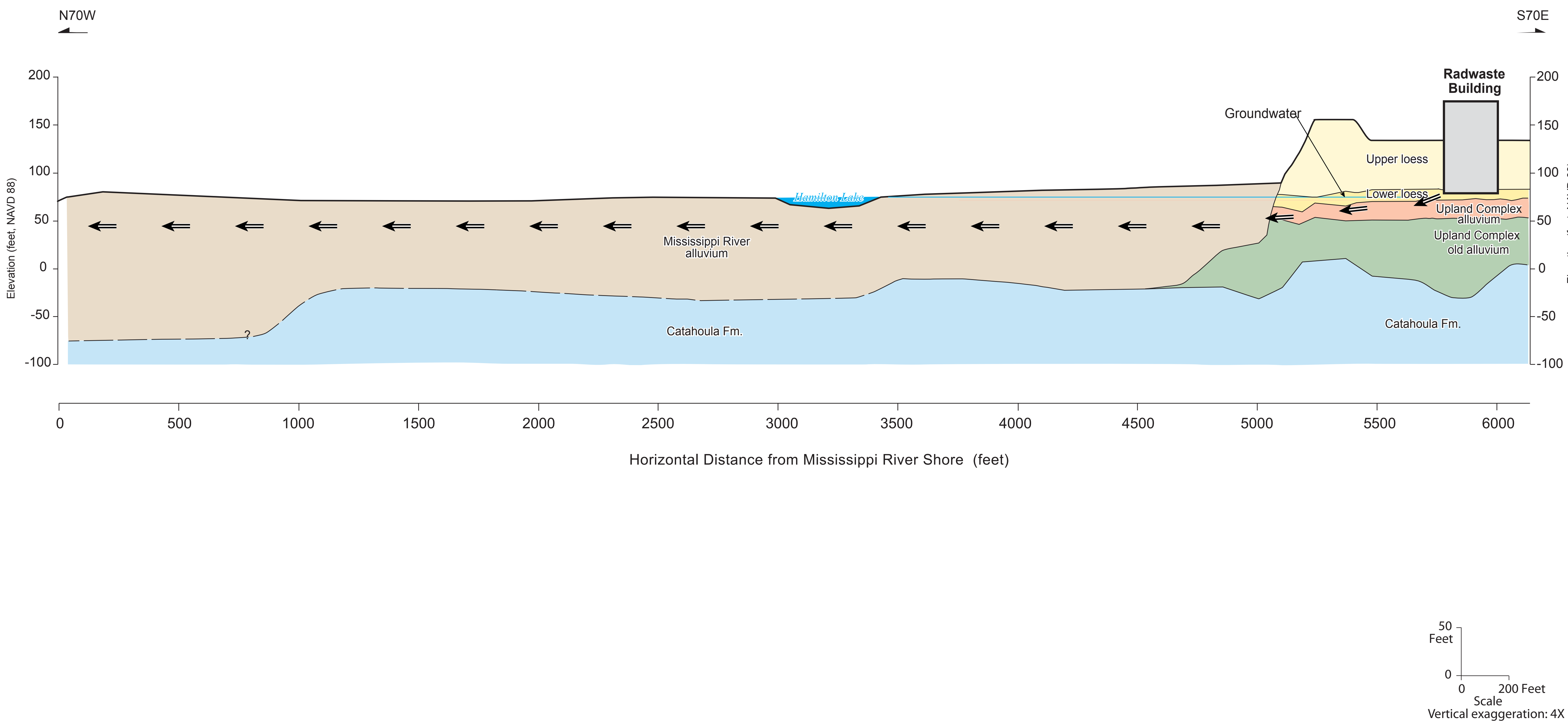


Figure 2.4.13-201. Schematic Model for Evaluating Radionuclide Transport in Groundwater

Add this new section after SSAR Section 2.4.13 and renumber SSAR Section 2.4.14, REFERENCES, as Section 2.4.15.

GGNS COL 2.0-25-A

2.4.14 TECHNICAL SPECIFICATIONS AND EMERGENCY OPERATION REQUIREMENTS

An evaluation was performed for the Unit 3 site to determine if any technical specifications or emergency protective measures were required to mitigate the impact of adverse hydrology-related events or other natural phenomena on safety-related structures, systems, and components (SSCs).

As described in SRP 2.4.14, relevant hydrological-related criteria include flood water surface elevation, hydrodynamic forces (i.e., due to groundwater), coincident wind-induced waves and runup, and water supply limitations caused by droughts and other natural phenomena.

2.4.14.1 HYDROLOGICAL EVENT AND NATURAL PHENOMENA PROTECTION REQUIREMENTS

This section evaluates the need for any technical specifications or emergency protective measures to mitigate the impact of adverse hydrology-related events or natural phenomena on safety-related SSCs.

As described in DCD Chapter 3, safety-related SSCs are protected by design from wind and tornado loading (DCD Section 3.3), flooding (DCD Section 3.4), missiles generated by natural phenomena (DCD Section 3.5), and seismic events (DCD Sections 3.7 and 3.8).

A site-specific analysis of the impact on SSCs from flooding is described in FSAR Section 2.4.10. FSAR Section 2.4.12 evaluates groundwater at the site. FSAR Section 2.4.3 evaluates the site-specific impact of coincident wind-induced waves and runup.

No technical specifications or emergency procedures are needed to protect SSCs from external flooding or other natural phenomena because the ESBWR standard plant design provides the necessary protection for safety-related SSCs and site-specific analyses indicate that the site maximum flood level and maximum ground water level are bounded by the ESBWR Standard Plant site parameters as shown in Table 2.0-201 and coincident wind-induced waves and runup cannot affect safety-related SSCs at the site.

2.4.14.2 ADEQUATE WATER SUPPLY REQUIREMENTS

This section evaluates the need for any technical specifications or emergency protective measures to mitigate the impact of hydrology related events, droughts or other natural phenomena on the plant's UHS.

As described in DCD Sections 9.2.1 and 9.2.5, the ESBWR uses a passive, safety-related decay heat removal system (UHS) contained within the Seismic Category I Reactor Building for heat removal capability following an accident, and does not depend on a separate safety-related reservoir outside of the Reactor Building. The safety-related Seismic Category I Reactor Building protects the UHS from the effects of natural phenomena, including hydrology related events, droughts, or seismic events.

Technical Specification 3.7.1 provides requirements for ensuring an adequate water supply for the passive decay heat removal system is available for the first 72 hours following an accident. Requirements for sufficient long-term makeup supplied by the Seismic Category I fire water storage tanks are provided for in the RTNSS Availability Control Manual in DCD Chapter 19, Appendix 19A.

Therefore, there would be no adverse impact on the availability of the UHS resulting from adverse hydrologic events or other natural phenomena and thus no need for technical specifications or emergency procedures for the UHS to mitigate the consequences of these events.

2.5 GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

Sections 3.1.4.2, 3.1.4.3, and 3.4 of the referenced ESP safety analysis report are incorporated by reference with no variances or supplements.

2.5.1 BASIC GEOLOGIC AND SEISMIC INFORMATION

GGNS COL 2.0-26-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.5.2 VIBRATORY GROUND MOTION

GGNS COL 2.0-27-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements.

Replace the text in SSAR Section 2.5.2 preceeding Section 2.5.2.1 with the following.

GGNS SUP 2.5.2-1

GGNS ESP VAR 2.0-1

GGNS ESP COL 2.5-3

This section describes the methodology and data used to develop the Ground Motion Response Spectra (GMRS) for Unit 3. The approach to develop the GMRS builds on the data and analyses that were conducted for the SSAR. The SSE ground motions for the GGNS ESP site were developed in accordance with RG 1.165, “Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion.” Since approval of the SSAR, the NRC released RG 1.208, “A Performance-based Approach to Define the Site-Specific Earthquake Ground Motion,” which provides an alternative for use in satisfying the requirements set forth in Section 100.23, “Geologic and Seismic Siting Criteria,” of Title 10, Part 100, of the Code of Federal Regulations (10 CFR Part 100), “Reactor Site Criteria.” The GMRS for Unit 3 was developed in accordance with RG 1.208 using an updated seismic source model and revised ground motion attenuation information.

In this section, the term SSE ground motion is related only to work conducted for the SSAR under RG 1.165. The term GMRS is related only to work conducted for Unit 3 under RG 1.208.

The SSE for the SSAR was developed following the guidance provided in RG 1.165. This guidance states that the SSE ground motion can be developed using either the Electric Power Research Institute (EPRI) Seismicity Owners Group (SOG) project (Reference 2.5.2-201) or Lawrence Livermore National Laboratory (LLNL) Probabilistic Seismic Hazard Analyses (PSHA) methodologies (NUREG-1488), updated through a comprehensive review of the geology, seismology and geophysics of the Site Region (200-mile radius around the site). If review of existing data shows a significant change to either the seismic source model or ground motion model (i.e., attenuation relationships), then RG 1.165 recommends that an updated PSHA be performed to develop the SSE ground motion.

RG 1.165, therefore, provides the following four-step process to develop the SSE ground motion:

1. Review and update the EPRI or LLNL seismic source model with new information, as appropriate.

2. Review and update the EPRI or LLNL ground motion (attenuation) model with new information, as appropriate.

3. Perform an updated PSHA utilizing the updated seismic source model and/or ground motion model, if appropriate.

4. Develop the SSE ground motion using the original or updated EPRI or LLNL PSHA results corrected for site-specific soil properties, as required.

This process was completed for the SSAR. During preparation of the SSAR the review and analysis of existing data indicated that with two exceptions, all tectonic features in the GGNS Site Region, and northern extension including the Reelfoot Rift Complex, were adequately characterized by the EPRI SOG seismic source model. The two exceptions identified in the review of existing data were identification of the Saline River source zone within the GGNS Site Region and revision of source parameters for the New Madrid Seismic Zone (NMSZ).

Since publication of the EPRI SOG model in 1986, new information regarding earthquake ground motion attenuation in the Central and Eastern United States (CEUS) has been developed. To address new information and approaches for ground motion attenuation modeling, EPRI (Reference 2.5.2-202) developed a new ground motion attenuation model for the CEUS, including the Gulf Coast region. These new relationships were used in the SSAR, as well as this Unit 3 PSHA.

The SSAR SSE was developed using the EPRI SOG methodology (Reference 2.5.2-201), including an update to the 1986 EPRI SOG seismic source model, an updated EPRI ground motion model (Reference 2.5.2-202), and updated EPRI EQHAZARD software (Reference 2.5.2-203).

RG 1.208 provides guidance for developing a performance-based GMRS based on the approach described in ASCE/SEI Standard 43-05 (Reference 2.5.2-204). The GMRS is developed by scaling the 10^{-4} mean Uniform Hazard Response Spectrum (UHRS) by a Design Factor (DF) based on the slope of the hazard curve from mean 10^{-4} to mean 10^{-5}. The DF ensures that the site-specific GMRS is equal to or greater than the mean 10^{-4} UHRS. The PSHA used to develop the rock ground motions is described in Section 2.5.2.2. Because the site is underlain by soils rather than rock, a site-specific site-response analysis was conducted following the methodology described in RG 1.208. The site-specific site-response analysis is described in Sections 2.5.2.3 and 2.5.2.4. The site investigations and laboratory analyses completed to provide soil parameters for the site-response analysis are described in Section 2.5.4.

RG 1.208 provides similar guidance for developing the seismic source model and ground motion attenuation model for the PSHA as RG 1.165. Therefore, the seismic source model and ground motion model developed for the SSAR have been adopted with two exceptions. These exceptions arise because of new information that has become available since approval of the GGNS ESP.

Since submission of the ESP Application, two moderate magnitude earthquakes (Reference 2.5.2-205) occurred within some of the EPRI SOG background seismic source zones that encompass the Gulf of Mexico region (Figure 2.5.2-201; NUREG-1488) and which partly lie within the site region. The occurrence of these earthquakes required an additional revision to the EPRI SOG source model (Section 2.5.2.1) and update to the Unit 3 PSHA (Section 2.5.2.2) through modification of the maximum magnitude (M_{max}) distributions in the Gulf of Mexico source zones. In addition, the EPRI 2003 ground motion model (Reference 2.5.2-202) was modified to reflect a reevaluation of the log standard deviation (sigma) (Reference 2.5.2-206).

Therefore, the seismic source model and PSHA used to develop the GMRS for Unit 3 adopts the following:

- Updated 1986 EPRI SOG source model with addition of the Saline River source zone and a characteristic earthquake model for the NMSZ (as presented in Sections 2.5.1 and 2.5.2 of the SSAR).
- Revised maximum magnitude (M_{max}) distributions for the Gulf of Mexico source zones used in the EPRI SOG source model (Section 2.5.2.1).
- Updated EPRI ground motion model (Reference 2.5.2-202) with revised sigma.
- Revised EPRI EQHAZARD software (Reference 2.5.2-203) for the PSHA calculation (Section 2.5.2.2).
- New site geological, geophysical and geotechnical data developed during the Unit 3 Site investigations conducted in 2006 (Section 2.5.4).
- New methodology and approach described in RG 1.208 for calculation of site response and the GMRS (Sections 2.5.2.3 through 2.5.2.6).

2.5.2.1 SEISMIC SOURCE CHARACTERIZATION

Add the following text to the end of SSAR Section 2.5.2.1.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

As described in SSAR Sections 2.5.1 and 2.5.2, a comprehensive review of available geological, seismological, and geophysical data was performed for the GGNS site and region. This review shows that the existing EPRI 1986 seismic source model generally captures the source information and uncertainty associated with new data and knowledge developed since the mid-1980's. Additions and revisions to the 1986 EPRI source model, based on new information include:

- Addition of the Saline River Source Zone. This zone represents a new postulated seismic source in southern Arkansas. The closest approach of this new source zone to the GGNS Site is approximately 90 miles.

- Revision of the NMSZ. The average recurrence interval for large magnitude earthquakes in the New Madrid source zone is approximately 300 to 800 years based on new paleoseismic and paleoliquefaction information (as opposed to several thousand years in the 1986 EPRI seismic source model) and the geometry of the source zone was modified to include three distinct fault segments. Also, new maximum earthquake magnitude distributions were developed for the source zone and a characteristic earthquake model was used to estimate recurrence for the fault segments.

- Revision of the maximum earthquake magnitude distribution for the Gulf of Mexico seismic source zones. The magnitude distributions for each EPRI team were raised to be consistent with the occurrence of the 2006 Mb 5.52 and Mb 6.11 events that occurred within this source zone.

The first two revisions (above) are described in SSAR Sections 2.5.1 and 2.5.2. The basis for the last revision (above) is described in Section 2.5.2.1.1.

2.5.2.1.1 Summary of EPRI Seismic Source Model

Add the following text to the end of SSAR Section 2.5.2.1.1.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Two moderate magnitude earthquakes occurred in the Gulf of Mexico in 2006 (Figure 2.5.2-201; Reference 2.5.2-205, Reference 2.5.2-207, and Reference 2.5.2-208). The two earthquakes include the 10 February 2006 body wave magnitude (Mb) 5.52 and the 10 September 2006 Mb 6.11 events. These two earthquakes occurred within or near to the EPRI SOG seismic source zones that characterize the Gulf Coast and Gulf of Mexico regions (Reference 2.5.2-202, Reference 2.5.2-207, and Reference 2.5.2-208). As a result, the maximum earthquake magnitude distribution values for each Gulf Coast source zone (GCSZ) have been evaluated and in some cases updated to reflect the occurrence of these recent earthquakes. Table 2.5.2-201 shows parameters of these two events.

M_{max} distributions for a particular GCSZ are updated only when the earthquake can be demonstrated with reasonable certainty to have occurred within the source zone and the observed Mb magnitude for the earthquake is greater than the minimum Mb magnitude of the EPRI 1986 source model M_{max} distribution.

These criteria conservatively result in updates to five of the six EPRI GCSZs (Table 2.5.2-202). The updated distributions follow as closely as possible the methodology used by the EPRI Earth Science Teams (EST) to develop the original M_{max} distribution and weighting as described in their respective volumes (Reference 2.5.2-202) and the EPRI EQHAZARD Primer (Reference 2.5.2-203) to ensure consistency between the original distributions and those updated here using more recent seismicity data. Details to the revisions for each of the EST GCSZ are described in Sections 2.5.2.1.1.1 through 2.5.2.1.1.6.

2.5.2.1.1.1 Bechtel Team

Add the following text to the end of SSAR Section 2.5.2.1.1.1.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Bechtel Group assigned M_{max} values of 5.4, 5.7, 6.0 and 6.6 to the Gulf Coast source zone (zone BZ1) in the 1986 EPRI model (Table 2.5.2-202). Because the Mb 5.52 and Mb 6.11 earthquakes from the updated catalog occur well within this zone (Table 2.5.2-203; Figure 2.5.2-201), and because these magnitudes are greater than the lowest M_{max} values for the source zone, the M_{max} distribution has been updated. The M_{max} values were revised following Bechtel's methodology (Reference 2.5.2-201):

1. The lower bound magnitude of the distribution is the greater magnitude of either observed earthquake magnitude within the zone or Mb 5.4.

2. The next greater magnitude is 0.3 magnitude units greater than the minimum.

3. The third magnitude is 0.6 magnitude units above the minimum.

4. The fourth magnitude, and upper bound of the distribution, is Mb 6.6.

5. The weightings on the four M_{max} values are 0.1, 0.4, 0.4, 0.1, assigned consecutively from the minimum M_{max} value.

6. If these guidelines result in an upper bound magnitude greater than Mb 6.6, the M_{max} distribution is truncated onto Mb 6.6 with all weightings for magnitudes greater than or equal to 6.6 summed and collapsed onto the magnitude 6.6 upper bound.

The updated M_{max} distribution is shown in Table 2.5.2-202.

2.5.2.1.1.2 Dames & Moore Team

Add the following text to the end of SSAR Section 2.5.2.1.1.2.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Dames & Moore assigned M_{max} values of Mb 5.3 and 7.2 to the South Coastal Margin source zone (zone 20) (Reference 2.5.2-201). The Mb 5.52 and Mb 6.11 earthquakes are 18 km and 245 km outside this zone, respectively (Table 2.5.2-203). The Mb 6.11 earthquake was recorded by numerous regional and global seismograph networks and its location has been very confidently established outside zone 20 (Reference 2.5.2-207). The Mb 5.52 earthquake was less well recorded, and attempts at relocating the event from the position reported in the updated seismicity catalog using proprietary data from ocean bottom seismographs have resulted in significant (tens of kilometers) variation in the position of the earthquake epicenter. The uncertainty in the epicenter of the Mb 5.52 earthquake precludes this event from being excluded from the source zone and has been conservatively assigned a location within the zone. Because the Mb 5.52 earthquake is larger than the lower bound M_{max} value, the M_{max} distribution for this source zone has been updated.

Documentation of the methodology used to select the M_{max} distribution is not explicitly stated in either the Dames & Moore volume (Reference 2.5.2-201) or the final description of the model (Reference 2.5.2-202). Given the lack of a well documented methodology, the M_{max} distribution is modified by simply increasing the lower magnitude bound to match the magnitude of the observed Mb 5.52 earthquake while maintaining the same upper bound and weightings of the original M_{max} distribution for the source zone. The updated M_{max} values are Mb 5.52 and 7.2 with weightings of 0.8 and 0.2, respectively (Table 2.5.2-202).

2.5.2.1.1.3 Law Engineering Team

Add the following text to the end of SSAR Section 2.5.2.1.1.3.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Law Engineering assigned M_{max} values of Mb 4.6 and 4.9 to the South Coastal Block source zone (zone 126) (Reference 2.5.2-201). The Mb 5.52 and Mb 6.11 earthquakes are 63 km and 157 km outside this zone, respectively (Table 2.5.2-203). The Mb 6.11 earthquake was recorded by numerous regional and global seismograph networks and its location has been very confidently established outside zone 126 (Reference 2.5.2-207). The uncertainty in the epicenter of the Mb 5.52 earthquake precludes this event from being excluded from the source zone and has been conservatively assigned a location within the zone. Because the Mb 5.52 earthquake is larger than the lower bound M_{max} value, the M_{max} distribution for this source zone has been updated.

The updated M_{max} values of 5.52 and 5.7 used in the analysis (Table 2.5.2-202) follow from Law Engineering's methodology (NUREG-1488) of defining M_{max}. The lower bound M_{max} is the magnitude of the maximum observed earthquake, and the upper bound for regions with earthquakes occurring within 10 km of the surface is Mb 5.7.

There is no documentation describing the determination of weightings for the original M_{max} distribution (Reference 2.5.2-201 and Reference 2.5.2-202), so the weights from the original M_{max} distribution, 0.9 on the lower bound M_{max} and 0.1 on the upper bound M_{max} are used in the updated M_{max} distribution (Table 2.5.2-202).

2.5.2.1.1.4 Rondout Team

Add the following text to the end of SSAR Section 2.5.2.1.1.4.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Rondout Associates assigned M_{max} values of Mb 4.8, 5.5, and 5.8 to the Gulf Coast to Bahamas Fracture Zone source zone (zone 51) in the 1986 EPRI model (Table 2.5.2-202). Because the Mb 5.52 and Mb 6.11 earthquakes from the updated catalog occur well within this zone (Table 2.5.2-203; Figure 2.5.2-201), and because these magnitudes are greater than the lowest M_{max} values for the source zone, the M_{max} distribution for this source zone has been updated (Reference 2.5.2-207).

The updated M_{max} values are 6.11, 6.3, and 6.5 with weightings of 0.3, 0.55, and 0.15 (Table 2.5.2-202). This distribution was developed by reclassifying the source zone as one capable of producing “moderate earthquakes” instead of one only capable of producing “smaller than moderate earthquakes” as per the 1986 EPRI model (Reference 2.5.2-201 and Reference 2.5.2-202). The original Rondout M_{max} distribution for “moderate earthquake” source zones is 5.2, 6.3, and 6.5 with weightings of 0.3, 0.55, and 0.15, respectively. The updated M_{max} distribution follows this distribution with the exception of an increase in the lower bound of the distribution to 6.11 to match the observed Mb 6.11 earthquake.

2.5.2.1.1.5 Weston Geophysical Corporation Team

Add the following text to the end of SSAR Section 2.5.2.1.1.5.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Weston Geophysical Corporation assigned M_{max} values of Mb 5.4 and Mb 6.0 to the Gulf Coast source zone (zone 107) in the 1986 EPRI model (Table 2.5.2-202). Because the Mb 5.52 and Mb 6.11 earthquakes from the updated catalog occur well within this zone (Table 2.5.2-203; Figure 2.5.2-201), and because these magnitudes are greater than the M_{max} values for the source zone, the M_{max} distribution for this source zone has been updated.

The updated M_{max} values are 6.6 and 7.2 with weightings of 0.89 and 0.11 (Table 2.5.2-202). The distribution was developed following from Weston Geophysical Corporation's original methodology (Reference 2.5.2-201). M_{max} distributions are based on developing discrete probability distributions with probabilities at M_{max} magnitudes of 3.6, 4.2, 4.8, 5.4, 6.0, 6.6, and 7.2 that are then truncated at the magnitude that is closest to, yet greater than, the maximum observed earthquake within the source zone. The truncated distribution is then renormalized so that the sum of all the probabilities is 1.0. The final M_{max} values form a truncated distribution with weights that are the renormalized probabilities. For the updated M_{max} distribution used for this analysis, the discrete probability distribution for the Gulf Coast source zone was truncated at Mb 6.6 because the largest observed earthquake was Mb 6.1.

2.5.2.1.1.6 Woodward Clyde Consultants Team

Add the following text to the end of SSAR Section 2.5.2.1.1.6.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

Woodward Clyde Consultants assigned M_{max} values of Mb 4.9, Mb 5.4, Mb 5.8, and Mb 6.5 to the Central U.S. Background source zone (zone B43) in the EPRI seismic source model (Table 2.5.2-202). Because the Mb 5.52 and Mb 6.11 earthquake occurred at distances of 273 km and 635 km outside of the Central U.S. Background source zone, respectively (Table 2.5.2-203; Figure 2.5.2-201), the M_{max} distribution for this source zone is not updated.

Add the following section to the end of SSAR Section 2.5.2.1.

GGNS COL 2.0-27-A

2.5.2.1.5 Effect of Post-ESP Revision of NMSZ Magnitude Estimates

The technical basis for selection of magnitude, recurrence, and source geometry parameter values for the NMSZ is presented in SSAR Section 2.5.1. Since

GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

submittal of the GGNS ESP Application, new estimates of earthquake magnitudes associated with the 1811-1812 earthquake sequence have been published.

The new information results in an increase in magnitude estimates for the earthquake sequence by Bakun and Hopper (Reference 2.5.2-209) and a decrease in the magnitude estimates of Johnston (Reference 2.5.2-210). The net effect of these revisions is a very slight decrease in the weighted mean magnitude estimate for the Blytheville Arch or New Madrid South (NMS) fault events from Mw 7.54 to 7.53. Because the changes in magnitude estimates result in a decrease in the weighted mean, the Unit 3 PSHA conservatively retains the original slightly higher magnitude distribution rather than reducing these values. The following is a summary of the current understanding of earthquake behavior in the NMSZ.

Bakun and Hopper (Reference 2.5.2-209) provide preferred estimates of the locations and moment magnitudes and their uncertainties for the three largest events in the 1811-1812 sequence near New Madrid. Their preferred intensity magnitude (MI), which is their preferred estimate of M, is 7.6 (6.8 to 7.9 at the 95 percent confidence interval) for the 16 December 1811 Event (NM1), 7.5 (6.8 to 7.8 at the 95 percent confidence interval) for the 23 January 1812 Event (NM2), and 7.8 (7.0 to 8.1 at the 95 percent confidence interval) for the 7 February 1812 Event (NM3). The MI is the calculated mean of intensity magnitudes estimated from individual MMI assignments. In their analysis, Bakun and Hopper (Reference 2.5.2-209) considered two alternative eastern North America (ENA) intensity attenuation models which they refer to as models 1 and 3. These two models gave significantly different results for larger magnitude earthquakes because the models are empirical relations based almost exclusively on **M** < 6 calibration events and lack the ability to confidently predict which relation better represents the MMI-distance data for **M** 7 earthquakes in ENA (Reference 2.5.2-209). However, it is likely that insufficient data exists regarding calibration of ENA earthquakes larger than **M** > 7 to rely strictly on ENA models as was done in Bakun and Hopper (Reference 2.5.2-209); **M** 7.6 (the size of the 2003 Bhuj earthquake) may be a more reasonable upper bound for the largest of the earthquakes in the 1811-1812 New Madrid earthquake sequence. This approach is more consistent with estimates cited in Hough et al. (Reference 2.5.2-210) and Mueller et al. (Reference 2.5.2-211). The estimates of Johnston (Reference 2.5.2-212) are likely to be high by about 0.2 to 0.3 magnitude units.

Mueller et al. (Reference 2.5.2-211) used instrumentally recorded locations of recent earthquakes (assumed to be aftershocks of the 1811-1812 sequence) and models of elastic stress change to develop a kinematically consistent rupture scenario for the mainshock earthquakes of the 1811-1812 New Madrid sequence. In general, the estimated magnitudes for NM1 and NM3 used in their analysis (**M** = 7.3 and **M** = 7.5, respectively) are consistent with those previously published by Hough et al. (Reference 2.5.2-210). Their results suggest that the mainshock Events NM1 and NM3 occurred on two contiguous faults, the strike-slip Cottonwood Grove fault (NM1) and the Reelfoot thrust fault (NM3). The locations of the NM1 and NM3 Events on the Cottonwood Grove and Reelfoot faults are relatively well constrained. In contrast to the earlier Hough et al. (Reference 2.5.2-

210) study that located the NM2 earthquake on the New Madrid North (NMN) fault, Mueller et al. (Reference 2.5.2-211) suggest a more northerly location for the NM2 Event, possibly as much as 200 kilometers to the north in the Wabash Valley of southern Indiana and Illinois. Hough et al. (Reference 2.5.2-213) also inferred a similar more northerly location. Using Bakun and Wentworth's (Reference 2.5.2-214) method, Mueller et al. (Reference 2.5.2-211) obtained an optimal location for the NM2 mainshock at 88.43°W, 36.95°N and a magnitude of **M** 6.8, however the location is not well constrained and could be fit almost as well by locations up to 100 kilometers northwest or northeast of the optimal location. Mueller et al. (Reference 2.5.2-211) concluded that the three events on the contiguous faults increased stress near fault intersections and end points, in areas where present-day microearthquakes have been interpreted as evidence of primary mainshock rupture. The interpreted results are consistent with established magnitude/fault area results and do not require exceptionally large fault areas or stress drop values for the New Madrid mainshocks.

With respect to the location of the NM2 Event, Bakun and Hopper (Reference 2.5.2-209) related location uncertainty to the paucity of MMI assignments available for this earthquake west of the NMSZ. Because two MMI sites closest to the NMSZ provide nearly all of control on NM2 Event location, a position northeast of Bakun and Hopper's (Reference 2.5.2-209) preferred site is indicated. However, lack of 1811-1812 liquefaction observations in western Kentucky, southern Illinois, and southern Indiana indicate that the NM2 Event location is southwest of these areas. Bakun and Hopper (Reference 2.5.2-209) follow Johnston and Schweig (Reference 2.5.2-212) in selecting a preferred location on the NMN. No evidence for liquefaction features exists in the Wabash Valley region that would support the more northerly location preferred by Mueller et al. (Reference 2.5.2-211), including those cited in the Yearby Land account referenced by Mueller et al. (Reference 2.5.2-211).

Review of the new publications above indicates that uncertainty and differing views within the research community still remain regarding the size and location of the 1811-1812 earthquakes. As such, maintaining the magnitude estimates of the approved SSAR adequately captures the range of uncertainty within the scientific community and results in a very slightly higher estimate of magnitude for the NMS fault, the structure closest to the site.

2.5.2.2 GGNS PROBABILISTIC SEISMIC HAZARD ANALYSIS

Replace the text in SSAR Section 2.5.2.2 with the following.

GGNS COL 2.0-27-A

A PSHA was performed for Unit 3 following the procedure provided in RG 1.208 and adhering fully to the guidance provided in NUREG/CR-6372. The results were deaggregated in terms of earthquake magnitude (Mw) and distance to determine

GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

the controlling earthquakes for the site. The PSHA calculations were performed for rock site conditions and input to a site response analysis to determine the GMRS.

2.5.2.2.1 Seismic Source Characterization

Replace the text in SSAR Section 2.5.2.2.1 with the following.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

The Unit 3 PSHA was performed using the EPRI SOG seismic sources (Reference 2.5.2-201), updated with the New Saline River seismic source and the revised New Madrid seismic source, as described in Section 2.5.2.1. Similar to the GGNS ESP, the Saline River seismic source and revised New Madrid seismic source are added to the EPRI SOG seismic sources without revision to these sources. The potential double-counting of hazard using this approach is conservative.

Starting with SSAR Section 2.5.2.2.3, replace the remainder of ESP Section 2.5.2 with the following.

2.5.2.2.3 Ground Motion Attenuation Models

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

The ground motion attenuation models developed as part of an EPRI-sponsored project were used in the PSHA (Reference 2.5.2-202). The EPRI 2003 ground motion models estimate ground motions for rock sites and include, for a given ground motion frequency (e.g., spectral acceleration (S_a) 1 Hz), alternative estimates of the median and aleatory uncertainty in ground motion. The alternative models of the median and aleatory uncertainty and their probability weights represent the epistemic uncertainty in ground motions.

A recent EPRI study evaluated the aleatory variability for CEUS ground motions (Reference 2.5.2-206). The result of this effort suggests the logarithmic standard deviation (sigma, the aleatory variability parameter) is lower than some of the alternative aleatory variability models developed as a part of the EPRI 2003 ground motion model. Based on this recent work, a change to the EPRI 2003 aleatory model was made for the Unit 3 PSHA.

In the EPRI 2003 ground motion model, the logarithmic standard deviation for spectral accelerations (S_a) at 0.5 Hz is higher than the estimates at 1.0 Hz. When compared to the findings of the recent EPRI sigma study, a number of the model estimates for the aleatory variability in the 2003 at 0.5 Hz are higher. To reflect the findings of the EPRI 2006 study findings, the S_a 1.0 Hz sigma models were used at S_a 0.5 Hz. In comparison, the average sigma at 1.0 Hz, now also used for 0.5 Hz (over the four aleatory models in the EPRI 2003 model) is consistent with the sigma at 0.5 Hz as estimated in the new EPRI sigma study. To summarize, for the Unit 3 PSHA and the development of the displacement response spectrum (DRS), the EPRI 2003 aleatory model was used (as in the ESP PSHA), with the exception that the 1.0 Hz aleatory variability model was also used for the 0.5 Hz ground motions.

The EPRI 2003 ground motion model provides median ground motion models for the Mid-continent and the Gulf region of the CEUS (Reference 2.5.2-202). In addition, the model is defined for different seismic source types, including General Area sources, and Fault sources or sources capable of generating large magnitude (Mw > 7) events. In addition, specific ground motion models were defined for fault sources in rifted and non-rifted regions (Reference 2.5.2-215).

For the New Madrid seismic source, mid-continent rifted ground motion attenuation models were used. For this case there are 12 estimates of the median ground motion, and four estimates of the aleatory uncertainty, producing 48 ground motion model estimates. For seismic sources located proximal to GGNS, the General Area ground motion models for the Gulf region were used. For this case there are nine estimates of the median ground motion, combined with four aleatory variability models to produce 36 ground motion model estimates.

As described in the EPRI ground motion report (Reference 2.5.2-202), when General Area sources and Fault sources (also sources capable of generating large magnitude events at large distances) are included in a seismic source combination (i.e., both seismic source types are simultaneously active), these models are correlated.

2.5.2.2.4 Lower-Bound Magnitude

The PSHA calculations were performed using a lower-bound magnitude of Mw 5.0. This value is consistent with the findings in EPRI (Reference 2.5.2-216) which recommended a lower-bound magnitude for PSHA calculations performed for well-engineered facilities such as nuclear power plants. The study recommended a lower-bound magnitude of 5.0 Mw. At the time, a lower-bound magnitude of Mw 5.0 was estimated to correspond to a lower-bound magnitude of 5.3 in terms of Mb. Thus, the lower-bound of Mb 5.0, used in the EPRI SOG study, is slightly conservative.

The deaggregation of the seismic hazard at the Unit 3 Site was performed for seven magnitude and seven distance bins. The magnitude-distance bins are:

Magnitude (M_w): 5.0-5.5, 5.5-6.0, 6.0-6.5, 6.5-7.0, 7.0-7.5, 7.5-8.0, 8.0, and greater.

Distance (km): 0.0-15, 15-25, 25-50, 50-100, 100-200, 200-300, 300, and greater.

The distance bins are defined in terms of epicentral distance.

2.5.2.2.5 PSHA Calculations

The seismic hazard calculations for the Unit 3 PSHA were performed using the EPRI EQHAZARD software which has been upgraded to include the characteristic earthquake model, the EPRI 2003 ground motion model, expanded logic tree modeling capabilities, and the calculations described in RG 1.208.

To manage the execution time of these calculations, one simplification was introduced. For seismic sources defined in the original EPRI SOG study (Reference 2.5.2-202) that have multiple seismicity options (e.g., alternative models for the a- and b-values of the exponential recurrence relationship), the mean hazard for these options was calculated and used in the final hazard calculation. This simplification reduced the number of branches in the logic tree and significantly reduced the computation time. This simplification is reasonable due to the low sensitivity of the median hazard to alternative seismicity options defined by the ESTs (Reference 2.5.2-203). The sensitivity of the Grand Gulf median seismic hazard estimates was evaluated and determined to be small as shown in SSAR Figures 2.5-48 and 2.5-49 for spectral accelerations of 1 and 10 Hz.

2.5.2.2.5.1 Results

The seismic hazard results for rock site conditions are shown in Figures 2.5.2-202 through 2.5.2-208 for each ground motion frequency (0.5 Hz, 1 Hz, 2.5 Hz, 5 Hz, 10 Hz, 25 Hz and PGA). The results are provided in terms of the 0.15, 0.50, and 0.85 fractiles and the mean. Table 2.5.2-204 lists the hazard results for each ground motion frequency. Figure 2.5.2-209 shows the mean uniform hazard response spectra (UHRS) for annual frequencies in exceedance of 10^{-4}, 10^{-5}, and 10^{-6} at GGNS for rock site conditions. Table 2.5.2-205 lists abscissae of the UHRS from Figure 2.5.2-209.

Following the procedure in RG 1.208 the mean hazard results were deaggregated for low (1 and 2.5 Hz) and high frequencies (5 and 10 Hz) at annual frequencies of exceedance of 10^{-4}, 10^{-5}, and 10^{-6}. Figures 2.5.2-210 and 2.5.2-211 show the deaggregation results for annual frequencies of exceedance of 10^{-4}, 10^{-5}, and 10^{-6} for 1 and 2.5 Hz and for 5 and 10 Hz, respectively. The results show that for the low frequency hazard, the primary contribution to the hazard is from the characteristic earthquake events associated with the New Madrid seismic source zone for all annual frequencies of exceedance. The high-frequency deaggregation results are shown in Figure 2.5.2-211. These results show that the majority of the contribution to high frequency hazard also is produced by events associated with the characteristic earthquakes of the New Madrid seismic source zone at frequencies of exceedance of 10^{-4} and 10^{-5}. For an annual frequency of exceedance of 10^{-6}, there is a contribution from both small and moderate size

(**M**<6.5), close in events (R<50 km), as well as the distant, New Madrid characteristic size earthquakes.

2.5.2.2.5.2 Controlling Earthquakes

Following the procedure recommended in RG 1.208, the controlling earthquakes for low and high-frequency ground motions were determined. The magnitudes and distances for the controlling earthquakes for 1-2.5 Hz and 5-10 Hz are listed in Table 2.5.2-206. For GGNS, the contribution of large distant events (distances greater than 100 km) to low frequency ground motions was greater than 5 percent. Therefore, as recommended in RG 1.208, the controlling event for distances greater than 100 km and for 1-2.5 Hz was calculated. This event is also listed in Table 2.5.2-206.

2.5.2.3 SEISMIC WAVE TRANSMISSION CHARACTERISTICS OF THE SITE

The rock outcrop UHRS as well as the associated 1 to 2.5 Hz and 5 to 10 Hz scaled spectra presented in Section 2.5.2.2.5.1 (Figure 2.5.2-211) are based on updated CEUS attenuation relations for hard rock site conditions (Reference 2.5.2-202). The hard rock site conditions reflect a mid-continent crustal structure (Reference 2.5.2-215 and Reference 2.5.2-217) with a defined shear-wave velocity of 2.83 km/sec. This high velocity is generally associated with very competent crystalline or metamorphic basement material, which occurs at the Unit 3 Site at depths exceeding 10,000 ft. in Paleozoic basement material (SSAR Section 2.5.1).

To develop the GMRS at the surface, site response analyses must accommodate the effects of the local shallow soils as well as deeper soils and soft rock to a depth where the shear-wave velocity reaches about 2.8 km/sec. Because the UHRS is defined to 0.5 Hz (2 seconds) as the lowest frequency, accommodation of the deeper materials is required to depths which result in capturing amplification to the lowest frequency of interest (Reference 2.5.2-217 through Reference 2.5.2-219 and NUREG/CR-6728). For typical deep firm profiles, maximum amplification at 0.5 Hz is reached at depths of about 1000 ft. (305 m) at low levels of loading (Reference 2.5.2-219). To conservatively accommodate potential low frequency amplification, the local soil profile is extended to a depth of 3030 ft. (1 km) and Approach 3 of NUREG/CR-6769 is used to accommodate the effects of local soils and deeper materials (as well as their variabilities) on the design ground motions.

A laterally averaged shear and compression wave velocity profile for the Unit 3 site was developed to a depth of 446 ft. below site grade, the limit of site geophysical measurements. Four base case profiles were developed to accommodate epistemic variability (uncertainty in the mean) in profile extrapolations to depths beyond which measurement sets were available (Figure 2.5.4-212). A full description of the inputs and methods used to develop these base cases is provided in Section 2.5.4.7.1. This site-specific profile was extended to a depth of 3030 ft. (1km) by applying a generic Mississippi embayment shear-wave velocity profile developed for ground shaking studies in the embayment (described below). The profile is based on a large number of shallow and several deep velocity surveys and extends to a depth of 3600 ft. (1100 m). The complete (site-specific and general Mississippi embayment) base case profile is shown in Figure 2.5.2-213 to a depth of 1 km, where shear-wave velocity is set to 2.8 km/s, appropriate for hard rock conditions.

For deep shear-wave velocities below the local site explorations, no measurements are known to exist within tens to hundreds of kilometers of the site. Old water wells and oil exploration boreholes exist within the southern Mississippi embayment, some possibly with stratigraphic logs, but these are of little added value because the overall stratigraphy (geology) of the Mississippi embayment is laterally uniform (see SSAR Section 2.5.1.1). The notable exceptions are Crowley's Ridge, located within the northeastern embayment and the roughly north-south boundary between the lowlands and uplands. Based on rather extensive measurements near the Memphis area and surrounding regions, the differences in stratigraphy and velocities across the lowland-upland boundary extend only to shallow depths (upper several hundred feet), are reasonably well characterized, and are generally considered uniform throughout the embayment (see SSAR Section 2.5.1.1). A number of surface wave analyses as well as low-frequency site amplification studies suggest generally uniform (laterally) soil column properties throughout the Mississippi embayment. As a result, ground motion hazard maps are computed with regional soil columns primarily differentiated into lowland and upland areas. Ground motion hazard maps for long periods also consider depth to Paleozoic basement, which diminishes to zero to the north near Cairo, Illinois and to the east and west away from the Mississippi River (the approximate centerline of the embayment) (see SSAR Section 2.5.1.1). The general lateral uniformity of the deeper velocities (deeper than several hundred feet) is consistent with other large basins (e.g., Los Angeles and Imperial Valley, California) and provides a basis for employing a generic deep profile beneath the local site profile. Because the profile is randomized, expected random fluctuations due to lateral variability in velocity and depth to basement are accommodated in the mean amplification, consistent with a fully probabilistic hazard analysis. Additionally, the deep profile gradient (depth greater than 477 ft.) largely controls low frequencies (< 1 Hz) and the high frequencies (> 1 Hz) are controlled predominately by the site-specific profile (measured to a depth of 477 ft.) as well as the damping in the top 1 to 2 km, characterized through kappa (Reference 2.5.2-220). The kappa value employed is based on observations of motions recorded in shallower (3000 to 6000 ft.) portions of the embayment. For lower frequencies, the amplification is controlled by the average column shear-wave velocity and depth to basement, defining the fundamental column resonance. Any revisions to the deep velocity profile will only affect mean amplification for periods longer than the revised fundamental resonance and as a result, differences in the deep profile gradient have little impact on design motions provided that overall damping is constrained (kappa) and that the profile is deep enough to accommodate the lowest frequency of interest. The empirical kappa value to be employed is considered conservative as a deeper sedimentary column (over 10,000 ft. at the site) over hard rock is expected to show larger kappa values (more cumulative damping) compared to shallower sedimentary columns.

Nonlinear dynamic material properties, G/G_{max} and hysteretic damping curves, are based on laboratory testing of undisturbed samples taken during the site exploration program (Section 2.5.4.2.2.3). Generally, the laboratory dynamic test results showed similarity with the EPRI G/G_{max} and hysteretic damping curves for cohesionless soils (Reference 2.5.2-217). Samples of Upper loess (approximately top 30 to 80 ft.) are consistent with EPRI curves for depths of 50 to 120 ft. and samples of Lower loess are consistent with EPRI curves for depths of 120 to 250 ft. Samples of Upland Complex alluvium (UCA) and old alluvium are consistent with EPRI curves for depths of 250 to 500 ft. and samples of Catahoula Formation are consistent with EPRI curves for depths of 500 to 1000 ft. Due to the similarity between the laboratory dynamic testing results and those developed by EPRI (Reference 2.5.2-217), the EPRI curves were adopted for use (shown in SSAR Figure 2.5.2-62). The deeper EPRI curves (500 to 1000 ft.) were used to characterize dynamic non-linearity for materials to a depth of 500 ft., below which linearity was assumed (NUREG/CR-6728).

To constrain high frequency motions which are sensitive to the overall damping in the profile to bedrock, a total low-strain kappa value of 0.04 sec was adopted. This value reflects a conservative estimate for this portion of the Mississippi embayment with sediment depths exceeding 10,000 ft. and includes the contribution of the low strain damping in the hysteretic damping curves over the nonlinear portion of the profile (top 500 ft.) as well as any scattering damping due to velocity fluctuations in the profile randomization process. The 0.04 sec value also includes the defined kappa value of 0.006 sec included in hard rock attenuation relations (Reference 2.5.2-221). Sensitivity of the input motions is such that an increase in kappa to 0.05 sec or a decrease to 0.03 sec would result in about a 15% decrease or increase respectively in motions for frequencies exceeding about 5 Hz (Reference 2.5.2-222). Kappa (total low-strain damping) may be treated as epistemic variability with full analyses performed (site-specific hazard curves developed) for a suite of values, followed by weighting of the resulting hazard curves to develop a single set of mean curves. This approach would greatly increase the analyses beyond that which is practical and necessitate development of appropriate weights. As a result and because kappa can only be estimated from recordings of earthquakes, a conservative estimate of 0.04 sec is assumed in characterizing the motions. Typical kappa values for deep soils in the western United States range from about 0.05 to 0.07 sec (Reference 2.5.2-220 and Reference 2.5.2-223). Deep soils in the CEUS are not expected to have significantly different dynamic material properties such as shear-wave velocity and material damping, particularly at depths exceeding approximately 500 ft.

The equivalent uniform shear wave velocity (V_{eq}) of soil columns underneath Seismic Category I structures was calculated at low bound seismic strain values. Height of the soil column below each critical structure is the embedment depth plus two times the largest foundation plan dimension. Because the median and mean +/- 1 sigma value profiles were determined as layered models, the nearest bounding values to the V_{eq} soil column depths were used to envelope the V_{eq} value (Table 2.5.2-207).

2.5.2.4 SITE RESPONSE ANALYSIS

In calculating the probabilistic ground motions at the Unit 3 Site, the surface motions must be hazard consistent (i.e., the annual exceedance probability of the soil UHRS should be the same as the rock UHRS) to provide a reasonable basis for implementing performance based design. In NUREG/CR-6728, several site response approaches are recommended to produce soil motions consistent with the rock outcrop hazard. These approaches incorporate site-specific aleatory variabilities of soil properties into the soil motions. NUREG/CR-6728 identified four basic approaches for determining the UHRS at a soil site. The approaches range from a PSHA using ground motion attenuation relations developed for the specific site (or location) of interest (Approach 4) to scaling the rock UHRS on the basis of a site response analysis using a broadband input motion (Approach 1). Conceptually, Approach 4 is the ideal approach and other approaches are approximations to it. To compute the site-specific ground-shaking hazard at the Unit 3 Site the more accurate Approach 3 was implemented rather than the simpler deterministic Approaches 1 or 2 (A or B). These approaches are described below.

2.5.2.4.1 Approaches to Perform Site Response

NUREG/CR-6728 describes four approaches to develop site-specific design motions or hazard. These four approaches are characterized by increasing accuracy from Approach 1 to Approach 4, defined as preserving the desired probability in the site-specific hazard or motions (hazard-consistent) as well as accommodating site-specific aleatory and epistemic variabilities.

Approach 1: This approach is fundamentally deterministic and involves using the outcrop UHRS to drive the overlying site-specific soil column(s). By definition it assumes a rock outcrop hazard (UHRS) but has no mechanism to conserve the outcrop APE. For cases where the hazard is dominated by earthquakes with significantly different **M** at low and high (or intermediate) structural frequencies, the outcrop UHRS may be quite broad (unlike any single earthquake), resulting in unconservative high-frequency motions (too nonlinear in site response). Even if only a single earthquake is the major contributor at all structural frequencies, variabilities (aleatory variability about median attenuation relations and use of multiple relations) incorporated in the hazard analysis may result in a broad spectrum, again unlike any single earthquake. For these reasons, this approach is discouraged in NUREG/CR-6728 and Approach 2, an alternative semi-deterministic method, is preferred over Approach 1.

Approach 2: This approach is intended to avoid the broad-band control motion of Approach 1 and uses low- and high-frequency (and intermediate-frequency if necessary) deterministic spectra computed from the weighted attenuation relations used in the PSHA or, alternatively, from the rock spectral shape developed in NUREG/CR-6728, and scaled to the UHRS at the appropriate frequencies (e.g., RG 1.165). It is important to note the use of a weighted mean attenuation relation to develop control motions is considered inappropriate for two principal reasons. First, the composite relation blends both single- and double-corner source models, resulting in site response unlike any single earthquake. Second, use of a single spectral shape as control motions ignores the increased epistemic variability implicit in the potential differences in site response for single- and double-corner source models. Potential impacts are likely to be greatest for deep and/or highly nonlinear soils.

The scaled motions, computed for the modal deaggregation **M** and *D* are then used as control motions to develop multiple (typically 2 to 3) mean transfer functions based on randomized soil columns. The mean transfer functions are then enveloped with the resulting single envelope transfer function applied to the outcrop (rock or soil) UHRS. This method was termed Approach 2A in NUREG/CR-6728. The use of mean (rather than median) transfer functions followed by enveloping is an empirical procedure to conservatively maintain the outcrop exceedance probability of NUREG/CR-6728 and NUREG/CR-6769. Hazard consistency is typically maintained to a mean APE of about 10^{-4} and may be slightly unconservative under Approach 2A at high frequency and for a mean APE of 10^{-5} and lower, particularly for highly nonlinear sites.

For cases where there may be a wide magnitude range contributing to the hazard at low or high frequency and (or) the site has highly nonlinear dynamic material properties, low, medium, and high **M** control-motion spectra may be developed at each frequency of interest. A weighted mean transfer function (e.g., weights of 0.2, 0.6, and 0.2 reflecting 5%, mean, and 95% **M** contributions, respectively) is then developed at each structural frequency of interest. Following Approach 2A, the weighted-mean transfer functions for each frequency of interest are then enveloped with the resultant applied to the outcrop UHRS. This more detailed analysis procedure was termed Approach 2B. Comparisons detailed in NUREG/CR-6769 indicate that Approach 2B is adequately conservative at APEs down to 10^{-4} with respect to Approach 4.

Another potential drawback to Approach 2 is the ambiguity in accommodating site epistemic variability. Because epistemic variability is treated by averaging multiple hazard curves over probability in a PSHA (as well as in Approach 3), it is clear that simple averaging of transfer functions is not appropriate and is likely unconservative. Enveloping mean transfer functions reflecting alternate site dynamic models remains the only alternative but may result in overly conservative estimates of motions or significantly lower probability than desired.

Approach 3: This approach is a fully probabilistic analysis procedure which moves the site response, in an approximate way, into the hazard integral. The approach is described by Bazzurro and Cornell (Reference 2.5.2-224) and NUREG/CR-6769. In this approach, the hazard at the soil or rock surface is computed by integrating the hazard curve developed by a PSHA at a generic rock or soil outcrop with the probability distribution of the amplification factors or transfer functions (Reference 2.5.2-225 and Reference 2.5.2-226) reflecting site-specific dynamic material properties. The potential effects of magnitude on site response are accommodated with multiple suites of transfer functions reflecting **M** deaggregation at each structural frequency, as well as APEs of interest.

In this study, the soil site-specific amplification is characterized by suites of frequency-dependent amplification factors that account for nonlinearity in soil response. Approach 3 involves approximations to the hazard integration using suites of transfer functions which result in complete hazard curves at the ground surface for specific ground motion parameters (e.g., spectral accelerations) and a range of structural frequencies.

It is important to note that there are two ways to implement Approach 3: either by integration method or by simply modifying the attenuation relation ground motion value during the hazard analysis with a suite (distribution) of transfer functions (Reference 2.5.2-224). Both approaches will tend to double count site aleatory variability, once in the suite of transfer function realizations and again in the aleatory variability about each median attenuation relation. The full integration method tends to lessen any potential impacts of the large total site aleatory variability (Reference 2.5.2-220).

Potential conservatism introduced by double counting site aleatory variability may be reduced by removing the site-specific aleatory variability (sigma of the transfer functions) from the resulting hazard curves. This can easily be done using the analytical Approach 3 approximation given in Reference 2.5.2-202 and Reference 2.5.2-220 and setting the slope of the transfer function to zero. The equation for amplitude becomes:

$$A_C = Ae^{\frac{-k\sigma^2}{2}} \qquad (2.5.2\text{-}1)$$

where A_C is the corrected amplitude at a given APE, k is the slope (log) of the hazard curve, and σ is the standard deviation of the transfer function. For hazard curve slopes about 3 and sigma in the 0.2 to 0.3 range, the correction (reduction) is about 10%. This correction can be applied to either implementations of Approach 3. Alternatively, in the implementation of Approach 3 wherein attenuation relations are modified one can simply use the median transfer function rather than the full distribution or remove the transfer function sigma from the attenuation relation aleatory variability and use the full distribution. Any of these corrections will approximately remove potential double counting of site aleatory variability.

A distinct advantage of Approach 3 is the proper incorporation of site epistemic variability. Multiple hazard curves may be developed reflecting multiple site models (e.g., velocity profiles, G/G_{max}, and hysteretic damping curves) which are then averaged over probability to develop mean, median, and fractile estimates.

Additionally, vertical hazard curves may also be developed that are consistent with the horizontal by employing distributions of V/H ratios (transfer functions) to the resulting site-specific horizontal hazard curves.

Approach 3, as used to complete the Unit 3 analysis, does not require the use of an acceleration time history to develop the FIRS at the various foundation levels.

Approach 4: Approach 4 entails the use of site-specific attenuation relations which incorporate the site-response characteristics of the site. The PSHA is performed using these site-specific relations for the specified APE. The relations accommodate site-specific and perhaps region-specific median estimates as well as site/region specific aleatory variabilities about the median. As a result, potential double counting site variability with either of the Approach 3 approximations (integrating of suites of transfer functions outside the hazard integral or modifying generic attenuation relations with transfer functions within the hazard integral) is avoided. Approach 4 is considered the most accurate as it is intended to accommodate the appropriate amounts of aleatory variability into site- and region-specific attenuation relations. Epistemic variability is appropriately captured through the use of multiple attenuation relations. Approach 3 is considered to be a fully probabilistic approximation to Approach 4.

2.5.2.4.2 Implementation of Approach 3

Approach 3 was selected for use in this analysis because it satisfies the requirement for a performance-based method called for in RG 1.208, unlike approaches 1 and 2 which do not include transfer functions and do not appropriately consider aleotoric uncertainty. Approach 3 is hazard-consistent and most closely approximates strong ground motion shaking. Approach 4, while performance-based, is a theoretical approach that is impractical to implement under current standards of practice.

For Approach 3, the following steps were taken for the Unit 3 Site:

- Randomization of base case site-dynamic material properties to produce a suite of velocity profiles as well as G/G_{max} and hysteretic damping curves that incorporate site randomness.
- Computation of transfer functions (amplification for horizontal motions and V/H ratios for vertical motions) as characterized by a distribution for each set of base case site properties using the RVT-based equivalent-linear site response model.
- Based on the deaggregation (Section 2.5.2.2) transfer functions were computed for **M** 8.0 (single and double corner source models) and **M** 5.1 using the omega-square source model and CEUS parameters.
- Full integration of the generic hard rock Mississippi embayment mean hazard curves with transfer function factors to arrive at a distribution of

site-specific horizontal and vertical hazard curves reflecting site aleatory and epistemic variabilities.

- Computation of site-specific UHRS and DRS.

2.5.2.4.2.1 Development of Transfer Functions

Transfer functions include spectral ratios (5% damping) of horizontal soil motions to hard rock (Table 2.5.2-208) as well as vertical-to-horizontal ratios (5% damping) computed for the site-specific soil profiles for a suite of expected peak accelerations (0.01 to 1.50 g; Table 2.5.2-208).

To approximate nonlinear soil response for horizontal motions, an RVT based equivalent-linear approach was used (Reference 2.5.2-227). The approach has been validated by modeling strong ground motions recorded at over 500 sites and 19 earthquakes for a wide range in site conditions and loading levels (up to 1g) (Reference 2.5.2-217 and Reference 2.5.2-227). Comparisons with fully nonlinear codes for loading levels up to 1g showed the equivalent-linear approach adequately captured both high- and low-frequency soil response in terms of 5% damped response spectra. The validations revealed that the equivalent-linear approach significantly underestimated durations (time domain) of high-frequency motions at high loading levels compared to both fully nonlinear analysis as well as recorded motions. However, for 5% damped response spectra the equivalent-linear approach performed as well as fully nonlinear codes and was somewhat conservative near the fundamental column resonance (Reference 2.5.2-217). For vertical motions, site-specific V/H ratio were developed using the point-source model to compute both horizontal (normally incident SH-waves) and vertical (incident inclined P- SV-waves) (Reference 2.5.2-216 and Reference 2.5.2-228).

Empirical western North America (WNA) V/H ratios were included in the development of vertical motions in addition to site-specific point-source simulations. The use of WNA empirical V/H ratios implicitly assumes similarity in shear- and compression-wave profiles as well as nonlinear dynamic material properties between deep firm soils in WNA and site-specific soil columns. While this may not be the case for the average WNA deep firm soil (Reference 2.5.2-229), the range in soil conditions sampled by the WNA empirical generic rock and soil relations likely accommodates the local Holocene and Pleistocene soils. Additionally, because the model for vertical motions is not as thoroughly validated as the model for horizontal motions (Reference 2.5.2-216, Reference 2.5.2-227, and Reference 2.5.2-229), inclusion of empirical models is warranted. The additional epistemic variability introduced by inclusion of both analytical and empirical models also appropriately reflects the difficulty and lack of industry consensus on developing (modeling) site-specific vertical motions (Reference 2.5.2-219). In the implementation of Approach 3 to develop vertical hazard curves, the epistemic variability is properly accommodated in the vertical mean UHRS, reflecting a weighted average over multiple vertical hazard curves computed for each model. The vertical DRS (and UHRS's) then maintain the desired risk and hazard levels, consistent with the horizontal DRS and UHRS's.

2.5.2.4.2.1.1 Horizontal Amplification Factors

The omega-square point-source model (Reference 2.5.2-214 through Reference 2.5.2-219, NUREG/CR-6728, Reference 2.5.2-227, and Reference 2.5.2-229 through Reference 2.5.2-231) was used to generate hard rock outcrop as well as site-specific soil motions for a range in expected hard rock peak acceleration values (0.01 to 1.50 g; Table 2.5.2-208). For this approach, use of a validated model (Reference 2.5.2-202, Reference 2.5.2-214, Reference 2.5.2-225 and Reference 2.5.2-227), or alternatively, use of the hard rock response spectral shapes presented in Reference 2.5.2-219 as control motions to develop transfer functions is much preferred over the use of scaled spectra developed from the weighted attenuation relations used in computing the hard rock hazard. The scaled spectra from the weighted attenuation relations (e.g., 1 to 2 Hz and 5 to 10 Hz deaggregation earthquakes) appropriately reflect realistic earthquake spectra independently (components of the weighted average) but the combination over single- and double-corner source models results in a composite spectrum which is unrealistic and unlikely to occur in a real earthquake. As a result the composite weighted and scaled spectrum may result in site response which is unrealistic and result in inappropriate and largely unknown exceedance probabilities.

Additionally, use of a weighted mean spectrum over single- and double-corner source models would not accommodate the effects of epistemic variability in source central eastern North America processes on site response, resulting in unconservative (higher probability than desired) design motions, everything else being equal. The correct approach to achieve hazard consistent spectra is development of separate transfer functions for single- and double-corner source models, computation of hazard curves for each, followed by weighting and averaging over probability to develop mean hazard curves. The weighting should naturally reflect the relative contributions of single- and double-corner source models comprising the attenuation relations used in the hard rock PSHA.

Two sets of modulus reduction and damping curves were run for each base case profile (1 through 4, Figures 2.5.2-212 and 2.5.2-213). One set (Set 1) is based on similarities between the EPRI cohesionless soil curves with dynamic laboratory test data (Section 2.5.4.2.2.3). The second set (Set 2) reflects an empirical correction for sample disturbance based on the ratio of laboratory (at in-situ confining stress) -to-field shear-wave velocities (Section 2.5.4.2.2.3). This correction, which scales the reference strain to larger values by dividing by the laboratory-to-field shear wave velocity ratio results in more linear (and lower damping) curves for ratios less than 1.0. For ratio exceeding 1.0, reflecting the influence of large scale fractures on shear-wave velocity not sampled in laboratory testing, the correction results in more nonlinear curves (Reference 2.5.2-217). The two sets of curves, reflecting epistemic variability in in-situ dynamic material are run for each base case profile and each **M** (6.25, 7.69; Table 2.5.2-208), as well as single- and double-corner source models. The two source models and multiple magnitudes are used to accommodate potential effects of spectral shape on soil amplification (Reference 2.5.2-219). The moment magnitudes (**M**) are listed in Table 2.5.2-208 and reflect mean controlling earthquakes across structural frequency at APE in the range of 10^{-4} to 10^{-7} yr^{-1}. Since site amplification does not strongly depend on **M** (Reference 2.5.2-219 and Reference 2.5.2-232), the selection of **M** 6.25 and **M** 7.69 is based on mean deaggregation and is intended to cover the dominate range in **M** contributing to hazard at the site for the APE of interest (10^{-4} to 10^{-5} yr^{-1}, Figures 2.5.2-210 and 2.5.2-211). Model distances reflect more realistic distances and are dominated by New Madrid (**M** 7.69) at a distance of 470 km. At high frequency and low APE, the distance is within 50 km, approaching 10 km, with a mean **M** of about 6.0 to 6.5.

2.5.2.4.2.1.2 Site Aleatory Variability

To accommodate random fluctuations in velocity, depth to basement, G/G_{max}, and hysteretic damping values across the site, multiple realizations are developed for dynamic material properties. The profile randomization scheme for shear-wave velocity was developed by Dr. Gabriel Toro in 1993 (Reference 2.5.2-216) and updated in 1997 (Reference 2.5.2-227). This scheme is based on a variance analysis of over 500 measured shear-wave velocity profiles and varies both velocity and layer thickness. The model includes a velocity distribution at depth coupled with a velocity correlation with depth. The depth correlation is intended to eliminate unnatural velocity variations at a given depth that are independent of realizations above and below. Driven by measured velocities, the correlation length (distance) increases with depth with a corresponding decrease in the velocity COV at a given depth. Profiles vary less as depth increases and become more uniform, on average.

For the Unit 3 analysis, the profile was randomized to a depth of about 3000 ft. (1 km) with depth to basement randomized from about 2000 to about 4000 ft. (700 to 1300 m) assuming a uniform distribution. The mean depth was selected to provide appropriate amplification to frequencies as low as 0.2 Hz, the lowest frequency defined by the hard rock hazard (Section 2.5.2.2). A footprint correlation model was assumed which has a shear-wave velocity COV near the surface of about 0.25, decreasing to about 0.15 at depth (Š300 ft). The footprint model is based on variability in velocity sampled in borings over a typical large footprint, about 300 by 600 ft.

To accommodate random fluctuations in compression-wave velocity when modeling vertical motions (Section 2.5.2.3), Poisson ratio is held constant at the base-case values and random compression-wave velocities are then generated based on shear-wave velocity realizations and base-case Poisson ratios. In reality Poisson ratio will vary but is likely correlated with shear-wave velocity. As a result, varying Poisson ratio when properly correlated with shear-wave velocity will likely not result in a greater variation in compression-wave velocity than assumed here. Additionally, variation in compression-wave velocity has a much less significant effect on motions than shear-wave velocity as the wavelengths typically are 2 to 5 times greater. A correlated shear- and compression-wave profile randomization scheme is desirable but not yet available.

To capture random fluctuations in modulus reduction and damping curves, values are randomized assuming a log-normal distribution consistent with shear-wave velocity and material damping (Reference 2.5.2-216). Based on random variations in laboratory dynamic testing for soils of the same type or classification (Reference 2.5.2-216) a σ_{ln} of 0.15 and 0.3 is used for G/G_{max} and hysteretic damping respectively. These standard deviations are taken at a cyclic shear-strain of 0.03%, where the G/G_{max} curves typically show significant reduction. Suites of curves are generated by sampling the distribution, applying the random perturbation to the base-case (initial) curve at 0.03% shear strain, and preserving the shape of the base case curve to generate an entire random curve. Bounds are placed at ±2s over the entire strain range to prevent nonphysical excursions.

Shear-wave damping is separately (independently) randomized following the same procedure. The randomization code can accommodate coupling or correlation of any degree (-1 to 1) between modulus reduction and hysteric damping, which is expected to occur between mean or base-case curves reflecting different material type curves. However, for random fluctuations within the same material type the correlation is likely low; that is, a randomly linear curve is not necessarily associated with a randomly low damping. Additionally, because modulus reduction is far more significant than material damping in site response (Reference 2.5.2-233), the issue is not significant.

2.5.2.4.2.1.3 Horizontal Transfer Functions

To illustrate the soil-to-rock transfer functions, Figure 2.5.2-214 shows factors (median and ±1s values) computed for **M** 7.69 at the suite of expected hard rock peak acceleration values (0.01 to 1.50 g; Table 2.5.2-208) for Profile 1, reactor ground surface and curve set 1 (uncorrected). This figure clearly shows that the effects of nonlinearity with high-frequency factors decrease with increasing loading levels. For example, at 1.5g and 30 Hz, the median factors decrease to about 0.25. This large deamplification may represent a shortcoming of the equivalent-linear approach that reflects a frequency independent softening. However, careful validations with recorded motions at high loading levels (Reference 2.5.2-216, Reference 2.5.2-227, and Reference 2.5.2-232) showed no indication of equivalent-linear inadequacy in modeling overall levels of response spectra of recorded motions, particularly at high frequency. While these local particular soils were not sampled in the validations, the overall adequacy of the equivalent-linear approach has been validated for deamplification to levels approaching 0.5, which is set as a lower bound in all analyses.

At 1% g for **M** 7.69 the distance is over 400 km (Table 2.5.2-208), depleting much of the high-frequency energy (> 5 Hz) and resulting in a constant level of amplification at about 3. The fundamental column resonance is seen near 0.2 Hz with the first overtone near 0.5 Hz, the lowest frequency for which the hard rock hazard is defined.

To demonstrate the effects of magnitude, Figure 2.5.2-215 shows median factors developed for **M** 7.69 and **M** 6.25. At low loading levels the differences are at high-frequency and driven by large variation in distance (a factor of about 2; Table 2.5.2-208), decreasing the energy for **M** 7.69 at both hard rock and soil outcrop. For loading levels at 0.2g and above, the differences are mainly at high-frequency and range about 5 to 10%.

To examine the potential impacts of single- and double-corner source models on site response, Figure 2.5.2-216 shows a comparison for **M** 7.69 (the **M** which would have the largest effect). For loading levels below about 0.5g, the differences are about 5% and increase significantly at higher loading levels. For softer and or more nonlinear deep profiles, the differences would be expected to be greater.

2.5.2.4.2.1.4 Development of V/H Ratios

To model vertical motions, incident inclined P-SV waves are modeled from the source to the site using the plane-wave propagators of Silva (Reference 2.5.2-228) assuming a shear-wave point-source spectrum (Reference 2.5.2-216, Reference 2.5.2-227, and Reference 2.5.2-229). The angles of incidence are computed by two-point ray tracing through the crust and site-specific profile. To model site response, the near-surface V_P and V_S profiles (Section 2.5.2.3) are placed on top of the crustal structure (Table 2.5.2-208), the incident P-SV wavefield is propagated to the surface, and the vertical motions are computed.

For typical crustal structures without strong near-surface V_P gradients and at close distances, the predominant motion on the vertical component is principally due to the SV wavefield. However, because there is usually a large V_P gradient (larger for P-waves than for S-waves as Poisson's ratio generally decreases with depth) in a soil column (particularly deep profiles), the vertical component is generally controlled by the compressional wavefield at high frequency (Reference 2.5.2-229).

In the current implementation of the equivalent-linear approach to estimate V/H response spectral ratios, the horizontal component analyses are performed for vertically-propagating shear waves. To compute the vertical motions, a linear analysis is performed for incident inclined P-SV waves using low-strain V_P and V_S derived from the base-case profiles (Section 2.5.2.3). The P-wave damping is assumed to be equal to the low strain S-wave damping (Reference 2.5.2-234). The horizontal component and vertical component analyses are assumed to be independent.

The approximations of linear analysis for the vertical component and uncoupled vertical and horizontal components have been validated in two ways. Fully nonlinear modeling using a 3D soil model showed that the assumption of largely independent horizontal and vertical motions for loading levels up to about 0.5g (soil surface, horizontal component) for moderately stiff profiles was appropriate (Reference 2.5.2-216). Additionally, validation exercises with recorded motions were conducted at over 50 sites which recorded the 1989 **M** 6.9 Loma Prieta and

1992 **M** 6.7 Northridge earthquakes. These validations showed the overall bias and variability for vertical motions was acceptably low for engineering applications but was higher than that for horizontal motions (Reference 2.5.2-216 and Reference 2.5.2-229). An indirect validation was also performed by comparing V/H ratios from Western United States (WUS) empirical attenuation relations with model predictions (Reference 2.5.2-229) over a wide range in loading conditions (Reference 2.5.2-229). The results showed a favorable comparison with the model and were conservative in predictions at high frequency, particularly at soil sites and at high loading levels. For engineering design applications, this reflects a conservative and therefore acceptable bias. In the V/H comparisons with empirical relations, the model also showed a small underprediction at low frequency ($\leq$ 1 Hz) and at large distance ($\geq$ 20 km). To accommodate this potential unconservatism, a lower bound of 0.4 is used, based on WNA empirical attenuation relations.

To model the site-specific V/H ratios, the same **M**, stress drops, and suite of distances are used as in developing horizontal transfer functions (Table 2.5.2-208). For the vertical analyses, a total kappa value of 0.02 sec, half that of the horizontal, was used. This factor of 50% is based on observations of kappa at strong motion sites (Reference 2.5.2-220), validation exercises (Reference 2.5.2-216), and the observation that the peak in the vertical spectral acceleration (5% damped) for WNA rock and soil sites is generally near 10 to 12 Hz compared to the horizontal motion peak which occurs at about 5 Hz, conditional on **M** 6.5 at a distance of about 10 to 30 km. This difference of about 2 in peak frequency is directly attributable to differences in kappa of about 2.

As with the horizontal analyses, multiple base cases were run: site-specific velocity profiles 1 to 4 for each structure location (Figure 2.5.2-213) as well as **M** 6.25 and **M** 7.69 and both single- and double-corner source models. Multiple G/G_{max} and hysteretic damping curves were not run for the verticals as the analysis is linear, using the lowest small strain damping between uncorrected and corrected curves (Section 2.5.4.2.2.3). However V/H ratios do reflect multiple base-case modulus reduction and hysteretic damping curves in the denominator, or horizontal motions.

An example of the site-specific V/H ratios, Figure 2.5.2-217 shows median estimates computed with the stochastic model for **M** 6.25 single corner-frequency model. The profile is the reactor ground surface with site-specific profile 1 (Figure 2.5.2-213) and curve Set 1 (uncorrected). Distances range from 190 km (0.01g, horizontal motion) to 7 km (0.5g, horizontal motion), which adequately accommodates the hazard deaggregations (Figures 2.5.2-210 and 2.5.2-211). The ratios range from about 0.3 to 0.4 at low frequency ($\leq$ 2 Hz) to about 3 near the peak at 30 Hz. As the verticals are run linearly, the increase in the ratio as loading level increases (source distance decreases) is due to reduced motions in the horizontal but also due to a decrease in incidence angle for the P-SV wavefield, dominated by compression-waves at high frequency.

As previously discussed, the model predictions of V/H ratios may be slightly unconservative at low-frequency and conservative at high frequency. While it is important to include site-specific effects on the vertical hazard, potential model deficiencies are compensated with inclusion of empirical V/H ratios computed from WNA generic rock and soil site attenuation relations. Additionally a lower bound of 0.4 is placed on all V/H ratios based on examination of the full suite of **M**, *D*, and site conditions for which empirical relations are currently available.

For the empirical V/H ratios, Figure 2.5.2-218 shows comparable results to Figure 2.5.2-217 in terms of **M**. Distance bins differ between the empirical and analytical V/H ratios because the empirical ratios use a generic suite of distances used on many projects while the analytical V/H ratios are region specific. Since the ratios vary slowly with distance, the differences in distances are not significant.

It is important to note that the site-specific and generic model V/H ratios peak at very different frequencies (30 Hz and about 12 Hz respectively) with the site-specific having a much higher peak at high loading levels. Use of an empirical V/H ratio alone would underestimate the vertical hazard at high frequency, provided the model predictions are reasonably accurate.

In assigning the V/H ratios in the Approach 3 analysis, the source **M** and *D* change significantly as probability changes. To accommodate the deaggregation in integrating the horizontal hazard with the distributions of V/H ratios, the **M** and *D* selection followed that listed in Table 2.5.2-209. Since the V/H ratios vary slowly with distance, only a smooth approximation to the hazard deaggregation is necessary. To adequately capture the change in **M** and *D* with APE, only two distance bins were required: 8 km and 57 km for the empirical and 10 km and 190 km for the analytical (Table 2.5.2-209).

2.5.2.4.2.1.5 Weights

For each of the ground motion locations, reactor ground surface (GMRS), reactor ground surface (top 50 ft. replaced by fill), reactor embedment (FIRS), and CB embedment (FIRS), site-specific hazard curves were developed for multiple base-cases to accommodate site-specific epistemic and aleatory variabilities. As previously discussed, four base case profiles reflecting alternative extrapolations of the deep profile (Figure 2.5.2-213) were used along with two sets of modulus reduction and damping curves. Additionally, multiple magnitudes (**M** 6.25 and **M** 7.69) reflecting the hazard deaggregation were run along with single- and double-corner source models, to capture the effects of differences in spectral shape on site response.

For the verticals, both site-specific analytical (stochastic point-source) and empirical (generic rock, soil) V/H ratios were used to accommodate epistemic variability as well as potential model deficiencies in V/H ratios. The weights for each of the cases are summarized in Table 2.5.2-210. Basically, alternative models received equal weight for all cases. The exception is the rock/soil mix between embedment (Reactor Embedment and CB Embedment) and soil surface

(Reactor Ground Surface) locations. For the soil surface motions (Reactor Ground Surface), site-specific shear-wave velocities are somewhat higher (stiffer) than typical WNA deep firm soils reflected in the empirical V/H ratios (Reference 2.5.2-216, Reference 2.5.2-227, and Reference 2.5.2-229). However, the local soils are likely within the range of profiles sampled by WUS recordings and soil empirical V/H ratios are given a weight of 0.5.

For the embedment locations, the soil velocities are high for typical WNA soils so rock V/H ratios were included with a 20% weight (Table 2.5.2-210). The weights between rock and soil V/H are based on judgment regarding overall stiffness between generic WNA rock and soil sites and the embedment (soil removed) profiles.

2.5.2.4.2.1.6 Design Ground Motions

Horizontal and vertical UHRS developed for the reactor ground surface are shown in Figure 2.5.2-219 along with the horizontal hard rock UHRS, all at APE 10^{-4} yr^{-1}.

To provide realistic design spectra for frequencies below 0.5 Hz, the lowest frequency specified by the hard rock hazard (Section 2.5.2.2), a spectral ordinate at 0.1 Hz was added to the hard rock UHRS. Following Equation 2.5.2-2 (Reference 2.5.2-235)

$$\log_{10}(T) = -1.25 + 0.3m \qquad (2.5.2\text{-}2)$$

which provides an estimate of the transition period from approximately constant spectral velocity to constant spectral displacement (Reference 2.5.2-235) at about 12 sec for **M** 7.7, constant spectral velocity was assumed from 0.5 to 0.1 Hz. Comparisons of the extrapolation from 0.5 to 0.1 Hz with spectral shapes computed from recordings of large **M** earthquakes (**M** > 7) (NUREG/CR-6728) confirmed the assumption of constant spectral velocity while suggesting the possibility of conservatism at very low frequency. While the exact probability of spectral ordinates for frequencies below 0.5 Hz remains unknown, the likelihood of conservatism in the extrapolation suggests that exceedance probabilities below 0.5 Hz are lower than those at higher frequencies (e.g., 0.5 Hz and above).

The large site amplification over hard rock approaches a factor of 3 at low frequency with a moderate increase in peak acceleration as well a decrease at 25 Hz compared to hard rock motions. It is important to note that discrete frequencies are at 0.1, 0.2, 1.0, 2.5, 5.0, 10.0, 25.0, and 100.0 Hz. A soil spectral shape has not been used to interpolate as this process is somewhat ambiguous due to the change in contributing **M** and *D* as well as the effects of aleatory and epistemic variability on UHRS spectral shapes.

The vertical UHRS, through benefit of Approach 3, is at the same exceedance level as the horizontal and remains below the horizontal across structural frequency. This is expected as the distance deaggregation shows dominant earthquakes well beyond 100 km (Figures 2.5.2-214 and 2.5.2-215 and Table 2.5.2-209).

The 0.1 Hz soil motion was developed following Approach 3 (Section 2.5.2.4.1) applied to the hard rock 0.1 Hz extrapolated spectral ordinate. For appropriate soil amplification, the broad (through the randomization process) fundamental column resonance (3000 ft. column, Section 2.5.2.4.2.1) near 0.2 Hz (Figure 2.5.2-212) was applied at 0.1 Hz. Extending the soil depth beyond 10,000 ft. would move the resonance to frequencies below 0.1 Hz, resulting in amplification near 3 at 0.1 Hz. The peak in the amplification near 0.2 Hz (Figure 2.5.2-212) was used to partially compensate for the potential contribution of surface wave amplification exceeding body wave amplification at low frequency. This conservatism, combined with a likely conservatism in the hard rock spectral extrapolation to 0.1 Hz, are intended to approximately preserve the exceedance probability for structural frequencies below 0.5 Hz, the lowest frequency defined by the PSHA (Section 2.5.2.2). Both empirical attenuation relations (Reference 2.5.2-236), as well as numerical modeling of specific earthquakes (Reference 2.5.2-226), suggest that most of the low-frequency amplification can be adequately modeled as a one dimensional effect for amplitudes, but certainly not for durations (Reference 2.5.2-237).

At APE 10^{-5} yr^{-1}, Figure 2.5.2-220 shows horizontal and vertical UHRS's along with the hard rock UHRS. Similar trends to the 10^{-4} APE motions are seen with the vertical component slightly closer to the horizontal, reflecting overall source distances and **M** decreasing as probability decreases. This trend is readily apparent in the implied V/H ratios (H UHRS/V UHRS) shown in Figure 2.5.2-221 for APE 10^{-3} to 10^{-6} yr^{-1}. The implied V/H ratios for Reactor Ground Surface with the top 50 ft. replaced by fill are lower than the corresponding Reactor Ground Surface ratios. For probabilities in the range of 10^{-3} to 10^{-4} yr^{-1} the V/H ratios are nearly constant. At 10^{-5} and 10^{-6} APE, **M** and *D* decrease, increasing the V/H ratio. For 10^{-6} APE at 5 Hz and above the hazard is dominated by source distances at about 10 km and **M** 6.25 (Table 2.5.2-209).

For the other two locations, reactor embedment and CB embedment, similar trends in horizontal and vertical UHRS's and V/H ratios are seen (Figures 2.5.2-219 through 2.5.2-227).

Figure 2.5.2-228 shows the effects of extrapolating the four site-specific profiles to depths beyond which site geophysical data constrain the velocities (Figures 2.5.2-212 and 2.5.2-213). The horizontal UHRS is shown at APE of 10^{-4} yr^{-1} for Reactor Ground Surface compared to UHRS developed separately for profiles 1, 2, 3, and 4. The range above or below the combined UHRS (dotted line) averages a few percent. As expected, the impacts of the deep velocities are not significant over the frequency range of interest, provided the total kappa value remains fixed at 0.04 sec.

The UHRS computed for both sets of dynamic material model strain dependencies (G/G_{max} and hysteretic damping) are shown in Figures 2.5.2-220 and 2.5.2-230 for APE of 10^{-4} and 10^{-5} respectively. Model 1, uncorrected curves, and Model 2, corrected curves result in very similar motions showing that at this site the potential impacts of sample disturbance are quite small.

Finally, comparisons between the UHRS at 10^{-4} APE for all four locations [Reactor Ground Surface, Reactor Embedment, Reactor Ground Surface (top 50 ft. replaced by fill), and CB Embedment] are shown in Figures 2.5.2-231 and 2.5.2-232 for the horizontal and vertical components respectively. Because the foundation of the FWSC is at site grade, it is bounded by the Reactor Ground Surface analysis. The figures show that effects of the soil at Reactor Ground Surface increases the low-frequency ($\leq$ 5 Hz) motions while amplification and soil nonlinearity trade-off at high frequency. For the verticals (Figure 2.5.2-232) Reactor Ground Surface exceeds the embedment sites over the entire frequency range. This difference between horizontal and vertical UHRS with respect to the three site locations is partially due to the horizontal component but principally the effect of different weights used for the empirical rock and soil V/H ratios (Table 2.5.2-210). For Reactor Ground Surface, only empirical soil V/H ratios were used while the other sites included a 20% weight on empirical rock V/H ratios, which are significantly lower than soil V/H ratios (Reference 2.5.2-238 and Reference 2.5.2-239).

2.5.2.5 GMRS AND FIRS (SSE)

The site-specific design GMRS for Reactor Embedment risk informed horizontal and vertical design spectra at APE of 10^{-4} yr^{-1} are shown in Figures 2.5.2-233 and 2.5.2-234. A comparison of the GMRS and associated Foundation Input Response Spectra (FIRS) is shown in Figure 2.5.2-235. FIRS for Reactor Ground Surface with and without fill and CB Embedment are shown individually in Figures 2.5.2-236 and 2.5.2-237 respectively. In all cases the vertical and horizontal performance goals are consistent and at the desired levels.

GGNS DEP 2.0-1

GGNS ESP VAR 2.0-1

The site-specific GMRS/FIRS are compared with CSDRS in Table 2.0-201 and shown on Figures 2.5.2-234 and 2.5.2-235. The GMRS/FIRS are enveloped by the CSDRS except for exceedance below 0.2 Hz for the horizontal motion and below about 0.15 Hz for the vertical motion. This exceedance does not have an adverse impact on the seismic design of the ESBWR Standard Plant and is addressed in Section 3.7.1.1.4. See Table 2.0-201 for a comparison of the DCD and site-specific values and discussion of the DCD departure. Table 2.0-202 provides a variance against the ESP Design Response Spectrum site characteristic.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

The site peak ground acceleration (PGA) as shown in Figure 2.5.2-233 where the GMRS intersects the 100 Hz frequency is 0.11g.

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GGNS COL 2.0-27-A

GGNS ESP VAR 2.0-1

GGNS ESP COL 2.5-3

TABLE 2.5.2-201
PARAMETERS OF TWO GULF OF MEXICO EARTHQUAKES INCLUDED IN UNIT 3 PSHA

	Event 1[2]	**Event 2[3]**
Date	February 10, 2006	September 10, 2006
Time	04:14:17 UTC	14:56:07 UTC
Location[1]	27.60° North, 90.16° West	26.33° North, 86.58° West
Depth of focus	5 km	10 km
Highest intensity	n/d	n/d
Magnitude	5.2	5.6
Seismic moment	n/d	n/d
Source mechanism	long-term tectonic stresses	long-term tectonic stresses
Source dimensions	n/d	n/d
Distance from site	497 km (309 mi)	765 km (475 mi)
Strong motion recordings	n/d	n/d

Notes:

(1) Location given in WGS84

(2) Data from Reference 2.5.2-208

(3) Data from Reference 2.5.2-207

GGNS COL 2.0-27-A

GGNS ESP VAR 2.0-1

GGNS ESP COL 2.5-3

TABLE 2.5.2-202
REVISIONS TO MAXIMUM EARTHQUAKE MAGNITUDE DISTRIBUTIONS FOR EPRI (1986) GULF COASTAL SOURCE ZONES

EPRI Earth Science Team	Source Designation	Source Zone Name	M_{max} Distribution (EPRI, 1986)	Updated M_{max} Distribution
			M_{max} (Mb) and Wts.	M_{max} (Mb) and Wts.
Bechtel Group	BZ1	Gulf Coast	5.4 [0.1] 5.7 [0.4] 6.0 [0.4] 6.6 [0.1]	6.11 [0.10] 6.4 [0.40] 6.6 [0.50]
Dames & Moore	20	South Coastal Margin	5.3 [0.8] 7.2 [0.2]	5.52 [0.80] 7.2 [0.20]
Law Engineering	126	South Coastal Block	4.6 [0.9] 4.9 [0.1]	5.52 [0.90] 5.7 [0.10]
Rondout Associates	51	Gulf Coast to Bahamas Fracture Zone	4.8 [0.2] 5.5 [0.6] 5.8 [0.2]	6.11 [0.30] 6.3 [0.55] 6.5 [0.15]
Weston Geophysical Corporation	107	Gulf Coast	5.4 [0.71] 6.0 [0.29]	6.6 [0.89] 7.2 [0.11]
Woodward-Clyde Consultants	B43	Central U.S. Backgrounds	4.9 [0.17] 5.4 [0.28] 5.8 [0.27] 6.5 [0.28]	No Update(1)

Note:

(1) Not revised because the added earthquake events occurred in excess of 270 km outside the source zone (Section 2.5.2.1.1.6)

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-203
CLOSEST APPROACH OF GULF OF MEXICO EARTHQUAKES WITH MB > 5.5 TO BOUNDARY OF EPRI GULF COASTAL SOURCE ZONES

Earthquake	Gulf Coastal Source Zone					
	Bechtel Group Gulf Coast (BZ1)	Dames & Moore South Coastal Margin (20)	Law Engineering South Coastal Block (126)	Rondout Associates Gulf Coast to Bahamas Fracture Zone (51)	Weston Geophysical Corporation Gulf Coast (107)	Woodward-Clyde Consultants Central U.S. Backgrounds (B43)
2006-02-10 Mb 5.52	256 km	-18 km	-63 km	236 km	288 km	-273 km
2006-09-10 Mb 6.11	118 km	-245 km	-157 km	114 km	**138 km**	**-635 km**

Negative values indicate that earthquake occurred outside the source zone.

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-204 (Sheet 1 of 4)
UNIT 3 PSHA RESULTS FOR ROCK SITE CONDITIONS

S_a 0.50 Hz			Fractiles	
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.005	3.80E-03	1.33E-03	3.21E-03	6.20E-03
0.05	1.54E-04	1.23E-06	1.63E-05	2.05E-04
0.1	3.28E-05	6.95E-08	1.05E-06	2.23E-05
0.15	1.14E-05	1.17E-08	2.06E-07	4.64E-06
0.2	4.94E-06	3.05E-09	6.25E-08	1.47E-06
0.3	1.36E-06	3.83E-10	1.10E-08	2.76E-07
0.4	4.99E-07	1.00E-10	2.90E-09	8.25E-08
0.6	1.07E-07	1.00E-10	4.29E-10	1.50E-08
0.8	3.32E-08	1.00E-10	1.00E-10	4.72E-09
1	1.28E-08	1.00E-10	1.00E-10	1.89E-09

S_a 1.0 Hz			Fractiles	
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.005	5.86E-03	3.11E-03	5.32E-03	8.29E-03
0.05	3.40E-04	2.33E-05	1.27E-04	5.97E-04
0.1	6.90E-05	2.02E-06	1.32E-05	9.59E-05
0.15	2.29E-05	4.34E-07	3.03E-06	2.61E-05
0.2	9.67E-06	1.48E-07	1.05E-06	9.23E-06
0.3	2.59E-06	3.21E-08	2.49E-07	1.90E-06
0.4	9.54E-07	9.56E-09	9.42E-08	7.12E-07
0.6	2.18E-07	1.62E-09	2.14E-08	1.81E-07
0.8	7.50E-08	4.35E-10	7.04E-09	6.74E-08
1	3.30E-08	1.53E-10	2.84E-09	3.25E-08

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-204 (Sheet 2 of 4)
UNIT 3 PSHA RESULTS FOR ROCK SITE CONDITIONS

S_a 2.50 Hz		Fractiles		
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.005	8.66E-03	5.54E-03	7.78E-03	1.28E-02
0.05	9.18E-04	1.68E-04	5.90E-04	1.73E-03
0.1	2.16E-04	1.66E-05	9.08E-05	3.95E-04
0.2	3.40E-05	1.98E-06	8.90E-06	4.80E-05
0.25	1.74E-05	9.97E-07	4.35E-06	2.28E-05
0.4	3.92E-06	2.44E-07	1.08E-06	4.47E-06
0.6	1.06E-06	6.78E-08	3.49E-07	1.32E-06
0.8	4.26E-07	2.58E-08	1.54E-07	5.96E-07
1	2.16E-07	1.78E-08	7.98E-08	3.30E-07
1.2	1.26E-07	6.14E-09	4.55E-08	2.00E-07

S_a 5.0 Hz		Fractiles		
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.01	6.98E-03	4.16E-03	6.14E-03	9.79E-03
0.05	1.20E-03	2.73E-04	8.39E-04	2.06E-03
0.1	3.10E-04	3.19E-05	1.43E-04	5.12E-04
0.2	5.49E-05	4.47E-06	1.64E-05	7.39E-05
0.3	1.75E-05	1.53E-06	5.35E-06	2.09E-05
0.4	7.59E-06	7.37E-07	2.74E-06	8.85E-06
0.6	2.40E-06	2.55E-07	1.05E-07	3.11E-06
0.8	1.11E-07	1.26E-07	5.57E-07	1.65E-06
1.2	4.00E-07	4.28E-08	2.12E-07	6.77E-07
1.5	2.31E-07	2.33E-08	1.20E-07	4.10E-07

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-204 (Sheet 3 of 4)
UNIT 3 PSHA RESULTS FOR ROCK SITE CONDITIONS

S_a 10.0 Hz		Fractiles		
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.02	3.96E-03	1.74E-03	3.42E-03	5.83E-03
0.05	1.23E-03	2.31E-04	8.20E-04	2.03E-03
0.1	3.49E-04	3.26E-05	1.41E-04	5.61E-04
0.2	7.29E-05	5.86E-06	2.03E-05	9.16E-05
0.3	2.59E-05	2.34E-06	7.97E-06	2.83E-05
0.5	6.85E-06	7.70E-07	2.80E-06	7.95E-06
0.7	2.98E-06	3.69E-07	1.52E-06	4.10E-06
0.9	1.67E-06	2.26E-07	9.35E-07	2.57E-06
1.2	8.83E-07	1.19E-07	5.12E-07	1.45E-06
1.5	5.45E-07	7.00E-08	3.16E-07	9.35E-07

S_a 25.0 Hz		Fractiles		
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.02	3.59E-03	9.83E-04	2.95E-03	5.62E-03
0.05	1.19E-03	1.09E-04	6.50E-04	1.98E-03
0.1	4.08E-04	2.25E-05	1.12E-04	5.85E-04
0.3	5.15E-05	2.79E-06	1.02E-05	3.79E-05
0.5	1.63E-05	1.14E-06	4.35E-06	1.26E-05
0.7	7.45E-06	6.58E-07	2.50E-06	7.32E-06
0.9	4.19E-06	4.10E-07	1.63E-06	4.77E-06
1.2	2.22E-06	2.45E-07	9.80E-07	3.02E-06
1.6	1.21E-06	1.41E-07	5.76E-07	1.88E-06
2	7.71E-07	8.25E-08	3.65E-07	1.33E-06

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-204 (Sheet 4 of 4)
UNIT 3 PSHA RESULTS FOR ROCK SITE CONDITIONS

Peak Ground Acceleration		Fractiles		
Ground Motion Level (g)	Mean	0.15	0.50	0.85
0.02	1.85E-03	4.47E-04	1.28E-03	3.24E-03
0.1	8.25E-05	5.72E-06	2.05E-05	1.07E-04
0.15	2.99E-05	2.42E-06	8.46E-06	3.29E-05
0.2	1.43E-05	1.42E-06	4.84E-06	1.55E-05
0.25	8.14E-06	8.92E-07	3.29E-06	9.26E-06
0.3	5.23E-06	6.31E-07	2.45E-06	6.61E-06
0.4	2.71E-06	3.67E-07	1.44E-06	3.98E-06
0.6	1.17E-06	1.64E-07	6.71E-07	1.97E-06
0.8	6.74E-07	8.87E-08	3.76E-07	1.21E-06
1.0	4.39E-07	5.00E-08	2.36E-07	8.10E-07

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-205
MEAN UNIFORM HAZARD RESPONSE SPECTRA

Frequency (Hz)	Mean Annual Probability of Exceedance		
	10^{-4}	10^{-5}	10^{-6}
0.5	0.061	0.157	0.328
1.0	0.085	0.198	0.395
2.5	0.133	0.298	0.610
5.0	0.157	0.364	0.834
10	0.174	0.432	1.134
25	0.211	0.617	1.758
PGA	0.091	0.230	0.651

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-206
GRAND GULF CONTROLLING EARTHQUAKES

Mean Annual Probability	Frequency (Hz)	M_C	R_C (km)
10^{-4}	$1\text{-}2.5_{All}$	7.69	417
	$1\text{-}2.5_{>100}$	7.76	465
	5-10	7.52	343
10^{-5}	$1\text{-}2.5_{All}$	7.65	340
	$1\text{-}2.5_{>100}$	7.85	466
	5-10	7.13	165
10^{-6}	$1\text{-}2.5_{All}$	7.43	201
	$1\text{-}2.5_{>100}$	7.92	467
	5-10	6.32	36.9

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-207
SEISMIC CATEGORY I BUILDING V_{EQ} RESULTS
(STRAIN COMPATIBLE - LOW BOUND SEISMIC STRAIN)

Structure	Soil column depth (ft.)	Calculated depths (ft.)	Median -1 Sigma (ft/s)	V_s weighted mean (ft/s)	Median +1 Sigma (ft/s)
Reactor Building	526	429	1311	1630	2025
		559	1435	1782	2214
Control Building	309	302	1253	1556	1930
		310	1253	1554	1927
Fire Water Storage Tank	310	331	1072	1331	1650
		342	1076	1338	1658

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-208
POINT SOURCE PARAMETERS

M 6.25 1c(1), **M** 6.25 2c(2), **M** 7.69 1c, **M** 7.69 2c

G (g)	Distance (km)	Depth (km)
1.50	0, 0, 6, 8	4, 5, 8, 8
1.25	0, 0, 8, 11	4, 6, 8, 8
1.00	0, 0, 12, 14	6, 7, 8, 8
0.75	0, 4, 16, 19	8, 8, 8, 8
0.50	7, 10, 24, 28	8, 8, 8, 8
0.40	10, 13, 29, 33	8, 8, 8, 8
0.30	15, 18, 37, 42	8, 8, 8, 8
0.20	21, 25, 50, 56	8, 8, 8, 8
0.10	37, 42, 92, 103	8, 8, 8, 8
0.05	59, 67, 163, 172	8, 8, 8, 8
0.01	190, 197, 480, 443	8, 8, 8, 8

Notes:

(1) 1c = single corner source model

(2) 2c = double corner source model (Reference 2.5.2-230)

(3) $Q = 670\ f^{0.33}$

(4) $\Delta\sigma$ (1c) = 110 bars

(5) κ = 0.006 sec, hard rock

(6) Hard rock crustal model (Reference 2.5.2-217):

th (km)	V_s (km/sec)	V_p (km/sec)	ρ (cgs)
1	2.83	4.90	2.52
11	3.52	6.10	2.71
28	3.75	6.50	2.78
	4.62	8.00	3.35

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-209
V/H RATIOS M AND *D* RANGES

F (Hz)	APE (yr^{-1})	**M**	*D* (km)	
			Empirical	Model
0.5	10^{-4} to 10^{-5}	7.69	57	190
1.0	10^{-4} to 10^{-5}	7.69	57	190
2.5	10^{-4} to 10^{-5}	7.69	57	190
5.0	10^{-4} to 10^{-5}	6.25	57	190
10.0	10^{-4} to 10^{-5}	6.25	57	190
25.0	10^{-4} to 10^{-5}	6.25	57	190
PGA (100.0)	10^{-4} to 10^{-5}	7.69	57	190
0.5	10^{-6} to 10^{-7}	7.69	57	190
1.0	10^{-6} to 10^{-7}	7.69	57	190
2.5	10^{-6} to 10^{-7}	7.69	57	190
5.0	10^{-6} to 10^{-7}	6.25	8	10
10.0	10^{-6} to 10^{-7}	6.25	8	10
25.0	10^{-6} to 10^{-7}	6.25	8	10
PGA (100.0)	10^{-6} to 10^{-7}	6.25	8	10

Note:

M and *D* reflect selections of empirical and model V/H ratios (e.g., Figures 2.5.2-217 and 2.5.2-218)

GGNS COL 2.0-27-A
GGNS ESP VAR 2.0-1
GGNS ESP COL 2.5-3

TABLE 2.5.2-210
WEIGHTS

Base Case Profiles	Weight	
1	0.25	
2	0.25	
3	0.25	
4	0.25	
Modulus Reduction and Damping Curves	**Weight**	
Set 1 (uncorrected)	0.5	
Set 2 (corrected)	0.5	
V/H Ratios	**Weight**	
Empirical	0.5	
Model	0.5	
Empirical	**Embedment (Soil Removed) Outcrop Weight**	**Soil Surface Outcrop Weight**
Rock	0.2	0.0
Soil	0.8	1.0
Attenuation Relation	**Embedment (Soil Removed) Outcrop Weight**	**Soil Surface Outcrop Weight**
Abrahamson and Silva	0.5	---
Campbell and Borzorgina	0.5	---
Earthquake Source		**Weight**
Single-Corner		0.5
Double-Corner		0.5

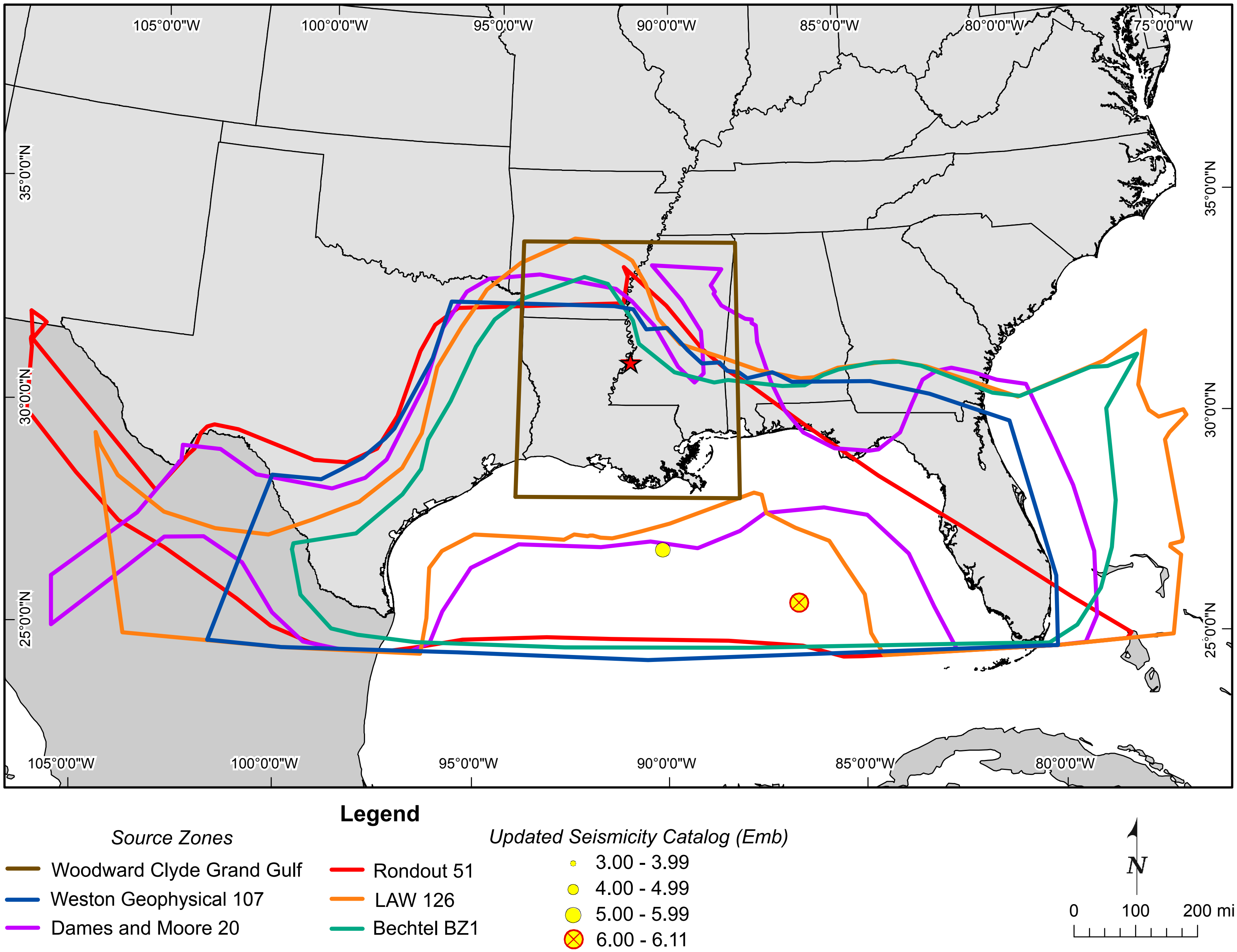

Figure 2.5.2-201. EPRI Coastal Source Zones

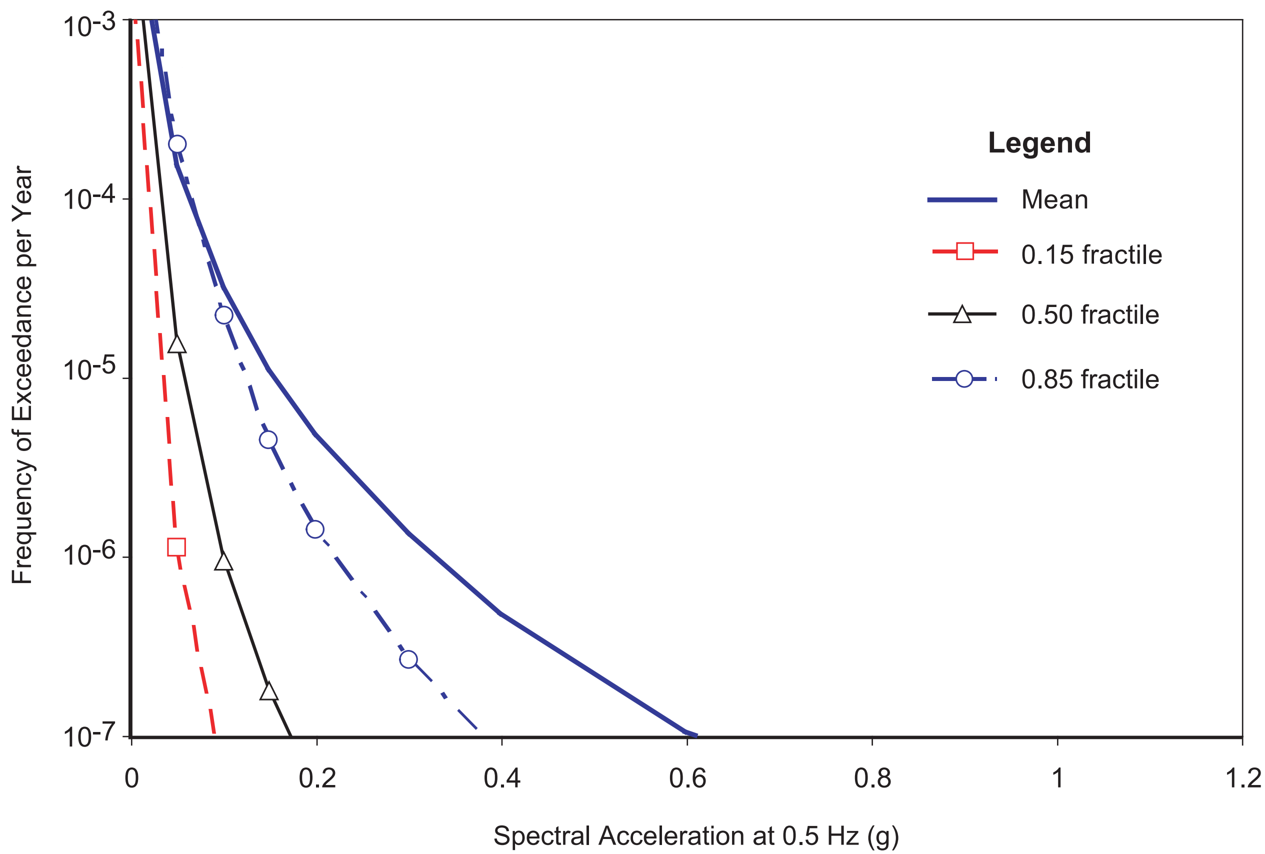

Figure 2.5.2-202. Seismic Hazard Results at S_a (0.5 Hz) for Rock Site Conditions

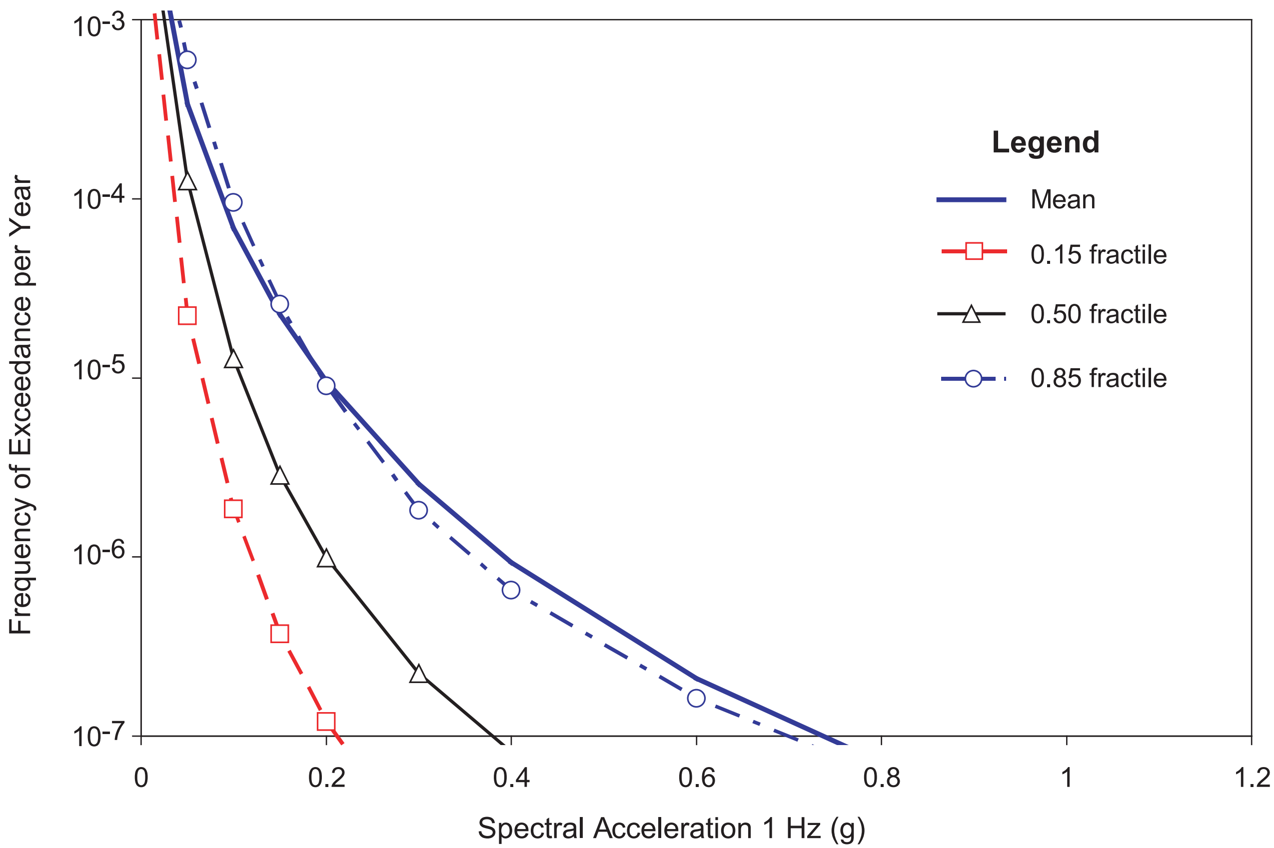

Figure 2.5.2-203. Seismic Hazard Results at S_a (1 Hz) for Rock Site Conditions

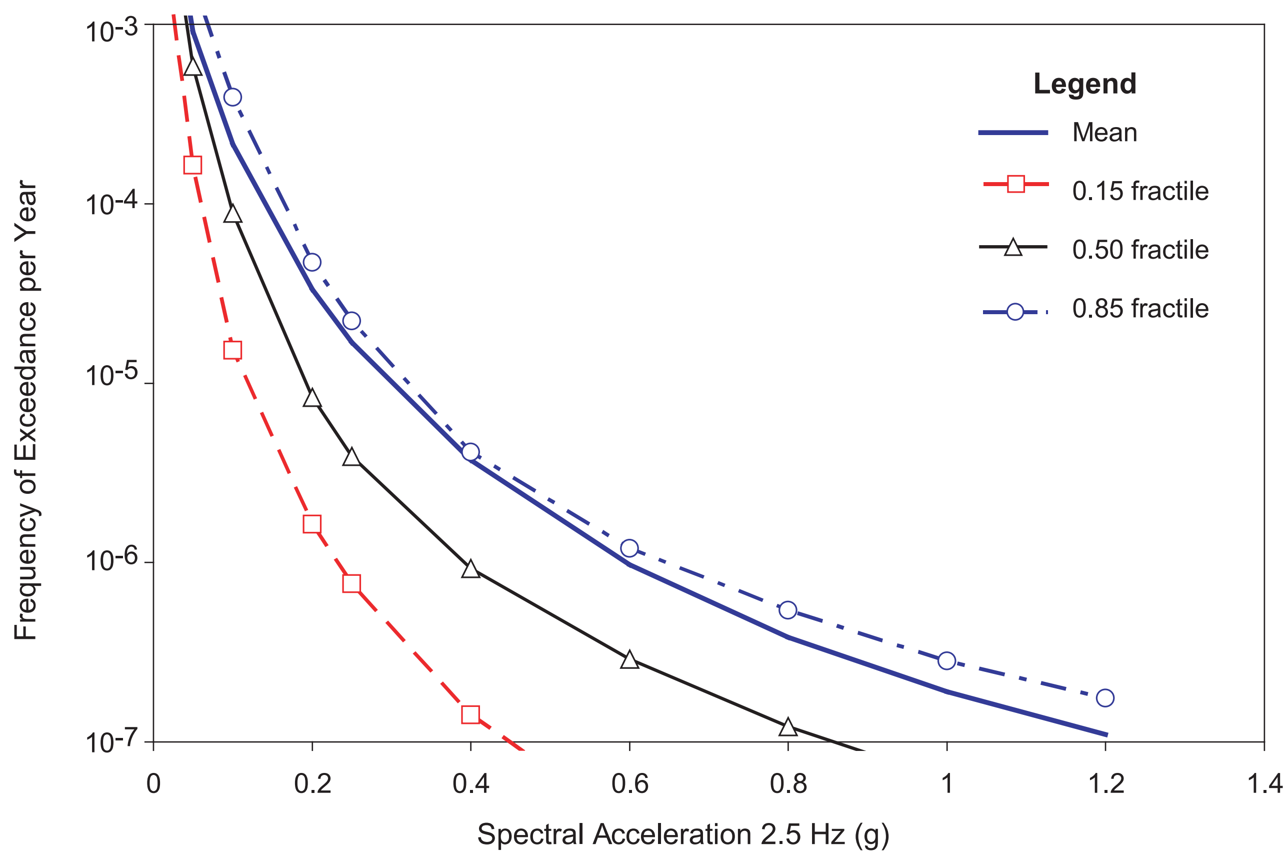

Figure 2.5.2-204. Seismic Hazard Results at S_a (2.5 Hz) for Rock Site Conditions

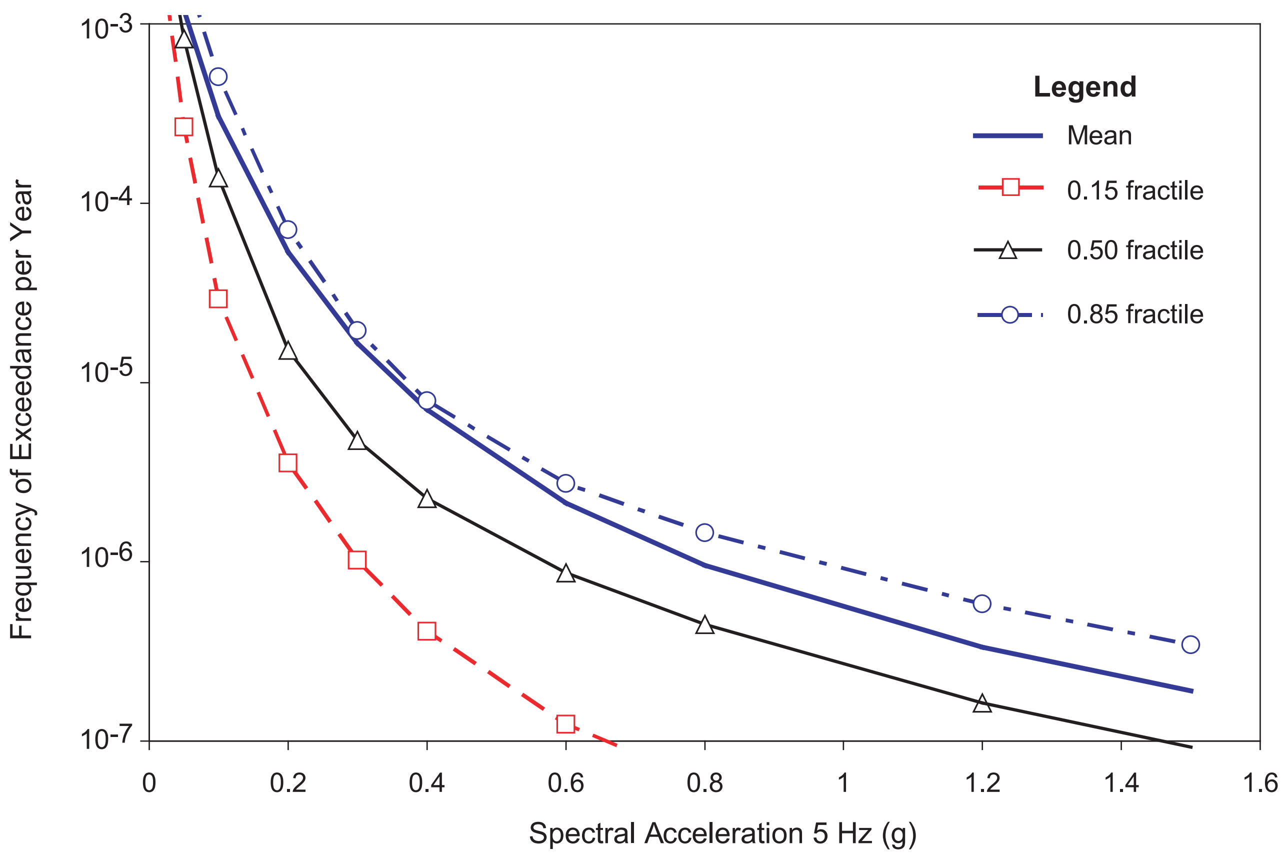

Figure 2.5.2-205. Seismic Hazard Results at S_a (5 Hz) for Rock Site Conditions

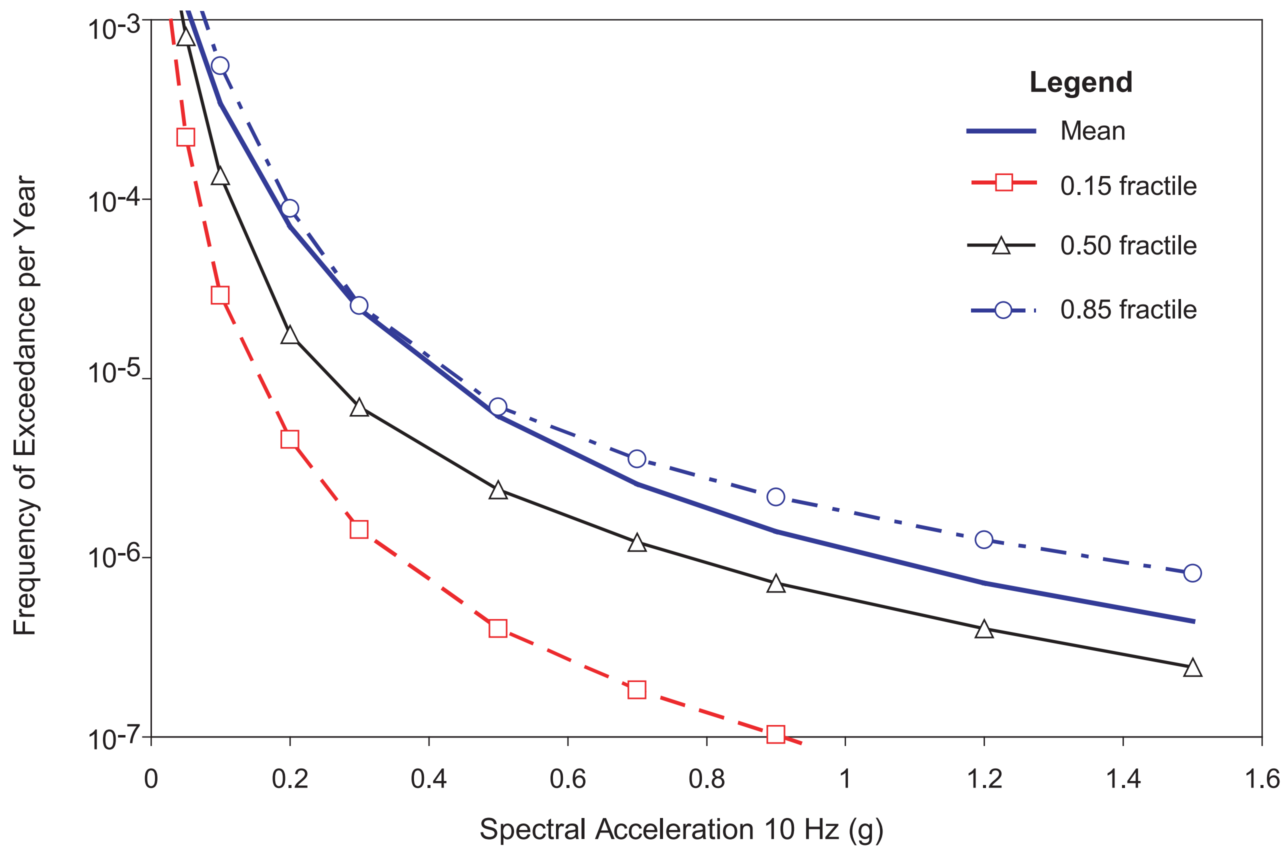

Figure 2.5.2-206. Seismic Hazard Results at S_a (10 Hz) for Rock Site Conditions

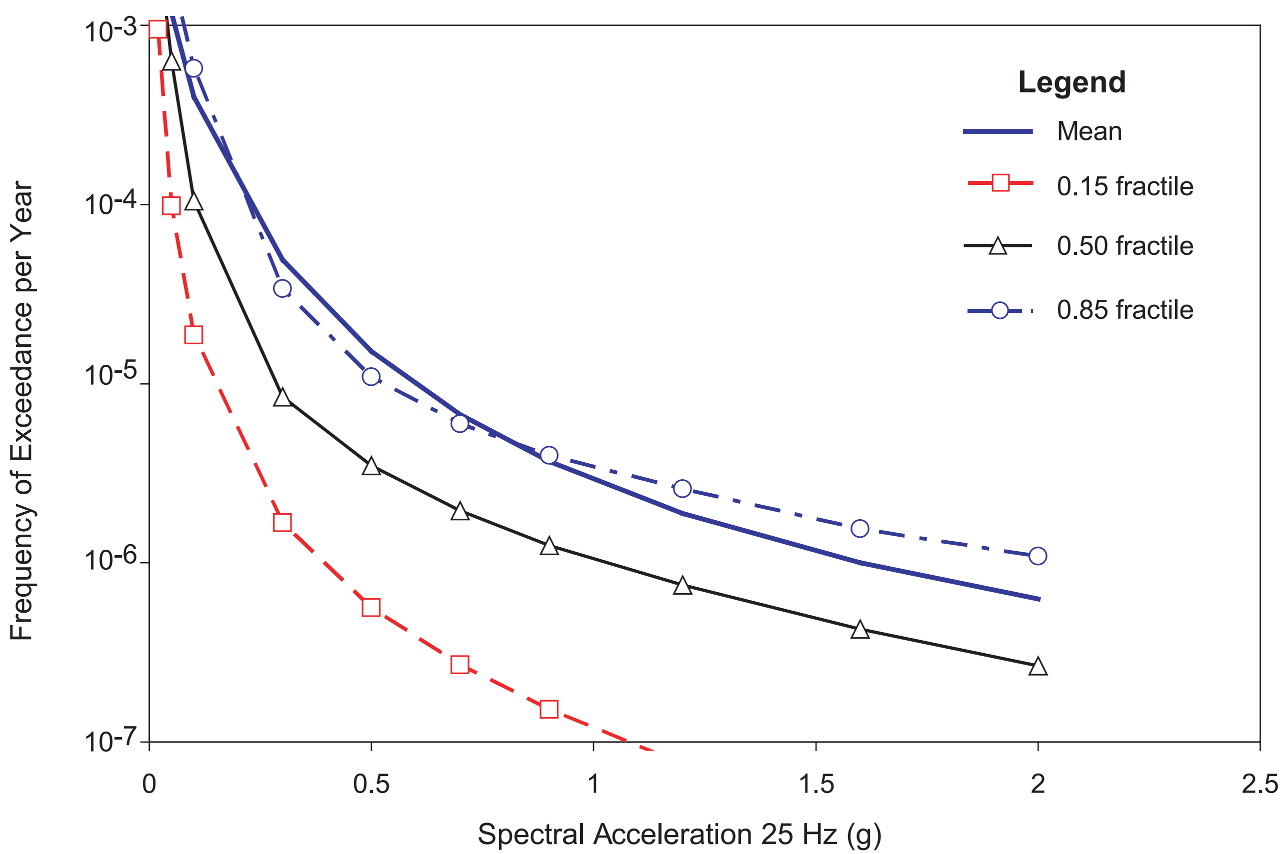

Figure 2.5.2-207. Seismic Hazard Results at S_a (25 Hz) for Rock Site Conditions

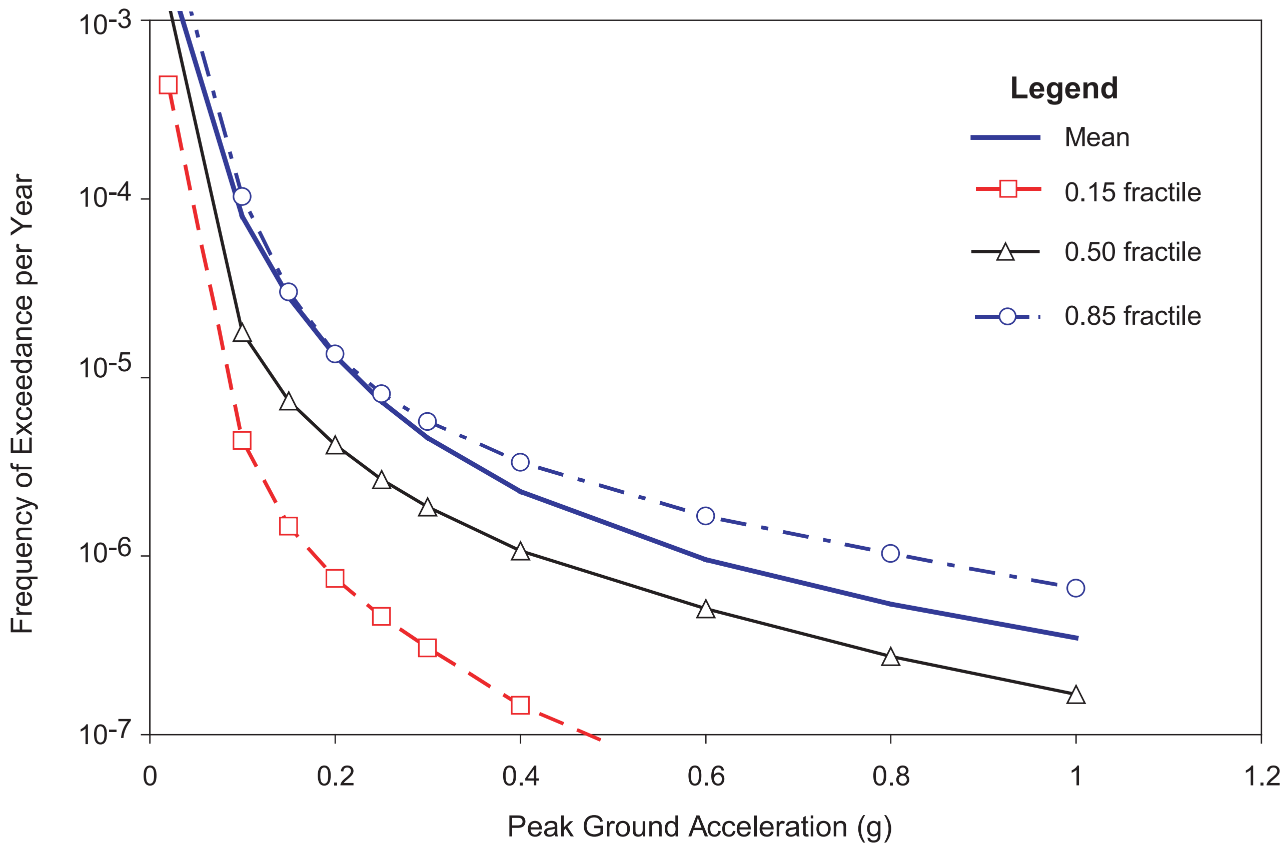

Figure 2.5.2-208. Seismic Hazard Results at PGA for Rock Site Conditions

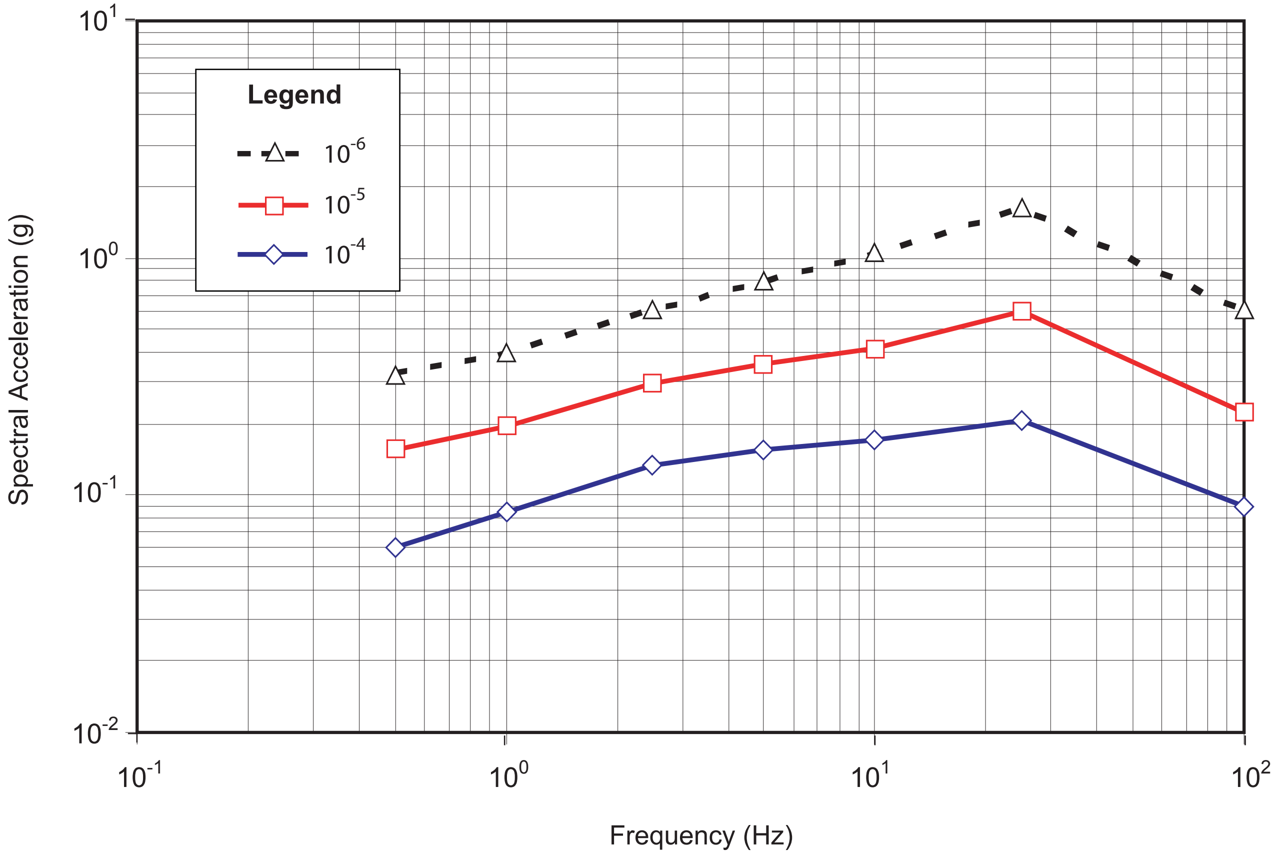

Figure 2.5.2-209.
Mean Uniform Hazard Response Spectra (UHRS) for Annual Frequencies in Exceedance of 10^{-4}, 10^{-5}, and 10^{-6} for Rock Site Conditions

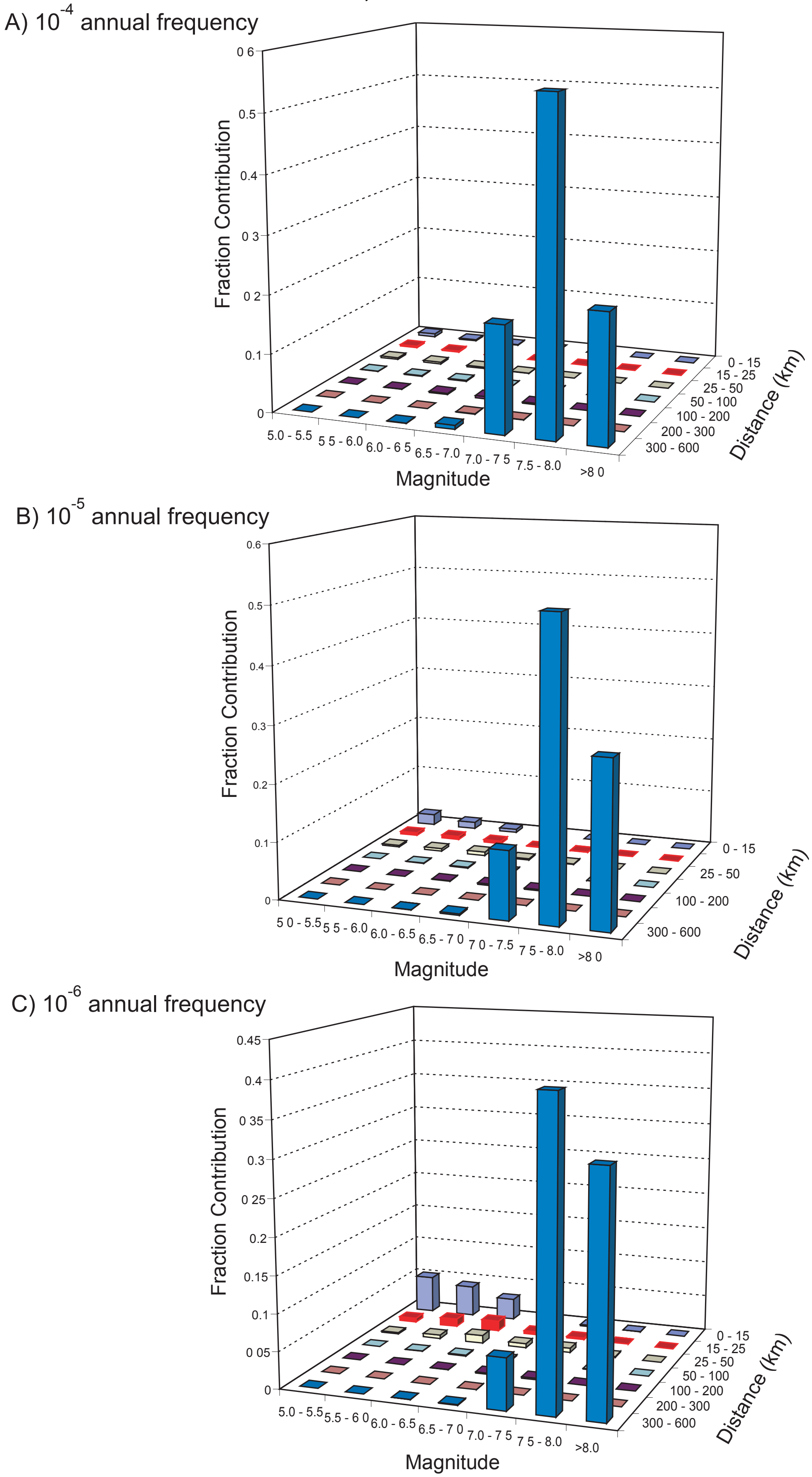

Figure 2.5.2-210. Deaggregation for Low Frequency (S_a = 1 Hz to 2.5 Hz) Ground Motions

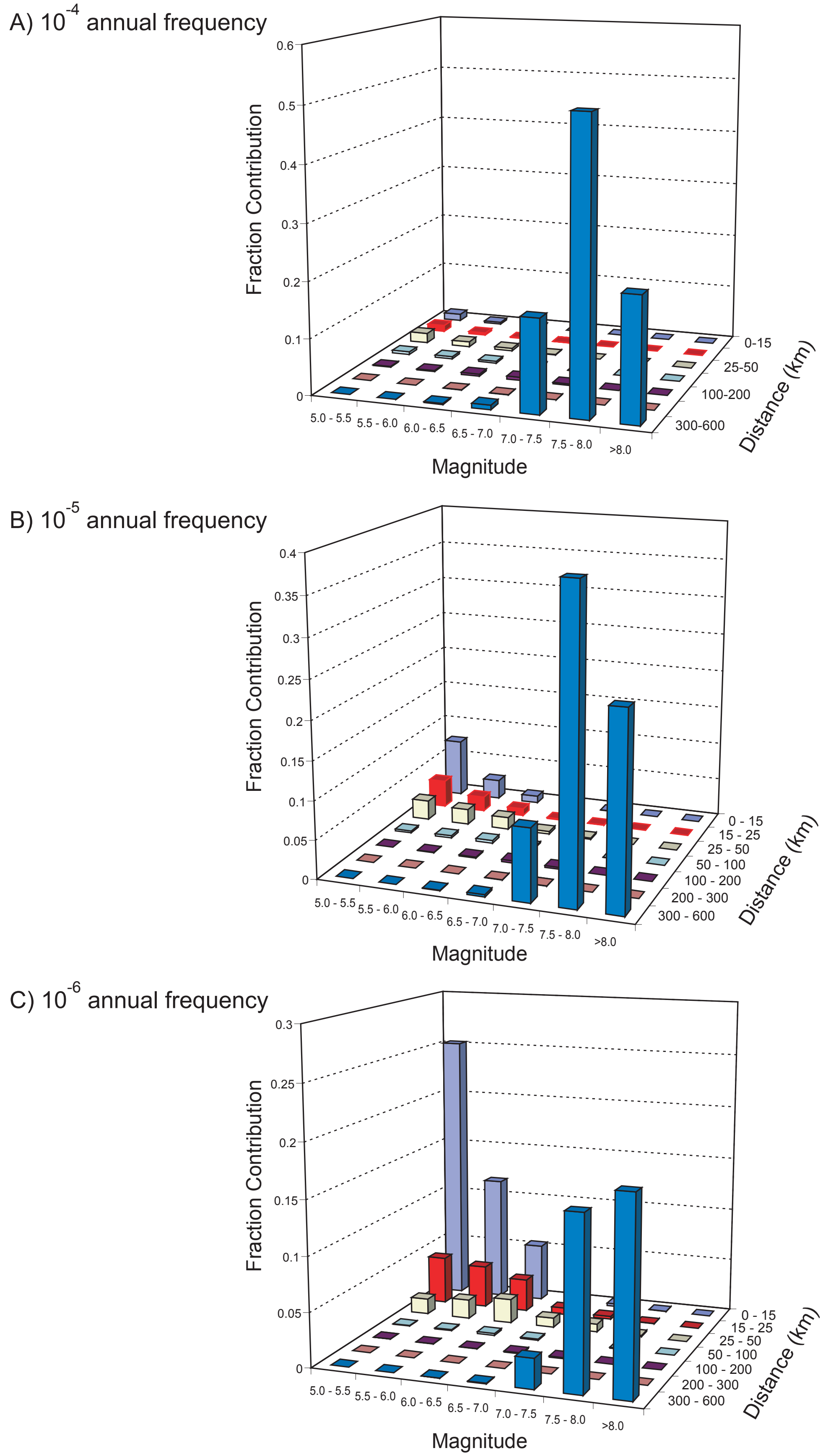

Figure 2.5.2-211. Deaggregation for Low Frequency (S_a = 5 Hz to 10 Hz) Ground Motions

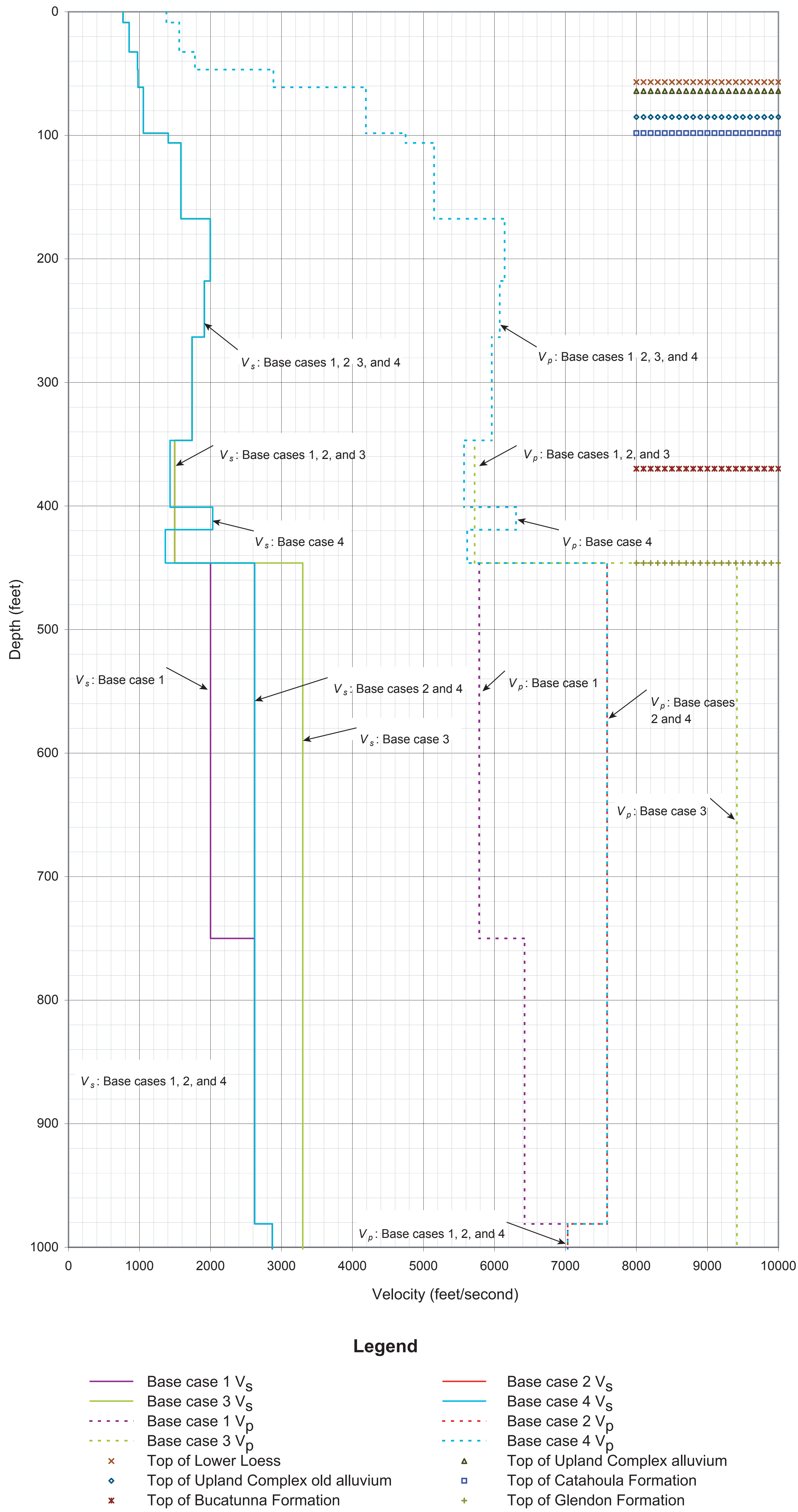

Figure 2.5.2-212. V_s and V_p Base Case Profiles 1 to 4

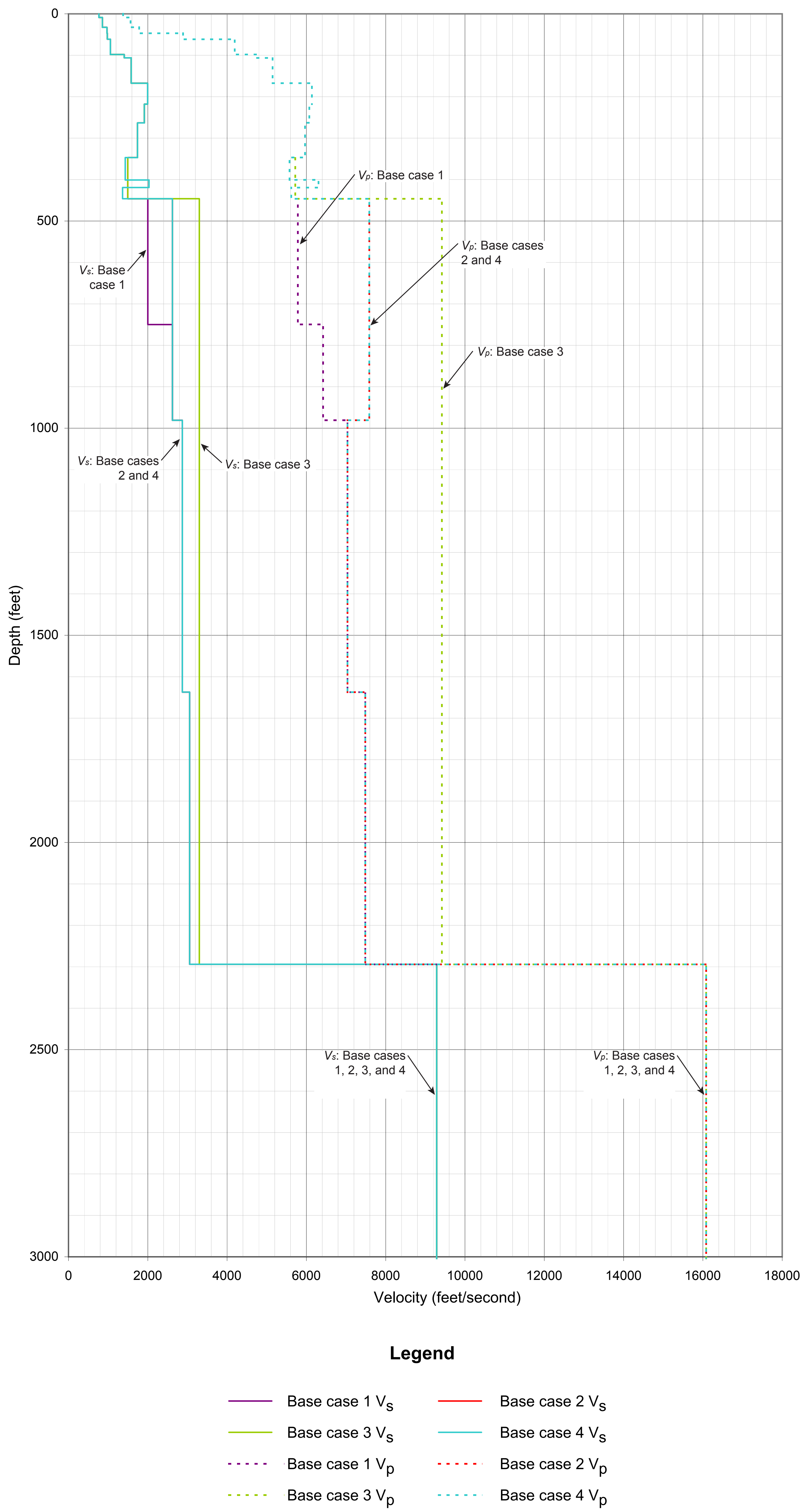

Figure 2.5.2-213. V_s and V_p Base Case Profiles 1 to 4 with Generic Mississippi Embayment Velocity Profile

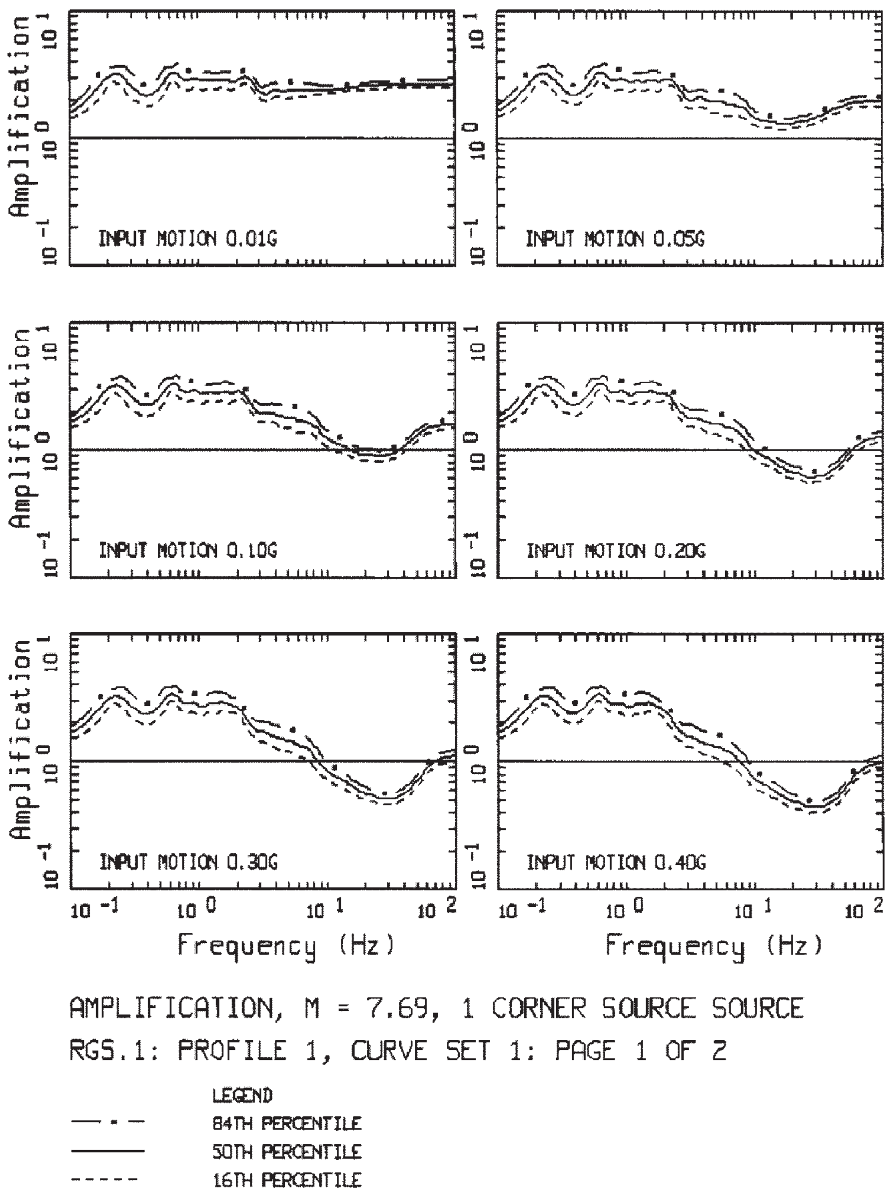

Figure 2.5.2-214.

Example of Amplification Factors Computed for M 7.69, Single-Corner Source Model, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 1 of 2)

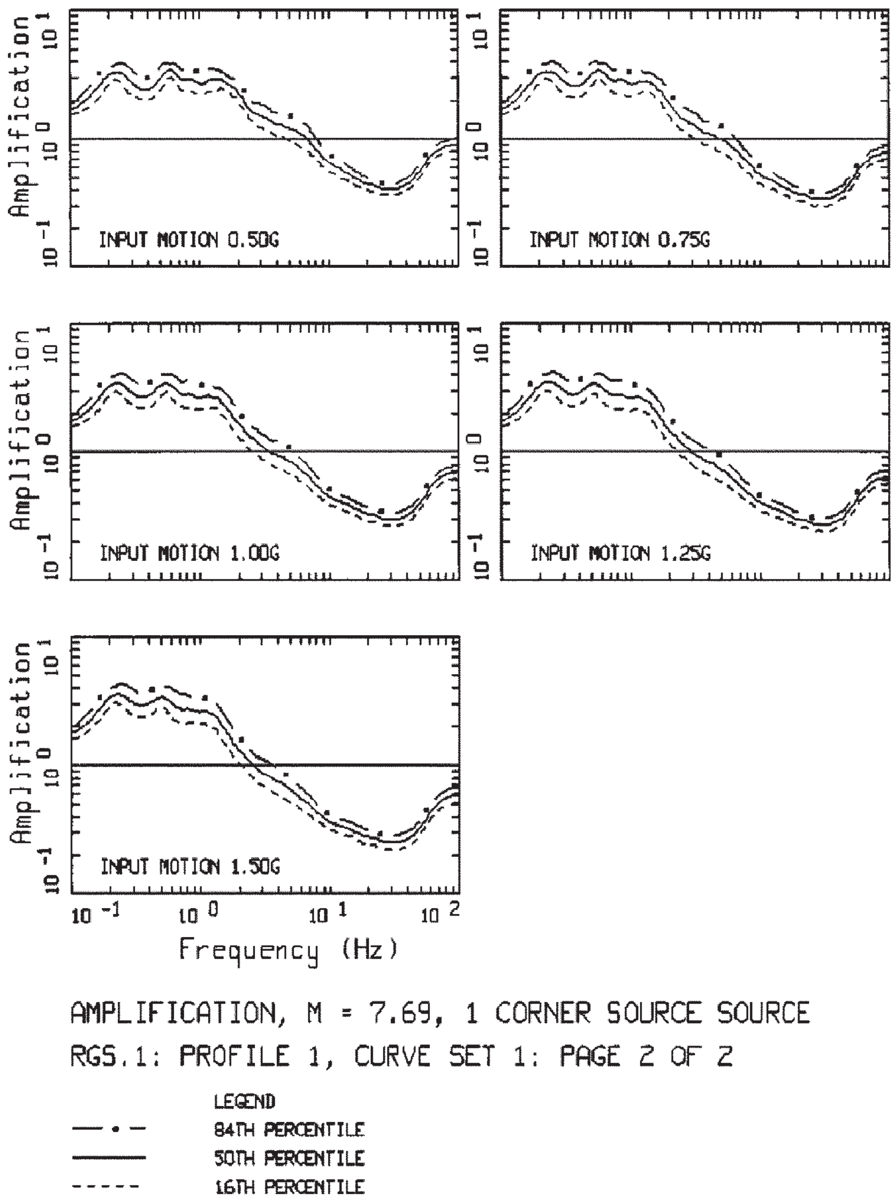

Figure 2.5.2-214.
Example of Amplification Factors Computed for M 7.69, Single-Corner Source Model, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 2 of 2)

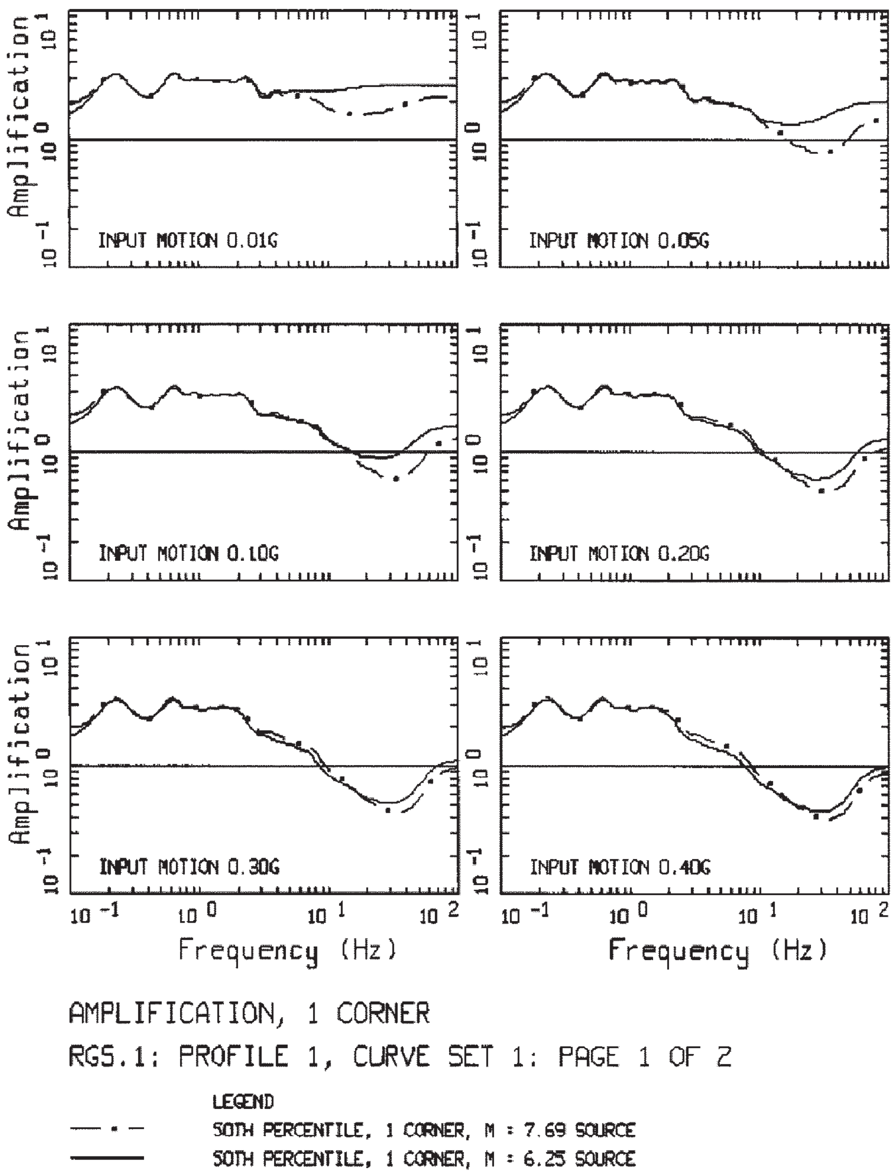

Figure 2.5.2-215.
Comparison of Median Amplification Factors Computed for M 7.69 and M 6.25 Single-corner Source model, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 1 of 2)

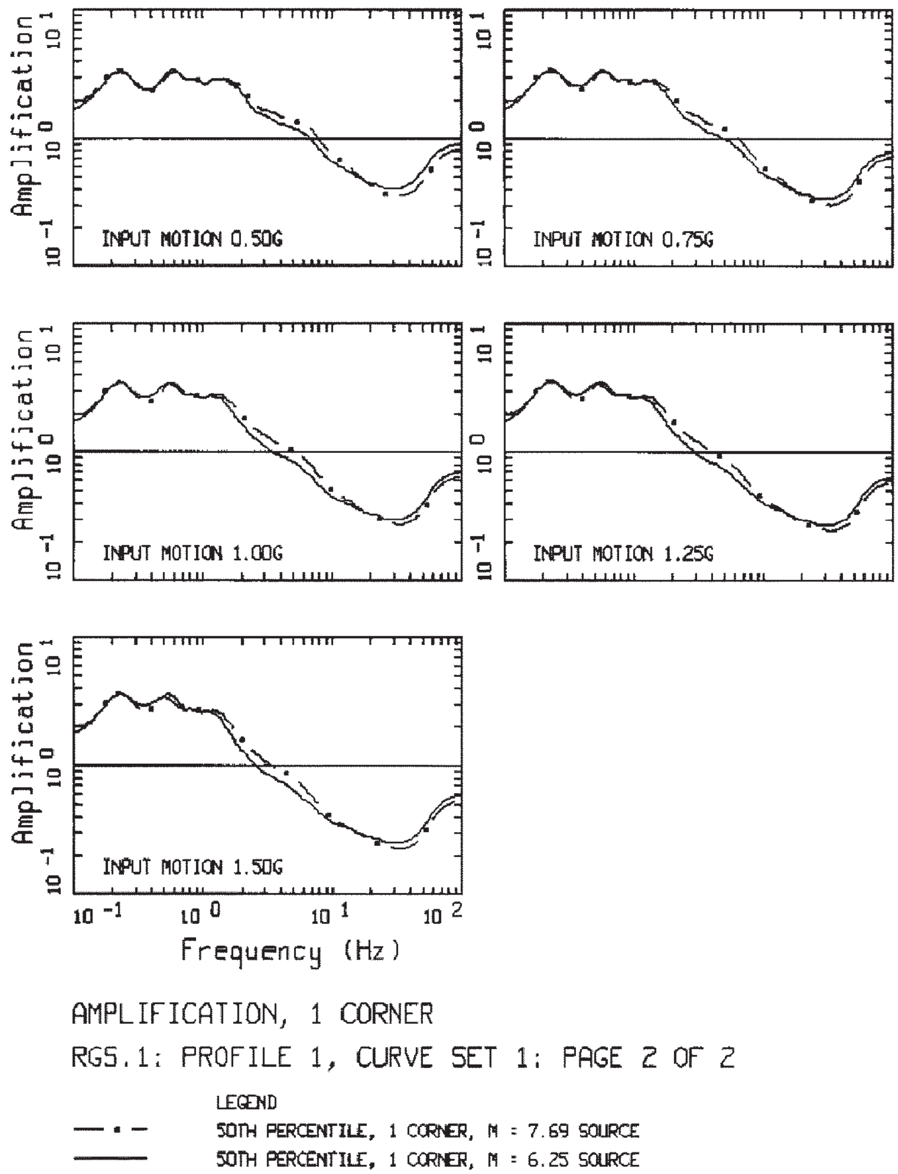

Figure 2.5.2-215.
Comparison of Median Amplification Factors Computed for M 7.69 and M 6.25 Single-corner Source model, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 2 of 2)

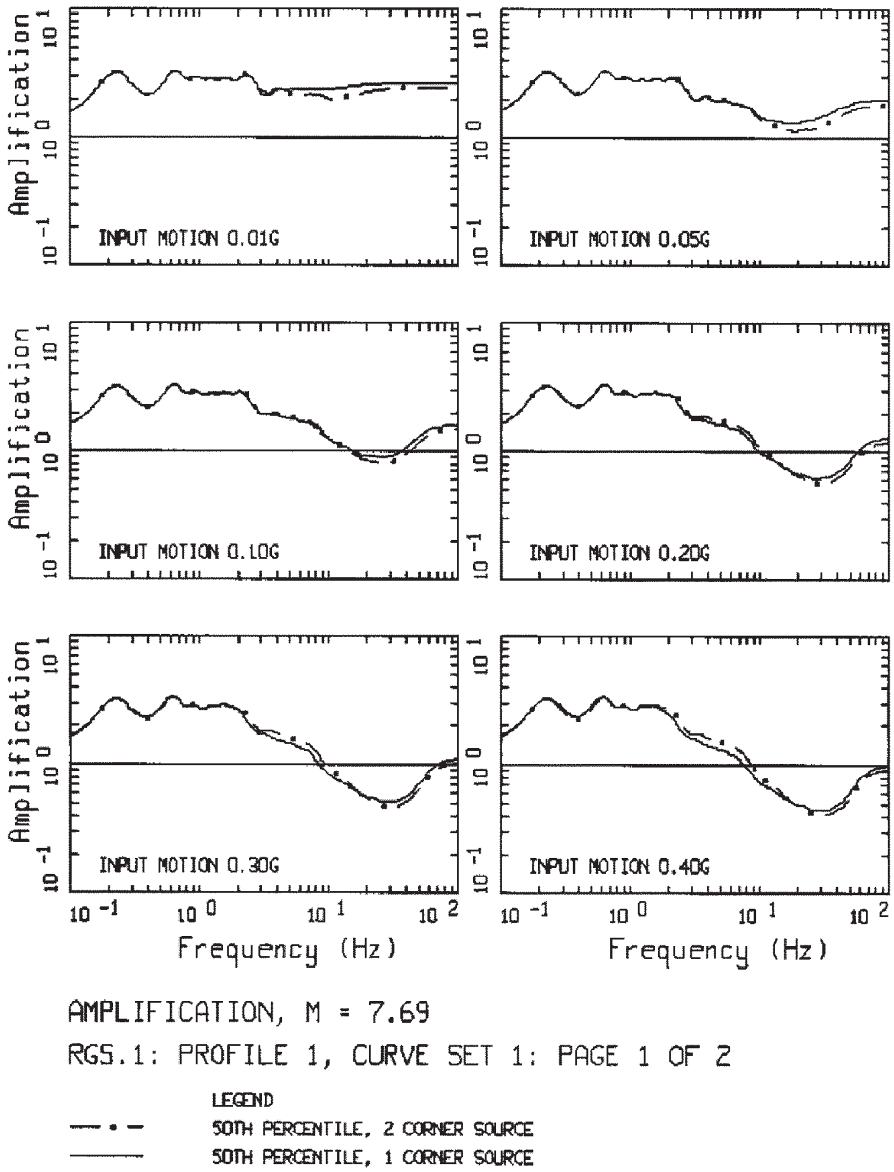

Figure 2.5.2-216.
Example of Amplification Factors Computed for Single- and Double-corner Source Models, M 7.69, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 1 of 2)

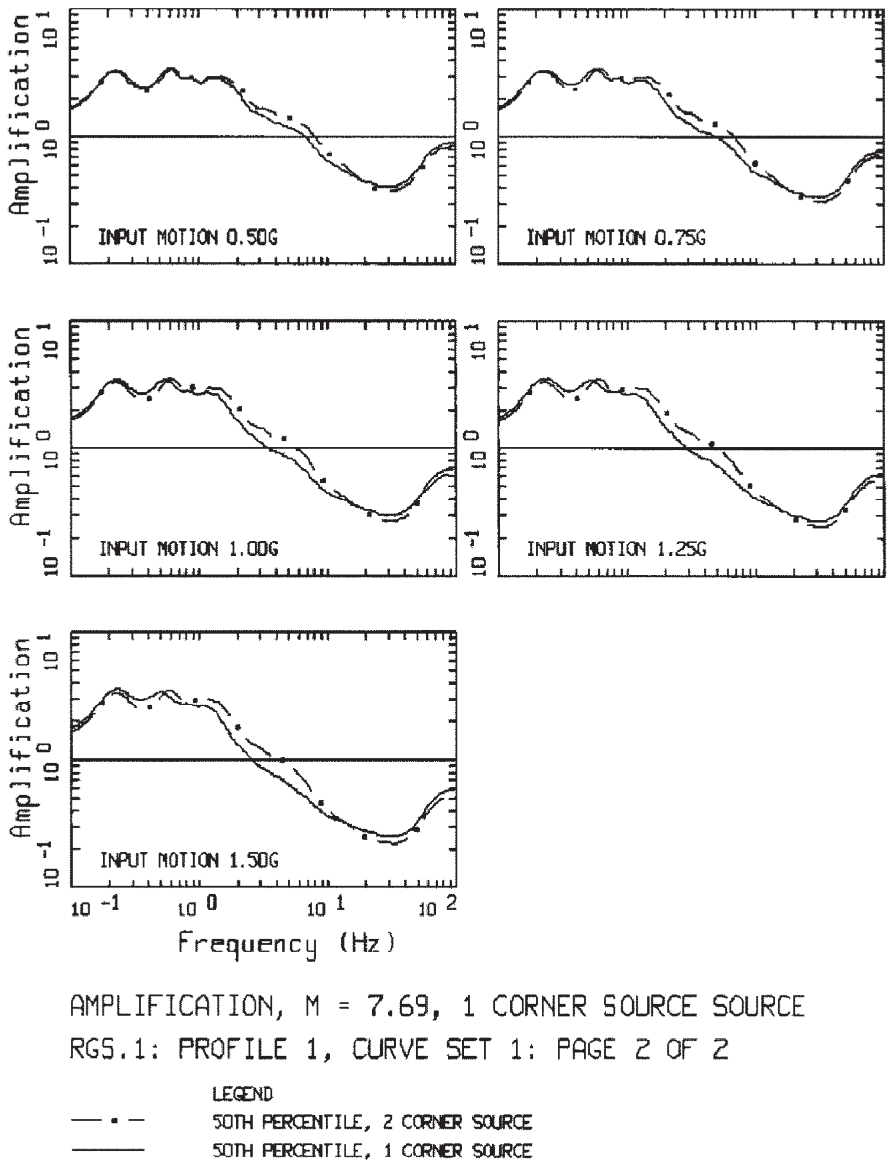

Figure 2.5.2-216.
Example of Amplification Factors Computed for Single- and Double-corner Source Models, M 7.69, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface (Sheet 2 of 2)

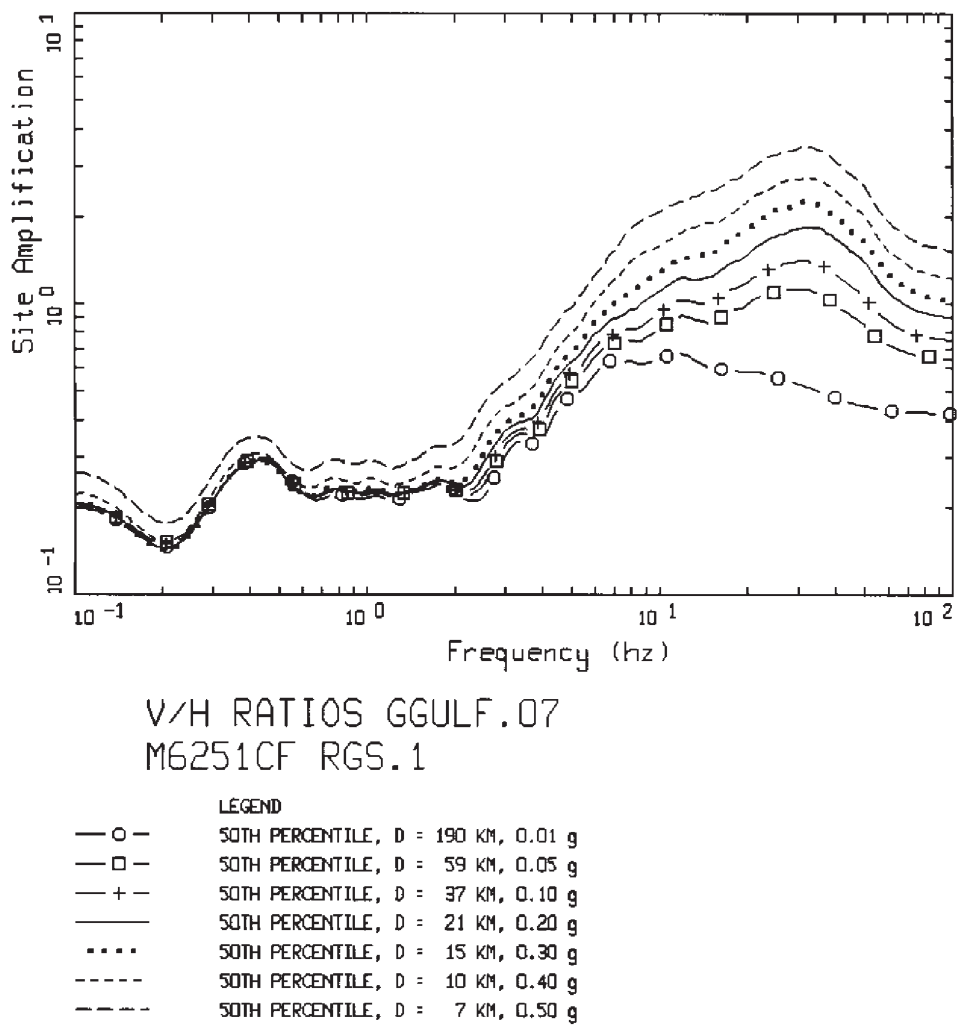

Figure 2.5.2-217.
Example of Median V/H Ratios Computed for M 6.25, Single-corner Source Model, Velocity Profile 1, and Non-linear Dynamic Material Model 1, Reactor Ground Surface

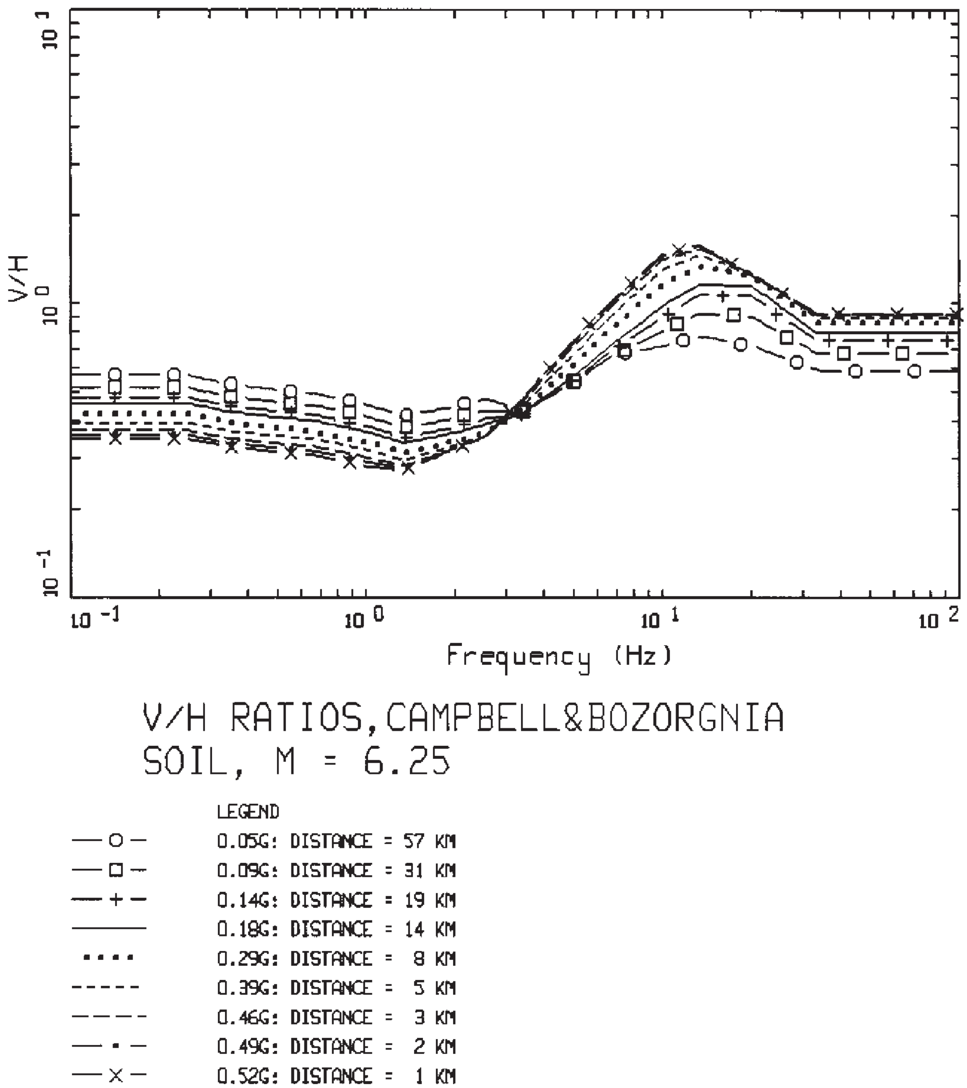

Figure 2.5.2-218.
Example of Median Empirical V/H Ratios Computed for M 6.25, Campbell and Bozorgnia Soil

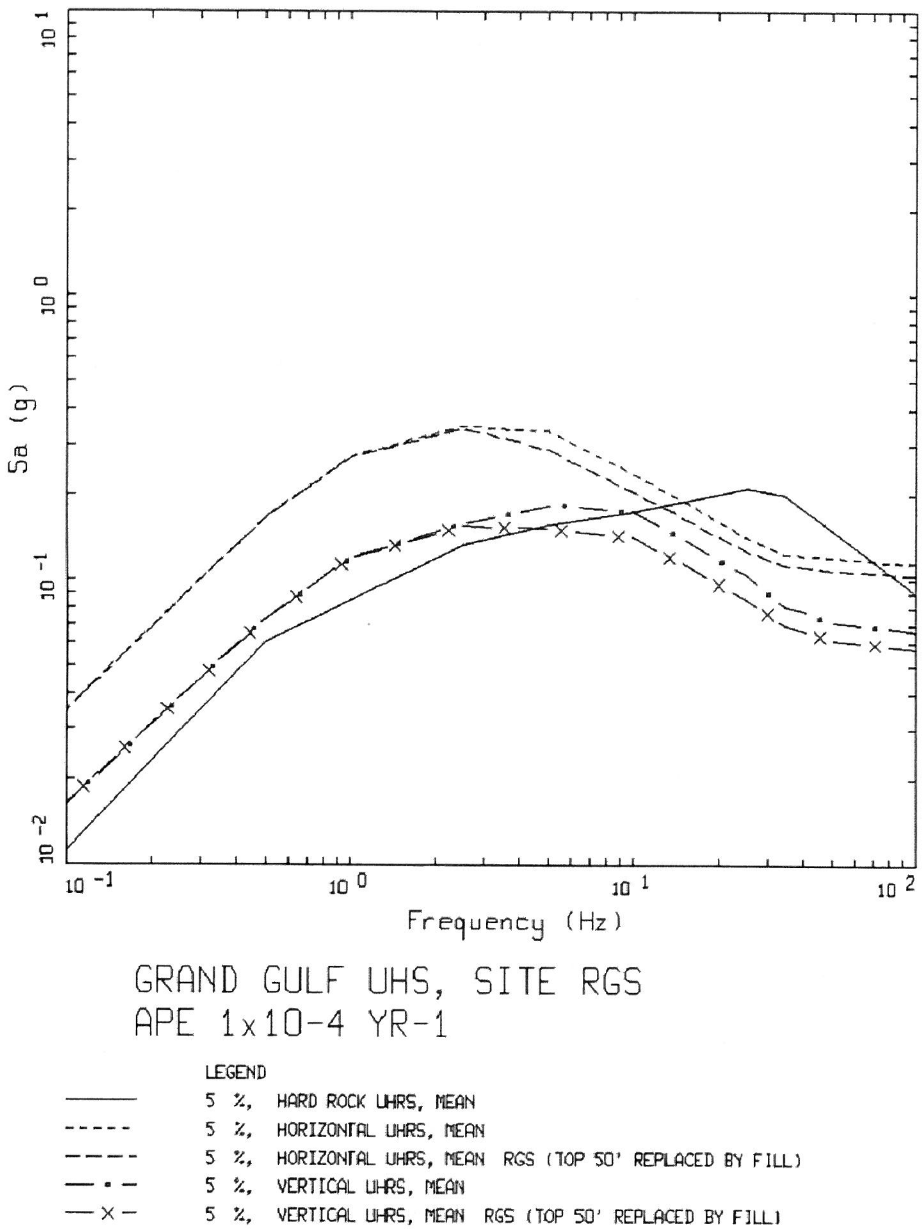

Figure 2.5.2-219.
Comparison of Horizontal and Vertical UHRS for Reactor Ground Surface and Reactor Ground Surface (top 50 ft replaced by fill) at APE 10^{-4} yr^{-1}

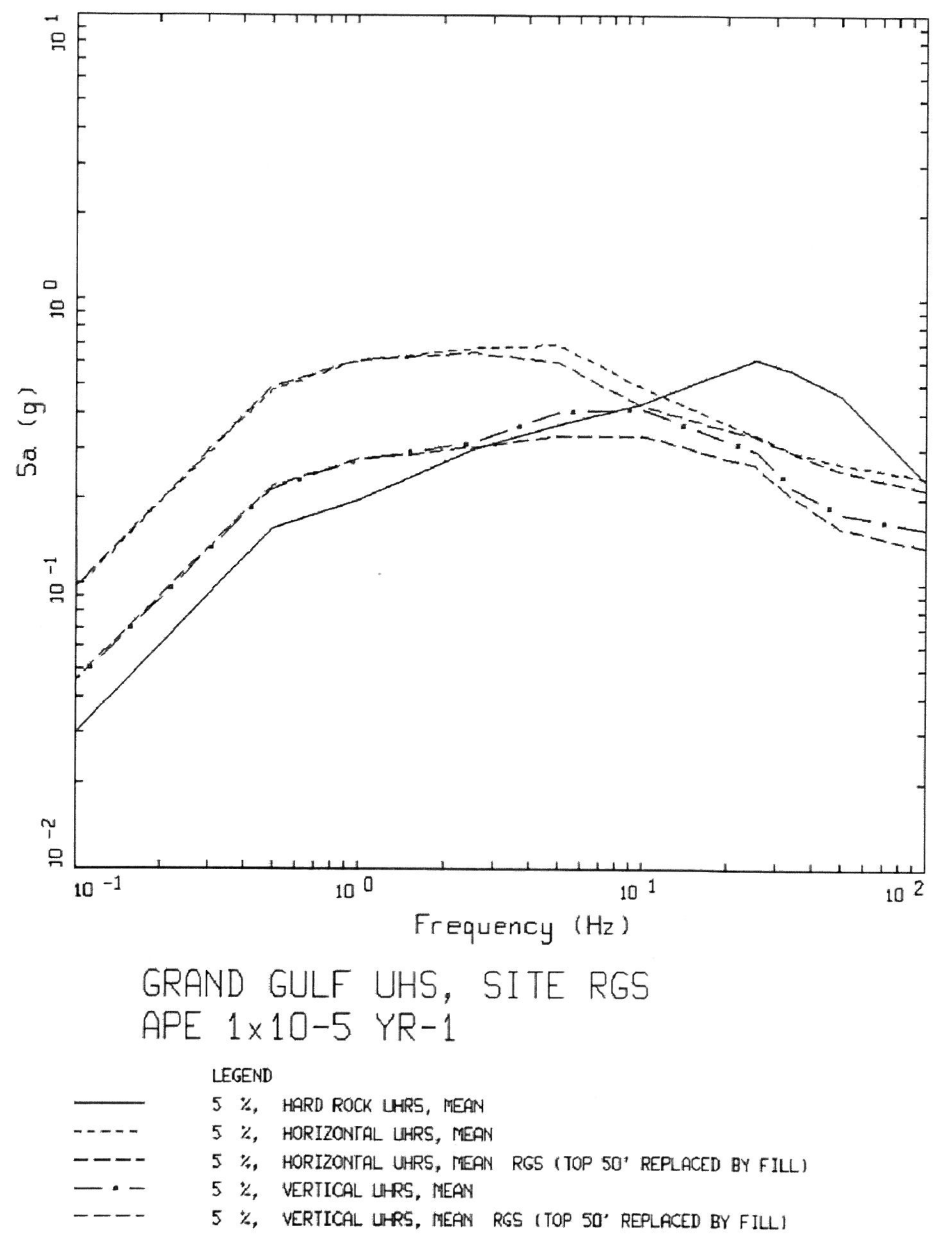

Figure 2.5.2-220.
Comparison of Horizontal and Vertical UHRS for Reactor Ground Surface at APE 10^{-5} yr^{-1}

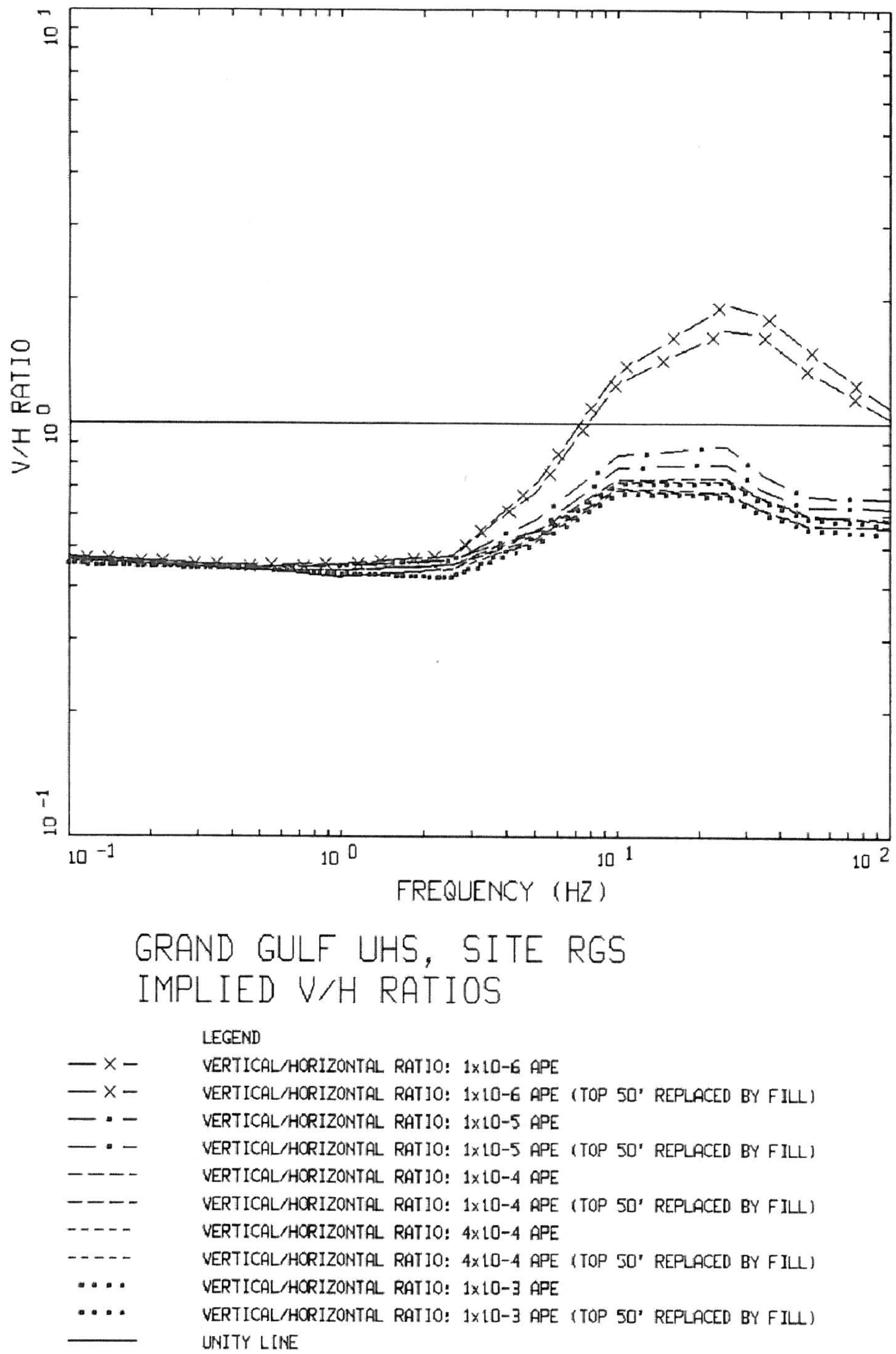

Figure 2.5.2-221.
V/H Ratio Based on Ratios of UHRS's for
Reactor Ground Surface at APE 10^{-3} to 10^{-6} yr^{-1}

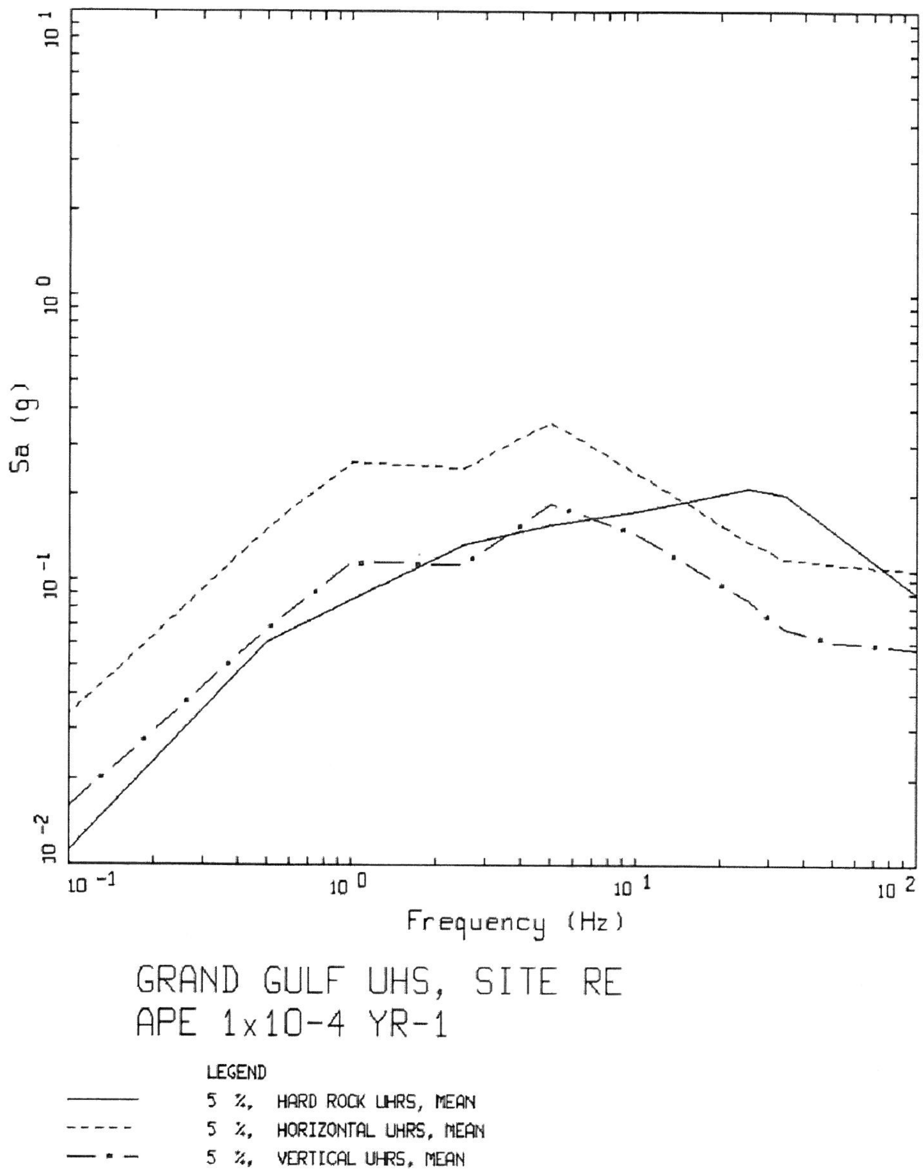

Figure 2.5.2-222.
Comparison of Horizontal and Vertical UHRS for Reactor Embedment at APE 10^{-4} yr^{-1}

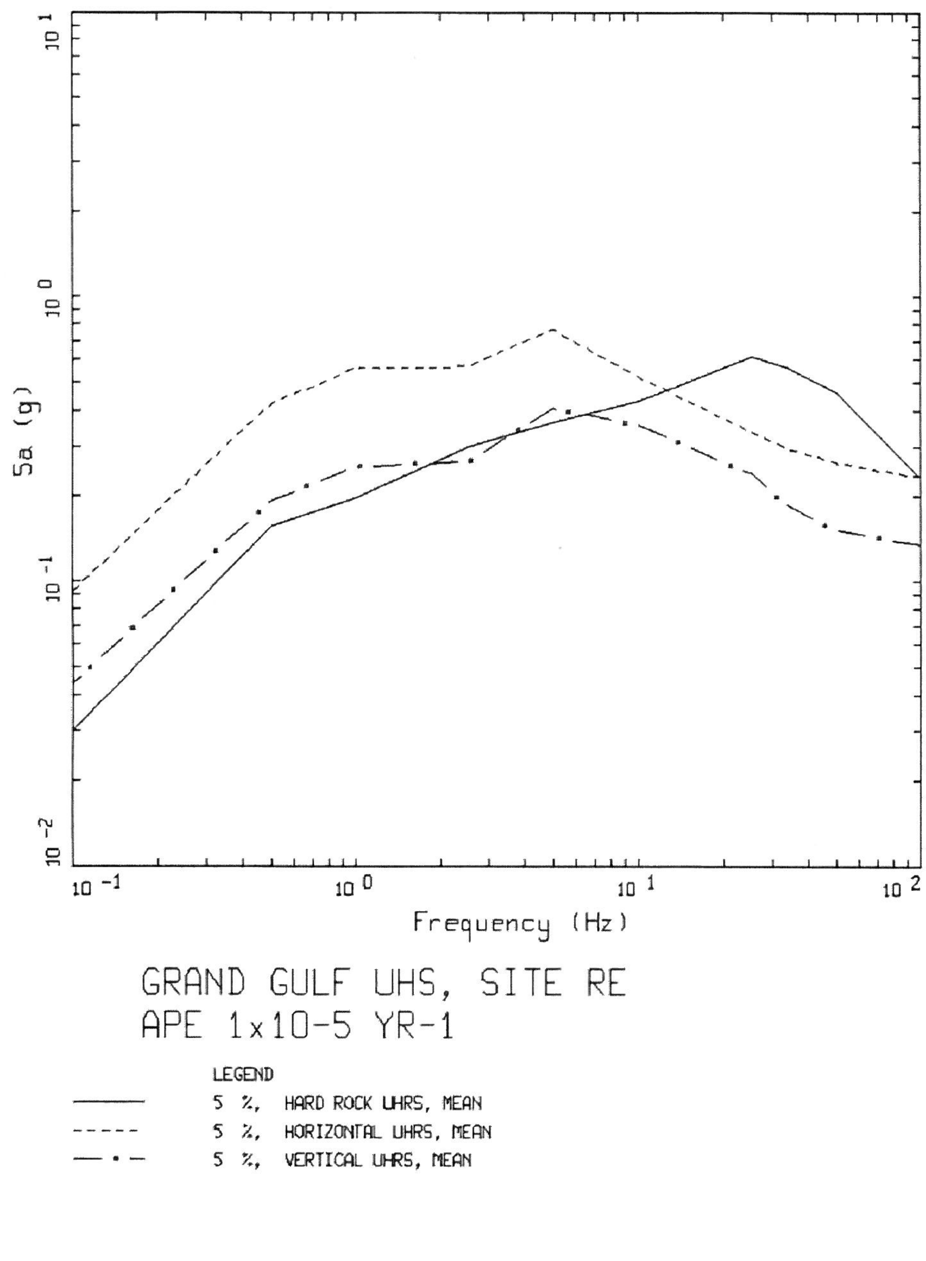

Figure 2.5.2-223.
Comparison of Horizontal and Vertical UHRS for Reactor Embedment at APE 10^{-5} yr^{-1}

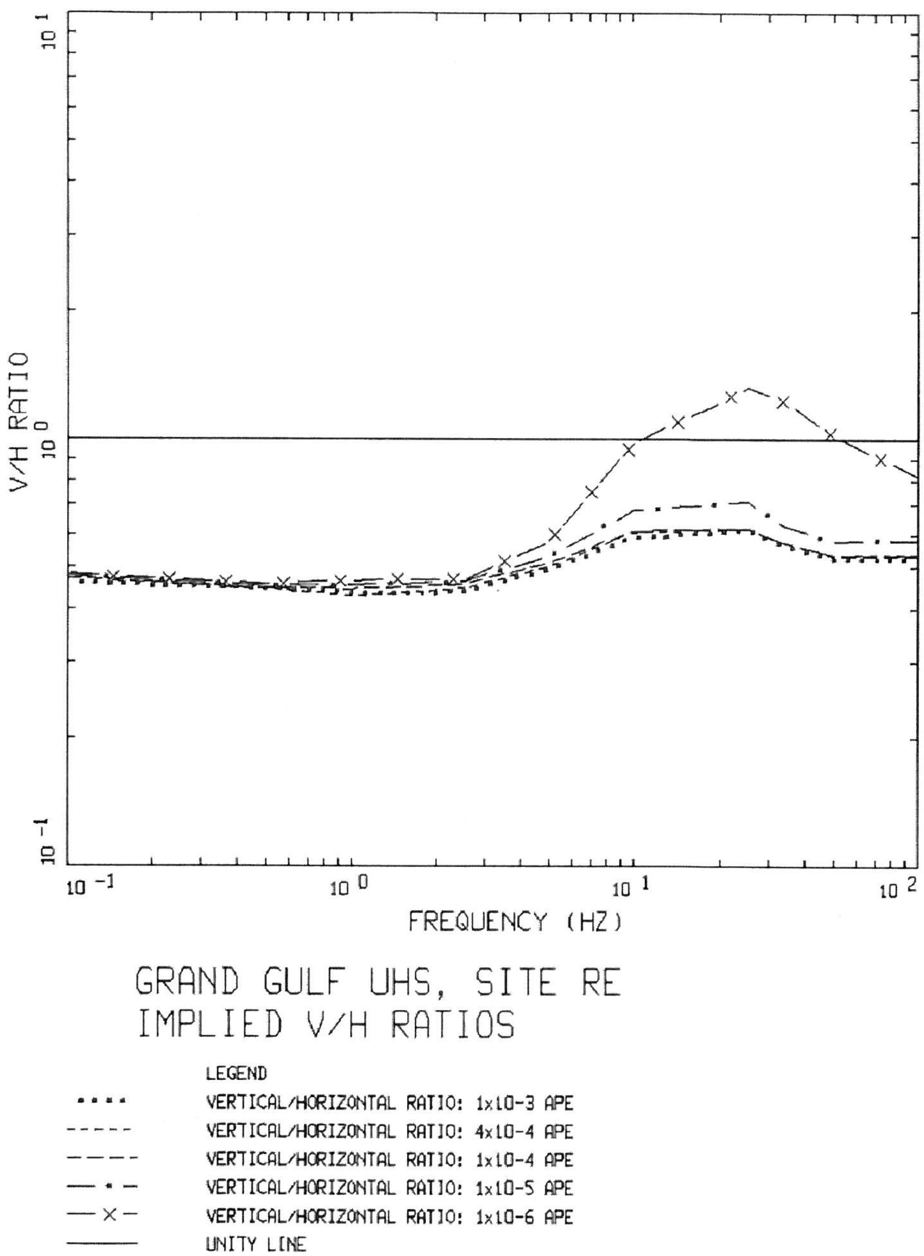

Figure 2.5.2-224.
V/H Ratio Based on Ratios of UHRS for Reactor Embedment at APE 10^{-3} to 10^{-6} yr^{-1}

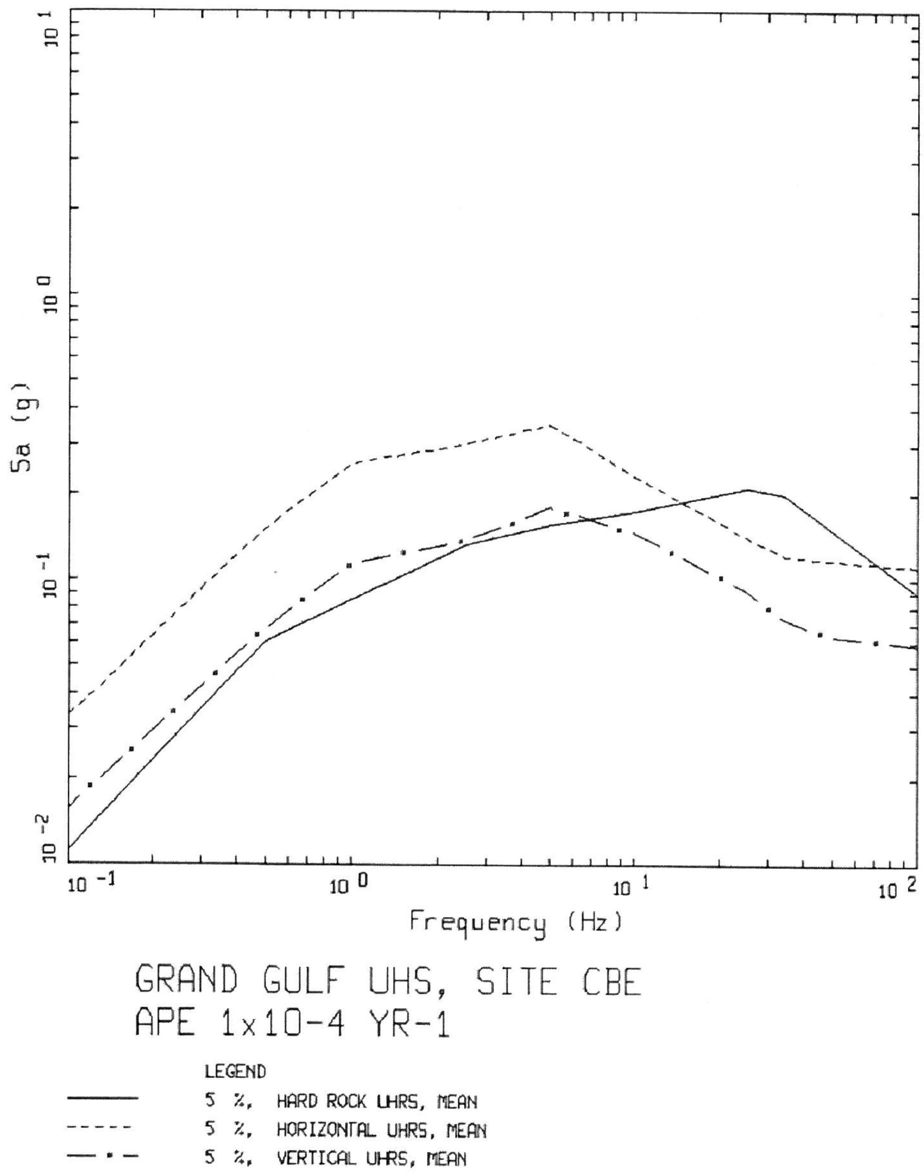

Figure 2.5.2-225.
Comparison of Horizontal and Vertical UHRS for Control Building Embedment at APE 10^{-4} yr^{-1}

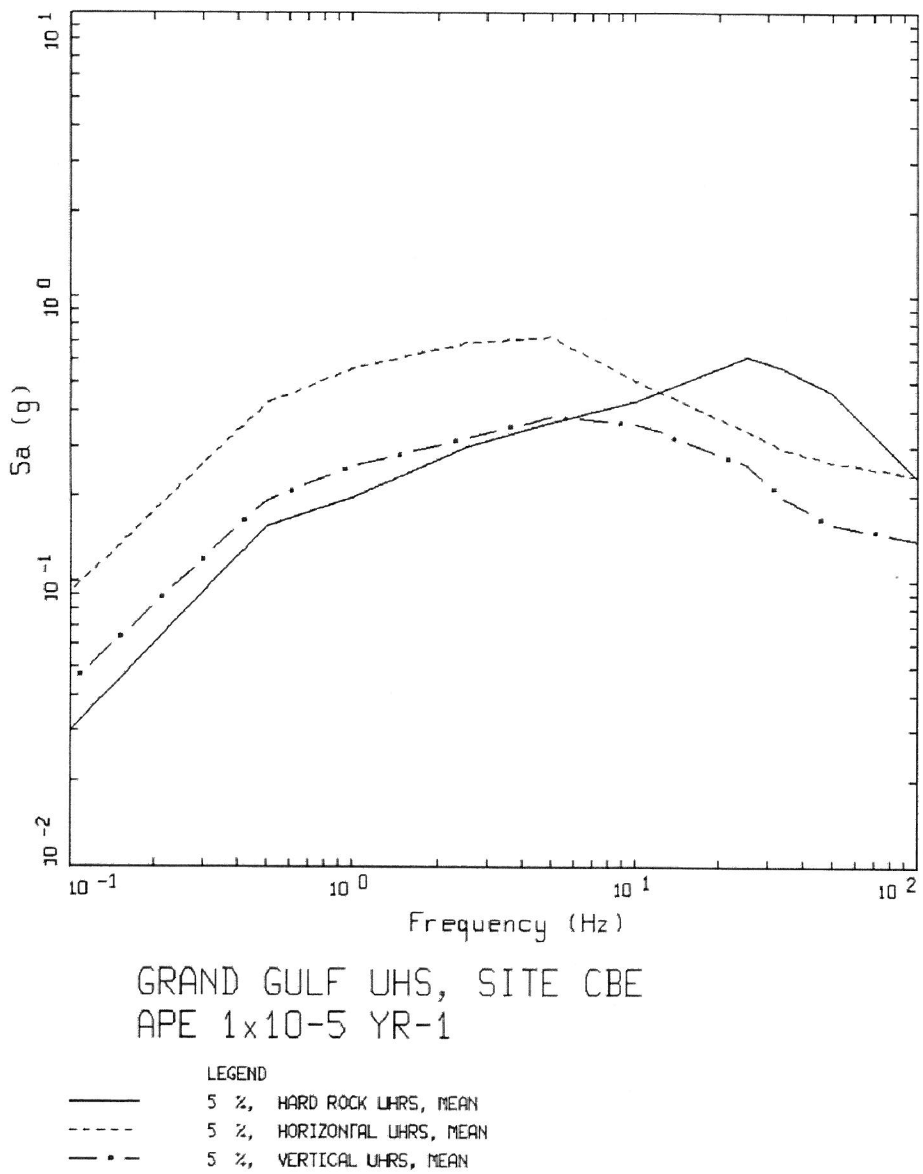

Figure 2.5.2-226.
Comparison of Horizontal and Vertical UHRS for Control Building Embedment at APE 10^{-5} yr^{-1}

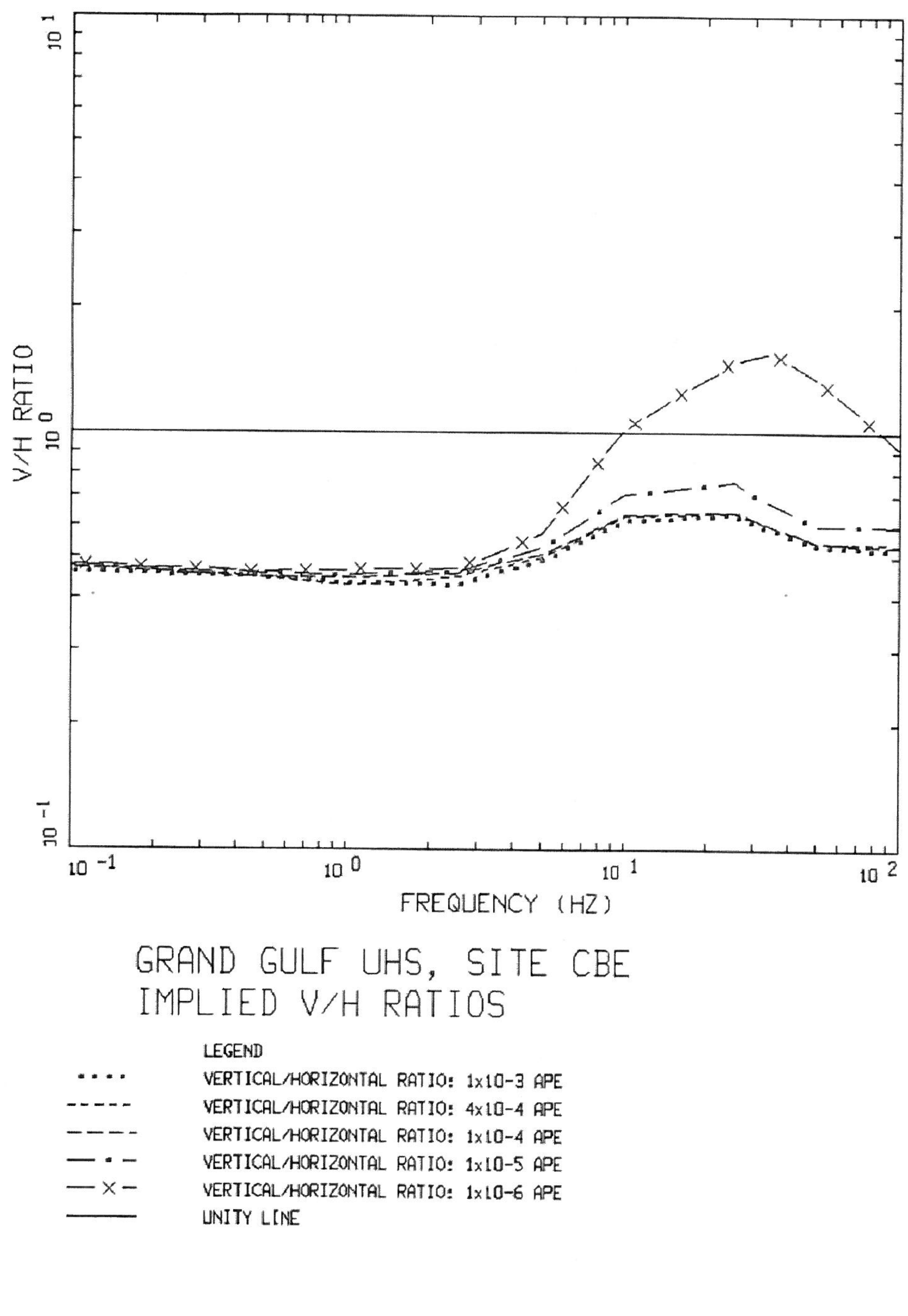

Figure 2.5.2-227.
V/H Ratio Based on Ratios of UHRS for Control Building Embedment at APE 10^{-3} to 10^{-6} yr^{-1}

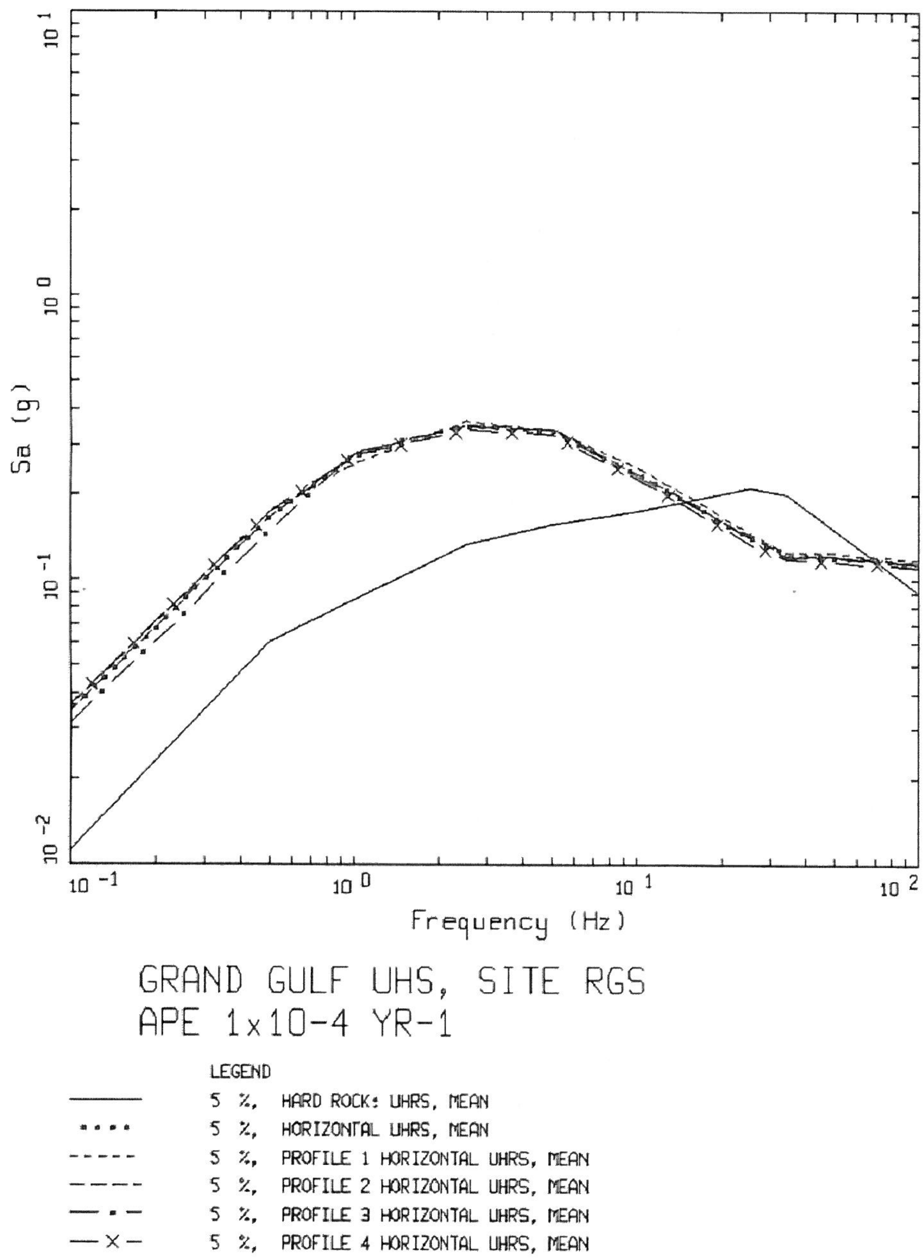

Figure 2.5.2-228.

Comparison of UHRS for Reactor Ground Surface at APE 10^{-4} yr^{-1} for Velocity Profiles 1, 2, 3, and 4.

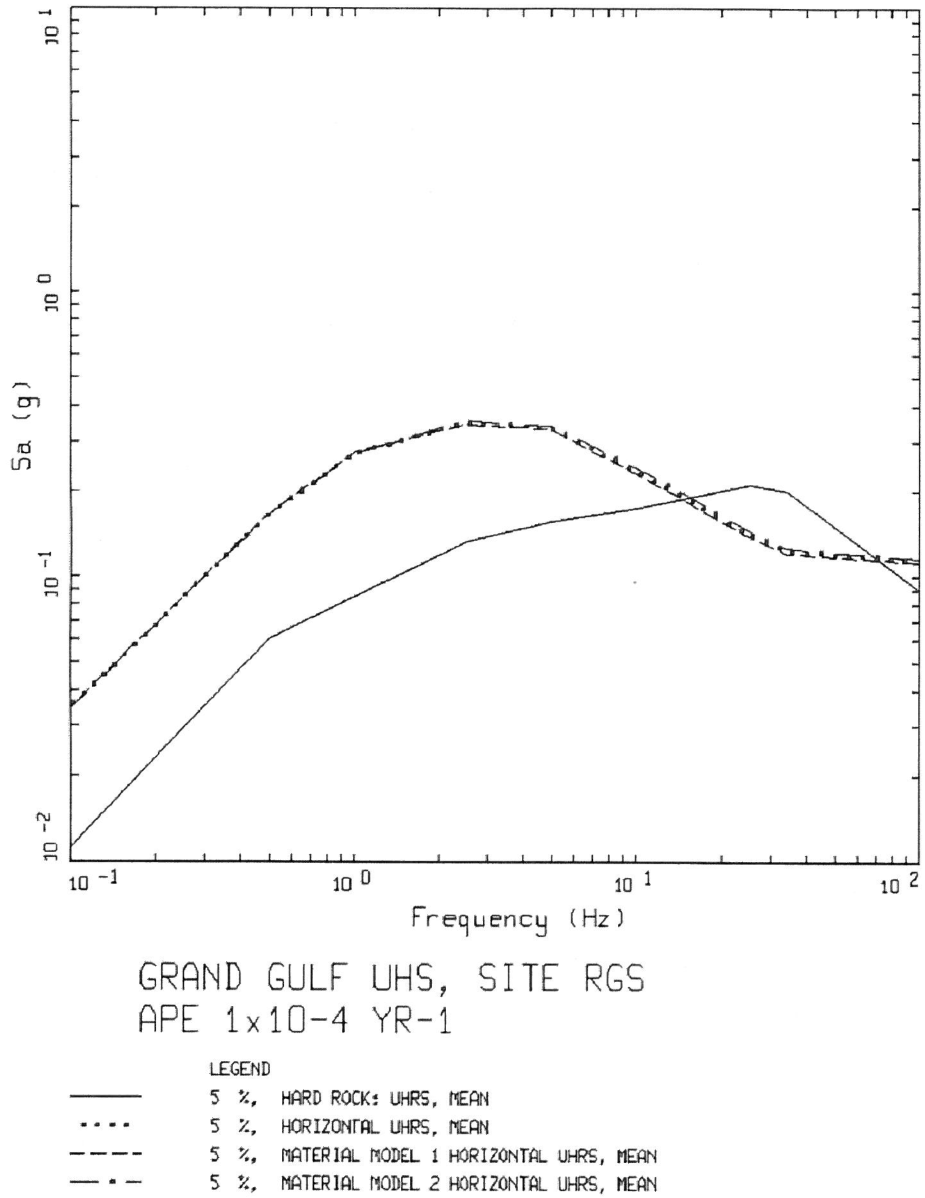

Figure 2.5.2-229.

Comparison of UHRS for Reactor Ground Surface at APE 10^{-4} yr^{-1} for Dynamic Material Models 1 and 2 (Uncorrected and Corrected Curves)

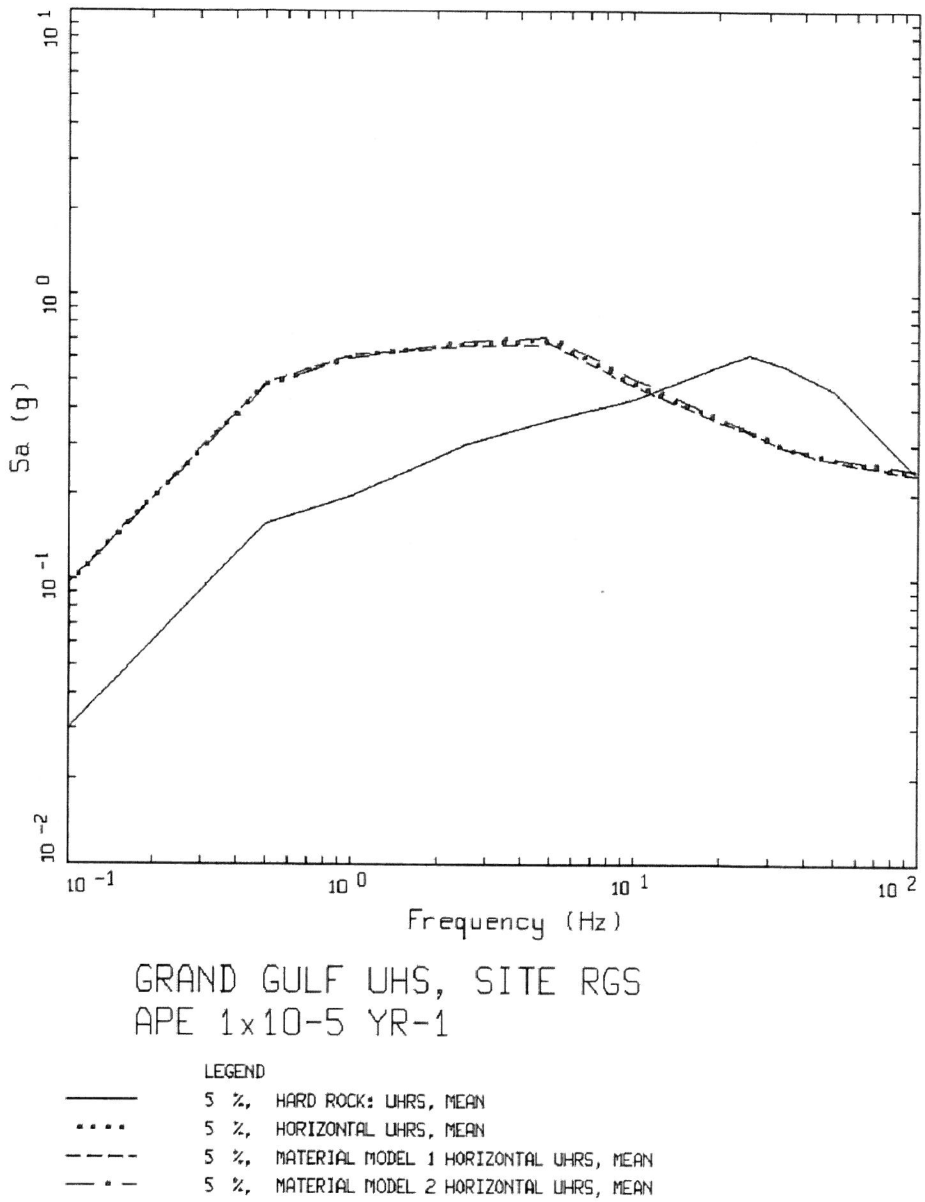

Figure 2.5.2-230.

Comparison of UHRS for Reactor Ground Surface at APE 10^{-5} yr^{-1} for Dynamic Material Models 1 and 2 (Uncorrected and Corrected Curves)

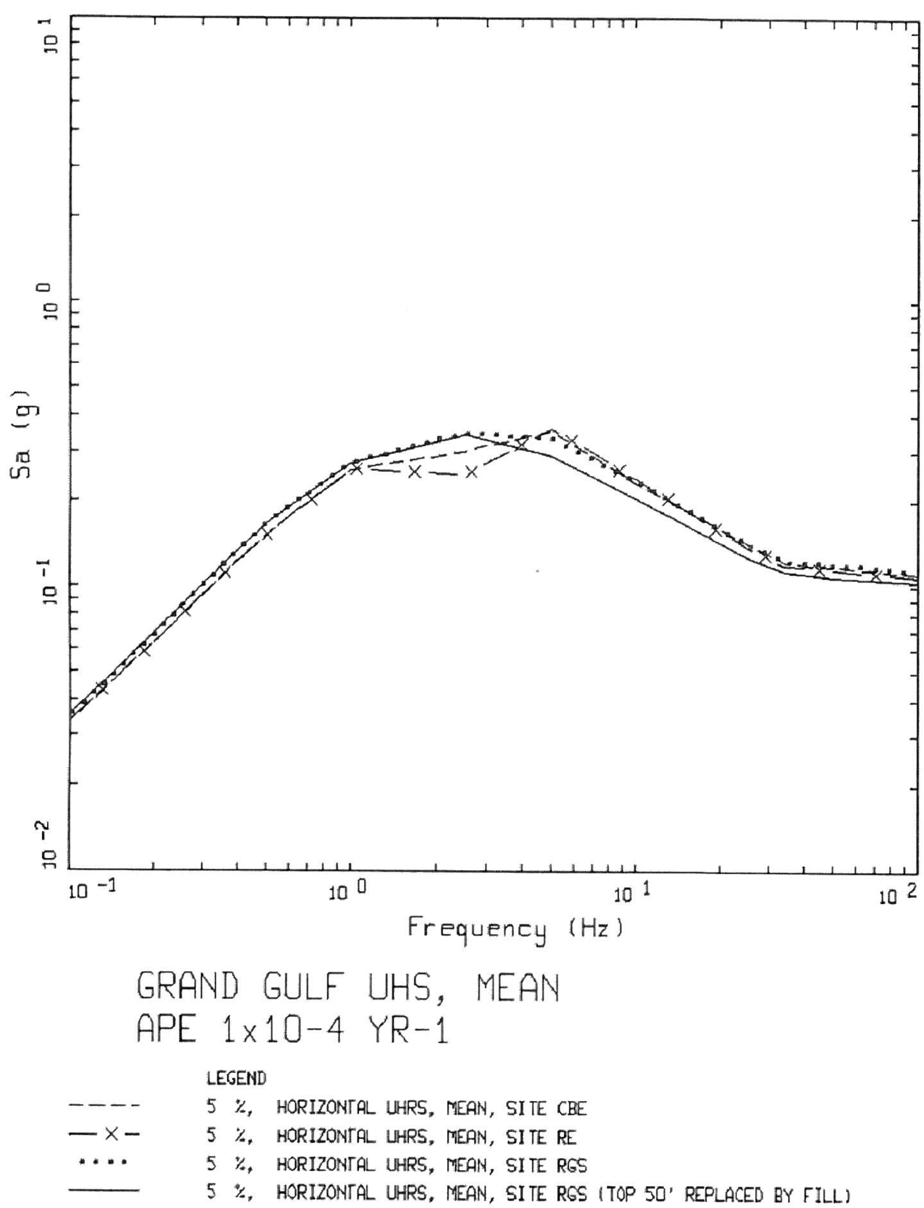

Figure 2.5.2-231.

Comparison of Horizontal UHRS at APE 10^{-4} yr^{-1} for Reactor Ground Surface, Reactor Embedment, Control Building Embedment, and Reactor Ground Surface (top 50 ft replaced by fill)

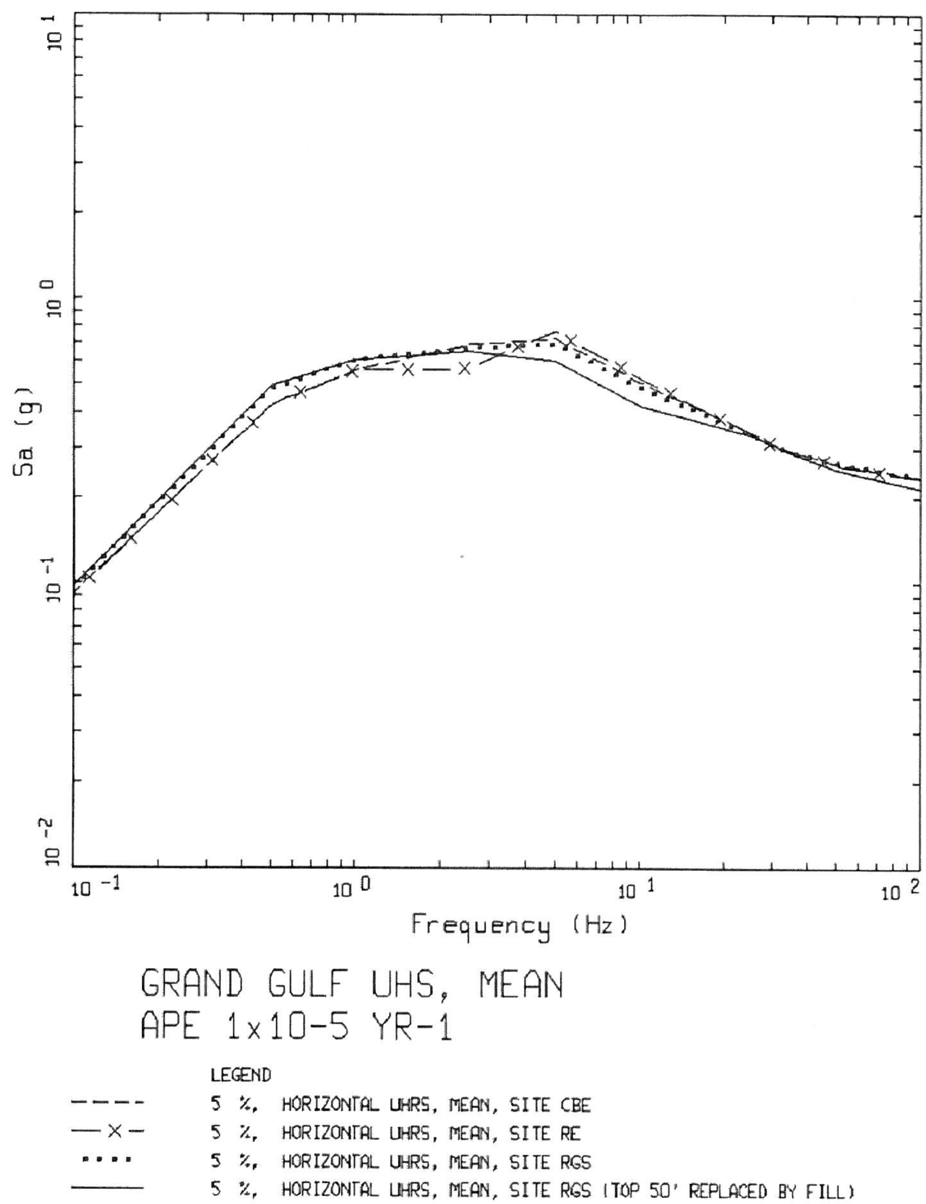

Figure 2.5.2-232.

Comparison of Vertical UHRS at APE 10^{-4} yr^{-1} for Reactor Ground Surface, Reactor Embedment, Control Building Embedment, and Reactor Ground Surface (top 50 ft replaced by fill)

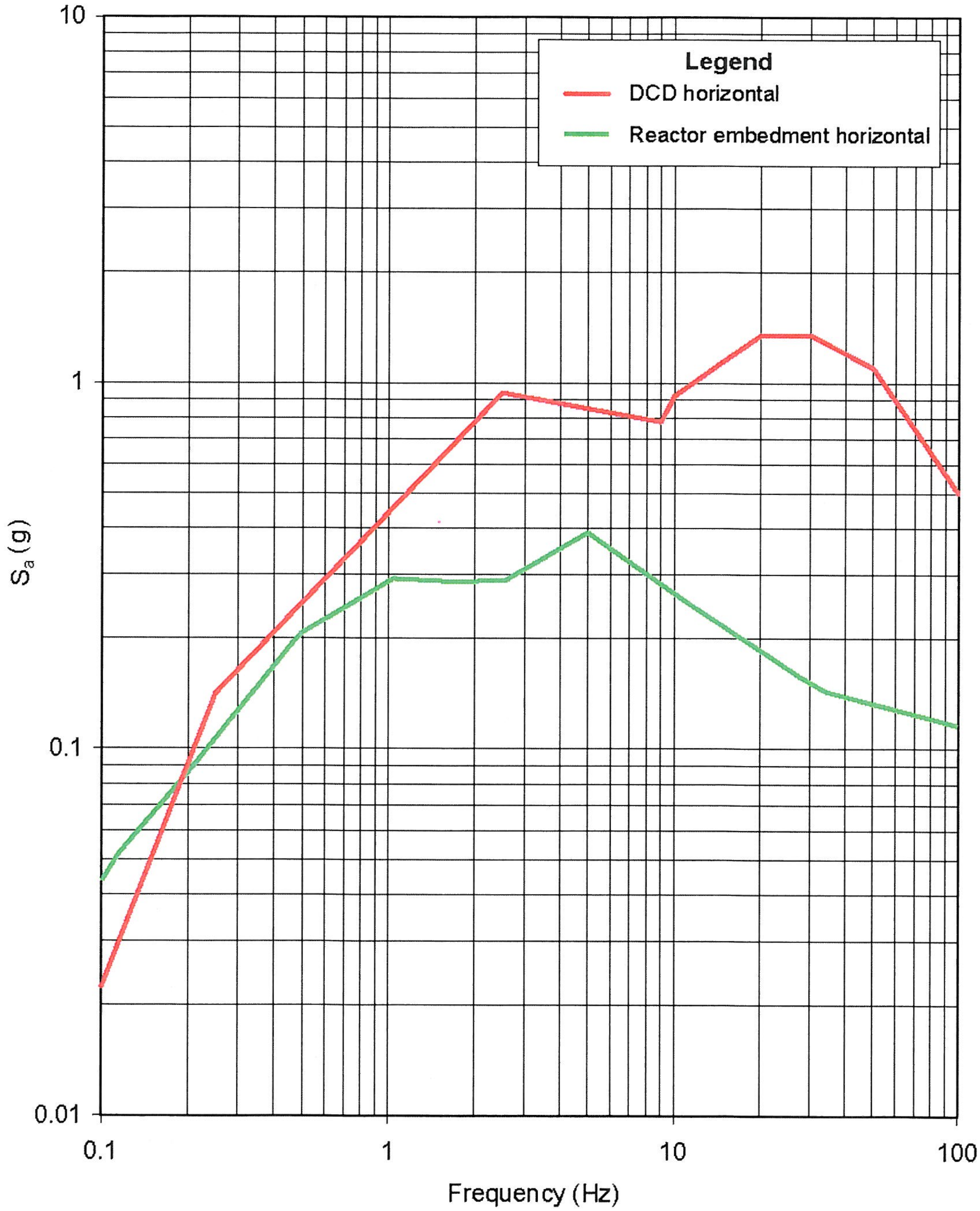

Figure 2.5.2-233.
Horizontal GMRS for APE 10^{-4} yr^{-1} (DRS SDC 5) at Reactor Embedment and ESBWR Horizontal SSE Design Ground Spectra at Foundation Level

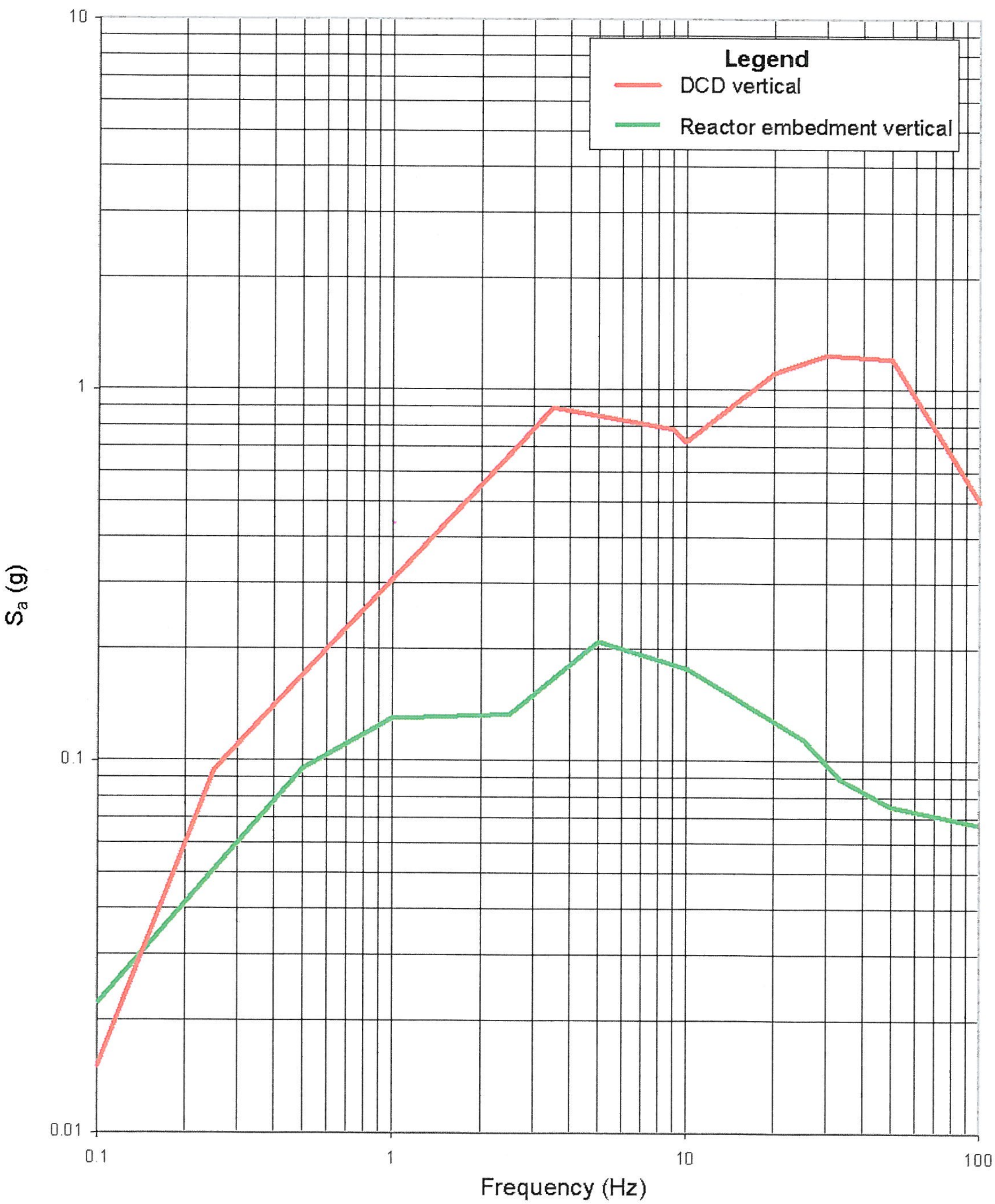

Figure 2.5.2-234.
Vertical GMRS for APE 10^{-4} yr^{-1} (DRS SDC 5) at Reactor Embedment and ESBWR Vertical SSE Design Ground Spectra at Foundation Level

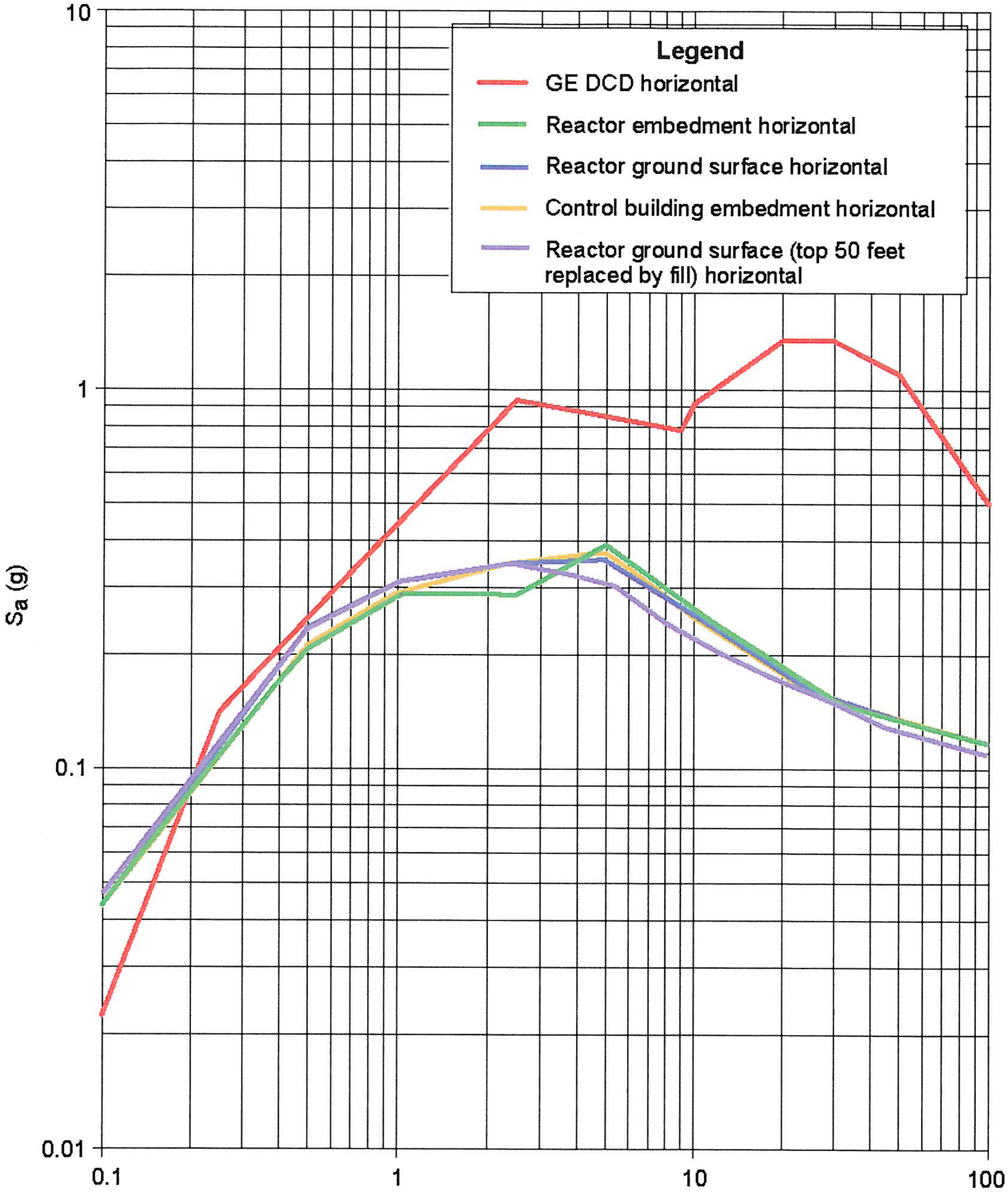

Figure 2.5.2-235.
Horizontal FIRS and GMRS for APE 10^{-4} yr^{-1} at Reactor Embedment, Reactor Ground Surface, Control Building Embedment, Reactor Ground Surface (top 50 feet replaced by fill), and ESBWR Horizontal SSE Design Ground Spectra at Foundation Level

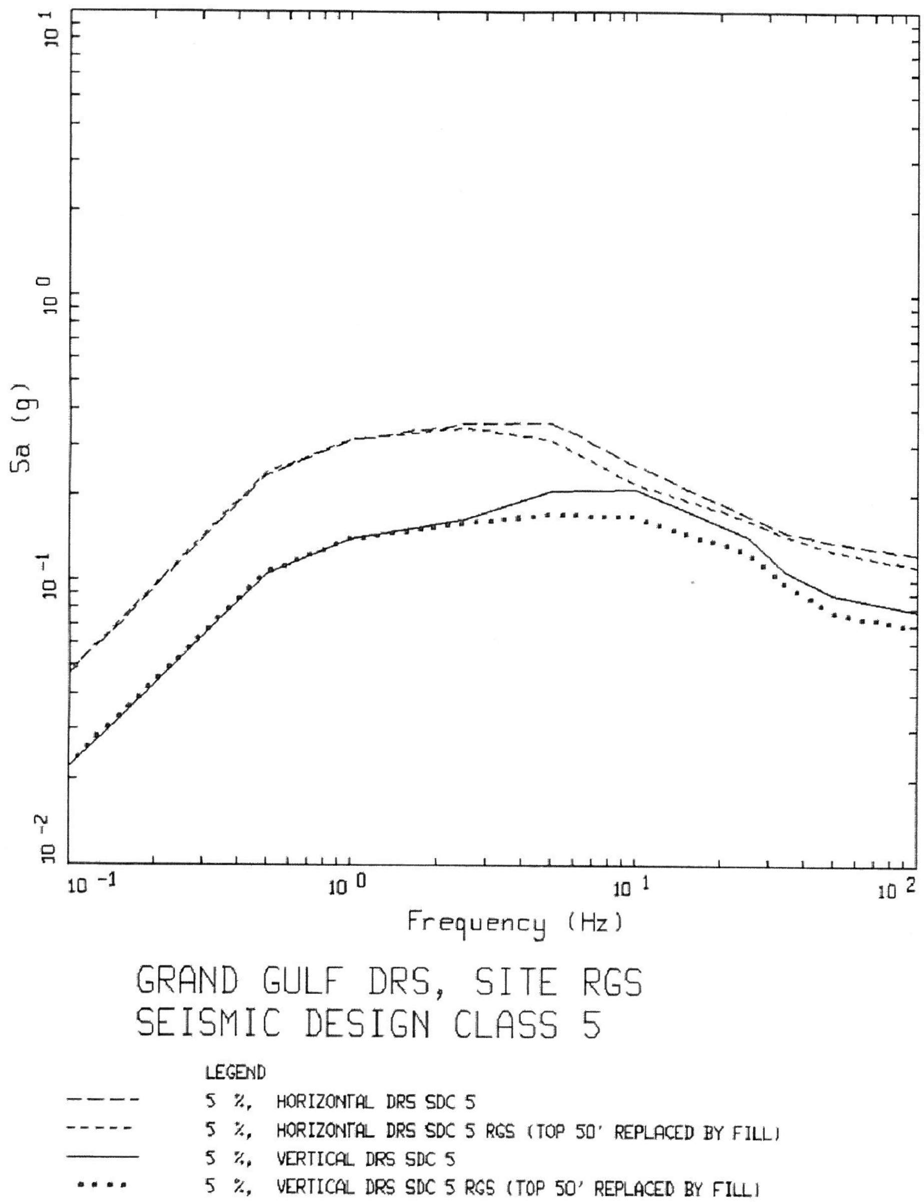

Figure 2.5.2-236.

Horizontal and Vertical FIRS for APE 10^{-4} yr^{-1} at Reactor Ground Surface and Reactor Ground Surface (top 50 ft replaced by fill)

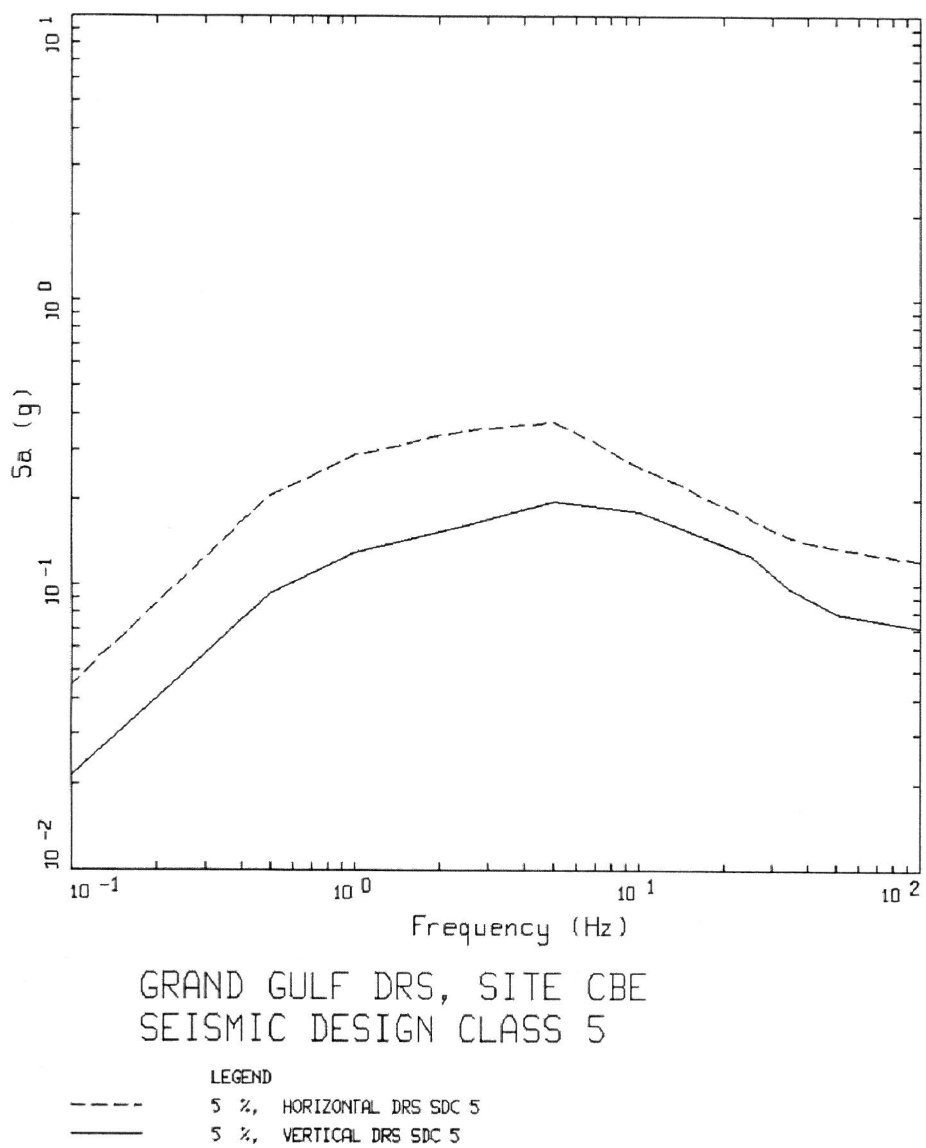

Figure 2.5.2-237.
Horizontal and Vertical FIRS for APE 10^{-4} yr^{-1} (DRS SDC 5) at Control Building Embedment

2.5.3 SURFACE FAULTING

GGNS COL 2.0-28-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

2.5.4 STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS

GGNS COL 2.0-29-A

This section of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

The information provided in the ESP application is supplemented in this section to integrate the results of the COL investigation and testing program, with references to previous programs and results performed for the ESP site and Unit 1 included where applicable. Because of the extensive nature of the revision to the information presented in the ESP, this section was structured to match the format of SRP 2.5.4 and RG 1.206, and therefore section numbering varies from that used in the ESP safety analysis report.

2.5.4.1 GEOLOGIC FEATURES

GGNS COL 2.0-29-A
GGNS ESP COL 2.5-3
GGNS ESP COL 2.5-4

This section presents a summary of site geologic features at GGNS. Section 2.5.4.1.1 describes site stratigraphy, Section 2.5.4.1.2 describes site geologic units, Section 2.5.4.1.3 provides the geologic history of the site, and Section 2.5.4.1.4 describes site geologic stability. Information is provided specific to the following items:

- Surface and subsurface subsidence, solution activity, uplift, and collapse.
- Zones of alteration or irregular weathering profiles, and zones of structural weakness.
- Unrelieved stresses in bedrock and potential for creep and rebound.
- Rock and soil stability with respect to mineralogy, consolidation, water content, and seismic response.
- Rock joint set orientations/stability.
- History of deposition and erosion, including glacial and preloading influence.
- Estimates of consolidation and preconsolidation pressures.

2.5.4.1.1 Site Stratigraphy and Lithology

A site stratigraphic framework (Table 2.5.4-201) was developed based on field examination of recovered borehole samples (including standard penetration tests (SPTs)), cone penetrometer test (CPT) soundings, and test pits from site investigation (Figure 2.5.4-201) and geologic mapping (Figure 2.5.4-202) undertaken at the GGNS Site from April to December, 2006. Table 2.5.4-202 and

Figure 2.5.4-203 summarize stratigraphic data from boreholes and CPT soundings.

Field classifications were reviewed by senior geologists and compared with laboratory test data and classifications to arrive at final geologic unit classifications. This stratigraphic framework was confirmed by comparison of borehole and CPT sounding data to Unit 1 Updated Final Safety Analysis Report (UFSAR) borehole logs (Reference 2.5.4-201) and the SSAR borehole logs (SSAR Figures 2.5-71 through 2.5-74). GGNS Site stratigraphy was placed in regional geologic context presented in various published reports and maps developed by the U.S. Geological Survey, Mississippi Geological Survey, and U.S. Army Corps of Engineers (USACE).

The GGNS Site stratigraphic framework was correlated to previous stratigraphic classifications presented in the Unit 1 UFSAR and the SSAR (Table 2.5.4-201). Subsurface materials were classified during field borehole logging activities pursuant to ASTM D2487-00 (Reference 2.5.4-202). Classification of materials included evaluation of textural composition, degree of sorting, relative density, color, and sedimentary structures. Correlation of subsurface materials to geologic (stratigraphic) units, age assignments, and interpretations of genesis were performed following standard practice geologic interpretive procedures (Reference 2.5.4-203). Figures 2.5.4-204 through 2.5.4-214 and SSAR Figures 2.5-71 through 2.5-74 show summary logs of encountered conditions. Detailed boring logs are included in Appendix 2AA.

All subsurface materials encountered during site exploration at the GGNS Site (Table 2.5.4-201) can be grouped into the following four categories:

- Modern undocumented fill.
- Holocene shallow deposits in stream valleys and along the Mississippi River plain.
- Pleistocene and Pliocene strata east of the steep natural bluff (Mississippi River Bluff) underlying the Unit 3 site.
- Miocene and Oligocene “bedrock” strata underlying the entire site.

Of these, only the second category (Holocene deposits) is not present beneath the Unit 3 powerblock. The spatial distribution of these materials is shown in Figures 2.5.4-215 through 2.5.4-233.

Section 2.5.4.1.1.1 provides a description of stratigraphic units present within each of the four above categories, and Section 2.5.4.1.1.2 provides a comparison of these units to geologic material descriptions in previous studies.

2.5.4.1.1.1 Stratigraphic Units

Several stratigraphic units are recognized within each of the four subsurface material categories except undocumented fill, and are described below. Complete geologic material descriptions are provided in Section 2.5.4.1.2 and engineering material properties are described in Section 2.5.4.2.

Eight surficial Holocene geologic units are recognized at the site in stream valleys and along the Mississippi River plain on the basis of geomorphic mapping and regional studies:

- Stream channel deposits
- Stream terrace deposits
- Colluvium
- Alluvial fan deposits
- Levee deposits
- Lacustrine deposits
- Backswamp deposits
- Mississippi River alluvium (undifferentiated)

These geologic units are recognized by geologic and geomorphic mapping and air photo analysis at the GGNS Site and are shown in Figure 2.5.4-202.

For Sections 2.5.4.2 through 2.5.4.12, the following subunits that exhibit similar age and genesis are grouped into the single designation “Mississippi River alluvium”:

- Alluvial fan deposits
- Mississippi River alluvium (undifferentiated)
- Levee deposits
- Lacustrine deposits
- Backswamp deposits

None of these units occur beneath the Unit 3 powerblock or factor into the geotechnical response and evaluations for ESBWR Seismic Category I safety-related plant structures (Figures 2.5.4-217 through 2.5.4-228). These materials are grouped to simplify discussions in the following sections, because these strata are not important to safety and performance of the plant safety components.

Pleistocene and Pliocene strata are divided into four subsurface geologic units that underlie the Site in the area of geotechnical influence for the Unit 3 powerblock (Figures 2.5.4-217 through 2.5.4-228):

- Upper loess
- Lower loess
- UCA
- Upland Complex old alluvium (UCOA)

Miocene and Oligiocene “bedrock” units underlying the Pleistocene and Pliocene strata at the site (Figures 2.5.4-217 through 2.5.4-228):

- Catahoula Formation clay
- Bucatunna Formation clay
- Glendon Formation marlstone and sand

The composite stratigraphic section extending from the Glendon Formation up through the Upper loess represents the geologic/geotechnical profile below the Unit 3 powerblock that was considered for geologic hazard screening, seismic site response (including deeper strata to hard basement), and geotechnical foundation stability evaluation.

2.5.4.1.1.2 Comparison of Stratigraphy to Previous Studies

Stratigraphy documented during site investigation agrees with the stratigraphy shown on SSAR (SSAR Figures 2.5-71 through 2.5-74) and Unit 1 UFSAR borehole logs (Reference 2.5.4-201), with the following exceptions (Table 2.5.4-201):

- ESP SSAR borehole logs classify some UCOA as Catahoula Formation.
- Unit 1 UFSAR borehole logs classify UCA and UCOA as “terrace alluvium.”
- Unit 1 UFSAR and ESP SSAR borehole logs classify loess but do not differentiate between Upper loess and Lower loess.
- Unit 1 UFSAR and ESP SSAR borehole logs classify stream channel deposits, stream terrace deposits, colluvium, and alluvial fan deposits as “alluvium.”

- Unit 1 UFSAR borehole logs classify Mississippi River alluvium and levee deposits as “alluvium” and ESP SSAR borehole logs classify these materials as “meander belt deposits.”

- Unit 1 UFSAR borehole logs classify lacustrine deposits and backswamp deposits as “alluvium” and ESP SSAR borehole logs classify these materials as “backswamp deposits.”

Material descriptions and contacts from the site investigation are consistent with SSAR and Unit 1 UFSAR borehole log data sets after accounting for these differences in unit nomenclature. Terminology used for the Unit 1 UFSAR is based, in part, on older regional classifications that have been updated and superseded. Changes in terminology used for the SSAR reflect refinement and sub-classification of loess and Holocene deposits based on the additional Unit 3 subsurface exploration data.

2.5.4.1.2 Geologic Material Descriptions

GGNS COL 2.0-29-A

GGNS ESP COL 2.5-2

2.5.4.1.2.1 Modern Undocumented Fill

Undocumented fill used to infill pre-existing swales and other topographically low areas to form the current level site grades during construction of the Unit 1 facility was encountered in several boreholes advanced during site investigation (Figures 2.5.4-215 through 2.5.4-228). Undocumented fill was placed outside of the Unit 1 foundation influence zone and therefore was not placed as a controlled engineered fill (Reference 2.5.4-201). This fill material is generally dark yellowish brown to dark gray silt and silty clay with rare silty sand, and appears to be primarily derived from excavated on-site Upper loess spoil material from past plant site grading (Figure 2.5.4-234). Woody and fibrous organic debris is commonly incorporated in the fill and/or forms a basal layer between the fill and native ground surface (Appendix 2AA). Distribution of undocumented fill material described in borehole logs generally corresponds well to the depth and extent of pre-construction swales documented in the Unit 1 UFSAR (Reference 2.5.4-201). Figure 2.5.4-233 shows the generalized distribution and depth of undocumented fill, compiled by integrating pre-construction swale depth below current site grade with undocumented fill thickness values from borehole logs. Thickness of undocumented fill ranges from 0 to 56 ft. in the Unit 3 powerblock area.

In addition, a thin (0.5 to 2.0 ft. thick) surficial veneer of gravelly sandy aggregate placed to develop a level lay-down area for the Unit 1 construction covers most of the Unit 3 powerblock area (Appendix 2AA).

GGNS COL 2.0-29-A

2.5.4.1.2.2 Shallow Holocene Deposits

2.5.4.1.2.2.1 Stream Channel Deposits

GGNS ESP COL 2.5-3

Holocene stream channel deposits are shallow deposits of unconsolidated gravel, sand, silt, and clay located in active natural stream channels, such as the drainages that border the powerblock area to the north and south (Figure 2.5.4-202). These materials were deposited by natural fluvial sedimentation, and seasonal fluctuation of water flow has caused reworking and development of micro stratigraphy in these deposits. Stream channel deposits are variable in texture and are unconsolidated. These materials are not present beneath or within the area of influence of Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.2.2 Stream Terrace Deposits

Holocene stream terrace deposits are unconsolidated gravel, sand, silt, and clay deposited in overbank terraces or point bars adjacent to active natural stream channels, such as the drainages that border the powerblock area to the north and south (Figure 2.5.4-202). Post-deposition incision of the parent stream has left the deposits as a series of relatively flat terraces above the elevation of modern flooding or stream re-occupation and the terrace surfaces exhibit varying degrees of soil development relative to the age of deposition. Terrace deposits are not present beneath or within the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.2.3 Colluvium

Holocene colluvium deposits are shallow (typically 0 to 35 ft. thick; Reference 2.5.4-201) surficial deposits of unconsolidated sand, silt, and clay mantling slopes and swales at the site area, such as the steep natural escarpment or bluff west of the Unit 3 powerblock area which slopes to the Mississippi River floodplain (termed “Mississippi River bluff”) (Figure 2.5.4-202). These materials were deposited by long term creep and erosion of steeper natural slopes and are primarily derived from Upper loess that forms most slopes at the GGNS Site. The loose, heterogeneous character of colluvium deposits reflects continual creep and remobilization. Textural similarity to the parent material (Upper loess) indicates that colluvium collected on or at the base of the Mississippi River bluff slope has not been transported far. Colluvium does not exist below or within the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228). Colluvium does occur as a surface mantle on the Mississippi River bluff slopes and was included as a specific layer in the slope stability analysis described in Section 2.5.5.

2.5.4.1.2.2.4 Alluvial Fan Deposits

Holocene alluvial fan deposits are shallow deposits of unconsolidated gravel, sand, and silt associated with streams emanating from incised drainages in the loess uplands bordering the east margin of the Mississippi River valley that discharge onto the Mississippi River plain. These deposits are spatially confined to the alluvial plain west of the Mississippi River bluff, and west of the Unit 3 powerblock area (Figure 2.5.4-202). Alluvial fan deposits locally infill part of the low relief area occupied by Gin Lake and Hamilton Lake where they are estimated to be approximately 0 to 25 ft. thick (Reference 2.5.4-201). Alluvial fan deposits are typically saturated because of their location in low lying areas on the Mississippi River floodplain (Appendix 2AA). Alluvial fan deposits are not present beneath or within the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.2.5 Levee Deposits

Holocene levee deposits are shallow (typically 0 to 20 ft. thick; Reference 2.5.4-201) unconsolidated gravel, sand, and silt deposited along the margins of present or former river channels and represent overbank and/or crevasse-splay deposits. Two long, narrow zones of levee deposits form low-relief ridges oriented roughly north-south on the floodplain west of the Mississippi River bluff (Figure 2.5.4-202). The two levees demarcate the positions of active (western levee) and abandoned (eastern levee) Mississippi River channel margins. Levee deposits are not present beneath, or within the area of influence of, any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228). They do, however, provide geologic criteria to help evaluate the history of river migration.

2.5.4.1.2.2.6 Lacustrine Deposits

Holocene lacustrine deposits are shallow (typically 0 to 40 ft. thick; Reference 2.5.4-201) unconsolidated clay, silt, and sand deposited in lakes occupying a low relief area former river channel on the river plain west of the Mississippi River bluff (Figure 2.5.4-202). Typically, lacustrine sediments at the GGNS Site are deposited in oxbow lakes formed by abandoned meander loops in the river floodplain. The low-energy (“slack water”) suspension settlement mode within the floodplain lakes favors deposition of fine sediment and stratification of deposits. These sediments typically remain in a saturated, unconsolidated condition (Reference 2.5.4-201). Lacustrine deposits are not present beneath or in the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.2.7 Backswamp Deposits

Holocene backswamp deposits are shallow (typically 0 to 75 ft. thick; Reference 2.5.4-201) unconsolidated gravel, sand, silt, and clay deposited in ephemeral marshes occupying areas of low relief on the alluvial plain west of the Mississippi River bluff (Figure 2.5.4-202). Backswamp sediments were transported and deposited by a mix of suspension settlement and fluvial transport. These sediments typically remain in a saturated, unconsolidated condition (Reference 2.5.4-201). Backswamp deposits are not present beneath or within the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.2.8 Mississippi River Alluvium, Undifferentiated

Holocene Mississippi River Alluvium (undifferentiated) is composed of unconsolidated gravel, sand, silt, and clay deposits that have obvious genetic affiliation to fluvial processes of the Mississippi River, but lack discrete geomorphologic characteristics for further subclassification. These materials occur on the active alluvial plain west of the Mississippi River bluff (Figure 2.5.4-202) and include a combination of levee, lacustrine, and backswamp deposits previously described above (Sections 2.5.4.1.2.2.5 to 2.5.4.1.2.2.7). These materials are not present beneath or within the area of influence of any Unit 3 safety-related structures (Figures 2.5.4-217 through 2.5.4-228).

2.5.4.1.2.3 Pleistocene and Pliocene Strata

2.5.4.1.2.3.1 Upper Loess

Upper loess is correlative to the sequence of Peoria, Roxanna, and Loveland loess sheets of Wisconsin age that are regionally extensive in the GGNS Site vicinity (Reference 2.5.4-204 through Reference 2.5.4-206). The Upper loess deposits underlie the higher elevation uplands that form the eastern border of the Mississippi alluvial valley (SSAR Figure 2.5-2). The bluff that separates the Mississippi River plain from the Unit 3 powerblock area is comprised principally of Upper loess (Figure 2.5.4-202). Upper loess sediment is sourced from glacial outwash and drift material transported to the south along the Late Pleistocene Mississippi River valley (Reference 2.5.4-204, Reference 2.5.4-207, and Reference 2.5.4-208). Upper loess was identified in the majority of boreholes and CPT soundings associated with the Unit 3 site investigation east of the Mississippi River bluff (Table 2.5.4-202). This material represents the uppermost naturally-occurring geologic strata in the Unit 3 powerblock area (below areas of thin fill), except in active stream channels south and north of the powerblock and in localized areas where undocumented fill was placed in former topographic swales eroded into the upper loess (Section 2.5.4.1.2.1) (Figures 2.5.4-217 through 2.5.4-228). Of the seven subsurface stratigraphic units defined in Section 2.5.4.1.1.1 that occur within the powerblock area, only Upper loess is exposed in outcrop (Mississippi River bluff and existing cut-slopes) (Figure 2.5.4-202). Thickness of Upper loess ranges from about 30 to 80 ft. thick (Table 2.5.4-202) and is controlled in part by past grading activity that removed portions of the Upper loess soil in some locations (Reference 2.5.4-208). The Upper loess is underlain by the Lower loess, and the contact between these units is a subplanar disconformity (Figures 2.5.4-217 through 2.5.4-229).

Upper loess consists of generally dry to damp, homogeneous yellowish brown silt to clayey silt (ML) with low to moderate plasticity (mean plasticity index 10) and blocky structure (Table 2.5.4-203, Figures 2.5.4-235 and 2.5.4-236, Appendix 2AA). Interspersed and clustered small gastropod shells are common to rare, fine root pores are pervasive, and fine laminations are rare to common (Appendix 2AA). Hydrometer analysis results for Upper loess samples (Section 2.5.4.2) indicate a majority (about 85 percent) silt component (Table 2.5.4-203, Figure

2.5.4-235), imparting a silky texture in hand sample. Upper loess exhibits slight gradational variation defined by minor differences in clay content, color, shell content, and consistency, however these variations are not sufficiently well developed or uniform to trace discrete marker horizons between adjacent boreholes. Geotechnical index properties of Upper loess samples generally fall within a narrow range of values (Table 2.5-203) and indicate a lean silt to clay (ML to CL) based on the Uniform Soil Classification System (USCS). It is possible that irregular zones of increased clay content in Upper loess soils represent discontinuous paleosol horizons that formed between discreet pulses of loess deposition. Based on SPT sampling, Upper loess is generally in a medium to very stiff condition (mean corrected N-value 14.5 +/- 7.4 blows/ft).

Upper loess borehole samples produce moderate effervescent response to hydrochloric acid (Appendix 2AA), suggesting weakly developed calcium carbonate cementation. Typically, calcium carbonate cementation in loess deposits occurs as a precipitate in root pores and other void spaces, forming a skeletal bonding between silt grains. Calcite precipitates are visible as small white streaks and blebs in some loess specimens. Carbonate precipitate may be more highly developed in zones of gastropod concentration observed in some loess samples. Additional secondary cohesion imparted by clay film formation on silt grain surfaces (Reference 2.5.4-209) is present in some loess samples. Weak carbonate/clay film cementation in Upper loess increases shear strength, permitting vertical or steep slopes in road cuts and stream banks both regionally and locally. However, carbonate cementation and clay film bonding are affected by water saturation that can re-dissolve carbonate precipitates and soften clay films. Long term loess slopes, such as the Mississippi River bluff have persisted in spite of periodic wetting by rainfall and/or overland sheet flow with good gross stability, but localized gullying and erosion occurs where surface water flows or collects. Initial degradation of loess cementation and resulting erosion typically manifests as small piping holes or shallow rills, with continued saturation and water flow contributing to development of deep, steep-sided gullies with a characteristic dissected pattern of dendritic ephemeral swales.

2.5.4.1.2.3.2 Lower Loess

Pleistocene Lower loess was identified in the majority of boreholes and CPT soundings during site investigation for Unit 3 east of the Mississippi River bluff. Lower loess is differentiated from Upper loess by stratigraphic position, higher clay content, and less-uniform texture and character. The Lower loess represents the initial pulses of loess soil deposited in low relief areas developed on an eroded landscape. Comparison of GGNS Site investigation borehole logs with Unit 1 UFSAR borehole logs suggests that the Lower loess may be discontinuous in the GGNS Site vicinity and laterally restricted at the GGNS Site between the Mississippi River bluff and west of Unit 1 (Figure 2.5.4-229). This observation is supported by the absence of Lower loess in borehole B-1061 (Table 2.5.4-202) and the absence of material similar to Lower loess in Unit 1 UFSAR borehole logs (Reference 2.5.4-201). Thickness of Lower loess (where present) averages 12 +/- 5 ft. (Table 2.5.4-202). The top of Lower loess ranges in elevation from 67 to 83 ft.

(North American Vertical Datum of 1988 (NAVD 88)) (Table 2.5.4-202, Figure 2.5.4-229). Lower loess rests unconformably over Pleistocene UCA.

Lower loess generally consists of damp to moist light yellowish brown silty clay (CL), silty clay (ML), and clayey sand (SC) interstratified in beds ranging in thickness from 0.5 to greater than 9 ft. (Figures 2.5.4-237 and 2.5.4-238). Stratification within Lower loess cannot be reliably correlated between adjacent boreholes and is laterally discontinuous. Silty clay and clayey silt is moderately plastic (mean plasticity index 14) with common to abundant iron oxide and manganese oxide staining and mottling and common fine-grained sand laminae (less than 0.2 in. thick). Gastropod shells, fine root pores, and blocky structure common in Upper loess are generally absent or less well-developed in Lower loess. Clayey sand is low to non-plastic with subrounded to subangular poorly graded fine-grained quartz sand and minor fine-grained mafic sand. Clayey sand is generally restricted to the basal portion of Lower loess deposits and is interpreted to be a product of reworking of the underlying UCA during Lower loess deposition. Hydrometer analysis results for Lower loess samples indicate that this material is primarily (59 percent) silt with significant amounts of fine-grained sand (22 percent) and clay (20 percent) (Table 2.5.4-203, Figure 2.5.4-237). Based on SPT sampling, Lower loess is generally in a medium to very stiff condition (mean corrected N-value 16.3 +/- 9.5 blows/ft.).

Greater clay content in the Lower loess with respect to the Upper loess locally creates a partial aquitard, permitting development of ephemeral perched groundwater in the Lower loess and at the base of the Upper loess (Figure 2.5.4-239). The use of the term perched groundwater in Sections 2.5.4 and 2.5.5 refers to the modeled layer of high water content shown in Figure 2.5.4-239. Lithologic description of continuous core samples collected during site characterization indicated moist to saturated soils were encountered in soil borings in many areas within the Loess. Monitoring wells screened in the Loess identified only small localized areas of perched groundwater. Those wells with measurable perched groundwater are illustrated in Figure 2.4.12-205. CPT soundings also recorded a thin elevated layer of high pore water content within the loess in many locations. This modeled layer of higher water content is “perched” above the groundwater table but is unconfined and discontinuous throughout the site. Figure 2.5.4-239 shows this modeled surface as continuous within the power block for the purposes of evaluating excavation and dewatering analyses and for providing conservative liquefaction and slope stability calculations. Perched water is further discussed in Section 2.4.12.

Borehole samples of Lower loess do not exhibit an effervescent response to contact with hydrochloric acid indicating absent or less well-developed carbonate than the Upper loess (Appendix 2AA). The absent or reduced carbonate in Lower loess appears to be related to several possible factors including general absence of gastropod shells, higher moisture dissolution of carbonate precipitates, and less paleosol development.

2.5.4.1.2.3.3 Upland Complex Alluvium

Pleistocene UCA was identified in the majority of Unit 3 borings located east of the Mississippi River bluff (Table 2.5.4-202). UCA is a fluvial sequence dominated by sugary textured sand that was deposited as overbank, crevasse splay, and point bar sediments of the ancient Mississippi River. These deposits accumulated over an erosional surface (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-230). The top of the Upland Complex sequence was eroded prior to deposition of the overlying Lower loess and is represented by two subplanar surfaces that range between roughly 75 and 135 ft. (NAVD 88) (Table 2.5.4-202, Figure 2.5.4-230). The irregular, eroded surface between the UCA and overlying loess indicate a significant post-deposition erosional event. Erosion of the formerly thicker alluvial sediments exerted a higher surcharge confining stress on the remaining UCA, resulting in preconsolidation of these deposits with respect to existing topography and confining stress.

The UCA rests unconformably over the UCOA (described below) (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-230). Comparison of stratigraphy defined by Unit 3 borehole logs (Appendix 2AA) with Unit 1 UFSAR borehole logs (Reference 2.5.4-201) indicates that UCA at the GGNS Site occurs as two separate inset paleoterrace sequences that are laterally disconformable and separated by an elevation difference of about 60 ft. (Figure 2.5.4-230). The lower UCA paleoterrace has a basal elevation of about 75 ft. (NAVD 88), and extends east from the Mississippi River bluff to immediately west of the Unit 1 facility, entirely underlying the Unit 3 powerblock (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-230). The higher Upland Complex paleoterrace has a base elevation of about 135 ft. (NAVD 88) and extends east from the western edge of the Unit 1 powerblock (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-230). Because of spatial, temporal, and stratigraphic differences in paleoterrace deposition, discreet subunit stratigraphy within UCA cannot be directly correlated between Unit 3 powerblock and Unit 1 powerblock locations. Thickness of UCA below the Unit 3 powerblock averages 19 ft. +/- 8 (Table 2.5.4-202).

UCA in the powerblock area consists of moist to wet light yellowish brown and gray poorly graded sand (SP) with some discontinuous thin interbeds of silty sand (SM) and clayey silt (ML) (Table 2.5.4-203, Figures 2.5.4-240 and 2.5.4-241, Appendix 2AA). Fine stratification within UCA is laterally discontinuous and cannot be correlated between adjacent boreholes. The predominately poorly graded sand is non-plastic with subrounded to subangular fine- to medium-grained quartz sand and lesser fine-grained mafic sand (Appendix 2AA). UCA has common iron oxide staining, but less pervasive than the overlying Lower loess (Appendix 2AA). Grain-size analysis indicates that sand content of the alluvium averages about 70 percent, with some fines and trace gravel (Table 2.5.4-203, Figure 2.5.4-240).

Borehole samples of UCA do not exhibit an effervescent response to hydrochloric acid and lack evidence of significant paleosol development (Appendix 2AA). Based on SPT sampling, UCA is generally in a medium to very dense condition (mean corrected N-value 37.8 +/- 19.7 blows/ft.) and CPT soundings commonly met tip refusal in these deposits (Figure 2.5.4-203). The contact between UCA and underlying UCOA is a subplanar erosional disconformity that exhibits relief on the order of about 35 ft. (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-230). Top of unit elevation ranges from about 30 to 65 ft. (NAVD 88) (Table 2.5.4-202, Figure 2.5.4-230). Laboratory testing performed for the Unit 3 study and field testing reported in the Unit 1 UFSAR (Reference 2.5.4-201) both confirm measurable overconsolidation of the UCA (Section 2.5.4.2).

2.5.4.1.2.3.4 Upland Complex Old Alluvium

Pleistocene UCOA was identified in the majority of Unit 3 boreholes east of the Mississippi River bluff (Table 2.5.4-202). Comparison of Unit 3 site investigation borehole logs with those from the Unit 1 UFSAR (Reference 2.5.4-201) suggests that UCOA is areally restricted between the Mississippi River bluff and west of the Unit 1 facility (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-231). UCOA appears to have been deposited as fluvial channel sediments over a highly irregular erosional surface developed on the underlying Miocene Catahoula Formation (Figure 2.5.4-231). Because of this irregular erosional/deposition surface, the extent and thickness of the unit is variable under the Unit 3 powerblock area (Figure 2.5.4-231). Thickness of UCA is typically about 38 ft. +/- 26 (Table 2.5.4-202, Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-231). Thicker deposits of UCOA exist where deeper channels were eroded into the top of the Catahoula Formation (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-231).

A prominent, deep, northeast-trending buried paleochannel in-filled by UCOA is present along the west margin of the Unit 3 powerblock. Dimensions of the channel are well demonstrated by Figure 2.5.4-232, an elevation isopach map of the unconformable contact between UCOA and Catahoula Formation. This buried channel may reflect a former location of a tributary drainage to the Mississippi River that is now located north of the Unit 3 area (Figure 2.5.4-202) or a possible former meander course of the Mississippi River during the early Pleistocene. The buried paleochannel is approximately 750 ft. wide and incised roughly 70 ft. into the top of the Catahoula Formation. Inclination of side slopes on the buried paleochannel range from 10 to 20 degrees (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-231). The southeast margin of the channel is located directly west of the Unit 3 powerblock, and under the radwaste building (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-231). Thick lenses of gravelly sand to sandy gravel within the UCOA are abundant within the buried paleochannel and appear to represent channel lag deposits (Appendix 2AA).

UCOA consists of well-graded gravelly sand (SW) and dark gray silty clay (CL) interstratified in laterally discontinuous beds ranging in thickness from less than 0.5 to (especially in the case of gravelly sand) to about 10 ft. (Table 2.5.4-203, Figures 2.5.4-242 and 2.5.4-243, Appendix 2AA). Stratification within UCOA cannot be confidently correlated between adjacent boreholes and the thickness of discrete lenses or zones vary laterally (“pinch and swell”). Well-graded gravelly sand is non-plastic with subrounded to subangular well-graded fine- to coarse-grained sand (Table 2.5.4-203). The majority of grains in the gravelly sand are quartz with abundant lithic and common feldspathic grains, whereas the gravel is largely siliceous (chert) with rare to common irregularly shaped rip-up clasts of greenish clay from the underlying Catahoula Formation (Appendix 2AA). Silty clay lenses are moist and moderately to highly plastic with common carbon streaks and some woody or fibrous plant materials (Appendix 2AA). UCOA is markedly less uniform than the overlying UCA and represents a more dynamic, changing depositional environment. Discrete lenses and layers appear to be crudely bedded with lateral cross cutting erosion/cross bedding interfaces (Appendix 2AA). Catahoula rip up clasts and gravelly lenses indicate high velocity fluvial flow, typical of channel flow (Appendix 2AA). Laboratory grain-size analysis of UCOA samples show that the dominant texture of sandier beds is fine- to coarse-grained sand (average 53 percent) with gravel (Table 2.5.4-203, Figure 2.5.4-242). Hydrometer analyses indicate typical silt percentage of about 26% and clay content of about 14% (Table 2.5.4-203, Figure 2.5.4-242). Based on SPT sampling, UCOA is generally in a medium dense to dense condition (mean corrected N-value 32.1 +/- 17.6 blows/ft).

UCOA borehole samples do not exhibit an effervescent response to contact with hydrochloric acid (Appendix 2AA). Deposits typically are dark colored and range from dark green to dark gray, with a gleyed appearance (Appendix 2AA). This coloration suggests reducing conditions and/or mafic mineralogy. Granular lenses are typically dense and clayey layers and zones generally are medium stiff to stiff (Appendix 2AA). As with the overlying UCA, UCOA appears to be in an overconsolidated state as the result of erosional stripping of former thicker alluvial surcharge. Laboratory testing performed for the Unit 3 study and field testing reported in the Unit 1 UFSAR both confirm significant overconsolidation of the UCOA (Section 2.5.4.2).

2.5.4.1.2.4 Miocene and Oligocene strata

2.5.4.1.2.4.1 Catahoula Formation

Miocene Catahoula Formation is a semi-indurated marine sequence of claystone/clay and sandstone/sand that was identified in all boreholes advanced through the overlying Pleistocene and Holocene deposits in the Unit 3 powerblock (Table 2.5.4-202). Catahoula Formation also was recorded in borehole logs for the Unit 1 UFSAR (Reference 2.5.4-201) and one deep borehole described in the SSAR. Outcrops of Catahoula Formation have been described near the historic town of Grand Gulf, 1 mile north of the GGNS Site (Reference 2.5.4-201). The Catahoula Formation is a regionally extensive formation that is relatively continuous in the subsurface within the Mississippi River embayment, and at the Grand Gulf site represents the first occurrence of “bedrock” (soft rock). One borehole (B-1013) from the Unit 3 investigation was advanced deep enough to penetrate through the Catahoula Formation, 270 ft. thick at the borehole location (Section 2.5.4.3) (Appendix 2AA). This thickness is similar to documented Catahoula Formation thicknesses in Unit 1 UFSAR borehole logs (Ho). Top of Catahoula elevation ranges between minus 37 and plus 93 ft. (NAVD 88) (Table 2.5.4-202, Figures

2.5.4-217 through 2.5.4-228 and 2.5.4-231) and represents an irregular erosional unconformity with the overlying UCOA. As discussed in Section 2.5.4.1.2.3.4, deep channels were eroded into the top of the Catahoula Formation that later were backfilled by deposition of UCOA (Figures 2.5.4-217 through 2.5.4-228 and 2.5.4-232).

The Catahoula Formation consists of damp to moist greenish gray silty clay (CL) and clayey sand (SC) graded in some beds to weakly indurated claystone that exhibits a “brittle” blocky structure (Table 2.5.4-203, Figures 2.5.4-244 and 2.5.4-245, Appendix 2AA). The weakly indurated Catahoula Formation breaks with strong hand pressure into numerous granule-sized weakly cemented clay shards (Appendix 2AA). Clay beds are moderately to highly plastic with no significant organic materials observed in recovered borehole samples (Appendix 2AA). Clayey sand lenses range from low to non-plastic, and contains fine-grained subangular quartz (Appendix 2AA). Stratification within the Catahoula Formation is laterally discontinuous and it is typically difficult to trace individual marker beds between adjacent boreholes. Hydrometer analysis results for Catahoula Formation samples indicate a substantial (52 percent) silt component with significant fine-grained sand (37 percent) and clay (24 percent) (Table 2.5.4-203, Figure 2.5.4-244).

Borehole samples of the Catahoula Formation do not exhibit an effervescent response to contact with hydrochloric acid (Appendix 2AA), and thermogravimetric analysis of one Catahoula Formation sample yielded a carbonate content of 0.9 percent by weight (Table 2.5.4-204). The measured carbonate content and observed field and hydrochloric acid response indicate that the Catahoula Formation does not contain sufficient carbonate to undergo significant dissolution or karst development. SPT tests and borehole seismic velocity measurements show that the Catahoula Formation is hard (mean corrected N-value 45.1 +/- 17.0 blows/ft), with geotechnical engineering properties typical of very competent, partly cemented soils and soft rock.

Grain size and sedimentary structures in the Catahoula Formation are consistent with an interpretation of deposition in a marine marginal shoreline environment (Reference 2.5.4-201). The indurated nature of rip-up clasts from the Catahoula Formation in UCOA gravelly sand deposits (Appendix 2AA) indicates that a significant amount of time passed between deposition of the two units, allowing for the Catahoula Formation to become weakly indurated. The geologic history of past sedimentation and erosional stripping suggests that the Catahoula Formation is in a significantly overconsolidated state with past surcharge loading perhaps many times greater than the present confinement imposed by the overlying Pleistocene and/or Holocene deposits. Laboratory testing performed for the Unit 3 study and field testing reported in the Unit 1 UFSAR (Reference 2.5.4-201) both confirm significant overconsolidation of the Catahoula Formation (Section 2.5.4.2).

2.5.4.1.2.4.2 Bucatunna Formation

One borehole (B-1013) advanced for the Unit 3 study was deep enough to encounter and penetrate through the Oligocene Bucatunna Formation, which underlies the Catahoula Formation (described above) (Appendix 2AA). The top of the Bucatunna Formation was encountered in the boring at a depth of 372 ft. (-239.5 ft. elevation) below site grade (Section 2.5.5.3) and was about 75 ft. thick at the boring location (Appendix 2AA). Similar depth and thickness values were recorded in Unit 1 UFSAR borehole logs (Reference 2.5.4-201). Based on descriptions of regional geology (SSAR Section 2.5.1.1.4.2.3.3), the Bucatunna Formation is a regionally extensive formation that likely underlies the entire GGNS Site (Reference 2.5.4-201).

The Bucatunna Formation consists of damp to moist greenish black silty clay (CL) and sand with shell hash (SP) (Figure 2.5.4-246, Appendix 2AA). The Bucatunna Formation is weakly indurated and parts easily along common silt laminae (Appendix 2AA). Clay is moderately to highly plastic with no trace of organic materials (Appendix 2AA). Sand component ranges from low to non-plastic and contains abundant mollusk shell fragments (Table 2.5.4-203, Appendix 2AA).

Borehole samples of the Bucatunna Formation do not exhibit an effervescent response to contact with hydrochloric acid (Appendix 2AA), and thermogravimetric analysis of one Bucatunna Formation sample yielded a carbonate content of 3.3 percent by weight (Table 2.5.4-204). The measured carbonate content and observed field and hydrochloric acid response, indicate that the Bucatunna Formation does not contain sufficient carbonate to undergo significant dissolution or karst development. Borehole sample descriptions (Appendix 2AA) and seismic velocity measurements (Section 2.5.4.2.2.7) show that the Bucatunna Formation is very stiff to hard, with geotechnical engineering properties ranging between those typical for very competent, partly cemented soils and soft rock.

The Byram Marl, a roughly five foot-thick unit recorded between the Bucatunna and Glendon Formations in three Unit 1 UFSAR borehole logs (Reference 2.5.4-201), was not encountered during Unit 3 site exploration (Appendix 2AA).

2.5.4.1.2.4.3 Glendon Formation

The Glendon Formation is the deepest strata encountered during site exploration and was identified in the deepest borehole (B-1013) at a depth of 447 ft. (-314.5 ft. elevation) below site grade (Appendix 2AA). This borehole was terminated in the Glendon Formation and the local unit thickness was therefore not determined (Appendix 2AA). Regional geologic descriptions suggest that the Glendon Formation is on the order of 300 ft. thick (SSAR Figure 2.5.4-9). Some deep Unit 1 UFSAR borehole logs also record the Glendon Formation, at depths similar to that in Unit 3 borehole B-1013 (Reference 2.5.4-201). A structure contour map of the top of the Glendon Formation in SSAR Figure 2.5-15 has been used for regional evaluation of salt dome occurrence and deformation.

The Glendon Formation encountered in B-1013 consists of two to six foot-thick interbeds of light gray marly limestone and greenish gray sandy clay (CL) (Figure 2.5.4-247, Appendix 2AA). Sandy clay is moderately to plastic and weakly indurated with abundant mollusk shell fragments and no visible trace of organic materials (Appendix 2AA). The limestone component of the Glendon Formation is weak to medium strong and recovered samples effervesce in response to contact with hydrochloric acid (Appendix 2AA).

No dissolution features were identified in the core samples. Additionally, thermogravimetric analysis of two Glendon Formation samples yielded carbonate contents of 87.9 percent and 87.1 percent by weight (Table 2.5.4-204). These laboratory measurements indicate significant carbonate content in the formation beds, but the level of purity is below typical percentages common to limestone formations with documented well-developed dissolution and karst (Reference 2.5.4-211). The samples tested were selected based on field determination that the samples were of the highest carbonate content recovered.

Borehole seismic velocity measurements show that the Glendon Limestone Formation is dense with geotechnical engineering properties typical of soft rock (Section 2.5.4.2.2.8).

2.5.4.1.3 Geologic History

Geological formations underlying the GGNS Site record a long history of tectonic stability, deposition, and transition from marine to terrestrial sedimentation, as described in SSAR Section 2.5.1.2.2. Unconformities between geologic formations record changes in depositional environment, climate, and glacial-eustatic cycles over the past 34 Ma (SSAR Section 2.5.1.2). Regionally, laterally continuous deposits of Oligocene age and younger dip very gently southward along the plunge direction of the Mississippi River embayment towards the Gulf of Mexico (SSAR Figures 2.5-6, 2.5-11 and 2.5-12). Long term tectonic stability is reflected by lack of deformation in these deposits.

During the Oligocene epoch, paleogeography of the GGNS Site and surrounding region was dominated by shallow marine seas in which the Glendon and Byram Marl Formations of the Vicksburg Group were deposited (Reference 2.5.4-201). These deposits primarily consist of limestone and marl with interbedded calcareous sands and clays (Appendix 2AA, Reference 2.5.4-201). The Byram Marl was later buried by clay of the late Oligocene Bucatunna Formation, representing a transition to a low-energy, deep water environment. These deposits are overlain unconformably by the Miocene Catahoula Formation (Figures 2.5.4-217 through 2.5.4-228).

GGNS Site paleogeography during the Miocene included marine to marginal shoreline depositional environments reflected by deposition of silty clay and clayey sand of the Catahoula Formation (Reference 2.5.4-201).

In the Late Pliocene or Early Pleistocene, GGNS Site paleogeography changed to an alluvial environment dominated by fluvial sedimentation from the ancestral Mississippi River, during which the surface of the Catahoula Formation was deeply incised by a southwest-trending river/stream channel (Figure 2.5.4-232). The geometry of this channel, represented by the eroded top of the Catahoula Formation, is shown by the structure contour map in Figure 2.5.4-232. This river/stream channel was subsequently backfilled with alluvial deposits correlative with the UCA, probably in response to a rise in regional base level (Figures 2.5.4-217 through 2.5.4-228). These deposits consist of coarse sand and gravel derived from both glacial and non-glacial sources (Reference 2.5.4-208), termed UCOA in this report. One or more episodes of alluvial erosion and deposition resulted in emplacement of fine sands and clays of the UCA in a series of two inset terraces shown in Figures 2.5.4-225 and 2.5.4-230.

At various periods in the late Pleistocene, strong seasonally prevailing winds transported silt from unvegetated glacial outwash in the central United States (Reference 2.5.4-208), depositing loess sheets in the region between Vicksburg and Natchez (SSAR Figure 2.5-8). The youngest loess sheet, the Peoria Loess, is late Wisconsin in age (Reference 2.5.4-205). Texture of Lower loess reflects deposition in an alluvial environment that blended windblown silt with clay and sand, probably reworked from eroded UCA (Table 2.5.4-203). The disconformable contact between Lower and Upper loess represents a depositional hiatus of unknown length, after which windblown silt of Upper loess was deposited across the site to a thickness of greater than 50 to 80 ft. (Figures 2.5.4-217 through 2.5.4-228).

Throughout the Holocene, loess deposits were deeply eroded by tributary streams to the Mississippi River through establishment of dendritic drainage systems (Figure 2.5.4-202). During this time alluvial sediment was also deposited on the Mississippi River plain west of the Mississippi River bluff and in tributary stream valleys along the northern and southern portions of the site (Figure 2.5.4-202).

2.5.4.1.4 Geologic Stability

2.5.4.1.4.1 Overview

Information in Section 2.5.4.1.4 is provided specific to the following items:

- Surface and subsurface subsidence and unrelieved bedrock stresses.
- Volcanic domes.
- Solution activity and collapse.
- Zones of alteration, irregular weathering profiles, and zones of structural weakness

- History of deposition and erosion, estimates of consolidation and preconsolidation pressures, and potential for rebound.
- Rock and soil stability with respect to mineralogy, water content, creep, and seismic response.
- Rock joint set orientations and stability.

Each of these specific items are discussed below. In summary, the Unit 3 powerblock is on stable ground in an area of low tectonic activity, and absent of geologic and geotechnical hazards that could pose a safety hazard to the plant. No unstable, or potentially unstable, geologic/geotechnical conditions have been identified in the Unit 3 powerblock, and the nearby Unit 1 plant has performed well without development of adverse conditions. The Unit 1 site yard and former lay-down areas, including the Unit 3 powerblock, are relatively level with intact surfaces and pavements and do not show evidence of any significant settlement, subsidence, collapse, or deformation since the initial site grading was completed in the 1970's (Figure 2.5.4-202). Cut slopes made along access roads and level pads in the Unit 3 powerblock area have been stable without evidence for development of instability or damaging erosion (Figure 2.5.4-248).

2.5.4.1.4.2 Surface and Subsurface Subsidence and Unrelieved Bedrock Stresses

There is no evidence for geologic hazards or human activities that would result in surface subsidence or unrelieved stresses in bedrock that could affect plant safety or performance. As discussed in SSAR Section 2.5.3, no active or capable faults or geologic structures were found at or within a five mile radius of the GGNS Site (SSAR Figure 2.5-9), nor are any expected to be present based on the geologic and tectonic setting. No capable faults or tectonic structures were found during the site construction and excavations for the Unit 1 powerblock that were examined and logged by geologists (Reference 2.5.4-201). Based on a review of potential regional sources (SSAR Section 2.5.3.3), potential for surface-fault rupture at the site can be considered negligible. In addition, there is no evidence of non-tectonic deformation in the site area, such as collapse structures, differential uplift, subsidence, salt diapirs, growth faults, or volcanic intrusion (SSAR Section 2.5.1.1.5.10).

The Unit 3 powerblock is on an existing stable, level cut area that served as a lay-down site during construction of the Unit 1 plant. Pleistocene loess and alluvium and underlying Tertiary (Oligocene to Miocene) deposits encountered and characterized in the subsurface explorations for Unit 3 powerblock and documented in the SSAR (SSAR Section 2.5.1.2) and Unit 1 UFSAR (Reference 2.5.4-201) are undeformed with erosional unconformity contacts that can be traced across the site (Figures 2.5.4-217 through 2.5.4-228). Mapping and subsurface explorations (described in Section 2.5.4.3) confirm that soil and rock materials at the GGNS Site have not experienced seismically-induced ground failure from historic or paleoearthquakes (Figures 2.5.4-202 and Figures 2.5.4-

217 through 2.5.4-228). No sand boils or other paleoliquefaction features were observed during GGNS Site geologic and geomorphic mapping (Figures 2.5.4-202 and 2.5.4-248), and no sand dikes were observed in continuous soil core samples, test pits, or surface soil profiles (Figures 2.5.4-249 through 2.5.4-252, Table 2.5.4-205, Appendix 2AA). The uniform character of this subsurface stratigraphy was confirmed by a dense network of soil and rock boreholes (to a maximum depth of 506 ft.) and can be predictably traced between borings throughout the Unit 3 powerblock area (Figures 2.5.4-201 and 2.5.4-217 through 2.5.4-228). Discrete marker beds and laminae in these materials are horizontal to subhorizontal, evidence that major deformation or subsidence has not occurred later than Oligocene time, and measurable deformation (within a resolution of several feet) has not occurred since Pleistocene time (Figures 2.5.4-217 through 2.5.4-228).

No significant industrial groundwater extraction wells are located within the 0.6 mi. (1 km) radius of the site with the exception of radial makeup water wells at the east shoreline of the Mississippi River that support the Unit 1 plant. Operation of these radial wells has caused no adverse subsidence or impacts on the stability of strata below the Unit 3 powerblock area. Past groundwater dewatering performed during foundation excavation for Unit 1 similarly did not cause adverse subsidence or effects (Reference 2.5.4-201). Groundwater extraction activities are further discussed in Section 2.5.4.6.

As discussed in SSAR Section 2.5.1, there are no mining or underground extraction activities occurring on or near the site. No petroleum producing areas exist within 10 mi. of the site, and in general, petroleum exploration in Claiborne County has been highly unsuccessful. Within a six mile radius of the site, 12 petroleum exploration wells have been drilled, all of which have been dry (SSAR Section 2.5.1). The potential for future petroleum production in the site vicinity is unfavorable. Sand and gravel excavated from pre-loess alluvial deposits (e.g. UCA and old alluvium) is an economic resource in Claiborne County, and clay derived from the Catahoula Formation is a potential economic resource in the county (SSAR Section 2.5.1). However, no economic deposits of gravel and sand, or Catahoula clay, are identified near the site, and no previous activity associated with quarrying of these deposits has affected the stability of the foundation materials in the Unit 3 powerblock area, as discussed in SSAR Section 2.5.1.

2.5.4.1.4.3 Volcanic Domes

As discussed in SSAR Section 2.5.1, no active or capable volcanic domes or structures exist within a 5 mi. radius of the Unit 3 site, nor are any expected in this geologic setting. Regional volcanic domes include the Jackson Dome (near the city of Jackson in west-central Mississippi), the Monroe Uplift (straddling southern Arkansas, northern Louisiana, and west-central Mississippi), and the Sabine Uplift (east Texas and western Louisiana). None of these domes are located in sufficient proximity to represent a potential volcanic or dome-growth deformation hazard. As discussed in Section 2.5.4.1.4.2, Holocene, Pleistocene, and Oligocene-Miocene strata characterized within the 5 mi. radius do not exhibit characteristic dome-related warping.

2.5.4.1.4.4 Salt Domes

The GGNS Site is located near the north margin of the Mississippi Salt Basin; however, no salt domes occur within a 5 mi. radius of the site (SSAR Section 2.5.1.1.5.10). The nearest salt domes are the Bruinsburg Dome (located 6.5 mi. southwest) and the Galloway Dome (located 8 mi. northeast), as described in SSAR Section 2.5.1. Both of these salt domes deform the Oligocene Glendon Limestone and are defined by structural contouring of the top of this formation as shown in SSAR Figure 2.5-15. Similar deformation in the Glendon Formation is not known within 5 mi. of the Unit 3 powerblock, and there is no near surface evidence for salt domes below the GGNS Site (SSAR Section 2.5.1.1.5.10).

GGNS COL 2.0-29-A

GGNS ESP COL 2.5-8

2.5.4.1.4.5 Solution Activity (Karst) and Collapse

Interbedded limestone, sandy clay, and marl of the Glendon Formation underlie the Unit 3 powerblock area at approximately 450 ft. below ground surface (Figures 2.5.4-217 through 2.5.4-219 and 2.5.4-221, Appendix 2AA). As discussed in Section 2.5.4.1.2.4, the Glendon Formation is the shallowest significant occurrence of calcareous rocks with laboratory-measured carbonate content of about 87 to 88% by weight (Table 2.5.4-204). The overlying Bucatunna and Catahoula Formations exhibit laboratory-measured carbonate contents of about 3% and 1% respectively by weight (Table 2.5.4-204) with sufficient clay content to effectively impede any significant dissolution or karst development (Reference 2.5.4-211).

As stated in Section 2.5.4.1.2.4.3, no dissolution features were identified in the core samples. Laboratory testing of recovered Glendon Formation strata from borehole B-1013 shows significant carbonate content (Table 2.5.4-204); however, the measured percentages are below typical percentages common to limestone formations with documented well-developed dissolution and karst (Reference 2.5.4-211). The samples tested were selected based on field determination that those samples were of the highest carbonate content recovered. Additionally, the non-calcareous argillaceous and silty component of Glendon Formation limestone would tend to plug any potential incipient solution conduits and the thinly bedded character of the Glendon Formation would restrict their size and continuity (Appendix 2AA).

Evaluation of aerial photography, topographic maps and field reconnaissance show that there are no karstic features (e.g., sinkholes, circular depressions, caves, etc.) within 5 mi. of the site (Figure 2.5.4-202). The nearest outcrop of the Glendon Formation is about 25 miles north of the GGNS Site in Vicksburg, MS (Reference 2.5.4-201). No karst-related features or documented cave development was found by reviewing topographic and geologic maps covering the outcropping area or were identified as a result of contacting researchers familiar with properties of Vicksburg Group strata.

Absence of karst-related geomorphic or topographic features in the Pleistocene loess suggests that karst development has not occurred at or near the site for at least several hundreds of thousands of years and therefore is not an actively occurring geologic process at the GGNS Site. Karst development is therefore not likely to influence the site area in the future.

GGNS COL 2.0-29-A

2.5.4.1.4.6 Zones of Alteration, Irregular Weathering Profiles, and Zones of Structural Weakness

GGNS ESP COL 2.5-3

Unconsolidated Upper and Lower loess, UCA and UCOA, and Miocene Catahoula Formation within the Unit 3 powerblock foundation influence zone are separated by erosional contacts and do not exhibit significant weathering-related weakening. Weakly developed and discontinuous paleosols occur within the various strata (Appendix 2AA), but are not sufficiently well developed or ubiquitous to adversely affect foundation response or geotechnical properties. There is no evidence from geologic mapping (Figure 2.5.4-202) or from borehole data (Appendix 2AA) for zones of potential structural weakness, including slickensides, shear zones, joints, fractures, faults, folds, or irregular weathering profiles in any subsurface materials beneath the Unit 3 powerblock, including all potential foundation bearing strata (Sections 2.5.4.1.2 and 2.5.4.2.2). Additionally, no evidence of localized or differential subsidence or deformation was observed in the Pleistocene to Holocene natural surfaces within a 5 mi. radius of the GGNS Site and no subsidence or deformation has occurred at the GGNS Site since construction in the developed plant area surrounding Unit 1 (including the Unit 3 powerblock area) (Figure 2.5.4-202).

2.5.4.1.4.7 History of Deposition and Erosion, Estimates of Consolidation and Preconsolidation Pressures, and Potential for Rebound

Section 2.5.4.1.3 discusses the history of deposition and erosion for site geologic materials. In summary, all identified geologic strata in the Unit 3 powerblock foundation influence area are separated by erosional unconformities and exhibit varying degrees of overconsolidation induced by previous higher surcharge loading from stripped sediment. Estimated overconsolidation ratios for these materials were developed based on results of in-situ and laboratory testing (as described in Sections 2.5.4.2.2.1) and from reported laboratory test results in the Unit 1 UFSAR (Reference 2.5.4-201). Estimated overconsolidation ratios are on the order of about 1.5 to 3.0 and generally appear to be greater in the deeper UCOA and Catahoula Formation than in the overlying loess (Section 2.5.4.10).

Section 2.5.4.10 discusses the relationship between overconsolidation and foundation loading imposed by the Unit 3 safety-related foundations, along with amounts of predicted heave and/or settlement. Manageable levels (fractions of an inch to about 2 inches) of heave and foundation load-imposed recompression are predicted. Instrumentation and settlement monitoring for the Unit 1, founded in Catahoula Formation, indicated excavation-induced rebound on the order of about 1.5 to 2.0 inches, and post construction settlement related to elastic recompression of 2.0 inches (Reference 2.5.4-201). Material testing and analysis and historical precedence indicate that excavation rebound and foundation-induced settlement will not present stability concerns for the Unit 3 powerblock safety-related foundations (Section 2.5.4.10).

2.5.4.1.4.8 Rock and Soil Stability with Respect to Mineralogy, Water Content, Creep, and Seismic Response

Section 2.5.4.2 discusses rock and soil mineralogy and properties. Results from field and laboratory testing indicate that no unusual rock or soil mineralogies are present in the Unit 3 powerblock safety-related foundation influence zone that pose a potential stability or adverse performance concern (Table 2.5.4-203, Appendix 2AA).

GGNS Site stratigraphy has been well established by a comprehensive site exploration and testing program (Figure 2.5.4-201). Material underlying the Unit 3 powerblock area is generally low to moderate plasticity (PI range of 8 to 25) (Table 2.5.4-203), coarse-grained materials are dense to very dense (Appendix 2AA), and fine-grained materials are stiff to hard (Appendix 2AA).

As discussed in Sections 2.5.1 and 2.5.4.1, no evidence of historic or prehistoric seismic ground failure, including liquefaction and lateral spreading, was found during the site investigation. No features indicative of paleoliquefaction, such as sand dikes, were observed in the extensive borings or reconnaissance surface mapping throughout the Unit 3 powerblock and adjacent ground. Loess and UCA and old alluvium are Pleistocene in age and overconsolidated, suggesting that liquefaction is not likely to develop. Section 2.5.4.8 discusses numerical liquefaction analysis of the unconsolidated loess and UCA and old alluvium.

The steep natural bluff in loess soils that descends from the western and northern margins of the ESP site to the Mississippi River floodplain shows evidence of surficial soil creep and limited headward regression, but no evidence for slope failure features, such as landsliding, slumping, lurching, or lateral spreading, were observed during GGNS Site geologic and geomorphic mapping (Figures 2.5.4-202 and 2.5.4-248).

GGNS COL 2.0-29-A

2.5.4.2 PROPERTIES OF SUBSURFACE MATERIALS

GGNS ESP COL 2.5-3

This section presents a summary of subsurface material properties at the GGNS Site. Section 2.5.4.2.1 provides a description of laboratory testing and sample control procedures and Section 2.5.4.2.2 provides a summary of static and dynamic engineering properties of site materials. See Section 2.5.4.3.1 for a discussion of GGNS Site exploration activities and sampling techniques.

Laboratory and field investigations were specifically developed to comply fully with requirements in:

- NRC RG 1.132, Site Investigations for Foundations of Nuclear Power Plants.
- NRC RG 1.138, Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants.

2.5.4.2.1 Laboratory Testing

2.5.4.2.1.1 Purpose and Scope

One hundred seventy-five samples recovered during site investigation activities were submitted for static laboratory analysis (Table 2.5.4-203). Samples were selected and submitted toward a goal of obtaining data from:

- Representative samples for each stratigraphic unit of engineering interest
- Coarse-grained samples with relatively low blow counts for liquefaction analysis
- Samples used to evaluate slope stability characteristics
- Even spatial distribution of samples across the investigation area

The safety analysis uses the developed data for addressing geologic hazards and engineering design characteristics.

The scope of the static laboratory testing program included the following analyses (with applicable ASTM Standard, USACE procedure, or Environmental Protection Agency (EPA) method in parentheses):

- 113 natural moisture tests (ASTM D2216-05 [Reference 2.5.4-212]).
- 31 unit weight tests (ASTM D5084-03 [Reference 2.5.4-213]).
- 25 specific gravity tests (ASTM D854-06 [Reference 2.5.4-214]).
- 82 Atterberg index tests (ASTM D4318-05 [Reference 2.5.4-215]).
- 106 mechanical sieve tests (ASTM D422-63e1 [Reference 2.5.4-216]).
- 48 hydrometer tests (ASTM D422-63e1 [Reference 2.5.4-216]).

- 6 consolidated-undrained triaxial compression tests (ASTM D2850-03a [Reference 2.5.4-217]).
- 1 unconsolidated-undrained triaxial compression test (ASTM D4767-04 [Reference 2.5.4-218]).
- 2 consolidated-drained triaxial compression tests (USACE procedure EM1110-2-1906 [Reference 2.5.4-219]).
- 28 one-dimensional consolidation tests (ASTM D2435-04 [Reference 2.5.4-220]
- 10 one-dimensional collapse tests (ASTM D5333-03 [Reference 2.5.4-257]).
- 2 moisture-density standard Proctor tests (ASTM D698-00ae1 [Reference 2.5.4-221]).
- 2 moisture-density modified Proctor tests (ASTM D1557-02e1 [Reference 2.5.4-222]).
- 4 bulk permeability analyses (ASTM D5084-03 [Reference 2.5.4-213]).
- 20 pH, chlorate, and sulfate analyses (EPA methods SW-846 9045DC [Reference 2.5.4-223] and MCAWW 300.0A [Reference 2.5.4-224]).
- 4 thermogravimetric analyses (CTL Method WIC-0075 [Reference 2.5.4-225]).

These tests are supplemental to the static laboratory index data set (64 samples) completed for the SSAR. The static laboratory data set is shown in Table 2.5.4-203.

Dynamic laboratory testing included eight resonant column and torsional shear (RCTS) analyses conducted in accordance with University of Texas procedure RCTS GR06-04 (Reference 2.5.4-227). These analyses are supplemental to the six RCTS analyses completed for the SSAR (SSAR Section 2.5.4.1.7). The entire available dynamic laboratory data set is shown in Table 2.5.4-206.

2.5.4.2.1.2 Sample Control

Samples were obtained from split spoon, soil core or undisturbed tube samples taken under the direct observation of rig geologists as part of the geotechnical exploration process (Table 2.5.4-203). Split spoon samples were placed in glass jars and sealed using a moisture-tight lid. Undisturbed tube samples were sealed in the field using a petroleum-based wax. Soil cores were wrapped in plastic and placed in heavy wax-coated cardboard core boxes. All samples were labeled with identifying information, transferred to the lockable site temporary storage area, and inventoried into the sample inventory records. All samples were later transferred to a permanent sample storage area at GGNS where access is controlled by Entergy.

Soil boring field records were reviewed by project engineers and samples were identified for possible laboratory testing. Work instructions were issued listing samples to be removed from the site storage and shipped to the laboratories. In accordance with the work instructions, samples were removed from the site storage area and prepared for shipping.

Samples were handled and transported or shipped to the appropriate laboratory location following handling methods in ASTM D4220-95 (Reference 2.5.4-226). Samples for index testing were handled as Group B samples and undisturbed tube samples were handled as Group C samples. The undisturbed samples were transported by project personnel in passenger vehicles. All samples were shipped under Chain of Custody (COC) and the receiving laboratory signed for them upon receipt. Samples were stored in the controlled laboratory environment in a secure location. Laboratory assignment sheets were prepared by project engineers and provided to the testing laboratories.

For soil samples selected for chemical testing, a portion of the total sample received was prepared by laboratory personnel, placed into labeled sample jars with moisture-tight lids, and shipped under COC to the chemical testing laboratory as directed in a work instruction.

Appropriate portions of jar and undisturbed tube samples were taken to complete the assigned tests. In many cases, the entire sample was used for testing. Any unused portion of the jar or undisturbed sample was properly re-sealed and stored in the laboratory controlled environment.

COC forms were filled out by project personnel at GGNS and accompanied samples to the laboratories. COCs were then completed by the receiving lab and returned for inclusion in the project file. All parties involved in sample transportation completed and signed COC forms to completely document the handling process.

2.5.4.2.1.3 Testing Procedures

All testing was performed in accordance with ASTM standards, EPA methods, and USACE procedures listed in Section 2.5.4.2.1.1. Methodology descriptions of critical tests are provided below.

2.5.4.2.1.3.1 Consolidated-Undrained Triaxial Compression

Consolidated-Undrained (CU) testing was performed pursuant to ASTM D2850-03a (Reference 2.5.4-217) on undisturbed test specimens extruded from sampling tubes and trimmed to appropriate dimensions. The specimens were encased in rubber membranes and saturated by backpressure prior to shearing. Specimen saturation was determined as prescribed in Section 8.2.3.1 of ASTM Standard D2850-03a (Reference 2.5.4-217). The specimen was permitted to drain during the consolidation phase, allowing equilibrium under the confining stress, but no drainage was allowed during the loading phase. Failure was assumed to have occurred when the specimens had reached the maximum deviator stress or an axial strain of 17 percent, whichever had occurred first.

Vertical load, vertical displacement, chamber pressure, and pore pressures generated during the loading phase were measured and recorded. The test is termed CU and total stresses result if no pore pressure corrections are included. When the pore pressures generated during the loading phase are subtracted from the total stresses, effective stresses result.

Some of the tests were performed on unsaturated samples to aid in evaluating effects of saturation. In these tests, the sample was confined as described above and drain valves were left open to allow movement of air and water out of the sample. Once the sample showed no further change in volume, the drain valves were closed and the sample sheared.

2.5.4.2.1.3.2 Unconsolidated-Undrained Triaxial Compression

Unconsolidated-undrained (UU) testing was performed in a manner similar to the CU test described above, except that no drainage is allowed under the confining pressure or the loading. Testing was performed pursuant to ASTM D4767-04 (Reference 2.5.4-218).

2.5.4.2.1.3.3 Consolidated-Drained Triaxial Compression

Consolidated-drained (CD) testing was performed in a manner similar to the CU test described above, except that complete drainage is allowed during the shearing, preventing development of excess pore water pressures. This test is applicable to rapidly-draining soils such as the sands of the UCA. Testing was performed pursuant to USACE Method EM 1110-2-1906 (Reference 2.5.4-219).

2.5.4.2.1.3.4 One-Dimensional Consolidation

One-dimensional consolidation testing was performed pursuant to ASTM D2435-04 (Reference 2.5.4-220) on undisturbed test specimens extruded from sampling tubes. Specimens were trimmed to form a disc approximately 2.5 in. diameter and 1 in. thick. The disc was confined in a stainless steel ring, sandwiched between porous plates, and subjected to incrementally increasing vertical loads. The vertical load on the sample and number of loading increments varied slightly among the samples. Resulting changes in specimen height with respect to time were measured with a linear variable differential transformer and recorded on the data collector. The load increments were doubled with each loading phase and deformation (consolidation) under each load increment was considered complete when log-time plots of deformation indicated that each sample had achieved 100% consolidation.

Test results for samples from the loess materials and the Catahoula Formation were used to estimate the coefficient of consolidation (C_c) the coefficient of recompression (C_r) and pre-consolidation stress (p_c) (Table 2.5.4-203). Undisturbed samples of UCA, UCOA, and Catahoula Formation were difficult to analyze due to their generally dense consistency and significant coarse-grained components. Comments on potential for sample disturbance are included in Table 2.5.4-203.

A variation of the one-dimensional consolidation test was used to check for collapse potential of the unsaturated loess. In this test (ASTM D5333-03 [Reference 2.5.4-257]), the sample is prepared as described above but no water is added to saturate the sample initially. The sample is loaded in increments to a desired pressure approximating the overburden pressure or the overburden plus anticipated foundation pressure, and then inundated. The vertical compression occurring after the inundation is measured and converted to a collapse index.

2.5.4.2.1.3.5 Resonant Column and Torsional Shear

Damping ratio and modulus reduction curves for the site soil column were obtained from RCTS testing of eight undisturbed samples. Dynamic testing was performed to obtain dynamic modulus reduction curves and damping data for site soils for ground motion site-response analyses. Testing was conducted in accordance with University of Texas procedure RCTS GR06-04 (Reference 2.5.4-227).

Each test specimen was subjected to a suite of tests at varying confining pressures and cyclic strain levels. Specimens were driven in the torsion shear mode of the RCTS equipment at increasing cyclic strain levels up to the limit of the equipment and were then excited in the resonant column mode to obtain results at higher strain levels. Table 2.5.4-206 shows the estimated in situ confining pressure (K_0) for each test specimen.

The ratio of the shear wave velocity measured in the laboratory at small strains and the shear wave velocity measured in the field at the sample depth are shown in Table 2.5.4-206 for laboratory test specimens consolidated to the estimated in situ confining pressure and four times the estimated in situ confining pressure. Ideally this ratio should approach unity.

2.5.4.2.2 Material Engineering Properties

2.5.4.2.2.1 Static Material Properties

2.5.4.2.2.1.1 Mississippi River Alluvium

Static laboratory indices were determined for 12 Mississippi River alluvium samples (Table 2.5.4-203). All samples were recovered from four boreholes advanced into Holocene sediments of the Mississippi River plain west of the Unit 3 powerblock (Appendix 2AA). Sample classifications range from clay (CL) and silt (ML) to silty sand (SM) and gravel (GW) (Table 2.5.4-203). Moisture content ranges from 1.4 to 39.3 percent (average 25.3 percent) (Table 2.5.4-203). The fine component of coarse-grained samples (silt and clay; minus 200 sieve) ranges from 0.4 to 35.3 percent, averaging 13.4 percent (Figure 2.5.4-253) (Table 2.5.4-203). Plasticity indices (PIs) for Mississippi River alluvium samples range from 0 to 27, with corresponding liquid limits (LLs) of 26 to 49: PIs for sandy samples are generally non-plastic, and PIs for clayey/silty samples indicate low plasticity clays (Table 2.5.4-203).

Mean undrained shear strength calculated from CPT data is 3400 +/- 2500 psf (Table 2.5.4-207). Mean corrected SPT N-value of Mississippi River alluvium is 30.7 +/- 28.3 blows/ft.

Results of chemical analyses returned an average pH of 8.0, average chlorate content of 2.5 parts per million (ppm), and average sulfate content of 35.9 ppm (Table 2.5.4-203).

Results of the collapse potential tests were variable. Samples from the western area of the powerblock showed minimal collapse potential while samples from the FWSC borings showed moderate collapse potential.

2.5.4.2.2.1.2 Upper Loess

Static laboratory indices were determined for 40 Upper loess samples (Table 2.5.4-203) recovered from three test pits and 16 boreholes advanced in the topographically high area east of the Mississippi River bluff (Figure 2.5.4-201). Together with SSAR data (SSAR Section 2.5.4.1.6), 64 total static laboratory sample indices are available for Upper loess (Table 2.5.4-203). Figure 2.5.4-236 shows a representative photograph of Upper loess for a recovered soil core sample.

Samples are generally classified as silt (ML), less commonly clay (CL). Moisture content ranges from 8.1 to 31.2 percent (average 20.8 percent) (Table 2.5.4-203). The fine-grained component of Upper loess samples (silt and clay; minus 200 sieve) ranges from 82.2 to 99.8 percent, but clusters around an average of 98.1 percent (Table 2.5.4-203, Figure 2.5.4-235). Hydrometer analyses of the fine-grained component returned 65.3 to 91.3 percent silt (average 84.7 percent) and 7.0 to 31.9 percent clay (average 20.4 percent) (Table 2.5.4-203, Figure 2.5.4-235). PIs cover a wide range from 1 to 56, but most are clustered around the unit average of 12; corresponding LLs are 24 to 89 (average 40) (Table 2.5.4-203). Although hydrometer analysis results and field classification describe the fine-grained component of Upper loess as silt-dominated, Atterberg index testing results are divided subequally between low plasticity silt and low plasticity clay, suggesting that Upper loess silts exhibit significant clay-like behavior (Table 2.5.4-203).

Three triaxial CU test series performed on Upper loess samples indicate zero cohesion and effective strength internal friction angles of 33, 34, and 36 degrees

(Table 2.5.4-203). Mean undrained shear strength calculated from CPT data is 6300 +/- 2300 psf (Table 2.5.4-207). These strength results are on the high end of published values for loess (Reference 2.5.4-209), and indicate a relatively high degree of grain interlocking and cementation. Locally, steep and vertical road cuts in loess soils appear to be quite stable, suggesting that some cementation and apparent cohesion exists in the natural, undisturbed loess. Mean corrected SPT N-value of the Upper loess is 14.5 +/- 7.4 blows/ft.

Results of chemical analyses returned an average pH of 8.5, average chloride content of 4.1 ppm, and average sulfate content of 9.1 ppm (Table 2.5.4-203).

2.5.4.2.2.1.3 Lower Loess

Static laboratory indices were determined for 15 Lower loess samples (Table 2.5.4-203) recovered from 10 boreholes advanced in the topographically high area east of the river bluff (Figure 2.5.4-201). Together with SSAR data (SSAR Section 2.5.4.1.6), 18 total static laboratory sample indices are available for Lower loess (Table 2.5.4-203). Figure 2.5.4-238 shows a representative photograph of Lower loess for a recovered soil core sample.

Samples are generally classified as clay (CL), less commonly as silt (ML) (Table 2.5.4-203). Moisture content ranges from 15.2 to 25.3 percent (average 19.9 percent) (Table 2.5.4-203). The fine-grained component of Lower loess samples (silt and clay; minus 200 sieve) ranges from 45.6 to 92.6 percent and averages 77.6 percent (Table 2.5.4-203, Figure 2.5.4-237). Hydrometer analyses of the fine-grained component returned 34.2 to 70.4 percent silt (average 58.5 percent) and 7.0 to 31.9 percent clay (average 20.4 percent) (Table 2.5.4-203, Figure 2.5.4-237). Lower loess sample PIs range from 3 to 34, but most are clustered around the unit average of 14; corresponding LLs are 22 to 52 (average 31) (Table 2.5.4-203). Hydrometer analysis results and Atterberg index testing are consistent with classification of the fine-grained component of Lower loess as low plasticity clay (Table 2.5.4-203).

One triaxial CU test series performed on a Lower loess sample indicates zero cohesion and an effective strength internal friction angle of 26 degrees. Mean undrained shear strength calculated from CPT data is 2900 +/- 2000 psf (Table 2.5.4-207). Mean corrected SPT N-value of the Lower loess is 16.3 +/- 9.5 blows/ft.

Results of chemical analyses returned an average pH of 8.1, average chloride content of 6.8 ppm, and average sulfate content of 2.8 ppm (Table 2.5.4-203).

2.5.4.2.2.1.4 Upland Complex Alluvium

Static laboratory indices were determined for 46 UCA samples (Table 2.5.4-203) recovered from 24 boreholes advanced in the topographically high area east of the Mississippi River bluff (Figure 2.5.4-201). Together with SSAR data (SSAR Section 2.5.4.1.6), 55 total static laboratory sample indices are available for UCA

(Table 2.5.4-203). Figure 2.5.4-241 shows a representative photograph of UCA for a recovered SPT sample.

Samples are generally classified as poorly graded sand (SP) and silty sand (SM), less commonly as clay (CL) (Table 2.5.4-203). Moisture content ranges from 11.7 percent to 30.8 percent (average 20.5 percent) (Table 2.5.4-203). The sand-sized fraction of UCA ranges from 10.0 to 99.8 percent (average 70.2 percent) (Table 2.5.4-203, Figure 2.5.4-240). The fine-grained fraction of UCA samples (silt and clay; minus 200 sieve) ranges widely from 0.2 to 90.0 percent but averages 29.6 percent (Table 2.5.4-203, Figure 2.5.4-240). Hydrometer analyses of the fine-grained component returned 9.5 to 59.4 percent silt (average 32.1 percent) and 2.2 to 26.0 percent clay (average 12.4 percent) (Table 2.5.4-203, Figure 2.5.4-240). UCA sample PIs range from 0 to 29, but most are clustered around the unit average of 8; corresponding LLs are 17 to 49 (average 30) (Table 2.5.4-203). As reflected by hydrometer analysis results and Atterberg index testing, classification of the fine-grained component of UCA ranges from low plasticity clay to low plasticity silt (Table 2.5.4-203).

Two triaxial CU test series performed on UCA samples indicate zero cohesion and effective strength internal friction angles of 36 and 39 degrees (Table 2.5.4-203). Mean undrained shear strength calculated CPT data is 6100 +/- 3800 psf (Table 2.5.4-207). These results are relatively high for alluvium with silty sand to poorly graded sand consistency (Reference 2.5.4-209), and show that the alluvium is dense with interlocking packed grains. Mean corrected SPT N-value of the UCA is 37.8 +/- 19.7 blows/ft.

Results of chemical analyses returned an average pH of 8.6, average chloride content of 3.8 ppm, and average sulfate content of 5.9 ppm (Table 2.5.4-203).

2.5.4.2.2.1.5 Upland Complex Old Alluvium

Static laboratory indices were determined for 28 UCOA samples (Table 2.5.4-203) recovered from 20 boreholes advanced in the topographically high area east of the Mississippi River bluff (Figure 2.5.4-201). Together with SSAR data (SSAR Section 2.5.4.1.6), 45 total static laboratory sample indices are available for UCOA (Table 2.5.4-203). Figure 2.5.4-243 shows a representative photograph of UCOA for a recovered SPT sample.

Sample classifications tend to be bi-modal with coarse-grained samples grouping as well-graded sand (SW) or gravel (GW) and fine-grained samples grouping as clay (CL) (Table 2.5.4-203). Moisture content ranges from 5.6 percent to 45.4 percent (average 19.9 percent) (Table 2.5.4-203). The gravel-sized fraction of UCOA samples ranges from 0.0 to 85.9 percent (average 22.0 percent) (Table 2.5.4-203, Figure 2.5.4-242). The sand-sized fraction of UCOA samples ranges from 0.9 to 95.7 percent (average 53.0 percent) (Table 2.5.4-203, Figure 2.5.4-242). The fine-grained fraction of UCOA samples (silt and clay; minus 200 sieve) ranges from 1.9 to 99.1 percent and averages 25.0 percent (Table 2.5.4-203, Figure 2.5.4-242). Hydrometer analyses of the fine-grained component returned

3.5 to 51.0 percent silt (average 25.8 percent) and 2.8 to 51.8 percent clay (average 13.7 percent) (Table 2.5.4-203, Figure 2.5.4-242). UCOA sample PIs range from 0 to 29, but most are clustered around the unit average of 19; corresponding LLs are 17 to 52 (average 38) (Table 2.5.4-203). Based on Atterberg indices the fine-grained component of UCOA samples can be classified as low plasticity clay (Table 2.5.4-203).

Two triaxial CU test series performed on UCOA samples indicate zero cohesion and effective strength internal friction angles of 40 and 41 degrees (Table 2.5.4-203). Mean corrected SPT N-value of the UCOA is 32.1 +/- 17.6 blows per ft.

2.5.4.2.2.1.6 Catahoula Formation

Static laboratory indices were determined for 31 Catahoula Formation samples (Table 2.5.4-203) recovered from 13 boreholes advanced in the topographically high area east of the river bluff. Together with data from the SSAR (SSAR Section 2.5.4.1.6), 42 total static laboratory sample indices are available for the Catahoula Formation (Table 2.5.4-203). Figure 2.5.4-245 shows a representative photograph of Catahoula Formation for a recovered SPT sample.

Samples are generally classified as clay (CL) or silt (ML), less commonly as silty sand (SM) (Table 2.5.4-203). Moisture content ranges from 16.9 percent to 51.6 percent (average 26.4 percent). The sand-sized fraction of Catahoula Formation samples ranges from 1.6 percent to 92.9 percent (average 37.2 percent) (Figure 2.5.4-244). The fine-grained fraction of Catahoula Formation samples (silt and clay; minus 200 sieve) ranges from 7.1 to 98.4 percent and averages 59.6 percent. Hydrometer analyses of the fine-grained component returned 14.8 to 69.2 percent silt (average 52.4 percent) and 7.4 to 47.1 percent clay (average 23.7 percent). Catahoula Formation sample PIs range from 0 to 35, but most are clustered around the unit average of 25; corresponding LLs are 29 to 65 (average 49). Based on Atterberg indices the fine-grained component of Catahoula Formation samples can be classified subequally as low and high plasticity clay. Mean corrected SPT N-value of the Catahoula Formation is 45.1 +/- 17.0 blows per ft.

Because the Catahoula Formation is not a founding material for plant structures, no triaxial strength tests and no chemical analyses were performed on Catahoula Formation samples. Thermogravimetric analysis of one Catahoula Formation sample yielded a result of 0.9 percent calcium carbonate by weight (Table 2.5.4-204).

2.5.4.2.2.1.7 Bucatunna Formation

Because the Bucatunna Formation is not a founding material for plant structures, and because the Bucatunna Formation is considered to be a rock unit, no static index testing, triaxial strength tests, or chemical analyses were performed on Bucatunna Formation samples. Thermogravimetric analysis of one Bucatunna

Formation sample yielded a result of 3.3 percent calcium carbonate by weight (Table 2.5.4-204).

2.5.4.2.2.1.8 Glendon Formation

Because the Glendon Formation is not a founding material for plant structures, and because the Glendon Formation is considered to be a rock unit, no static index testing, triaxial strength tests, or chemical analyses were performed on Glendon Formation samples. Thermogravimetric analysis of two Glendon Formation sample yielded a result of 87.9 percent and 87.1 percent calcium carbonate by weight (Table 2.5.4-204).

2.5.4.2.2.2 Dynamic Material Properties

The results of RCTS testing are shown in Figures 2.5.4-254 through 2.5.4-257 as a function of the cyclic shear strain described by the damping ratio and the modulus reduction ratio (G/G_{max}), that is, the shear modulus divided by the low strain shear modulus. Data from six additional RCTS tests presented in the SSAR (Reference 2.5.4-202) are included in these figures. The data are plotted on depth dependent modulus reduction and damping ratios developed by the EPRI (Reference 2.5.4-228). RCTS data are generally similar to the shape of the EPRI curves, but more linear (Figures 2.5.4-254 through 2.5.4-257). This is likely because the EPRI curves were developed for normally consolidated Holocene silty and clayey sands (Reference 2.5.4-228), whereas the soils at the GGNS Site are both older (Pliocene to Pleistocene) and overconsolidated (Section 2.5.4.10).

Dynamic test results were evaluated for analysis by geologic origin and index properties to identify logical groupings for the purpose of assigning dynamic modulus reduction curve and damping values for ground motion site-response analysis. As a result of this analysis, RCTS testing data were partitioned onto four different sets of plots (Figures 2.5.4-254 through 2.5.4-257):

- Upper loess
- Lower loess
- UCA and UCOA
- Catahoula Formation

Analysis of these data and application to evaluation of material response to dynamic loading is discussed in Section 2.5.4.7.2. Table 2.5.4-206 summarizes dynamic sample properties.

The ranges of shear wave velocity (V_s), compression wave velocity (V_p), and Poisson's ratio values described in Sections 2.5.4.2.2.3 to 2.5.4.2.2.8 include values from suspension velocity logging data analysis procedures described in Section 2.5.4.7.1. Although the range of V_s and V_p values in the raw data sets are slightly wider, the values discussed below provide a more consistent approach that reduces the influence of outlying data points and more accurately reflects the very consistent and regular character of materials in the Unit 3 powerblock area.

2.5.4.2.2.3 Dynamic Laboratory Results for Upper Loess

RCTS analysis of two Upper loess samples produced damping ratio and modulus reduction curves that plot along the 50 to 120 ft. curve of EPRI (Reference 2.5.4-228) (Figures 2.5.4-254 through 2.5.4-257). Laboratory to field shear wave velocity ratios of 0.67 and 0.81 for Upper loess samples suggest that assumed K_0 values (the coefficient of earth pressure at rest) may have been too low (laboratory to field shear wave velocity ratio of 1.0 is ideal) (Table 2.5.4-206). Following the concept of reference strain defined by EPRI (Reference 2.5.4-228), the damping ratio and modulus reduction curves can be adjusted to better approximate a laboratory to field shear wave velocity ratio of 1.0. For example, assuming that the shear strength was not affected by limited sample disturbance, a laboratory to field modulus ratio of 0.5 requires values to be shifted by the same amount as is obtained by doubling the laboratory reference strain so that the apparent reference strain in the field is restored. Were an adjustment of this nature applied to the two Upper loess data sets, the shear wave velocity and damping ratio curves would plot no higher than the next deepest EPRI curve (120 to 250 ft.). This approach is supported by Figures 2.5.4-256 and 2.5.4-257, showing that damping ratio and modulus reduction curves lie along deeper EPRI curves when testing was conducted under confining stress conditions of four times the estimated in-situ value (Table 2.5.4-206).

In short, the damping ratio and modulus reduction curves in Figures 2.5.4-254 and 2.5.4-255 are very likely minimum values. Upper loess sample depths are less than 50 to 120 ft. deep (Table 2.5.4-206), suggesting that this unit may be overconsolidated.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for Upper loess yielded a V_s value range of 770 to 990 ft/sec, a V_p value range of 1290 to 1780 ft/sec, and a Poisson's ratio value range of 0.25 to 0.42.

2.5.4.2.2.4 Dynamic Laboratory Results for Lower Loess

RCTS analysis of three Lower loess samples produced damping and shear modulus curves that plot along the 120 to 250 ft. curve of EPRI (Reference 2.5.4-228) (Figures 2.5.4-254 through 2.5.4-257). Laboratory to field shear wave velocity ratios of 0.69, 0.78, and 0.83 for Lower loess samples suggest that assumed K_0 values may have been too low (Table 2.5.4-206) and that the 250 to 500 ft. EPRI curve may be a closer fit to damping ratio and modulus reduction curves (see discussion in Section 2.5.4.2.2.1). The damping ratio and modulus reduction curves in Figures 2.5.4-254 and 2.5.4-255 are very likely minimum values. Lower loess sample depths are less than 120 to 250 ft. deep (Table 2.5.4-206), suggesting that this unit may be overconsolidated.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for Lower loess yielded a V_s value range of 970 to 1060 ft/sec, a V_p value range of 2670 to 4810 ft/sec, and a Poisson's ratio value range of 0.42 to 0.48.

2.5.4.2.2.5 Dynamic Laboratory Results for Upland Complex Alluvium and Upland Complex Old Alluvium

RCTS analysis of three UCA samples and four UCOA samples produced damping ratio and modulus reduction curves that plot along the 250 to 500 ft. curve of EPRI (Reference 2.5.4-228) (Figures 2.5.4-254 through 2.5.4-257). Laboratory to field shear wave velocity ratios of 0.71 and 0.75 for UCA samples and 0.66 and 0.79 for UCOA samples suggest that in some cases assumed K_0 values may have been too low (Table 2.5.4-206) and that the 500 to 1000 ft. EPRI curve may be a closer fit to damping ratio and modulus reduction curves (see discussion in Section 2.5.4.2.2.1). Indeed, UCA and UCOA samples tested with a K_0 value of 1.0 returned laboratory to field shear wave velocity ratios of 0.91 and 1.0, respectively (Table 2.5.4-206). Thus, some of the damping ratio and modulus reduction curves in Figures 2.5.4-254 and 2.5.4-255 are very likely minimum values. UCA and UCOA sample depths are less than 250 to 500 ft. deep (Table 2.5.4-206), suggesting that this unit may be overconsolidated.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for UCA yielded a V_s value range of 970 to 1070 ft/sec, a V_p value range of 2670 to 5500 ft/sec, and a Poisson's ratio value range of 0.42 to 0.48. UCOA yielded a V_s value range of 1060 to 1090 ft/sec, a V_p value range of 4190 to 6130 ft/sec, and a Poisson's ratio value range of 0.47 to 0.48.

2.5.4.2.2.6 Dynamic Laboratory Results for the Catahoula Formation

RCTS analysis of two Catahoula Formation samples produced damping ratio and modulus reduction curves that plot along the 500 to 1000 ft. curve of EPRI (Reference 2.5.4-228) (Figures 2.5.4-254 through 2.5.4-257). Catahoula Formation sample depths are less than 500 to 1000 ft. deep (Table 2.5.4-206), suggesting that this unit may be overconsolidated.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for the Catahoula Formation yielded a V_s value range of 1070 to 2000 ft/sec, a V_p value range of 4750 to 6320 ft/sec, and a Poisson's ratio value range of 0.44 to 0.48.

2.5.4.2.2.7 Dynamic Laboratory Results for the Bucatunna Formation

The Bucatunna Formation was only encountered in one borehole (Appendix 2AA). The depth of this unit (approximately 370 ft. below ground surface) precluded the use of standard undisturbed sampling equipment to sample for RCTS analysis.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for the Bucatunna Formation yielded a V_s value range of 1500 to 2030 ft/sec, a V_p value range of 5720 to 5570 ft/sec, and a Poisson's ratio value range of 0.44 to 0.47.

2.5.4.2.2.8 Dynamic Laboratory Results for the Glendon Formation

The Glendon Formation was only encountered in one borehole. The depth of this unit (approximately 447 ft. below ground surface) precluded the use of standard undisturbed sampling equipment to sample for RCTS analysis.

Analysis of velocity data from aggregated suspension velocity logging data and SASW data for the Glendon Formation yielded a V_s value of 2620 ft/sec, a V_p value of 7590 ft/sec, and a Poisson's ratio value of 0.43.

GGNS COL 2.0-29-A

GGNS ESP COL 2.5-5

GGNS ESP COL 2.5-8

2.5.4.3 FOUNDATION INTERFACES

This section presents a summary of foundation interface conditions at the GGNS Site. Section 2.5.4.3.1 provides a description GGNS Site exploration activities and sampling techniques. Section 2.5.4.3.2 summarizes the relationship of subsurface stratigraphy to Unit 3 powerblock Seismic Category I structures.

2.5.4.3.1 Site Exploration

2.5.4.3.1.1 Purpose and Scope

A detailed engineering geological and geotechnical site investigation (herein referred to as site investigation) was performed at the GGNS Site to:

- Characterize site conditions and develop site-specific seismic design criteria
- Evaluate potential for seismically induced ground failure and hazard
- Obtain information to inform foundation design and site grading

Exploration activities were specifically developed to comply with requirements of 10 CFR Part 52, 10 CFR 50 Appendix S, and 10 CFR Part 100.23, using guidance provided in:

- NRC RG 1.132, Site Investigations for Foundations of Nuclear Power Plants.
- NRC RG 1.138, Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants.

- NRC RG 1.165, Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion.

Investigation activities involved the following modes of data collection:

- Exploratory borehole drilling and sampling
- In-situ geophysical testing
- Monitoring and observation wells
- CPT soundings
- Test pits
- Surface geophysical testing

Methodology and extent of each investigation activity is discussed below.

2.5.4.3.1.2 Exploratory Borehole Drilling and Sampling

During GGNS COL investigation activities, 97 exploratory boreholes were advanced to depths of between 63 and 506 ft. to characterize subsurface geologic conditions, perform in-situ testing, and to obtain laboratory geotechnical test samples (Figure 2.5.4-201 and Table 2.5.4-208). Forty-seven boreholes were advanced specifically to investigate the subsurface conditions beneath the powerblock area, and 50 boreholes were advanced to investigate Unit 3 nonsafety-related facility footprints (i.e., cooling towers, intake facilities, pipelines, and transmission corridor, and general site coverage) (Table 2.5.4-208).

As a result of initial findings, boreholes B-1035, B-1036, and B-1037 were added to the investigation program to better characterize the paleochannel margin represented by UCOA deposits (Figures 2.5.4-201, 2.5.4-231, and 2.5.4-232) (Table 2.5.4-208). This allowed the western edge of the powerblock area to be more accurately modeled (Figures 2.5.4-217 through 2.5.4-222). Boreholes B-1085 and B-1086 were added to the investigation program to better characterize subsurface materials beneath the FWSC footprint (Figure 2.5.4-201, 2.5.4-218, and 2.5.4-219). Logs of all boreholes conducted for Unit 3 Site investigation are shown in Appendix 2AA.

Most boreholes were advanced into the first ten feet of Catahoula Formation, considered to represent site bedrock (Section 2.5.4.1.2). Selected boreholes in the powerblock footprint area were advanced further to characterize the Catahoula Formation and underlying strata, including the Bucatunna and Glendon Formations, up to 506 ft. below ground surface (Table 2.5.4-208, Appendix 2AA). Geotechnical borings intended to characterize the subsurface beneath nonsafety-related infrastructure (e.g. transmission lines, heavy haul road) were advanced to 75 ft. below surface (Table 2.5.4-208, Appendix 2AA). Spacing of boreholes was carefully planned to correspond to the powerblock footprint as well as to thoroughly and efficiently document the geometry of all site stratigraphy of engineering significance (Figure 2.5.4-201).

All boreholes were advanced and sampled using one or more of the following techniques (Table 2.5.4-208):

- Hollow stem auger with continuous soil core barrel sampling.
- Mud rotary wash with SPT unlined split barrel drive sampling.
- Wire-line bit HQ-gauge (3.775 inside diameter) rock core drilling and sampling.

Hollow stem auger equipment was used to advance boreholes and collect disturbed samples pursuant to ASTM D1452-80 (Reference 2.5.4-229). Auger flights had a nominal outside diameter of eight inches and a hollow stem inside diameter of 4.5 in. Samples were collected using five-foot long hollow-stem auger continuous soil core barrel samplers in 19 boreholes at locations where monitoring or observation wells were installed (Figure 2.5.4-201). Hollow-stem auger equipment generally encountered refusal conditions upon contact with the UCA-direct rotary drilling and SPT sampling equipment was then used to advance the borehole (see below for description of direct rotary operations). After recovery, continuous soil core samples were wrapped in plastic sheeting and placed in wax-coated cardboard boxes, labeled on at least three outer panels and one inner panel, pursuant to ASTM D4220-95 (Reference 2.5.4-226). All samples were immediately assigned alphanumeric sample identifications, photographed, described, and recorded on field borehole logs, pursuant to ASTM D2487-00 (Reference 2.5.4-202) and ASTM D2488-00 (Reference 2.5.4-230).

Mud rotary wash boring equipment was used to advance boreholes and collect disturbed samples pursuant to ASTM D5783-95 (Reference 2.5.4-231) and D1586-99 (Reference 2.5.4-232). Samples were collected using 18 in. long SPT unlined split barrel drive samplers. All samplers were of standard manufacture, and were in good condition. Drilling diameter ranged from 2.5 in. to 4.5 in, depending on the conditions encountered (e.g., 4 in. outside diameter casing was often necessary to facilitate recirculation of drilling fluid in gravelly sand strata). Drive sampling by SPT method was conducted with automatic trip hammers, generally at five foot intervals where possible and increasing to 10 ft. intervals in Catahoula Formation. Rarely, sample intervals exceeded 10 ft. where collapse of gravelly sand strata made sampling at closer intervals impractical or impossible. After recovery, representative portions of each SPT sample up to four in. long were selected by rig geologists and placed in one or more labeled glass jars with sealed, lined caps, pursuant to ASTM Standard D4220-95 (Reference 2.5.4-226). All samples were immediately assigned alphanumeric sample identifications, photographed, described, and recorded on field logs, pursuant to ASTM D2487-00 (Reference 2.5.4-202) and ASTM D2488-00 (Reference 2.5.4-230).

Wire-line bit HQ-gauge rock core equipment was used to advance three boreholes to depths of 292 to 506 ft. and collect and describe rock core samples pursuant to ASTM D2113-99 (Reference 2.5.4-233). Boreholes were 4.5 in. outside diameter and continuously sampled with four inch diameter, five foot long core sample barrels. After recovery, rock core samples were wrapped in plastic sheeting and placed in wood boxes, labeled on at least three outer panels and one inner panel, pursuant to ASTM D5079-02 (Reference 2.5.4-234). All samples were immediately assigned alphanumeric sample identifications, photographed, described, and recorded on field borehole logs, pursuant to ASTM D2487-00 (Reference 2.5.4-202). Samples of the core were logged using soil descriptions which was more conducive to properly describing the material.

Undisturbed samples were collected in targeted intervals using thin-wall, 3-inch diameter Shelby tubes, with and without the use of a Pitcher barrel sampler apparatus pursuant to ASTM D1587-00 (Reference 2.5.4-235). Shelby tubes were attached to the drill rod string with a fixed head sample holder with a check valve and were advanced with steady hydraulic push of the drill head. After recovery, Shelby tubes were carefully purged of excess drilling fluid and drill cuttings while remaining upright. One to two in. of melted paraffin was poured into the top of each sample tube to preserve moisture and stabilize the sample, and plastic caps were placed over each end and sealed with melted paraffin. Adhesive tape was used to further secure the plastic end caps. Shelby tube samples were stored upright in a climate-controlled room, secured from accidental disturbance by specially designed padded plywood crates. Those samples transported off site for laboratory analysis were secured upright in padded wooden crates in passenger vehicles and hand-delivered by project personnel. Sample preparation and preservation methods conform to ASTM D4220-95 (Reference 2.5.4-226). All samples were immediately assigned alphanumeric sample identifications, photographed, described, and recorded on field logs pursuant to ASTM D2487-00 (Reference 2.5.4-202) and ASTM D2488-00 (Reference 2.5.4-230).

As mentioned above, SPTs were conducted at regular intervals during borehole advancement to provide estimates of the in situ density/consistency of site materials, obtain disturbed samples for index testing, and to use as a screening tool to evaluate potential liquefaction susceptibility and foundation properties. Testing was conducted using standardized drilling equipment. To achieve each SPT a 140 lb. sliding automatic cyclic trip hammer safety hammer with measured 30 in. hammer drop was allowed to impact a steel anvil screwed onto the top of drill rods. Blow counts were measured for each 6 in. driving interval etched on the anvil. Driving was terminated at a count of 50 blows in any 6 in. interval and the actual penetration distance recorded. Blow counts were recorded independently by rig geologists and drillers and immediately noted on the borehole logs (Appendix A).

Energy measurements were made on drill rig equipment performing SPTs. Energy measurements were recorded during sampling at several different intervals. Energy measurement was done pursuant to ASTM D4633-05 (Reference 2.5.4-236). The ratio of average measured energy to the theoretical potential energy of the SPT system is the energy transfer ratio (ETR). The ETR range of automatic hammers used at the GGNS Site is 74.5 percent to 108.6 percent of the theoretical potential energy. These ETR values are within the range of typical values for automatic hammers.

Field-recorded SPT blow counts were later corrected for equipment and confining stress. Ranges and averages of SPT results for each geologic layer are summarized in Section 2.5.4.2.2.1.

2.5.4.3.1.3 In-situ Geophysical Testing

In-situ geophysical testing was performed in 13 boreholes in and around the powerblock area (Table 2.5.4-208). Suspension compression and shear wave (P-S) velocity logging was performed in 11 boreholes to depths from 153 to 477 ft. below ground surface, and pressuremeter testing was performed in two boreholes in the powerblock area (Figure 2.5.4-201 and Table 2.5.4-208). Section 2.5.4.4 presents a complete discussion of data collection methods used for P-S velocity logging.

Twenty-three pressuremeter tests were conducted in two boreholes. Test locations are described in Table 2.5.4-208 and summarized results are shown in Table 2.5.4-209.

Each test began by lowering a single-cell pressuremeter device into stable boreholes and inflating the cell membrane to deform adjacent material at prescribed intervals. The pressuremeter used for this testing features three electronic displacement sensors spaced 120 degrees apart and covered with a flexible membrane, in turn covered with a protective sheet of stainless steel strips. A cable transmits data from the displacement sensors to a recorder at surface grade. The membrane was expanded by controlling the flow of compressed nitrogen into the pressuremeter from a tank at surface grade.

Pressure was increased slowly until the average strain of the membrane against the borehole wall was about 1 percent. The pressure was then reduced approximately 50 percent and then increased again. The resulting unload-reload loop was used to evaluate the elastic behavior of tested material (materials with linear elastic characteristics exhibit weak hysteretic behavior in that the plot of the reloading path closely follows the unloading path).

Pressure was then increased to about 4 percent average strain and held for up to three minutes before completing another unload-reload cycle. In some cases a third unload-reload loop was conducted if the initial loop indicated that there was some disturbance to the borehole wall during pressuremeter insertion.

Of the 23 attempted tests, 21 yielded useful data (Table 2.5.4-209). In two cases, attempted tests were aborted before useful data could be obtained due to feedback from one or more expansion sensors that indicated the membrane was at risk to rupture. This likely occurred due to instability of coarse-grained sediment in one or more sides of the borehole wall.

2.5.4.3.1.4 Monitoring and Observation Wells

During site investigation activities 40 monitoring wells and four observation wells were installed in 23 locations at the GGNS Site (Figure 2.5.4-201 and Table 2.5.4-210). Eleven monitoring wells and all four observation wells were installed in and around the Unit 3 powerblock and the remaining 29 monitoring wells were installed to investigate nonsafety-related Unit 3 facility footprints (i.e., cooling towers, intake facilities, pipelines, and transmission corridor, and general site coverage). Figures 2.5.4-217 through 2.5.4-228 show cross-sections constructed from borehole logs and relates groundwater level to Unit 3 powerblock embedment depths. Table 2.5.4-210 presents summaries of monitoring and observation well depths and diameters.

2.5.4.3.1.5 Cone Penetrometer Test (CPT) Soundings

CPT equipment was used to advance 28 CPT soundings to depths of between 28 and 86 ft. to characterize subsurface geologic conditions pursuant to ASTM D5778-95 (Reference 2.5.4-237) (Figure 2.5.4-201 shows the CPT locations, and Table 2.5.4-211 contains a summary of the CPT testing). Nineteen CPT soundings were advanced specifically to investigate the subsurface conditions beneath the Unit 3 powerblock area and nine CPT soundings were advanced to investigate important nonsafety-related Unit 3 facility footprints (i.e., cooling towers, intake facilities, pipelines, and transmission corridor, and general site coverage).

Correlation of CPT data to the stratigraphic framework outlined in Table 2.5.4-201 was achieved in two primary steps: (1) Development of a stratigraphic model for each CPT sounding, and (2) Correlation of the layer model from each CPT sounding to stratigraphy in adjacent boreholes and to specific lithologic units within the site stratigraphic framework.

Stratigraphic models for CPT soundings were initially developed qualitatively by evaluating the variance of key data values with depth below surface. Data parameters used to build stratigraphic models include dynamic pore pressure (u), and friction ratio (R_f) where is R_f is described by the equation

$$R_f = \frac{100 f_s}{q_c}$$

as a function of sleeve friction (f_s) and cone bearing (q_c). Sandy, cohesionless soils commonly return low R_f and low u values, and clayey, cohesive soils commonly return high R_f and high u values (Reference 2.5.4-238).

After developing stratigraphic models for each CPT sounding, individual layers were correlated to stratigraphy in adjacent boreholes and assigned to specific lithologic units within the site stratigraphic framework. Table 2.5.4-207 was developed as a result of this process and summarizes the range of friction ratio and dynamic pore pressure data values for each geologic unit encountered during CPT investigation at the GGNS Site. Stratigraphic interpretations were verified by comparing stratigraphy from the Unit 3 field investigation borehole logs adjacent to CPT soundings where possible. Three representative CPT-borehole comparisons are included as Figure 2.5.4-258.

2.5.4.3.1.6 Test Pits and Surface Soil Profiles

Four test pits, each approximately five feet deep, were logged to characterize surface soils at the GGNS Site. Soils were described pursuant to ASTM D2487-00 (Reference 2.5.4-202) and ASTM D2488-00 (Reference 2.5.4-230). Test pit locations are shown in (Figure 2.5.4-201, test pit logs are shown in Figures 2.5.4-249 through 2.5.4-252, and Table 2.5.4-212 presents summaries of test pit depths.

Four surface soil profiles were also described from road-cuts located at the GGNS Site. Soils were described pursuant to the U.S. Department of Agriculture Soil Survey Manual (Reference 2.5.4-239), ASTM D2487-00 (Reference 2.5.4-202), and ASTM D2488-00 (Reference 2.5.4-230). All four surface soil profiles have very similar characteristics (Table 2.5.4-205). A representative surface soil profile is shown in Figure 2.5.4-259.

2.5.4.3.1.7 Surface Geophysical Testing

Fifteen SASW surveys were performed during site investigation activities at the GGNS Site. Survey depths ranged from 130 to 295 ft. below ground surface, depending on material attenuation conditions and length of survey lines. Figure 2.5.4-260 shows the location of SASW survey lines at the GGNS Site and Table 2.5.4-213 records the positions of these survey lines. Discussion of SASW survey testing results methodology is located in Section 2.5.4.4.2.

2.5.4.3.2 Foundation Interfaces

Figures 2.5.4-217 through 2.5.4-228 show cross-sections constructed from borehole logs and CPT soundings and demonstrate the position of subsurface stratigraphy to Unit 3 powerblock Seismic Category I structure embedment depths. (Figure 2.5.4-201 shows all boreholes, monitoring wells, CPT soundings, and test pits performed during the course of GGNS Site investigation.

The three Unit 3 powerblock Seismic Category I structures are:

- Reactor Building/Fuel Building
- Control Building

- Fire Water Service Complex

Key dimensions of foundations for the Reactor Building/Fuel Building (RB/FB), the CB, and the FWSC are shown in DCD Table 3.8-13. Using the embedments from this table and the elevations in DCD Table 3.4-1, the elevation that is the basis for the required embedments is the finished ground level grade (referred to hereafter as “site grade”). As shown in Section 2.4.1, the site grade is at elevation 133.5 ft. msl (NAVD 88 [North American Vertical Datum of 1988]).

The RB/FB embedment depth is 20 m (65.6 ft.) below site grade. As shown in Figures 2.5.4-217, 2.5.4-218, and 2.5.4-220 through 2.5.4-222, the base of the RB/FB foundation lies on and immediately above the subplanar, undulating contact between UCA and Lower loess. An over-excavation of approximately four feet completely removes Lower loess to the top of UCA.

The CB embedment depth is 14.9 m (45.1 ft.) below site grade. As shown in Figures 2.5.4-218 and 2.5.4-222, the base of the CB foundation at this depth is in Upper loess. Over-excavation of the loess to the top of the UCA removes the loess (Sections 2.5.4.5 and 2.5.4.10)

The top of the FWSC foundation is at 0.15 m (0.5 ft.) above site grade. The foundation mat is 2.5 m (8.2 ft.) thick resulting in a bearing level at elevation 125.8 ft where Upper loess and undocumented fill are present. An over-excavation of 47 ft. completely removes the undocumented fill (Sections 2.5.4.5 and 2.5.4.10).

GGNS COL 2.0-29-A

GGNS ESP COL 2.5-4

GGNS ESP COL 2.5-5

2.5.4.4 GEOPHYSICAL SURVEYS

This section presents a summary of geophysical data collected at the GGNS Site. Section 2.5.4.4.1 provides a description of borehole suspension velocity logging procedures and Section 2.5.4.4.2 provides a description of SASW survey procedures. See Section 2.5.4.7 for a description of data set analysis and discussion of the response of site materials to dynamic loading

2.5.4.4.1 Suspension Velocity Logging

In-situ surveys of seismic wave velocity were performed in 11 borings. The surveys were performed with an OYO Model 170 Suspension Logging system that measures both compression wave (V_p) and horizontal shear wave (V_s) velocity in subsurface materials that form borehole walls. Results of the surveys are presented as velocity-depth plots in Figures 2.5.4-204 through 2.5.4-214. Locations of Suspension velocity logging are shown in (Figure 2.5.4-201 and listed in Table 2.5.4-208.

Four boreholes (G-1011, G-1013, G-1019, and G-1100) solely used for P-S suspension logging were advanced to depth adjacent to existing exploration boreholes (B-1011, B-1013, B-1019, and B-1100) to accommodate logistical differences between the in-situ geophysical testing schedule and the borehole exploration schedule. In one case (G-1013/B-1013), suspension velocity logging was conducted in two adjacent boreholes; data from the two boreholes was combined to provide a single borehole data set (B/G-1013).

The suspension velocity logging technique obtains a vertical velocity profile of the borehole walls using both compressive (V_p) and shear (V_s) waves. Both the wave generating source and recording geophones were lowered into the borehole within a flexible sleeve by a power winch. Two biaxial receivers incorporated within the instrument string were spaced approximately 3.3 ft. apart. This receiver separation permits determination of local average wave velocity by inversion of the wave travel time between receivers. Comparisons of source-to-receiver and receiver-to-receiver travel time data sets provided a quality check of acquired data and confirmed that the survey results are valid and of high quality. All suspension velocity surveys were performed in uncased holes because this results in better surveys and resolution of stratigraphic velocity layers.

At the beginning of each survey, the instrument string was lowered to the bottom of the hole and then raised incrementally, recording data points every 1.64 ft. All geophysical field surveys were observed and documented by project personnel. A column of thick drilling fluid was kept within 2 ft. of the top of the borehole to maintain wall stability during suspension velocity logging. Circulation of drilling fluid was minimized after achieving borehole total depth to reduce destabilization of the borehole wall.

Suspension velocity logging is a relatively new technique and an ASTM standard for this procedure has not been developed. The technical procedure used for the suspension velocity logging was developed by GeoVision and approved by the site exploration team. Suspension velocity logging has been performed for numerous important civil projects, including nuclear projects, and the method is well documented and accepted by industry and regulatory groups on the basis of rigorous testing and research.

Recorded velocity data was processed upon completion of the surveys to develop the velocity-depth plots presented in Figures 2.5.4-204 through 2.5.4-214. The survey results were good, and excellent correlation was found between the 11 surveys after the plots were normalized for differences between elevations and variation in thickness of UCOA.

2.5.4.4.2 SASW Surveys

Fifteen SASW surveys of subsurface material at the Unit 3 powerblock area were conducted. Survey depths ranged from 130 to 295 ft. below ground surface, depending on material attenuation conditions and length of survey lines. Collection and processing of SASW survey data was performed pursuant to a proprietary protocol.

The SASW surveys determined V_s by measuring dispersion of surface seismic waves as they propagated through subsurface stratigraphy. Rayleigh-type surface waves were generated using truck-mounted vibroseis equipment and motions perpendicular to the surface were measured at points arranged on a single radial path from the source. Eight to 10 receiver spacings from 6 to 300 ft. were used across each survey line. Testing was conducted using Mark Products Model L-4C vertical velocity transducers with natural frequencies of 1 Hz. Data were recorded using a four-channel Agilent 35670A Dynamic Signal Analyzer. Field data were transferred to a desktop computer for analysis using WinSASW software. Data were converted into composite dispersion curves and iterative forward modeling was used to create layer stiffness models with synthetic dispersion curves that most closely matched the experimental curves. Location of the SASW surveys conducted at the GGNS Site are shown in Figure 2.5.4-260 and listed in Table 2.5.4-213.

Taking into account that the SASW technique averages V_s values from across the length of each survey line, results of the SASW surveys compare very favorably when compared to adjacent suspension velocity logs (Figures 2.5.4-204 through 2.5.4-214). Survey data sets determined to most accurately represent the condition of strata beneath Unit 3 powerblock Seismic Category I structures were used to determine the response of material within the foundation influence zone to dynamic loading (Section 2.5.4.7).

2.5.4.5 EXCAVATION AND BACKFILL

GGNS COL 2.0-29-A
GGNS ESP COL 2.5-1
GGNS ESP COL 2.5-6

This section discusses the excavation, backfill, and earthwork requirements for the Seismic Category I structures. The following items are addressed in this section:

- The horizontal and vertical limits of excavation
- Construction excavation and dewatering
- Backfill types, sources, specifications, and quality control testing
- Foundation excavation monitoring

2.5.4.5.1 Plans and Sections

As discussed in Section 2.5.5, the overall grading for the site will not produce cut or fill slopes that are near enough to the Seismic Category I structures to impair their safety. The horizontal and vertical extents of the foundation excavation for the RB/FB, the CB, and the FWSC were determined based on information in DCD Figures 3G.1-1, 3G.1-6, and 3G.2-1 and DCD Table 3.8-13.

2.5.4.5.1.1 Lateral Limits of Excavation - RB/FB and CB

Figure 2.5.4-261 shows the plan lateral limits of the excavation for the RB/FB and CB. Due to the close proximity of these two structures and the depth of excavation required to reach the embedment required in DCD Table 3.8-13, a single, combined excavation will be made to accommodate both buildings. In addition, the Radwaste Building (RW) embedment depth and proximity to the RB/FB indicate that the excavation for the RW will proceed in parallel with that for the RB/FB. The result is one L-shaped excavation.

As discussed in Section 2.5.4.5.2, a vertical excavation supported by a tie-back wall will be made. The minimum lateral limits of the excavation were established by adding 6 ft. to the outside dimensions of the foundations including stairwells that are shown on the foundation plans in DCD Figures 3G.1-1 and 3G.2-1. Other lateral limits were based on maintaining a reasonable geometry for construction ease.

The overall lateral limits for the combined RB/FB and CB excavation shown on Figure 2.5.4-261 are approximately 246 ft. north-south and 316 ft. east-west. These limits will be adjusted to accommodate detailed construction plans as required; however, large dimensional changes are not expected.

2.5.4.5.1.2 Vertical Limits of Excavation - RB/FB and CB

DCD Figure 3G.1-6 shows the relationship of the RB/FB to a reference “Grade” elevation of 4500 mm. The finished floor elevation shown on DCD Figure 3G.1-6 is 4650 mm. For Unit 3, this corresponds to a design plant grade of 134 ft. (Section 2.4.1). Using the relationship shown on DCD Figure 3G.1-6, the computed site grade elevation corresponding to the GE reference “Grade” is 133.5 ft.

DCD Table 3.8-13 provides a depth to top of the RB/FB foundation (16 m below grade) and the mat thickness (4 m); these numbers provide a depth to the bottom of the foundation relative to the GE reference grade of 20 m (65.6 ft.). Subtracting the 65.6 ft. from elevation 133.5 ft. results in a bottom of mat elevation for the RB/FB of 67.9 ft.

Similarly, using the information on DCD Table 3.8-13 and Figure 3G.2-15, the bottom of mat elevation for the CB is 84.6 ft.

Evaluation of the foundation stability for the RB/FB discussed in Section 2.5.4.10 concludes that some additional excavation below the design bearing elevation will be required to remove unsuitable soils that exist below the bearing level. This will require additional excavation depths of up to 8 ft., with an average of 4 ft. The depth of this undercut will vary across the excavation, and will generally occur as localized pockets. An average undercut depth of 4 ft. was used for evaluation of excavation support and dewatering, resulting in a bottom of excavation elevation of 63.9 ft., rounded to elevation 64 ft.

In the case of the CB, removal and replacement of loess below the minimum mat bearing level will be required to provide foundation stability. As discussed in Section 2.5.4.10, an additional 15 to 16 ft. of vertical excavation will be required to reach suitable bearing soils. Therefore, the excavation for the CB mat will need to extend to an elevation range of about 69.5 to 68.5 ft.

The current elevations within the RB/FB and CB areas (excluding the existing slope at the west edge of the RB/FB) are generally about 133 ft. The excavation depths below the current grade to reach the elevations in the previous paragraphs are thus about 69 ft. and about 64 ft.

Although the excavation depth for the CB is slightly less than that for the RB/FB, the evaluation of excavation support and dewatering has assumed the RB/FB depth applies, because the contractor may elect to excavate the entire excavation to a common, average base elevation. Figure 2.5.4-262 shows a west-east section view of the excavation used in the evaluation.

2.5.4.5.1.3 Lateral Limits of Excavation - FWSC

The FWSC area is over-excavated and backfilled to provide suitable support for the FWSC foundation mat. The excavation is temporary and is made and backfilled prior to excavations for the adjacent CB and RB/FB. Figure 2.5.4-263 shows the plan extent of the temporary excavation. The lateral extent is controlled by the pattern of stress distribution below the mat and the planned depth of the excavation as indicated on the figure.

2.5.4.5.1.4 Vertical Limits of Excavation - FWSC

Excavation to a depth of about 47 ft. (elevation 86.5 ft.) is made to remove undocumented fill and Upper loess that has potential for collapse when saturated. The excavation stops above the highest modeled perched water level measured (Section 2.5.4.1) to preclude the need for dewatering for the FWSC during construction. Figure 2.5.4-263 shows a cross section illustrating the vertical excavation.

2.5.4.5.2 Construction Excavation and Dewatering

The excavation for the mat foundations will utilize a vertical cut slope, and will therefore require excavation support. As discussed in Section 2.5.4.6, the groundwater at the site is at a typical elevation range of 74 to 75 ft. in the RB/FB, CB, and FWSC areas. Also, groundwater may occur as localized, perched conditions in sandy lenses in the loess at elevations as high as 89 ft. Dewatering will be required for the RB/FB and CB during construction.

2.5.4.5.2.1 Excavation Support - RB/FB and CB

Excavation for the RB/FB and CB will be performed after the FWSC temporary excavation has been made and backfilled. To accommodate a vertical excavation for the RB/FB and CB, two types of temporary shoring walls were considered: Soil Nail and Tied-Back Soldier Pile walls. The soil nail wall option was evaluated as being unsuitable for two reasons. First, the vertical cuts for the RB/FB and CB would remain open for extended periods of time. These cuts could potentially be exposed to water from groundwater seepage and from surface inflow. The loess has the potential for collapse of the soil structure and significant reduction of soil strength under such conditions. Secondly, a 1 horizontal to 12 vertical facing batter is needed to construct a Soil Nail retention system, and stepped construction is needed for high walls (Reference 2.5.4-256). The batter and stepping, when applied to the depth of the excavation, would result in requirements for excessive backfill quantities. Therefore, the tied-back soldier pile wall option was chosen.

A conceptual design for a tied-back soldier pile wall is shown on Figures 2.5.4-262 and 2.5.4-264. The design inputs used are shown on the figure in addition to the tie-back anchor lengths and loads. A water level at elevation 83 ft. was used, but the wall design includes drainage elements to allow water drainage, resulting in no excess hydrostatic pressure on the wall. The construction dewatering discussed in Section 2.5.4.5.2.2 will contribute to maintaining the water level at or below the base of the excavation and aid in precluding build-up of hydrostatic pressures on the wall.

Analysis of the tied-back soldier pile wall system shows that the system has a top lateral deflection (toward the excavation) of less than 1 inch. The analysis included examination of the global stability of the system. The results of the global stability analysis exceeded a FOS of 2.0 (a minimum FOS of 1.3 is required [Reference 2.5.4-255]).

The typical construction sequence for a tied-back wall includes the following steps, working from top down:

1. Drill soldier beam pilot hole to the plan depth.
2. Set soldier beam.
3. Backfill the pilot hole with lean concrete and allow it to cure until appropriate design strength is reached based on testing of concrete test cylinders.
4. Excavate soil to just below level of first tie-back anchor.
5. Cut out soldier beam web at anchor location at specified installation angle.
6. Install stiffeners and wedge plate.
7. Drill anchor borehole.
8. Install tie-back anchor with centralizers at 10 ft. on center.

9. Grout borehole.

10. Allow grout to set until appropriate design strength is reached based on testing of grout cubes.

11. Stress the tie-back anchor.

12. Perform tie-back anchor tests.

13. Upon passing the load tests lock off the tie-back anchor at the design load.

14. Repeat steps 1 through 13 until the limit of excavation is reached.

Each tied-back wall anchor is tested during installation. The testing requirements are discussed in Section 2.5.4.5.3.4.1.

2.5.4.5.2.2 Dewatering - RB/FB and CB

The plans for construction dewatering for the RB/FB and CB are discussed in Section 2.5.4.6. A system of pumped wells (or well points) will be installed around the perimeter of the excavation, approximately 4 to 5 ft. on the excavation side of the tied-back wall. The dewatering installation will start when the excavation reaches about elevation 90 ft., or sooner if necessary for construction sequencing. The locations of the dewatering wells are shown on Figure 2.5.4-265. The dewatering is designed to lower the groundwater level within the excavation to a target depth of 4 ft. below the average excavation level (or at an elevation target of 60 ft.). Because the pumped wells will create a normal conical drawdown pattern, the groundwater levels will be lowered to elevations ranging from about 60 ft. to about 58 ft. over most of the excavation area.

The tops of the dewatering wells and the associated piping will be lowered progressively as the depth of the excavation increases. Water will be routed from the wells to one or several collection stations and pumped out of the excavation to discharge, after passing through sediment traps or ponds, into the permanent sediment pond located southwest of the Unit 3 area.

Maintaining the water level below the foundation levels by pumping will create a stable work area for preparing the foundations and placing concrete. The pumping creates a gradient toward the wells that precludes upward gradients into the base of the excavation. Thus foundation degradation or instability due to upward water seepage or piping will not occur.

The construction dewatering system will remain in operation until the building structural construction is completed. As the excavation is backfilled, the dewatering well tops and piping will be extended upward to maintain the system in operation.

2.5.4.5.2.3 Excavation Support - FWSC

The excavation for the FWSC removal and replacement work is a temporary excavation made prior to starting the RB/FB and CB excavation. This sequencing provides for a stable work area adjacent to the CB for construction equipment use. Because the excavation will be stopped above the water level and will be quickly backfilled, the use of soil nailing with a shotcrete facing is suitable. The conceptual soil nail design is illustrated on Figure 2.5.4-263. Final design will be performed by the excavation contractor, including incorporation of the entry and exit ramps. The construction sequence for soil nails typically includes the following steps, working from top down:

1. Excavate to just deeper than the first row of soil nails using conventional equipment.

2. Install first row of nails. Nails may be installed by driving in reinforcing bar to the desired length or, if required by the site conditions, drilling a pilot hole and setting the nail in grout, similar to a tieback. A combination of driven nails near the top of the excavation and grouted nails near the base is often used.

3. Place vertical drainage strips to intercept possible surface infiltration

4. Place welded wire mesh reinforcing over the nail heads in preparation for shotcrete.

5. Place shotcrete, typically 6 inches thick.

6. Excavate to below next row of nails and repeat steps 2 through 5.

Preventing exposure of the Upper loess to infiltrating rainwater is important and can be accomplished by maintaining a surface ground slope away from the excavation and using a layer of compacted soil above the loess to restrict infiltration.

2.5.4.5.2.4 Excavation Mapping and Photography

GGNS COL 2.0-29-A

GGNS ESP PC 3.E(3)

The excavation for safety-related structures will be geologically mapped and photographed by experienced geologists. Unforeseen geologic features that are encountered will be evaluated. The NRC will be notified no later than 30 days before the start of an excavation for safety-related structures to allow for NRC staff examination and evaluation.

GGNS COL 2.0-29-A

2.5.4.5.3 Backfill

GGNS ESP COL 2.5-1

2.5.4.5.3.1 Materials and Sources

Backfill will be required between the building walls and the adjacent excavation support system. Backfill will also be required to replace unsuitable soils removed as part of the foundation preparations and to fill in the area between the RB/FB and the CB. The DCD shows the use of concrete fill between the mat foundations of the RB/FB and the CB and adjacent excavation walls. Concrete fill is also the desired material for use in backfilling required excavations made to remove unsuitable soils below design mat foundation bearing elevations. Based on the expected excavation depths and areas for the RB/FB and the CB, the volume of concrete fill is estimated as approximately 6500 yd^3.

Above top-of-mat levels for the RB/FB and CB, and as backfill below the FWSC, clean sand will be used. This material will be placed around buried structure walls and between the RB/FB and the CB. The required volume of sand backfill for the RB/FB and CB excavation is estimated at 40,000 yd^3. The required volume of sand backfill required below the FWSC is estimated at 59,000 yd^3. The sand backfill will be obtained from on-site borrow sources, if available. The COL site investigation did not search for borrow sources. According to the Unit 1 UFSAR (Reference 2.5.4-201), a borrow source for clean sand was found on-site, and termed “the onsite point bar deposit near the river edge of the floodplain”. This location was stated as having millions of cubic yards of sand available at the time of the reference. It is not known how much of this sand has been used, and how much remains.

If not available on-site, the sand will be obtained from local borrow pits. If available from on-site sources, backhoe-excavated observation pits and/or exploratory borings will be performed to determine the uniformity and thickness of the deposit, and to collect soil samples for laboratory testing. Some of this testing was performed for the Unit 1 UFSAR. If the sand is obtained from local borrow pits, samples of the borrow pit sands will also be collected and tested in the lab. The laboratory testing will include:

- Modified Proctor compaction testing
- Grain size distribution testing
- Atterberg limits testing
- Triaxial shear testing
- Dynamic properties testing on remolded samples
- Organic content (loss-on-ignition) tests

2.5.4.5.3.2 Backfill Properties

Concrete fill for backfill purposes beneath and around mat foundations is defined as unreinforced, normal weight concrete having a 28-day design compressive strength of 2500 psi, and a lower bound modulus of elasticity (E) of 120,000 kips per square foot. Fill concrete will have a unit weight of at least 135 pcf, and a slump between 6 and 8 inches. An on-site concrete batch plant will be constructed to supply the fill concrete and structural concrete.

Sand for backfill around and below the Seismic Category I structures will be an inorganic, non-plastic, clean, fine to medium sand having a Unified Soil Classification System symbol of SP, SP-SM, or SP-SC. The evaluations in this section are based on the sand having the same properties as shown on Figure 2.5-91 of Reference 2.5.4-201. The fines content of the sand will not exceed 10 percent. The organic content of the sand will not exceed 2 percent. The plasticity index (PI) of the sand will be zero (non-plastic). The sand will possess a friction angle of at least 35 degrees when compacted to a 95 percent ASTM D1557-02 (Reference 2.5.4-222) criterion and have a static modulus of E of 1800 kips per square foot (Reference 2.5.4-201).

2.5.4.5.3.3 Compaction Specifications

Compaction of the concrete fill will not be necessary due to the required design slump of at least 6 inches. Vibration of the concrete fill may be performed in confined areas, if needed, to prevent the formation of voids or honeycombing of the concrete during placement. Concrete fill placement will be in horizontal layers not exceeding 24 inches in thickness. Additional layers of lean concrete will not be placed until the underlying layer has reached its initial set.

Clean sand backfill will be compacted to a minimum dry density equal to 95 percent of the Modified Proctor maximum dry density (ASTM D1557-02 (Reference 2.5.4-222)). The moisture content of the fill material will be maintained within plus or minus two percentage points of the optimum moisture content determined by ASTM D1557-02 (Reference 2.5.4-222). These specified values are consistent with normal engineering practice for important construction work.

Where sufficient space is available to use heavy compaction equipment, the loose layer thickness will not exceed 12 inches. In confined spaces, or where lightweight compaction equipment will be used, the loose lift layer thickness will be reduced to 6 inches. The weight of compaction equipment and the proximity of equipment to the wall can create additional lateral stresses. Reference 2.5.4-254 can be used by the designers to determine combinations of construction equipment weight and distance so the design earth pressures are not exceeded by construction operations.

2.5.4.5.3.4 Quality Control Testing

2.5.4.5.3.4.1 Tied-back Wall Anchors

Each anchor in a tied-back wall is tested as part of the construction quality control. Two types of tests are performed - performance testing and proof testing. The testing requirements listed below are compatible with recommendations in Reference 2.5.4-253:

1. The maximum test load must not exceed 80 percent of the guaranteed ultimate tensile strength of the tendon.

2. Performance test the first two anchors installed of each specified design load capacity and 5 percent of the remaining anchors at locations to be chosen by the engineer.

    a. Perform performance tests by incrementally loading and unloading the tie-back anchor in accordance with the following schedule.

Cycle	Load	Cycle	Load
1	0	4	0.50P
	0.25P		0.75P
	AL		1.00P
2	0.25P		0.75P
	0.5P		0.50P
	0.25P		AL
	AL	5	0.50P
3	0.50P		0.75P
	0.75P		1.00P
	0.50P		1.20P
	AL		1.33P*

*Hold 50 minutes for creep test.

P = Design Load

AL = Alignment Load = 0.05P

Adjust to lock-off load. Actual lock-off loads may be 5 to 10 percent higher than the design load to account for seating losses.

b. Record movement of the tendon to the nearest 0.001 inch with respect to an independent fixed reference point.

c. The jack and pressure gauge shall be calibrated as a unit. Use a pressure gauge graduated in 100 psi increments or less. Use a master gauge to verify the accuracy of the production gauge at the beginning of each shift.

d. Hold each load increment until movement ceases or for a minimum of one minute. Submit loading and unloading rates (tons per minute) for approval. Apply each load in less than 30 seconds after the jack pump is started.

e. Perform a creep test by holding the 1.33P load for 50 minutes while maintaining a constant load. Record anchor movement (total movement) at 0, 0.5, 1, 3, 5, 10, 20, 30, 40 and 50 minutes. Begin the observation time when load is applied to the pump.

f. The engineer will review all performance tests to determine if the anchor is acceptable. An anchor is acceptable if:

- The total elastic movement obtained exceeds 80 percent of the theoretical elastic elongation of the free length.

- The creep movement does not exceed 0.08 inches during the five minutes to 50 minutes time increments regardless of tendon length and load.

3. Proof test all remaining anchors. Install no additional anchors until the first two anchors have been successfully performance tested.

a. Perform proof tests by incrementally loading and unloading the anchor in accordance with the following schedule:

0

0.25P

0.50P

0.70P

1.00P

1.20P

1.33P (Hold for creep test)

Adjust to lock-off load. Actual lock-off loads may be 5 to 10 percent higher than the design load to account for seating losses.

b. Record the movement of the tendon to the nearest 0.001 inch with respect to an independent fixed reference point. Monitor the jack load with a pressure gauge or load cell.

c. Perform a creep test by holding the 1.33P load for 5 minutes. While holding the load constant record anchor movement (total movement) at 0 second, 30 second, 1 minute, 3 minute and 5 minute intervals. Begin observation times the moment the jack begins to apply the 1.33P load. If the movement between the 30 second and the 5 minutes reading is 0.08 inches or more maintain the load for an additional 45 minutes and record the movement at 10, 20, 30, 40 and 50 minutes. Record all movement in relation to a fixed reference point. The acceptance criteria shall be the same as that for the performance test.

4. Make a lift-off reading of all anchors after transferring the load to the end anchorage and prior to removing the jack. The load determined shall be within 5 percent of lock off load. If the lift off load is not within this tolerance reset the end anchorage and make another lift off reading. Perform lift off tests within 7 days of when the load was locked off in the tie-back anchor. After 5 lift off tests are performed the engineer will specify lift off tests be performed on a random basis such that the total number of tests will be on no more than 10 percent of the remaining anchors.

5. Upon passing the load tests lock off the tie-back anchor at the design load.

2.5.4.5.3.4.2 Concrete Fill

A review of the concrete fill mix design will be performed to confirm that it is acceptable for backfilling purposes. Unconfined compression tests with strain measurements will be performed on representative concrete cylinders made from trial batches of the concrete fill mix design to determine the modulus of E of the concrete at design strength. If necessary, field plate load tests will be performed at representative locations to measure the in-place stiffness of the concrete fill after placement and curing. A test section may be used for this purpose, prior to actual backfill placement beneath a foundation.

During concrete fill placement beneath mat foundations, at least one set of six concrete cylinders will be made for every 250 yd^3 of concrete fill placed. These cylinders will be tested for compressive strength at 3, 7, and 28 days. Slump and unit weight testing of plastic concrete will be performed at a frequency of one set of tests for every 100 yd^3 of concrete fill placed in accordance with normal engineering practice.

2.5.4.5.4.3 Clean Sand

During fill operations, field density tests will be performed in the sand backfill using current versions of one or more of the following ASTM procedures: ASTM D1556

(Reference 2.5.4-242), ASTM D2937 (Reference 2.5.4-243), ASTM D4564 (Reference 2.5.4-244), or ASTM D6938 (Reference 2.5.4-245). The field density tests will be performed at a frequency of at least one test per 232 m^2 (2500 ft^2) of compacted sand backfill placed and per 30-cm (12-inch) lift thickness in accordance with normal engineering practice.

2.5.4.5.4 Foundation Excavation Monitoring

Observations and monitoring of excavations during construction will be performed by appropriately qualified and trained geotechnical personnel working under the supervision of a geotechnical engineer. These observations will be performed during general excavation to achieve mat foundation bearing elevations, during additional loess excavation below the design mat bearing elevations, and during placement of lean concrete backfill. Geotechnical instrumentation will be installed prior to any excavation in the RB and CB structure areas in order to measure heave of the excavation bottom due to unloading from excavation. Additional information concerning geotechnical instrumentation is provided in Section 2.5.4.5.4.2.

2.5.4.5.4.1 Mat Foundation Inspection

Geotechnical personnel will observe and document the initial RB/FB and CB mat foundation excavation to the design bearing elevations to confirm that the soil conditions conform to those used in design, and as depicted on the boring logs. Documentation will include:

- Types of soil penetrated
- Thicknesses of layers
- Presence and depths to perched groundwater
- Equipment used for excavation
- Relative difficulty of excavation.

Once the design mat bearing elevations for the RB/FB and CB (refer to Section 2.5.4.5.1.2) are reached, the exposed bearing soils will be observed by the Geotechnical Inspection personnel to determine if the bearing soils are acceptable and meet design requirements. Based on the borings, it is expected that additional excavation will be required for both mat foundations, as discussed in Section 2.5.4.5.1.2. The Geotechnical Inspection personnel will observe and document this additional excavation process, and will determine when suitable granular alluvial bearing material is encountered.

Once a suitable bearing elevation is reached for the RB/FB and CB, the Geotechnical Inspection personnel will observe use of proofrolling techniques in conjunction with manual probing, manual borings, and/or manual cone penetration test soundings at the base of the excavation to identify small, isolated pockets of unsuitable soils that may remain, and determine their lateral extent and thickness. These soft soil pockets will be removed to competent materials, in preparation for concrete fill placement. A fully-loaded dump truck or other suitable rubber-tired vehicle having a wheel load of at least 35 kips will be used for the proofrolling operations. The proofrolling operations will be observed and documented by the Geotechnical Inspection personnel.

The boring logs presented in Appendix 2AA provide information on the types of soils that could be encountered in the upper few feet of the UCA, following complete removal of the loess. The UCA consists of several types of soils, and includes soils having Unified Soil Classification System (USCS) symbols of SP, SP-SM, SP-SC, ML, SC, SM, and SW. These soils had typical (field-measured with automatic hammer) SPT resistances (N-values) of 20 to 50 blows/ft, with some values exceeding 100. Because additional improvement in these soils due to heavy compaction is unlikely, the exposed UCA soils in the mat foundation areas will not be compacted prior to concrete fill placement, unless disturbance due to weather and construction activity occurs. These existing soils will be kept as undisturbed as possible, and protected through use of a low-strength concrete mud mat until the concrete fill can be placed. As stated above, proofrolling will help identify any localized zones of soft or disturbed soil, which will be removed and replaced, or compacted, depending on the soil type. Compaction will be performed only to re-densify existing soils that have been loosened due to excavation.

Once the excavation surface has been inspected, proofrolled, and prepared as discussed above, concrete fill will be placed to reach the design mat bearing elevations. Placement of the concrete fill will be observed and documented by the Geotechnical or Materials Inspection personnel. Quality control testing, as described above, will be performed on samples of the concrete fill during placement. The expected construction sequence is to place the concrete fill in layers of uniform thickness until the entire mat foundation bearing area is covered, followed by placement of the next, overlying layer; however, construction sequences may modify that approach. Any single lift of concrete fill will not exceed 2 ft. in thickness. Depending on the method of batching of concrete, it may be necessary to place the concrete fill in sections created by bulkheading or forming smaller areas of the overall mat foundation bearing area. Regardless, the concrete placement process will be observed and documented by the Geotechnical or Materials Inspectors.

2.5.4.5.4.2 Geotechnical Instrumentation

In order to measure heave or rebound of the RB/FB and CB excavation bottom, geotechnical instrumentation consisting of extensometers will be installed prior to excavation at pre-determined locations within the footprints of the RB/FB and CB foundations. Figure 2.5.4-261 shows the general plan for instrumentation. Five extensometer (heave monitor) locations will be installed in the footprint of the RB/

FB, and a minimum of two extensometers (heave monitors) will be installed in the footprint of the CB.

Instrumentation will be installed to measure heave or rebound of the excavation floor. From this data, the amount of rebound and the elastic modulus of the alluvium layers and the Catahoula Formation will be calculated and compared to the predicted values of heave from the foundation settlement analysis discussed in Section 2.5.4.10. Either heave points or borehole extensometers will be used to measure rebound. Rebound extensometers were used to measure heave in the Unit 1 UFSAR. A similar monitoring method is anticipated for Unit 3. Each location will include an anchor rod that will be placed in a deep borehole at a depth of 150 ft. below the upper surface of the Catahoula Formation. A total of four measuring rods and four sensing elements will be used at each location. Measuring rods will be installed just below the mat bearing level, at the interface of the UCOA and the underlying Catahoula Formation, and at 15 m (50 ft.) depth intervals within the upper 100 ft. of the Catahoula. The “fixed” anchor will be installed 150 ft. below the upper surface of the Catahoula. Therefore, three, 50 ft. thick zones of the Catahoula (and the UCOA) will be monitored for heave (rebound) due to excavation. The extensometers will also be monitored for settlement during structural load application. Figure 2.5.4-262 presents a section drawing which shows the locations and elevations of the geotechnical instrumentation.

Once the baseline elevations of the anchor points are determined prior to excavation, periodic elevation measurements of the anchor points will be obtained during excavation using optical leveling techniques. The frequency of measurements will be related to the construction schedule and rates of material removal. A typical frequency would be at least weekly during excavation. When excavation is complete, elevation measurements will be obtained at least weekly. Measurements will be obtained at least once per week during structural load application. In order to protect the instrumentation during construction, the boreholes will be drilled using a bentonitic drilling fluid, which includes a colored dye so that the instrumentation boreholes can be re-located during excavation.

For the FWSC, settlement plates will be placed at the base of the excavation, before backfilling begins, so settlement during backfill placement and later may be monitored. Three settlement plates equally spaced along the long axis will be placed and monitored weekly during backfill placement.

The tied-back wall for the RB/FB and CB excavation will include instrumentation to check for tilt of the wall and retained soil and to check for loads in the anchors. Figure 2.5.4-261 shows approximate locations for instrumentation. These locations will be modified as needed to avoid conflicts with construction activities as much as possible.

Inclinometer casings will be installed in the retained soil at nine locations around the Seismic Category I excavation. The inclinometer casings will be installed within 5 ft. of the wall and will be installed prior to beginning the wall construction. Readings of movement in the inclinometer casings will be obtained for at least three days prior to excavation, and again after the excavation has reached a tie back level and stopped for installation of the anchors at that level. Readings will be made weekly once the initial tiebacks are installed until the excavation reaches the planned bottom elevation. Thereafter, readings will be made bi-weekly unless unusual activity is noted.

The tie back anchor loads will be monitored by placing load cells on each tieback anchor at each inclinometer location. Figure 2.5.4-264 shows the plan of the locations. Load cells will be checked daily for a week after the load is locked off and then weekly. Regardless of planned schedules, readings will be made immediately prior to beginning excavation to the next lower tie back level and daily while the excavation to that level is progressing.

2.5.4.6 GROUNDWATER CONDITIONS

GGNS COL 2.0-29-A
GGNS ESP COL 2.5-1
GGNS ESP COL 2.5-7

This section includes information on the groundwater conditions at the site relative to the foundation stability for the safety-related structures. The occurrence of groundwater and the history of groundwater fluctuations as presented in Section 2.4.12 are reviewed. The results of field and laboratory hydraulic conductivity tests are presented. Dewatering during construction and the analysis and interpretation of seepage and potential piping conditions during construction are presented.

2.5.4.6.1 Groundwater Occurrence

Extensive geological and hydrogeological data are available from the groundwater investigations for Unit 1 (Reference 2.5.4-201). For the COL site investigation, 97 geotechnical borings were drilled to characterize the geologic conditions at the Unit 3 site. Groundwater monitoring wells were installed at 23 of the COL boring locations to characterize groundwater conditions at the site. The data from the monitoring wells are presented and discussed in detail in Section 2.4.12.

SSAR Section 2.5.1.2 describes the geologic units present at the site within the depth of interest for the excavations as consisting of Loess (Upper and Lower) underlain successively by UCA, UCOA, and Catahoula Formation. The loess is largely comprised of low permeability wind-deposited sediments. The UCA is a unit typically comprised of sands and clayey, silty sands. The UCOA is a unit typically comprised of coarse sands and gravels and clayey, silty sands. The Catahoula Formation is characterized as having a high percentage of fines and low permeability. Note that there have been changes in nomenclature for geologic formations to be consistent with the newer geologic references (e.g., UCA was formerly named the Pleistocene Terrace Formation).

As discussed in Section 2.5.4.5, excavations for the RB/FB and the CB foundations will extend through the Loess and into the UCA. The majority of the loess is unsaturated. The piezometric surface and first zone of saturation occur within the lower 10 ft. of the loess. The sediments of the UCA are fully saturated and contain permeable sands as well as clayey, silty sands and sandy clays. The UCOA is saturated and contains highly permeable zones of coarse sands and gravels in addition to less permeable clayey and silty sands. The stratigraphy of these units is discussed in SSAR Section 2.5.1.2, and detailed hydrogeologic descriptions are contained in Section 2.4.12.

Historical groundwater elevations are presented in Section 2.4.12 (all elevations discussed herein are based on North American Vertical Datum [NAVD] 88). Groundwater elevations measured on March 20, 2007 indicate groundwater elevations in the Loess and UCA are approximately 74 to 75 ft. in the area of the excavation for the RB/FB, CB, and the FWSC. The site grade in the area of the RB/FB, CB, and FWSC as noted in Section 2.5.4.5.1.2 is 133.5 ft. Thus, the expected depth to groundwater in the vicinity of the RB/FB, CB, and FWSC is approximately 59 ft. based on the groundwater elevations measured on March 20, 2007.

Historical groundwater data as shown in Section 2.4.12 indicate limited fluctuation of groundwater elevations within the UCA, generally within the range of two to three feet. DCD Table 2.0-1 requires that the maximum groundwater elevation be 2 ft. below the plant grade. Here, "plant grade" is taken as the finished grade adjacent to the Reactor Building which is elevation 133.5 ft. as discussed in Section 2.5.4.5.1.2. The historical groundwater elevation data for the wells in the immediate vicinity of Unit 3 indicate that the piezometric surface remains well below the DCD Table 2.0-1 requirement. Therefore, post-construction dewatering is not required.

2.5.4.6.2 Field and Laboratory Hydraulic Conductivity Testing

Testing of hydraulic conductivity and other aquifer parameters is discussed in detail in Section 2.4.12. The testing of these parameters included long-term constant discharge (pumping) aquifer tests, variable head hydraulic conductivity tests and laboratory tests conducted both for the Unit 1 UFSAR (Reference 2.5.4-201) and the COL site investigation. Table 2.5.4-214 summarizes the results of the previous hydraulic conductivity testing from Reference 2.5.4-201.

For the granular soils of the UCA and UCOA, coefficients of hydraulic conductivity (k) were estimated based on laboratory grain size distribution measurements conducted on samples obtained during the COL site investigation. The results are summarized in Table 2.5.4-215. Four laboratory tests for k were conducted on undisturbed samples obtained from the Catahoula formation. The test results showed an average k value of about 1E-7 ft/min. Such a value indicates low permeability, as would be expected for a hard, predominately clayey material.

2.5.4.6.3 Construction Dewatering

Because the FWSC temporary excavation stops above the groundwater table, no construction dewatering is needed for this activity. Construction dewatering is necessary for the excavation of foundations for the RB/FB and CB. An analysis was made to evaluate the layout of a dewatering system and the groundwater withdrawal rates needed to facilitate the excavation of the two foundations and to maintain the water level at a safe distance below the excavation during construction.

A dewatering analysis was based on a projected lowering of the groundwater surface to a minimum of 4 ft. below the base of the construction excavation. As discussed in Section 2.5.4.5, the estimated bottom of the excavation is about elevation 64 ft. The dewatering analysis was based on a projected maximum piezometric surface elevation of 60 ft. as the target to be maintained while the excavation is at final depth. At this elevation, the minimum required drawdown of the piezometric surface is approximately 14 to 15 ft. based on the average piezometric surface elevations from March 20, 2007.

The dewatering analysis was based on a series of simulated wells installed around the perimeter of the excavation as shown on Figure 2.5.4-265. Each well would be screened in the sands of the UCA and terminated above the gravelly soils of the UCOA. Two analyses of the dewatering plan were made - the first used a modified Theis method represented by a numerical model, and the second, more detailed, analysis used the United States Geologic Survey's Modular Groundwater Flow (USGS MODFLOW, Reference 2.5.4-258) numerical model. Parameters for the models were derived from the information discussed in Section 2.4.12 and review of the geotechnical boring records and laboratory test data discussed in Sections 2.5.4.2 and 2.5.4.3. For the Theis numerical model, the basic model input values were:

Transmissivity (lower bound)	750 ft^2/day
Transmissivity (upper bound)	3000 ft^2/day
Storativity	0.25
Regional Gradient	0.0027 ft/ft east to west

The USGS MODFLOW model uses a network of grid cells for horizontal information and allows multiple layers in the vertical direction. Properties of the grid cells and layers may be varied to allow consideration of horizontal and vertical variability of soil properties. Boring records and laboratory test data near the planned dewatering wells were reviewed, and values for horizontal hydraulic conductivity selected for 5-foot vertical layers in each boring reviewed. Within the UCA and UCOA (the primary aquifer zones), the estimated values for horizontal hydraulic conductivity had a large range (0.04 ft/day to 860 ft/day) due to some borings having localized zones of silty or clayey material (low horizontal hydraulic conductivity) interbedded with the more common clean sand and gravel (high horizontal hydraulic conductivity). For areas where no borings were present, average values for the unit were used.

In addition to the horizontal conductivity, other basic input values for the USGS MODFLOW MODEL were:

Vertical Hydraulic Conductivity	1/10 of Horizontal Hydraulic Conductivity
Specific Yield	0.25
Specific Storage	0.0003 m^{-1}

The Mississippi River is used as a constant head (50 ft.) down-gradient boundary for the USGS MODFLOW model, while the upgradient boundary is a line of constant head cells along the southeastern grid edge with a head of 82 ft., to simulate the regional gradient.

The results of the MODFLOW analysis indicated that a most likely estimate of the total flow (withdrawal) of groundwater required to lower the water to at least elevation 60 ft. throughout the foundation excavation footprint is 420 gallons per minute (gpm) for the most likely estimates of horizontal hydraulic conductivity. Sensitivity analysis using a range of 1/10 to 10 times the most likely value for the horizontal hydraulic conductivity of each cell produced a range in the dewatering rate of 30 to 2800 gpm. The dewatering was simulated with the 30 recovery wells shown on Figure 2.5.4-265 pumping constantly for both an infinite time (static conditions) and for the transient case (for 0 to more than 10,000 days).

It is anticipated that the dewatering wells (or well points) will terminate above the coarse sands and gravels of the UCOA with the base of the dewatering wells at approximately elevation 50 ft. Dewatering wells are expected to be constructed of 2-inch or 4-inch diameter PVC casing attached to machine-slotted 15- to 20-foot lengths of PVC screen surrounded by an appropriately sized sand pack. It is also expected that the pumping will be accomplished by a system of wells connected to a central large-volume pump that will discharge the water to a collection point outside the excavation. Discharged water will be directed through appropriate sediment traps and ultimately into the existing permitted sediment pond located southwest of the Unit 3 site.

2.5.4.6.4 Groundwater Impacts on Foundation Stability

Groundwater elevation measurements on wells proximal to the reactor building and CB (Section 2.4.12) show that groundwater elevations are about elevation 74 to 75 ft. The top of the RB/FB mat foundation, the lowest building level, is at elevation 81 ft. as derived from DCD Figure 3G.1-6. The natural groundwater levels are thus below the lowest building level. Therefore no permanent dewatering system is required. Perched water that may enter the backfill soil above the RB mat is collected in the wall drain system and routed to a local sump pump for removal.

The drawdown predicted by the MODFLOW model during the construction time frame is essentially zero (about 1 in.) at a distance of 600 ft. (the distance to the nearest existing Unit 1 building) from the excavation, thus no impacts on this closest existing structure are expected. Additional discussion about impacts of dewatering is given in Section 2.4.12.

2.5.4.6.4.1 Seepage and Potential Piping During Construction

As reported in the Unit 1 UFSAR (Reference 2.5.4-201), perched groundwater above the first permanent zone of saturation was encountered in the Unit 1 powerblock foundation excavation. This resulted in low flows of groundwater into the excavation. In addition, surface water runoff is reported to have entered the excavation as a result of poor surface drainage conditions (Reference 2.5.4-201).

There are local lenses of sandy soil in the lower portion of the loess, and some of these indicated possible perched water during the COL site investigation in the vicinity of Unit 3. These lenses could drain toward the excavation. The anticipated quantities of water entering the foundation excavation are low given the limited areal extent of any perched groundwater, the high content of fines and correspondingly low hydraulic conductivities of the loess. The excavation support system described in Section 2.5.4.5 will have drainage measures that will intercept perched water and allow it to drain down to the base of the excavation where it will be managed through a system of shallow ditches and sumps, similar to the techniques described for the excavation of the Unit 1 Powerblock foundation.

Management of surface runoff during the excavation will be done to prevent water from ponding near the excavation.

2.5.4.7 RESPONSE OF SOIL AND ROCK TO DYNAMIC LOADING

GGNS COL 2.0-29-A
GGNS ESP COL 2.5-4
GGNS ESP COL 2.5-5

Dynamic GGNS Site properties (seismic wave velocity, shear modulus, damping, Poisson's ratio) for evaluation of earthquake ground motion site response were developed from extensive field measurements of soil and “bedrock” in boreholes within the Unit 3 powerblock and laboratory dynamic testing of soil from select undisturbed borehole samples (discussed in Section 2.5.4.3). The lateral thickness variability of UCOA does not produce a ratio of the largest to smallest V_s exceeding 1.7 over the Unit 3 powerblock at the foundation level.

These data were compiled and statistically analyzed to develop a dynamic profile for general classification of the site for comparison to DCD generic site classification and CSDRS, development of the site GMRS (Section 2.5.2.5), and development of FIRS (Sections 3.7.1 and 3.7.2).

The following techniques were used to measure dynamic properties within the Unit 3 powerblock area:

- Field measurements

  -suspension P-S seismic velocity logging surveys ranging in depth from 153 to 477 ft. in 14 boreholes.

  -SASW surveys in 15 locations.

- Laboratory measurements

  -RCTS testing of shear modulus and damping of 14 undisturbed soil samples.

Geologic units beneath the Unit 3 powerblock include the following (described in detail in Section 2.5.4.1):

- Upper loess
- Lower loess
- UCA
- UCOA
- Catahoula Formation
- Bucatunna Formation
- Glendon Formation

Stratigraphy in the Unit 3 powerblock area is generally subhorizontal and of consistent thickness, with the exception of a paleochannel eroded into Catahoula Formation "bedrock" and backfilled with sands, gravels, and clay of UCOA, described in Section 2.5.4.1 (Figure 2.5.4-232). The geometry and character of subsurface stratigraphy was confirmed by a dense network of boreholes (Figure 2.5.4-201) and can be predictably traced between borings throughout the powerblock area (Figures 2.5.4-215 through 2.5.4-228). Borehole summary sheets show simplified borehole logs with corresponding suspension velocity survey data and data from adjacent SASW surveys (Figures 2.5.4-204 through 2.5.4-214).

As discussed in Sections 2.5.1 and 2.5.4.1, no evidence of historic or prehistoric seismic ground failure, including liquefaction and lateral spreading, was found during the site investigation. No features indicative of paleoliquefaction, such as sand dikes, were observed in the extensive borings or surface mapping throughout the Unit 3 powerblock and adjacent ground. Loess and UCA and old alluvium are Pleistocene in age and overconsolidated, suggesting that liquefaction is not likely to develop. Section 2.5.4.8 discusses numerical liquefaction analysis of the unconsolidated loess and UCA and old alluvium.

2.5.4.7.1 Calculation of Dynamic Soil Property Profiles

Lateral change in thickness of UCOA required the selection of velocity data sets that best characterize the subsurface conditions beneath Seismic Category I structures within the Unit 3 powerblock (DCD Table 3.2-1). In order to isolate the analysis of response of soil and rock to dynamic loading from this potential stratigraphic variance, dynamic data sets were sorted by relative proximity to the UCOA paleochannel and Unit 3 powerblock Seismic Category I structures as shown in Figure 2.5.4-266. Approximate elevations of prominent channel margin slope breaks are indicated in Figure 2.5.4-266 as well as the channel thalweg and paleo-flow direction. The approximate vertical relief between channel thalweg and channel margin elevations is 60 ft.

As shown in Figure 2.5.4-266, a subset of two SASW (SASW-1009 and SASW-1012) and four P-S suspension velocity log (B-1010, B-1013/G-1013, B-1014, and G-1100) data sets located in the Unit 3 nuclear island share similar subsurface geologic conditions. Velocity layer models were developed for each of these P-S suspension velocity logs by plotting travel time measurements against depth and noting changes in the slope of the resulting lines (representing shear and compressional wave velocities). This analysis is demonstrated in Figure 2.5.4-267, where data points are plotted as circles and best fit intervals for the regression line (e.g., mean velocity) are called out graphically. A visual confirmation of this technique was achieved by plotting depth against shear and compressional wave velocity measurements and overlaying the velocity layers determined from travel time versus depth slope analysis (Figure 2.5.4-268).

Each velocity layer model was checked and found to be satisfactory and mean shear wave (V_s) and compressional wave (V_p) velocities were determined using the equation:

$$\mathbf{b} = \frac{\sum(\mathbf{x}-\overline{\mathbf{x}})(\mathbf{y}-\overline{\mathbf{y}})}{\sum(\mathbf{x}-\overline{\mathbf{x}})^2}$$

to calculate the slope (b) of the least-squares regression line through depth and travel time data for each layer, where $\bar{x}$ is travel time (s), y is depth (ft.), $\bar{x}$ is mean travel time (s), and $\bar{y}$ is mean depth (ft.).

After developing P-S suspension velocity layer models, V_s and V_p values of layer velocity models were averaged horizontally by elevation using a geometric (base 10 log) averaging approach. The resulting geometric means of suspension velocity data for each profile were used to calculate Poisson's ratio (σ) values (dimensionless) by elevation using the equation (Reference 2.5.4-246):

$$\sigma = \frac{0.5(V_p/V_s)^2 - 1}{(V_p/V_s)^2 - 1}$$

Two SASW data sets (SASW-1009 and SASW-1012) were also aggregated into elevation-averaged profiles using a geometric (base 10 log) approach. The P-S suspension velocity and SASW data sets were then combined geometrically (with equal weighting) to arrive at a profile mean V_s. After calculating the combined mean V_s by profile, the Poisson's ratio data set generated from the analysis of suspension velocity data was used to extrapolate the profile mean V_p, in essence adjusting the V_p values to reflect aggregation of SASW into the profile mean V_s.

After calculation of V_s and V_p by profile, the data were smoothed by grouping velocity layers into multi-layer averages. This was done in order to reduce overall influence or weighting of any single layer calculation as well as to create profiles that more reasonably represent the consistent nature of site geologic units (as discussed in Sections 2.5.4.1 and 2.5.4.2) and that reflect distinct trends in velocity behavior. Vertical travel time of shear and compression waves through each layer was calculated by dividing V_s and V_p values by layer thickness. After visually examining layer velocity values and grouping into layers of similar value, smoothed multi-layer averaged velocities were determined by summing individual layer thicknesses and dividing by the sums of layer travel times.

In order to accommodate the potential influence of an 18 ft. thick zone of high velocity in the Bucatunna Formation from 401 to 419 ft. below ground surface the slope analysis described above was applied to shear wave and compression wave travel time measurements in suspension log B/G-1013 from 347 to 435 ft. below site grade to calculate an alternative three-layer model for that interval (Figure 2.5.4-269). This alternative three-layer model was extended to depth using only the 2622 ft/sec condition described below.

Base case values from 446 to 750 ft. below site grade, the estimated depth of the Vicksburg Group (a geologic unit that includes the Bucatunna and Glendon Formations; SSAR Figures 2.5-11 and 2.5-13), were determined by enveloping the range of reasonable values using the following three conditions:

- a hypothetical shear wave velocity of 2000 ft/s as the lowest credible shear wave velocity for the Vicksburg Group;
- a calculated shear wave velocity of 2622 ft/s, measured in the upper 29 ft. of the Glendon Formation within the Vicksburg Group;
- a hypothetical shear wave velocity of 3300 ft/s as the highest credible shear wave velocity for the Glendon Formation (and by extrapolation, the Vicksburg Group).

The range of reasonable shear wave velocity values is determined from the range of measured receiver-to-receiver velocity values in the Glendon Formation B/G-1013 from 448 to 477 ft. below site grade.

Because no shear wave velocity measurements are known to exist within tens of kilometers of the GGNS Site and because the general stratigraphy of the southern Mississippi embayment is laterally continuous over hundreds of miles (SSAR Figures 2.5-3, 2.5-4, 2.5-6, 2.5-11, and 2.5-13), a generic Mississippi embayment shear wave velocity profile was used to extend the base cases to a depth of about 3030 ft. (1000 m). The generic Mississippi embayment profile is based on a large number of shallow and several deep velocity surveys that were developed for ground shaking studies in the Mississippi embayment. See Section 2.5.2.3 of SSAR for a detailed discussion of the applicability of this generic profile to the GGNS Site. Figure 2.5.4-270 documents this velocity profile as applied to the reactor profile.

As described above, combination of the 2622 ft/s velocity model for the interval 446 to 750 ft. below site grade with the two discreet velocity models for the interval of 347 to 446 ft. below site grade yielded a fourth base case scenario for the dynamic soil behavior profile. These four base case scenarios are presented in Table 2.5.4-216.

A range of shear wave velocity values that span a reasonable range in expected mean velocities were developed to characterize the 50 ft. of planned structural backfill beneath the FWSC. The shear wave values of 850, 1000, and 1150 ft/s were estimated in part from published reports (Reference 2.5.4-260) and previous laboratory testing of on-site backfill materials (Reference 2.5.4-201). A Poisson's ratio of 0.4 was assigned to the material based on laboratory testing of materials used for Units 1 and 2 (Reference 2.5.4-201). The site response for the proposed backfill conditions beneath the FWSC are discussed in Section 2.5.2.4.

2.5.4.7.2 Evaluation of Modulus Reduction and Damping Values from RCTS Data

Testing of 14 undisturbed RCTS samples from the Unit 3 powerblock site was conducted as described in Section 2.5.4.2.1.3.5. Laboratory testing results are grouped by geologic origin and material properties in Table 2.5.4-206. A discussion of data analysis methods and conclusions is located in Section 2.5.4.2.2.3. Two sets of damping ratio and modulus reduction curves were considered in the analysis to develop the GMRS and FIRS. These two sets of EPRI curves are used because they span the range in regular nonlinear dynamic properties. Damping ratio and the modulus reduction ratio curves are shown in Figures 2.5.4-254 through 2.5.4-257.

2.5.4.7.3 Development of Ground Motion Response Spectra

The GMRS, used for comparison against the safety-related nuclear island basemat CSDRS, is derived at the top of competent material (defined as 1000 ft/s) at the reactor building embedment depth. Therefore, dynamic properties of Upper loess are not relevant for evaluation of the reactor building seismic response. However, the generic velocity model described in Section 2.5.4.7.2 allows for calculation of site response to site grade (133.5 ft. (NAVD 88)) for development of FIRS.

Seismic wave velocities exhibit an abrupt increase in velocity with depth across the UCOA/Catahoula Formation contact. Comparison of individual field borehole seismic velocity measurements using the P-S suspension method show that Lower loess, UCA, and UCOA velocities fall within relatively consistent ranges and therefore can be aggregated to develop a GMRS average generic velocity profile, shown in Figures 2.5.4-269 and 2.5.4-270.

The average velocity seismic velocity profile is shown on Figure 2.5.4-270. Derivation of the GMRS based on this velocity profile is described in Section 2.5.2.5.

GGNS COL 2.0-29-A

GGNS ESP COL 2.5-3

GGNS ESP COL 2.5-9

2.5.4.8 LIQUEFACTION POTENTIAL

2.5.4.8.1 Overview

In meeting the requirements of 10 CFR Parts 50 and 100, if the foundation materials at the site adjacent to and under Seismic Category I structures are saturated soils and the water table is above bedrock, then an analysis of the liquefaction potential at the site is required. The need for a detailed analysis is determined by a study on a case-by-case basis of the site stratigraphy, critical soil parameters, and the location of safety-related foundations.

As discussed in Section 2.5.4.10, the Seismic Category I safety-related Reactor Building basemat for Unit 3 is founded at elevation 67.9 ft. (NAVD, 65.6 ft. below site grade) within Pleistocene UCA consisting of dense alluvial sand and stiff clay. Plan maps, cross sections, and summary boring logs presented in Section 2.5.4.3 show the locations and foundation conditions of the Seismic Category I nuclear island basemat.

The Seismic Category I safety-related CB basemat is founded at elevation 84.6 ft. (NAVD, 48.9 ft. below site grade), within Upper loess soils that overlie the UCA. Overexcavation through the loess (Upper and Lower loess), and into the dense sands and stiff clays of the UCA, will bear the CB structure on suitably competent material. Concrete backfill extending from the base of the excavation floor to the design elevation of the CB provides suitable static bearing, and eliminates potential settlement problems associated with the loess. As described in Section 2.5.4.6, the groundwater table occurs at approximate elevation 75 ft. (NAVD), near the contact between the loess and UCA. Higher groundwater levels could occur as the result of flood events, and are considered for the evaluation of liquefaction and potential instability of the Seismic Category I structures.

Geologic and groundwater conditions for the Seismic Category I Unit 3 structures conform to the 10 CFR Part 100 Appendix A criteria requiring analysis of liquefaction potential, including possible detailed liquefaction analysis. Specific subsurface explorations and laboratory testing to evaluate the potential for liquefaction were performed within the Unit 3 powerblock area, and both screening and detailed liquefaction analysis were performed in accordance with RG 1.198 “Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites”, as discussed below.

2.5.4.8.2 Geologically-Based Liquefaction Assessment

As discussed in Section 2.5.3, no active or potentially active faults or seismic deformation zones occur at the GGNS Site. Sections 2.5.1 and 2.5.4.1 describe geologic mapping and extensive subsurface explorations performed at the site that confirm that the geologic deposits underlying and around the Unit 3 powerblock have not experienced seismically-induced ground failure (e.g., slope failure, liquefaction, lurching, and subsidence) from historic or paleoearthquakes. These deposits range in age from Oligocene to Pleistocene, and therefore provide a long geologic record documenting the absence of deformation. Therefore, the geologic setting and past performance indicate that liquefaction is not expected to occur within the geologic deposits at the site that will support and surround the Seismic Category I safety-related structures and all other plant structures. Furthermore, the Unit 3 plant yard is a level surface extending for many hundreds of feet away from the plant footprint, and no potential free faces or sloping ground conditions exist that could result in a significant lateral spread failure in the event of partial cyclic pore pressure buildup (a process that may not develop indicative features preserved in the geologic deposits).

The geologic screening process described in RG 1.198 was applied to the unconsolidated or poorly consolidated GGNS deposits that include Upper loess, Lower loess, UCA, and UCOA defined in Section 2.5.4.1. These deposits extend from the plant yard grade (surface) to the top of the Miocene Catahoula Formation, a consolidated deposit consisting of very stiff to hard plastic clay/ claystone and dense to very dense sand and weakly cemented sandstone. The Catahoula Formation is assumed to not be susceptible to liquefaction based on a combination of Miocene age, deep occurrence (generally deeper than about 103 ft. below site grade), clayey composition, and dense/weakly lithified nature.

The geologic screening process is based largely on work by Youd (Reference 2.5.4-247) that shows most liquefaction risk is associated with saturated, recent Holocene deposits of loose sand and silt, and uncompacted fills (typically hydraulically-placed sandy fill). Geologic deposits in the Unit 3 powerblock area do not fall within the categories of deposits susceptible to liquefaction because no hydraulically placed fill or Holocene deposits were encountered or are expected to be encountered beneath the Unit 3 footprint or surrounding site area. This provides an initial screening showing that the deposits do not have significant liquefaction susceptibility. Figures 2.5.4-270 and 2.5.4-271 are geologically-based screening flow charts for Upper and Lower loess, and UCA and old alluvium, respectively, that factor past performance, deposit age, percent granular material, and estimated SSE (GMRS) PGA range. This screening process indicates very low liquefaction susceptibilities for the loess and alluvium. This analysis indicates a low potential liquefaction hazard to Unit 3 Seismic Category I safety-related structures.

2.5.4.8.3 SPT-Based Liquefaction Assessment

A second, detailed quantitative liquefaction analysis was performed for the loess and UCA and UCOA based on the RG 1.198 recommended SPT-based "Simplified Approach". The SPT procedure incorporates recent advances and modifications described in Reference 2.5.4-248, and that represent the current industry state of practice.

A dense network of boreholes with SPT testing typically at 5-foot intervals was made throughout the Unit 3 plant footprint and adjacent ground during the ESP and COL site investigations. Locations of these boreholes are shown on maps and cross sections in Section 2.5.4.3, and methods used for SPT testing are described in Section 2.5.4.2. In summary, SPT testing was performed under the direction of a rig geologist using standardized and calibrated equipment (140 pound hammer, 30-inch drop, standardized SPT split samplers without liners). Hammer weights and drop heights were manually checked, and field energy measurements, described in Section 2.5.4.2, were performed to determine actual delivered energy to establish site and equipment-specific blow count corrections. Data from boreholes located in the Seismic Category I safety-related structure footprints or adjacent ground were compiled for the analyses, and include each discrete SPT test made in Upper Loess, Lower Loess, UCA, and UCOA within a 100-foot depth below the ground surface.

All SPT tests performed within the boreholes, totaling 401 individual tests, were processed in the analysis. An initial textural screening based on grain size distribution and plasticity was not performed to reduce the SPT data set. This results in a conservative analysis, as many of the analyzed samples contain varying amounts of clay that could significantly inhibit development of liquefaction. Figure 2.5.4-273 is a flow chart showing the boring and SPT selection process.

The Simplified Approach was performed using spreadsheets, and includes various recent correction factors described by Youd et al. (Reference 2.5.4-248), including stress reduction coefficient (Rd), clean sand corrections, and magnitude-duration factors. For the analysis, the following earthquake/ PGA conditions were factored: (1) Mw 6.5 earthquake and 0.25g PGA; and, (2) Mw 7.5 earthquake and 0.17g PGA. These seismic conditions conservatively bound the site GMRS and magnitude-contribution deaggregations described in Section 2.5.2, and reasonably capture combinations of effects from a distant large earthquake (e.g., New Madrid source zone) and nearby moderate background earthquake. A calculated site specific PGA is presented in Section 2.5.2.5 as 0.11g. The conservative PGA ranges of 0.17g and 0.25g were combined with effective stress estimates based on SPT sample depth, assumed groundwater table, and laboratory-determined average or typical values of unit weight for each geologic strata that are described in Section 2.5.4.2. Groundwater levels measured in each specific boring at the time of SPT sampling were used to develop blow count $(N_1)_{60}$ corrections, and higher soil water levels corresponding to localized perched water at elevation 89 ft. In addition, a river flooding-related groundwater table at the PMF elevation of 103 ft. was used for calculation of Cyclic Stress Ratios (CSR); a measure of the earthquake induced shear stress in the soil. Laboratory test data, or conservative interpretations of field classifications, were used to estimate fines percentages for clean sand corrections. If the percent fines could not be confidently assigned, a default clean sand assumption was used based on average unit fines percentages.

Figure 2.5.4-274 presents the results for the Mw 6.5 scenario, and Figure 2.5.4-275 presents the results for the Mw 7.5 scenario. According to standard practice and Youd et al. (Reference 2.5.4-248), each SPT analysis point is shown as a ratio between CSR and N160cs, and plotted with a Cyclic Resistance Ratio (CRR) clean sand “triggering” curve shifted to reflect the triggering earthquake scenario. CRR is a soil strength factor that is calculated based on SPT (N1)60 blow counts and is empirically based on correlations to in situ density measurements from test sites that have undergone liquefaction during historic earthquakes as discussed in Reference 2.5.4-248. Points plotting to the right of the curve are considered to be non-liquefiable, and those plotting to the left are considered potentially liquefiable. The figures show that almost all processed SPT test data plot within the non-liquefiable zones, both for the Mw 6.5 and Mw 7.5 scenarios. Evaluated variations in groundwater table do not significantly affect the analysis results, but higher groundwater scenarios result in a slight increase in the number of SPT test points that fall within the liquefiable zone.

A FOS was calculated for each SPT test by comparing estimated CRR values against corresponding calculated CSR values related to the variations in groundwater and the two earthquake scenarios. Of the 401 analyzed samples, 393 (98%) show a FOS greater than 1.0, and only 8 (2%) have calculated FOS below 1.0, suggesting liquefaction triggering. Table 2.5.4-217 summarizes the analysis results for these 8 samples. The FOS for the 8 samples, that include both loess and alluvium, typically are between about 0.8 and 0.99, suggesting that major liquefaction would not occur but rather cyclic pore pressure buildup that is not of sufficient magnitude to cause significant adverse effects (e.g., settlement) of foundations or ground failure. These 8 samples are at different elevations and in different units and represent discontinuous isolated lenses. Two of the eight SPT data points have calculated FOS below 0.8 under the PMF-correlated high groundwater table. It is noted that the likelihood of a concurrent PMF and seismic event producing 0.17g or greater PGA at the site is very low. The very small percentage of SPT data (2%) that have FOS below 1.0, and even smaller percentage that have FOS below 0.8 (0.5%), indicate that all site geologic materials underlying, and adjacent to, the Unit 3 Seismic Category I safety-related structures exhibit a low to very low susceptibility to liquefaction under combined adverse conditions including PMF flood events and earthquake loading correlative with the low probability GMRS event. These results are consistent with the geologic-based screening analysis presented in Section 2.5.4.8.2.

2.5.4.9 EARTHQUAKE SITE CHARACTERISTICS

GGNS ESP VAR 2.0-1

A performance-based site-specific Ground Motion Response Spectrum (GMRS) was developed in accordance with the methodology provided in RG 1.208. This methodology and the GMRS are provided in Section 2.5.2.6. The GMRS satisfies the requirements of 10 CFR 100.23 for development of a site-specific SSE ground motion.

As recommended in RG 1.208, the following general steps were undertaken:

- Review and update the EPRI (1986) seismic source model for the site region (200-mile radius).
- Update the EPRI (1989) ground motion attenuation model using the EPRI (2004) ground motion attenuation model.
- Perform sensitivity studies and an updated Probabilistic Seismic Hazard Analysis (PSHA) to develop rock hazard spectra and define the controlling earthquakes.
- Derive performance-based GMRS from the updated PSHA at a free field hypothetical outcrop of the top of competent material beneath the nuclear island.

The dynamic properties of soil and rock at the site were determined through a program of field exploration, laboratory testing and analysis as described in Sections 2.5.4.2, 2.5.4.4, and 2.5.4.7. The GGNS Site is a soft soil site as defined in Reference 2.5.4-201 with an equivalent shear wave velocity (V_{eq}) greater than 1000 fps (Table 2.5.2-207). The seismic wave transmission characteristics of this soil are described in Sections 2.5.2.3 and 2.5.4.7. Top of hard rock is greater than 10,000 ft. below the site. Thus, a site response analysis was performed to develop the final GMRS for the site as described in Section 2.5.2.5.

2.5.4.10 STATIC STABILITY

GGNS COL 2.0-29-A
GGNS ESP COL 2.5-3
GGNS ESP COL 2.5-9

This section discusses the analyses performed to evaluate the stability of the safety-related structures under static loading conditions. Specifically, this section addresses three Seismic Category I structures - the RB/FB, the CB, and the FWSC. This section includes analyses of foundation bearing capacity and settlement, excavation rebound, and a discussion and evaluation of lateral earth pressures and hydrostatic pressures acting on these Seismic Category I structures.

DCD Figure 3G.1-6 and DCD Tables 2.0-1, 3.8-8, and 3.8-13 provide information on plan dimensions, embedment depths, and loads. The RB/FB mat foundation has plan dimensions of 60 by 230 ft., and bears 65.6 ft. below the DCD reference grade (4500 mm). As discussed in Section 2.5.4.5.1.2, the DCD reference grade is equivalent to a site grade elevation of 133.5 ft. (NAVD 88). The base of the RB/FB foundation is thus at elevation 67.9 ft. The 16.4 ft. thick mat is designed for allowable soil bearing pressures of 14,600 psf (static) and 56,400 psf (dynamic).

The CB mat foundation has plan dimensions of 75 by 100 ft., and bears 48.9 ft. below the DCD reference grade (4500 mm) which corresponds to site grade elevation 133.5 ft. as discussed above. The base of the CB foundation is thus at elevation 84.6 ft. The 9.8 ft. thick CB mat is designed for allowable soil bearing pressures of 6100 psf (static) and 58,500 psf (dynamic).

The FWSC mat foundation has plan dimensions of 65.6 by 170.6 ft. The mat thickness is 8.2 ft. and it bears 7.7 ft. below the DCD reference grade (4500 mm) which corresponds to site grade elevation 133.5 ft. as discussed above. The base of the FWSC foundation is thus at elevation 125.8 ft. The FWSC mat is designed for allowable soil bearing pressures of 3450 psf (static) and 9200 psf (dynamic). The weight of the foundation mat is included in the static bearing pressure.

The stabilities of the RB/FB, CB, and FWSC foundations were evaluated for the various design conditions, which included the DCD reference grade, the design maximum groundwater elevation, and the total static dead plus live loads. Seismic loading conditions were not considered in the analysis. Fill loads were also not considered because fill embankments are not required for Unit 3. Soil bearing capacity and foundation settlement potential were evaluated for the mat foundations using accepted current methods and practices. Lateral earth pressures were calculated for the situation where compacted sand backfill is placed against buried concrete walls (RB/FB and CB only). The lateral earth pressures were based on the at-rest lateral earth pressure condition.

The FWSC mat is bearing on a combination of undocumented fill and Upper loess. The thickness of the undocumented fill is near zero at the north end of the FWSC and increases toward the south, reaching about 30 ft. (elevation 98 ft.) at the southern end of the FWSC. Upper and then Lower loess extends down from the ground surface or from below the undocumented fill to the UCA which is present at about elevation 70 ft.

The conditions of the undocumented fill are uncertain with respect to lateral and vertical variability. No plant records regarding placement or compaction are known. The Upper loess is unsaturated and has potential for collapse upon saturation. For these reasons, removal of the Upper, unsaturated, loess and the undocumented fill is performed. The removed material is replaced with compacted sand fill having the characteristics described in Section 2.5.4.5.3.2.

2.5.4.10.1 Soil Property Determination

Engineering properties of the native soils were determined from field test data and laboratory test results obtained in the ESP and COL studies, from published sources, and from actual, field-measured data at the Unit 1 site, as documented in Reference 2.5.4-201. In particular, back-calculated elastic modulus values of the hard Catahoula clays obtained from the Unit 1 excavation rebound measurements were reviewed and compared to elastic modulus values estimated from geophysical testing performed in this study. The elastic modulus of the reinforced foundation mat concrete was obtained from DCD Table 3G.1-12. A high water table elevation of +85 ft. (NAVD 88) was used in the analyses. The basis for selection of this design high groundwater elevation is discussed in Section 2.5.4.5.

Estimated pre-consolidation pressures in the clay of the Catahoula Formation show that foundation stresses due to construction of the Unit 3 structures do not exceed maximum past pressures in the clay; therefore, only recompression elastic settlements occur, which can be modeled using elastic theory. When estimating elastic settlements, determination of the appropriate elastic modulus values for each soil layer is necessary. The soils below the mat foundation bearing levels include dense sand and gravel layers and hard clays and claystones. The conventional data collection methods (SPT borings, CPT soundings, and pressuremeter tests) used for the overall site exploration are not as reliable for estimating elastic modulus values in gravelly and hard soils as are in-situ geophysical measurements.

Geophysical data obtained by velocity suspension logging were used to estimate the elastic modulus of each soil layer. The elastic modulus determination was accomplished by direct measurement of small-strain shear wave velocities (V_s) in multiple boreholes, which were used to determine small-strain shear modulus values (G_{max}). The G_{max} values were then adjusted for the appropriate level of shear strain induced by a large mat foundation. The adjustment factors were obtained from results of the laboratory RCTS tests discussed in Section 2.5.4.2. The adjusted shear modulus values (G) were converted to elastic modulus (E) values using elastic theory. For analysis, the material below the mat bearing level was divided into layers. Table 2.5.4-218 presents the layered soil profile used in the settlement analyses, the average measured shear wave velocity values for each layer, and the calculated G_{max}, G/G_{max}, G, and elastic modulus values for each soil layer.

Engineering properties of sand backfill were taken from the Unit 1 UFSAR (Reference 2.5.4-201). A total unit weight of 120 pounds per cubic foot, a friction angle of 35 degrees and an elastic modulus of 1800 kips per square inch were used. Laboratory testing of borrow sources will be performed as discussed in Section 2.5.4.5.3.1 to confirm the borrow soil properties are equal to or better than those reported in the Unit 1 UFSAR.

2.5.4.10.2 Bearing Capacity

Bearing capacity of the soils at the design bearing depths was evaluated using conventional bearing capacity theory for shallow foundations (Reference 2.5.4-240 and Reference 2.5.4-241). Soil properties for materials below the bearing level were obtained as described in Section 2.5.4.10.1. Shape, size, and depth factors were applied to the foundation conditions based on the size and shape of the mat foundations. The ultimate bearing capacity was then calculated using these parameters and factors.

The design bearing elevation for the RB/FB mat foundation places it very close to the loess/UCA interface. For the CB, fill concrete, from the upper surface of the UCA to the design bearing specified in DCD Table 3.8-8, replaces about 15 ft. of excavated loess. Preparation of the subgrades for both mats is discussed in Section 2.5.4.5.

Bearing capacity calculations performed using the conventional methods estimated an ultimate bearing capacity of at least 261,000 psf for the RB/FB and at least 270,000 psf for the CB under static conditions. These values provide a factor-of-safety (FOS) of 17 or greater (static) and 4 or greater (dynamic) with respect to bearing capacity failure for the RB/FB mat foundation and a FOS of 36 or greater (static) and 5 or greater (dynamic) for the CB.

For the FWSC, the calculated ultimate bearing capacity for the mat bearing on compacted replacement fill is 193,000 psf. This value provides an FOS of greater than 50 for static loading and greater than 21 for dynamic loading.

2.5.4.10.3 Foundation Sliding

Sliding potential for the deeply-embedded mat foundations for the RB/FB and CB mat foundations was analyzed assuming that the resistance to sliding is provided by shear resistance along the base of the mat, and if necessary, from passive soil resistance in front of the mat in the direction of sliding. The horizontal loads were conservatively taken as the generic design loads specified by GE. The method described in Reference 2.5.4-251 was used to calculate the FOS. The results of the sliding analysis for the RB/FB mat show a calculated FOS of 1.12 and 1.28, respectively, depending on direction of applied force, with all resistance provided by the base friction.

For the CB, a FOS of 1.1 to 1.19 was calculated including base friction and about 65 to 80 percent of the calculated passive earth pressure resistance computed using the Rankine theory.

DCD Figures 3G.1-65 and 3G.2-15 show that concrete is placed between the edges of the mats and the excavation side walls. This provides proper lateral load transfer to the native soils where the excavation support system is directly adjacent to the mat. The open excavation area between the CB and the RB/FB is backfilled with compacted structural fill. The structural fill is sand, compacted as discussed in Section 2.5.4.5, and provides acceptable passive resistance. Some of the passive soil load is transferred to the RB wall.

No sliding calculations were made for the FWSC mat because the friction angle of the backfill below the mat (35 degrees) exceeds the DCD criterion of 30 degrees.

2.5.4.10.4 Settlement

Settlement of the RB/FB, CB, and FWSC mat foundations was calculated using elastic theory. Elastic theory was selected as a method of analysis due to the predominantly granular nature of the alluvium layers and the sand backfill for the FWSC, and due to the over-consolidated state of the Catahoula Formation clay. Three independent methods were used to estimate settlement of the RB/FB and CB:

- Finite Element (FE) analysis
- Elastic layer method as described in Bowles (Reference 2.5.4-249 and Reference 2.5.4-250)
- Incremental strain layer method

The settlement of the FWSC mat foundation was estimated using a FE program (STAAD [Reference 2.5.4-259]).

A FE analysis program (SIGMA/W published by GeoStudio, Reference 2.5.4-251) was the primary method used for the RB/FB and the CB. The program can model both the RB/FB and CB mat foundations at the same time and at different bearing elevations, and it accounts for the mat stiffness and soil-structure interaction effects.

The elastic settlement method discussed in Bowles (Reference 2.5.4-249) was used as a check of the FE results. This method allows for calculation of elastic settlement of a rigid shallow foundation constructed over an elastic half-space, which has a uniform elastic modulus. An equivalent elastic modulus for all of the soil layers located within the depth of influence of the mat foundations is used. The weighted elastic modulus was obtained using two different methods that indicated weighted average modulus values of about 12,000 to 16,000 kips per square foot (ksf) for the soils located below the mat bearing elevations.

The third method of estimating elastic settlements is called the incremental strain layer method, and computes the strain at the center of each soil layer beneath the mat foundation, which is then multiplied by the layer thickness to obtain the layer compression, or settlement. The stress increase at the center of each soil layer was determined using a Westergaard stress distribution. Multiple analyses were performed to determine the effect on settlement due to the use of different backfill materials (sand, gravel, or fill concrete) beneath the foundation bearing levels, and the effect of different groundwater levels. The incremental layer method allowed settlements to be calculated at multiple locations within the foundation area, and with different backfill materials, but the method assumes a flexible loading condition, and therefore does not account for the stiffness of the thick, heavily-reinforced mat foundations, which serves to reduce differential settlements within a given mat.

Boring logs show that sporadic lenses of firm clay are present in the UCA below the subgrade level in the RB/FB mat footprint, and, to a lesser extent, in the CB footprint. Clay lenses are not interpreted to be below the FWSC. These clay lenses, where encountered, had cumulative thickness in any one boring ranging from about 3 ft. to about 7 ft., and were thicker beneath the RB/FB footprint than beneath the CB footprint. SPT values (automatic hammer) as recorded in the field (N_{Field}) within these clay lenses generally ranged from about 10 to 57 blows/ft. These values and the low laboratory-measured moisture contents, as discussed in Section 2.5.4.2, indicate pre-consolidation.

The primary consolidation potential of these clay lenses was calculated using elastic theory. The secondary compression (long-term creep) settlement potential of the clay lenses was evaluated using conventional consolidation theory, and assuming clay lens thicknesses of 5 to 7 ft. in the RB/FB area, and a maximum thickness of 3.5 ft. in the CB foundation area. Because the clays are pre-consolidated to a pressure greater than the final soil pressures due to the building loads, an appropriately reduced value of the coefficient of secondary compression was used. Secondary compression settlements of 0.25 in. over 60 years and 0.5 in. over 60 years were estimated for the CB and RB/FB mat foundation areas, respectively, and were added to the elastic settlements calculated as described above.

Table 2.5.4-219 summarizes the predicted total settlements and post-construction settlements, and lists the allowable settlements stated in DCD Table 2.0-1. The DCD allowable settlements are those occurring post-construction. The predicted total and post-construction settlements for the RB/FB are less than the allowable settlements.

Predicted total settlements for the CB mat foundation shown in Table 2.5.4-219 exceed the criteria of DCD Table 2.0-1 for settlement; however, as noted above, the DCD Table 2.0-1 criteria are for post-construction settlement - that is the settlement occurring after the building is completed in place. The calculated total settlements in Table 2.5.4-219 are based on all loads from the design bearing pressure being applied instantaneously to the foundation. Because the initial settlement is due to elastic compression, settlement occurs as loads are applied during the construction time period. The amount of settlement that occurs during construction is directly related to the proportion of the bearing pressure due to the building dead load. For the CB, the dead load is estimated as 90 percent of the total applied load. The estimated post-construction settlements for the CB, as shown on Table 2.5.4-219, are less than the DCD allowable limits.

For the FWSC mat foundation, the DCD Table 2.0-1 criteria are for movement after all the tank and building loads are applied and both tanks are filled with water, with the exception of the differential settlement of the basemat after it has been placed. The differential settlement due to loadings on the basemat from the tanks filled with water and equipment is not to exceed 0.5 inches along the long dimension of the basemat.

The calculated settlement due to the loads applied from the tanks, equipment, and water fill during the construction is 0.41 inches, which meets the DCD Table 2.0-1 criterion. No long-term settlement is predicted.

A settlement monitoring program will be conducted during construction to determine how much settlement has occurred during the construction period.

The inclusion of creep settlement in the total settlement estimate for the RB/FB and the CB is considered to be conservative. The clay lenses are not shown by borings to be laterally extensive beneath the mat areas, and the stiffness of surrounding soils acts to reduce the settlement contribution of localized lenses. In addition, in the area of the CB mat, the net soil pressure felt by soils beneath the mat bearing level due to construction is negative (unloading situation), therefore, significant compression of the clay lenses beneath the CB structure is less likely to occur than beneath the RB/FB mat, where the net foundation pressure below the base mat is positive.

For Unit 1, one inch of mat foundation settlement was predicted in the UFSAR (Reference 2.5.4-201) based on an allowable soil bearing pressure of 12,000 psf. Settlement monitoring results reported in Table 2.5-10 of Reference 2.5.4-201 show measured average settlements (average of two settlement markers) of 0.5 to 1.0 inch for the Containment Building, Auxiliary Building, and Radwaste Building for Unit 1 after 100% of the dead load had been applied during the monitoring period. The range in settlement of the markers with greater settlement for these 3 structures was from 0.7 to 1.3 inches. These data were based on measurements obtained in May of 1991. The predicted settlements for Unit 3 are compatible with the measured settlements in Unit 1 when factors such as applied bearing pressure, type of bearing stratum and magnitude of stress relief due to excavation are taken into consideration.

2.5.4.10.5 Excavation Rebound

In addition to foundation settlement, estimates of excavation bottom heave (rebound) were made in each structure area. Heave or expansion of the excavation bottom soils occurs due to stress reduction as a result of excavation. It is estimated that a stress reduction of about 7850 psf occurs due to the required excavation depth. Based on the FE analysis, an excavation bottom heave of 1.2 to 1.5 inches is predicted at the center of the RB/FB and CB excavations. Rebound, if any, that occurs for the excavation made to remove undocumented fill and loess at the FWSC is of no consequence, because the replacement fill will be brought to the appropriate subgrade level, negating the effects of any rebound.

Geotechnical instrumentation, installed in the RB/FB and CB Geotechnical instrumentation, installed in the RB/FB and CB mat foundation areas, is used to measure heave during construction and compare the measured heave to predicted values. The monitoring program is discussed in more detail in Section 2.5.4.5. Direct measurement of heave with borehole extensometers allows for estimation of soil layer elastic modulus values, which can then be compared to those estimated from the P-S logging results, as in Section 2.5.4.10.1.

Excavation rebound data obtained in the Unit 1 construction (Reference 2.5.4-201) was reviewed. The Unit 1 safety-related structures were constructed on mat foundations bearing directly on the Catahoula Formation; the upper surface of the Catahoula is at a higher elevation in the Unit 1 area than in the Unit 3 area. Borehole extensometers were installed in the mat foundation areas to measure rebound. A total of 4 inches of excavation rebound was predicted in the UFSAR (Reference 2.5.4-201) using the results of consolidation testing; however, the maximum rebound measured was only about 2 inches. The stress reduction due to excavation was approximately 11 ksf in the Unit 1 area.

2.5.4.10.6 Static Lateral Earth Pressures and Hydrostatic Pressure

Compacted sand backfill is placed against completed concrete structures. The lateral earth pressure for the backfill was calculated using conventional earth pressure theory, and assuming that the buried concrete walls are sufficiently thick and rigid such that lateral deflection does not occur, and the at-rest lateral earth pressure state is applicable. Lateral earth pressures due to a level soil backfill condition, a 250 psf surcharge pressure from construction equipment (Reference 2.5.4-255), and hydrostatic pressures were computed and compared to the values presented in the DCD Figure 3G.2-10. Lateral pressures are not applicable to the FWSC because it has no below-grade walls.

The calculations used an excavation bottom at elevation 68 ft. for both structures, along with a design groundwater table elevation of 85 ft. as discussed in Section 2.5.4.10.1. The design water table elevation selected is higher than the average water table in the Upland Complex, and was used because it represents the estimated high elevation of localized perched groundwater that could occur in the immediate vicinity of Unit 3.

The loess is not a desirable backfill material due to its high fines content, collapse potential, and moisture sensitivity. The backfill used for Units 1 and 2 was clean sand obtained from borrow areas as discussed in Section 2.5.4.5. Use of similar material is assumed for the lateral earth pressure analysis for Unit 3. Material properties and compaction requirements are discussed in Section 2.5.4.5. For the sand backfill compacted to a minimum dry density equal to 95 percent of the Modified Proctor maximum dry density (ASTM D1557-02 [Reference 2.5.4-222]), Figure 2.5-91 from Reference 2.5.4-201 shows an internal friction angle of 35 degrees. These soil properties will need to be validated based on laboratory testing of representative soil samples once a borrow source is identified, prior to construction. A coefficient of lateral earth pressure at rest value of 0.7 is applicable to a well-compacted sand with the stated friction angle.

Calculated lateral earth pressures are shown in Figure 2.5.4-276 for compacted clean sand backfill placed against buried concrete walls, in addition to lateral surcharge pressures and hydrostatic pressure. The calculated maximum total lateral pressure is approximately 5885 psf near the base of the mat foundations. This total lateral earth pressure is less than the design total lateral earth pressures of 6790 to 10,220 psf presented in DCD Figure 3G.2-10.

The weight of compaction equipment and the proximity of equipment to the wall can create additional lateral stresses. Reference 2.5.4-254 can be used by the designers to determine combinations of construction equipment weight and distance so the earth pressures shown in Figure 2.5.4-275 are not exceeded by construction operations.

The at-rest lateral earth pressure coefficient for the in-place loess using the procedure outlined in Reference 2.5.4-252 was also calculated. Values of K_0 ranging from 0.55 to 1.46 resulted. A drained friction angle in the loess ranging from 31 to 32 degrees was used in the analysis. A drained friction angle on the low side of a range of values is considered conservative for lateral earth pressure estimation since K_0 increases as the friction angle decreases, and lateral earth pressures will increase as K_0 increases. In general, the largest K_0 values were calculated for the loess near the ground surface, with K_0 values decreasing with depth. This effect is due to the increased level of over-consolidation in the upper portion of the loess, which decreases with depth as the water content of the loess increases. Table 2.5.4-220 presents a summary of the estimated K_0 values in the loess as a function of depth.

2.5.4.11 DESIGN CRITERIA

The design of the safety-related foundations for the RB/FB, CB, and FWSC are based on the foundation mats supported on sands of the UCA, on fill concrete supported on the UCA, or on controlled backfill. Removal of unsuitable soils below the base of the foundation mat is expected locally for portions of the RB/FB and as mass undercut from the base of the CB down to the UCA. Fill concrete is placed between the suitable bearing soils and the foundation mat for the RB/FB and CB. Fill concrete material will meet the requirements presented in Section 2.5.4.5. Removal of undocumented fill and a portion of the loess, as discussed in Section 2.5.4.5, is made for the FWSC. Backfill will be sand meeting the requirements presented in Section 2.5.4.5.4.3.

The design criteria used for static stability analyses are identified in Section 2.5.4.10. Factors of safety estimates are applicable to the calculation of bearing capacity and sliding only and are discussed in Sections 2.5.4.10.2 and 2.5.4.10.3, respectively. Discussion of assumptions and conservatism in static stability analyses are included in Section 2.5.4.10.

GGNS ESP VAR 2.0-2

The minimum shear wave velocity is defined in Reference 2.5.4-201 as the equivalent uniform shear wave velocity (V_{eq}) over the entire soil column at seismic strain. V_{eq} is calculated to achieve the same wave traveling time over the depth equal to the embedment depth plus 2 times the largest foundation plan dimension below the foundation. Table 2.5.2-207 lists V_{eq} calculation results and confirms that the minimum shear wave velocity is greater than 1000 fps for all Seismic Category I structures. Table 2.0-202 provides a variance against the ESP minimum shear wave velocity site characteristic.

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Refer to Section 2.5.5 for slope stability design criteria. Computer analysis and methods of verification are discussed in the sections in which they are used.

2.5.4.12 TECHNIQUES TO IMPROVE SUBSURFACE CONDITIONS

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This section discusses techniques for soil improvement in the foundation areas of the RB/FB, the CB, and the FWSC.

Based on the static stability analysis discussed in Section 2.5.4.10, deep soil improvement of foundation bearing soils (such as vibro-compaction, vibro-replacement, vibro concrete columns, soil mix columns, or grouting) will not be necessary. Also, dental cleaning of rock defects and/or rock bolting will not be necessary because none of the foundations bear on or within rock.

Shallow-depth soil improvement techniques, including over-excavation and replacement and bearing surface compaction will apply to preparation of the foundation bearing surfaces. These techniques are described briefly in this section and are discussed in detail in Section 2.5.4.5.

As discussed in Section 2.5.4.5, removal of undocumented fill and loess with replacement by compacted sand backfill is planned for improvement of the soils.

2.5.4.12.1 RB/FB Mat Bearing Surface Preparation

As discussed in Section 2.5.4.10, the soils at the design bearing depth consist of granular alluvium (UCA) which is suitable for mat foundation support or locally a thin layer of Loess that is not suitable for mat support. The Loess will be completely excavated until granular alluvium (UCA) is reached, requiring an average overexcavation depth of about 4 ft. A program of inspection, shallow improvement and verification will be conducted as discussed in Section 2.5.4.5.4.1. After the competence of the shallow improvement is verified, the excavation will be backfilled with fill concrete meeting the requirements given in Section 2.5.4.5.3 to the design mat bearing elevation.

2.5.4.12.2 CB Mat Bearing Surface Preparation

At the design bearing depth given in DCD Table 3.8-8, approximately 15 to 16 ft. of Loess is present before the desired bearing soils of the UCA are reached. As discussed in Section 2.5.4.5, the Loess will be completely removed to the top of the UCA, and fill concrete will be placed to reach the design bearing elevation. The final excavation surface will be observed, evaluated (as discussed in Section 2.5.4.12.1) and approved by the Geotechnical Inspection personnel prior to placing the fill concrete.

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TABLE 2.5.4-201 (Sheet 1 of 3)
SUMMARY OF STRATIGRAPHIC UNITS AND CORRELATION TO PREVIOUS STUDIES

Epoch	GGNS Unit 1 UFSAR	GGNS ESP SSAR	GGNS Unit 3 FSAR[1]
Modern	**not described**	**artificial fill**	**af - undocumented fill**
Modern	**alluvium** sand, gravel, silt, and clay	**alluvium** gravel, sand, silt and clay in active river and stream channels	**Qhc - stream channel deposits (latest Holocene)** unconsolidated gravel, sand, silt and clay deposited in active, natural stream channels.
Holocene			**Qht - stream terrace deposits (Holocene)** unconsolidated gravel, sand, silt and clay associated with stream channel point bar and overbank deposits adjacent to fluvial channels.
Holocene			**Qc - colluvium (Holocene)** unconsolidated sand, silt and clay deposits accumulated on or at the base of slopes.
Holocene			**Qhf - alluvial fan deposits (Holocene)** unconsolidated gravel, sand and silt deposits associated with streams emanating from confined drainages onto alluvial valleys.
Holocene		**meander belt deposits** upward-fining gravel, sand, silt, and clay sequences	**Qha - Mississippi River alluvium, undifferentiated (Holocene)** unconsolidated gravel, sand, silt and clay deposited by the Mississippi River.
Holocene			**Qhlv - levee deposits (Holocene)** unconsolidated gravel, sand and silt deposited in a low ridge adjacent to presen or former river and stream channels.
Holocene		**backswamp deposits** silt and fine sand overbank deposits	**Qhlu - lacustrine deposits (Holocene)** unconsolidated clay, silt and sand associated with lake deposition.
Holocene			**Qhb - backswamp deposits (Holocene)** unconsolidated sand, silt and clay deposited in the flood basin behind a natural levee.

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TABLE 2.5.4-201 (Sheet 2 of 3)
SUMMARY OF STRATIGRAPHIC UNITS AND CORRELATION TO PREVIOUS STUDIES

Epoch	GGNS Unit 1 UFSAR	GGNS ESP SSAR	GGNS Unit 3 FSAR[1]
Pleistocene	**loess** dry, homogeneous, unstratified silt (ML) approximately 65 ft. thick	**loess** yellowish brown silt to clayey silt (ML) featuring a weak blocky structure and gastropod shells	**Qpl - Upper loess (late Pleistocene)** silt with clay (ML), massive, weak blocky structure, very thinly laminated and rare gastropod shells. gradual, planar, conformable contact with underlying Lower loess
	Terrace deposits single or multiple fluvial fining upward sequences of silty clay, sand, and gravel incorporates Lower loess, Upland Complex alluvium, and Upland Complex old alluvium of GGNS ESP SSAR and GGNS Unit 3 FSAR (archaic as used)	**Upland Complex alluvium** partially overconsolidated sand, silty to clayey sand, and gravel include both Lower loess and Upland Complex alluvium of COLA	**Lower loess (late Pleistocene)** light gray clayey silt (CL-MH) approximately 10 ft. to 20 ft. thick and featuring abundant Fe and Mn oxide mottling abrupt unconformable subplanar contact above Upland Complex alluvium
Pliocene-Pleistocene			**Upland Complex alluvium (mid-Pleistocene)** poorly graded fine subrounded fine-grained quartz sand and silty sand (SP-SM) approximately 20 ft. to 25 ft. thick subplanar unconformable contact above Upland Complex old alluvium
		Upland Complex old alluvium overconsolidated dense clay (very stiff to hard), sand, and gravel (minor) at least 40 ft. to 90 ft. thick some sand and clayey sand reclassified as Catahoula Formation in COLA	**Upland Complex old alluvium (mid- Pleistocene)** well graded sand and gravel (SW-GW) interbedded with clay (CH); thickness varies from 0 ft. to more than 100 ft. abrupt, high relief erosional contact with underlying Catahoula Formation
		Catahoula Formation weakly cemented claystone that is significantly more dense and lithified than the overlying alluvium and old alluvium	
Miocene	**Catahoula Formation** hard to very hard gray-green silty to sandy clay with locally indurated sand and silt seams estimated thickness 320 ft.		**Catahoula Formation (Pliocene to Miocene)** greenish gray silty clay (CL) and clayey sand (SC), very weakly lithified with rare to common cemented beds, 270 ft. thick below proposed reactor building unconformable contact with underlying Bucutana Formation

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TABLE 2.5.4-201 (Sheet 3 of 3)
SUMMARY OF STRATIGRAPHIC UNITS AND CORRELATION TO PREVIOUS STUDIES

Epoch	GGNS Unit 1 UFSAR	GGNS ESP SSAR	GGNS Unit 3 FSAR[1]
Oligocene	**Bucatana Formation** stiff to hard greenish-black clay with thin fine-grained sand seams	**below exploration depth**	**Bucatunna Formation (Oligocene)** stiff to hard greenish-black clay with thin fine-grained sand seams, reached only in deepest boring at 371 ft. below site grade; includes 20 ft. of greenish-black clay intercalated with fossiliferous sandy clay beds lithologically similar to Glendon Formation
	Byram Marl hard to very hard, green to gray, sandy calcareous clay roughly five ft. thick	**below exploration depth**	**not identified**
	Glendon Limestone interbedded light gray fossiliferous limestones and hard to partly indurated grayish green sandy calcareous clay with no evidence of solution activity approximately 46 ft. thick	**below exploration depth**	**Glendon Formation (Oligocene)** intercalated marlstone beds, clayey sand with shell hash, and green clay reached only in deepest boring at 447 ft. below site grade; no evidence of solution activity
	Mint Springs Marl hard grayish-green fossiliferous glauconitic sand and clay	**below exploration depth**	**below exploration depth**

Note:

(1) Geologic map nomenclature provided for surficial units (Figure 2.5.4-202)

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TABLE 2.5.4-202 (Sheet 1 of 4)
SUMMARY OF BOREHOLE AND CPT STRATIGRAPHIC DATA

Borehole/ sounding ID	Top of hole elevation ft. amsl	Base of hole depth ft. bgs	Top of MSA ft. bgs	Top of colluvium ft. bgs	Top of Upper loess ft. bgs	Top of Lower loess ft. bgs	Top of UCA ft. bgs	Top of UCOA ft. bgs	Top of Catahoula Formation ft. bgs
B-1003	132	200	---	43	---	59	80	84	104
B-1006	139	239	---	---	13	71	79	87	109
B-1007	133	200	---	---	32	68	78	83	105
B-1008	135	201	---	---	1	53	68	83	100
B-1009	134	225	---	---	1	55	72	87	105
B-1010	134	300	---	---	23	58	63	89	100
B-1011	155	301	---	---	7	73	84	105	159
B-1012	134	226	---	---	2	58	74	88	99
B-1013	134	506	---	---	13	61	67	84	103
B-1014	134	292	---	---	0	57	68	88	94
B-1015	155	200	---	---	7	77	89	114	182
B-1016	156	212	---	---	21	75	85	103	193
B-1019	134	224	---	---	2	60	75	89	167
B-1020	132	215	---	---	19	52	63	78	140
B-1022	134	201	---	---	2	55	62	79	163
B-1023	155	193	---	---	24	76	81	108	178
B-1024	156	198	---	---	17	70	84	109	150
B-1025	148	202	---	---	28	67	85	104	175
B-1026	132	200	---	---	7	53	64	82	140
B-1027	133	201	---	---	5	52	60	83	105
B-1029	109	99	---	12	---	---	47	57	77
B-1030	147	119	---	---	0	67	77	92	115
B-1032	148	124	---	---	7	67	77	97	122
B-1033	156	201	---	---	0	71	86	---	108
B-1035	150	200	---	---	0	72	87	107	119
B-1037	194	119	---	---	0	---	72	---	117
B-1040	159	200	---	---	0	81	94	103	129
B-1042	85	150	9	---	---	---	---	---	68

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TABLE 2.5.4-202 (Sheet 2 of 4)
SUMMARY OF BOREHOLE AND CPT STRATIGRAPHIC DATA

Borehole/ sounding ID	Top of hole elevation	Base of hole depth	Top of MSA	Top of colluvium	Top of Upper loess	Top of Lower loess	Top of UCA	Top of UCOA	Top of Catahoula Formation
	ft. amsl	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs
B-1043	122	202	---	---	5	44	49	69	128
B-1044	112	75	---	---	17	38	42	57	---
B-1045	100	150	10	---	---	---	---	73	129
B-1046	85	78	6	---	---	---	---	---	---
B-1047	82	75	6	---	---	---	---	---	---
B-1048	78	75	12	---	---	---	---	---	---
B-1049	75	77	6	---	---	---	---	---	---
B-1050	75	77	4	---	---	---	---	---	---
B-1051	72	120	0	---	---	---	---	---	---
B-1057	155	75	---	---	15	---	---	---	---
B-1058	155	100	---	---	0	72	87	---	---
B-1059	156	99	---	---	8	77	87	---	---
B-1061	137	75	---	---	0	52	57	72	---
B-1063	126	80	---	---	0	---	8	---	68
B-1067	155	92	---	---	2	74	90	---	---
B-1068	156	144	---	---	7	77	92	109	138
B-1069	155	75	---	---	4	---	---	---	---
B-1070	132	75	---	---	6	56	65	---	---
B-1074	154	115	---	---	0	77	87	95	---
B-1075	152	75	---	---	5	---	---	---	---
B-1078	156	182	---	---	6	76	82	111	179
B-1079	159	117	---	---	8	78	83	113	---
B-1082	196	202	---	---	0	---	79	---	103
B-1083	155	225	---	---	37	82	87	107	180
B-1084	155	249	---	---	18	73	86	109	183
B-1085	133	68	---	---	6	56	64	---	---
B-1086	133	63	---	---	20	58	67	---	---
B-1100	134	149	---	---	6	57	64	86	104
B-1101	134	130	---	---	4	51	71	81	102
B-1102	133	149	---	---	56	71	77	85	102

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TABLE 2.5.4-202 (Sheet 3 of 4)
SUMMARY OF BOREHOLE AND CPT STRATIGRAPHIC DATA

Borehole/ sounding ID	Top of hole elevation	Base of hole depth	Top of MSA	Top of colluvium	Top of Upper loess	Top of Lower loess	Top of UCA	Top of UCOA	Top of Catahoula Formation
	ft. amsl	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs
B-1103	134	105	---	---	1	56	67	83	102
B-1104	134	150	---	---	27	61	71	89	102
B-1105	133	140	---	---	21	56	64	93	100
B-1106	134	140	---	---	2	54	68	93	98
B-1107	135	150	---	---	16	53	66	87	117
B-1108	134	120	---	---	1	53	68	88	98
B-1109	134	149	---	---	5	56	68	---	95
B-1110	134	169	---	---	2	52	67	90	125
B-1111	134	149	---	---	2	51	71	97	106
B-1112	133	150	---	---	12	53	61	---	73
B-1113	133	167	---	---	4	52	68	---	73
B-1114	134	170	---	---	6	52	68	88	133
B-1115	134	174	---	---	2	51	71	81	124
B-1116	133	167	---	---	7	52	62	79	82
B-1117	133	179	---	---	6	52	68	86	126
B-1118	133	159	---	---	0	52	62	80	106
B-1119	135	197	---	---	8	58	73	83	163
B-1120	133	151	---	---	0	---	68	77	137
B-1121	133	179	---	---	6	52	67	92	137
B-1123	134	169	---	---	3	52	67	83	167
B-1124	132	150	---	---	2	52	64	87	---
B-1125	133	139	---	---	0	52	67	92	134
B-1134	134	202	---	---	---	55	67	78	110
B-1135	156	139	---	---	7	72	94	107	132
B-1136	156	199	---	---	0	77	94	107	166
B-1137	155	204	---	---	8	76	85	105	190
B-1138	133	190	---	---	2	52	67	87	166
B-1139	134	139	---	---	1	55	67	86	138

GGNS COL 2.0-29-A

TABLE 2.5.4-202 (Sheet 4 of 4)
SUMMARY OF BOREHOLE AND CPT STRATIGRAPHIC DATA

Borehole/ sounding ID	Top of hole elevation	Base of hole depth	Top of MSA	Top of colluvium	Top of Upper loess	Top of Lower loess	Top of UCA	Top of UCOA	Top of Catahoula Formation
	ft. amsl	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs	ft. bgs
B-1140	155	194	---	---	22	77	81	102	187
B-1142	134	140	---	---	0	52	72	82	97
B-1143	133	119	---	---	27	52	67	88	104
CPT-1001	132	76	---	---	36	46	62	---	---
CPT-1002	128	59	---	---	29	48	56	---	---
CPT-1003	133	68	---	---	8	49	64	---	---
CPT-1004	133	75	---	---	30	63	69	---	---
CPT-1005	135	71	---	---	4	50	63	---	---
CPT-1006	133	55	---	---	5	50	---	---	---
CPT-1010	133	66	---	---	19	50	63	---	---
CPT-1011	155	82	---	---	8	70	80	---	---
CPT-1012	133	65	---	---	7	52	59	---	---
CPT-1013	133	66	---	---	3	52	60	---	---
CPT-1015	155	81	---	---	24	71	79	---	---
CPT-1016	155	86	---	---	4	68	72	---	---
CPT-1017	71	67	11	---	---	---	---	---	---
CPT-1018	70	53	12	---	---	---	---	---	---
CPT-1019	71	75	0	---	---	---	---	---	---
CPT-1020	70	57	3	---	---	---	---	---	---
CPT-1021	77	28	2	---	---	---	---	---	---
CPT-1022	72	79	3	---	---	---	---	---	---
CPT-1023	80	28	2	---	---	---	---	---	---
CPT-1024	133	65	---	---	0	51	64	---	---
CPT-1025	133	63	---	---	5	51	62	---	---
CPT-1026	133	65	---	---	6	53	62	---	---
CPT-1027	132	66	---	---	13	51	62	---	---
CPT-1028	132	71	---	---	33	53	67	---	---
CPT-1028a	132	35	---	---	35	---	---	---	---

Note: Borehole data summarized from GGNS Unit 3 borehole logs (Appendix 2AA)

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 1 of 7) SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit[1]	Data source[2]	Depth (ft. bgs) from	Depth (ft. bgs) to	Sample method[3]	USCS class Lab	USCS class Field	Natural moisture (%)	Dry unit weight (pcf)	G_s	Atterberg Index[4] LL	Atterberg Index[4] PI	Mechanical sieve analysis % gravel	Mechanical sieve analysis % sand	Mechanical sieve analysis % fines	Hydrometer analysis % silt	Hydrometer analysis % clay	Cohesion[5] (psf)	Internal friction angle (effective)[5] (degrees)	Maximum dry density (pcf)	Optimum moisture %	Permeability (cm/sec.)	pH	Chlorate[8] ppm	Sulfate ppm	Consolidation testing[11] p_c (psf)	Consolidation testing[11] C_c	Consolidation testing[11] C_r
1059-1	Fill	FSAR	3.5	5.0	SPT	---	MH	13.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.2	2.0[9,10]	11.4[9]	---	---	---
SC-3TOP	MSA	FSAR	10.0	12.0	SC	---	SM	1.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7.9	2.3[9]	2.1[9,10]	---	---	---
1045-15	MSA	FSAR	70.0	71.5	SPT	---	CL	38.6	---	---	49	27	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1048-7A	MSA	FSAR	23.5	24.5	SPT	SM	SM	---	---	---	26	1	0.0	64.7	35.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1048-13	MSA	FSAR	53.5	55.0	SPT	SP	SP	---	---	---	---	---	0.4	99.2	0.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1049-3	MSA	FSAR	15.5	17.0	SPT	---	CL	19.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.0	2.7[9]	37.5[9]	---	---	---
1049-4	MSA	FSAR	20.5	22.0	SPT	---	CL	39.3	---	---	42	19	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1049-8	MSA	FSAR	40.5	42.0	SPT	---	CL	34.3	---	---	47	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1049-12	MSA	FSAR	60.5	62.0	SPT	---	GP	---	---	---	---	---	45.6	44.9	9.5	---	---	---	---	---	---	---	---	---	---	---	---	---
1050-2	MSA	FSAR	10.0	11.5	SPT	---	SM	5.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7.9	2.5[9]	68.1[9]	---	---	---
1050-4	MSA	FSAR	20.0	21.5	SPT	---	ML	38.6	---	---	37	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1050-11	MSA	FSAR	55.0	56.5	SPT	SP-SM	SP-SM	---	---	---	NV	NP	0.0	93.6	6.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1050-13	MSA	FSAR	65.0	66.5	SPT	SM	SM	---	---	---	NV	NP	0.0	84.4	15.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1011-9	UL	FSAR	38.2	39.7	SPT	---	ML	18.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.3	13.9[9]	7.5[9]	---	---	---
1012-2	UL	FSAR	9.0	10.0	SC	ML	ML	14.0	---	---	28	5	0.0	0.6	99.4	88.3	11.1	---	---	---	---	---	---	---	---	---	---	---
1012-4	UL	FSAR	19.0	20.0	SC	---	ML	17.6	---	---	---	---	0.0	0.2	98.8	88.0	11.8	---	---	---	---	---	---	---	---	---	---	---
1012-6	UL	FSAR	29.0	30.0	SC	---	ML	14.5	---	---	---	---	0.0	0.4	99.6	89.6	10.0	---	---	---	---	---	---	---	---	---	---	---
1012-8	UL	FSAR	39.0	40.0	SC	---	ML	14.9	---	---	---	---	0.1	0.6	99.3	90.5	8.8	---	---	---	---	---	---	---	---	---	---	---
1012-10	UL	FSAR	49.0	50.0	SC	---	ML	15.7	---	---	---	---	0.0	0.9	99.1	90.1	9.0	---	---	---	---	---	---	---	---	---	---	---
1013-12	UL	FSAR	50.0	52.0	UD	ML	ML	---	---	2.77	27	2	0.0	2.7	97.3	87.6	9.7	---	---	---	---	---	---	---	---	---	---	---
1015-7	UL	FSAR	33.5	35.0	SPT	---	ML	17.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.5	3.1[9]	22.3[9]	---	---	---
1043-3	UL	FSAR	12.0	13.0	SC	---	ML	---	---	---	---	---	0.0	1.2	98.8	91.3	7.5	---	---	---	---	---	---	---	---	---	---	---
1043-8	UL	FSAR	35.0	36.0	SC	---	ML	---	---	---	---	---	7.1	10.7	82.2	73.3	8.9	---	---	---	---	---	---	---	---	---	---	---
1044-6	UL	FSAR	28.5	30.0	SPT	---	ML	23.6	---	---	24	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1059-6	UL	FSAR	18.5	20.0	SPT	---	ML-MH	12.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.3	6.5[9]	15.4[9]	---	---	---
1061-1	UL	FSAR	3.5	5.0	SPT	---	ML	15.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.7	2.3[9,10]	1.9[9,10]	---	---	---
1061-2	UL	FSAR	8.5	10.0	SPT	---	ML	18.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.1	1.9[9,10]	3.3[9,10]	---	---	---
1084-7	UL	FSAR	34.5	36.0	SPT	---	ML	20.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.4	1.9[9,10]	5.7[9,10]	---	---	---
1102-14	UL	FSAR	67.5	69.0	SPT	---	ML	29.7	---	---	26	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1106-2	UL	FSAR	10.0	11.5	SPT	---	ML	10.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.3	ND	7.7[9]	---	---	---
1106-4	UL	FSAR	20.0	21.5	SPT	---	ML	---	---	---	---	---	0.0	0.7	99.3	86.6	12.7	---	---	---	---	---	---	---	---	---	---	---
1106-6	UL	FSAR	30.0	31.5	SPT	---	ML	21.5	---	---	27	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1106-8	UL	FSAR	40.0	41.5	SPT	---	ML	---	---	---	---	---	0.0	0.5	99.5	90.1	9.4	---	---	---	---	---	---	---	---	---	---	---
1106-10	UL	FSAR	50.0	51.5	SPT	---	ML-CL	24.5	---	---	29	8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-3	UL	FSAR	13.5	15.0	SPT	---	ML	17.8	---	---	27	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-UD-3	UL	FSAR	58.0	60.0	UD	CL	CL	---	---	2.66	33	14	0.0	2.8	97.2	65.3	31.9	---	---	---	---	---	---	---	---	---	---	---
1107-5	UL	FSAR	23.5	25.0	SPT	---	ML	---	---	---	---	---	0.0	0.4	99.6	89.5	10.1	---	---	---	---	---	---	---	---	---	---	---
1107-7	UL	FSAR	33.5	35.0	SPT	---	ML	21.6	---	---	24	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-9	UL	FSAR	43.5	45.0	SPT	---	ML	---	---	---	---	---	0.0	1.5	98.5	89.9	8.6	---	---	---	---	---	---	---	---	---	---	---
1107-10	UL	FSAR	50.0	51.5	SPT	---	CH	23.5	---	---	89	56	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1108-6	UL	FSAR	30.0	31.5	SPT	---	ML	20.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.8	4.0[9]	13.4[9,10]	---	---	---
1108-7	UL	FSAR	34.5	36.0	SPT	---	CL-ML	19.4	---	---	26	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1108-9	UL	FSAR	45.0	46.5	SPT	---	ML	---	---	---	---	---	0.0	0.6	99.4	89.6	9.8	---	---	---	---	---	---	---	---	---	---	---
1108-10	UL	FSAR	49.0	50.5	SPT	---	ML	17.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.7	3.0[9]	4.7[9,10]	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 2 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit[1]	Data source[2]	Depth (ft. bgs)		Sample method[3]	USCS class		Natural moisture	Dry unit weight	G_s	Atterberg Index[4]		Mechanical sieve analysis			Hydrometer analysis		Cohesion[5]	Internal friction angle (effective)[5]	Maximum dry density	Optimum moisture	Permeability	pH	Chlorate[8]	Sulfate	Consolidation testing		
			from	to		Lab	Field	(%)	(pcf)		LL	PI	% gravel	% sand	% fines	% silt	% clay	(psf)	(degrees)	(pcf)	%	(cm/sec.)		ppm	ppm	P_c (psf)	C_c	C_r
1117-10	UL	FSAR	45.5	47.5	UD	ML	ML	24.2	100.1	2.68	---	---	0.3	2.5	97.2	90.2	7.0	0.0	35.8	---	---	---	---	---	---	---	---	---
1117-12	UL	FSAR	50.5	52.5	UD	CL	CL	23.0	---	---	29	11	0.0	6.2	93.8	67.2	26.6	---	---	---	---	---	---	---	---	9000	0.178	0.025
1125-9	UL	FSAR	43.5	45.5	UD	ML	ML	31.2	89.7	2.74	---	---	0.0	0.7	99.3	88.6	10.7	---	---	---	---	---	---	---	---	11000	0.198	0.027
1135-6	UL	FSAR	28.0	30.0	UD	CL	CL	24.9	95.9	2.72	32	15	4.1	1.2	94.7	69.6	25.1	516[6]	8.8[6]	---	---	---	---	---	---	21500	0.155	0.024
1135-11	UL	FSAR	48.0	50.0	UD	ML	ML	16.1	91.7	2.72	---	---	0.0	0.3	99.7	88.4	11.3	---	---	---	---	---	---	---	---	---	---	---
TP-1-1	UL	FSAR	4.0	4.0	Bulk	CL	ML	8.6	101.6	---	31	8	0.0	6.6	93.4	75.6	17.8	---	---	101.6	15.2	---	---	---	---	---	---	---
TP-1-2	UL	FSAR	4.0	4.0	Bulk	---	ML	8.1	107.6	---	---	---	---	---	---	---	---	---	---	107.6	12.7	---	---	---	---	---	---	---
TP-2-1	UL	FSAR	4.0	4.0	Bulk	CL	ML	9.1	110.4	---	36	13	0.0	0.6	99.4	76.3	23.1	---	---	110.4	15.2	---	---	---	---	---	---	---
TP-3-1	UL	FSAR	4.0	4.0	Bulk	CL	ML	11.4	101.7	---	39	17	0.0	0.4	99.6	73.8	25.8	---	---	101.7	20.7	---	---	---	---	---	---	---
1-4A	UL	ESP	11.0	12.5	PD	CL	ML-CL	25.6	---	---	28	13	0.0	0.7	99.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1-8A	UL	ESP	22.5	23.0	PD	ML	ML	19.6	93.1	---	---	---	0.0	0.3	99.7	89.1	10.6	---	---	---	---	---	---	---	---	---	---	---
1-8B	UL	ESP	22.0	22.5	PD	ML	ML	20.2	97.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1-8C	UL	ESP	21.5	22.0	PD	ML	ML	22.3	---	---	---	---	0.0	0.9	99.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1-10	UL	ESP	29.0	31.0	UD	ML	ML	27.3	85.8	---	30	3	0.0	2.0	98.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1-12	UL	ESP	36.0	38.0	SPT	CL	ML-CL	26.1	---	---	26	9	0.0	1.4	98.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1-14A	UL	ESP	45.5	46.0	PD	ML	ML-CL	29.5	89.1	2.69	---	---	---	---	---	---	---			---	---	---	---	---	---	---	---	---
1-14B	UL	ESP	45.0	45.5	PD	ML	ML-CL	28.1	90.6	2.69	---	---	---	---	---	---	---	0.0	33.0	---	---	---	---	---	---	---	---	---
1-14C	UL	ESP	44.5	45.0	PD	ML	ML-CL	25.6	93.7	2.69	---	---	---	---	---	---	---			---	---	---	---	---	---	---	---	---
1-15	UL	ESP	46.0	48.0	SPT	ML	ML-CL	24.2	---	---	---	---	0.0	2.6	97.4	89.2	8.2	---	---	---	---	---	---	---	---	---	---	---
2-1A	UL	ESP	4.5	5.0	PD	ML	ML	15.7	92.8	---	---	---	0.4	0.6	99.0	---	---	---	---	---	---	---	---	---	---	---	---	---
2-3	UL	ESP	13.5	15.0	SPT	ML	ML	24.8	---	---	---	---	0.0	0.8	99.2	---	---	---	---	---	---	---	---	---	---	---	---	---
2-4A	UL	ESP	19.5	20.0	PD	CL	ML	16.4	96.1	---	29	11	0.0	0.2	99.8	90.2	9.6	---	---	---	---	---	---	---	---	---	---	---
2-6A	UL	ESP	29.5	30.0	PD	ML	ML	17.3	96.1	---	---	---	0.0	0.4	99.6	---	---	---	---	---	---	---	---	---	---	---	---	---
2-6B	UL	ESP	29.0	29.5	PD	ML	ML	20.0	97.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2-9A	UL	ESP	44.5	45.0	PD	ML	ML-SM	22.6	96.6	2.69	---	---	---	---	---	---	---	0.0	34.0	---	---	---	---	---	---	---	---	---
2-9B	UL	ESP	44.0	44.5	PD	ML	ML-SM	22.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2-10	UL	ESP	48.5	50.0	SPT	CL	ML	24.2	---	---	25	9	0.0	1.1	98.9	---	---	---	---	---	---	---	---	---	---	---	---	---
3-3A	UL	ESP	16.0	16.5	PD	CL	ML-CL	22.9	94.1	---	32	16	0.0	0.2	99.8	---	---	---	---	---	---	---	---	---	---	---	---	---
3-3B	UL	ESP	15.5	16.0	PD	ML	ML-CL	23.9	---	---	---	---	0.0	0.5	99.5	---	---	---	---	---	---	---	---	---	---	---	---	---
3-5	UL	ESP	25.0	26.5	SPT	ML	ML	24.2	---	---	---	---	0.0	0.8	99.2	89.1	10.1	---	---	---	---	---	---	---	---	---	---	---
3-9	UL	ESP	45.0	46.5	SPT	CL	ML-CL	26.3	---	---	28	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3-10A	UL	ESP	51.0	51.5	PD	ML	ML-CL	20.1	99.5	---	---	---	0.0	0.2	99.8	88.7	11.1	---	---	---	---	---	---	---	---	---	---	---
3-10B	UL	ESP	50.5	51.0	PD	ML	ML-CL	23.3	---	---	---	---	0.0	0.9	99.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-16	LL	FSAR	68.5	70.0	SPT	CL	CL	25.3	---	---	29	9	0.0	10.1	89.9	70.4	19.5	---	---	---	---	---	---	---	---	---	---	---
1012-13	LL	FSAR	64.0	65.0	SC	---	ML	18.8	---	---	---	---	0.0	7.4	92.6	64.6	28.0	---	---	---	---	---	---	---	---	---	---	---
1012-15	LL	FSAR	72.0	73.0	SC	CL	SC	24.4	---	---	28	9	0.0	14.2	85.8	65.8	20.0	---	---	---	---	---	---	---	---	---	---	---
1030-14	LL	FSAR	68.5	70.0	SPT	---	CL	18.7	---	---	30	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1030-15	LL	FSAR	73.5	75.0	SPT	---	CL	22.6	---	---	29	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1032-14	LL	FSAR	68.5	70.0	SPT	---	CH	20.4	---	---	52	34	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 3 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit(1)	Data source(2)	Depth (ft. bgs) from	Depth (ft. bgs) to	Sample method(3)	USCS class Lab	USCS class Field	Natural moisture (%)	Dry unit weight (pcf)	G_s	Atterberg Index(4) LL	Atterberg Index(4) PI	Mechanical sieve analysis % gravel	Mechanical sieve analysis % sand	Mechanical sieve analysis % fines	Hydrometer analysis % silt	Hydrometer analysis % clay	Cohesion(5) (psf)	Internal friction angle (effective)(5) (degrees)	Maximum dry density (pcf)	Optimum moisture %	Permeability (cm/sec.)	pH	Chlorate(8) ppm	Sulfate ppm	Consolidation testing P_c (psf)	Consolidation testing C_c	Consolidation testing C_r
1035-16	LL	FSAR	78.5	80.0	SPT	CL	CL	19.1	---	---	33	17	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1035-17	LL	FSAR	83.5	85.0	SPT	---	CL	---	---	---	---	---	0.0	29.9	70.1	54.6	15.5	---	---	---	---	---	---	---	---	---	---	---
1104-14	LL	FSAR	68.0	69.5	SPT	CL	CL	---	---	---	26	8	0.0	22.3	77.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1106-3	LL	FSAR	58.0	60.0	UD	CL	CL-ML	21.4	105.8	2.70	32	16	0.0	10.7	89.3	61.1	28.2	0.0	26.0	---	---	---	---	---	---	---	---	---
1106-12	LL	FSAR	60.0	61.5	SPT	---	CL	16.6	---	---	34	17	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-12	LL	FSAR	60.0	61.5	SPT	---	CL	15.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.2	3.2(9)	1.7(9,10)	---	---	---
1108-12	LL	FSAR	60.0	61.5	SPT	---	MH	16.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.2	3.4(9)	2.9(9,10)	---	---	---
1108-13	LL	FSAR	64.2	65.7	SPT	---	MH	16.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.0	13.8(9)	3.8(9,10)	---	---	---
1135-20	LL	FSAR	88.0	90.0	UD	SC	SC	22.6	102.7	2.70	27	18	0.0	54.4	45.6	34.2	11.4	125(7)	33.7(7)	---	---	---	---	---	---	24500(12)	0.162(12)	0.021(12)
1-18	LL	ESP	56.0	57.5	SPT	SP-SM	ML	19.6	---	---	---	---	0.0	26.8	73.2	---	---	---	---	---	---	---	---	---	---	---	---	---
2-11	LL	ESP	58.5	60.5	UD	CL	ML-CL	22.2	104.7	---	32	13	0.0	2.0	98.0	---	---	---	---	---	---	---	---	---	---	---	---	---
3-13	LL	ESP	80.0	82.0	UD	ML	SC-CL	19.0	108.7	---	22	4	0.0	46.0	54.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-19	UCA	FSAR	83.5	85.0	SPT	---	SP-SM	---	---	---	---	---	0.0	88.1	11.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-14	UCA	FSAR	65.0	67.0	UD	---	ML	---	---	---	---	---	0.0	28.8	71.2	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-15	UCA	FSAR	67.0	68.5	SPT	---	SM-MH	18.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.4	4.1(9)	13.5(9)	---	---	---
1010-16	UCA	FSAR	75.0	76.5	SPT	---	ML	---	---	---	---	---	0.0	27.1	72.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-16	UCA	FSAR	75.3	76.5	SPT	SP	SP	---	---	---	---	---	0.0	98.9	1.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-17	UCA	FSAR	80.5	81.5	SPT	SP	SP	---	---	---	---	---	0.0	99.0	1.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-18	UCA	FSAR	85.0	86.5	SPT	SP		---	---	---	---	---	0.0	99.8	0.2	---	---	---	---	---	---	---	---	---	---	---	---	---
1013-18	UCA	FSAR	75.0	77.0	UD	---	SP-SM	---	---	---	---	---	0.6	66.0	33.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1013-19	UCA	FSAR	77.0	78.5	SPT	---	SP-SM	---	---	---	---	---	0.0	91.1	8.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1014-17	UCA	FSAR	75.0	75.9	UD	---	SP	11.9	93.1	---	---	---	0.0	94.9	5.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1030-17	UCA	FSAR	83.5	85.0	SPT	---	SP	---	---	---	---	---	0.0	81.5	18.5	---	---	---	---	---	---	---	---	---	---	---	---	---
1032-18	UCA	FSAR	88.5	90.0	SPT	---	SP	---	---	---	---	---	0.0	84.4	15.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1035-18	UCA	FSAR	88.5	90.0	SPT	---	SP-SM	---	---	---	---	---	0.0	92.0	8.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1035-19	UCA	FSAR	93.5	95.0	SPT	---	SP/CL	---	---	---	---	---	3.4	44.3	52.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1079-21	UCA	FSAR	105.0	106.5	SPT	---	SM	---	---	---	---	---	1.8	83.0	15.2	---	---	---	---	---	---	---	---	---	---	---	---	---
1100-17	UCA	FSAR	73.5	74.4	SPT	SM	SM	18.3	---	---	NV	NP	0.0	81.0	19.0	14.0	5.0	---	---	---	---	---	---	---	---	---	---	---
1100-19	UCA	FSAR	83.5	85.0	SPT	---	SP	---	---	---	---	---	0.0	93.1	6.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1101-15	UCA	FSAR	73.0	74.5	SPT	---	SP-SC	---	---	---	---	---	0.0	88.3	11.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1101-16	UCA	FSAR	78.0	79.5	SPT	---	ML/SP	---	---	---	---	---	0.0	43.0	57.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1102-P04	UCA	FSAR	81.0	83.5	UD	---	SP	24.6	93.2	2.65	NV	NP	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1103-10A	UCA	FSAR	70.0	70.4	SPT	CL	CL	---	---	---	28	9	0.0	18.1	81.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1103-11	UCA	FSAR	75.0	76.5	SPT	---	SM	---	---	---	---	---	0.0	76.0	24.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-16	UCA	FSAR	78.0	79.5	SPT	---	SP-SM	---	---	---	---	---	0.0	88.3	11.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1105-P01	UCA	FSAR	73.5	76.0	UD	---	CL-ML	20.1	97.8	---	---	---	0.0	15.0	85.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1105-P02	UCA	FSAR	76.0	77.5	UD	SP	SP	23.8	95.6	---	---	---	0.0	95.9	4.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1105-P03	UCA	FSAR	88.5	91.0	UD	SM	SP	---	---	2.66	NV	NP	0.0	78.4	21.6	13.7	7.9	---	---	---	---	---	---	---	---	---	---	---
1105-UD4	UCA	FSAR	73.0	74.5	UD	SM	SM	23.3	99.4	---	---	---	0.0	61.2	38.8	---	---	1440(7)	30.0(7)	---	---	---	---	---	---	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 4 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit(1)	Data source(2)	Depth (ft. bgs)		Sample method(3)	USCS class		Natural moisture	Dry unit weight	G_s	Atterberg Index(4)		Mechanical sieve analysis			Hydrometer analysis		Cohesion(5)	Internal friction angle (effective)(5)	Maximum dry density	Optimum moisture	Permeability	pH	Chlorate(8)	Sulfate	Consolidation testing		
			from	to		Lab	Field	(%)	(pcf)		LL	PI	% gravel	% sand	% fines	% silt	% clay	(psf)	(degrees)	(pcf)	%	(cm/sec.)		ppm	ppm	P_c (psf)	C_c	C_r
1105-P04	UCA	FSAR	91.0	93.5	UD	ML	SP	---	---	2.68	19	2	0.0	45.3	54.7	39.8	14.9	---	---	---	---	---	---	---	---	---	---	---
1105-18	UCA	FSAR	88.5	90.0	SPT	---	SM	---	---	---	---	---	0.0	87.9	12.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1106-14	UCA	FSAR	70.0	71.5	SPT	---	SC	---	---	---	---	---	0.0	50.9	49.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-13	UCA	FSAR	68.5	70.0	SPT	---	SP-SC	---	---	---	---	---	0.0	93.4	6.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1108-14B	UCA	FSAR	70.5	71.5	SPT	---	SP-SM	15.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.3	4.6(9)	5.4(9,10)	---	---	---
1108-16	UCA	FSAR	78.1	79.6	SPT	---	SP-SM	---	---	---	---	---	0.0	94.9	5.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P01	UCA	FSAR	68.5	71.0	UD	---	SP	19.8	108.7	---	---	---	0.0	10.0	90.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P02	UCA	FSAR	71.0	73.5	UD	---	CL-ML	22.5	104.1	---	23	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P04	UCA	FSAR	76.0	77.5	UD	---	SP-SM	20.4	93.3	---	---	---	0.0	93.1	6.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P05	UCA	FSAR	78.5	80.0	UD	---	SP-SM	22.1	95.4	---	---	---	0.0	92.7	7.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P06	UCA	FSAR	88.5	91.0	UD	CL-ML	CL	---	---	2.68	27	6	0.0	17.8	82.2	59.4	22.8	---	---	---	---	---	---	---	---	---	---	---
1109-P07	UCA	FSAR	91.0	93.5	UD	CL	SC-SM	---	---	2.70	33	15	0.0	21.8	78.2	52.2	26.0	---	---	---	---	---	---	---	---	---	---	---
1109-16	UCA	FSAR	77.5	79.0	SPT	---	SM	---	---	---	---	---	0.0	67.3	32.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-18	UCA	FSAR	87.5	89.0	SPT	---	CL	30.8	---	---	49	29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-19	UCA	FSAR	92.5	94.0	SPT	---	CL	26.0	---	---	42	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1110-14	UCA	FSAR	68.5	70.0	SPT	---	SM	14.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8.5	3.6(9)	1.4(9,10)	---	---	---
1116-14	UCA	FSAR	65.0	67.0	UD	---	SP	22.7	103.3	---	---	---	0.0	38.6	61.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1116-15	UCA	FSAR	67.0	68.5	SPT	---	SP	11.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	9.0	2.9(9)	3.1(9,10)	---	---	---
1116-16	UCA	FSAR	69.0	71.0	UD	---	SP	---	---	---	---	---	0.0	94.5	5.5	---	---	---	---	---	---	---	---	---	---	---	---	---
1-21	UCA	ESP	64.0	66.0	UD	---	SM	17.0	107.0	---	22	NP	0.0	66.0	34.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1-22A	UCA	ESP	66.0	67.5	SPT	SP-SM	SP-SM	24.9	---	---	---	---	0.0	88.3	11.7	9.5	2.2	---	---	---	---	---	---	---	---	---	---	---
1-22B	UCA	ESP	66.0	67.5	SPT	SP-SM	SP-SM	---	---	---	---	---	0.0	90.3	9.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1-26	UCA	ESP	75.1	76.3	SPT	SP	SP	25.5	---	---	---	---	0.0	95.3	4.7	---	---	---	---	---	---	---	---	---	---	---	---	---
2-12A	UCA	ESP	69.5	70.0	PD	SP	SM	16.5	113.0	2.65	---	---	0.0	55.8	44.2	35.9	8.3	0.0	36.0	---	---	---	---	---	---	---	---	---
2-12B	UCA	ESP	69.0	69.5	PD	SP	SM	17.0	111.8	2.65	---	---	0.0	55.8	44.2	35.9	8.3			---	---	---	---	---	---	---	---	---
2-13	UCA	ESP	78.5	80.0	SPT	SC	SM	16.7	---	---	---	---	2.8	85.0	12.2	---	---	---	---	---	---	---	---	---	---	---	---	---
3-14A	UCA	ESP	90.5	91.0	PD	SP	SP-SC	23.2	93.2	2.65	---	---	---	---	---	---	---	0.0	39.0	---	---	---	---	---	---	---	---	---
3-14B	UCA	ESP	90.0	90.5	PD	SC	SP-SC	22.9	---	2.65	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1007-17	UCOA	FSAR	85.0	86.5	SPT	SP	SP	---	---	---	---	---	30.7	65.8	3.5	---	---	---	---	---	---	---	---	---	---	---	---	---
1008B-2	UCOA	FSAR	85.0	86.5	SPT	---	CL	20.7	---	---	45	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1008B-3	UCOA	FSAR	90.0	91.5	SPT	---	SP-SM	45.4	---	---	---	---	45.4	47.6	7.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-20	UCOA	FSAR	88.5	90.0	SPT	---	CL	26.1	---	---	40	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-21	UCOA	FSAR	93.5	95.0	SPT	---	SM	---	---	---	---	---	28.3	44.3	27.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-21	UCOA	FSAR	95.0	96.5	SPT	SP	SP	---	---	---	---	---	46.0	50.2	3.8	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-19	UCOA	FSAR	90.0	90.9	SPT	---	SP-SM	---	---	---	---	---	10.1	84.6	5.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-20	UCOA	FSAR	94.0	95.5	SPT	SP	SP	---	---	---	---	---	45.3	50.2	4.5	---	---	---	---	---	---	---	---	---	---	---	---	---
1013-24	UCOA	FSAR	90.2	91.7	SPT	SP	SP	---	---	---	---	---	3.5	94.5	2.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1030-20	UCOA	FSAR	98.5	100.0	SPT	CL	CL	21.2	---	---	33	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1032-22	UCOA	FSAR	108.5	110.0	SPT	GW	GW	---	---	---	---	---	55.6	40.1	4.3	---	---	---	---	---	---	---	---	---	---	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 5 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit(1)	Data source(2)	Depth (ft. bgs) from	Depth (ft. bgs) to	Sample method(3)	USCS class Lab	USCS class Field	Natural moisture (%)	Dry unit weight (pcf)	G_s	Atterberg Index(4) LL	Atterberg Index(4) PI	Mechanical sieve analysis % gravel	Mechanical sieve analysis % sand	Mechanical sieve analysis % fines	Hydrometer analysis % silt	Hydrometer analysis % clay	Cohesion(5) (psf)	Internal friction angle (effective)(5) (degrees)	Maximum dry density (pcf)	Optimum moisture %	Permeability (cm/sec.)	pH	Chlorate(8) ppm	Sulfate ppm	Consolidation testing p_c (psf)	Consolidation testing C_c	Consolidation testing C_r
1035-22	UCOA	FSAR	108.5	110.0	SPT	GW	GW	---	---	---	---	---	51.8	45.3	2.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1040-23	UCOA	FSAR	109.0	110.5	SPT	CL	CL	26.5	---	---	37	19	---	2.9	97.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1101-17	UCOA	FSAR	83.5	85.0	SPT	---	CL	14.5	---	---	22	9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1101-19	UCOA	FSAR	94.0	95.5	SPT	GW	GW	---	---	---	---	---	51.5	46.5	2.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-19	UCOA	FSAR	94.0	95.5	SPT	GW	GW	---	---	---	---	---	59.9	38.2	1.9	---	---	---	---	---	---	---	---	---	---	---	---	---
1105-P06	UCOA	FSAR	96.0	98.5	UD	SC	SP	17.7	109.7	2.66	49	28	6.5	46.7	46.8	34.1	12.7	---	---	---	---	---	---	---	---	21500	0.083	0.025
1105-P07	UCOA	FSAR	98.5	100.5	UD	GP-GC	GP-GC	18.5	98.6	2.60	50	25	85.9	7.7	6.4	3.5	2.9	---	---	---	---	---	---	---	---	22500	0.173	0.026
1105-20	UCOA	FSAR	98.5	100.0	SPT	---	CL	21.5	---	---	44	24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1106-19	UCOA	FSAR	95.0	96.5	SPT	---	SM	---	---	---	---	---	15.4	70.6	14.0	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-17	UCOA	FSAR	88.5	90.0	SPT	---	CL-ML	38.7	---	---	28	6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-20	UCOA	FSAR	103.5	105.0	SPT	SP	SP	---	---	---	---	---	39.2	56.2	4.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-21A	UCOA	FSAR	108.5	109.2	SPT	GW	GW	---	---	---	---	---	51.9	46.0	2.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1108-19B	UCOA	FSAR	95.5	96.5	SPT	---	CL	21.8	---	---	39	22	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P09	UCOA	FSAR	96.0	98.2	UD	SC	SC	19.6	105.7	2.59	52	29	5.6	46.2	48.2	35.7	12.5	---	---	---	---	---	---	---	---	22600	0.146	0.029
1117-28	UCOA	FSAR	122.5	124.0	UD	ML	ML	22.5	102.1	2.69	---	---	0.0	30.3	69.7	51.0	18.7	---	---	---	---	---	---	---	---	23000	0.180	0.028
1123-UD3	UCOA	FSAR	83.5	85.3	UD	ML	ML	21.0	103.2	---	---	---	0.0	49.9	50.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1142-21	UCOA	FSAR	88.5	91.0	UD	CH	SW	---	---	2.71	51	29	0.0	0.9	99.1	47.3	51.8	---	---	---	---	---	---	---	---	---	---	---
1-27A	UCOA	ESP	86.0	86.5	PD	SP	SM	20.3	106.5	2.66	---	---	0.0	62.9	37.1	26.5	10.6	0.0	40.0	---	---	---	---	---	---	---	---	---
1-27B	UCOA	ESP	85.5	86.0	PD	SP	SM	22.2	105.8	2.66	---	---	0.0	84.2	15.8	11.7	4.1			---	---	---	---	---	---	---	---	---
1-28	UCOA	ESP	86.5	88.0	SPT	SM	SM	22.1	---	---	---	---	0.0	75.9	24.1	16.1	8.0	---	---	---	---	---	---	---	---	---	---	---
1-30	UCOA	ESP	95.3	96.7	SPT	SM	SM	19.4	---	---	---	---	4.4	83.5	12.1	---	---	---	---	---	---	---	---	---	---	---	---	---
1-32	UCOA	ESP	105.6	107.0	SPT	SP	SP	16.5	---	---	---	---	24.3	71.3	4.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1-33A	UCOA	ESP	115.0	115.5	PD	SP-SM	SP	20.2	---	---	---	---	9.1	82.3	8.6	---	---	---	---	---	---	---	---	---	---	---	---	---
1-33B	UCOA	ESP	114.5	115.0	PD	SP	SP	19.9	101.8	2.65	---	---	0.8	95.7	3.5	---	---	0.0	41.0	---	---	---	---	---	---	---	---	---
1-33C	UCOA	ESP	114.0	114.5	PD	SW	SP	14.5	---	---	---	---	6.9	83.3	9.8	---	---	---	---	---	---	---	---	---	---	---	---	---
1-34	UCOA	ESP	115.5	117.0	SPT	SP	SP	15.2	---	---	---	---	4.5	87.6	7.9	5.1	2.8	---	---	---	---	---	---	---	---	---	---	---
1-36	UCOA	ESP	124.2	125.8	SPT	SC	SC-CL	24.7	---	---	24	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2-15	UCOA	ESP	98.5	100.0	SPT	SP-SM	SP-SM	16.1	---	---	---	---	5.0	86.2	8.8	---	---	---	---	---	---	---	---	---	---	---	---	---
2-16	UCOA	ESP	108.5	110.5	UD	CL	CL	27.2	94.9	---	33	12	0.0	1.0	99.0	---	---	---	---			---						
2-29	UCOA	ESP	121.5	122.1	RC	CL	CL-ML	5.6	---	---	---	---	8.5	13.3	78.2	---	---	---	---	---	---	---	---	---	---	---	---	---
2-31	UCOA	ESP	122.7	123.6	RC	SM	SM	5.6	---	---	17	1	0.0	67.3	32.7	---	---	---	---	---	---	---	---	---	---	---	---	---
2-32	UCOA	ESP	126.5	127.5	RC	SM	SM	8.4	---	---	---	---	0.0	73.3	26.7	20.5	6.2	---	---	---	---	---	---	---	---	---	---	---
2-33	UCOA	ESP	128.0	128.9	RC	ML	SP	12.5	---	---	---	---	0.0	14.4	85.6	---	---	---	---	---	---	---	---	---	---	---	---	---
3-16	UCOA	ESP	110.0	111.5	SPT	SP-SM	SP-SM	9.9	---	---	---	---	41.6	51.7	6.7	---	---	---	---	---	---	---	---	---	---	---	---	---
1007-22	CF	FSAR	110.0	111.5	SPT	---	CL-CH	22.6	---	---	51	24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1008B-6	CF	FSAR	105.0	106.5	SPT	---	CH	21.6	---	---	58	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1008B-10	CF	FSAR	125.0	126.5	SPT	---	CH	23.2	---	---	65	40	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-22	CF	FSAR	108.5	110.0	SPT	---	CH	18.6	---	---	54	29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1009-28	CF	FSAR	138.5	140.0	SPT	---	MH	27.7	---	---	60	27	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 6 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit[1]	Data source[2]	Depth (ft. bgs) from	Depth (ft. bgs) to	Sample method[3]	USCS class Lab	USCS class Field	Natural moisture (%)	Dry unit weight (pcf)	G_s	Atterberg Index[4] LL	Atterberg Index[4] PI	Mechanical sieve analysis % gravel	Mechanical sieve analysis % sand	Mechanical sieve analysis % fines	Hydrometer analysis % silt	Hydrometer analysis % clay	Cohesion[5] (psf)	Internal friction angle (effective)[5] (degrees)	Maximum dry density (pcf)	Optimum moisture %	Permeability (cm/sec.)	pH	Chlorate[8] ppm	Sulfate ppm	Consolidation testing p_c (psf)	Consolidation testing C_c	Consolidation testing C_r
1009-33	CF	FSAR	163.5	165.0	SPT	---	SM	---	---	---	---	---	0.0	73.7	26.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-22	CF	FSAR	100.0	101.5	SPT	---	MH	21.4	---	---	44	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-23	CF	FSAR	105.0	105.7	UD	---	MH	27.6	86.9	2.65	---	---	---	---	---	---	---	---	---	---	---	1.5E-08	---	---	---	---	---	---
1010-27	CF	FSAR	118.0	119.5	SPT	---	CH	24.2	---	---	63	34	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1010-29	CF	FSAR	128.0	129.5	SPT	---	SP	---	---	---	---	---	0.0	88.7	11.3	---	---	---	---	---	---	---	---	---	---	---	---	---
1012-22	CF	FSAR	100.0	101.5	SPT	CL	SC	51.6	---	---	37	18	0.0	13.7	86.3	56.7	29.6	---	---	---	---	---	---	---	---	---	---	---
1012-25	CF	FSAR	115.0	116.5	SPT	CL	CL	27.2	---	---	48	27	0.0	2.7	97.3	59.7	37.6	---	---	---	---	---	---	---	---	---	---	---
1012-27	CF	FSAR	125.0	126.5	SPT	CL	CL	19.6	---	---	40	21	0.0	33.7	66.3	37.8	28.5	---	---	---	---	---	---	---	---	---	---	---
1012-31	CF	FSAR	145.0	146.5	SPT	CH	CH	33.6	---	---	56	29	0.0	1.6	98.4	51.3	47.1	---	---	---	---	---	---	---	---	---	---	---
1012-36	CF	FSAR	170.0	171.5	SPT	CL	CL	25.0	---	---	35	14	0.0	11.5	88.5	70.9	17.6	---	---	---	---	---	---	---	---	---	---	---
1012-41	CF	FSAR	195.0	195.5	SPT	CL	CL	26.7	---	---	39	16	0.0	18.8	81.2	58.7	22.5	---	---	---	---	---	---	---	---	---	---	---
1013-29	CF	FSAR	108.0	109.5	SPT	---	MH	26.7	---	---	60	24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1013-33	CF	FSAR	128.0	129.5	SPT	---	CL	16.9	---	---	46	24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1013-34	CF	FSAR	133.0	134.5	SPT	---	ML	---	---	---	---	---	0.0	47.8	52.2	---	---	---	---	---	---	---	---	---	---	---	---	---
1014-24	CF	FSAR	100.0	101.2	UD	---	CL	14.9	99.6	2.68	---	---	---	---	---	---	---	---	---	---	---	1.3E-07	---	---	---	---	---	---
1035-26	CF	FSAR	123.5	125.0	SPT	---	CH	19.8	---	---	53	29	0.0	7.0	93.0	69.2	23.8	---	---	---	---	---	---	---	---	---	---	---
1100-23	CF	FSAR	103.5	105.0	SPT	---	CH	21.3	---	---	61	35	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1100-28	CF	FSAR	127.5	129.0	SPT	---	CL	23.5	---	---	47	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1101-25	CF	FSAR	128.0	129.5	SPT	---	CL	24.0	---	---	46	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-21	CF	FSAR	104.0	105.5	SPT	---	CL	25.8	---	---	48	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-25	CF	FSAR	123.0	124.5	SPT	---	MH	24.9	---	---	58	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-27	CF	FSAR	133.0	134.5	SPT	---	SM	---	---	---	---	---	0.0	74.8	25.2	---	---	---	---	---	---	---	---	---	---	---	---	---
1104-29	CF	FSAR	143.0	144.5	SPT	---	MH	31.4	---	---	63	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1107-23	CF	FSAR	118.5	120.0	SPT	---	CL	21.5	---	---	33	7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1109-P09	CF	FSAR	96.0	98.2	UD	---	SC	19..1	102.9	2.62	52	29	---	---	---	---	---	---	---			3.1E-08	---	---	---	---	---	---
1109-P10	CF	FSAR	98.5	101.0	UD	CL	SM	---	---	2.68	43	21	0.0	34.8	65.2	34.3	30.9	---	---	---	---	---	---	---	---	---	---	---
1109-P11	CF	FSAR	101.0	102.2	UD	SM	SM	20.1	101.2	2.60	---	---	34.1	43.7	22.2	14.8	7.4	---	---	---	---	3.7E-08	---	---	---	20000[12]	0.206[12]	0.038[12]
1109-20	CF	FSAR	97.5	99.0	SPT	---	CL	19.5	---	---	44	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1142-25	CF	FSAR	103.5	104.0	UD	CH	CH	32.7	87.3	2.61	51	28	12.9	34.7	52.4	34.3	18.1	---	---	---	---	---	---	---	---	19000[12]	0.258[12]	0.036[12]
1-41A	CF	ESP	155.0	155.5	PD	ML	CL-ML	33.8	85.5	---	---	---	0.0	14.4	85.6	63.4	22.2	---	---	---	---	---	---	---	---	---	---	---
1-41B	CF	ESP	154.5	155.0	PD	ML	CL-ML	38.4	77.9	---	---	---	0.0	15.2	84.8	60.9	23.9	---	---	---	---	---	---	---	---	---	---	---
1-42	CF	ESP	154.0	154.5	SPT	CL	CL-ML	35.1	---	---	40	15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1-43	CF	ESP	164.0	166.0	UD	SM	CL-ML	28.6	89.3	---	29	NP	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1-44	CF	ESP	166.0	167.5	SPT	ML	CL-ML	31.5	---	---	---	---	0.0	21.4	78.6	68.6	10.0	---	---	---	---	---	---	---	---	---	---	---
1-46	CF	ESP	175.5	177.0	SPT	CL	CL-ML	29.8	---	---	37	16	0.3	21.3	78.4	---	---	---	---	---	---	---	---	---	---	---	---	---
1-47	CF	ESP	184.0	185.5	SPT	ML	CL-ML	36.1	---	---	---	---	0.2	24.8	75.0	62.8	12.2	---	---	---	---	---	---	---	---	---	---	---
2A-2	CF	ESP	173.0	174.0	SPT	SC	SM	35.2	---	---	---	---	22.0	48.5	29.5	---	---	---	---	---	---	---	---	---	---	---	---	---
2A-3	CF	ESP	202.0	203.0	SPT	CH	CH-CL	21.5	---	---	54	35	0.4	19.0	80.6	---	---	---	---	---	---	---	---	---	---	---	---	---
3-17	CF	ESP	150.0	151.5	SPT	SP-SM	SP-SM	21.0	---	---	---	---	0.0	92.9	7.1	---	---	---	---	---	---	---	---	---	---	---	---	---

GGNS COL 2.0-29-A

TABLE 2.5.4-203 (Sheet 7 of 7)
SUMMARY OF STATIC LABORATORY ANALYSIS

Sample ID	Geologic unit(1)	Data source(2)	Depth (ft. bgs)		Sample method(3)	USCS class		Natural moisture	Dry unit weight	G_s	Atterberg Index(4)		Mechanical sieve analysis			Hydrometer analysis		Cohesion(5)	Internal friction angle (effective)(5)	Maximum dry density	Optimum moisture	Permeability	pH	Chlorate(8)	Sulfate	Consolidation testing		
			from	to		Lab	Field	(%)	(pcf)		LL	PI	% gravel	% sand	% fines	% silt	% clay	(psf)	(degrees)	(pcf)	%	(cm/sec.)		ppm	ppm	p_c (psf)	C_c	C_r
3-18	CF	ESP	180.5	181.5	SPT	SP-CL	SP-SM	24.9	---	---	---	---	0.0	89.2	10.8	---	---	---	---		---	---	---	---	---	---	---	---
Average Mississippi River alluvium								25.3	---	---	40	12	9.2	77.4	13.4	---	---	---	---	---	---	---	8.0	2.5	35.9	---	---	---
Average Upper loess								20.8	96.9	2.71	32	10	0.3	1.5	98.1	84.7	13.2	0.0	34.3	105.3	16.0	---	8.5	4.1	9.1	13833	0.177	0.025
Average Lower loess								19.9	105.5	2.70	31	14	0.0	22.4	77.6	58.5	20.4	0.0	26.0	---	---	---	8.1	6.8	2.8	24500	0.162	0.021
Average Upland Complex alluvium								20.5	99.7	2.67	30	8	0.2	70.2	29.6	32.1	12.4	0.0	37.5	---	---	---	8.6	3.8	5.9	---	---	---
Average Upland Complex old alluvium								19.9	102.8	2.65	38	19	22.0	53.0	25.0	25.8	13.7	0.0	40.5	---	---	---	---	---	---	22400	0.146	0.027
Average Catahoula Formation								26.4	92.7	2.63	49	25	3.2	37.2	59.6	52.4	23.7	---	---	---	---	5.3E-08	---	---	---	19500	0.232	0.037

Notes:
(1) CF = Catahoula Formation; Fill = Undocumented fill; LL = Lower loess; UCA = Upland Complex alluvium; UCOA = Upland Complex old alluivum; UL = Upper loess;
(2) ESP = GGNS ESP SSAR; FSAR = GGNS Unit 3 FSAR
(3) PD = 2.5-inch I.D. push drive split spoon sampler; RC = rock core; SC = soil core; SPT = Standard Penetration Test; UD = Shelby tube
(4) LL = liquid limit; NV = sample slid in cup; NP = non-plastic; PI = plasticity index
(5) consolidated, undrained test results unless otherwise noted
(6) consolidated, drained results, not included in unit averages
(7) unconsolidated, undrained results, not included in unit averages
(8) ND = analyte not detected above method detection limit
(9) estimated result; result is less than the reporting limit
(10) method blank contamination; associated method blank contains target analyte at a reportable level
(11) p_c = preconsolidation pressure; C_c = coefficient of consolidation; C_r = Coefficient of Recompression
(12) Values from tests with excessive strain levels on recompression which indicates significant disturbance

GGNS COL 2.0-29-A

TABLE 2.5.4-204
THERMOGRAVIMETRIC ANALYSES OF CALCIUM CARBONATE CONTENT

Sample ID	TGA data (weight percent)[(1)]	Percent Carbonate as $CaCO_3$
1013:350.9'-351.1'	0.38	0.9
1013:400.7'-400.9'	1.45	3.3
1013:455.2'-455.4'	38.65	87.9
1013:499.8'-499.9'	38.31	87.1

Notes:

(1) weight loss due to decomposition of carbonates and liberation of CO_2

GGNS COL 2.0-29-A

TABLE 2.5.4-205
SUMMARY OF SOIL PROFILE DATA

Profile ID	Horizon	Depth (cm)	Color	Texture	Structure grade	Structure size(1)	Structure type(2)	Comments
SP-1	A	0-5	10YR 3/4	silt (ML)	weak	f	gr	
	Bt1	5-37	10YR 5/6	silt (ML)	moderate	m-c	sbk	Few to common clay films on ped faces; hydrophobic
	Bt2	37-50	10YR 6/4	silt (ML)	moderate	m	sbk	
	Bt3	50-60	10YR 5/6	silt (ML)	moderate	m-c	sbk	Slight noticable increase in clay %
	Bt4	60-130	10YR 6/6	silt (ML)	moderate-strong	m-c	sbk	
SP-2	A	0-5	10YR 3/2	silt (ML)	weak	m-c/f	gr-sbk	
	Bt1	5-18	10YR 6/4	silt (ML)	weak-moderate	m/m	sbk	Hydrophobic; clay films on root traces
	Bt2	18-55	10YR 5/6	silt (ML)	moderate	m	sbk-pl	Common clay films on ped faces
	Bt3	55-160	10YR 7/6	silt (ML)	moderate	m-c	sbk	Few clay films on ped faces
SP-3	A	0-12	10YR 3/4	silt (ML)	weak	f/f-m	gr-sbk	
	Bt1	12-40	10YR 5/4	silt (ML)	weak	f-m	sbk	
	Bt2	40-70	10YR 6/4	silt (ML)	weak	f-c	sbk	
	Bt3	70-80	10YR 6/4	silt (ML)	weak	f-c	sbk	
	Bt4	80-170	10YR 6/4	silt (ML)	moderate	f	pl	
	CB	170-290	10YR 6/3	silt (ML)	weak-moderate	m	sbk	Strong HCl reaction
SP-4	A	0-8	10YR 3/3	silt (ML)	weak	f	gr-sbk	
	Bt1	8-13	10YR 4/4	silt (ML)	moderate	m	gr-sbk	
	Bt2	13-36	10YR 6/4	silt (ML)	moderate	f/f	sbk-pl	Distinct clay films present on ped faces
	Bt3	36-70	7.5 YR 4/4	silt (ML)	strong	m	sbk	Common clay flims present on ped faces

Notes:
(1) Structure size: f = fine, m = medium, c = coarse
(2) Structure type: gr = granular, sbk = subangular blocky, pl = platy

GGNS COL 2.0-29-A

TABLE 2.5.4-206
SUMMARY OF DYNAMIC LABORATORY SAMPLES

UTA sample ID	WLA sample ID	Data source[1]	Sample depth		Geologic unit[2]	Isotropic confining pressure (σ_o)		Assumed K_o	Lab-measured V_s		In-situ V_s	Mean in-situ V_s[3]	Lab/field V_s ratio[4]
			from	to		in-situ	4x		in-situ σ_o	4x			
			ft. bgs	ft. bgs		psi	psi		ft./sec.	ft./sec.	ft./sec.	ft./sec.	in-situ σ_o
UTA-33-B	B-1-10	ESP	29.0	31.0	UL	16	64	0.5	634	881	940	960	0.67
UTA-53-A	1013-12	FSAR	50.0	52.0	UL	28	112	0.5	742	1050	920	989	0.81
UTA-33-A	B-2-11	ESP	58.5	60.5	LL	30	120	0.5	666	965	970	985	0.69
UTA-33-D	B-3-13	ESP	80.0	82.0	LL	60	240	1.0	930	1374	1120	985	0.83
UTA-53-B	UD-3	FSAR	58.0	60.0	LL	29	116	0.5	774	1023	---	989	0.78
UTA-33-C	B-1-21	ESP	64.0	66.0	UCA	55	220	1.0	837	1236	920	985	0.91
UTA-53-D	1105-P03	FSAR	88.5	91.0	UCA	40	160	0.5	705	1071	---	989	0.71
UTA-53-E	1105-P04	FSAR	91.0	93.5	UCA	41	164	0.5	739	1067	---	989	0.75
UTA-33-F	B-2-16	ESP	108.5	110.5	UCOA	72	---	1.0	1033	---	1030	1152	1.00
UTA-53-C	1142-21	FSAR	88.5	91.0	UCOA	36	144	0.5	653	914	---	989	0.66
UTA-53-F	1109-P06	FSAR	88.5	91.0	UCOA	39	156	0.5	777	1110	---	989	0.79
UTA-53-G	1109-P07	FSAR	91.0	93.5	UCOA	39	157	0.5	925	1124	---	989	0.94
UTA-33-E	B-1-43	ESP	164.0	166.0	CF	90	---	1.0	1011	---	1650	1449	0.61
UTA-53-H	1109-P10	FSAR	98.5	101.0	CF	42	168	0.5	1648	1902	---	1440	1.14

Notes:

(1) ESP = ESP SSAR; FSAR = Unit 3 FSAR

(2) CF = Catahoula Fm.; LL = Lower loess; UCA = Upland Complex alluvium; UCOA = Upland Complex old alluvium; UL = Upper loess

(3) Mean in-situ V_s calculated from suspension velocity logs collected in boreholes B-1006, B-1010, B-1013, and B-1014.

(4) Lab to field V_s ratio for samples UTA-53-B, UTA-53-C, UTA-53-D, UTA-53-E, UTA-53-F, UTA-53-G, and UTA-53-H were calculated using mean in-situ V_s

GGNS COL 2.0-29-A

TABLE 2.5.4-207
SUMMARY OF CPT PROPERTIES

Interpreted parameter	Undocumented fill		Upper loess		Lower loess		Upland Complex alluvium		Mississippi River alluvium	
	mean	st dev	mean	st dev	mean	st dev	mean	st dev	mean	st dev
q_c (tsf)	135.9	92.9	47.4	17.7	28.3	27.3	155.9	92.1	147.0	97.8
q_t (tsf)	136.3	88.8	47.5	17.7	29.3	27.2	156.3	91.8	147.1	97.8
R_f (%)	2.0	1.2	2.6	1.1	2.9	1.3	1.7	1.1	1.9	2.8
u (psi)	1.7	16.1	5.1	12.8	86.8	42.0	35.5	39.6	7.2	8.8
SBT (zone)	7.1	2.1	5.9	1.0	5.2	1.3	7.8	1.6	7.6	2.4
SBTn (zone)	6.0	1.3	4.4	0.8	3.3	0.6	5.0	1.0	5.6	1.0
N (blows/ft.)	32.1	17.3	17.4	8.4	13.0	13.0	35.5	15.5	31.7	14.0
$(N_1)_{60}$ (blows/ft.)	45.6	30.7	16.3	7.8	9.3	9.4	23.9	10.7	29.8	14.6
Phi (F)	44.8	4.2	36.3	2.7	34.4	4.4	39.5	3.3	42.9	3.0
S_u (psf)	8396	4358	6131	2356	2892	2142	6488	3956	3372	2528
OCR	8.8	2.7	8.8	2.7	2.5	2.5	5.6	3.7	7.3	3.6

GGNS COL 2.0-29-A

TABLE 2.5.4-208 (Sheet 1 of 4)
SUMMARY OF BOREHOLE LOCATIONS, DEPTHS, DRILLING METHODS, AND IN-SITU TESTING

Facility or zone	Borehole ID	Location(1)		Borehole method			Depth (ft)		Well conversion		In-situ testing	
		Northing	Easting	Cont. soil core	Direct rotary	HQ rock core	Prop.	Actual	MW	OW	P-S Velocity	Pressure meter
Power block primary boreholes	B-1003	549472	277142	n/a	x	n/a	200	200				
	B-1006	549563	277114	n/a	x	n/a	225	239			x	
	B-1007	549590	277377	x	x	n/a	200	200	x			
	B-1008	549741	277244	n/a	x	n/a	200	201		x		
	B-1009	549814	277288	x	x	n/a	225	225	x			
	B-1010	549646	277471	n/a	x	x	300	300			x	
	B-1011	549991	277212	n/a	x	n/a	300	301			[G-1011]	
	B-1012	549832	277331	x	x	n/a	225	226	x			
	B-1013	549788	277335	n/a	x	x	550	506		x	x	
	B-1014	549862	277492	n/a	x	x	300	292			x	
	B-1015	550077	277255	n/a	x	n/a	200	200				
	B-1019	550215	277560	x	x	n/a	225	224	x		[G-1019]	
	B-1020	550119	277891	x	x	n/a	200	215	x		x	
Power block secondary boreholes	B-1085	549700	277593	x	n/a	n/a	75	68				
	B-1086	549614	277550	x	n/a	n/a	75	62				
	B-1100	549672	277218	n/a	x	n/a	150	149			[G-1100]	
	B-1101	549646	277258	n/a	x	n/a	150	130				
	B-1102	549564	277423	n/a	x	n/a	150	149				
	B-1103	549717	277293	n/a	x	n/a	115	105		x		x
	B-1104	549650	277412	n/a	x	n/a	150	150				
	B-1105	549713	277446	n/a	x	n/a	150	140				
	B-1106	549734	277522	n/a	x	n/a	150	140				
	B-1107	549916	277358	n/a	x	n/a	150	150				
	B-1108	549849	277428	n/a	x	n/a	115	120				x
	B-1109	549806	277503	n/a	x	n/a	150	149				
	B-1110	549963	277383	n/a	x	n/a	150	169			x	
	B-1111	549924	277467	n/a	x	n/a	150	149				
	B-1112	549849	277628	n/a	x	n/a	150	150				

GGNS COL 2.0-29-A

TABLE 2.5.4-208 (Sheet 2 of 4)
SUMMARY OF BOREHOLE LOCATIONS, DEPTHS, DRILLING METHODS, AND IN-SITU TESTING

Facility or zone	Borehole ID	Location(1)		Borehole method			Depth (ft)		Well conversion		In-situ testing	
		northing	easting	Cont. soil core	Direct rotary	HQ rock core	Prop.	Actual	MW	OW	P-S Velocity	Pressure meter
Power block secondary boreholes	B-1113	549827	277710	n/a	x	n/a	150	167			x	
	B-1114	550016	277415	n/a	x	n/a	150	170				
	B-1115	549998	277506	n/a	x	n/a	150	174				
	B-1116	549895	277571	n/a	x	n/a	150	167			x	
	B-1117	549996	277628	n/a	x	n/a	150	179				
	B-1118	549979	277735	n/a	x	n/a	150	159				
	B-1119	550167	277492	n/a	x	n/a	150	197				
	B-1120	550100	277558	n/a	x	n/a	150	151				
	B-1121	550073	277682	n/a	x	n/a	150	179				
	B-1124	550086	277765	n/a	x	n/a	150	150				
	B-1125	550039	277824	n/a	x	n/a	150	139				
	B-1083	550053	277114	n/a	x	n/a	225	225				
	B-1084	550130	277162	n/a	x	x	300	249				
	B-1067	550037	277313	n/a	x	n/a	115	92				
Primary pipelines	B-1068	549852	277221	n/a	x	n/a	115	144		x		
	B-1069	549696	277115	n/a	x	n/a	75	75				
	B-1074	549103	276565	n/a	x	n/a	115	115				
	B-1075	548903	276805	n/a	x	n/a	75	75				
Cooling towers	B-1029	548784	277100	n/a	x	n/a	115	99				
	B-1030	548525	276941	n/a	x	n/a	115	119				
	B-1032	548325	276934	n/a	x	n/a	115	124				
	B-1033	548246	276387	x	x	n/a	200	201	x			
	B-1037	548157	275856	n/a	x	n/a	115	119				
	B-1040	549237	276266	x	x	n/a	200	200	x			
Intake facilities and pipelines	B-1043	549689	276648	x	x	n/a	200	202	x			
	B-1044	549808	276377	n/a	x	n/a	75	75				
	B-1045	549985	276157	x	x	n/a	150	150	x			
	B-1046	550486	275831	n/a	x	n/a	115	78				

GGNS COL 2.0-29-A

TABLE 2.5.4-208 (Sheet 3 of 4)
SUMMARY OF BOREHOLE LOCATIONS, DEPTHS, DRILLING METHODS, AND IN-SITU TESTING

Facility or zone	Borehole ID	Location[1]		Borehole method			Depth (ft)		Well conversion		In-situ testing	
		Northing	Easting	Cont. soil core	Direct rotary	HQ rock core	Prop.	Actual	MW	OW	P-S Velocity	Pressure meter
Intake facilities and pipelines	B-1047	550798	275652	n/a	x	n/a	75	75				
	B-1048	551222	275412	n/a	x	n/a	75	75				
	B-1050	551939	274725	n/a	x	n/a	75	77				
	B-1051	553641	272673	n/a	x	n/a	150	120				
Transmission lines	B-1057	550508	277570	n/a	x	n/a	75	75				
	B-1058	550961	277663	n/a	x	n/a	75	100				
	B-1061	551125	278625	n/a	x	n/a	75	75				
	B-1063	549691	279409	n/a	x	n/a	75	80				
River bluff stability	B-1023	550110	276880	x	x	n/a	200	193	x			
	B-1024	550710	277174	x	x	n/a	200	199	x			
	B-1078	550171	276692	n/a	x	n/a	115	182				
	B-1079	550196	276570	n/a	x	n/a	115	117				
General site coverage and facilities	B-1016	550158	277359	n/a	x	n/a	225	212	x			
	B-1022	550463	277753	n/a	x	n/a	225	201	x			
	B-1026	550213	278141	x	x	n/a	200	200	x			
	B-1027	549374	277668	x	x	n/a	200	201	x			
	B-1042	551263	276591	x	x	n/a	150	150	x			
	B-1082	546548	276132	n/a	x	n/a	200	202	x			
	B-1134	548911	277324	n/a	x	n/a	200	202	x			
	B-1135	549781	277176	n/a	x	n/a	150	139				
	B-1136	550006	277302	n/a	x	n/a	150	199				
	B-1137	550240	277442	n/a	x	n/a	150	204				
	B-1138	550274	277654	n/a	x	n/a	150	190				
	B-1143	549674	277365	n/a	x	n/a	150	119				
	P-1101	549642	277256	n/a	x	n/a	105	84				
	P-1102	549562	277421	n/a	x	n/a	105	89				
	P-1105	549710	277443	n/a	x	n/a	105	101				

GGNS COL 2.0-29-A

TABLE 2.5.4-208 (Sheet 4 of 4)
SUMMARY OF BOREHOLE LOCATIONS, DEPTHS, DRILLING METHODS, AND IN-SITU TESTING

Facility or zone	Borehole ID	Location(1)		Borehole method			Depth (ft)		Well conversion		In-situ testing	
		Northing	Easting	Cont. soil core	Direct rotary	HQ rock core	Prop.	Actual	MW	OW	P-S Velocity	Pressure meter
General site coverage and facilities	P-1109	549804	277501	n/a	x	n/a	105	102				
	G-1011	549998	277215	n/a	x	n/a	300	320			x	
	G-1100	549668	277226	n/a	x	n/a	225	236			x	

Note:
(1) Location coordinates referenced to Mississippi State Plane System, NAD 27.

GGNS COL 2.0-29-A

TABLE 2.5.4-209
SUMMARY OF PRESSUREMETER TEST RESULTS

Borehole ID	Test ID	Geologic unit(1)	Test depth (ft.)	Limit pressure (psi)	Shear strength(2) (psi)	G Menard (psi)	G unload-reload (psi)
B-1108	GG-2	UL	32.8	150	20	1300	5050
B-1108	GG-1	UL	34.3	150	20	1700	4900
B-1108	GG-4	UL	47.5	210	34	2290	8080
B-1108	GG-3	UL	49.0	210	35	1800	7020
B-1108	GG-6	LL	62.6	---	---	---	---
B-1108	GG-5	LL	64.1	220	27	2130	3740
B-1108	GG-8	UCA	76.6	420	[80]	2130	11,000
B-1108	GG-7	UCA	78.1	750	[200]	2380	16,500
B-1108	GG-10	UCA	87.6	300	65	1590	4200
B-1108	GG-9	UCOA	89.1	240	35	960	1960
B-1108	GG-12	CF	98.1	230	50	760	2560
B-1108	GG-11	CF	99.6	890	240	2760	28,400
B-1108	GG-14	CF	108.7	1950	420	17,920	24,000
B-1108	GG-13	CF	110.2	890	120	4710	11,000
B-1108	GG-16	CF	117.8	---	---	3300	---
B-1108	GG-15	CF	119.3	1790	270	25,700	56,000
B-1103	GG-18	UL	34.0	150	15	500	7000
B-1103	GG-17	UL	35.5	170	25	2150	6100
B-1103	GG-20	LL	64.0	250	55	850	4000
B-1103	GG-19	LL	65.5	180	19	1900	2900
B-1103	GG-22	UCA	77.6	400	[85]	1600	8000
B-1103	GG-21	UCA	79.1	910	[225]	3700	24,000
B-1103	GG-23	UCOA	87.3	---	---	---	---

Notes:

(1) CF = Catahoula Formation; LL = Lower loess; UCA = Upland Complex alluvium; UCOA = Upland Complex old alluvium; UL = Upper loess

(2) The shear strengths are based on a simple model assuming a cohesive material. In the frictional materials, the shear strength derived may not be appropriate. These values are shown in brackets.

GGNS COL 2.0-29-A

TABLE 2.5.4-210 (Sheet 1 of 2)
SUMMARY OF MONITORING AND OBSERVATION WELLS

Facility or zone	Well ID	Location(1)		Depth (ft.)	Casing diameter			Screened interval		Comments
		northing	easting		2 in.	4 in.	6 in.	base (ft.)	top (ft.)	
ESBWR power block	MW-1007A	549594	277384	65	x			65	45	
	MW-1007B	549580	277375	95	x			95	75	
	MW-1007C	549587	277369	165		x		165	145	
	MW-1009B	549748	277249	100			x	100	80	well for pumping test
	MW-1009C	549735	277252	180		x		169	149	
	MW-1012B	549806	277294	106			x	100	80	well for pumping test
	MW-1012C	549805	277284	170		x		170	150	
	MW-1019A	550224	277561	52	x			52	32	
	MW-1019B	550213	277551	109	x			109	89	
	MW-1020B	550121	277867	80	x			80	60	
	MW-1020C	550130	277849	140		x		140	120	
Cooling towers	MW-1033A	548248	276391	70	x			70	50	
	MW-1033B	548241	276383	90	x			90	70	
	MW-1040A	549241	276274	80	x			80	60	
	MW-1040B	549231	276272	115		x		115	95	
	MW-1042B	551256	276590	48	x			48	28	
	MW-1042C	551264	276581	99	x			99	79	
Intake facilities and pipelines	MW-1043A	549693	276641	45	x			45	25	
	MW-1043B	549686	276655	75	x			75	55	
	MW-1045B	549975	276163	85	x			85	65	
River bluff stability	MW-1023A	550117	276883	75	x			75	55	
	MW-1023B	550102	276884	100	x			100	80	
	MW-1024A	550714	277179	70	x			70	50	
	MW-1024B	550701	277171	110	x			110	90	
	MW-1024C	550712	277165	175		x		175	155	
	MW-1025A	550634	277857	70	x			70	50	
	MW-1025B	550626	277871	110	x			110	90	

GGNS COL 2.0-29-A

TABLE 2.5.4-210 (Sheet 2 of 2)
SUMMARY OF MONITORING AND OBSERVATION WELLS

Facility or zone	Well ID	Coordinates(1)		Depth (ft.)	Casing diameter			Screened interval		Comments
		Northing	Easting		2 in.	4 in.	6 in.	base (ft.)	top (ft.)	
General site coverage and facilities	MW-1026A	550216	278138	40	x			40	20	
	MW-1026B	550210	278138	100	x			100	80	
	MW-1027A	549378	277671	50	x			50	30	
	MW-1027B	549368	277670	103	x			103	83	
	MW-1027C	549373	277662	170		x		168	148	
	MW-1082B	546549	276139	100	x			98	78	
	MW-1082C	546537	276135	170		x		169	149	
	MW-1016A	550164	277367	75	x			75	55	
	MW-1016B	550151	277359	115		x		115	95	
	MW-1022B	550457	277753	110	x			110	90	
	MW-1134A	548917	277332	55	x			55	35	
	MW-1134B	548902	277326	85	x			85	65	
	MW-1134C	548903	277318	164		x		164	144	
Observation wells	OW-1008	549727	277267	95	x			75	95	
	OW-1013	549782	277339	96	x			75	95	
	OW-1068	549843	277217	111	x			90	110	
	OW-1108	549842	277430	96	x			75	95	

Note:
(1) Location coordinates referenced to Mississippi State Plane System, NAD 27.

GGNS COL 2.0-29-A

TABLE 2.5.4-211
SUMMARY OF CONE PENETROMETER TEST SOUNDINGS

Facility or zone	Sounding ID	Coordinates[1]		Depth (ft.)	
		Northing	Easting	Prop.	Actual
Power block	CPT-1001	549447	277188	65	76
	CPT-1002	549598	276847	65	59
	CPT-1003	549443	277441	65	68
	CPT-1004	549570	277522	65	75
	CPT-1005	549914	277351	65	71
	CPT-1006	550006	277542	65	55
	CPT-1007	549943	277772	65	61
	CPT-1008	550132	277864	65	61
	CPT-1009	549545	277309	65	75
	CPT-1010	549501	277381	65	66
	CPT-1012	549685	277550	65	65
	CPT-1013	549970	277705	65	66
	CPT-1015	550118	276864	65	81
	CPT-1024	549718	277603	65	65
	CPT-1025	549667	277607	65	63
	CPT-1026	549653	277566	65	65
	CPT-1027	549622	277584	65	66
	CPT-1028	549558	277548	65	71
	CPT-1028a	549562	277550	65	35
Primary pipelines	CPT-1011	549723	277122	65	82
Intake facilities and pipelines	CPT-1017	552230	274504	65	67
	CPT-1018	552459	274272	65	53
	CPT-1019	552706	274017	65	75
	CPT-1020	553112	273700	65	57
	CPT-1021	553456	273300	65	28
	CPT-1022	553615	272659	65	79
	CPT-1023	553699	272911	65	28
River bluff stability	CPT-1016	550945	277671	65	86

(1) Location coordinates referenced to Mississippi State Plane System, NAD 27.

GGNS COL 2.0-29-A

TABLE 2.5.4-212
SUMMARY OF TEST PITS

Facility or zone	Test pit ID		Location(1) northing	Location(1) easting	Elevation(2) (ft. amsl)	Depth (ft.)
River bluff stability	TP-1001	south end	550626	278056	147	4.5
		north end	550637	278050	145	
	TP-1002	south end	550797	277773	156	4.5
		north end	550807	277785	153	
	TP-1003	south end	550921	277690	155	4.5
		north end	550932	277713	153	
	TP-1004	east end	550406	276580	160	5.0
		west end	550413	276570	159	

Notes:
(1) Location coordinates referenced to Mississippi State Plane System, NAD 27
(2) Elevations referenced to NGVD 29

GGNS COL 2.0-29-A

TABLE 2.5.4-213
SUMMARY OF SPECTRAL ANALYSIS OF SURFACE WAVES (SASW) SURVEYS

Facility or zone	SASW survey ID	Endpoint locations[1]		Elevation[2] (ft. amsl)
		northing	easting	
Power block	SASW-1001	550239.7	277102.9	154.3
		550452.4	277510.5	155.0
	SASW-1002	550153.3	277098.7	154.3
		550343.4	277459.7	155.2
	SASW-1003	549957.3	276996.6	154.3
		550189.1	277414.7	155.7
	SASW-1004	549833.1	276973.1	154.9
		550081.5	277354.6	155.9
	SASW-1005	549746.5	277022.6	155.2
		549883.8	277241.0	155.6
	SASW-1006	549682.9	277087.4	155.5
		550026.7	277276.4	155.2
	SASW-1007	550125.4	277474.7	134.0
		550368.3	277806.3	133.2
	SASW-1008	549929.5	277426.4	133.4
		550188.3	277732.6	132.9
	SASW-1009	549735.1	277232.5	136.4
		549877.3	277502.9	133.6
	SASW-1010	549589.3	277391.2	133.5
		549846.7	277533.3	133.7
	SASW-1011	549627.9	277466.7	133.4
		550014.2	277692.5	132.9
	SASW-1012	549580.2	277160.5	133.9
		549708.6	277577.9	132.8
	SASW-1013	549404.4	277254.7	133.3
		549571.8	276900.9	129.5
	SASW-1014	548938.4	277423.1	131.8
		549306.0	277340.0	133.6
	SASW-1015	549485.0	277481.4	132.8
		549829.1	277668.0	132.9

Notes:
(1) Location coordinates referenced to Mississippi State Plane System, NAD 27
(2) Elevations referenced to NAVD 88

GGNS COL 2.0-29-A

TABLE 2.5.4-214
SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS FROM PREVIOUS SITE STUDIES

Test Well #1

Location	Depth, ft	Formation	Hydraulic Conductivity Drawdown		Hydraulic Conductivity Recovery	
			ft/day	cm/sec	ft/day	cm/sec
TW#1	153	Terrace	--	--	680.3	2.4×10^{-1}
OW29A	130	Terrace	737.0	2.6×10^{-1}	793.7	2.8×10^{-1}
OW29B	153	Terrace	793.7	2.8×10^{-1}	737.0	2.6×10^{-1}
OW69A	100	Terrace	595.3	2.1×10^{-1}	--	--
OW69B	95	Terrace	396.9	1.4×10^{-1}	595.3	2.1×10^{-1}
OW73	110	Terrace	396.9	1.4×10^{-1}	--	--
OW9	100	Terrace	680.3	2.4×10^{-1}	--	--

Variable Head Permeability Tests

Location	Depth, ft	Formation	Hydraulic Conductivity	
			ft/day	cm/sec
P34B	40	Terrace	$1.1 \times 10^{+1}$	4.0×10^{-3}
P34C	55	Terrace	$2.3 \times 10^{+2}$	8.0×10^{-2}
P 4	275	Catahoula	1.8×10^{-5}	6.3×10^{-9}
TW-3	121	Terrace	7.4×10^{-1}	2.6×10^{-4}

Laboratory consolidation Test

Location	Depth, ft	Formation	Unified Classification	Hydraulic Conductivity	
				ft/day	cm/sec
B-110	114-116	Catahoula	CL	1.2×10^{-4}	4.3×10^{-8}
B-110	137-139	Catahoula	CL	6.8×10^{-5}	2.4×10^{-8}
B-120	114-116	Catahoula	CL	1.6×10^{-4}	5.8×10^{-8}
B-120	134-136	Catahoula	CL	6.2×10^{-4}	2.2×10^{-8}
B-120	144-146	Catahoula	SC	8.2×10^{-5}	2.9×10^{-8}
B-4	19-20	Alluvium	CH	2.2×10^{-4}	7.8×10^{-8}
B-4	49-51	Alluvium	ML	1.7×10^{-4}	5.9×10^{-8}

NOTES:
1. Well, Piezometer, and Boring Locations are shown in UFSAR Figure 2.4-27.
2. Information taken from UFSAR Table 2.4-26.
3. Stratigraphic nomenclature used in UFSAR was slightly different from the GGNS Unit 3 nomenclature. Refer to Table 2.5.4-201 for correlations.

GGNS COL 2.0-29-A

TABLE 2.5.4-215 (Sheet 1 of 2)
ESTIMATED COEFFICIENT OF HYDRAULIC CONDUCTIVITY (K) VALUES FROM GRAIN SIZE ANALYSIS

BORING NUMBER	SAMPLE DEPTH, ft. below ground	USCS (1)	FORMATION (3)	D_{10} mm(4)	k_h (cm/s) Estimated from USACE Graph	k_v (cm/sec) Estimated using Hazen Equation	k_v (cm/sec) Estimated using Kozeny-Carman Equation
B-1048	53.5'-55'	SP	MRA	0.1422	5.6E-01	2.0E-02	ND (5)
B-1049	60.5'-62'	GP(2)	MRA	0.0875	1.6E-01	7.7E-03	ND
B-1050	55'-56.5'	SP-SM	MRA	0.0935	2.0E-01	8.7E-03	ND
MISSISSIPPI RIVER ALLUVIUM AVERAGE (6)					**3.E-01**	**1.E-02**	**ND**
B-1012	75.3'-76.5'	SP	UCA	0.1138	3.5E-01	1.3E-02	1.5E-01
B-1012	80.5'-81.5'	SP	UCA	0.1228	4.2E-01	1.5E-02	1.5E-01
B-1012	85'-86.5'	SP	UCA	0.2094	1.1E+00	4.4E-02	1.9E-01
B-1013	77'-78.5'	SP-SM	UCA	0.0886	1.8E-01	7.8E-03	3.3E-02
B-1014	75'-76'	SP(2)	UCA	0.14	5.1E-01	2.0E-02	5.9E-02
B-1035	88.5'-90'	SP-SM	UCA	0.122	4.1E-01	1.5E-02	ND
B-1104	78'-79.5'	SP-SM	UCA	0.075	1.1E-01	5.6E-03	2.3E-02
B-1107	68.5'-70'	SP-SC	UCA	0.0779	1.3E-01	6.1E-03	4.6E-02
B-1108	78.1'-79.6'	SP-SM	UCA	0.1094	3.1E-01	1.2E-02	5.9E-02
B-1116	69'-71'	SP(2)	UCA	0.1	2.4E-01	1.0E-02	5.5E-02
P-1105	76'-77.5'	SP	UCA	0.25	1.4E+00	6.3E-02	7.2E-02
P-1109	76'-77.5'	SP-SM(2)	UCA	0.15	5.7E-01	2.3E-02	4.4E-02
P-1109	78.5'-88'	SP-SM	UCA	0.11	3.1E-01	1.2E-02	4.1E-02
UPLAND COMPLEX ALLUVIUM AVERAGE(6)					**5.E-01**	**2.E-02**	**8.E-02**

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TABLE 2.5.4-215 (Sheet 2 of 2)
ESTIMATED COEFFICIENT OF HYDRAULIC CONDUCTIVITY (K) VALUES FROM GRAIN SIZE ANALYSIS

BORING NUMBER	SAMPLE DEPTH, ft. below ground	USCS (1)	FORMATION (3)	D10 mm(4)	k_h (cm/s) Estimated from USACE Graph	k_v (cm/sec) Estimated using Hazen Equation	k_v (cm/sec) Estimated using Kozeny-Carman Equation
B-1007	85'-86.5'	SP	UCOA (7)	0.2561	1.5E+00	6.6E-02	7.6E-02
B-1008B	90'-91.5'	SP-SM	UCOA (7)	0.1788	8.2E-01	3.2E-02	4.0E-02
B-1010	95'-96.5'	SP	UCOA(7)	0.2932	1.8E+00	8.6E-02	8.5E-02
B-1012	90'-90.9'	SP-SM	UCOA	0.1432	5.5E-01	2.1E-02	3.8E-02
B-1012	94'-95.5'	SP	UCOA(7)	0.2455	1.4E+00	6.0E-02	7.0E-02
B-1013	90.2'-91.7'	SP	UCOA	0.4307	3.1E+00	1.9E-01	7.2E-02
B-1032	108.5'-110'	GW	UCOA	0.3792	2.7E+00	1.4E-01	ND
B-1035	108.5'-110'	GW	UCOA	0.4556	3.2E+00	2.1E-01	ND
B-1100	83.5'-85'	SP(2)	UCOA	0.1094	3.1E-01	1.2E-02	2.6E-02
B-1101	94'-95.5'	GW	UCOA(7)	0.5399	4.0E+00	2.9E-01	1.7E-01
B-1104	94'-95.5'	GW	UCOA(7)	0.5373	3.9E+00	2.9E-01	2.2E-01
B-1107	103.5'-105'	SP	UCOA(7)	0.2471	1.4E-01	6.1E-02	6.2E-02
B-1107	108.5'-109.25'	GW	UCOA(7)	0.6014	4.3E+00	3.6E-01	1.7E-01
UPLAND COMPLEX OLD ALLUVIUM AVERAGE(6)					**2.E+00**	**1.E-01**	**9.E-02**

Notes
(1) Unified Soil Classification Symbol from laboratory tests
(2) USCS based on field log description
(3) MRA = Mississippi River Alluvium; UCA = Upland Complex Alluvium; UCOA = Upland Complex Old Alluvium

GGNS COL 2.0-29-A

TABLE 2.5.4-216 (Sheet 1 of 4)
GMRS PROFILE BASE CASES

Base Case 1				
Depth interval (ft. bgs)		V_s (ft/s)	V_p (ft/s)	Poisson's ratio (σ)
from	to			
0	9	767	1379	0.28
9	33	854	1562	0.29
33	47	971	1780	0.29
47	61	979	2888	0.44
61	98	1055	4191	0.47
98	106	1405	4748	0.45
106	168	1582	5150	0.45
168	218	1996	6142	0.44
218	263	1914	6075	0.44
263	347	1740	5963	0.45
347	446	1496	5723	0.46
446	750	2000	5786	0.43
750	981	2622	6424	0.40
981	1637	2871	7032	0.40
1637	2294	3055	7483	0.40
2294	3280	9285	16082	0.25
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GGNS COL 2.0-29-A

TABLE 2.5.4-216 (Sheet 2 of 4)
GMRS PROFILE BASE CASES

Base Case 2				
Depth interval (ft. bgs) from	to	V_s (ft/s)	V_p (ft/s)	Poisson's ratio (σ)
0	9	767	1379	0.28
9	33	854	1562	0.29
33	47	971	1780	0.29
47	61	979	2888	0.44
61	98	1055	4191	0.47
98	106	1405	4748	0.45
106	168	1582	5150	0.45
168	218	1996	6142	0.44
218	263	1914	6075	0.44
263	347	1740	5963	0.45
347	446	1496	5723	0.46
446	981	2622	7586	0.43
981	1637	2871	7032	0.40
1637	2294	3055	7483	0.40
2294	3280	9285	16082	0.25
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GGNS COL 2.0-29-A

TABLE 2.5.4-216 (Sheet 3 of 4)
GMRS PROFILE BASE CASES

Base Case 3

Depth interval (ft. bgs) from	to	V_s (ft/s)	V_p (ft/s)	Poisson's ratio (σ)
0	9	767	1379	0.28
9	33	854	1562	0.29
33	47	971	1780	0.29
47	61	979	2888	0.44
61	98	1055	4191	0.47
98	106	1405	4748	0.45
106	168	1582	5150	0.45
168	218	1996	6142	0.44
218	263	1914	6075	0.44
263	347	1740	5963	0.45
347	446	1496	5723	0.46
446	2294	3300	9417	0.43
2294	3280	9285	16082	0.25
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GGNS COL 2.0-29-A

TABLE 2.5.4-216 (Sheet 4 of 4) GMRS PROFILE BASE CASES

Base Case 4				
Depth interval (ft. bgs)		V_s (ft/s)	V_p (ft/s)	Poisson's ratio (σ)
from	to			
0	9	767	1379	0.28
9	33	854	1562	0.29
33	47	971	1780	0.29
47	61	979	2888	0.44
61	98	1055	4191	0.47
98	106	1405	4748	0.45
106	168	1582	5150	0.45
168	218	1996	6142	0.44
218	263	1914	6075	0.44
263	347	1740	5963	0.45
347	401	1430	5571	0.46
401	419	2031	6305	0.44
419	446	1364	5618	0.47
446	981	2622	7586	0.43
981	1637	2871	7032	0.40
1637	2294	3055	7483	0.40
2294	3280	9285	16082	0.25

Notes:

(1) Data below 475 ft. bgs from generic Mississippi embayment velocity profile (Section 2.5.2.3)

(2) Data range from 446 to 800 ft. bgs varies between base cases 1, 2, and 3 in order to envelop the potential range of velocity values through Vicksburg Group sediments

(3) Data from 347 to 446 ft. bgs parsed into three layers in base case 4

GGNS COL 2.0-29-A

TABLE 2.5.4-217
SUMMARY TABLE FOR LIQUEFACTION EVALUATION

Boring Number	Sample Depth	Unit Weight	Lab Determined USCS	Laboratory Fines Content	Unit Average Fines Content	Fines Content	Atmospheric Pressure (psf)	Earthquake Moment Magnitude Scenario 1	Earthquake Moment Magnitude Scenario 2	In-Situ depth to Ground Water (GW)	Perched depth to GW	PMF depth to GW	Mactec Calculated Overburden (psf)	Effective Overburden with insitu Water level (lbs/ft^2)	Effective Overburden with Perched Water level (lbs/ft^2)	Effective Overburden with PMF Water level (lbs/ft^2)	Corrected Blow Counts	Coefficients for Correction to Clean Sand Values	
	ft	pcf		%	%	%	P	Mw	Mw	(ft)	(ft)	(ft)	σvo	σ'vo	$\sigma'vo_1$	$\sigma'vo_2$	$(N_1)_{60}$	α	β
B-1013	78	120	SP-SM	8.9	29.6	8.9	2116.8	7.5	6.5	66.5	44	30	9204	8486.4	7082.4	6208.8	6	0.5	1.0
B-1067	76	117			98.1	98.1	2116.8	7.5	6.5	90.4	66	52	8914.5	8914.5	8290.5	7416.9	0	5.0	1.2
B-1102	58.5	117			98.1	98.1	2116.8	7.5	6.5	73.5	44	30	6732.5	6732.5	5827.7	4954.1	2	5.0	1.2
B-1102	68.5	120	ML		29.6	29.6	2116.8	7.5	6.5	73.5	44	30	7902.5	7902.5	6373.7	5500.1	1	4.7	1.2
B-1102	73.5	120			29.6	29.6	2116.8	7.5	6.5	73.5	44	30	8510	8510	6669.2	5795.6	0	4.7	1.2
B-1111	48.5	117			98.1	98.1	2116.8	7.5	6.5	70.5	44	30	5674.5	5674.5	5393.7	4520.1	4	5.0	1.2
B-1111	53.5	117			98.1	98.1	2116.8	7.5	6.5	70.5	44	30	6282	6282	5689.2	4815.6	0	5.0	1.2
B-1117	48.5	117			98.1	98.1	2116.8	7.5	6.5	68	44	30	5662.5	5662.5	5381.7	4508.1	4	5.0	1.2

Boring Number	Sample Depth	Blow Counts Corrected to Clean Sand Curve	Stress Reduction Coefficient	Cyclic Resistance Ratio	Mw 7.5 Scaling Factor Scenario 1	Mw 6.5 Scaling Factor Scenario 2	Cyclic Stress Ratio Scenario 1 (0.17G PGA)			Cyclic Stress Ratio Scenario 2 (0.25G PGA)			Factor of Safety Scenario 1 (0.17G PGA)			Factor of Safety Scenario 2 (0.25G PGA)		
	ft	(N1)60cs	r_d	$CRR_{7.5cs}$	MSF	MSF	in situ H_20	Perched H_20	PMF H_20	in situ H_20	Perched H_20	PMF H_20	in situ H_20	Perched H_20	PMF H_20	in situ H_20	Perched H_20	PMF H_20
B-1013	78	6	0.54	0.08	1	1.44	0.06	0.08	0.09	0.10	0.11	0.13	1.28	1.07	0.94	1.26	1.05	0.92
B-1067	76	5	0.56	0.07	1	1.44	0.06	0.07	0.07	0.09	0.10	0.11	1.17	1.09	0.98	1.15	1.07	0.96
B-1102	58.5	8	0.70	0.10	1	1.44	0.08	0.09	0.10	0.11	0.13	0.15	1.23	1.07	0.91	1.21	1.05	0.89
B-1102	68.5	6	0.62	0.08	1	1.44	0.07	0.08	0.10	0.10	0.12	0.14	1.21	0.97	0.84	1.18	0.95	0.82
B-1102	73.5	5	0.58	0.07	1	1.44	0.06	0.08	0.09	0.09	0.12	0.14	1.10	0.86	0.75	1.07	0.84	0.73
B-1111	48.5	9	0.78	0.11	1	1.44	0.09	0.09	0.11	0.13	0.13	0.16	1.25	1.19	0.99	1.22	1.16	0.98
B-1111	53.5	5	0.74	0.07	1	1.44	0.08	0.09	0.11	0.12	0.13	0.16	0.88	0.80	0.68	0.87	0.78	0.66
B-1117	48.5	9	0.78	0.11	1	1.44	0.09	0.09	0.11	0.13	0.13	0.16	1.25	1.19	0.99	1.22	1.16	0.98

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TABLE 2.5.4-218
ELASTIC SOIL PROPERTIES USED FOR RB/FB AND CB ELASTIC SETTLEMENT ANALYSIS

Layer No.	Depth (ft)	Formation Name	Dry Unit Weight, γ_{dry} (pcf)	Average Shear Wave Velocity, V_s (ft/sec)	Low –strain Shear Modulus, G_{max} (psf)	Modulus Degradation Factor, G/G_{max}	Adjusted Shear Modulus, G (psf)	Modulus of Elasticity, E (psf)
1	0-65	Loess	100	---	---	---	---	---
2	65-87	UCA	100	920	2.6E06	0.58	1.51E06	3.62E06
3	87-100	UCA	103	1186	4.32E06	0.58	2.50E06	6.0E06
4	100-110	UCOA/ Catahoula	104	1694	9.18E06	0.65	5.97E06	1.43E07
5	110-152.5	Catahoula	104	1876	1.15E07	0.65	7.48E06	1.80E07
6	152.5-165.5	Catahoula	104	1498	7.32E06	0.65	4.76E06	1.14E07
7	165.5-185.5	Catahoula	104	2577	2.17E07	0.65	1.41E07	3.38E07
8	185-5-192	Catahoula	104	1552	7.85E06	0.65	5.1E06	1.22E07
9	192-200	Catahoula	104	2740	2.45E07	0.65	1.59E07	3.82E07
10	200-216.5	Catahoula	104	2155	1.51E07	0.65	9.82E06	2.36E07
11	216.5-243	Catahoula	104	1699	9.41E06	0.65	6.12E06	1.47E07
12	243-266	Catahoula	104	2173	1.54E07	0.65	1.00E07	2.4E07
13	266-385	Catahoula	104	1686	9.27E06	0.65	6.03E06	1.45E07

G/G_{max} obtained from results of laboratory tests as described in Section 2.5.4.2 and adjusted for a strain level of 10^{-3}

GGNS COL 2.0-29-A

TABLE 2.5.4-219
ALLOWABLE AND PREDICTED MAT FOUNDATION SETTLEMENTS

Reactor Building/Fuel Building

Location of Allowable Settlement	DCD Allowable Settlement, in. (1)	Calculated Total Settlement, in. (2,3)	Post Construction Settlement (4)
At any corner of mat	4	1-1/2 to 2	3/4 to 1
Averaged at 4 corners of mat	2.6	<2	<1
Maximum Differential along Mat Long Dimension	3	<1/2	<1/4
Maximum Differential between RB/FB and CB	3.3	1 to 1-1/2	1/2 to 3/4

Control Building

Location of Allowable Settlement	DCD Allowable Settlement, in. (1)	Calculated Total Settlement, in. (2, 3)	Post Construction Settlement (4)
At any corner of mat	0.7	1/2 to 1	1/4 to 3/8
Averaged at 4 corners of mat	0.5	1/2 to 3/4	1/4 to 3/8
Maximum Differential along Mat Long Dimension	0.6	0.3	<1/4
Maximum Differential between RB/FB and CB	3.3	1 to 1-1/2	3/4

Fire Water Service Complex

Location of Allowable Settlement	DCD Allowable Settlement, in. (1)	Calculated Total Settlement, in. (5)	Post Construction Settlement, in. (6)
At any corner of mat	0.7	NA	<1/4
Averaged at 4 corners of mat	0.4	NA	<1/4
Maximum Differential along Mat Long Dimension	0.5	0.41	<1/4

NOTES:

1. With the exception of the differential settlement along the mat long dimension, these criteria are for post-construction settlement only as stated in Note 15 to DCD Table 2.0-1.
2. Creep settlements of 1/2 inch for RB/FB and 1/4 inch for CB over 60 years are included in the above numbers. No creep settlement is included for the FWSC.
3. Total settlements based on all loads applied instantaneously and are elastic in nature. The DCD criteria do not apply to these settlements, only to the Post Construction settlements.
4. Application of building dead loads during construction will cause settlement to occur during construction. For the RB/FB, the proportion of dead load to total load is estimated at 50%. For the CB, the proportion of the dead load to the total load is estimated by GE at 90%. For the FWSC, the entire applied load is placed in the period considered as construction by GE. The settlements in this column are a result of removing the estimated construction settlement.
5. The calculation is made for loads applied during construction after the basemat is in place, including water loads. Except for differential, the DCD Table 2.0-1 criteria do not apply for the cases listed as NA.
6. No long-term settlement due to consolidation is predicted. The values listed are estimates only.

GGNS COL 2.0-29-A

TABLE 2.5.4-220
SUMMARY OF LOESS K_0 ANALYSIS

Depth Range (ft)	Average layer V_s (ft/sec)	Depth to Layer Mid-Depth (ft)	γ_{total} (pcf)	σ'_p (ksf)	OCR	Φ' (º)	K_o
0 - 14	810	7	123	7.3	8.5	32	1.46
14 - 25.5	855	19.75	120	7.9	3.3	32	0.88
25.5 - 33.5	960	29.5	121	9.4	2.6	32	0.78
33.5 - 50	1025	41.75	121	10.4	2.0	32	0.69
50 - 53.5	890	51.75	117	8.4	1.34	32	0.55
53.5 - 68	990	60.75	118	9.9	1.35	31	0.57

V_s: Shear wave velocity
γ_{total}: Total soil unit weight
σ'_p: Pre-Consolidation stress (maximum past pressure)
OCR: Over-consolidation ratio
Φ': Drained angle of internal friction
K_0: At-rest earth pressure coefficient

FSAR 2.5.4 Figures

Due to the large file sizes of the figures for FSAR Section 2.5.4, they are collected in a single .pdf file and not included within the flow of this document. When cited in the text, the links will go to the page for the specific figure.

2.5.5 STABILITY OF SLOPES

GGNS COL 2.0-30-A

This section of the referenced ESP safety analysis report is incorporated by reference with the following variances and/or supplements. The information provided in the ESP application is supplemented in this section to integrate the results of the COL analyses.

Section 2.5.6 of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

GGNS COL 2.0-30-A

GGNS ESP COL 2.5-3

GGNS ESP COL 2.5-10

This section provides an evaluation of the stability of all earth slopes, both natural and manmade, failure of which could adversely affect the safety of Category I structures. Potential dam failures are discussed in Section 2.4.4. No safety-related retaining walls, bulkheads, or jetties are on the site. The plant is centrally sited on a broad, relatively level fill pad forming yard grade, and no natural or manmade slopes exist in proximity to the safety-related nuclear islands that could pose a potential slope stability hazard to the safe operation of the plant. Additionally, no natural descending slopes, such as riverbanks or ridge slopes, exist near the perimeter of the Unit 3 powerblock area that could pose a potential encroachment or undermining hazard. Therefore, a potential slope stability hazard does not exist under static or dynamic conditions that could adversely affect the Category I structures.

Temporary cuts, below existing ground surface, are required for construction of the nuclear island basemat foundations. These cuts are completely backfilled up to the level site grade with engineered fill, and do not pose a potential post-construction or operational slope stability hazard. Section 2.5.4.5 discusses the stability of these excavation cuts. This section therefore focuses on existing bluff slopes north and west of the Unit 3 powerblock area, the Tributary Slope and Mississippi River Bluff Slope, respectively. Background information utilized for slope evaluation includes:

- Interpreted surface and subsurface characteristics for input into slope stability analysis (Section 2.5.5.1).
- Design criteria and methods of analysis (Section 2.5.5.2).
- Borings, soil testing, and other investigations performed for the analysis (Section 2.5.5.3).
- Backfill materials and quality control procedures to be implemented during construction (Section 2.5.5.4).

2.5.5.1 SLOPE CHARACTERISTICS

2.5.5.1.1 General Discussion

Based on the grades in the plant area as shown on Figures 2.5.4-201 and 2.5.4-202, no permanent cut slopes, or man-made fill slopes, exist that could compromise the operation of the safety-related plant facilities. The Unit 3 power block area, as it exists, is nearly level at elevation 132.5 ft. An existing north-south trending cut slope located at the western margin of the Unit 3 nuclear island is limited in height to about 25 ft., and is inclined at grades less than about 14 percent. It forms the transition between the two level pads in the site area. No slope instability, erosional, or incipient slope failure features were observed on this transitional cut slope, which will be removed in the final grading for Unit 3 and be replaced with a retaining wall as indicated in Figure 2.4.1-201.

The relatively flat pads of the Unit 3 powerblock area are bounded on the north and west by erosional escarpments (bluffs) that descend to a tributary drainage on the north and the Mississippi River floodplain on the west (Figures 2.5.5-201, 2.5.5-202, and 2.5.5-203). Existing natural ground surface inclinations of these bluffs are relatively steep, but do not show evidence of past large scale instability or potentially unstable conditions as described in Section 2.5.4.1. The Tributary Slope as shown on Figure 2.5.5-201 is approximately 1140 ft. to the north of the nuclear island center trending east to west and has a gain of elevation of 52 ft. from north to south at a 27 percent grade. The Mississippi River Bluff Slope (Figure 2.5.5-201) is approximately 1000 ft. west of the nuclear island center, and trends north to south parallel to the flow of the Mississippi River. The Mississippi River Bluff slope is considerably steeper than the Tributary Slope, with a gain of elevation of 76 ft. at a 52 percent grade.

The minimum separation distance between the Unit 3 nuclear island and the top of slopes both north and west of the nuclear island is over 10 times the slope height, providing a very substantial safety buffer zone against possible slope failure under dynamic or static loading conditions.

Previously mapped slopes and possible slumps were reassessed during the COL application investigation and show that there are no active or ancient landslides on either slope (Figure 2.5.5-204). No discernible slope retreat is observable from reviews of historical aerial photographs from the past 70 years (Figure 2.5.5-205). The dominant form of mass wasting is shallow gullying and swale erosion originated in part by piping of loose near surface loess material by ground water movement through the slope (Figure 2.5.5-206). Potential failures of the bluff slopes do not impact lateral capacity of the soils to support Unit 3 structures. The relatively large distances of the slope to the Unit 3 powerblock facility preclude an impact on the lateral stability.

2.5.5.1.2 Exploration Program

Site investigations and subsurface geotechnical characterization used for the slope stability evaluation are presented in Sections 2.5.4.1, 2.5.4.2, and 2.5.4.3. This information was used to evaluate possible slope stability hazards.

The geologic exploration program for the Unit 3 COL application investigation, described in Section 2.5.4.1, included borings, CPTs, monitoring wells, and tests pits focused on the Unit 3 powerblock area, shown on Figure 2.5.4-201. A series of borings, test pits, and CPTs were designed to provide input for numerical stability calculations for existing slopes. These include:

- Seven borings to evaluate slope conditions: B-1025, B-1042, B-1045, B-1058, B-1059, B-1078, and B-1079. Additional borings were used to interpret subsurface conditions further back from the slope to facilitate cross-sectional analyses:

  - B-1022, B-1023, B-1057, and B-1140.

  - Two borings from SSAR Section 2.5.4.1.1: WLA B-1 and WLA B-2.

- Four test pits, TP-1001 thru TP-1004, performed to investigate the possibility of incipient failures, tension cracks, and mass wasting processes at the top of each slope (Figures 2.5.4-249 through 2.5.4-252).

- Two CPTs: CPT-1015 and CPT-1016 (Figure 2.5.4-203), conducted to further investigate subsurface constraints.

Boring logs are presented in Appendix 2AA.

2.5.5.1.3 Groundwater and Seepage

A detailed discussion of groundwater conditions is included in Section 2.5.4.6 and 2.4.12. Across the site, measured groundwater elevation ranged between 64 and 78 ft. Groundwater elevation was modeled at 75 ft. near the slope margins. A potential perched groundwater unit was modeled at elevations between 80 and 92 ft. based on localized measured perched water in the immediate vicinity of Unit 3 and higher pore water content in the lower loess, as shown in Figure 2.5.4-239. Perched groundwater was modeled for Sections 2.5.4 and 2.5.5 based on high pore water in CPT soundings and moisture descriptions recorded on boring logs from site characterization. Monitoring wells screened in the Loess identified localized areas of perched groundwater. The limited areas of measurable perched groundwater are illustrated in Figure 2.4.12-205. This modeled layer of high water content is “perched” above the groundwater table but is unconfined and discontinuous throughout the site. Figure 2.5.4-239 shows this modeled surface as continuous within the power block for the purposes of evaluating excavation and dewatering analyses and for providing conservative liquefaction and slope stability calculations. Perched water is further discussed in Section 2.4.12.

The modeled perched water was found to be approximately 89 ft. above mean sea level in elevation in proximity to slope transects. Mississippi River PMF conditions are reported at elevation 103 ft. in SSAR Section 2.4.3.6. Seepage was not observed on any of the slopes inspected during the Unit 3 COL application investigation (Figure 2.5.5-204).

2.5.5.1.4 Slope Materials and Properties

The modeled slope profiles, Sections A-A' (Figure 2.5.5-202) and B-B' (Figure 2.5.5-203), consist of seven geologic units described in more detail in Section 2.5.4.1:

- Upper loess (silt)
- Lower loess (clayey silt)
- UCA (poorly graded sand)
- UCOA (well-graded sand, gravel, and clay)
- Mississippi River alluvium (clay, silt, and poorly graded sand)
- Colluvium (silt)
- Undocumented Fill (clayey silt and organics)

The Tributary Slope face is comprised entirely of Upper loess, whereas the Mississippi River Bluff Slope face contains a thin veneer of colluvium in addition to Upper loess. The most critical units in modeling were the Upper and Lower loess. It is within these units that failure geometries were constrained. UCA and old alluvium served as a lower bound for the slope model. Additionally, colluvium and Mississippi River alluvium was found in the toe region of the slopes. Undocumented fill was not a critical unit in the failure analyses.

Soil properties for each unit are based on laboratory tests as discussed in Section 2.5.4.3. For stability analysis, laboratory test values for Atterberg limits, unit weight calculations, and triaxial shear tests were extracted and compiled. The Unit 3 investigation yielded five laboratory triaxial shear tests. Additional laboratory data from SSAR Section 2.5.4.1.6 was also utilized. Laboratory results were reasonably consistent between the two studies. Final soil properties for slope stability analysis input are shown in Table 2.5.5-201.

2.5.5.2 DESIGN CRITERIA AND ANALYSES

After developing the soil properties' input data and creating slope profiles in the slope stability modeling program GALENA® (Reference 2.5.5-201), a series of potential failure planes was outlined for each of the two slopes shown in Figures 2.5.5-202 and 2.5.5-203. Failure planes were grouped by distance from top of slope. Each location contains a pair of failure plane ranges modeling a shallow failure (plane A) and a deep failure (plane B), with the exception of planes 1 and 3 in Section A-A'. Deep failure planes were designed to explore the Lower loess' capacity to function as a weak layer in potential slope failure.

A series of five iterative runs were outlined and analyzed for each failure plane:

- Static condition with a measured water table level of 75 ft. elevation.
- Static condition with PMF water level of 103 ft. elevation.
- Static condition with modeled perched water level of 89 ft. elevation.
- Pseudo-dynamic condition with modeled perched and drawdown water level of 89 ft. elevation and a PGA of 0.17 g.
- Pseudo-dynamic condition with modeled perched and drawdown water level of 89 ft. elevation and a PGA of 0.25 g.

PGA values are based on values reported in SSAR Section 2.5.2 and site response analyses. The PGA values used are considered conservative, as site PGA values are approximately 0.11 g as listed in Section 2.5.2.5

Failure planes were allowed to vary through an established range to ensure that the potential failure planes with the lowest FOS were selected. The program's analyses evaluated 1501 potential failure planes for each iterative run of each potential failure plane outlined, yielding a critical FOS and its associated critical failure plane. The results from the analyses are shown in Tables 2.5.5-202 and 2.5.5-203.

2.5.5.2.1 Section A-A' Tributary Slope Stability Results

The Tributary Slope analyses yielded a static critical FOS value of 1.88, approximately 9 ft. from the top of slope under all modeled water level conditions. In pseudo-static scenarios modeled with a PGA of 0.17 g, a critical FOS of 1.21 was determined to be approximately 9 ft. from the top of slope. For a PGA of 0.25 g, a critical FOS of 1.02 was determined to be approximately 9 ft. from the top of slope. This is shown in Figure 2.5.5-207.

These results suggest that the Tributary Slope has a very high safety margin under drained and saturated conditions and under seismic loading. Failures preferred shallow orientations, and a large sliding failure is unlikely. Based on Figure 2.5.5-207, the entire slope has a static FOS greater than 1.8 and a dynamic FOS greater than 1.2 for dynamic loading conditions with a PGA of 0.17 g. Due to the distance of the slope relative to Unit 3, failure of the tributary slope as described above will not impact Unit 3 structures.

2.5.5.2.2 Section B-B' Mississippi River Bluff Slope Stability Results

The Mississippi River Bluff Slope analyses yielded a static critical FOS of 1.5 under modeled perched water level conditions, approximately 30 ft. from top of the slope for shallow failures and 22 ft. from the top of slope under deep failures. The perched water level models yield slightly lower FOS than under measured water table levels and slightly higher FOS than under PMF conditions. Under static and PMF conditions, an FOS of 1.5 was observed approximately 43 ft. from the top of slope for both shallow and deep failures. In pseudo-static (dynamic) scenarios modeled with a PGA of 0.17 g, a critical FOS of 1.1 was determined to be approximately 53 ft. from the top of slope for shallow failures and 60 ft. from the top of slope for deep failures. For a dynamic condition with PGA of 0.25 g, an FOS of 1.1 was determined to be approximately 105 ft. from the top of slope for shallow failures and 109 ft. from the top of slope for deep failures. Shallow and deep results are shown in Table 2.5.5-203 and Figures 2.5.5-208 and 2.5.5-209.

These results suggest that the Mississippi River Bluff Slope has a relative moderate to high safety margin under static drained and saturated conditions; however, a relatively low to moderate safety margin under seismic loading. The slight variability in FOS due to water levels indicates that the slope stability is somewhat sensitive to hydrologic conditions. Further, in deep failure models it was determined that the Lower loess acts as a weak layer and increases potential for failure, with a very slight potential that failures could result along the Upper and Lower loess contact. Due to the distance of the Mississippi River Bluff slope relative to Unit 3, failure of the slope as described above will not impact Unit 3 structures.

GGNS ESP COL 2.5-11

Potential flooding of the Mississippi River may contribute to shallow failures and shallow erosion of the Mississippi River Bluff Slope. No discernible slope retreat is observable from reviews of historical aerial photographs from the past 70 years (Figure 2.5.5-205) over which time several large-scale flood events have occurred. Any erosion or shallow failures caused as a result of potential flooding of the Mississippi River should not result in a measurable reduction of soil lateral capacity for plant structures located in the Unit 3 powerblock facility.

Liquefaction is addressed in Section 2.5.4.8. Results indicate there is a very low probability of liquefaction occurrence in the studied site area.

2.5.5.3 LOGS OF BORINGS

GGNS COL 2.0-30-A

GGNS ESP COL 2.5-3

Boring logs are provided in Appendix 2AA. Boring data was used in part to construct cross sections across the Unit 3 ESP site. Slope profiles were recreated in GALENA® (Reference 2.5.5-201) from cross sections compiled in Section 2.5.4.1. Borings B-1022, B-1023, B-1025, B-1079, B-1078, and B-1140 were projected into respective Sections A-A' and B-B'. Additional boring data from Reference 2.5.5-202 and SSAR Section 2.5.4.1.1 were used to evaluate and constrain subsurface geologic conditions. Further details on boring logs and their applications are discussed in Section 2.5.4.

2.5.5.4 COMPACTED FILL

GGNS ESP COL 2.5-2

As discussed in Section 2.5.4.5 and 2.5.4.10, backfill will be placed beneath the FWSC following removal of the upper 50 ft. of loess material. There are no safety-related fill embankments or fill slopes necessary. Compaction requirements for compacted fill or backfill placement are discussed in Section 2.5.4.5 in addition to quality control techniques and documentation during construction.

2.5.5.5 REFERENCES

2.5.5-201 Clover Technology Inc., GALENA® Users' Guide, Version 5.00.01.02, 2006

2.5.5-202 GGNS Unit 1 Updated Final Safety Analysis Report (UFSAR), June 2007.

GGNS COL
2.0-30-A

TABLE 2.5.5-201
SOIL PROPERTIES INPUT VALUES

Geologic Unit	Plasticity Index (%)	Wet Unit Weight (pcf)	Effective Stress	
			C' (psf)	Φ' (angle)
Upper loess	11	115.1	0	34.3
Lower loess	13.9	127.9	0	26
Upland Complex alluvium	8.1	120.3	0	37.5
Upland Complex old alluvium	18.6	124.2	0	40.5
Undocumented fill material	14	128	0	26
Colluvium	14	128	0	26
Mississippi River alluvium	11.7	127.3	0	32

TABLE 2.5.5-202 (Sheet 1 of 2)
TABULATED RESULTS FROM TRIBUTARY SLOPE STABILITY ANALYSIS SECTION A-A'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance(1)
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched(2) Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA		
1A	1	Shallow Failure	Effective	X			X			1.88	9
	2	Shallow Failure	Effective		X		X			1.88	9
	3a	Shallow Failure	Effective			X	X			1.88	9
	3b	Shallow Failure	Effective			X		X		1.21	9
	3c	Shallow Failure	Effective			X			X	1.02	9
2A	1	Shallow Failure	Effective	X			X			2.58	45
	2	Shallow Failure	Effective		X		X			2.58	45
	3a	Shallow Failure	Effective			X	X			2.58	45
	3b	Shallow Failure	Effective			X		X		1.51	45
	3c	Shallow Failure	Effective			X			X	1.25	45

TABLE 2.5.5-202 (Sheet 2 of 2)
TABULATED RESULTS FROM TRIBUTARY SLOPE STABILITY ANALYSIS SECTION A-A'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance(1)
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched(2) Groundwater Level 89 ft. el.	Static	Pseudo-Static			
							0.0 PGA	0.17 PGA	0.25 PGA		
2B	1	Deep Failure	Effective	X			X			3.13	44
	2	Deep Failure	Effective		X		X			2.31	44
	3a	Deep Failure	Effective			X	X			2.77	44
	3b	Deep Failure	Effective			X		X		1.41	44
	3c	Deep Failure	Effective			X			X	1.14	44
3A	1	Shallow Failure	Effective	X			X			3.54	84
	2	Shallow Failure	Effective		X		X			3.54	84
	3a	Shallow Failure	Effective			X	X			3.54	84
	3b	Shallow Failure	Effective			X		X		1.79	84
	3c	Shallow Failure	Effective			X			X	1.44	84

(1) Distance between top of slope and failure circle headscarp daylight; estimated margin of accuracy +/- 3 ft.

(2) Perched Groundwater refers to modeled layer described in text.

TABLE 2.5.5-203 (Sheet 1 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA		
1A	1	Shallow Failure	Effective	X			X			1.20	10
	2	Shallow Failure	Effective		X		X			1.17	10
	3a	Shallow Failure	Effective			X	X			1.19	10
	3b	Shallow Failure	Effective			X		X		0.82	10
	3c	Shallow Failure	Effective			X			X	0.71	10
1B	1	Deep Failure	Effective	X			X			1.35	10
	2	Deep Failure	Effective		X		X			1.20	10
	3a	Deep Failure	Effective			X	X			1.28	10
	3b	Deep Failure	Effective			X		X		0.88	10
	3c	Deep Failure	Effective			X			X	0.75	10

TABLE 2.5.5-203 (Sheet 2 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA		
2A	1	Shallow Failure	Effective	X			X			1.72	49
	2	Shallow Failure	Effective		X		X			1.55	49
	3a	Shallow Failure	Effective			X	X			1.65	49
	3b	Shallow Failure	Effective			X		X		1.07	49
	3c	Shallow Failure	Effective			X			X	0.90	49
2B	1	Deep Failure	Effective	X			X			1.80	50
	2	Deep Failure	Effective		X		X			1.56	50
	3a	Deep Failure	Effective			X	X			1.67	50
	3b	Deep Failure	Effective			X		X		1.05	50
	3c	Deep Failure	Effective			X			X	0.88	50

TABLE 2.5.5-203 (Sheet 3 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis: Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Earthquake Force: Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA	Critical Factor of Safety	Distance[1]
3A	1	Shallow Failure	Effective	X			X			2.19	83
	2	Shallow Failure	Effective		X		X			1.94	83
	3a	Shallow Failure	Effective			X	X			2.06	83
	3b	Shallow Failure	Effective			X		X		1.23	83
	3c	Shallow Failure	Effective			X			X	1.02	83
3B	1	Deep Failure	Effective	X			X			2.22	87
	2	Deep Failure	Effective		X		X			1.95	87
	3a	Deep Failure	Effective			X	X			2.08	87
	3b	Deep Failure	Effective			X		X		1.20	87
	3c	Deep Failure	Effective			X			X	0.99	87

TABLE 2.5.5-203 (Sheet 4 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA		
4A	1	Shallow Failure	Effective	X			X			2.77	135
	2	Shallow Failure	Effective		X		X			2.51	135
	3a	Shallow Failure	Effective			X	X			2.66	135
	3b	Shallow Failure	Effective			X		X		1.49	135
	3c	Shallow Failure	Effective			X			X	1.14	135
4B	1	Deep Failure	Effective	X			X			3.21	137
	2	Deep Failure	Effective		X		X			2.82	137
	3a	Deep Failure	Effective			X	X			3.01	137
	3b	Deep Failure	Effective			X		X		1.58	137
	3c	Deep Failure	Effective			X			X	1.19	137

TABLE 2.5.5-203 (Sheet 5 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	Pseudo-Static 0.25 PGA		
5A	1	Shallow Failure	Effective	X			X			3.63	183
	2	Shallow Failure	Effective		X		X			3.25	183
	3a	Shallow Failure	Effective			X	X			3.45	183
	3b	Shallow Failure	Effective			X		X		1.59	183
	3c	Shallow Failure	Effective			X			X	1.25	183
5B	1	Deep Failure	Effective	X			X			4.08	187
	2	Deep Failure	Effective		X		X			3.63	187
	3a	Deep Failure	Effective			X	X			3.87	187
	3b	Deep Failure	Effective			X		X		1.68	187
	3c	Deep Failure	Effective			X			X	1.31	187

TABLE 2.5.5-203 (Sheet 6 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static 0.0 PGA	Pseudo-Static 0.17 PGA	0.25 PGA		
6A	1	Shallow Failure	Effective	X			X			4.06	222
	2	Shallow Failure	Effective		X		X			3.62	222
	3a	Shallow Failure	Effective			X	X			3.83	222
	3b	Shallow Failure	Effective			X		X		1.66	222
	3c	Shallow Failure	Effective			X			X	1.29	222
6B	1	Deep Failure	Effective	X			X			4.84	223
	2	Deep Failure	Effective		X		X			4.29	223
	3a	Deep Failure	Effective			X	X			4.58	223
	3b	Deep Failure	Effective			X		X		1.79	223
	3c	Deep Failure	Effective			X			X	1.38	223

TABLE 2.5.5-203 (Sheet 7 of 7)
TABULATED RESULTS FROM MISSISSIPPI RIVER BLUFF SLOPE STABILITY ANALYSIS SECTION B-B'

GGNS COL 2.0-30-A

Scenario	Run	Geometry	Strength	Factor of Safety - Static Analysis			Earthquake Force			Critical Factor of Safety	Distance[1]
				Measured Groundwater Table 75 ft. el.	PMF Groundwater Level 103 ft. el.	Perched[2] Groundwater Level 89 ft. el.	Static	Pseudo-Static			
							0.0 PGA	0.17 PGA	0.25 PGA		
7A	1	Shallow Failure	Effective	X			X			5.28	323
	2	Shallow Failure	Effective		X		X			4.75	323
	3a	Shallow Failure	Effective			X	X			5.03	323
	3b	Shallow Failure	Effective			X		X		1.84	323
	3c	Shallow Failure	Effective			X			X	1.40	323
7B	1	Deep Failure	Effective	X			X			6.02	323
	2	Deep Failure	Effective		X		X			5.35	323
	3a	Deep Failure	Effective			X	X			5.72	323
	3b	Deep Failure	Effective			X		X		1.93	323
	3c	Deep Failure	Effective			X			X	1.46	323

(1) Distance between top of slope and failure circle headscarp daylight; estimated margin of accuracy +/- 3 ft.

(2) Perched Groundwater refers to modeled layer described in text.

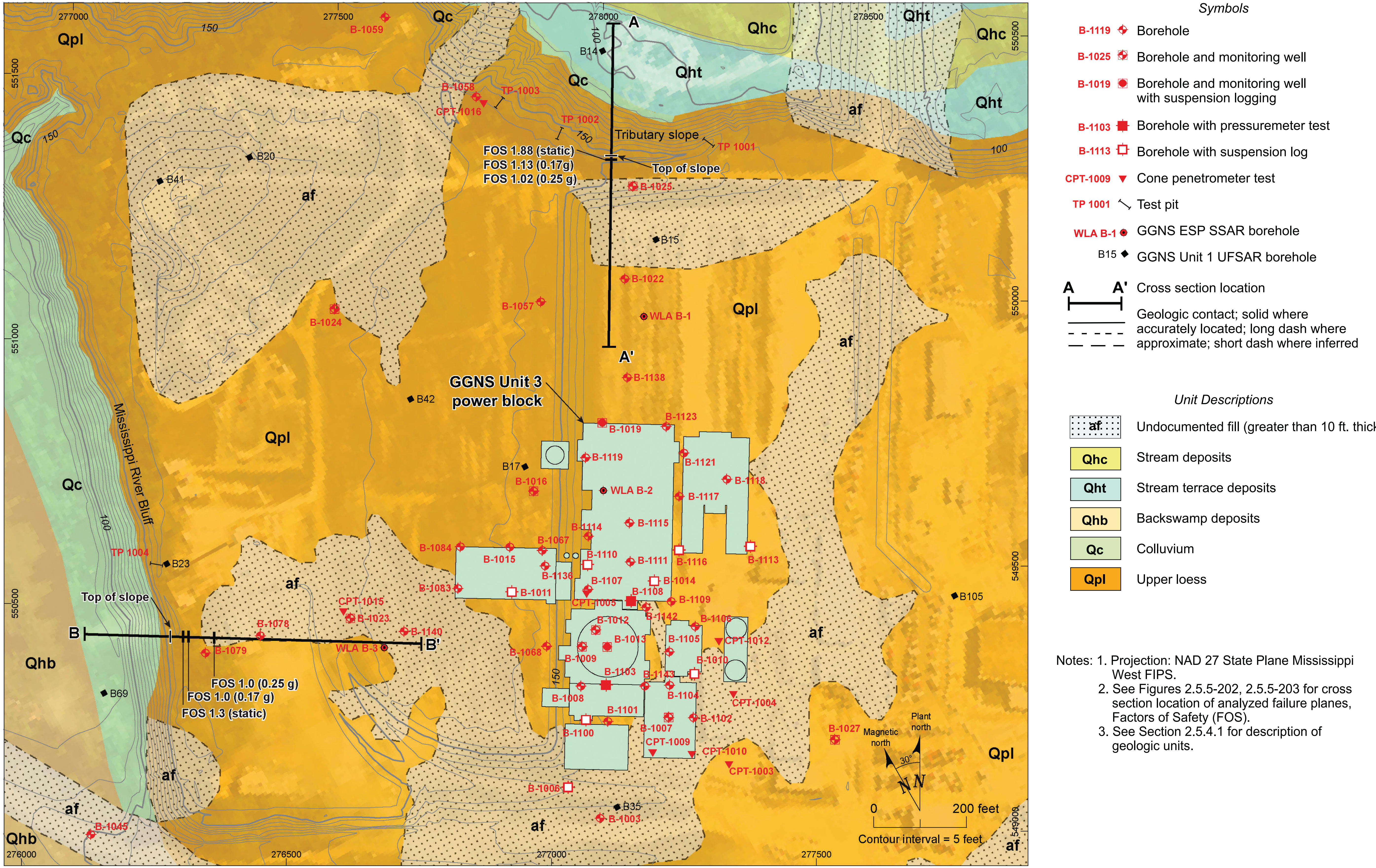
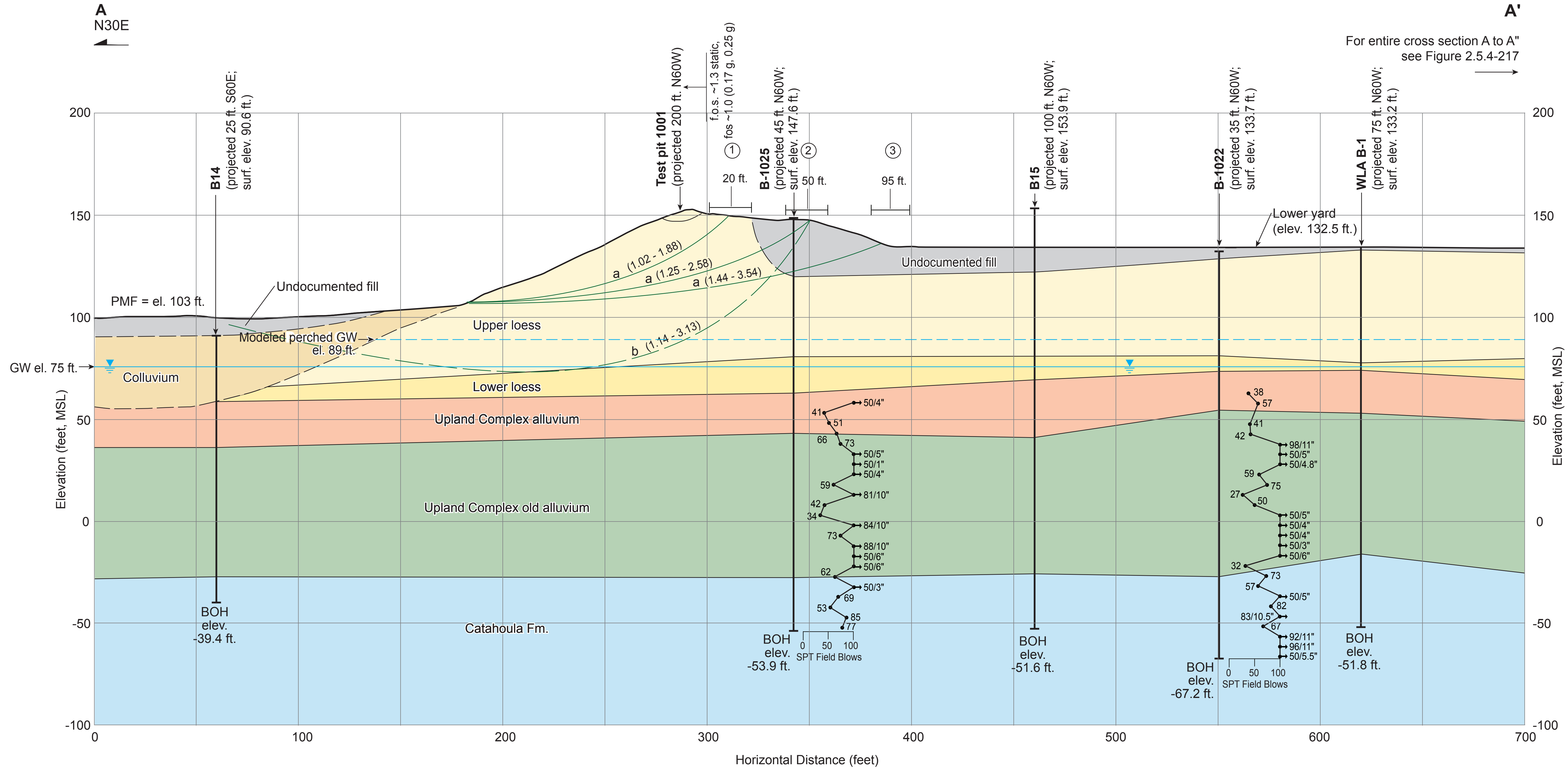


Figure 2.5.5-201. Slope Stability Transect Location Map



Legend

1 Failure range

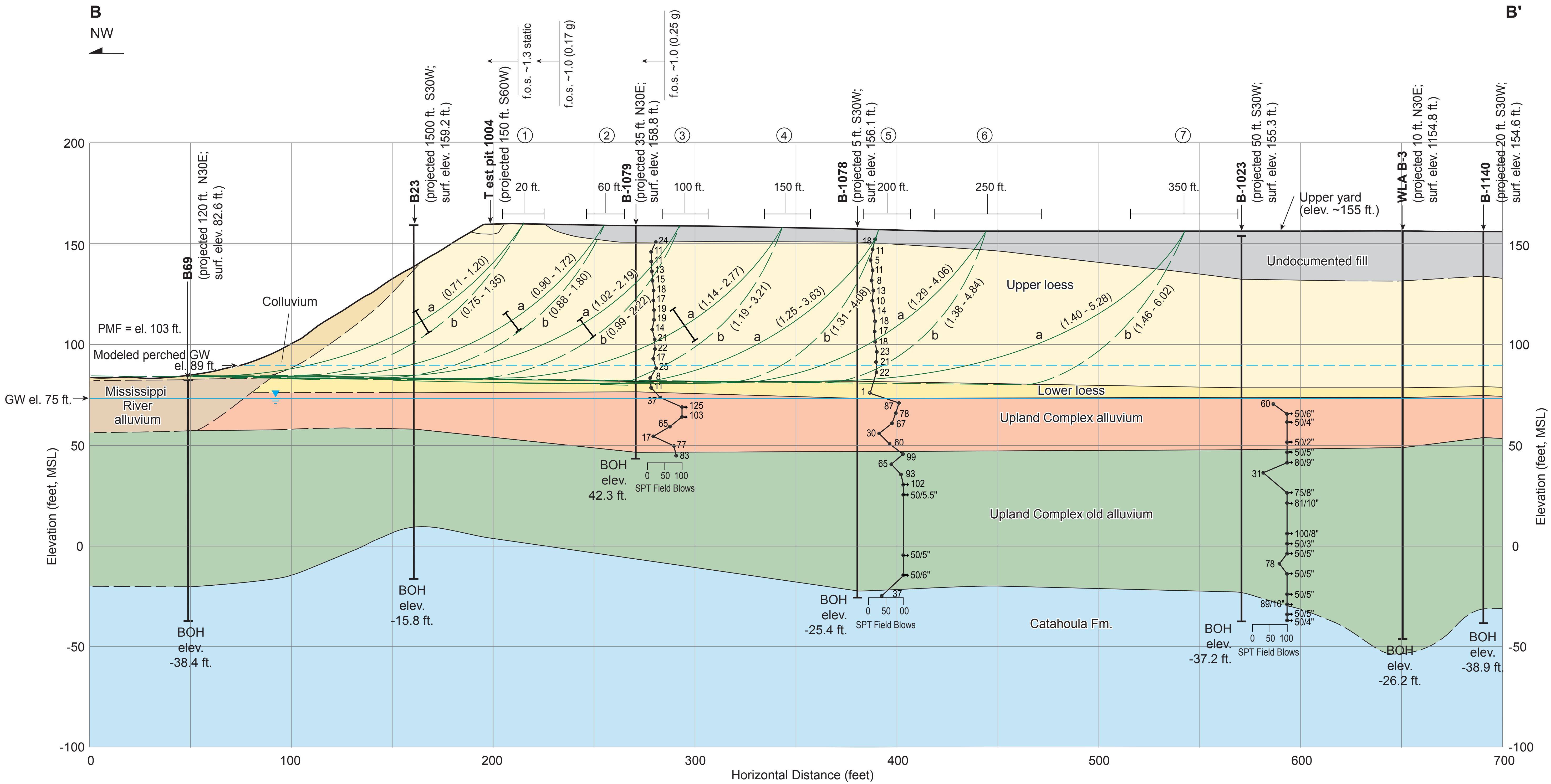
f.o.s. ~1.3 static — Location of critical factors of safety for two different dynamic conditions

(0.71 - 1.20) Factor of safety range for all modeled conditions in given failure range

Input Parameters

3 Groundwater Conditions	3 Dynamic Conditions	2 Depth Scenarios per Point
• Probable maximum flood (PMF) at 103 feet amsl • Modeled perched water at 89 feet amsl • Measured groundwater high at 74 feet amsl	• Static • 0.17 g • 0.25 g	• a – shallow • b – deep

Figure 2.5.5-202. Tributary Slope Profile A – A' Failure Planes



Legend

① Failure range

f.o.s. ~1.3 static — Location of critical factors of safety for two different dynamic conditions

(0.71 - 1.20) Factor of safety range for all modeled conditions in given failure range

Input Parameters

3 Groundwater Conditions	3 Dynamic Conditions	2 Depth Scenarios per Point
• Probable maximum flood (PMF) at 103 feet amsl • Modeled perched at 89 feet amsl • Measured groundwater high at 74 feet amsl	• Static • 0.17 g • 0.25 g	• a – shallow • b – deep

Figure 2.5.5-203. Mississippi River Bluff Slope B –B' Failure Planes

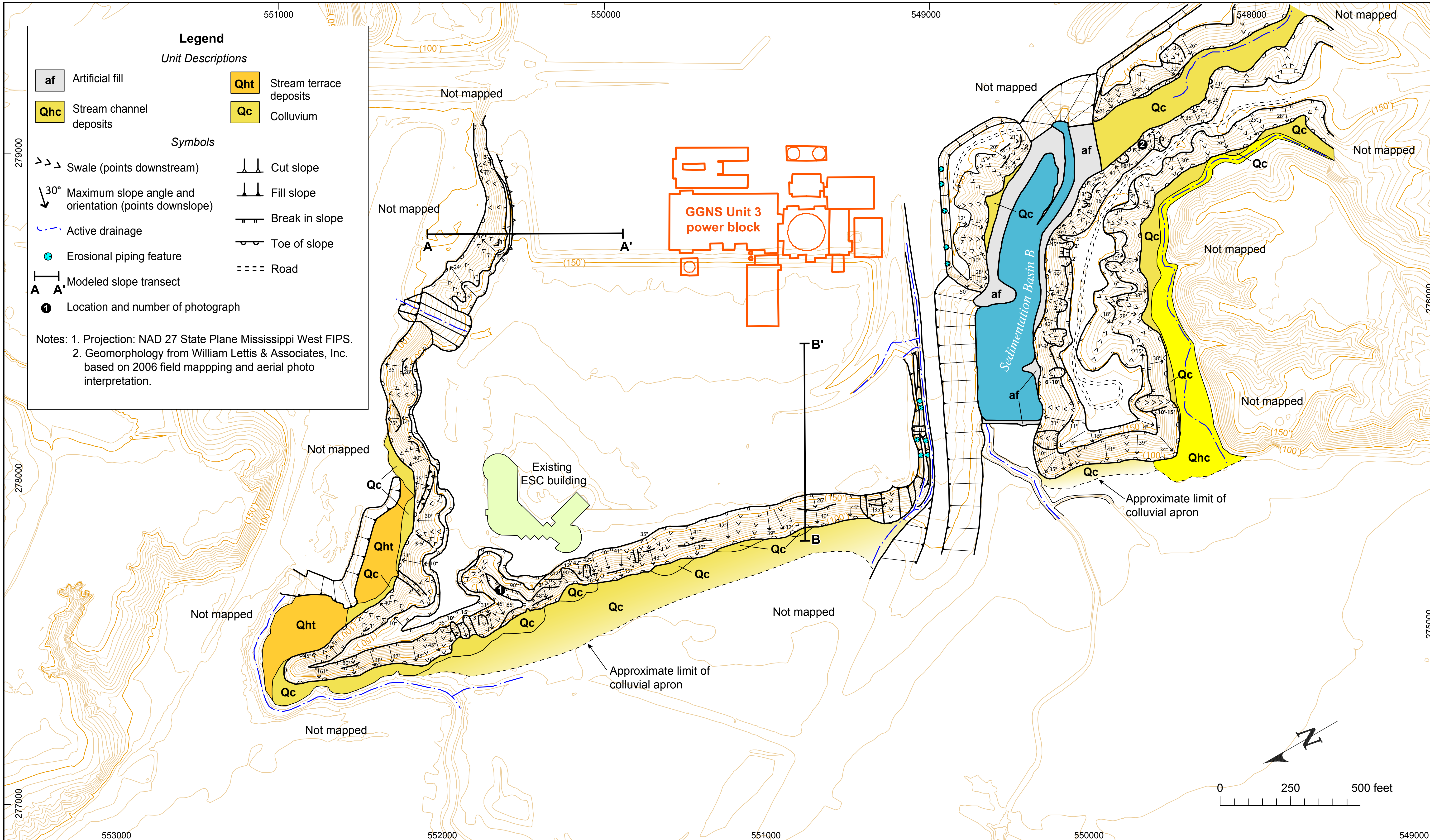
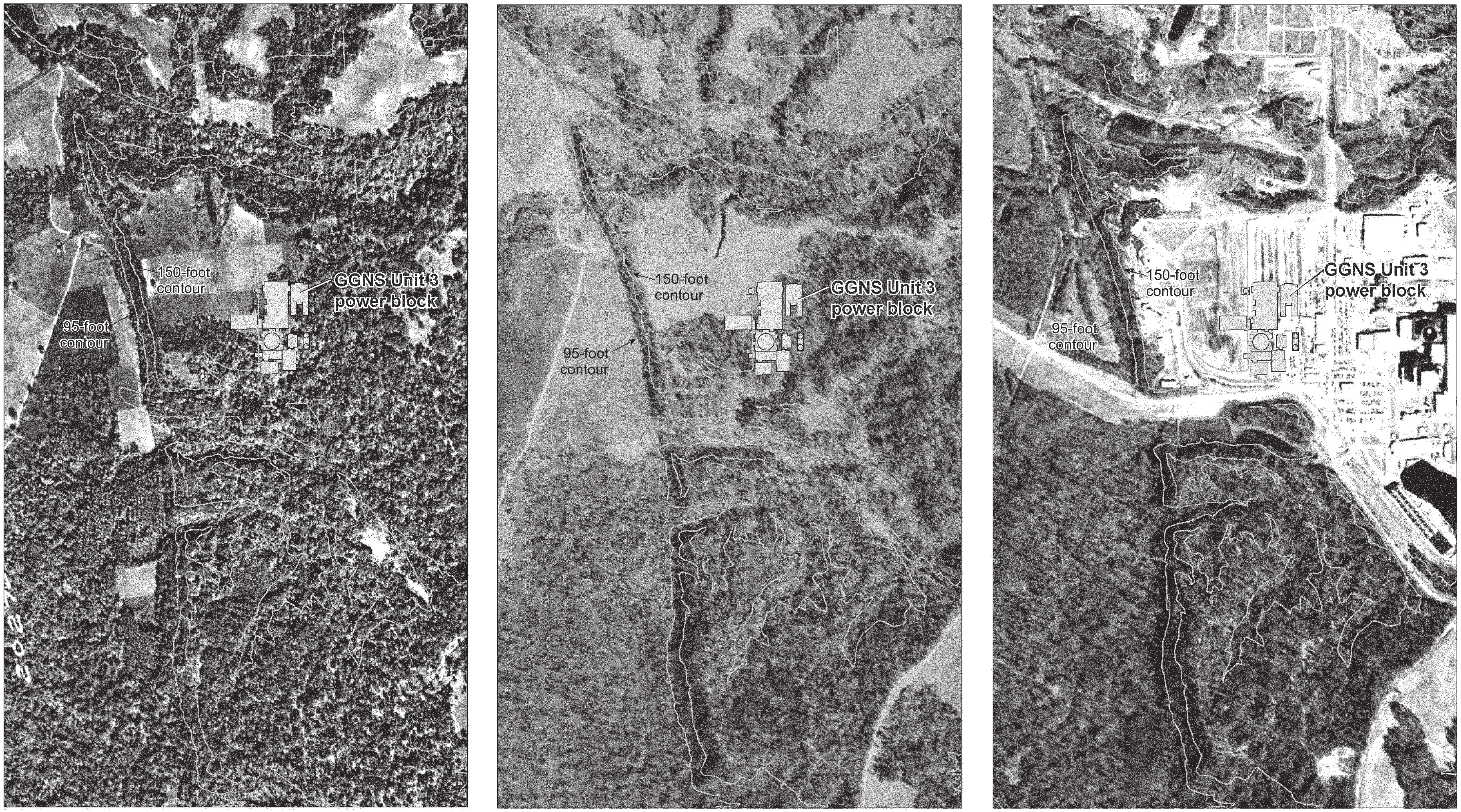


Figure 2.5.5-204. GGNS Hillslope Geomorphology Map

1937 1962 2004



Acquired from P2 Energy Solutions
Flightlines 2028, 2027 Claiborne County, MS
Georeferenced to Mississippi State Plane West NAD 27
Scanned contact prints 1200 DPI
0.5-meter resolution at 1:18000 scale
10/29/1937

USGS Vertical Cartographic Data
Project VAJY00 - ARDC1VAJY00140621
1-meter resolution at 1:22400 scale
Georeferenced to Mississippi State Plane West NAD 27
Scanned contact prints
01/31/1962

USDA National Aerial Imagery Program
Color infrared image
1-meter resolution at 1:12000 scale
Mississippi State Plane West NAD 27
Scanned contact prints
02/28/2004

Magne ic north
Plant north
30°
N N
0 1000 feet

GGNS ESP COL 2.5-10
GGNS ESP COL 2.5-11

Figure 2.5.5-205. Historic Bluff Retreat

Revision 0

Photograph 1 showing shallow headward erosion of swale in Mississippi River Bluff. See Figure 2.5.5-204 for location for photograph location.

Photograph 2 showing shallow slump feature along creek bed in southern woods. See Figure 2.5.5-204 for location for photograph location.

Figure 2.5.5-206. Slope Photographs

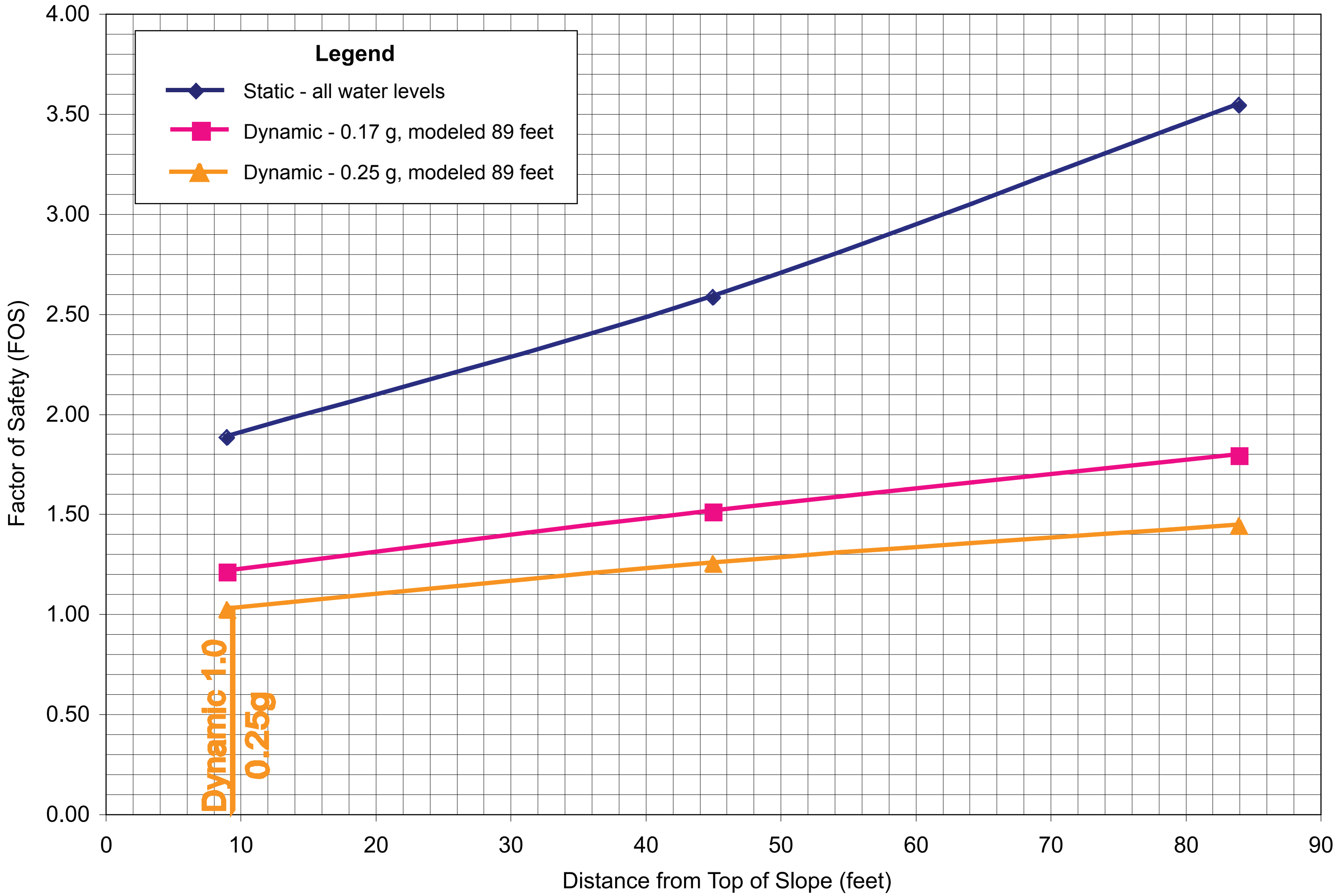


Figure 2.5.5-207. FOS vs. Distance from Top of Slope – Shallow Failure in Upper Loess, Section A - A'

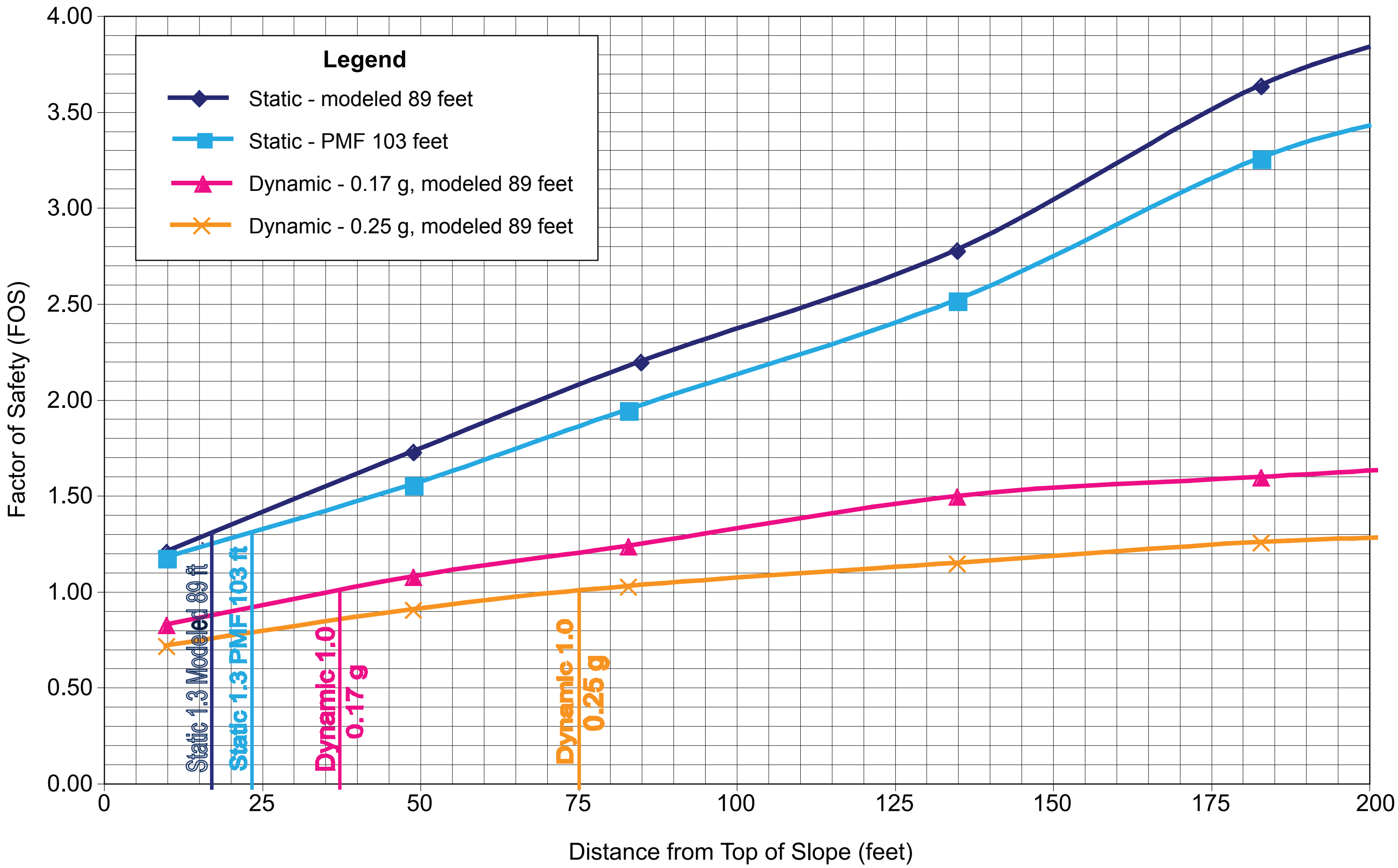


Figure 2.5.5-208. FOS vs. Distance from Top of Slope – Shallow Failure in Upper Loess, Section B - B'

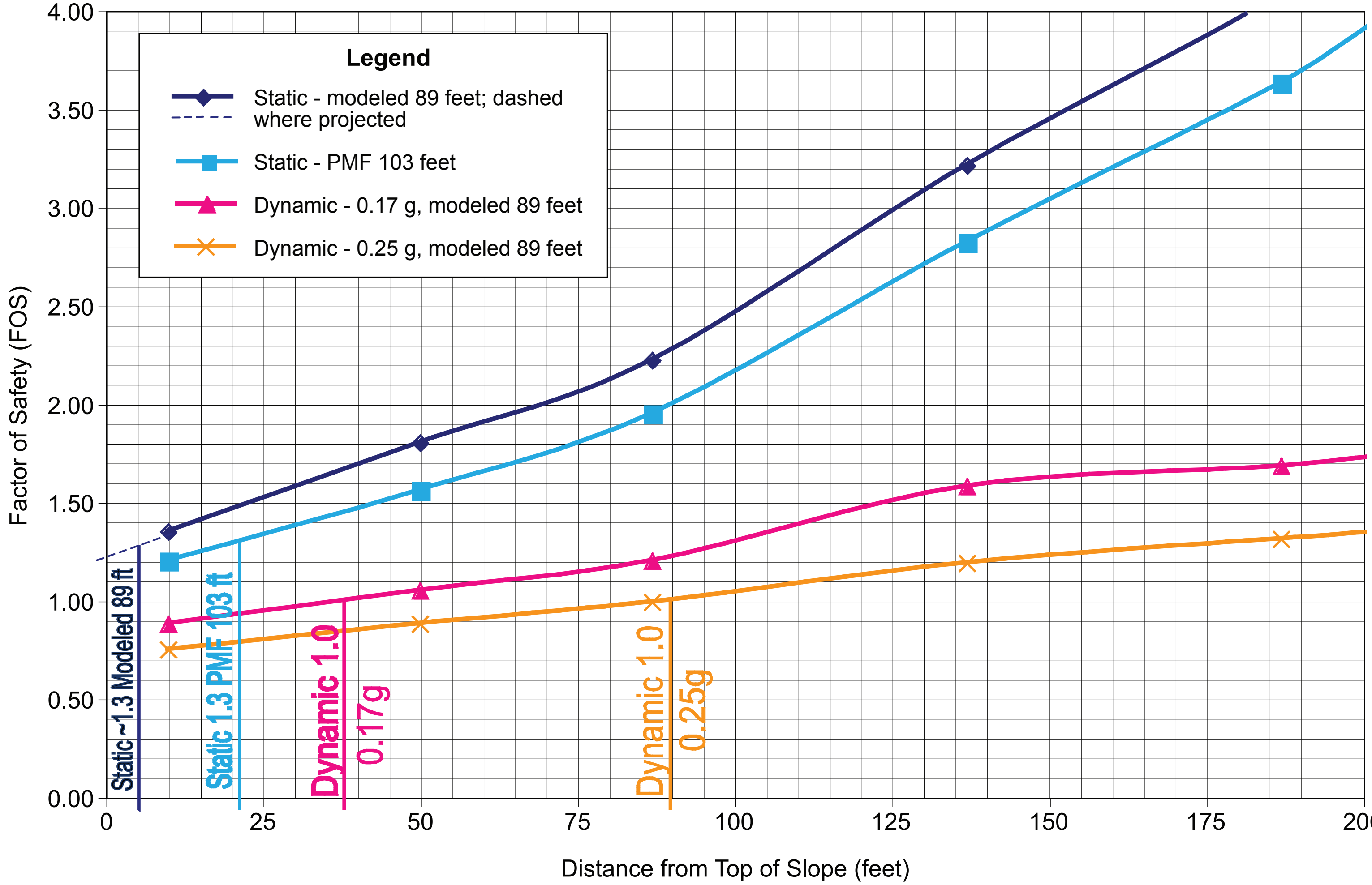


Figure 2.5.5-209. FOS vs. Distance from Top of Slope – Deep Failure in Lower Loess, Section B - B'

APPENDIX 2AA LOGS OF BORINGS

GGNS COL 2.0-30-A

GGNS ESP COL 2.5-3

This appendix contains the entire set of geotechnical boring logs and the appropriate Key to Logs for the Unit 3 site investigation conducted between April 10 and August 31, 2007.

CHAPTER 3 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.1 CONFORMANCE WITH NRC GENERAL DESIGN CRITERIA

This section of the referenced DCD is incorporated by reference with no departures or supplements.

3.2 CLASSIFICATION OF STRUCTURES, SYSTEMS AND COMPONENTS

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

Table 3.2-1 Classification Summary

Replace the note for System P73 with the following.

STD CDI The site-specific plant design includes the Hydrogen Water Chemistry System (HWCS). See Section 9.3.9 for further details.

Replace the note for System P74 with the following.

STD CDI The site-specific plant design does not include the Zinc Injection System.

3.3 WIND AND TORNADO LOADINGS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

3.4 WATER LEVEL (FLOOD) DESIGN

This section of the referenced DCD is incorporated by reference with no departures or supplements.

3.5 MISSILE PROTECTION

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

3.5.1.5 SITE PROXIMITY MISSILES (EXCEPT AIRCRAFT)

Add the following sentence after the first sentence in the first paragraph.

STD SUP 3.5-1 Site-specific missile sources are addressed in Section 2.2.

3.5.1.6 AIRCRAFT HAZARDS

Add the following at the end of the first paragraph.

STD SUP 3.5-2 Site-specific aircraft hazard analysis and the site-specific critical areas are addressed in Section 2.2.

3.6 PROTECTION AGAINST DYNAMIC EFFECTS ASSOCIATED WITH THE POSTULATED RUPTURE OF PIPING

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

3.6.2.5 PIPE BREAK ANALYSIS RESULTS AND PROTECTION METHODS

Replace the first sentence in this section with the following.

STD COL 3.6.5-1-A

The pipe break evaluation report will be completed in conjunction with closure of ITAAC 3.1-1, Item 3. This information will be included in the FSAR as part of a subsequent FSAR update. The pipe break evaluation report includes the following:

3.6.5 COL INFORMATION

3.6.5-1-A Pipe Break Analysis Results and Protection Methods

STD COL 3.6.5-1-A

This COL item is addressed in Section 3.6.2.5.

3.7 SEISMIC DESIGN

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

3.7.1.1 DESIGN GROUND MOTION

GGNS SUP 3.7-1

3.7.1.1.4 Site-Specific Design Ground Motion Response Spectra

GGNS DEP 2.0-1

The site-specific design Ground Motion Response Spectra (GMRS) and associated Foundation Input Response Spectra (FIRS) for Seismic Category I structures are described in Section 2.5.2. The site-specific GMRS/FIRS are compared with Certified Seismic Design Response Spectra (CSDRS) in Table 2.0-201. The GMRS/FIRS are enveloped by the CSDRS except for exceedance below 0.2 Hz for the horizontal motion and below about 0.15 Hz for the vertical motion. This exceedance does not have an adverse impact on the seismic design of the ESBWR Standard Plant because:

a. There are no structural frequencies below 0.2 Hz. in the frequency range of importance to structural response (frequencies greater than 0.2 Hz); the CSDRS are higher.

b. Although pools in Reactor Building/Fuel Building (RBFB) have sloshing frequencies less than 0.2 Hz, sloshing response is only a small portion of overall seismic-induced hydrodynamic loads on the pool structure and does not govern. The majority of hydrodynamic loads are due to the impulsive response of the water. Impulsive response is a function of the pool structure response at structural frequencies. The FIRS are enveloped by the CSDRS in the frequency range of importance to structural response (frequencies greater than 0.2 Hz). The impulsive response inherent in the CSDRS-based design is typically an order of magnitude higher than the sloshing response at lower accelerations of the FIRS.

c. The CSDRS for the Fire Water Service Complex (FWSC) is 1.35 times the RBFB/Control Building (CB) CSDRS. The FWSC sloshing frequency is 0.24 Hz and is enveloped by the CSDRS

d. The higher FIRS below 0.2 Hz is irrelevant to the CB because the CB does not contain water pools

e. The vertical exceedance at frequencies below 0.15 Hz is inconsequential because vertical earthquake components do not induce sloshing.

Therefore, the adequacy of CSDRS is confirmed for Unit 3 application.

GGNS SUP 3.7-2 3.7.1.1.5 Site-Specific Design Ground Motion Time History

The site-specific earthquake ground motion time history is not developed to match the GMRS/FIRS because the CSDRS are confirmed adequate (Section 3.7.1.1.4). Also Approach 3 of NUREG/CR-6728 was used to develop FIRS at the various foundation levels and did not require the use of acceleration time history.

3.7.1.3 SUPPORTING MEDIA FOR SEISMIC CATEGORY I STRUCTURES

Add the following at the end of the first paragraph.

GGNS SUP 3.7-3 Section 2.5.4 provides site-specific properties of subsurface materials.

3.7.2.4 SOIL/STRUCTURE INTERACTION

Add the following at the end of the first paragraph.

GGNS SUP 3.7-4 Section 2.5.4 describes the site-specific properties of subsurface materials.

3.7.2.8 INTERACTION OF NON-CATEGORY I STRUCTURES WITH SEISMIC CATEGORY I STRUCTURES

Add the following second paragraph.

GGNS SUP 3.7-5 The locations of plant structures are provided in Figure 1.1-201.

3.7.4 SEISMIC INSTRUMENTATION

Add the following at the end of the first paragraph.

GGNS SUP 3.7-6 The seismic monitoring program described in this section, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site.

3.8 SEISMIC CATEGORY I STRUCTURES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

3.9 MECHANICAL SYSTEMS AND COMPONENTS

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

3.9.2.4 INITIAL STARTUP FLOW-INDUCED VIBRATION TESTING OF REACTOR INTERNALS

Replace the last two paragraphs in this section with the following.

GGNS COL 3.9.9-1-H A vibration assessment program as specified in RG 1.20 will be completed no later than six months after the lead plant has completed its vibration assessment program.

3.9.3.1 LOADING COMBINATIONS, DESIGN TRANSIENTS AND STRESS LIMITS

Replace the last sentence with the following.

STD COL 3.9.9-2-H The piping stress reports identified in this DCD section will be completed within six months of completion of ITAAC Table 3.1-1. The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.

3.9.3.7.1(3)e Snubber Pre-service and In-service Examination Testing

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Replace the last two sentences at the end of this section with the following.

STD COL 3.9.9-4-A The inservice testing program for snubbers will be completed in accordance with milestones described in Section 13.4.

3.9.3.7.1(3)f Snubber Audit Support Data

Replace the first sentence of this section with the following.

STD COL 3.9.9-4-A A plant specific table will be prepared in conjunction with closure of ITAAC Table 3.1-1 and include the following specific snubber information:

Add the following at the end of this section.

STD COL 3.9.9-4-A This information will be included in the FSAR as part of a subsequent FSAR update.

3.9.6 IN-SERVICE TESTING OF PUMPS AND VALVES

Replace the last sentence of this section with the following.

STD COL 3.9.9-3-A Milestones for implementation of the ASME OM Code preservice and inservice testing programs and the motor operated valve testing program are defined in Section 13.4.

3.9.6.6 10 CFR 50.55A RELIEF REQUESTS AND CODE CASES

Add the following to the end of the first paragraph.

STD SUP 3.9-1 No relief from or alternative to the ASME OM Code is being requested beyond what is identified in the DCD.

3.9.7 RISK-INFORMED INSERVICE TESTING

Replace the text in this section with the following.

STD SUP 3.9-2 Risk informed inservice testing is not being utilized.

3.9.8 RISK-INFORMED INSERVICE INSPECTION OF PIPING

Replace the text in this section with the following.

STD SUP 3.9-3 Risk informed inservice inspection of piping is not being utilized.

3.9.9 COL INFORMATION

3.9.9-1-H Reactor Internals Vibration Analysis, Measurement and Inspection Program

GGNS COL 3.9.9-1-H This COL item is addressed in Section 3.9.2.4.

3.9.9-2-H ASME Class 2 or 3 or Quality Group D Components with 60 Year Design Life

STD COL 3.9.9-2-H This COL item is addressed in Section 3.9.3.1.

3.9.9.3-A Inservice Testing Programs

STD COL 3.9.9-3-A This COL item is addressed in Section 3.9.6.

3.9.9.4-A Snubber Inspection and Test Program

STD COL 3.9.9-4-A This COL item is addressed in Section 3.9.3.7.1(3)e and Section 3.9.3.7.1(3)f.

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.

3.10.1.4 DYNAMIC QUALIFICATION REPORT

Replace the last sentence in this section with the following.

STD COL 3.10.4-1-A The Dynamic Qualification Report will be completed prior to fuel load. FSAR information will be revised, as necessary, as part of a subsequent FSAR update.

STD SUP 3.10-1 Section 17.5 defines the Quality Assurance Program requirements that are applied to equipment qualification files, including requirements for handling safety-related quality records, control of purchased material, equipment and services, test control, and other quality related processes.

3.10.4 COMBINED OPERATING LICENSE INFORMATION

3.10.4-1-A Dynamic Qualification Report

STD COL 3.10.4-1-A This COL item is addressed in Section 3.10.1.4.

3.11 ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

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

3.11.2.2 QUALIFICATION PROGRAM, METHODS AND DOCUMENTATION

Add the following paragraphs at the end of this section.

STD COL 3.11-1-A

Implementation of the environmental qualification program, including development of the plant specific Environmental Qualification Document (EQD), will be in accordance with the milestone defined in Section 13.4.

Following program implementation, DCD Table 3.11-1 will be supplemented, as necessary, in a subsequent FSAR update to include additional equipment covered by the program but not identified in the table.

3.11.5 COL INFORMATION

3.11-1-A Equipment Qualification Document

STD COL 3.11-1-A

This COL item is addressed in Section 3.11.2.2.

3.12 PIPING DESIGN REVIEW

STD SUP 3.12-1 Information on seismic Category I and II, and nonseismic piping analysis and their associated supports is presented in DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4.

STD SUP 3.12-2 The location and distance between piping systems will be established as part of the completion of ITAAC Table 3.1-1. The FSAR will be revised as necessary, in a subsequent update to include this information.

3.13 THREADED FASTENERS - ASME CODE CLASS 1, 2, AND 3

STD SUP 3.13-1 Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in DCD Section 3.9.3.9, with supporting information in DCD Sections 4.5.1, 5.2.3, and 6.1.1.

APPENDIX 3A SEISMIC SOIL-STRUCTURE INTERACTION ANALYSIS

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

3A.1 INTRODUCTION

Replace the last sentence in the second paragraph with the following.

GGNS CDI Site-specific geotechnical data is described in Chapter 2. This data is compatible with the site enveloping parameters considered in the standard design.

3A.2 ESBWR STANDARD PLANT SITE PLAN

GGNS CDI Replace the first two sentences of the first paragraph with the following.

The site plan is shown in Figure 1.1-201. The plan orientation is denoted on the figure.

APPENDIX 3B CONTAINMENT HYDRODYNAMIC LOAD DEFINITIONS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3C COMPUTER PROGRAMS USED IN THE DESIGN AND ANALYSIS OF SEISMIC CATEGORY I STRUCTURES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3D COMPUTER PROGRAMS USED IN THE DESIGN OF COMPONENTS, EQUIPMENT AND STRUCTURES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3E (DELETED)

This section of the reference DCD is incorporated by reference with no departures or supplements.

APPENDIX 3F RESPONSE OF STRUCTURES TO CONTAINMENT LOADS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3G DESIGN DETAILS AND EVALUATION RESULTS OF SEISMIC CATEGORY I STRUCTURES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3H EQUIPMENT QUALIFICATION DESIGN ENVIRONMENTAL CONDITIONS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3I DESIGNATED NEDE-24326-1-P MATERIAL WHICH MAY NOT CHANGE WITHOUT PRIOR NRC APPROVAL

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3J EVALUATION OF POSTULATED RUPTURES IN HIGH ENERGY PIPES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3K RESOLUTION OF INTERSYSTEM LOSS OF COOLANT ACCIDENT

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 3L REACTOR INTERNALS FLOW INDUCED VIBRATION PROGRAM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 4 REACTOR

4.1 SUMMARY DESCRIPTION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

4.2 FUEL SYSTEM DESIGN

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

Add the following paragraph after the third paragraph.

STD COL 4.2.6 There are no changes to the design of the fuel assembly or control rods from that presented in the certified design.

4.2.6 COL INFORMATION

STD COL 4.2.6 This COL item is addressed in Section 4.2.

4.3 NUCLEAR DESIGN

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

Add the following paragraph after the first paragraph.

STD COL 4.3-1-A There are no changes to the fuel or core design from that described in the referenced certified design.

4.3.5 COL INFORMATION

4.3-1-A Variances from Certified Design

STD COL 4.3-1-A This COL Item is addressed in Section 4.3.

4.4 THERMAL AND HYDRAULIC DESIGN

This section of the referenced DCD is incorporated by reference with no departures or supplements.

4.5 REACTOR MATERIALS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

4.6 FUNCTIONAL DESIGN OF REACTIVITY CONTROL SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 4A TYPICAL CONTROL ROD PATTERNS AND ASSOCIATED POWER DISTRIBUTION FOR ESBWR

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

4A.1 INTRODUCTION

Add the following at the end of the first paragraph.

STD COL 4A-1-A There are no changes to the fuel or core design from that described in the referenced certified design.

4A.3 COL INFORMATION

4A-1-A Variances from Certified Design

STD COL 4A-1-A This COL item is addressed in Appendix 4A.

APPENDIX 4B FUEL LICENSING ACCEPTANCE CRITERIA

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 4C CONTROL ROD LICENSING ACCEPTANCE CRITERIA

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 4D STABILITY EVALUATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 5 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.1 SUMMARY DESCRIPTION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

5.2 INTEGRITY OF REACTOR COOLANT PRESSURE BOUNDARY

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

5.2.4 PRESERVICE AND INSERVICE INSPECTION AND TESTING OF REACTOR COOLANT PRESSURE BOUNDARY

Replace the last two sentences in the third paragraph with the following.

STD COL 5.2-1-H The initial inservice inspection program incorporates the latest edition and addenda of the ASME Boiler and Pressure Vessel Code approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load.

5.2.4.6 SYSTEM LEAKAGE AND HYDROSTATIC PRESSURE TESTS

Add the following paragraph at the end of this section.

STD SUP 5.2-1 System pressure tests and correlated technical specification requirements are provided in the plant Technical Specifications 3.4.4, “RCS Pressure and Temperature (P/T) Limits,” and 3.10.1, “Inservice Leak and Hydrostatic Testing Operation.”

5.2.4.11 COL INFORMATION FOR PRESERVICE AND INSERVICE INSPECTION AND TESTING PROGRAM OF REACTOR COOLANT PRESSURE BOUNDARY (RCPB)

Replace the first sentence of the first paragraph of this section with the following.

STD COL 5.2-1-H DCD Section 5.2.4 fully describes the Preservice and Inservice Inspection and Testing Programs for the RCPB. The implementation milestones for the Preservice and Inservice Inspection and Testing Programs are provided in Section 13.4.

Replace DCD Section 5.2.5.9 with the following.

5.2.5.9 LEAK DETECTION MONITORING

STD COL 5.2-2-H

Operators are provided with procedures to determine the identified and unidentified leakage in order to establish whether the leakage rates are within the limits in the Technical Specifications. These procedures assist operators in monitoring, recording, trending, determining the source of leakage, and evaluating potential corrective action. These procedures address the conversion of different parameter indications for identified and unidentified leakage (e.g., sump pump run time, sump level, condensate transfer rate) into common leak rate equivalents (e.g., volumetric or mass flow) and leak rate-of-change values. A description of the plant procedures program and implementation milestones are provided in Section 13.5.

5.2.6 COL INFORMATION

5.2-1-H Preservice and Inservice Inspection Program Plan

STD COL 5.2-1-H

This COL Item is addressed in Section 5.2.4 and Section 5.2.4.11.

5.2-2-H Leak Detection Monitoring

STD COL 5.2-2-H

This COL Item is addressed in Section 5.2.5.9.

5.3 REACTOR VESSEL

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

5.3.1.8 COL INFORMATION FOR REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM

Replace this section with the following.

STD COL 5.3-2-A

The description of the reactor vessel material surveillance program is provided in DCD Section 5.3.1.6. This program description addresses the following areas:

- Basis for selection of material in the program (DCD Section 5.3.1.6.1)
- Number and type of specimens in each capsule (DCD Section 5.3.1.6.1)
- Number of capsules and proposed withdrawal schedule (DCD Section 5.3.1.6.1)
- The method for calculating neutron flux and fluence calculations for vessel wall and surveillance specimens and conformance with guidance of RG 1.190 (DCD Section 5.3.1.6.2)
- Expected effects of radiation on vessel wall materials and basis for estimation (DCD Section 5.3.1.6.3)
- Location of capsules, method of attachment, and provisions to ensure that capsules are retained in position throughout the vessel lifetime (DCD Section 5.3.1.6.4)

A complete reactor vessel material surveillance program will be developed as described above in accordance with the implementation schedule provided in Section 13.4.

Report of Test Results

A summary technical report, including test results, is submitted as specified in 10 CFR 50.4, for the contents of each capsule withdrawn, within one year of the date of capsule withdrawal unless an extension is granted by the Director, Office of Nuclear Reactor Regulation. The report includes the data required by ASTM E185-82, as specified in Paragraph III.B.1 of 10 CFR 50, Appendix H, and includes the results of the fracture toughness tests conducted on the beltline materials in the irradiated and unirradiated conditions. If the test results indicate a change in the Technical Specifications is required, the expected date for submittal of the revised Technical Specification will be provided with the report.

5.3.3.6 OPERATING CONDITIONS

Add the following after the first sentence.

STD SUP 5.3-1

Development of plant operating procedures is addressed in Section 13.5. These procedures require compliance with the Technical Specifications. The Technical Specifications (which are developed by the methodology also identified in the Technical Specifications) are intended to ensure that the P-T limits identified in DCD Section 5.3.2 are not exceeded during normal operating conditions and anticipated plant transients.

5.3.4 COL INFORMATION

5.3-2-A Materials and Surveillance Capsule

STD COL 5.3-2-A

This COL Item is addressed in Section 5.3.1.8.

5.4 COMPONENT AND SUBSYSTEM DESIGN

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

5.4.8 REACTOR WATER CLEANUP/SHUTDOWN COOLING SYSTEM

Add the following paragraph at the end of this section.

STD SUP 5.4-1 Operating procedures provide guidance to prevent severe water hammer caused by mechanisms such as voided lines.

5.4.12 REACTOR COOLANT SYSTEM (RCS) HIGH POINT VENTS

Add the following paragraph at the end of this section.

STD SUP 5.4-2 A human factors analysis of the control room displays and controls for the RCS vents is included as part of the overall human factors analysis of the control room displays and controls described in DCD Chapter 18. This analysis considers:

- The use of this information by an operator during both normal and abnormal plant conditions;
- Integration into emergency procedures;
- Integration into operator training; and
- Other alarms during an emergency and the need for prioritization of alarms.

5.4.12.1 OPERATION OF RPV HEAD VENT SYSTEM

Add the following paragraph at the end of this section.

STD SUP 5.4-3 Operating procedures for the reactor vent system address considerations regarding when venting is needed and when it is not needed, including a variety of initial conditions for which venting may be required. The development of operating procedures is addressed in Section 13.5.

CHAPTER 6 ENGINEERED SAFETY FEATURES

6.0 GENERAL

This section of the referenced DCD is incorporated by reference with no departures or supplements.

6.1 ENGINEERED SAFETY FEATURE MATERIALS

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

6.1.2.3 EVALUATION

Delete the parenthetical statement at the end of the second paragraph, and insert a new third paragraph as follows.

STD COL 6.1.3-1-A

For protective coatings and organic materials used inside the containment that do not meet the requirements of ASTM D 5144 and RG 1.54 as per above, an evaluation is performed to determine the generation rate, as a function of time, of combustible gases that can be formed from these unqualified organic materials under DBA conditions. Surveys of the containment are used to identify this material. The technical basis and assumptions used for this evaluation are documented and retained as quality records. These evaluations will be completed before fuel load, and the FSAR will be revised, as necessary, in a subsequent update to incorporate the results of these evaluations.

6.1.3 COL INFORMATION

6.1.3-1-A Protective Coatings and Organic Materials

STD COL 6.1.3-1-A

This COL item is addressed in Section 6.1.2.3.

6.2 CONTAINMENT SYSTEMS

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

6.2.1.6 TEST AND INSPECTION

Add the following at the end of this section.

Inspections to Limit Debris

STD SUP 6.2-1

Procedures describe the activities necessary to prevent debris from affecting the emergency core cooling and long-term cooling safety functions in accordance with RG 1.82, including: 1) inspection of the cleanliness of pools within containment, 2) a visual examination for evidence of structural degradation or corrosion of debris screens, 3) an inspection of the wetwell and the drywell, including the vents, downcomers, and deflectors, for the identification and removal of debris or trash that could contribute to the blockage of debris screens for the ECC and long-term cooling safety functions, 4) containment cleanliness programs to clean the pools within containment on a regular basis, and 5) plant procedures for control and removal of foreign materials from the containment and abatement procedures to avoid latent debris generation during removal and/or replacement of insulation within containment.

6.2.4.2 SYSTEM DESIGN

Replace the parenthetical after the third sentence in the first paragraph with the following.

STD COL 6.2-1-H

DCD Tables 6.2-16 through 6.2-42 require an entry for the length of pipe from the containment to the inboard and outboard isolation valves. Pipe lengths will be determined as part of completion of the piping design ITAAC identified in DCD Tier 1, Table 3.1-1. The FSAR will be revised to reflect the pipe length information in a subsequent update.

6.2.5.2 CONTAINMENT INERTING SYSTEM

GGNS CDI In DCD Figure 6.2-29 remove the Utility Scope designation.

6.2.8 COL INFORMATION

STD COL 6.2-1-H 6.2-1-H This COL item is addressed in Section 6.2.4.2.

6.3 EMERGENCY CORE COOLING SYSTEMS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

6.4 CONTROL ROOM HABITABILITY SYSTEMS

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

6.4.4 SYSTEM OPERATION PROCEDURES

Replace the second paragraph with the following.

GGNS COL 6.4-1-A Operators are provided with training and procedures for control room habitability that address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83. Training and procedures are developed and implemented in accordance with Sections 13.2 and 13.5, respectively. The implementation milestones for training and procedures are provided in Sections 13.4 and 13.5, respectively.

6.4.5 DESIGN EVALUATIONS

System Safety Evaluation

Add the following after the second paragraph.

GGNS SUP 6.4-1 The impact of a postulated design basis accident (DBA) in Unit 1 on the Unit 3 control room was evaluated. The evaluation was performed as follows:

- Atmospheric dispersion factors, χ/Qs, at the Unit 3 MCR intakes were conservatively calculated assuming a point source, a distance of 350 m (1148 ft), and a release height of 10 m (32.8 ft). Meteorological data used for cross-unit impact is consistent with that used for the χ/Q values presented in Section 2.3. A nominal “receptor to source” direction of 135° was assumed (with respect to “true north”). To ensure all potential release points from Unit 1 were considered, a safety factor of 1.5 was applied to the nominal results. The χ/Q values are presented in Table 2.3-208.

- The Unit 1 Updated FSAR (UFSAR) was reviewed, and the bounding event with respect to dose to the Unit 3 control room was determined to be the design basis LOCA documented in UFSAR Section 15.6.4. The resultant dose at the Unit 3 control room is calculated using the NRC computer code RADTRAD 3.03. Modeling was based on the Unit 1 event documented in the UFSAR. The dose consequences to Unit 3 control room operators from an event at Unit 1 are bounded by the dose consequences from an event at Unit 3 (DCD Section 15.4.4). No credit was taken for the Unit 3 control room emergency filtration units.

Based on this conservative analysis, the resultant dose is bounded by the control room operator dose from a postulated Unit 3 DBA, and is less than GDC 19 limits.

GGNS COL 6.4-2-A

GGNS ESP COL 2.2-1

Delete DCD Table 6.4-2. Replace the third paragraph with the following.

Potential toxic gas sources are evaluated to confirm that an external release of hazardous chemicals does not impact control room habitability. These sources include: 1) off-site industrial facilities and transportation routes; 2) Unit 1; and 3) Unit 3.

Evaluation of potentially hazardous off-site chemicals within 8 km (5 miles) of the control room is addressed in Section 2.2. This includes potential accidental release of toxic chemicals transported on U.S. Highway 61 and materials transported near the site moving on the Mississippi River. As described therein, there are no manufacturing plants, chemical plants, storage facilities, oil pipelines or gas pipelines within 8 km (5 miles) of the control room. There are also no significant control room habitability impacts due to chemicals being transported along off-site routes within 8 km (5 miles) of the plant.

Toxic gas analysis for potentially hazardous chemicals stored on site is performed in accordance with the guidelines of RG 1.78 and on the basis of no action being taken by the control room operator. The results of the analysis, when compared to the toxicity limits given in RG 1.78 and National Air Quality Standards, show hazardous concentrations of toxic gas in the control room are not reached.

On-site locations with potentially toxic chemicals are identified in Table 2.2-201.

Unit 1 hydrogen and oxygen supplies are used for Unit 3. These supplies are in excess of 519 meters (1700 ft) from the Unit 3 control building. This distance is acceptable for toxic gas concerns per RG 1.78 based on hazards of postulated instantaneous release followed by vapor cloud explosion or intake of a flammable vapor concentration into a safety-related intake. The hazard for the oxygen supply was a postulated release with an increased concentration at a safety-related intake. Calculations performed to evaluate the habitability of the control room for accidental releases of hydrogen or oxygen from the hydrogen water chemistry system indicate control room personnel are not subject to the hazard of breathing air with insufficient oxygen inside the control room due to a release of hydrogen. Other identified chemicals are stored in amounts and locations that are adequately separated from the control room intakes such that detection and/or control room isolation is not required.

The maximum concentrations for on-site chemicals, as calculated for Unit 1, are based on the equations provided in NUREG-0570. This evaluation is bounding for the Unit 3 control room intake on the basis of a greater separation distance from Unit 3 control room than the Unit 1 control room. The relative locations for the chemical storage areas, as well as the control room intakes and refresh rates for Unit 1 and Unit 3 were considered in the analysis along with the properties of the stored chemicals. The maximum concentrations determined for the room intakes were evaluated for safety in comparison with the toxicity limits from RG 1.78. The analysis performed shows that the control room concentration for a given chemical does not exceed the applicable toxicity limit. Based on this analysis, Seismic Category I Class safety-related toxic gas monitoring instrumentation is not required.

6.4.9 COL INFORMATION

6.4-1-A CRHA Procedures and Training

GGNS COL 6.4-1-A This COL item addressed in Section 6.4.4.

6.4-2-A Toxic Gas Analysis

GGNS COL 6.4-2-A This COL item addressed in Section 6.4.5 and Table 2.2-201.

6.5 ATMOSPHERE CLEANUP SYSTEMS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

6.6 PRESERVICE AND INSERVICE INSPECTION AND TESTING OF CLASS 2 AND 3 COMPONENTS AND PIPING

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

Replace the last sentence and the parenthetical statement of the third paragraph of this section with the following.

STD COL 6.6-1-A The PSI/ISI program description for Class 2 and 3 components and piping is provided in DCD Section 6.6.

6.6.10 PLANT SPECIFIC PSI/ISI PROGRAM INFORMATION

6.6.10.1 RELIEF REQUESTS

Add the following at the end of this section.

STD COL 6.6-1-A No relief requests for the PSI/ISI program have been identified.

6.6.10.2 CODE EDITION

Replace the second sentence of this section with the following.

STD COL 6.6-1-A The initial ISI program incorporates the latest edition and addenda of the ASME Code approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load.

Add the following new section.

6.6.10.3 PROGRAM IMPLEMENTATION

STD COL 6.6-1-A The milestones for preservice and inservice inspection program implementation are provided in Section 13.4.

6.6.11 COL INFORMATION

6.6-1-A PSI/ISI Program Description

STD COL 6.6-1-A This COL item is addressed in Section 6.6.

APPENDIX 6A TRACG APPLICATION FOR CONTAINMENT ANALYSIS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 6B EVALUATION OF THE TRAGG NODALIZATION FOR THE ESBWR LICENSING ANALYSIS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 6C EVALUATION OF THE IMPACT OF CONTAINMENT BACK PRESSURE ON THE ECCS PERFORMANCE

This section of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 7 INSTRUMENTATION AND CONTROL SYSTEMS

This chapter of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 8 ELECTRIC POWER

8.1 INTRODUCTION

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

8.1.2.1 UTILITY POWER GRID DESCRIPTION

Add the following to the end of the first paragraph.

GGNS SUP 8.1-1 The output of Unit 3 is delivered to the Grand Gulf Nuclear Station (GGNS) 500-kV Switching Station through the unit main step-up transformers and an intermediate switchyard as described in Sections 8.2 and 8.3. The plant is connected to the Switching Station by a 500-kV normal preferred transmission line and a second 500-kV alternate preferred transmission line that supplies the two reserve auxiliary transformers (RATs). The GGNS 500 kV Switching Station is common to Units 1 and 3. It accommodates three 500 kV overhead lines: one line terminating at the Baxter Wilson Substation, the second line terminating at the Franklin Substation, and the third line terminating at the Ray Braswell 500 kV Switching Station. These intra-system ties transit from the GGNS 500-kV Switching Station as shown in Figure 8.2-201. Entergy’s transmission system and intra-system ties are further described in Section 8.2.

8.2 OFF-SITE POWER SYSTEMS

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

8.2.1.1 TRANSMISSION SYSTEM

Replace this section with the following.

GGNS COL 8.2.4-1-A

The Entergy Mississippi Inc./Entergy Electric System (EES) supplies off-site ac power from the power grid system to support plant operations. The grid system of Entergy Mississippi Inc./Entergy Electric Systems consists of interconnected hydro-plants, fossil fuel plants, and nuclear plants supplying electric energy over a 500/230/161/115 kV transmission system as shown in Figure 8.2-201.

Entergy Mississippi Inc. is a member of the EES. Other members of the system are Entergy Arkansas Inc., Entergy Louisiana Inc., System Energy Resources Inc. (SERI), New Orleans Public Services Inc., and Entergy Gulf States.

The EES is interconnected with the Southwestern Power Administration, Associated Electric Cooperatives Inc. Missouri Utilities, Union Electric Company, Tennessee Valley Authority, Mississippi Power Company, Central Louisiana Electric Company, Southwestern Electric Power Company, Oklahoma Gas and Electric Company, Empire District Electric Company, and Arkansas Electric Cooperative Corporation.

The off-site power system is designed and constructed with sufficient capacity and capability from the transmission network to support plant operations.

GGNS COL 8.2.4-1-A

GGNS COL 8.2.4-10-A

There are two separate 500 kV transmission lines from the GGNS 500 kV Switching Station connected to the preferred source and the alternate preferred source. The normal preferred source is connected to the unit auxiliary transformers (UATs) and the main transformers, and the alternate preferred source is connected to the RATs located in the Transformer Area. The normal preferred source and the alternate preferred source transmission lines are designed to carry the full output of Unit 3 and the full load of the RATs, respectively. The two 500 kV transmission lines are installed as overhead lines on separate towers and on separate right-of-ways from the GGNS Switching Station to the Transformer Area.

The GGNS 500 kV Switching Station is common to Units 1 and 3. It accommodates three 500 kV overhead lines: one line terminating at the Baxter Wilson Substation, the second line terminating at the Franklin Substation, and the third line terminating at the Ray Braswell 500 kV Switching Station. These three lines provide the off-site power source to the GGNS 500 kV Switching Station.

GGNS COL 8.2.4-1-A

The bulk power transmission and generation needs of the EES are planned on a system-wide basis. In 1965 the basic 500 kV system now in operation was designed and put into operation. The system has proven to be highly reliable.

To the east, EES interconnects with Tennessee Valley Authority at West Memphis, Arkansas and West Point, Mississippi. It interconnects to the southwest with Entergy Gulf States Inc. at Willow Glen, Louisiana, and to the west with Oklahoma Gas and Electric at Fort Smith, Arkansas. Agreements with each of these utilities provide a reliable and widely dispersed source of power when connected at 500 kV over such relatively short distances. These interconnections serve to enhance the reliability of the 500 kV bulk power system of the EES. Other system connections exist at 345 kV, 230 kV, 161 kV, and 115 kV voltages. Direct generation connections to the 500 kV transmission system include Arkansas Nuclear One, Grand Gulf Nuclear Units 1 and 3, Baxter Wilson, and Little Gypsy. Other 500 kV connections in the Entergy System, made through step-up transformers, include West Memphis, Mabelvale, El Dorado, Baxter Wilson, Ray Braswell, Franklin, Fancy Point, and Waterford. These diverse power inputs provide a highly reliable source of power for the grid that supplies off-site power to Unit 3.

None of the 500 kV lines to the GGNS 500 kV Switching Station share a common tower or common right-of-way. The lines diverge as they emanate from the GGNS Switching Station. The lines are widely dispersed to minimize the probability of multiple concurrent line damages due to tornadoes.

Table 8.2-201 provides information about the length and thermal rating of the three transmission lines that are connected to the GGNS 500 kV Switching Station.

The 500 kV grid transmission lines are designed with concrete or steel self supporting towers or self-supporting poles. Where lattice steel towers are used, the tower foundations are reinforced poured-in-place concrete with embedded stub angles. Conductor spacers are provided at approximately 249 feet spacing. Each span is provided with dampers on each conductor. The lines are designed to meet the National Electrical Safety Code. The design loading conditions are one half inch of ice and 105 mile per hour wind.

Because of these design parameters, there have been no problems with aeolian vibration or galloping of the conductors on the existing lines in the grid system. This design has proven to be satisfactory for the conditions of this area.

The nominal voltage of the 500 kV grid is 510 kV. The maximum and minimum voltages of the 500 kV grid are 525 kV and 491 kV, respectively. The recorded voltages in the past years indicate no voltage excursions outside these limits.

8.2.1.2.1 Switchyard

Replace the second, third, fourth, fifth, and sixth paragraphs of DCD Section 8.2.1.2.1 with the following sections.

8.2.1.2.1.1 Transmission Switchyard

GGNS COL 8.2.4-2-A

Unit 3 is connected to the GGNS 500 kV Switching Station.

GGNS COL 8.2.4-10-A

The Unit 1 portion of the GGNS 500 kV Switching Station is extended to the north to accommodate the Unit 3 interconnection to the grid. The GGNS Switching Station has two 500 kV main buses running in the north-south direction. The electrical configuration of the off-site power system is shown in Figure 8.2-202. The general arrangement of the GGNS Switching Station and its connection to the plant and the grid are shown in Figure 8.2-203.

The switchyard is extended with rigid tubing supported on insulators and galvanized towers and pedestals. The bus arrangement is in a double bus configuration at 30 feet and 55 feet height above ground. The buses are designed to withstand a maximum fault on any section. This is the maximum limiting force-loading that the buses would be subjected to.

The layout of the switchyard is designed as a double-bus double-breaker or breaker-and-a-half configuration. The breaker switching configuration provides for the isolation of any faulted line without affecting the operation of any other lines. This scheme also provides for isolation of any one breaker on the 500 kV East/West bus for inspection and maintenance without affecting the operation of any of the connecting lines or any other connection to the buses. The design provides for the isolation of any breaker, without limiting the operation of the unit or the transmission lines connecting to the 500 kV grid. Each bus in the Unit 3 section of the switchyard has sufficient capacity to carry its load under any postulated switching sequences. The upgrade of the Unit 1 section of the switchyard conforms to the new bus rating.

The switchyard is designed with a completely redundant protective relay scheme.

GGNS COL 8.2.4-6-A

GGNS COL 8.2.4-7-A

GGNS COL 8.2.4-10-A

There are two sources of ac auxiliary power from the 6.9 kV Plant Investment Protection (PIP) buses for the normal preferred switchyard power center and alternate preferred switchyard power center, as shown on DCD Figure 8.1-1. The switchyard auxiliary power system is designed with adequate equipment, standby power, and protection to provide maximum continuity of service for operation of the essential switchyard equipment during both normal and abnormal conditions. There are two independent sets of 125 V DC batteries, chargers, and DC panels for the switchyard relay and control systems DC supply requirements. Each charger is powered from a separate ac source with an automatic switchover to the alternate source, in the event the preferred source is lost. The distribution systems for the two battery systems are physically separated. This separation includes dual cable tray systems in the control building and dual cable trenches in the new portion of the switchyard.

High speed circuit breakers with adequate operating and interrupting rating are provided. The 500 kV circuit breakers are equipped with two independent trip coils for tripping by a separate set of protective relays. In addition, the circuit breakers are provided with breaker failure schemes. The protective relay systems are redundant. These systems are overlapping such that each high voltage component is covered by at least two sets of protective relays. The primary and backup relay systems are supplied from separate current inputs, separate DC circuits for control from each 125 V DC battery, and are connected to separate trip coils of the power circuit breakers.

In case of a spurious relay trip, or a trip due to a fault on one of the off-site circuits, the switchyard buses will continue to stay energized. There is adequate capacity in the system and the switchyard equipment to meet the auxiliary power requirements of Unit 3.

GGNS COL 8.2.4-10-A

Failure analysis shows that a single fault in any section of a 500 kV bus is cleared by the adjacent breakers and does not interrupt operation of the remaining part of the 500 kV switchyard bus or the connection of the unaffected transmission lines. Only those elements connected to the faulted section are interrupted.

The transmission line relay protection circuits continuously monitor the conditions of the off-site power system and are designed to detect and isolate faults with maximum speed causing minimal disturbance to the system.

GGNS COL 8.2.4-5-A

Each of the 500 kV transmission lines from the GGNS 500 kV Switching Station is protected by two independent pilot systems to achieve a high speed clearing for a fault on the line. The 500 kV transmission line protective relay system is designed to maximize the reliability of the incoming power to the plant. The protective relaying provides for fast detection of faults and should the transmission line protective relays fail to clear the fault, adequate backup protection is available in the form of breaker failure relays.

Each of the 500 kV switchyard bus sections is protected by a dual bus differential relay scheme. In addition to the line and bus protection schemes, the 500 kV switchyard breakers are protected by breaker failure relays with current supervision from separate current transformers. The breaker failure relays operate through a timing relay and should a breaker fail to trip within the time setting of its timing relay, the associated breaker failure trip relay will trip and lock out all breakers on the bus side, including the other breaker(s) in that bay.

The design of the protective relay scheme is coordinated, reviewed, and accepted by the Entergy organization responsible for grid reliability.

8.2.1.2.1.2 Transformer Area

GGNS COL 8.2.4-2-A
GGNS COL 8.2.4-3-A

The equipment arrangement at the Transformer Area is shown on Figure 8.2-204. The main transformers, UATs, and RATs are located in the area adjacent to the turbine and electrical buildings. This area also contains circuit breakers, disconnect switches, and the bus arrangements necessary to establish connections to the transformers.

The generator output from the high side of the main transformers is connected through a 500 kV generator circuit breaker in a high/low bus arrangement. The 500 kV connections to the UATs (the preferred power source) are through individual high voltage circuit breakers with disconnect switches on both ends. The 500 kV overhead line to the GGNS Switching Station emanates from a takeoff structure at the northwest corner of the area. The UATs are powered through the unit during normal operation and from the grid via a 500 kV overhead transmission line from the GGNS Switching Station when the unit is not operating.

GGNS COL 8.2.4-4-A

The source of power to the RATs (the alternate power source) is from a 500 kV transmission line from the GGNS Switching Station. This overhead line terminates on the eastern end of the Transformer Area. A common 500 kV circuit breaker with disconnect switches on either side is provided for protection and isolation of the two RATs. An additional individual disconnect switch is provided for isolation of supply to each RAT. There are two sources of ac auxiliary power for the Transformer Area from the 6.9 kV PIP buses.

There are independent sets of 125 V DC batteries, chargers, and DC panels for the transformer area DC supply requirements for relay and control systems. Each charger is powered from a separate ac source with an automatic switchover to the alternate source, in the event the preferred source is lost. The distribution systems for the two battery systems are physically separated. This separation includes dual cable tray systems in the control building and dual cable trenches in the transformer area.

8.2.1.2.1.3 Transmission System Operator Agreement

GGNS SUP 8.2-1 Prior to fuel load, the licensee will establish an agreement with the Transmission System Operator (TSO) to address switchyard and transmission interface issues, including the following items:

- Exclusion Area control, switchyard access, and security
- Operation of equipment and activities performed in the switchyard
- Maintenance of switchyard equipment
- Coordination of planned plant outages and activities directly affecting power supply to GGNS
- Review and approval of changes which might affect compliance with regulatory requirements and commitments which could affect off-site power supply to GGNS
- Procedures and training on the critical need for power at GGNS during emergencies

Entergy Mississippi Inc. is responsible for the maintenance of the GGNS switchyard and transmission equipment.

8.2.2.1 RELIABILITY AND STABILITY ANALYSIS

Replace this section with the following.

GGNS COL 8.2.4-9-A
GGNS COL 8.2.4-10-A

Entergy is a member of the Southeastern Electric Reliability Council (SERC). The guidelines of SERC provide assurance that transmission systems that are part of the interconnected network are planned, designed, and constructed to operate reliably within thermal, voltage, and stability limits. These guidelines, along with North American Electric Reliability Corporation transmission planning guidelines, were followed in the design of the off-site power system to support Unit 3, and are adhered to during the ongoing operation of the plant.

In the history of its operation Unit 1 has not experienced a complete loss of off-site power source availability. Only one brief storm-related concurrent loss of the

GGNS 500 kV Switching Station transmission source lines, Baxter Wilson and Franklin, occurred during this period. This event resulted in an upgrade of the carrier and protective relay schemes for these lines to provide greater availability of these sources to the station.

8.2.2.1.1 System Impact Study

A System Impact Study was conducted to assess the effect of Unit 3 on the reliability of the EES and to analyze the reliability of the off-site power supply for Unit 3.

The study addressed various elements of the grid stability, namely: (1) a load flow analysis to determine the adequacy of the existing transmission system to handle the full output of the plant; (2) a short circuit analysis to verify the fault duty of the existing equipment within the EES; (3) a transient stability analysis to verify the stability of the grid under normal and contingency conditions and an investigation of the grid voltage performance. The following criteria must be met in order to satisfy these elements:

- The grid must remain stable.
- Grid voltage at the GGNS Switching Station must remain between 491 and 525 kV, while supplying the required loads for the station.
- Grid frequency must be maintained between 57 and 61.8 Hz, and the potential short circuit current must not exceed the current rating of the equipment.

The analysis results establish that the grid is stable and that the designated off-site power supply to Unit 3 is not degraded during various contingencies. The analysis included worst case disturbances, as a result of a single event, such as loss of the largest generation capacity supplying the grid; removal of the largest load from the grid; and loss of the most critical transmission line.

As a standard operating procedure Entergy performs grid studies at least every three years. These periodic analyses incorporate updated grid configurations and conditions, which are projected for a future period of interest and include multiple contingencies such as the unit trip combined with other concurrent transmission/ generation contingencies to verify and confirm the adequacy of the grid sources following such an event. These scenarios include future projections for system load peaks and power transfers through the EES.

8.2.2.1.2 Transmission System Monitoring and Analysis

GGNS SUP 8.2-2 Compliance with General Design Criterion 18 is achieved by designing testability and inspection capability into the system and then implementing a comprehensive testing and surveillance program.

The transmission lines within the EES are inspected approximately every six months by an aerial observer.

Routine maintenance on power circuit breakers is performed, as required, to verify that the applicable design criteria for operation from DCD Section 8.2.3 are not exceeded.

Calibration checks of the protective relay systems in the switchyard are performed on a routine interval not to exceed two fuel cycles. Functional checks of relay and control equipment are also conducted on a two-fuel cycle interval.

Protective relay operation is announced locally and/or in the plant control room and may be simultaneously inputted to the balance-of-plant computer. The computer acts as a data logger with or without additional alarm, depending on the protective action.

The system dispatcher has control of the 500 kV Switching Station components. The generator circuit breaker, the UAT circuit breakers, and the isolation circuit breaker for RATs, which are located in the Transformer Area, are under the administrative control of the plant operator. Information transmitted remotely to the system dispatcher includes watt and var loadings of all transmission lines, transformers, and generators, as well as the status of all controlled devices. Various switchyard alarms are transmitted remotely to the system dispatcher to enable the necessary steps to correct problems before they become serious. Events involving switchyard components requiring plant operator information or action are annunciated similar to protective devices.

Entergy Transmission System Planning utilizes the PTI transmission analysis program as the analysis tool to predict the plant’s off-site power voltages under various transmission grid contingencies. Using this program, detailed transmission studies are performed for the next day, using daily cases representing that day of the month. These cases provide the advantage of the accuracy of a near term projection of the expected loads and load flows, system generating unit status, expected transmission system in or out of service and specific site requirements, in a single analysis. These cases are also re-performed during the period of interest (i.e., present day) if previously identified specific contingencies occur or if the system operator determines that system conditions have significantly changed during the period that could adversely affect the off-site power source post-trip voltage availability for the unit. This allows the analysis to remain bounding if system conditions change. If the results indicate the potential that site-specific requirements would not be met, the system operator then determines if these requirements can be met for the period of interest by making changes to transmission system configuration/operation. If the system operator determines that the requirements cannot be met, then plant notification is required.

The analysis program results are validated against transmission system response to actual events.

The studies are performed periodically to confirm that the off-site power system will remain available following a trip of the unit. Grid studies are performed at least every three years and before significant changes to transmission system elements such as loads, generators, and transmission lines. These periodic analyses incorporate updated grid configurations and conditions, which are projected for a future period of interest and include such multiple contingencies as the unit trip and accident condition loading combined with significant other concurrent transmission/generation contingencies to confirm the adequacy of these sources following such an event. This includes future projections for system load peaks and power transfers through the EES, as determined by Entergy Transmission System Planning.

The TSO has real time monitoring of transmission system conditions. This capability includes data acquisition, alarms, and analysis related to power flow and system elements. The analysis includes projection of future voltage conditions so that the plant may be notified of actual or potential conditions of degraded voltage and/or frequency in the case of loss of transmission system elements.

The existing protocols in plant procedures that require the TSO to monitor transmission system conditions and to notify and collaborate with the Control Room staff in the event of degraded transmission system are also applied to Unit 3. Procedures exist that describe actions to be taken to limit the risk associated with transmission system degradation and operate the plant safely.

8.2.3 DESIGN BASES REQUIREMENTS

GGNS COL 8.2.4-9-A

Revise the ninth bullet of DCD Section 8.2.3 to read as follows.

A transmission system reliability and stability review of the configuration to which the plant is connected was performed to determine the reliability of the off-site power system and verified that it is consistent with the probability risk analysis of Chapter 19. (See Sections 8.2.2.1 and 8.2.2.1.1.)

8.2.4 COL INFORMATION

8.2.4-1-A Transmission System Description

GGNS COL 8.2.4-1-A

This COL item is addressed in Section 8.2.1.1.

8.2.4-2-A Switchyard Description

GGNS COL 8.2.4-2-A

This COL item is addressed in Sections 8.2.1.2.1.1 and 8.2.1.2.1.2.

8.2.4-3-A Normal Preferred Power

GGNS COL 8.2.4-3-A

This COL item is addressed in Section 8.2.1.2.1.2.

8.2.4-4-A Alternate Preferred Power

GGNS COL 8.2.4-4-A

This COL item is addressed in Section 8.2.1.2.1.2.

8.2.4-5-A Protective Relaying

GGNS COL 8.2.4-5-A

This COL item is addressed in Section 8.2.1.2.1.1.

8.2.4-6-A Switchyard DC Power

GGNS COL 8.2.4-6-A

This COL item is addressed in Section 8.2.1.2.1.1.

8.2.4-7-A Switchyard AC Power

GGNS COL 8.2.4-7-A

This COL item is addressed in Section 8.2.1.2.1.1.

8.2.4-8-A Switchyard Transformer Protection

GGNS COL 8.2.4-8-A

This COL item is not applicable. There are no transformers located in the switchyard.

8.2.4-9-A Stability and Reliability of the Off-site Transmission Power Systems

GGNS COL 8.2.4-9-A

This COL item is addressed in Sections 8.2.2.1 and 8.2.3.

8.2.4-10-A Interface Requirements

GGNS COL 8.2.4-10-A

This COL item is addressed in Sections 8.2.1.1, 8.2.1.2.1.1, and 8.2.2.1.

GGNS COL
8.2.4-1-A

TABLE 8.2-201
GGNS SWITCHING STATION 500 KV TRANSMISSION LINES

500 kV Line	Termination Point	Length (miles)	Thermal Rating (MVA)
Franklin	Franklin Substation	44	1730
Baxter Wilson	Baxter Wilson Substation	21	2600
Ray Braswell	Ray Braswell Switching Station	49	1732

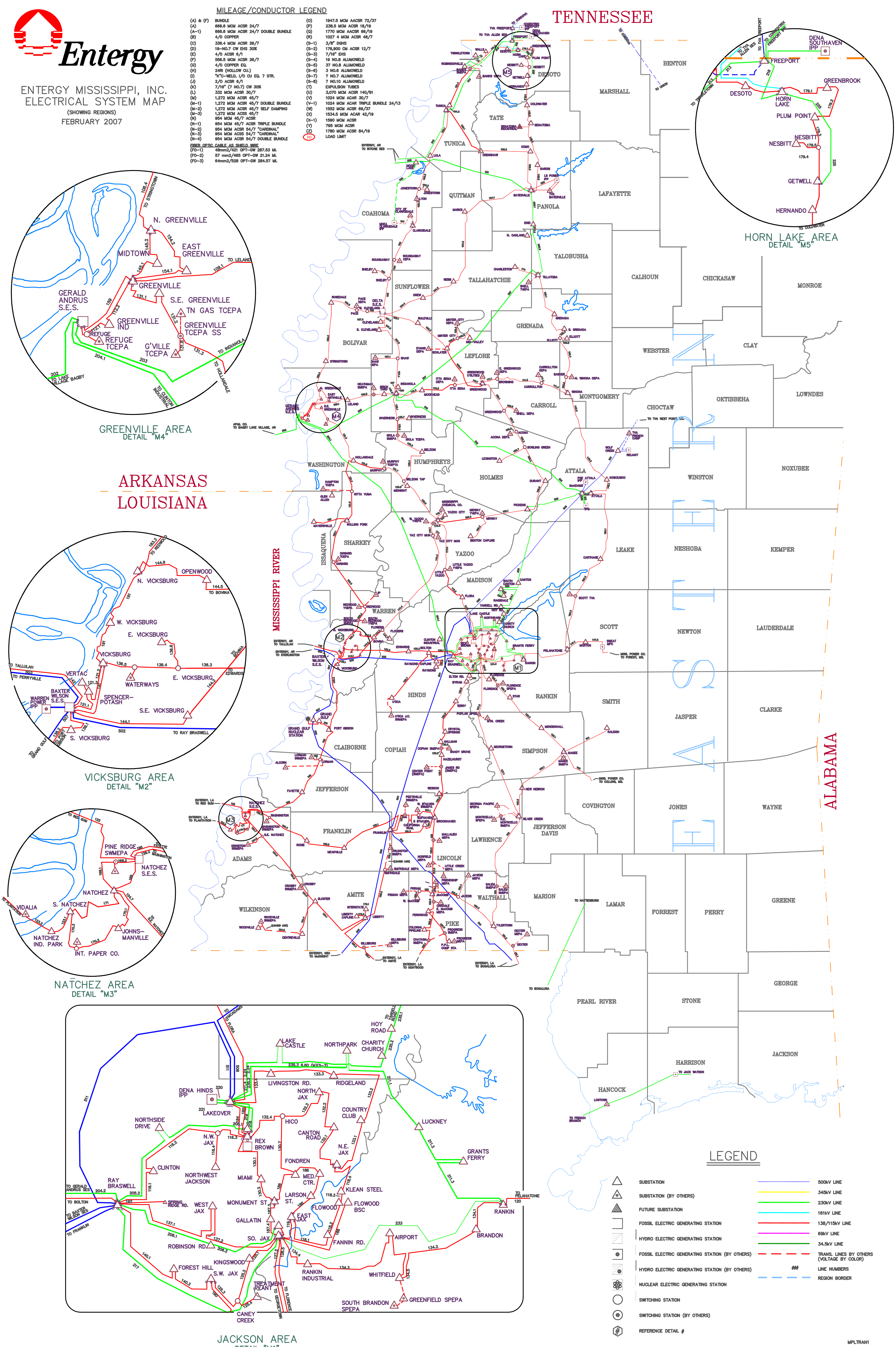


Figure 8.2-201. Entergy Mississippi, Inc. Electrical System Map

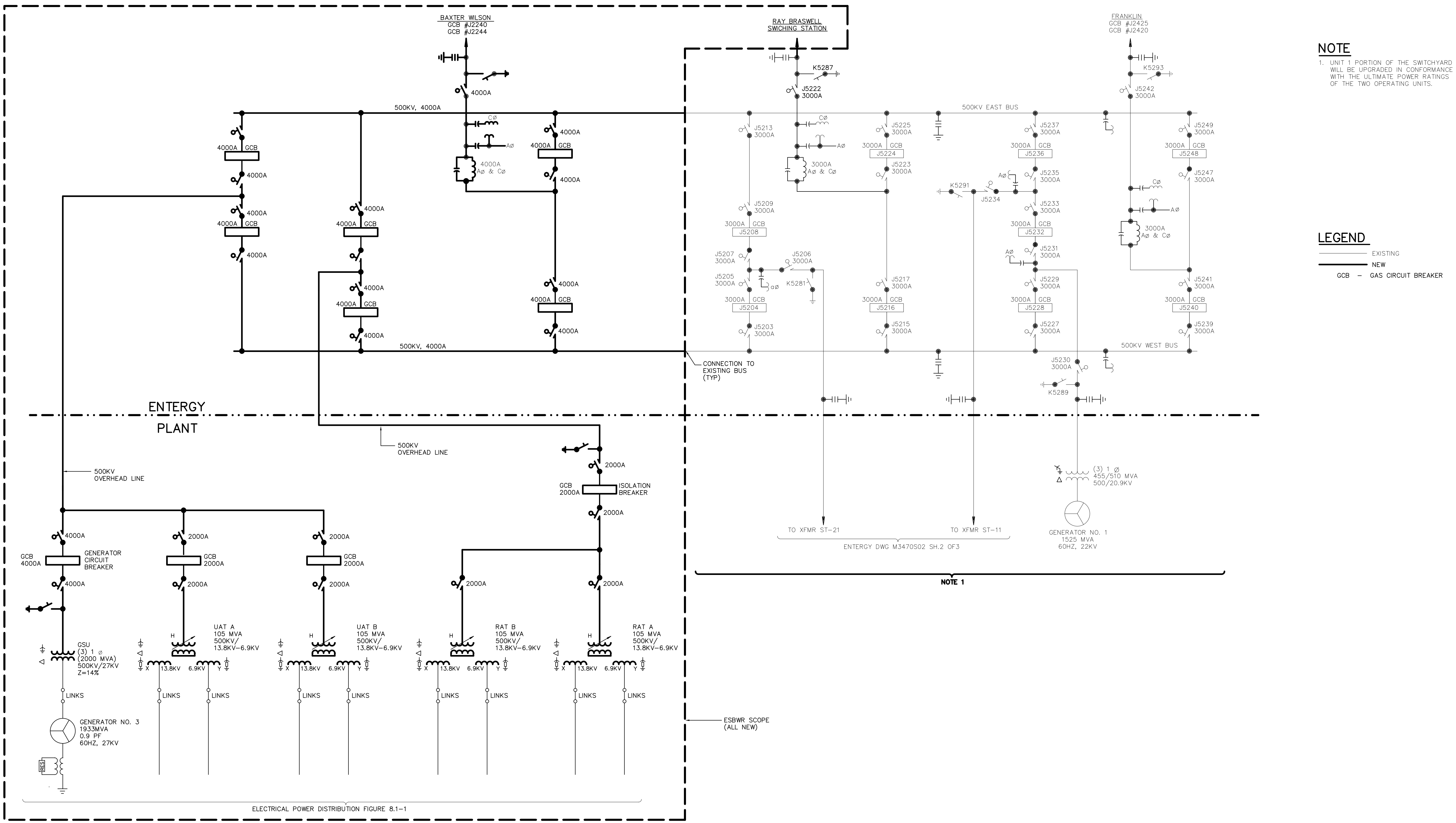


Figure 8.2-202. Offsite Power System One Line Dragram

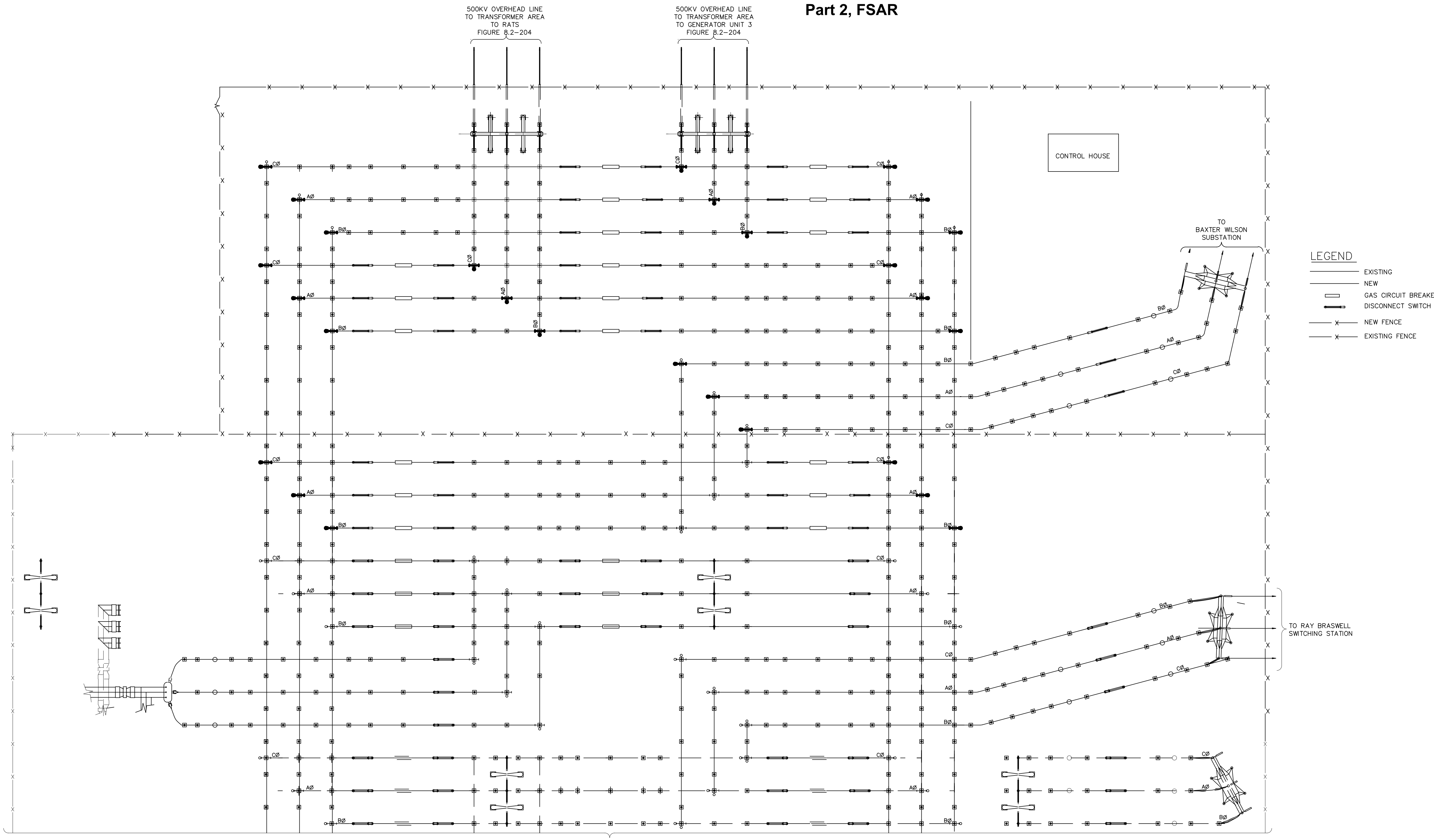


Figure 8.2-203. Switchyard Plan

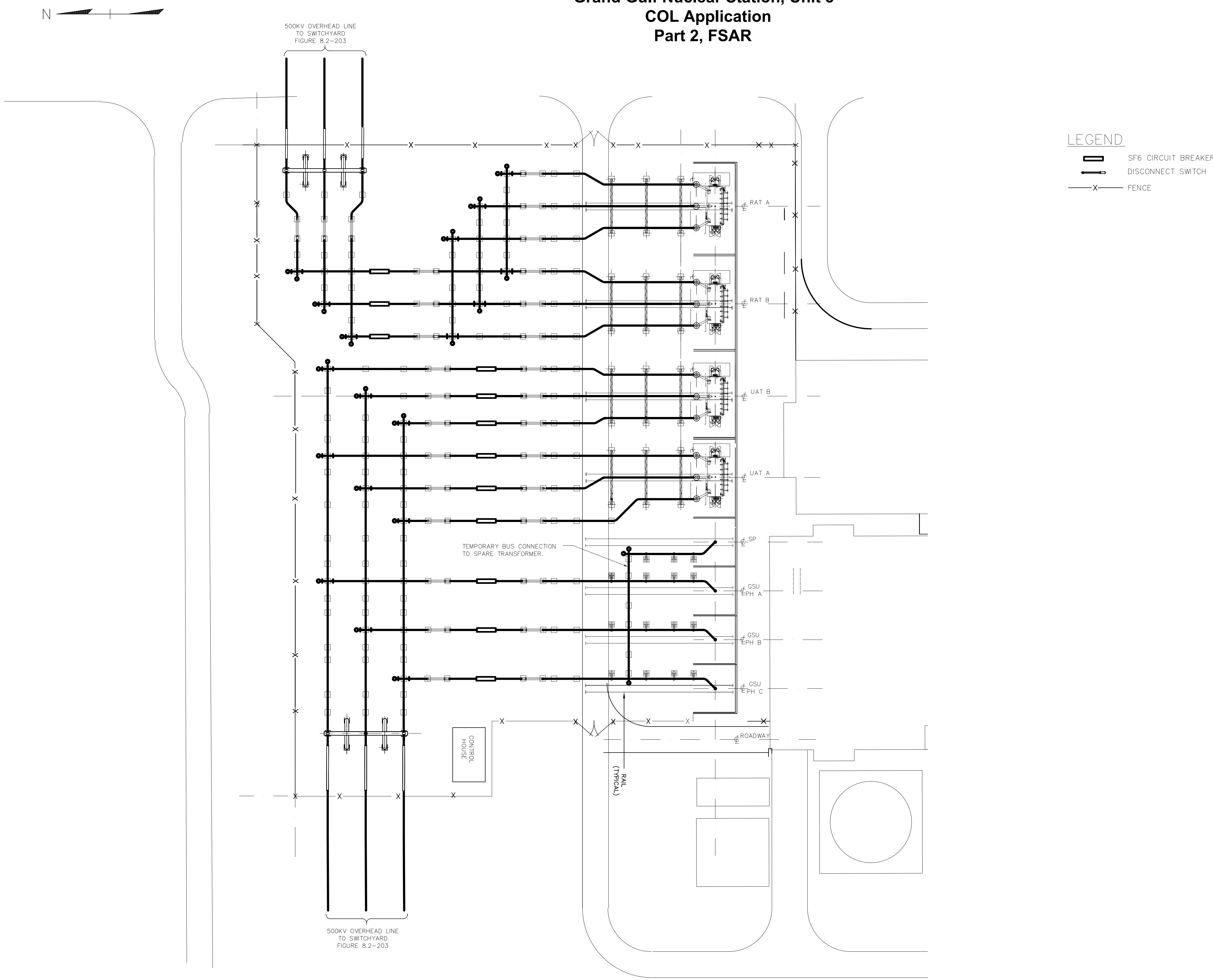


Figure 8.2-204. Transformer Area

8.3 ON-SITE POWER SYSTEMS

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

8.3.1.1 DESCRIPTION

Insert the following as the first paragraph.

GGNS SUP 8.3-1 An intermediate switchyard is utilized to transition off-site power from the GGNS 500-kV Switching Station to the Unit 3 main power transformers, the 500/13.8-6.9-kV UATs and the 500/13.8-6.9-kV RATs. This intermediate switchyard contains the generator circuit breaker, supply circuit breakers to the UATs and a supply circuit breaker to the RATs.

8.3.2.1.1 Safety-Related Station Batteries and Battery Chargers

Station Blackout

Add the following paragraph at the end of the Station Blackout section.

GGNS SUP 8.3-2 Training and procedures to mitigate an SBO event are implemented in accordance with Sections 13.2 and 13.5, respectively. The ESBWR is a passive design and does not rely on off-site or on-site AC sources of power for at least 72 hours after an SBO event, as described in DCD Section 15.5.5, Station Blackout. In addition, there are no nearby large power sources, such as a gas turbine or black start fossil fuel plant, that can directly connect to the station to mitigate the SBO event. Restoration from an SBO event will be contingent upon power being made available from any one of the following sources:

- Either of the station diesel generators
- Restoration of any one of the three 500 kV transmission lines described in Section 8.2

APPENDIX 8A MISCELLANEOUS ELECTRICAL SYSTEMS

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

8A.2 CATHODIC PROTECTION

8A.2.1 DESCRIPTION

Replace Section 8A.2.1 with the following.

GGNS COL 8A.2.3-1-A

The need for cathodic protection system will be determined during final design of the plant. If a cathodic protection system is required, it will be designed in accordance with the requirements of the National Association of Corrosion Engineers (NACE) Standards (DCD Reference 8A-5).

This section of the FSAR will be updated as necessary to describe the final design of the cathodic protection system.

8A.2.3 COL INFORMATION

8A.2.3-1-A Cathodic Protection System

GGNS COL 8A.2.3-1-A

This COL item is addressed in Section 8A.2.1.

CHAPTER 9 AUXILIARY SYSTEMS

9.1 FUEL STORAGE AND HANDLING

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

9.1.4 LIGHT LOAD HANDLING SYSTEM (RELATED TO REFUELING)

9.1.4.13 REFUELING OPERATIONS

Add the following paragraphs at the end of this section.

STD COL 9.1.6-4-A

Section 13.5 requires development of fuel handling procedures. Fuel handling procedures address the status of plant systems required for refueling; inspection of replacement fuel and control rods; designation of proper tools; proper conditions for spent fuel movement and storage; proper conditions to prevent inadvertent criticality; proper conditions for fuel cask loading and movement; and status of interlocks, reactor trip circuits and mode switches. These procedures provide instructions for use of refueling equipment, actions for core alterations, monitoring core criticality status, and accountability of fuel for refueling operations. Fuel handling procedures are developed six months before fuel receipt to allow sufficient time for plant staff familiarization, to allow NRC staff adequate time to review the procedures, and to develop operator licensing examinations.

Personnel qualifications and training for fuel handlers are addressed in Section 13.2.

9.1.4.19 INSPECTION AND TESTING REQUIREMENTS

Add the following paragraph at the end of this section.

STD COL 9.1.6-4-A

Section 17.5 describes the QA program that is applied to monitoring, implementing, and ensuring compliance with fuel handling procedures. As part of normal plant operations, the fuel-handling equipment is inspected for operating conditions before each refueling operation. During the operational testing of this equipment, procedures are followed that will affirm the correct performance of the fuel-handling system interlocks. Other maintenance and test procedures are developed based on manufacturer’s requirements.

9.1.5 OVERHEAD HEAVY LOAD HANDLING SYSTEMS (OHLHS)

9.1.5.6 OTHER OVERHEAD LOAD HANDLING SYSTEM

Add the following at the end of this section.

STD COL 9.1.6-5-A

Special Lifting Devices

For special lifting devices, the guidelines of ANSI N14.6 are implemented as specified with the following exceptions/clarifications:

- The acceptance criteria of paragraph 5.5.2 are applied to fabrication and repair welds only.
- The acceptance criteria for inservice inspection shall be limited to "No Cracks."
- The use of later editions of ASME Section V may be used to permit the use of advanced NDE technology.
- For the Dryer/Separator Strongback the requirement to routinely examine the load bearing welds every fifth refueling outage by nondestructive examination (NDE) (Magnetic Particle or Liquid Penetrant) will not be used. The lifting device shall be examined visually and dimensionally. The visual and dimensional examination shall be performed prior to the initial lift each outage. Any cracks in the coating or dimension out of tolerance shall require magnetic particle or liquid penetrant examination of the suspect welds and/or additional welds as required by Design Engineering.

Other Lifting Devices

Slings used for heavy load lifts meet the requirements specified for slings in ANSI B30.9 with the following clarification. Since dynamic loads constitute a small percentage of the total load imposed on slings, the sling's ratings are expressed in terms of maximum static load only.

9.1.5.8 OPERATIONAL RESPONSIBILITIES

Replace this section with the following.

STD COL 9.1.6-5-A

Procedures

Section 13.5 requires the development of administrative procedures to control heavy loads prior to fuel load to allow sufficient time for plant staff familiarization, to allow NRC staff adequate time to review the procedures, and to develop operator licensing examinations. Heavy loads handling procedures address:

- Equipment identification
- Required equipment inspections and acceptance criteria prior to performing lift and movement operations
- Approved safe load paths and exclusion areas
- Safety precautions and limitations
- Special tools, rigging hardware, and equipment required for the heavy load lift
- Rigging arrangement for the load
- Adequate job steps and proper sequence for handling the load

Safe load paths are defined for movement of heavy loads to minimize the potential for a load drop on irradiated fuel in the reactor vessel or spent fuel pool or on safe shutdown equipment. Paths are defined in procedures and equipment layout drawings. Safe load path procedures address the following general requirements:

- When heavy loads must be carried directly over the spent fuel pool, reactor vessel or safe shutdown equipment, procedures will limit the height of the load and the time the load is carried.
- When heavy loads could be carried (i.e., no physical means to prevent) but are not required to be carried directly over the spent fuel pool, reactor vessel or safe shutdown equipment, procedures will define an area over which loads shall not be carried so that if the load is dropped, it will not result in damage to spent fuel or operable safe shutdown equipment or compromise reactor vessel integrity.
- Where intervening structures are shown to provide protection, no load travel path is required.
- Defined safe load paths will follow, to the extent practical, structural floor members.

- When heavy loads movement is restricted by design or operational limitation, no safe load path is required.

- Supervision is present during heavy load lifts to enforce procedural requirements.

Inspection and Testing

Cranes addressed in this section are inspected, tested, and maintained in accordance with Section 2-2 of ANSI B30.2, Section 11.2 of ANSI B30.11, or Sections 16-1.2.1 and 16-1.2.3 of ANSI B30.16 with the exception that tests and inspections may be performed prior to use for infrequently used cranes. Prior to making a heavy load lift, an inspection of the crane is made in accordance with the above applicable standards.

Training and Qualification

Training and qualification of operators of cranes addressed in this section meet the requirements of ANSI B30.2, and include the following:

- Knowledge testing of the crane to be operated in accordance with the applicable ANSI crane standard.

- Practical testing for the type of crane to be operated.

- Supervisor signatory authority on the practical operating examination.

- Applicable physical requirements for crane operators as defined in the applicable crane standard.

Quality Assurance

Procedures for control of heavy loads are developed in accordance with Section 13.5. In accordance with Section 17.5, other specific quality program controls are applied to the heavy loads handling program, targeted at those characteristics or critical attributes that render the equipment a significant contributor to plant safety.

9.1.5.9 SAFETY EVALUATIONS

Add the following paragraph at the end of this section.

STD COL 9.1.6-5-A

No heavy loads are identified that are outside the scope of the certified design.

9.1.6 COL INFORMATION

9.1.6-4-A FUEL HANDLING OPERATIONS

STD COL 9.1.6-4-A

This COL item is addressed in Section 9.1.4.13 and Section 9.1.4.19.

9.1.6-5-A HANDLING OF HEAVY LOADS

STD COL 9.1.6-5-A

This COL item is addressed in Section 9.1.5.6, Section 9.1.5.8, and Section 9.1.5.9.

9.2 WATER SYSTEMS

9.2.1 PLANT SERVICE WATER SYSTEM

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

9.2.1.2 SYSTEM DESCRIPTION

Summary Description

Replace the Summary Description with the following information.

GGNS CDI

The source of cooling water to the Plant Service Water system (PSWS) is from either the normal power heat sink (NPHS) or the auxiliary heat sink (AHS) depending on plant conditions. The PSWS rejects heat from nonsafety-related RCCWS and TCCWS heat exchangers to the environment via either the NPHS or the AHS. A combination of a natural draft cooling tower and mechanical draft cooling towers is utilized for the NPHS and mechanical draft cooling towers are utilized for the AHS. Table 9.2-201 provides information on the PSWS cooling tower design characteristics.

GGNS COL 9.2.1-1-A

The materials for the various components of the PSWS are selected to preclude long-term corrosion and fouling of the PSWS based on site water quality.

Materials for the mechanical draft cooling towers and accessories contain, to the maximum extent practicable, noncombustible materials as defined in NFPA 220 (Reference 9.2.1-201).

GGNS CDI

A simplified diagram of the PSWS is shown in DCD Figure 9.2-1.

Detailed System Description

In the sixth paragraph, replace the last sentence with the following information.

GGNS COL 9.2.1-1-A

Fiberglass reinforced polyester pipe is used for buried PSWS piping to preclude long-term corrosion. Appropriate chemical treatment is added to the NPHS or the

AHS, as required to preclude long-term corrosion and fouling of the PSWS based on site water quality analysis.

In the eighth paragraph, replace the first sentence with the following information.

GGNS CDI

Unit 3 design heat loads are shown in DCD Table 9.2-1.

Delete the last paragraph.

Operation

Add the following text to the end of the second paragraph of this section.

GGNS SUP 9.2.1-1

During normal power operation, PSWS flow is directed to the NPHS cooling tower where heat removed from the RCCWS and TCCWS is rejected to the NPHS. During this mode of operation, the NPHS basin provides makeup to the AHS basin. During other modes of power operation, PSWS flow is directed to the AHS cooling tower where heat removed from the RCCWS and TCCWS is rejected to the AHS. During this mode of operation, makeup to the AHS basin is provided from the Station Water System (SWS).

9.2.1.6 COL INFORMATION

9.2.1-1-A Material Selection

GGNS COL 9.2.1-1-A

This COL Item is addressed in Section 9.2.1.2.

9.2.1.7 REFERENCES

9.2.1-201 National Fire Protection Association (NFPA), “Standard on Types of Building Construction” NFPA 220.

9.2.2 REACTOR COMPONENT COOLING WATER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.2.3 MAKEUP WATER SYSTEM

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

9.2.3.2 SYSTEM DESCRIPTION

Replace the introductory text and the Demineralization Subsystem portions of this section with the following.

GGNS CDI

The MWS consists of two subsystems: (1) the demineralization subsystem and (2) the storage and transfer subsystem. The makeup water transfer pumps and the demineralization subsystem are sized to meet the demineralized water needs of all operating conditions except for shutdown/refueling.

The MWS major equipment is housed in the Service Water/Water Treatment Building except for the demineralized water storage tank (which is outdoors and adjacent to this building) and the distribution piping to the interface systems.

The MWS equipment and associated piping in contact with demineralized water are fabricated from corrosion resistant materials such as stainless steel to prevent contamination of the makeup water due to corrosion.

Based on local weather conditions, the demineralized water storage tank and MWS piping and instrumentation that are exposed to freezing conditions are provided with freeze protection.

Table 9.2-202 lists the major MWS components.

Clarified, filtered river water is supplied to the MWS by the SWS (Section 9.2.10). Prior to transfer to the demineralized water storage tank, the clarified water is processed through a vendor supplied mobile water treatment system.

9.2.4 POTABLE AND SANITARY WATER SYSTEMS

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

Replace the information in this section with the following information.

9.2.4.1 DESIGN BASES

GGNS CDI

Safety Design Basis

The Potable Water System (PWS) and Sanitary Waste Discharge System (SWDS) do not perform any safety-related function. Therefore the PWS and SWDS have no safety design bases.

Power Generation Design Basis

The PWS and SWDS are designed to provide potable water supplies and sewage treatment necessary for normal plant operation and shutdown periods. The PWS is designed to supply 12.6 liters per second (200 gallons per minute) of potable water during peak demand periods.

The PWS is designed to produce and maintain the quality of water required by the authorities having jurisdiction.

The SWDS is designed to produce an effluent quality required by federal, state, and local regulations and permits.

9.2.4.2 SYSTEM DESCRIPTION

Potable Water System

The PWS consists of pumps, water heaters, and interconnecting piping and valves as shown on Figure 9.2-201. PWS component characteristics are shown in Table 9.2-203. Treated water from the GGNS site water tower is supplied to the potable water storage tank. In addition to non-radiological areas, potable water is provided to areas where inadvertent backflow into the system could result in radiological contamination of the potable water. For those branches with outlets in areas where the potential for radiological contamination exists, backflow prevention is provided through the installation of air gaps.

Sanitary Waste Discharge System

The SWDS consists of a prefabricated, aerobic, digestion-type sewage-treatment plant, capable of treating between 100,000 and 160,000 gallons per day of potable sewage. The plant includes a comminutor and clarifier in addition to the aeration chamber. The effluent is discharged to Stream A. The quality of effluent meets, as a minimum, the standards established by federal, state, and local regulations and permits. The sewage treatment plant is shared with Unit 1. A simplified diagram of the SWDS is shown in Figure 9.2-202.

9.2.4.3 SAFETY EVALUATION

Potable Water System

The PWS has no safety-related function and is not connected to any safety-related structure, system or component. The PWS meets GDC 60 for features provided to control the release of liquid effluents containing radioactive material. Failure of the system will not compromise any safety-related equipment or component and will not prevent safe shutdown of the plant. The PWS does not handle radioactive fluids. It is not connected to any system that may contain radioactive fluids. Any possibility of back flow which could introduce radioactive fluids into the PWS is precluded by the installation of air gaps.

Sanitary Waste Discharge System

The SWDS has no safety-related function and is not connected to any safety-related structure, system or component. The SWDS System meets GDC 60 for features provided to control the release of liquid effluents containing radioactive material. Failure of the system will not compromise any safety-related equipment or component and will not prevent safe shutdown of the plant.

The SWDS does not handle radioactive fluids. It is neither connected to, nor does it interface with any system that may contain radioactive fluids. This system does not have any potential for radioactive contamination. SWDS effluent is monitored as described in Table 11.5-201.

9.2.4.4 INSPECTION AND TESTING

Ongoing monitoring of the availability of the PWS and SWDS is maintained through regular use of the systems during plant operation.

9.2.4.5 INSTRUMENTATION APPLICATION

The PWS and SWDS are furnished with instrumentation that will permit local and/or remote monitoring and control of each respective process. This instrumentation includes all meters, switches, indicators, pressure gauges, transmitters, controllers, and valves required for service operation and for the protection of plant personnel and equipment.

9.2.5 ULTIMATE HEAT SINK

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

Replace the second to last sentence in the seventh paragraph with the following.

STD COL 9.2.5-1-A

Procedures that identify and prioritize available makeup sources seven days after an accident, and provide instructions for establishing necessary connections, will be developed in accordance with the procedure development milestone in Section 13.5.

9.2.5.1 COL INFORMATION

9.2.5-1-A POST 7 DAY MAKEUP TO UHS

STD COL 9.2.5-1-A

This COL Item is addressed in Section 9.2.5.

9.2.6 CONDENSATE STORAGE AND TRANSFER SYSTEM

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

9.2.6.2 SYSTEM DESCRIPTION

Add the following at the end of the first paragraph.

STD SUP 9.2.6-1 Freeze protection is provided for the CS&TS.

9.2.7 CHILLED WATER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.2.8 TURBINE COMPONENT COOLING WATER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.2.9 HOT WATER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.2.10 STATION WATER SYSTEM

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

9.2.10.2 SYSTEM DESCRIPTION

Detailed System Description

Replace the Detailed System Description and System Operation portions of this section with the following.

GGNS CDI

The SWS provides clarified water from the Mississippi River to the Circulating Water System (CIRC) (Section 10.4.5) and PSWS (Section 9.2.1) cooling tower basins to make up for losses resulting from evaporation, drift, and blowdown from the cooling towers. The SWS also provides filtered clarified water to the Makeup Water System (MWS) (Section 9.2.3) for further treatment for use as demineralized water, and to the Fire Protection System (FPS) (Section 9.5.1) to fill the primary and yard fire water storage tanks.

The SWS draws raw water from an embayment in the Mississippi River through two strainers located below the extreme low water level of the river. The water is drawn through two intake pipes to two dry-pit type vertical pumps located in an intake structure. One pump normally operates with the other on standby. An interconnection between the two suction pipes permits an operating pump to draw river water through either strainer.

A simplified diagram of the SWS is shown in Figure 9.2-203. The design characteristics of the major SWS components are provided in Table 9.2-204.

A vacuum system provides priming of the suction piping for starting of the SWS pumps, and maintains prime during operation of the SWS. Provisions for venting, filling and draining the suction and discharge piping are included in the SWS design. Recirculation lines that discharge back to the river embayment protect the SWS pumps during low flow operation. Backflow lines enable flushing of the standby strainer in the idle suction pipe by reverse flow from the operating SWS pump discharge.

The SWS pumps discharge into a common pipe that extends from the intake structure to a splitter box adjacent to two clarifiers. The makeup flow rate is controlled by water level in the splitter box.

Flow to the four 33-1/3 percent clarifiers is equally divided in the splitter box to the operating clarifiers. Coagulants are automatically added to the streams by skid mounted pumps. The rate of coagulant addition is automatically adjusted according to the influent flow rate. The effluent from the clarifiers is collected in a clearwell basin. Clarifier underflow is forwarded to the cooling tower blowdown line for discharge to the river.

Makeup to the CIRC is provided by gravity feed from the clearwell to the NPHS cooling tower basin via a flow control valve.

Two wet-pit type vertical pumps located in the clearwell basin provide PSWS makeup to the AHS cooling tower basins via a flow control valve. Each pump is sized for full makeup capacity.

Two wet-pit type vertical demineralizer feed pumps, also located in the clearwell, discharge through granular media filters to provide continuous feed to the MWS demineralizers. One pump and two of the three filters function to support the MWS. The demineralizer feed pumps also provide pretreated filtered water for filling the FPS primary and yard firewater storage tanks. This equipment is sized such that the yard firewater storage tank can be refilled within eight hours, as specified by RG 1.189, when both pumps and three filters are in operation. Backwash from the filters is drained to the cooling tower blowdown piping for discharge to the river.

System Operation

The SWS operates during all modes of normal plant operations. One SWS pump provides sufficient flow for all plant requirements. The standby pump starts automatically if the operating pump trips.

Makeup flow to the NPHS, which represents over 90% of total plant makeup, is not normally required when the plant is not operating. During these low makeup conditions, the operating SWS pump is throttled to the minimum flow necessary for safe pump operation, and excess flow not required for makeup is recirculated to the intake embayment.

9.2.10.5 INSTRUMENTATION REQUIREMENTS

Replace the first and second paragraphs of this section with the following.

Instruments are provided for monitoring system parameters. Operation of the SWS pumps and clarifiers is monitored in the Main Control Room (MCR).

GGNS CDI

High and low level of pretreated water in the clarifier clearwell, and low suction pressure for each pump taking suction from the clearwell, are alarmed in the MCR.

GGNS CDI Replace the "PSWS Cooling Towers and Basins" section of DCD Table 9.2-2 with the following.

TABLE 9.2-201
PSWS COMPONENT DESIGN CHARACTERISTICS

PSWS Mechanical-Draft Cooling Towers

	Type	Mechanical draft, multi-cell, redundant dual speed, reversible fans
	Quantity	2
	Heat Load Each[2]	[87.2 MW (2.98 x 10^8 BTU/h)]*
	Flow Rate (Water)	2.524 m^3/s (40,000 gpm)
	Ambient Wet Bulb Temperature	27.2°C (81°F)
	Approach Temperature	3.9°C (7°F)
	Cold Leg Temperature	31.1°C (88°F)
GGNS SUP 9.2.1-2	Basin Reserve Storage Capacity[1]	2.4 million gallons

1. PSWS required to remove 2.02 x 10^7 MJ (1.92 x 10^{10} BTU) for period of 7 days without active makeup. The volume is defined as the minimum volume above the pump minimum submergence water level.

2. Minimum heat load cooling towers need to be able to reject.

*Per DCD Table 9.2-1.

GGNS CDI Replace DCD Table 9.2-9 with Table 9.2-202.

TABLE 9.2-202
MAJOR MAKEUP WATER SYSTEM COMPONENTS

- One 950 m^3 (250,963 gal) demineralized water storage tank.
- Two 1,249 l/min (330 gpm) makeup water transfer pumps.

TABLE 9.2-203
POTABLE WATER SYSTEM COMPONENT CHARACTERISTICS

GGNS CDI

Potable Water Pumps	
Quantity	2
Capacity	45.4 m^3/hr (200 gpm)
Potable Water Jockey Pump	
Quantity	1
Capacity	2.3 m^3/hr (10 gpm)
Potable Water Storage Tank	
Quantity	1
Capacity	75.7 m^3 (20,000 gal)
Hot Water Tank	
Quantity	1 per building
Type	Electric Emersion Heater or On-Demand In-Line Heaters.

TABLE 9.2-204 (Sheet 1 of 2)
STATION WATER SYSTEM
COMPONENT DESIGN CHARACTERISTICS

GGNS CDI

Intake Strainers	
Quantity	2 – 100%
Capacity each	7,222.6 m^3/hr (31,800 gpm)
Maximum Pressure Drop	14.95 kPa (5 ft.)
Maximum Flow Velocity	0.152 m/s (0.5 fps)[(a)]
SWS Pumps	
Type	Vertical, dry-pit
Quantity	2 – 100%
Capacity each	7,222.6 m^3/hr (31,800 gpm)
Clarifiers	
Quantity	4 – 33 1/3%
Type	Internal sludge recirculation
Capacity each	2,407.5 m^3/hr (10,600 gpm)
Coagulant	Aluminum sulfate
Clearwell Basin	
Storage volume	1,136 m^3 (300,000 gal)
Demineralizer Feed Pumps	
Type	Vertical, wet-pit
Quantity	2 – 100%
Capacity each	129.4 m^3/hr (570 gpm)

TABLE 9.2-204 (Sheet 2 of 2)
STATION WATER SYSTEM
COMPONENT DESIGN CHARACTERISTICS

GGNS CDI

Granular Media Filters	
Type	Air scour
Quantity	3 – 50%
Capacity each	84.1 m^3/hr (370 gpm)
PSWS Makeup Pumps	
Type	Vertical, wet-pit
Quantity	2 – 100%
Capacity each	220.5 m^3/hr (971 gpm)

(a) The maximum flow velocity for the intake strainers is based on 40 CFR Parts 9, 122, et. al., "Regulations Addressing Cooling Water Intake Structures for New Facilities."

NOTES

1. ALL COMPONENT NUMBERS START WITH U42-.
2. THE HOT WATER TANK AND WATER DISTRIBUTION ARE TYPICAL FOR EACH BUILDING. BUILDINGS ARE THE ADMIN BUILDING, SERVICE BUILDING / OSC, EB/TSC, AND CB.
3. SERVICE FAUCETS AND HOSE CONNECTIONS SHOWN ON DETAILED DESIGN DRAWINGS.

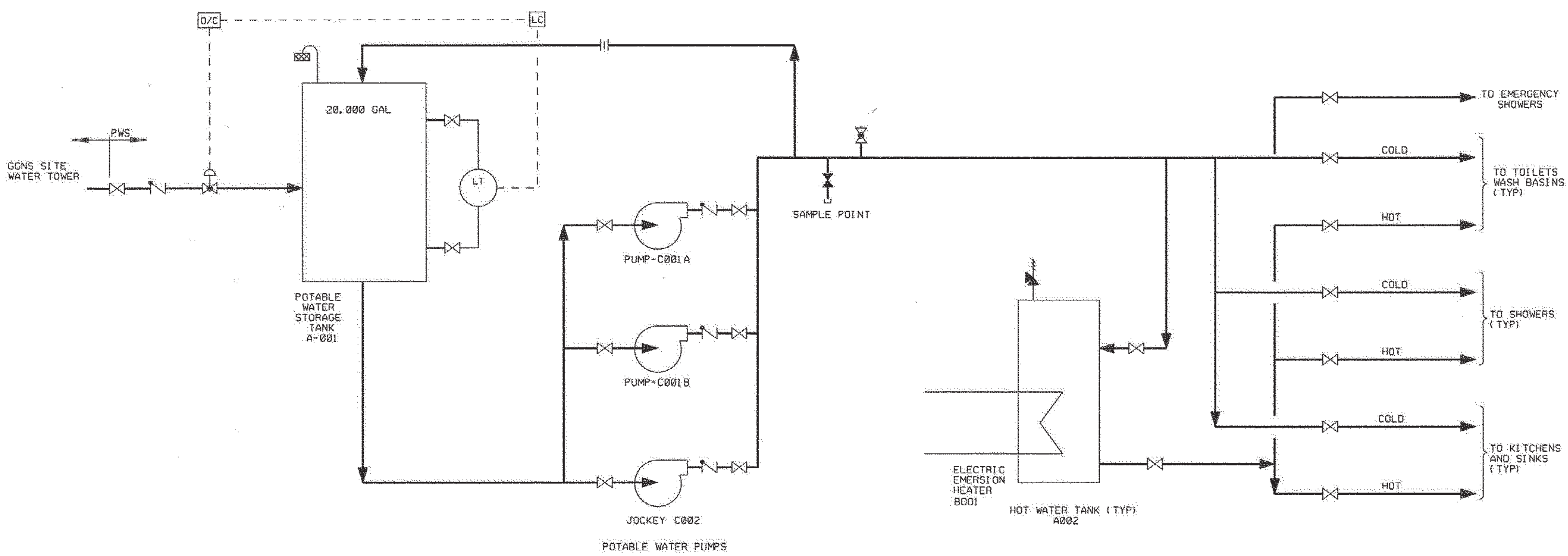


Figure 9.2-201. Potable Water System Simplified Diagram

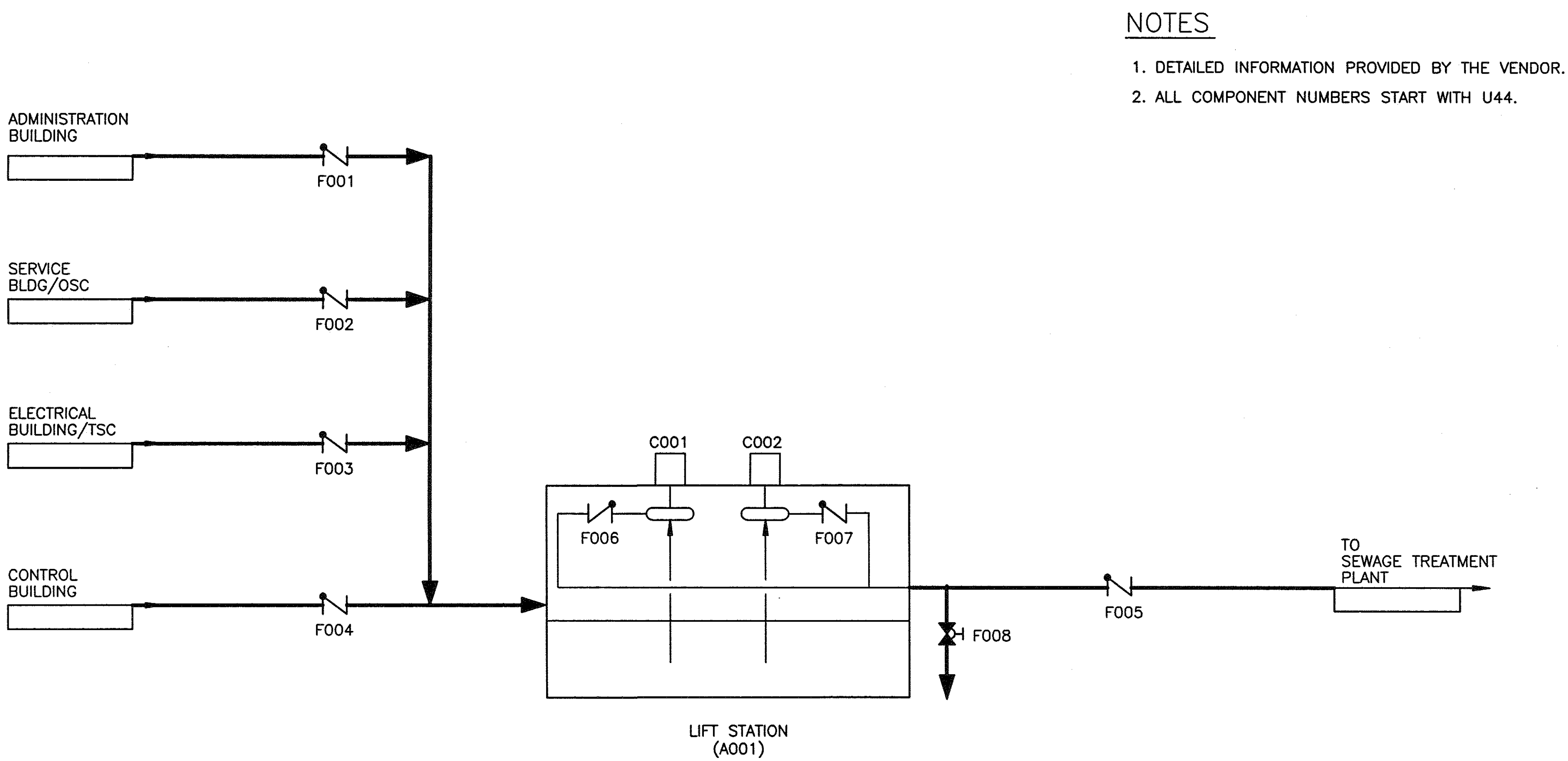


Figure 9.2-202. Sanitary Waste Discharge System Simplified Diagram

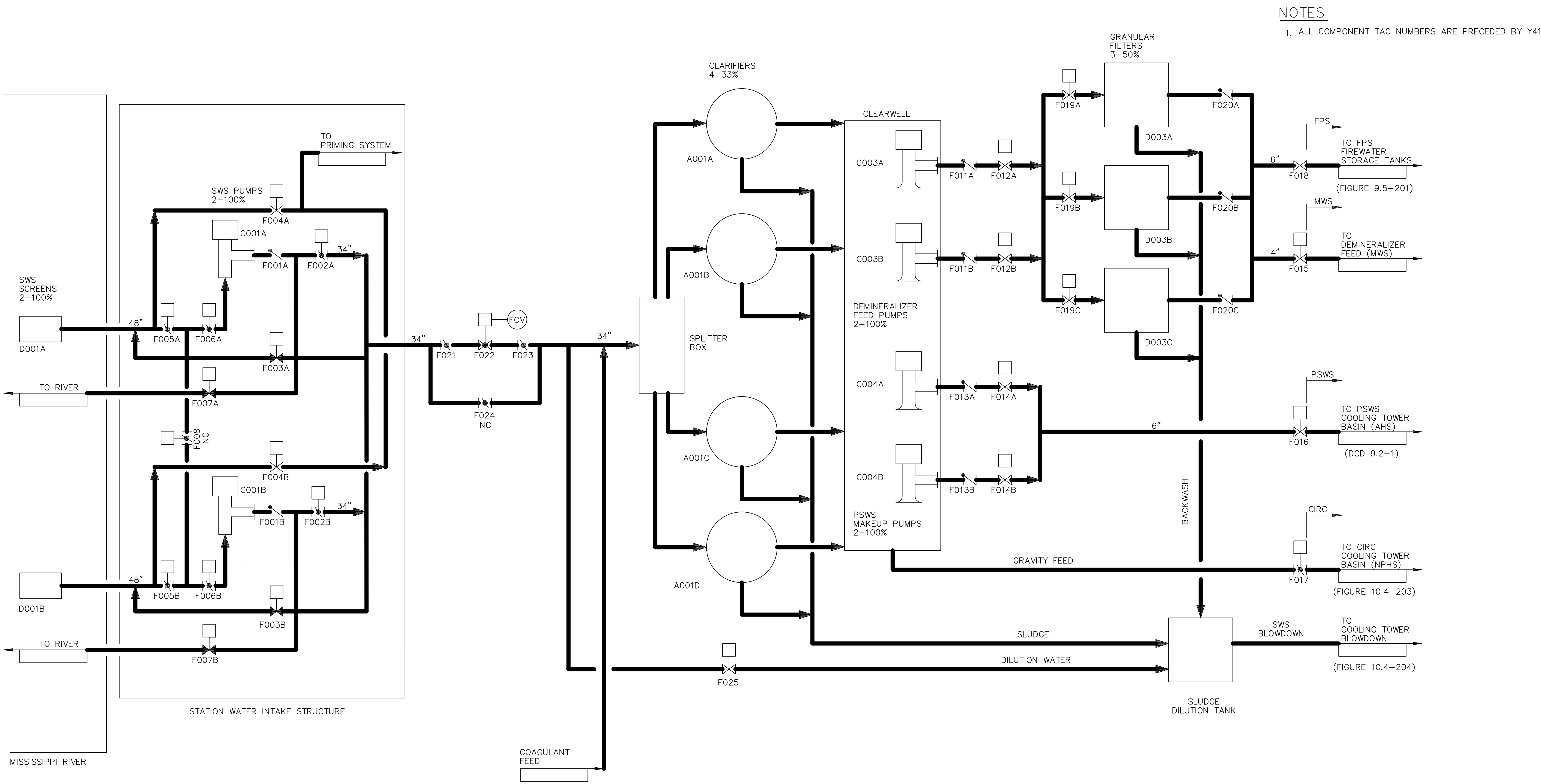


Figure 9.2-203. Station Water System Simplified Diagram

9.3 PROCESS AUXILIARIES

9.3.1 COMPRESSED AIR SYSTEMS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.2 PROCESS SAMPLING SYSTEM

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

9.3.2.2 SYSTEM DESCRIPTION

Add the following at the end of this section.

STD COL 9.3.2-1-A

Post-Accident Sampling Program

The post-accident sampling program consists of the following:

- Emergency Operating Procedures that rely on Emergency Action Levels, defined in the Emergency Plan, are used to classify fuel damage events. These procedures rely on installed post-accident radiation monitoring instrumentation described in DCD Section 7.5 and do not require the capability to obtain and analyze highly radioactive coolant samples although sample analyses may be used for classification as well.

- Plant procedures contain instructions for obtaining highly radioactive grab samples from the following:

  Reactor Coolant - from the RWCU/SDC sample line using the Reactor Building Sample Station. These samples can be analyzed for the parameters indicated in DCD Table 9.3-1. If coolant activity is greater than 1.0 Ci/ml, handling of the samples is delayed to avoid overexposure of personnel.

  Suppression Pool - from FAPCS sample line at the Reactor Building Sample Station. These samples can be analyzed for the parameters indicated in DCD Table 9.3-1. If coolant activity is greater than 1.0 Ci/ml, handling of the samples is delayed to avoid overexposure of personnel.

  Containment Atmosphere - may be taken as described in DCD Section 11.5.3.2.12 and analyzed for fission products.

- DCD Section 7.5.2.2 describes Containment Monitoring System operation in post-LOCA mode for gaseous sampling for O_2 and H_2.

- Effluent radiation monitoring is described in DCD Section 7.5. Field sampling and monitoring capability is maintained in accordance with the Emergency Plan.

- Post accident monitoring is adequate to implement the Emergency Plan without reliance on post accident sampling capability; therefore, the absence of a dedicated Post-Accident Sampling System does not reduce the effectiveness of the Emergency Plan.

- The post-accident sampling program meets the requirements of NUREG-0800, Section 9.3.2 for actions required in lieu of a Post Accident Sampling System.

9.3.2.6 COL INFORMATION

9.3.2-1-A POST-ACCIDENT SAMPLING PROGRAM

STD COL 9.3.2-1-A

This COL item is addressed in Section 9.3.2.2.

9.3.3 EQUIPMENT AND FLOOR DRAIN SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.4 CHEMICAL AND VOLUME CONTROL SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.5 STANDBY LIQUID CONTROL SYSTEM

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

9.3.5.2 SYSTEM DESCRIPTION

Detailed System Description

Add the following to the end of the fifth paragraph.

STD SUP 9.3.5-1 The above provisions adequately prevent loss of solubility of borated solutions (sodium pentaborate).

9.3.6 INSTRUMENT AIR SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.7 SERVICE AIR SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.8 HIGH PRESSURE NITROGEN SUPPLY SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.3.9 HYDROGEN WATER CHEMISTRY SYSTEM

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

STD COL 9.3.9-1-A

Replace the first paragraph with the following.

The site specific design includes HWCS.

9.3.9.1 DESIGN BASIS

Power Generation Design Basis

Replace the first sentence with the following.

STD CDI

Hydrogen is added into the feedwater at the suction of the feedwater pumps and oxygen into the offgas system.

9.3.9.2 SYSTEM DESCRIPTION

Replace this section with the following.

GGNS CDI

GGNS COL 9.3.9-2-A

The HWCS, illustrated in DCD Figure 9.3-5, is composed of hydrogen and oxygen supply systems to inject hydrogen in the feedwater and oxygen in the offgas. Monitoring systems are used to track the effectiveness of the HWCS. The HWCS utilizes the existing Unit 1 cryogenic skid. The skid is located north of Unit 1 outside the protected area to facilitate vendor deliveries. The cryogenic skid is vendor supplied, monitored and maintained.

GGNS CDI

The HWCS is implemented with On-line Noble Chem™ (OLNC). Plant personnel conduct the OLNC process while the plant is operating.

The hydrogen supply system is integrated with the generator hydrogen supply system (as described in DCD Section 10.2.2.2.8).

9.3.9.2.1 Hydrogen Storage Facility

GGNS CDI

GGNS COL 9.3.9-2-A

The Unit 1 cryogenic skid has 20,000 gallons of storage capacity for hydrogen and 9,000 gallons of storage capacity for oxygen. The skid is more than 737 ft. away from Unit 3 safety-related structures.

9.3.9.4 INSPECTION AND TESTING REQUIREMENTS

Replace this section with the following.

STD CDI

The connections for the Hydrogen Water Chemistry System are tested and inspected with the feedwater and offgas piping.

Major components of the HWCS are tested and inspected as separate components prior to installation. The system is tested in accordance with vendor requirements after installation to ensure proper performance.

9.3.9.5 INSTRUMENTATION AND CONTROLS

Replace the first sentence with the following.

STD CDI

Instrumentation is provided to control the injection of hydrogen and augment the injection of oxygen.

9.3.9.6 COL INFORMATION

9.3.9-1-A Implementation of Hydrogen Water Chemistry

STD COL 9.3.9-1-A This COL item is addressed in Section 9.3.9.

9.3.9-2-A Hydrogen and Oxygen Storage and Supply

GGNS COL 9.3.9-2-A This COL item is addressed in Sections 9.3.9.2 and 9.3.9.2.1.

9.3.10 OXYGEN INJECTION SYSTEM

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

9.3.10.2 SYSTEM DESCRIPTION

GGNS COL 9.3.10-1-A

Replace the last sentence in this section with the following.

The Unit 3 Oxygen Injection System is supplied from the Unit 1 liquid oxygen storage tank. The Unit 1 cryogenic skid holds 9000 gallons of oxygen. It is located north of Unit 1 outside the protected area to facilitate vendor deliveries. The cryogenic skid is vendor supplied, monitored and maintained. There are regular deliveries of oxygen based on vendor monitoring. Hazards associated with the storage of liquid oxygen were evaluated in SSAR Section 2.2.3.

9.3.10.6 COL INFORMATION

9.3.10-1-A Oxygen Storage Facility

GGNS COL 9.3.10-1-A

This COL item is addressed in Section 9.3.10.2.

9.3.11 ZINC INJECTION SYSTEM

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

9.3.11.2 SYSTEM DESCRIPTION

Replace the second paragraph with the following.

STD COL 9.3.11-1-A A Zinc Injection System is not utilized.

9.3.11.4 TEST AND INSPECTIONS

Replace the second paragraph with the following.

STD COL 9.3.11-2-A A Zinc Injection System is not utilized.

9.3.11.6 COL INFORMATION

9.3.11-1-A Determine Need for Zinc Injection System

STD COL 9.3.11-1-A This COL item is addressed in Section 9.3.11.2.

9.3.11-2-A Provide System Description for Zinc Injection System

STD COL 9.3.11-2-A This COL item is addressed in Section 9.3.11.4.

9.3.12 AUXILIARY BOILER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.4 HEATING, VENTILATION, AND AIR CONDITIONING

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5 OTHER AUXILIARY SYSTEMS

9.5.1 FIRE PROTECTION SYSTEM

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

9.5.1.1 DESIGN BASES

Codes, Standards, and Regulatory Guidance

Add the following sentence at the end of this section.

GGNS SUP 9.5.1-1

Table 9.5-201 supplements DCD Table 9.5-1. for those portions outside the DCD and operational aspects of the fire detection and suppression systems.

9.5.1.2 SYSTEM DESCRIPTION

Add the following sentence after the first sentence in the first paragraph.

GGNS COL 9.5.1-4-A

Figure 9.5-201 provides a simplified diagram of the site-specific firewater supply piping.

GGNS COL 9.5.1-1-A 9.5.1-2-A

Delete the “*” and “**” footnotes in DCD Table 9.5-2.

9.5.1.4 FIRE PROTECTION WATER SUPPLY SYSTEM

Water Sources

Replace the first paragraph, with the exception of the next to last sentence with the following.

GGNS COL 9.5.1-4-A

As identified by DCD Figure 9.5-1 and Figure 9.5-201, water for the FPS is supplied from a minimum of two sources: i) at least one “primary” source to the suctions of primary fire pumps and corresponding jockey fire pumps and, ii) at least one "secondary" source to suctions of secondary fire pumps and corresponding jockey fire pumps. The primary source is two dedicated, Seismic Category I, firewater storage tanks. Each primary firewater storage tank has sufficient capacity to meet the maximum firewater demand for a period of up to 120 minutes.

GGNS COL 9.5.1-1-A

The secondary firewater source is two 100 percent, non-seismic, firewater storage tanks. Each tank has a capacity of 300,000 gallons which meets NFPA 804 requirements. The tanks are interconnected such that fire pumps can take suction from either or both of the storage tanks. The size of each tank is sufficient to supply the total water demand of the yard loop for a period of at least 120 minutes or 50% of the maximum firewater demand to the turbine building loop for a period of up to two hours. The tanks are nonsafety-related, non-seismic, and are constructed in accordance with NFPA 22. Clarified makeup water to the tanks is supplied from the SWS with makeup capacity sufficient to refill the tank within an 8 hour period.

Fire Pumps

STD COL 9.5.1-2-A

Replace the sixth sentence in the first paragraph with the following.

Testing will be performed to demonstrate that the secondary fire protection pump circuit supplies a minimum of 484 m^3/hr (2130 gpm) with sufficient discharge pressure to develop a minimum of 107 psig line pressure at the Turbine Building/ yard interface boundary. This cannot be performed until the system is built. This activity will be completed prior to fuel receipt.

9.5.1.5 FIREWATER SUPPLY PIPING, YARD PIPING, AND YARD HYDRANTS

GGNS COL 9.5.1-4-A

Delete the last sentence in this section, and add the following sentence at the end of the first paragraph of this section.

Figure 9.5-201 provides a simplified diagram of the site-specific firewater supply piping.

9.5.1.10 FIRE BARRIERS

STD COL 9.5.1-5-A

Replace the last paragraph with the following.

Mechanical and electrical penetration seals and electrical raceway fire barrier systems are qualified to the requirements delineated in RG 1.189 by an independent testing laboratory in accordance with the applicable guidance of NFPA 251 and/or ASTM E-119. Detailed design in this area is not complete. Specific design and certification test results for penetration seal designs and electrical raceway fire barrier systems will be available for review at least six months prior to fuel receipt

9.5.1.11 BUILDING VENTILATION

STD COL 9.5.1-6-H

Replace the last sentence in the third paragraph with the following.

Procedures for manual smoke control will be developed as part of the Fire Protection Program implementation. The required elements of the Fire Protection Program are fully operational prior to receipt of new fuel for buildings storing new fuel and adjacent fire areas that could affect the fuel storage area. Other required elements of the Fire Protection Program described in this section are fully operational prior to initial fuel loading per Section 13.4.

9.5.1.12 SAFETY EVALUATION

STD COL 9.5.1-7-H

Replace the fifth paragraph with the following.

A compliance review of the as-built design against the assumptions and requirements stated in the FHA will be completed in accordance with the milestones in Section 13.4.

STD SUP 9.5.1-2

Add the following after the fifth paragraph.

An as-built review of final post-fire safe-shutdown analysis will be performed based on final plant cable routing and equipment arrangement. This review will include verification that purchased components required for post-fire safe shutdown are not impacted by indirect effects of fire such as smoke migration from one fire area to another. This activity will be completed in accordance with the milestones in Section 13.4.

9.5.1.15 FIRE PROTECTION PROGRAM

STD COL 9.5.1-8-A

Replace the last sentence of the first paragraph with the following.

The elements of the Fire Protection Program necessary to support receipt and storage of fuel on-site for buildings storing new fuel and adjacent fire areas that could affect the fuel storage area are fully operational prior to receipt for new fuel. Other required elements of the Fire Protection Program described in this section are fully operational prior to initial fuel loading per Section 13.4.

9.5.1.15.1 Fire Protection Program Criteria

Add the following sentence at the end of this section.

GGNS SUP 9.5.1-1

Table 9.5-201 supplements DCD Table 9.5-1.

9.5.1.15.2 Organization and Responsibilities

STD COL 9.5.1-9-A

Replace the last sentence of the thirteenth bullet of the section as follows.

Control of changes to the fire protection program is defined in a license condition. Changes to the approved fire protection program may be made without prior approval of the NRC only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

9.5.1.15.4 Onsite Fire Operations Training

GGNS COL 9.5.1-10-H

Replace the first paragraph with the following.

The organization of the fire brigade is discussed in Section 13.1. Implementation of the fire brigade will be in accordance with the milestone in Section 13.4 for the Fire Protection Program.

9.5.1.15.9 Quality Assurance

STD COL 9.5.1-11-A

Replace the last sentence of this section with the following.

The Quality Assurance Program implements the requirements of RG 1.189 through site-specific administrative control procedures. The procedures will be developed six months prior to fuel receipt and will be fully implemented prior to fuel receipt.

9.5.1.16 COL INFORMATION

9.5.1-1-A Secondary Firewater Storage Source

GGNS COL 9.5.1-1-A

This COL item is addressed in Sections 9.5.1.2 and 9.5.1.4.

9.5.1-2-A Secondary Firewater Capacity

GGNS COL 9.5.1-2-A

This COL item is addressed in Sections 9.5.1.2 and 9.5.1.4.

9.5.1-4-A Piping and Instrument Diagrams

GGNS COL 9.5.1-4-A

This COL item is addressed in Sections 9.5.1.2, 9.5.1.4, 9.5.1.5, and Figure 9.5-201.

9.5.1-5-A Fire Barriers

STD COL 9.5.1-5-A

This COL item is addressed in Section 9.5.1.10.

9.5.1-6-H Smoke Control

STD COL 9.5.1-6-H

This COL item is addressed in Section 9.5.1.11.

9.5.1-7-H FHA Compliance Review

STD COL 9.5.1-7-H

This COL item is addressed in Section 9.5.1.12.

9.5.1-8-A Fire Protection Program Description

STD COL 9.5.1-8-A

This COL item is addressed in Section 9.5.1.15.

9.5.1-9-A Fire Protection Program License Changes

STD COL 9.5.1-9-A

This COL item is addressed in Section 9.5.1.15.2.

9.5.1-10-H Fire Brigade

GGNS COL 9.5.1-10-H

This COL item is addressed in Sections 9.5.1.15.4 and 13.1.2.1.5.

9.5.1-11-A Quality Assurance

STD COL 9.5.1-11-A

This COL item is addressed in Section 9.5.1.15.9.

9.5.2 COMMUNICATIONS SYSTEM

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

9.5.2.2 SYSTEM DESCRIPTION

Emergency Communications Systems

Replace the last sentence of the first bullet with the following.

GGNS COL 9.5.2.5-1-A

The description of the ENS is provided in the plant Emergency Plan. The ENS phone lines are routed directly to the Port Gibson Central Office via 24 phone lines through a telephone utility switch that is located on site in the telephone equipment building. The normal power for this device is the Site Power Loop. The Site Power Loop is nonsafety-related and is de-energized during a loss of off-site power. The utility switch equipment on site is battery powered for a period of approximately eight hours following a loss of normal power. This design ensures that the ENS located at the site is fully operable from the site in the event of a loss of off-site power at the site and is in compliance with the requirements of NRC Bulletin 80-15 for the ENS. The Operational Hotlines (described in the plant Emergency Plan) are normally powered from the Site Power Loop with battery and emergency diesel generator backup power supply. Computerized ENS is used to notify the plant emergency response personnel upon declaration of an emergency. The system is located in the EOF and receives electrical power from the EOF emergency diesel generator in the event of loss of normal power supply. A battery powered backed uninterruptible power supply provides power to the emergency notification system during the electrical power switchover.

Replace the last bullet with the following.

GGNS COL 9.5.2.5-2-A

- Transmission System Operator Communications Link: Voice communications with the grid operator are provided via a Company-owned and -maintained fiber optic transmission system that allows telephone communications with the entire Corporation System. Access to this mode of transmission is made via the plant telephone system. A dedicated handset is provided between the Control Room and the power system operator.

9.5.2.5 COL INFORMATION

9.5.2.5-1-A Off-site Interfaces

GGNS COL 9.5.2.5-1-A

This COL item is addressed in Section 9.5.2.2.

9.5.2.5-2-A Grid Transmission Operator

GGNS COL 9.5.2.5-2-A

This COL item is addressed in Section 9.5.2.2.

9.5.3 LIGHTING SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5.4 DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM

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

9.5.4.2 SYSTEM DESCRIPTION

Detailed System Description

Replace the third to last sentence in the first paragraph with the following.

STD COL 9.5.4-1-A

Procedures require that the quantity of DG fuel oil in the fuel oil storage tanks is monitored on a periodic basis. The diesel fuel oil usage is tracked against planned deliveries. Regular transport replenishes the fuel oil inventory during periods of high demand and ensures continued supply in the event of adverse weather conditions. These procedures ensure sufficient diesel fuel oil inventory is available on site so that the diesel can operate continually for seven days. The procedures will be developed in accordance with the milestone and processes described in Section 13.5.

Replace the 3rd paragraph with the following.

GGNS COL 9.5.4-2-A

The material for the underground piping portion of the fuel oil transfer system is carbon steel. The buried section of the piping is provided with waterproof protected coating.

9.5.4.6 COL INFORMATION

STD COL 9.5.4-1-A

9.5.4-1-A Fuel Oil Capacity

This COL item is addressed in Section 9.5.4.2.

GGNS COL 9.5.4-2-A

9.5.4-2-A Protection of Underground Piping

This COL item is addressed in Section 9.5.4.2.

9.5.5 DIESEL GENERATOR JACKET COOLING WATER SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5.6 DIESEL GENERATOR STARTING AIR SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5.7 DIESEL GENERATOR LUBRICATION SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5.8 DIESEL GENERATOR COMBUSTION AIR INTAKE AND EXHAUST SYSTEM

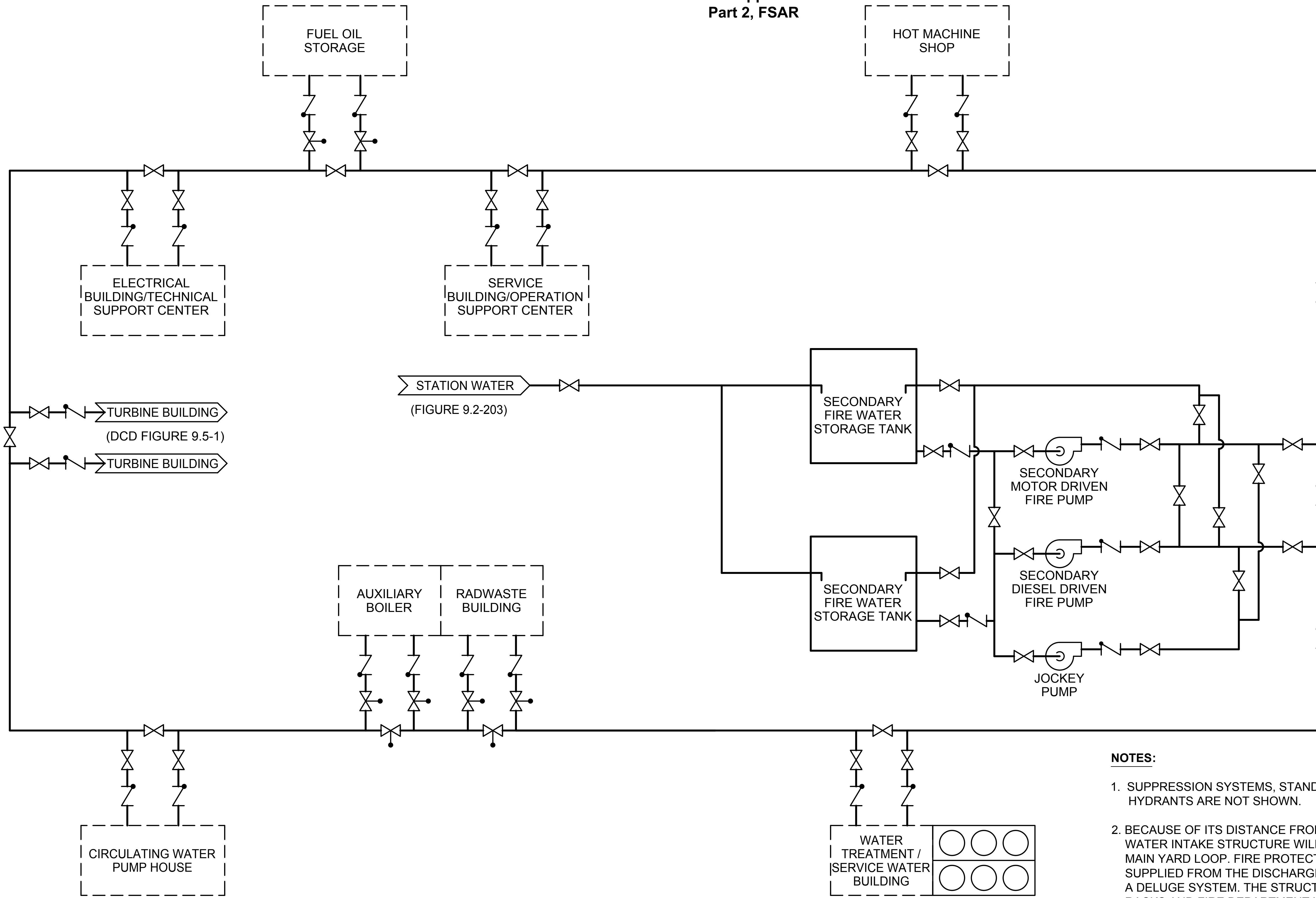
This section of the referenced DCD is incorporated by reference with no departures or supplements.

GGNS SUP 9.5.1-1

GGNS SUP 9A-1

TABLE 9.5-201
CODES AND STANDARDS

American Society of Mechanical Engineers (ASME)	
Boiler and Pressure Vessel Code	Section IX, Qualification Standard for Welding and Brazing Procedures, Welder, Brazers and Welding and Brazing Operators
Applicable Building Codes	
Standard Southern Building Code	Standard Southern Building Code
Uniform Building Code	Uniform Building Code
National Fire Protection Association (NFPA)	
NFPA 25	Recommended Practices for Inspection, Testing, and Maintenance of Standpipes and Hose Systems
NFPA 55	Standard for Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks
Environmental Protection Agency (EPA)	
EPA	EPA Standards of Performance for Stationary Compression Ignition Internal Combustion Engines; Final Rule (40 CFR Parts 60, 85 et al.)



NOTES:

1. SUPPRESSION SYSTEMS, STAND PIPES, HOSE RACKS AND HYDRANTS ARE NOT SHOWN.

2. BECAUSE OF ITS DISTANCE FROM THE PLANT, THE STATION WATER INTAKE STRUCTURE WILL NOT BE CONNECTED TO THE MAIN YARD LOOP. FIRE PROTECTION FOR THIS AREA WILL BE SUPPLIED FROM THE DISCHARGE SIDE OF THE SWS PUMPS TO A DELUGE SYSTEM. THE STRUCTURE WILL ALSO INCLUDE HOSE RACKS AND FIRE DEPARTMENT HOSE CONNECTIONS, AS REQUIRED.

Figure 9.5-201. Fire Protection System Yard Main Loop

APPENDIX 9A FIRE HAZARDS ANALYSIS

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

9A.2.1 CODES AND STANDARDS

Add the following second paragraph.

GGNS SUP 9A-01

The codes and standards that are applicable to the design of the site-specific portions of the yard are listed in Table 9.5-201. Tables 1.9-202, 1.9-203 and 1.9-204 identify the relevant editions for each applicable code and standard. These codes and standards also apply to the operational aspects of the fire detection and suppression systems.

9A.4.7 YARD

Replace the first paragraph with the following.

GGNS COL 9A.7-1-A

The Yard includes all portions of the plant site external to the Reactor Building, Fuel Building, Control Building, Turbine Building, Radwaste Building, and Electrical Building. Fire Zone drawings of those portions of the Yard, except for that associated with the Turbine and Electrical Building equipment, will be developed six months prior to fuel load. The FSAR will be revised to include this information, as appropriate, as part of a subsequent FSAR update.

Replace the second sentence of the second paragraph with the following.

GGNS COL 9A.7-2-A

The more detailed evaluations of the Service Water/Water Treatment Building, Service Building, and the portions of the yard area outside the scope of the certified design are addressed in Sections 9A.5.7, 9A.5.8, and 9A.5.9.

9A.5.7 YARD

Replace the last two sentences with the following.

GGNS COL 9A.7-2-A

A detailed fire hazards analysis of the yard area that is outside the scope of the certified design cannot be completed until cable routing is performed during final design. This analysis will be completed six months prior to fuel load. The FSAR will be revised to include this information, as appropriate, as part of a subsequent FSAR update.

9A.5.8 SERVICE BUILDING

Replace the last two sentences with the following.

GGNS COL 9A.7-2-A

A detailed fire hazards analysis of the yard area that is outside the scope of the certified design, which includes the Service Building, cannot be completed until cable routing is performed during final design. This analysis will be completed six months prior to fuel load. The FSAR will be revised to include this information, as appropriate, as part of a subsequent FSAR update.

9A.5.9 SERVICE WATER/WATER TREATMENT BUILDING

Replace the last two sentences with the following.

GGNS COL 9A.7-2-A

A detailed fire hazards analysis of the yard area that is outside the scope of the certified design, which includes the Service Water/Water Treatment Building, cannot be completed until cable routing is performed during final design. This analysis will be completed six months prior to fuel load. The FSAR will be revised to include this information, as appropriate, as part of a subsequent FSAR update.

9A.7 COL INFORMATION

9A.7-1-A Yard Fire Zone Drawings

GGNS COL 9A.7-1-A

This COL Item is addressed in Section 9A.4.7.

9A.7-2-A FHA for Site Specific Areas

GGNS COL 9A.7-2-A

This COL Item is addressed in Sections 9A.4.7, 9A.5.7, 9A.5.8, and 9A.5.9.

APPENDIX 9B SUMMARY OF ANALYSIS SUPPORTING FIRE PROTECTION DESIGN REQUIREMENTS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 10 STEAM AND POWER CONVERSION SYSTEM

10.1 SUMMARY DESCRIPTION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

10.2 TURBINE GENERATOR

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

10.2.3.4 Turbine Design

Insert the following as the first paragraph.

STD SUP 10.2-1 The General Electric Company manufactures the turbine and generator. The model N1R turbine is from General Electric's N series nuclear steam turbines.

10.2.3.8 Turbine Missile Probability Analysis

Replace the last paragraph with the following.

STD COL 10.2-1-H The probability of turbine missile generation will be calculated for the specific turbine selected. Final information on TGS material properties, fabrication, and design features will also be provided in the turbine missile analysis. This analysis will be completed no later than one year prior to fuel load. The FSAR will be revised, as necessary, to reflect this analysis as part of a subsequent FSAR update.

10.2.5 COL INFORMATION

10.2-1-H Turbine Missile Probability Analysis

STD COL 10.2-1-H This COL Item is addressed in Section 10.2.3.8.

10.3 TURBINE MAIN STEAM SYSTEM

This section of the referenced DCD is incorporated by reference with no departures or supplements.

10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM

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

10.4.5.2.1 General Description

Replace the text with the following.

GGNS CDI The Circulating Water System (CIRC) is depicted in Figures 10.4-201 through 10.4-204. The CIRC consists of the following components:

- Condenser water boxes, piping, and valves
- Condenser tube cleaning equipment
- Water box drain subsystem
- Four 25% capacity pumps and pump discharge valves
- One hyperbolic natural draft cooling tower (NDCT) and one mechanical draft cooling tower (MDCT)

Table 10.4-3R includes the NPHS temperature range of the water return from the main condenser to the cooling towers and the temperature range of the water delivered by the CIRC pumps to the main condenser.

The CIRC water is normally circulated by four motor-driven pumps through the condenser and back to the cooling towers. The operating circulating water flow rate varies depending on ambient conditions, system configuration, and heat load.

The four pumps are arranged in parallel. Discharge lines combine into two parallel circulating water supply lines to the main condenser. Each main circulating water supply line connects to a low pressure condenser inlet water box. An interconnecting line fitted with a butterfly valve is provided to connect both circulating water supply lines. The discharge of each pump is fitted with a remotely operated valve. This arrangement permits isolation and maintenance of any one pump while the others remain in operation and minimizes the backward flow through an out-of-service pump.

The CIRC and condenser are designed to permit isolation of half of the three series connected tube bundles to permit repair of leaks and cleaning of water boxes while operating at reduced power.

The CIRC includes water box vents to help fill the condenser water boxes during startup and remove accumulated air and other gases from the water boxes during normal operation.

Circulating water chemistry is maintained by the circulating water chemical feed system and with blowdown. Circulating water chemical equipment injects the required chemicals into the cooling tower basin before entering the circulating water pumps. Additional injection points are located in the inlet piping of each cooling tower.

10.4.5.2.2 Component Description

Replace the text with the following.

GGNS CDI Codes and standards applicable to the CIRC are listed in DCD Section 3.2 with the exception of large bore piping (piping with a nominal diameter of 700 mm (27.6 in) and larger). Large bore CIRC piping is constructed using AWWA standards. The system is designed and constructed in accordance with Quality Group D specifications.

Table 10.4-3R provides reference parameters for the major components of the CIRC.

10.4.5.2.2.1 CIRC Chemical Injection

Circulating water chemistry is maintained by the circulating water chemical feed system. Chemical feed equipment injects the required chemicals into the circulating water in the cooing tower basin before water enters the circulating water pumps.

Additional injection points are located at the inlet of the cooling towers. This maintains a non-corrosive, non scale-forming condition and limits the biological film formation that reduces the heat transfer rate in the condenser and cooling tower fill.

Plant chemistry specifies the required chemicals used within the system. The chemicals can be divided into five categories based upon function: biocide, algaecide, pH adjuster, corrosion inhibitor, and scale inhibitor. The pH adjuster, corrosion inhibitor, and scale inhibitor are metered into the system continuously or as required to maintain proper concentrations. Biocide application frequency may vary with seasons. Algaecide is applied, as necessary, to control algae formation in the cooling towers.

The following chemicals are used, as specified by plant chemistry to control circulating water chemistry:

- Biocide - 10 to 15 percent sodium hypochlorite with the aid of a surfactant, if required

- Algaecide - 10 to 15 percent sodium hypochlorite with the aid of a surfactant, if required
- pH Adjuster - 90 percent sulfuric acid
- Corrosion Inhibitor - 50 to 60 percent zinc chloride
- Scale Inhibitor - 55 percent organic phosphate with the aid of a dispersant, if required

Chemicals selected are compatible with selected materials or components used in the CIRC.

10.4.5.2.3 System Operation

Add the following at the end of this section.

GGNS CDI The four circulating water pumps take suction from the circulating water pump pit and circulate the water through the main condenser. Circulating water returns through the condenser discharge to the cooling towers. During normal operation, the NDCTs and MDCTs distribute circulating water through nozzles in the cooling tower distribution headers. The water then falls through fill material to the basin beneath the tower and, in the process, rejects heat to the atmosphere. Provisions are made during cold weather to stop circulating water flow through the MDCT and reduce overall flow through the system. Circulating water flow may also be returned directly to the NDCT basin.

The Station Water System (SWS) supplies makeup water to the NDCT basin to replace water losses due to evaporation, wind drift, and blowdown. Blowdown from the CIRC is taken from the discharge weir of the NDCT and is discharged to the plant outfall.

A condenser tube cleaning subsystem cleans the circulating water side of the main condenser tubes.

Leakage of condensate from the main condenser into the CIRC via a condenser tube leak is not likely during power operation, since the CIRC normally operates at a greater pressure than the shell (condensate) side of the condenser.

10.4.5.5 Instrumentation Applications

Insert the following between the fourth and fifth paragraphs.

GGNS CDI Level instrumentation provided in the circulating water pump pit controls makeup flow from the SWS to the NDCT basin. Level instrumentation in the pump pit initiates alarms in the main control room on abnormally low or high water level.

Pressure indication is provided on the circulating water pump discharge. Differential pressure instrumentation is provided between one inlet and outlet branch to the condenser and may be used to determine the frequency of operating the condenser tube cleaning system.

Local grab samples are used to periodically test the circulating water quality.

10.4.5.8 Normal Power Heat Sink

Replace the text with the following.

GGNS CDI A NDCT, in conjunction with a MDCT, supports a maximum cold water temperature of 35°C (95°F).

The NDCT design flow rate is 163529.8 m^3/hr (720,000 gpm) including Plant Service Water System supply. The operating flow rate varies from 100 percent to 66 percent of the total design flow depending on ambient conditions and heat load.

The MDCT is sized for approximately 33 percent of total circulating water flow. The MDCT is a fiber reinforced plastic counter-flow cluster design with low-clog PVC film fill.

The NDCT is located at least 168m (550 ft.) away from any seismic Category 1 or 2 structures. Thus if there were any structural failure of the cooling towers, no seismic Category 1 or 2 structures or any safety-related systems or components would be affected or damaged. Also, given the location of the cooling towers and the prevailing northeast wind at the plant site, cooling tower plumes are normally directed away from the plant toward the Mississippi River. Under prevailing conditions, the plumes will have no effect on the plant HVAC intakes or the plant switchyard. The direction of the prevailing wind and location of the towers make fogging near the plant unlikely. The NDCT is made of non-combustible material. The materials used in the construction of the MDCT are of the type with a low flame spread rating.

The MDCT has multiple fans with associated motors, couplings and gearboxes. The fans rotate at relatively slow speed and the fan blades are made of relatively low-density material. A failure of a fan could result in the generation of missiles.

However, due to the attributes discussed above and due to the location of the MDCT, any damage would be confined to the MDCT itself. Therefore, there would be no damage to any seismic Category 1 or 2 structures or any safety-related systems or components.

10.4.6.3 Evaluation

Replace the second sentence in the third paragraph with the following.

STD COL 10.4-1-A A table summarizing the manufacturer's recommended threshold values of key chemistry parameters and associated operator actions is provided as Table 10.4-201.

10.4.10 COL INFORMATION

10.4-1-A Leakage (of Circulating Water Into the Condenser)

STD COL 10.4-1-A This COL Item is addressed in Section 10.4.6.3.

STD COL 10.4-1-A

TABLE 10.4-201
RECOMMENDED WATER QUALITY AND ACTION LEVELS

Reactor Water Quality-Power Operation

	Action Levels			
Control Parameter	0	1	2	3
Conductivity, S/cm at 25ºC*	≤ 0.100	> 0.300	> 1	≥ 2
Chloride, ppb	≤ 0.3	> 5	> 50	≥ 200
Silica, ppb	≤ 200	> 500	N/A	N/A
Sulfate, ppb	≤ 2	> 5	> 50	≥ 200

Feedwater Quality—Power Operation***

	Action Levels		
Control Parameter	0	1	2
Conductivity, S/cm at 25ºC**	< 0.057	> 0.065	> 0.100
Dissolved Oxygen, ppb as O_2**	30-50	< 20 or > 200	N/A

*Value depends on Hydrogen Water Chemistry System operation

**Applicable when Reactor Power >10%

***Also Condensate Purification System Effluent

Action Level 0:Target Value. The parameter may be outside the Action Level 0 value and not in Action Level 1, 2, or 3. In this case, efforts should be made to return the parameter to the Action Level 0 value.

Action Level 1:Lowest Severity. The parameter should be brought below this value within 96 hours. A technical review should be performed to determine the appropriate response.

Action Level 2:Moderate Severity. If the parameter is not reduced below this level within 24 hours, an orderly shutdown should be initiated.

Action Level 3:Highest Severity. If the parameter is not reduced below this level within 6 hours, an orderly shutdown should be initiated.

GGNS CDI

TABLE 10.4-3R
CIRCULATING WATER SYSTEM

Parameter	Value
Circulating Water Pumps:	
Number of pumps	4
Pump type	Vertical, wet pit
Unit flow capacity**, m^3/hr (gpm)	Approx. 38300 (170000)
Driver Type	Electric motor
Ball Cleaning System	
Ball recirculation pump	2 (one for each condenser train)
Ball discharge pump	2 (one for each condenser train)
Chemical injection pumps	Various metering pumps
Mechanical draft fans, gearboxes, and motors	12
System design pressure MPa (psi)	0.448 (65)
Mechanical Draft Cooling Tower	
Number of towers	1
Basin diameter*, m (ft)	79.2 (260)
Height*, m (ft)	18.3 (60)
Natural Draft Cooling Tower	
Number of towers	1
Basin diameter*, m (ft)	140 (460)
Height*, m (ft)	168 (550)
Operating Temperatures:	
Normal Power Heat Sink temperature range for water entering the CIRC, ºC (ºF)	0*** to 37.8 (32 to 100)
Temperature range of water delivered to the main condenser, ºC (ºF)	5*** to 37.8 (41 to 100)
CIRC temperature for rated turbine performance, ºC (ºF)	30 (86)
Maximum CIRC temperature for 100% turbine bypass capability, ºC (ºF)	35.6 (96)

* Cooling tower dimensions are approximate.

** This capacity is for condenser cooling requirements only; see DCD Table 9.2-2 for potential additional capacity requirements for Plant Service Water.

*** If the Normal Power Heat Sink does not maintain temperatures above the minimum temperature, then the minimum temperature is maintained by warm water recirculation.

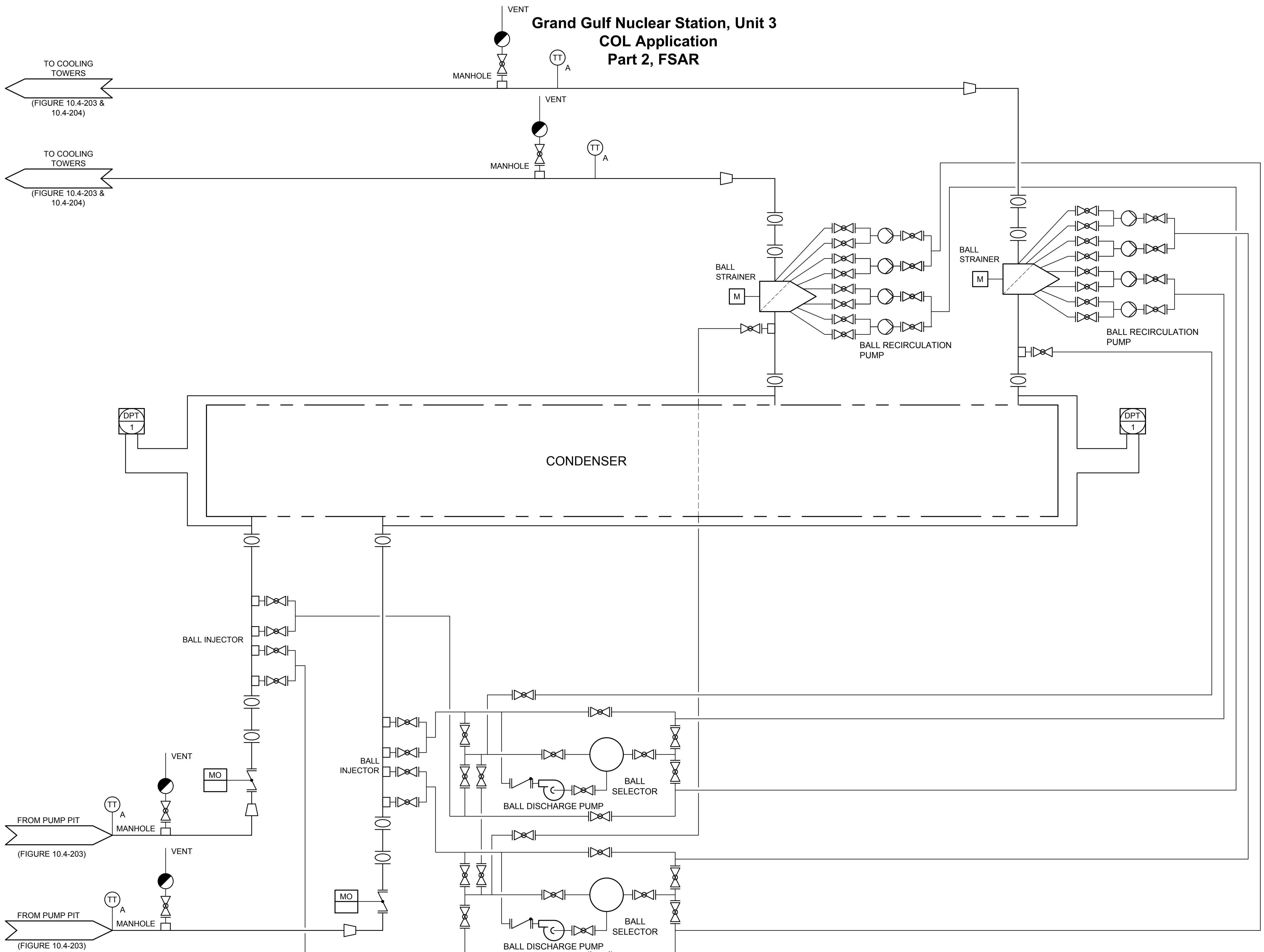


Figure 10.4-201. Circ Condenser Inlet and Outlet Including Ball Cleaning Subsystem

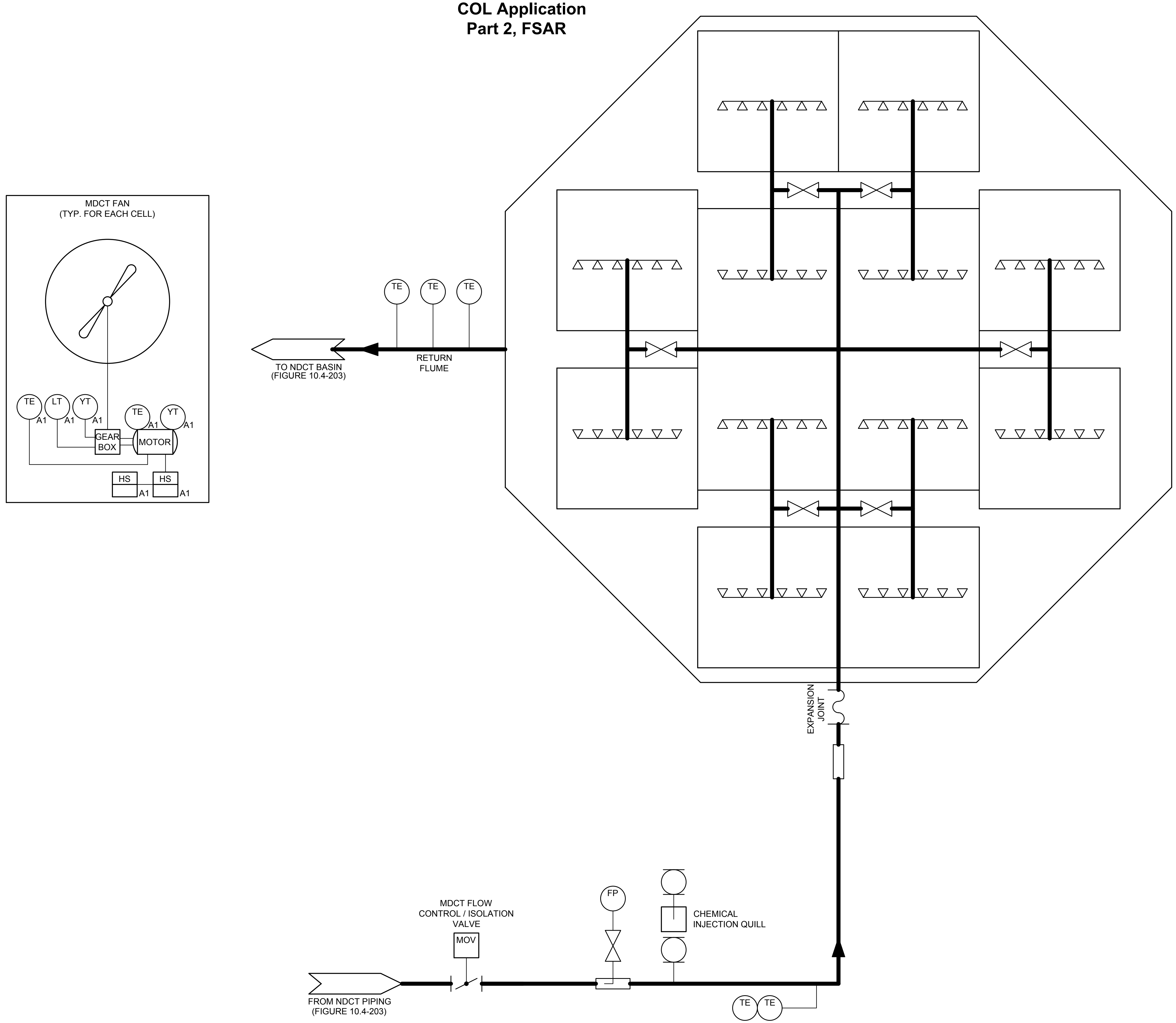


Figure 10.4-202. Circ Mechanical Draft Cooling Tower

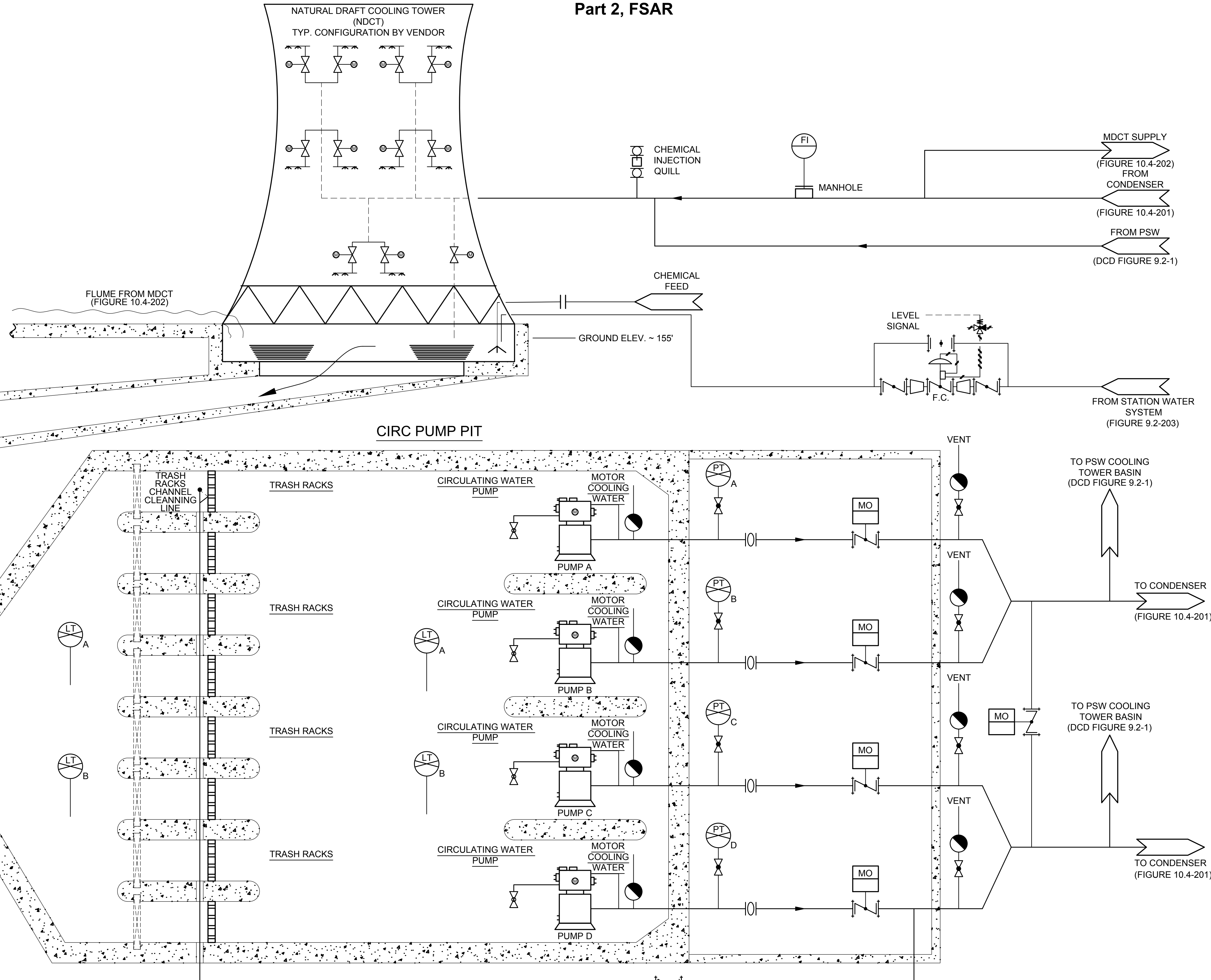


Figure 10.4-203. Circ Natural Draft Cooling Tower and Pump Pit

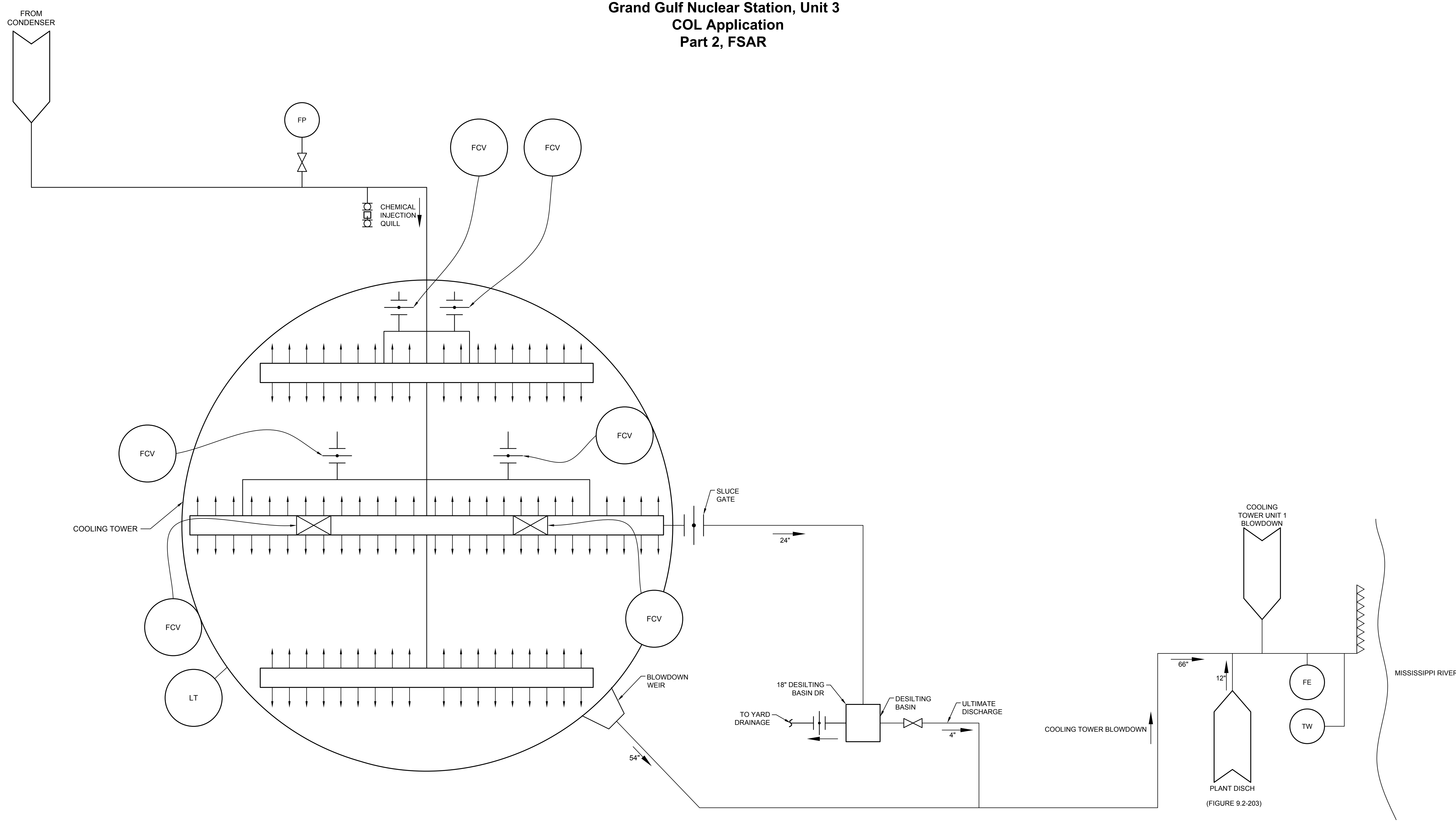


Figure 10.4-204. Circulating Water Blowdown

CHAPTER 11 RADIOACTIVE WASTE MANAGEMENT

11.1 SOURCE TERMS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

11.2 LIQUID WASTE MANAGEMENT SYSTEM

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

STD CDI The conceptual design information in this DCD section is the plant specific design.

11.2.1 DESIGN BASES

Safety Design Bases

Add the following paragraph at the end of this section.

STD SUP 11.2-1 NEI 07-11, Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors, which is currently under review by the NRC staff, is incorporated by reference. (Reference 11.2-201)

11.2.2.3 DETAILED SYSTEM COMPONENT DESCRIPTION

Replace the sixth paragraph with the following.

STD COL 11.2-1-A Specific equipment connection configuration and plant sampling procedures are used to implement the guidance in Inspection and Enforcement (IE) Bulletin 80-10 (DCD Reference 11.2-10). The permanent and mobile/portable non-radioactive systems, which are connected to radioactive or potentially radioactive portions of mobile/portable LWMS, are protected from contamination with an arrangement of double check valves in each line. The configuration of each line is also equipped with a tell-tale connection, which permits periodic checks to confirm the integrity of the line and its check valve arrangement. Sampling of permanently installed clean system normal sample points further upstream is also included in the plant's sampling program.

Replace the seventh paragraph with the following.

STD COL 11.2-2-A Section 12.6 discusses how ESBWR design features and procedures for operation will minimize contamination of the facility and environment, facilitate decommissioning, and minimize the generation of radioactive wastes, in compliance with 10 CFR 20.1406. Section 13.5 describes the requirement for procedures for operation of radioactive waste processing system. Operating procedures for mobile/portable LWMS required by Section 12.4, Section 12.5, and Section 13.5 address the requirements of 10 CFR 20.1406.

11.2.6 COL INFORMATION

11.2-1-A Implementation of IE Bulletin 80-10

STD COL 11.2-1-A This COL item is addressed in Section 11.2.2.3.

11.2-2-A Implementation of Part 20.1406

STD COL 11.2-2-A This COL item is addressed in Section 11.2.2.3.

11.2.7 REFERENCES

11.2-201 NEI 07-11, Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors.

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

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

11.3.1 DESIGN BASIS

Add the following paragraph at the end of this section.

GGNS SUP 11.3-1

The cost-benefit analysis for the gaseous radwaste system is addressed in NEI 07-11, Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors (Reference 11.3-201) which is currently under review by the NRC staff, and in Section 12.2. The NEI 07-11 template is incorporated by reference into Section 11.2.

11.3.2 OFFGAS SYSTEM DESCRIPTION

Releases

GGNS COL 12.2-2-A

Replace the last sentence of the 1st paragraph of the Releases portion of this section with the following.

As indicated in Section 12.2.2.2 and Table 12.2-206, releases from the plant stack or vent do not exceed the maximum permissable concentration to the environment.

11.3.9 REFERENCES

11.3-201 NEI 07-11, Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors

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11.4 SOLID WASTE MANAGEMENT SYSTEM

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

STD CDI The conceptual design information in this DCD section is the plant specific design.

11.4.1 DESIGN BASES

SWMS Bases

Add the following to the seventh bullet.

STD COL 11.4-4-A The site does not utilize any temporary storage facilities to support plant operation.

Replace the fourth sentence of the fifth paragraph with the following.

STD COL 11.4-5-A Section 12.6 discusses how the ESBWR design features and procedures for operation will minimize contamination of the facility and environment, facilitate decommissioning, and minimize the generation of radioactive wastes, in compliance with 10 CFR 20.1406. Section 13.5 describes the requirement for procedures for operation of the radioactive waste processing system. Operating procedures for mobile/portable SWMS required by Section 12.4, Section 12.5, and Section 13.5 address requirements of 10 CFR 20.1406.

11.4.2.3 Detailed System Component Description

Mobile Systems

Replace the last three sentences of the second paragraph with the following paragraphs.

STD COL 11.4-1-A Mobile/portable SWMS that are used at the plant to process wet solid radioactive wastes are procured with specifications that comply with RG 1.143 (DCD Reference 11.4-3). By procuring mobile/portable systems rather than permanent systems, the turnover in equipment results in continuously improved designs for access, operation, inspection, testing, and maintenance. The improved designs in turn help maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable. This type of continuous improvement meets the requirements of RG 8.8 (DCD Reference 11.4-4) for mobile/portable SWMS. Placing requirements in procurement specifications ensures compliance with RG 1.143 for mobile/portable SWMS. Implementing the Radiation Protection Program to meet ALARA goals and repeated upgrades ensures compliance with RG 8.8 for mobile/portable SWMS.

STD COL 11.4-2-A Specific equipment connection configuration and plant sampling procedures are used to implement the guidance in IE Bulletin 80-10 (DCD Reference 11.4-19). The permanent and mobile/portable non-radioactive systems, which are connected to radioactive or potentially radioactive portions of mobile/portable SWMS, are protected from contamination with an arrangement of double check valves in each line. The configuration of each line is also equipped with a tell-tale connection, which permits periodic checks to confirm the integrity of the line and its check valve arrangement. Sampling of permanently installed clean system normal sample points further upstream is also included in the plant's sampling program.

STD COL 11.4-3-A Waste classification and process controls are described in the Process Control Program (PCP). NEI 07-10, "Generic FSAR Template Guidance for Process Control Program (PCP) Description," which is under review by the NRC, is incorporated by reference. (Reference 11.4-201) The milestone for development and implementation of the PCP is addressed in Section 13.4.

11.4.6 COL INFORMATION

11.4-1-A Mobile System Regulatory Guide Compliance

STD COL 11.4-1-A This COL item is addressed in Section 11.4.2.3.

11.4-2-A Compliance with IE Bulletin 80-10

STD COL 11.4-2-A This COL item is addressed in Section 11.4.2.3.

11.4-3-A Process Control Program

STD COL 11.4-3-A This COL item is addressed in Section 11.4.2.3.

11.4-4-A Temporary Storage Facility

STD COL 11.4-4-A This COL item is addressed in Section 11.4.1.

11.4-5-A Compliance with Part 20.1406

STD COL 11.4-5-A This COL item is addressed in Section 11.4.1.

11.4.7 REFERENCES

11.4-201 NEI 07-10, Generic FSAR Template Guidance for Process Control Program (PCP) Description.

11.5 PROCESS RADIATION MONITORING SYSTEM

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

Add the following paragraph at the end of this section.

STD COL 11.5-3-A Replace text references to DCD Table 11.5-5 with Table 11.5-201.

11.5.4.4 SETPOINTS

Replace the first sentence in this section with the following.

STD COL 11.5-2-A The derivation of setpoints used for off-site dose monitors are described in the ODCM. Refer to Section 11.5.4.5 for a discussion regarding ODCM development and implementation.

11.5.4.5 OFFSITE DOSE CALCULATION MANUAL

Replace this section with the following.

STD COL 11.5-2-A The methodology and parameters used for calculation of off-site dose and monitoring are described in the ODCM. NEI 07-09, Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description, which is under review by the NRC, is incorporated by reference. (Reference 11.5-201) The milestone for development and implementation of the ODCM is addressed in Section 13.4. The provisions for sampling liquid and gaseous waste streams identified in Table 11.5-201 and DCD Table 11.5-6 will be included in the ODCM.

11.5.4.6 PROCESS AND EFFLUENT MONITORING PROGRAM

Replace this section with the following.

STD COL 11.5-3-A The program for process and effluent monitoring and sampling are described in the ODCM. Refer to Section 11.5.4.5 for a discussion regarding ODCM development and implementation.

11.5.4.7 SUBSYSTEM LOWER LIMIT OF DETECTION

Replace this section with the following.

STD COL 11.5-1-A The methodology for derivation of each subsystem lower limit of detection are described in the ODCM. Refer to Section 11.5.4.5 for a discussion regarding ODCM development and implementation.

11.5.4.8 SITE SPECIFIC OFFSITE DOSE CALCULATION

Replace this section with the following.

STD COL 11.5-4-A 10 CFR 50, Appendix I guidelines are addressed in the ODCM. Refer to Section 11.5.4.5 for a discussion regarding ODCM development and implementation.

Site-specific evaluations for dose to members of the public are addressed in Section 12.2.

11.5.4.9 INSTRUMENT SENSITIVITIES

Replace this section with the following.

STD COL 11.5-5-A The sensitivities, frequencies and bases for each gaseous and liquid sample are described in the ODCM. Refer to Section 11.5.4.5 for a discussion regarding ODCM development and implementation.

11.5.5.8 SETPOINTS

Replace this section with the following.

STD COL 11.5-2-A Refer to Section 11.5.4.4.

Replace DCD Table 11.5-5 with Table 11.5-201.

11.5.7 COL INFORMATION

11.5-1-A Subsystem Lower Limit of Detection

STD COL 11.5-1-A This COL item is addressed in Section 11.5.4.7.

11.5-2-A Offsite Dose Calculation Manual

STD COL 11.5-2-A This COL item is addressed in Sections 11.5.4.4, 11.5.4.5, 11.5.5.8, and 12.2.

11.5-3-A Process and Effluent Monitoring Program

STD COL 11.5-3-A This COL item is addressed in Sections 11.5 and 11.5.4.6, and Table 11.5-201.

11.5-4-A Site Specific Offsite Dose Calculation

STD COL 11.5-4-A This COL item is addressed in Section 11.5.4.8.

11.5-5-A Instrument Sensitivities

STD COL 11.5-5-A This COL item is addressed in Section 11.5.4.9.

11.5.8 REFERENCES

11.5-201. NEI 07-09, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description"

STD COL 11.5-3-A

TABLE 11.5-201 (SHEET 1 OF 3)
PROVISIONS FOR SAMPLING LIQUID STREAMS

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System (s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process	In Effluent	
			Grab Notes 2 & 7	Grab Notes 2 & 7	Continuous Notes 2 & 7
1.	Liquid Radwaste (Batch) Effluent System Note 3	Equipment (Low Conductivity Drain Subsystem Floor (High Conductivity) Drain Subsystem	S&A	S&A, H3	-
2.	Service Water System	Plant Service Water System	-	S&A, H3	(S&A) Notes 6 & 8
3.	Component Cooling Water System	Reactor Component Cooling Water System	S&A	S&A H3	(S&A) Notes 6 & 8
4.	Spent Fuel Pool Treatment System	Spent Fuel Pool Treatment System	S&A	S&A H3	(S&A) Notes 6 & 8
5.	Equipment & Floor Drain Collection and Treatment Systems	LCW Drain Subsystem HCW Drain Subsystem Detergent Drain Subsystem Chemical Waste Drain Subsystem Reactor Component Cooling Water System (RCCWS) Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
6.	Phase Separator Decant & Holding Basin Systems	Equipment (Low Conductivity) Drain Subsystem Floor (High) Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
7.	Chemical & Regeneration Solution Waste Systems	Chemical Waste Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8

STD COL 11.5-3-A

TABLE 11.5-201 (SHEET 2 OF 3)
PROVISIONS FOR SAMPLING LIQUID STREAMS

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System (s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process	In Effluent	
			Grab Notes 2 & 7	Grab Notes 2 & 7	Continuous Notes 2 & 7
8.	Laboratory & Sample System Waste Systems	Chemical Waste Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
9.	Laundry & Decontamination Waste Systems	Detergent Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
10.	Resin Slurry, Solidification & Baling Drain Systems	Equipment (Low Conductivity) Drain Subsystem, Floor (High) Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
11.	Storm & Underdrain Water System	Storm Drains and Cooling Tower Blowdown	-	(S&A, H3) Notes 3, 4, & 6	(S&A) Notes 3& 6
12.	Tanks and Sumps Inside Reactor Building	Equipment (Low Conductivity) Drain Subsystem Floor (High) Drain Subsystem Chemical Waste Drain Subsystem Detergent Drain Subsystem	-	S&A H3	(S&A) Notes 6 & 8
13.	Ultrasonic Resin Cleanup Waste Systems	Note 5	-	Note 5	Note 5
14.	Non-Contaminated Waste Water System	Sanitary Waste Water	-	(S&A, H3) Notes 3, 4 & 6	(S&A) Note 4
15.	Mobile Liquid Radioactive Waste Processing Systems (Includes Reverse Osmosis Systems)	Mobile Liquid Radioactive Waste Processing Systems (Includes Reverse Osmosis Systems)	S&A	(S&A, H3)	(S&A) Notes 6 & 8

STD COL 11.5-3-A

TABLE 11.5-201 (SHEET 3 OF 3)
PROVISIONS FOR SAMPLING LIQUID STREAMS

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System (s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process	In Effluent	
			Grab Notes 2 & 7	Grab Notes 2 & 7	Continuous Notes 2 & 7

Notes for Table 11.5-201:

1. Table 11.5-5 addresses sampling provisions for BWRs as identified in Table 2 of SRP 11.5. For process systems identified for BWRs in Table 2, but not shown in Table 11.5-5, those systems are not applicable to ESBWR. In some cases, there are multiple subsystems that are used to perform the overall equivalent SRP function and are listed as such in the column.
2. S&A = Sampling & Analysis of radionuclides, to include gross radioactivity, identification and concentration of principal radionuclides and concentration of alpha emitters; R = Gross radioactivity (beta radiation, or total beta plus gamma); H3 = Tritium
3. Liquid Radwaste is processed on a batch-wise basis. The Liquid Waste Management System sample tanks can be sampled for analysis of the batch. See DCD Section 11.2.2.2 for more information on Liquid Radwaste Management.
4. Monitoring of effluents from storm drains, the cooling tower blow down, and sanitation wastes are included in the plant specific ODCM.
5. The ESBWR does not include ultrasonic resin cleanup waste system at this time. Should one be installed, the Liquid Waste Management System would provide sampling and monitoring provisions.
6. The use of parenthesis indicates that these provisions are required only for the systems not monitored, sampled, or analyzed (as indicated) prior to release by downstream provisions.
7. The sensitivity of detection, also defined here as the Lower Limit of Detection (LLD), for each indicated measured variable, is based on the applicable radionuclide (or collection of radionuclides as applicable) as given in ANSI/IEEE N42.18.
8. Processed through radwaste Liquid Waste Management System (LWMS) prior to discharge. Therefore, this process system is monitored, sampled, or analyzed prior to release by downstream provisions. See Note 6 above. Depending on Utility’s discretion, additional sampling lines may be installed. Continuous Effluent sampling is not required per Standard Review Plan 11.5 Draft Rev. 4, April 1996, Table 2 for this system function.

CHAPTER 12 RADIATION PROTECTION

12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE ALARA

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

Add the following as introductory text.

STD SUP 12.1-1 The ALARA program is addressed in Appendices 12AA and 12BB.

12.1.4 COL INFORMATION

12.1-1-A Regulatory Guide 8.10

STD COL 12.1-1-A This COL item is addressed in Appendix 12BB.

12.1-2-A Regulatory Guide 1.8

STD COL 12.1-2-A This COL item is addressed in Appendix 12BB.

12.1-3-A Occupational Radiation Exposures

STD COL 12.1-3-A This COL item is addressed in Appendix 12BB.

12.1-4-A Regulatory Guide 8.8

STD COL 12.1-4-A This COL item is addressed in Appendix 12BB.

12.2 PLANT SOURCES

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

Section 3.2 of the referenced ESP safety analysis report is incorporated by reference with no variances or supplements.

STD SUP 12.2-1

12.2.1.5 OTHER CONTAINED SOURCES

In addition to the contained sources identified above, additional contained sources which contain byproduct, source, or special nuclear materials may be maintained on site. These contained sources are typically used as calibration or radiography sources. These sources are not part of the permanent plant design, and their control and use are governed by plant procedures. The procedures consider the guidance provided in RG 8.8 to ensure that occupational doses from the control and use of the sources are as low as is reasonably achievable (ALARA).

Various types and quantities of radioactive sources are employed to calibrate the process and effluent radiation monitors, the area radiation monitors, and portable and laboratory radiation detectors. Check sources that are integral to the area, process, and effluent monitors consist of small quantities of by-product material and do not require special handling, storage, or use procedures for radiation protection purposes. The same consideration applies to solid and liquid radionuclide sources of exempt quantities or concentrations which are used to calibrate or check the portable and laboratory radiation measurement instruments.

Instrument calibrators are normally used for calibrating gamma dose rate instrumentation. These may be self-contained, heavily shielded, multiple source calibrators. Beta and alpha radiation sources are also available for instrument calibration. Calibration sources are traceable to the National Institute of Standards and Technology, or equivalent.

Radiography sources are surveyed upon entry to the site. Radiation protection personnel maintain copies of the most recent leak test records for owner-controlled sources. Contractor radiography personnel provide copies of the most recent leak test records upon radiation protection personnel request. Radiography is conducted in accordance with approved procedures.

12.2.2.1 AIRBORNE RELEASE OFFSITE

GGNS COL 12.2-2-A

Add the following at the beginning of this section, and add the sentence below under "*Annual Releases*."

The discussion in this section, and the associated DCD Tables 12.2-15, 12.2-16, 12.2-17, 12.2-18a, are applicable to the ESBWR standard plant design and the associated airborne release concentrations and dose analyses for a generic site, and for which representative off-site doses were calculated and reported in DCD Table 12.2-18b. As discussed in Section 12.2.2.2 below, the Unit 3 off-site dose analysis was performed using a site-specific atmospheric dispersion coefficient and relative deposition factor, and the ESP-002 "composite" source term that is bounding of the DCD source term. (See SSAR Section 3.2.) Therefore, data in DCD Tables 12.2-15, 12.2-16, 12.2-17, 12.2-18a specifically related to the DCD offsite dose calculations and the DCD dose results presented in 12.2-18b are not applicable for Unit 3.

Annual releases

Unit 3 site-specific normal operating source terms, as defined in ESP-002 Appendix D, Table D7, are given in Table 12.2-206, and a comparison to 10 CFR 20 criteria is given in Table 12.2-206.

12.2.2.2 AIRBORNE DOSE EVALUATION OFFSITE

GGNS COL 12.2-2-A
GGNS ESP COL 11.1-1

Replace the last two sentences of this section with the following.

A comparison of the gaseous effluent releases in DCD Table 12.2-17 with the bounding gaseous effluent releases in ESP-002 Appendix D, Table D7, is provided in Table 12.2-206. Unit 3 composite airborne concentrations reported in Table 12.2-206 are developed using the ESP-002 Appendix D, Table D7 composite releases and the ESP site characteristic (i.e., site-specific) χ/Q values. Table 12.2-206 shows that the resulting ESP gaseous effluent release concentrations bound the ESBWR DCD gaseous effluent release concentrations for every radioisotope in the ESBWR release. Therefore, the Grand Gulf ESP gaseous effluent releases result in conservative estimates of the offsite doses due to normal gaseous effluent releases for Unit 3.

The site-specific long-term atmospheric dispersion coefficient (χ/Q) at the site boundary given in Table 2.0-201 (8.8E-06 s/m^3) is higher than the value given in DCD Table 12.2-15 (2.0E-06 s/m^3), as noted in Table 2.0-201. This site-specific χ/Q value is utilized in the calculation of site-specific offsite doses reported in

SSAR Section 3.2. The site-specific relative deposition factor (D/Q) at the site boundary in Table 2.0-201 (1.2E-08 m^{-2}) is also not bounded by the equivalent DCD site parameter (4.0E-09 m^{-2}). This higher site-specific D/Q value is also utilized in the site-specific dose analysis in SSAR Section 3.2. However, as indicated in SSAR Section 3.2, calculated doses using the higher site-specific parameters for χ/Q, D/Q and the composite ESP-002 release are within regulatory limits.

12.2.2.2.1 Compliance with 10 CFR 50, Appendix I, Sections II.B and II.C

The ESP estimated whole-body and critical organ annual doses to the maximally exposed individual (MEI) due to release of radioactive materials in airborne effluents meet the guidelines of Appendix I to 10 CFR Part 50 (SSAR Table 3.2-3B). The off-site doses calculated using the ESP-002 gaseous effluent releases and site-specific input parameters meet the guidelines of Appendix I to 10 CFR Part 50, Appendix I, Sections II.B and II.C. The released activity, atmospheric dispersion coefficients, and ground deposition values used in the ESP dose analysis all bound the corresponding DCD parameters.

12.2.2.2.2 Compliance with 10 CFR 50, Appendix I, Section II.D

The population doses determined for the gaseous effluent releases from Unit 3 given in SSAR Table 3.2-4 are bounded by the results presented in NEI 07-11, Generic Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors (Reference 12.2-201). See Section 11.3.1 for more details. Therefore, Unit 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.2.3 Compliance with 10 CFR 20 Appendix B, Table 2, Column 1

Table 12.2-206 shows the site-specific gaseous effluent release used to determine bounding offsite doses reported in SSAR Table 3.2-3B. The Unit 3 maximum annual average χ/Q value at the site boundary is 8.8E 06 s/m^3, as identified in ESP-002 Appendix A (page A-5). Site-specific gaseous effluent concentrations reported in Table 12.2-206 are derived by taking the annual ESP release activities, and multiplying by the site-specific annual average χ/Q. The site-specific gaseous effluent concentrations in Table 12.2-206 are less than (bounded by) the 10 CFR 20 Appendix B, Table 2, Column 1 concentration limits.

Additionally, the gaseous effluent concentrations of DCD Table 12.2-17 when adjusted by the ratio of the site-specific χ/Q and the DCD χ/Q are also shown to be less than (bounded by) the 10 CFR 20 Appendix B, Table 2, Column 1 concentration limits.

12.2.2.2.4 Compliance with 10 CFR 20.1301

10 CFR 20.1301(a)(1) indicates that operations shall be conducted such that the total effective dose equivalent to individual members of the public from the

licensed operation does not exceed 0.1 rem (1 mSv) in a year, and additionally, the dose in any unrestricted area from external sources, does not exceed 0.002 rem (0.02 millisievert) in any one hour. For the gaseous pathway, the annual whole body dose for the MEI located at the EAB is 1.62 mrem TEDE (SSAR Table 3.2-3B). The MEI annual whole body dose from the liquid pathway is 0.62 mrem TEDE (Table 12.2-203). Direct radiation as a result of plant operation has been shown to be negligible. Therefore, combined annual dose to the MEI is 2.3 mrem (0.023 mSv) TEDE. This is well below the limit given in 10 CFR 20.1301. The MEI dose rate also meets the limit of 2 mrem/hr given in 10 CFR 20.1301(a)(2).

Table 12.2-205 shows that the total site doses from all pathways resulting from the normal operation of Unit 1 and Unit 3 are well within the regulatory limits of 40 CFR 190.

12.2.2.2.5 Compliance with 10 CFR 20.1302

Surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas are conducted to demonstrate compliance with the dose limits given in §20.1302 for individual members of the public. These surveys are conducted in accordance with the Off-site Dose Calculation Manual (ODCM) required by the Technical Specifications.

Compliance with the annual dose limit in §20.1301 is demonstrated in Section 12.2.2.2.4 by showing that the calculated total effective dose equivalent to the individual likely to receive the highest dose does not exceed the annual dose limit.

12.2.2.4 LIQUID DOSES OFF-SITE

GGNS COL 12.2-3-A Delete DCD Tables 12.2-20a and 12.2-20b and replace this section with the following.

GGNS ESP COL 11.1-1

Exposure Pathways

The release of small amounts of radioactive liquid effluents is permitted as long as releases comply with the requirements specified in 10 CFR 20. The important exposure pathways for liquid effluents include:

- Internal exposure from ingestion of water or contaminated food chain components;
- External exposure from the surface of contaminated water or from shoreline sediment; and,
- External exposure from immersion in contaminated water.

Irrigation has not been found necessary or observed in the area around the Grand Gulf site, therefore, this pathway has not been considered. Similarly, the dose due to drinking water intake has not been considered; there is no downstream user of potable water from the river within 100 miles of the site. There is no record of consumption of aquatic vegetation in the area surrounding the Grand Gulf site; therefore, this pathway is not evaluated. Shoreline use is very limited with essentially no swimming, sunbathing, or fishing from the bank, and consequently is an insignificant pathway in comparison with the pathway of aquatic foods consumption. Nevertheless, for purposes of conservatism, this pathway has been included in the evaluation of doses for the maximum exposed individual. Rates for fish and invertebrate consumption and shoreline use are the default values given in LADTAP-II. Invertebrate usage factors for saltwater sites are applied to the Mississippi River crawfish and shrimp catch. A single dilution factor was conservatively chosen for all points of exposure or harvest of aquatic food.

Liquid pathway doses were calculated to demonstrate compliance with 10 CFR 50, Appendix I. Dose conversion factors and methodologies consistent with RG 1.109 were used. The liquid effluent pathway off-site dose calculation bases are provided in Tables 12.2-201 and 12.2-202. The LADTAP-II code (NUREG/CR-4013) is used to perform the liquid effluent dose analysis. The results of the dose calculation are given in Table 12.2-203.

Discharge from the liquid radwaste is combined with the discharge from the cooling tower blowdown before discharging to the Mississippi River. Other dilution from clarifier blowdown and from Unit 1 are not considered, which adds conservatism to the calculation. Mixing of the diluted radioactive effluent with the Mississippi River water is analyzed for the mean river level of 54 feet msl, corresponding to a discharge of 560,000 cfs. The isotopic releases in the liquid effluent are given in DCD Table 12.2-19b. The outflow from the combined discharge mixes with the Mississippi River water, resulting in additional dilution of the effluent.

Pathway Doses

Maximum dose rate estimates to man due to liquid effluent releases were determined in the following ways:

- Eating fish or invertebrates caught near the point of discharge;
- Using the shoreline for activities, such as sunbathing or fishing; and
- Swimming and boating on the Mississippi River near the point of discharge.

The calculated whole-body and critical organ doses from these interactions are presented in Table 12.2-203. These doses are within the limits given in 10 CFR 50, Appendix I and would only occur under conditions that maximize the resultant dose. It is unlikely that any individual would receive doses of the magnitude calculated because of little or no shoreline activities at or near the site, and very limited swimming (if any) occurs in the river at or downstream of the site.

12.2.2.4.1 Compliance with 10 CFR 50, Appendix I, Section II.A

The maximum exposed individual annual doses from the discharge of radioactive materials in liquid effluents meet the guidelines of Appendix I, Section II.A, to 10 CFR Part 50. In addition, the maximally exposed individual dose calculated was compared to and meets the 40 CFR 190 criteria (Table 12.2-204) for liquid effluents.

12.2.2.4.2 Compliance with 10 CFR 50, Appendix I, Section II.D

Dose rates determined for the normal liquid effluent releases are bounded by the results presented in NEI 07-11, Generic Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors (Reference 12.2-201). See Section 11.2.1 for more details. Therefore, Unit 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.4.3 Compliance with 10 CFR 20 Appendix B, Table 2, Column 2

Compliance with 10 CFR 20 Appendix B, Table 2, Column 2 is demonstrated in DCD Table 12.2-19b.

12.2.2.4.4 Compliance with 10 CFR 20.1301

See Section 12.2.2.2.4.

12.2.2.4.5 Compliance with 10 CFR 20.1302

See Section 12.2.2.2.5.

12.2.4 COL INFORMATION

12.2-2-A Airborne Effluents and Doses

GGNS COL 12.2-2-A This COL item is addressed in Sections 11.3.2, 12.2.2.1 and 12.2.2.2.

12.2-3-A Liquid Effluents and Doses

GGNS COL 12.2-3-A This COL item is addressed in Section 12.2.2.4.

12.2.5 REFERENCES

Delete DCD Reference 12.2-4.

12.2-201 NEI 07-11, Generic Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors.

GGNS COL 12.2-3-A

GGNS ESP COL 11.1-1

TABLE 12.2-201
LIQUID PATHWAY PARAMETERS

Description	Parameter
Effluent Discharge	35 gpm
Dilution Flow	7000 gpm
Mississippi River Dilution Factor	2
Shore Width Factor	0.2
Source Term	DCD Table 12.2-19b
Commercial Fish Catch	446,467 kg
Invertebrate Harvest	3511 kg

GGNS COL 12.2-3-A

GGNS ESP COL 11.1-1

TABLE 12.2-202
LIQUID PATHWAY CONSUMPTION FACTORS

Age Group	Fish (kg/yr)	Invertebrates (kg/yr)	Shoreline (hr/yr)
Adult	21	5.0	12
Teen	16	3.8	67
Child	6.9	1.7	14
Infant	0.0	0.0	0.0

GGNS COL 12.2-3-A

GGNS ESP COL 11.1-1

TABLE 12.2-203
LIQUID PATHWAY COMPARISON OF MAXIMUM INDIVIDUAL DOSE TO APPENDIX 10 CFR 50, APPENDIX I CRITERIA

Pathway	Annual Dose Total Body[2] mrem/yr (mSv/yr) (Per Unit)	Maximum Organ (bone)[3] mrem/yr (mSv/yr) (Per Unit)	Dose Limit[1] (mrem/yr)
Aquatic Foods	6.2E-01 (6.2E-03)	9.0 (9.0E-02)	
Shoreline Use	5.6E-04 (5.6E-06)	6.6E-04 (6.6E-06)	Total Body: 3 Any organ: 10
Total	6.2E-01 (6.2E-03)	9.0 (9.0E-02)	

NOTES:

1. 10 CFR 50 Appendix I limits.
2. An adult was found to receive the maximum individual total body dose.
3. A child was found to receive the maximum individual organ dose.
4. 1 mrem = 0.01 mSv.

GGNS COL 12.2-3-A

GGNS ESP COL 11.1-1

TABLE 12.2-204
LIQUID PATHWAY COMPARISON OF MAXIMUM INDIVIDUAL DOSE TO 40 CFR 190 CRITERIA

Type of Dose (Annual)	Design Objective[1] mrem/yr (mSv/yr)	Calculated Dose mrem/yr (mSv/yr)
Whole body dose equivalent	25 (0.25)	6.2E-01 (6.2E-03)
Thyroid dose	75 (0.75)	1.43E-01 (1.43E-03)
Dose to another organ	25 (0.25)	9.0 (9.0E-02) (Bone)

NOTES:

1. 40 CFR 190 Appendix I limits.

GGNS COL 12.2-3-A

GGNS ESP COL 11.1-1

TABLE 12.2-205
COMPARISON OF MAXIMUM INDIVIDUAL DOSE FOR THE SITE TO 40 CFR 190 CRITERIA

Type of Dose (Annual)	Unit 3 Dose (3) mrem (mSv)	Unit 1 Dose (2) mrem (mSv)	Total Site Dose (1) mrem (mSv)	Design Objective (4) mrem (mSv)
Whole Body Dose Equivalent	2.24 (2.24E-02)	1.33 (1.33E-02)	3.57 (3.57E-02)	25 (0.25)
Thyroid Dose	3.35 (3.35E-02)	9.65 (9.65E-02)	13.00 (0.13)	75 (0.75)
Dose to Another Organ	10.39 (1.039E-01) (bone)	9.65(5) (9.65E-02) (thyroid)	20.04 (2.004E-01)	25 (0.25)
	4.42 (4.42E-02) (skin)	2.16 (2.16E-02) (skin)	6.58 (6.58E-02) (skin)	

NOTES:

1. Includes all pathways for all effluents and direct radiation sources for all units at the site. Direct radiation has been shown to be negligible.

2. Includes all pathways for all effluents and direct radiation sources. Direct radiation has been shown to be negligible. Source for Unit 1 data is Unit 1 UFSAR Tables 11.2-11 and 11.3-12.

3. Includes all pathways for all effluents and direct radiation sources. Direct radiation has been shown to be negligible.

4. Source: 40 CFR 190.

5. Doses to other organs are less than the dose to the thyroid.

6. 1 mrem = 0.01 mSv.

GGNS COL 12.2-2-A

GGNS ESP COL 11.1-1

TABLE 12.2-206 (Sheet 1 of 4)
COMPARISON OF SITE-SPECIFIC AIRBORNE CONCENTRATIONS WITH 10 CFR 20 TABLE 2 COLUMN 1 CONCENTRATIONS

Nuclide	DCD Table 12.2-17 Airborne Release (MBq/yr)	DCD Table 12.2-17 Airborne Concentration (Bq/m^3)	Adjusted DCD Table 12.2-17 Concentration[2] (Bq/m^3)	Unit 3 Composite Normal Airborne Release[1] (MBq/yr)	Unit 3 Composite Airborne Concentration[1] (Bq/m^3)	10 CFR 20 Appendix B, Table 2, Column 1 (Bq/m^3)	Concentration Ratio (10CFR20 / Unit 3)	Concentration Ratio (Unit 3 / DCD)	Concentration Ratio (10CFR20 / Adjusted DCD)
Kr-83m	3.73E+01	2.36E-06	1.04E-05	6.22E+01	1.73E-05	2.00E+06	1.2E+11	7.33E+00	1.9E+11
Kr-85m	6.50E+05	4.12E-02	1.81E-01	2.66E+06	7.43E-01	4.00E+03	5.4E+03	1.80E+01	2.2E+04
Kr-85	4.29E+06	2.72E-01	1.20E+00	3.03E+08	8.46E+01	3.00E+04	3.5E+02	3.11E+02	2.5E+04
Kr-87	1.45E+06	9.17E-02	4.03E-01	1.86E+06	5.19E-01	7.00E+02	1.3E+03	5.66E+00	1.7E+03
Kr-88	2.18E+06	1.38E-01	6.07E-01	3.40E+06	9.49E-01	3.00E+02	3.2E+02	6.88E+00	4.9E+02
Kr-89	1.40E+07	8.90E-01	3.92E+00	1.78E+07	4.96E+00	4.00E+01	8.1E+00	5.58E+00	1.0E+01
Kr-90	1.25E+01	7.94E-07	3.49E-06	2.40E+01	6.70E-06	4.00E+01	6.0E+06	8.43E+00	1.1E+07
Xe-131m	1.10E+05	6.97E-03	3.07E-02	1.33E+08	3.71E+01	7.00E+04	1.9E+03	5.33E+03	2.3E+06
Xe-133m	8.59E+01	5.44E-06	2.39E-05	6.44E+06	1.80E+00	2.00E+04	1.1E+04	3.30E+05	8.4E+08
Xe-133	3.11E+07	1.97E+00	8.67E+00	3.40E+08	9.49E+01	2.00E+04	2.1E+02	4.82E+01	2.3E+03
Xe-135m	2.27E+07	1.44E+00	6.34E+00	3.00E+07	8.37E+00	1.00E+03	1.2E+02	5.81E+00	1.6E+02
Xe-135	2.43E+07	1.54E+00	6.78E+00	3.40E+07	9.48E+00	3.00E+03	3.2E+02	6.16E+00	4.4E+02
Xe-137	2.90E+07	1.84E+00	8.10E+00	3.81E+07	1.06E+01	4.00E+01	3.8E+00	5.78E+00	4.9E+00
Xe-138	2.32E+07	1.47E+00	6.47E+00	3.20E+07	8.92E+00	7.00E+02	7.8E+01	6.07E+00	1.1E+02
Xe-139	1.57E+01	9.93E-07	4.37E-06	3.00E+01	8.37E-06	4.00E+01	4.8E+06	8.43E+00	9.2E+06
I-131	1.51E+04	9.57E-04	4.21E-03	1.92E+04	5.35E-03	7.00E+00	1.3E+03	5.60E+00	1.7E+03
I-132	5.89E+04	3.74E-03	1.65E-02	1.62E+05	4.52E-02	7.00E+02	1.5E+04	1.21E+01	4.3E+04
I-133	4.88E+04	3.09E-03	1.36E-02	1.26E+05	3.52E-02	4.00E+01	1.1E+03	1.14E+01	2.9E+03
I-134	1.06E+05	6.72E-03	2.96E-02	2.80E+05	7.81E-02	2.00E+03	2.6E+04	1.16E+01	6.8E+04

GGNS COL 12.2-2-A

GGNS ESP COL 11.1-1

TABLE 12.2-206 (Sheet 2 of 4)
COMPARISON OF SITE-SPECIFIC AIRBORNE CONCENTRATIONS WITH 10 CFR 20 TABLE 2 COLUMN 1 CONCENTRATIONS

Nuclide	DCD Table 12.2-17 Airborne Release (MBq/yr)	DCD Table 12.2-17 Airborne Concentration (Bq/m^3)	Adjusted DCD Table 12.2-17 Concentration[2] (Bq/m^3)	Unit 3 Composite Normal Airborne Release[1] (MBq/yr)	Unit 3 Composite Airborne Concentration[1] (Bq/m^3)	10 CFR 20 Appendix B, Table 2, Column 1 (Bq/m^3)	Concentration Ratio (10CFR20 / Unit 3)	Concentration Ratio (Unit 3 / DCD)	Concentration Ratio (10CFR20 / Adjusted DCD)
I-135	6.14E+04	3.89E-03	1.71E-02	1.78E+05	4.96E-02	2.00E+02	4.0E+03	1.28E+01	1.2E+04
C-14	3.54E+05	2.24E-02	9.86E-02	8.10E+05	2.26E-01	1.00E+02	4.4E+02	1.01E+01	1.0E+03
Na-24	5.42E-01	3.44E-08	1.51E-07	3.00E+02	8.37E-05	3.00E+02	3.6E+06	2.43E+03	2.0E+09
P-32	1.34E-01	8.50E-09	3.74E-08	6.81E+01	1.90E-05	2.00E+01	1.1E+06	2.23E+03	5.3E+08
Ar-41	2.85E+02	1.81E-05	7.96E-05	3.77E+06	1.05E+00	4.00E+02	3.8E+02	5.81E+04	5.0E+06
Cr-51	7.73E+01	4.90E-06	2.16E-05	2.60E+03	7.25E-04	1.00E+03	1.4E+06	1.48E+02	4.6E+07
Mn-54	1.47E+02	9.29E-06	4.09E-05	4.00E+02	1.11E-04	4.00E+01	3.6E+05	1.20E+01	9.8E+05
Mn-56	1.07E+00	6.80E-08	2.99E-07	2.60E+02	7.25E-05	7.00E+02	9.7E+06	1.07E+03	2.3E+09
Fe-55	4.72E+00	2.99E-07	1.32E-06	4.81E+02	1.34E-04	1.00E+02	7.5E+05	4.49E+02	7.6E+07
Co-57	NA	N/A	N/A	9.10E-01	2.54E-07	3.33E+01	1.3E+08	N/A	N/A
Co-58	3.70E+01	2.35E-06	1.03E-05	2.55E+03	7.12E-04	4.00E+01	5.6E+04	3.03E+02	3.9E+06
Fe-59	1.94E+01	1.23E-06	5.41E-06	5.99E+01	1.67E-05	2.00E+01	1.2E+06	1.36E+01	3.7E+06
Co-60	3.18E+02	2.02E-05	8.89E-05	9.66E+02	2.69E-04	2.00E+00	7.4E+03	1.33E+01	2.3E+04
Ni-63	4.74E-03	3.01E-10	1.32E-09	4.81E-01	1.34E-07	4.00E+01	3.0E+08	4.46E+02	3.0E+10
Cu-64	6.93E-01	4.39E-08	1.93E-07	7.40E+02	2.06E-04	1.00E+03	4.8E+06	4.70E+03	5.2E+09
Zn-65	2.80E+02	1.78E-05	7.83E-05	8.21E+02	2.29E-04	1.00E+01	4.4E+04	1.29E+01	1.3E+05
Rb-89	2.01E-02	1.27E-09	5.59E-09	3.20E+00	8.92E-07	7.00E+03	7.8E+09	7.03E+02	1.3E+12
Sr-89	1.48E+02	9.38E-06	4.13E-05	4.22E+02	1.18E-04	7.00E+00	6.0E+04	1.25E+01	1.7E+05
Sr-90	7.65E-01	4.85E-08	2.13E-07	1.33E+02	3.71E-05	2.00E-01	5.4E+03	7.66E+02	9.4E+05
Y-90	3.27E-02	2.07E-09	9.11E-09	3.40E+00	9.48E-07	3.00E+01	3.2E+07	4.58E+02	3.3E+09

GGNS COL 12.2-2-A

GGNS ESP COL 11.1-1

TABLE 12.2-206 (Sheet 3 of 4)
COMPARISON OF SITE-SPECIFIC AIRBORNE CONCENTRATIONS WITH 10 CFR 20 TABLE 2 COLUMN 1 CONCENTRATIONS

Nuclide	DCD Table 12.2-17 Airborne Release (MBq/yr)	DCD Table 12.2-17 Airborne Concentration (Bq/m^3)	Adjusted DCD Table 12.2-17 Concentration[2] (Bq/m^3)	Unit 3 Composite Normal Airborne Release[1] (MBq/yr)	Unit 3 Composite Airborne Concentration[1] (Bq/m^3)	10 CFR 20 Appendix B, Table 2, Column 1 (Bq/m^3)	Concentration Ratio (10CFR20 / Unit 3)	Concentration Ratio (Unit 3 / DCD)	Concentration Ratio (10CFR20 / Adjusted DCD)
Sr-91	6.72E-01	4.26E-08	1.87E-07	7.40E+01	2.06E-05	2.00E+02	9.7E+06	4.84E+02	1.1E+09
Sr-92	4.63E-01	2.93E-08	1.29E-07	5.81E+01	1.62E-05	3.00E+02	1.9E+07	5.53E+02	2.3E+09
Y-91	1.74E-01	1.10E-08	4.84E-08	1.78E+01	4.96E-06	7.00E+00	1.4E+06	4.51E+02	1.4E+08
Y-92	3.68E-01	2.33E-08	1.03E-07	4.59E+01	1.28E-05	4.00E+02	3.1E+07	5.49E+02	3.9E+09
Y-93	7.23E-01	4.58E-08	2.02E-07	8.21E+01	2.29E-05	1.00E+02	4.4E+06	5.00E+02	5.0E+08
Zr-95	4.49E+01	2.85E-06	1.25E-05	1.18E+02	3.29E-05	1.00E+01	3.0E+05	1.15E+01	8.0E+05
Nb-95	2.44E+02	1.55E-05	6.82E-05	6.22E+02	1.73E-04	7.00E+01	4.0E+05	1.12E+01	1.0E+06
Mo-99	1.66E+03	1.05E-04	4.62E-04	4.40E+03	1.23E-03	7.00E+01	5.7E+04	1.17E+01	1.5E+05
Tc-99m	2.23E-01	1.41E-08	6.20E-08	2.20E+01	6.14E-06	7.00E+03	1.1E+09	4.35E+02	1.1E+11
Ru-103	1.04E+02	6.58E-06	2.90E-05	2.60E+02	7.25E-05	3.00E+01	4.1E+05	1.10E+01	1.0E+06
Rh-103m	8.24E-02	5.22E-09	2.30E-08	8.21E+00	2.29E-06	7.00E+04	3.1E+10	4.39E+02	3.0E+12
Ru-106	1.35E-02	8.56E-10	3.77E-09	8.66E+00	2.41E-06	7.00E-01	2.9E+05	2.82E+03	1.9E+08
Rh-106	1.35E-02	8.56E-10	3.77E-09	1.40E+00	3.90E-07	4.00E+01	1.0E+08	4.56E+02	1.1E+10
Ag-110m	5.86E-02	3.71E-09	1.63E-08	1.48E-01	4.13E-08	4.00E+00	9.7E+07	1.11E+01	2.5E+08
Sb-124	5.37E+00	3.40E-07	1.50E-06	1.34E+01	3.73E-06	1.00E+01	2.7E+06	1.10E+01	6.7E+06
Sb-125	NA	N/A	N/A	6.77E+00	1.89E-06	2.59E+01	1.4E+07	N/A	N/A
Te-129m	1.63E-01	1.03E-08	4.53E-08	1.62E+01	4.52E-06	1.00E+01	2.2E+06	4.39E+02	2.2E+08
Te-131m	5.50E-02	3.49E-09	1.54E-08	5.59E+00	1.56E-06	4.00E+01	2.6E+07	4.46E+02	2.6E+09
Te-132	1.41E-02	8.91E-10	3.92E-09	1.40E+00	3.90E-07	3.00E+01	7.7E+07	4.38E+02	7.7E+09
Cs-134	1.78E+02	1.13E-05	4.97E-05	4.59E+02	1.28E-04	7.00E+00	5.5E+04	1.13E+01	1.4E+05

GGNS COL 12.2-2-A

GGNS ESP COL 11.1-1

TABLE 12.2-206 (Sheet 4 of 4)
COMPARISON OF SITE-SPECIFIC AIRBORNE CONCENTRATIONS WITH 10 CFR 20 TABLE 2 COLUMN 1 CONCENTRATIONS

Nuclide	DCD Table 12.2-17 Airborne Release (MBq/yr)	DCD Table 12.2-17 Airborne Concentration (Bq/m^3)	Adjusted DCD Table 12.2-17 Concentration[2] (Bq/m^3)	Unit 3 Composite Normal Airborne Release[1] (MBq/yr)	Unit 3 Composite Airborne Concentration[1] (Bq/m^3)	10 CFR 20 Appendix B, Table 2, Column 1 (Bq/m^3)	Concentration Ratio (10CFR20 / Unit 3)	Concentration Ratio (Unit 3 / DCD)	Concentration Ratio (10CFR20 / Adjusted DCD)
Cs-136	1.47E+01	9.31E-07	4.10E-06	4.40E+01	1.23E-05	3.00E+01	2.4E+06	1.32E+01	7.3E+06
Cs-137	2.69E+02	1.70E-05	7.48E-05	6.99E+02	1.95E-04	7.00E+00	3.6E+04	1.15E+01	9.4E+04
Cs-138	8.50E-02	5.39E-09	2.37E-08	1.26E+01	3.52E-06	3.00E+03	8.5E+08	6.53E+02	1.3E+11
Ba-140	7.82E+02	4.96E-05	2.18E-04	2.00E+03	5.58E-04	7.00E+01	1.3E+05	1.13E+01	3.2E+05
La-140	1.29E+00	8.19E-08	3.60E-07	1.34E+02	3.73E-05	7.00E+01	1.9E+06	4.56E+02	1.9E+08
Ce-141	2.66E+02	1.69E-05	7.44E-05	6.81E+02	1.90E-04	3.00E+01	1.6E+05	1.12E+01	4.0E+05
Ce-144	1.35E-02	8.53E-10	3.75E-09	1.40E+00	3.90E-07	7.00E-01	1.8E+06	4.57E+02	1.9E+08
Pr-144	1.35E-02	8.53E-10	3.75E-09	1.40E+00	3.90E-07	7.00E+00	1.8E+07	4.57E+02	1.9E+09
W-187	1.29E-01	8.21E-09	3.61E-08	1.40E+01	3.90E-06	4.00E+02	1.0E+08	4.75E+02	1.1E+10
Np-239	8.28E+00	5.25E-07	2.31E-06	8.81E+02	2.46E-04	1.00E+02	4.1E+05	4.68E+02	4.3E+07
H-3	2.80E+06	1.78E-01	7.83E-01	2.81E+08	7.84E+01	4.00E+03	5.1E+01	4.41E+02	5.1E+03

NOTES:

1. Composite Release from ESP-002 Appendix D, Table D7.

2. Adjusted based on ratio of site-specific χ/Q and DCD χ/Q: (8.8E-06 / 2.0E-06 = 4.4)

12.3 RADIATION PROTECTION

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

12.3.1.3 RADIATION ZONING

STD COL 12.3-3-A Replace the last sentence with the following.

Access to "Very High Radiation Areas" is discussed in Section 12.5.

12.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

Replace the last bullet with the following.

STD COL 12.3-2-A The radiation instrumentation that monitors airborne radioactivity is classified as nonsafety-related. Airborne radiation monitoring operational considerations, such as the procedures for operation and calibration of the monitors, as well as the placement of the portable monitors, are discussed in Section 12.5.

12.3.7 COL INFORMATION

12.3-2-A Operational Considerations

STD COL 12.3-2-A This COL item is addressed in Section 12.3.4.

12.3-3-A Controlled Access

STD COL 12.3-3-A This COL item is addressed in Section 12.3.1.3.

12.4 DOSE ASSESSMENT

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

Add the following paragraph at the end of Section 12.4, prior to Section 12.4.1.

GGNS SUP 12.4-1 Doses to Unit 3 construction workers from the operation of Unit 1 are presented in Appendix 12CC, Doses to Construction Workers Historical Information.

12.5 OPERATIONAL RADIATION PROTECTION PROGRAM

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

STD COL 12.5-1-A
STD COL 12.5-2-A
STD COL 12.5-3-A

Add the following as introductory text.

The operational program for radiation protection is addressed in Appendix 12BB.

12.5.4 COL INFORMATION

12.5-1-A Radiation Protection Program

STD COL 12.5-1-A This COL item is addressed in Appendix 12BB.

12.5-2-A Equipment, Instrumentation, and Facilities

STD COL 12.5-2-A This COL item is addressed in Appendix 12BB.

12.5-3-A Compliance with Paragraph 50.34(f)(xxvii) of 10 CFR 50 and NUREG-0737 Item III.D.3.3

STD COL 12.5-3-A This COL item is addressed in Appendix 12BB.

12.6 MINIMIZATION OF CONTAMINATION AND RADWASTE GENERATION

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

12.6.1 MINIMIZATION OF CONTAMINATION TO FACILITATE DECOMMISSIONING

STD SUP 12.6-1 Add the following at the end of this section.

In addition to design features, measures are implemented in operating procedures to minimize contamination. Appendix 12BB establishes contamination control measures to ensure compliance with 10 CFR 20.1406. Practical measures to prevent the spread of contamination are employed, including:

- Engineering controls, such as portable ventilation or filtration units to reduce concentrations of radioactivity in air or fluids, are used where practical
- Criteria for selecting tools, material, and equipment for use in contaminated areas include minimizing the use of porous or other materials that are difficult to decontaminate
- Leaks and spills are contained promptly and repaired or cleaned up as soon as practical
- Containments, caches, and enclosures are used during maintenance, repairs, and testing, when practical, to contain spills or releases
- Contaminated tools and equipment are segregated from clean tools and equipment
- Potentially contaminated systems, equipment, and components are surveyed for the presence of contamination when opened or prior to removal
- Procedures ensure that equipment performs and is operated in accordance with the design requirements
- Temporary and permanent design modifications require compensatory measures be taken to prevent and limit the spread of contamination

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APPENDIX 12A CALCULATION OF AIRBORNE RADIONUCLIDES

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 12AA ALARA PROGRAM

STD SUP 12.1-1 NEI 07-08, Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA), which is currently under review by the NRC staff, is incorporated by reference. (Reference 12AA-201)

12AA.1 REFERENCES

12AA-201 Nuclear Energy Institute (NEI), Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA), NEI 07-08.

STD COL 12.1-1-A
STD COL 12.1-2-A
STD COL 12.1-3-A
STD COL 12.1-4-A
STD COL 12.5-1-A
STD COL 12.5-2-A
STD COL 12.5-3-A

APPENDIX 12BB RADIATION PROTECTION

NEI 07-03, Generic FSAR Template Guidance for Radiation Protection Program Description, which is currently under review by the NRC staff, is incorporated by reference. (Reference 12BB-201)

12BB.1 REFERENCES

12BB-201 Nuclear Energy Institute (NEI), Generic FSAR Template Guidance for Radiation Protection Program Description, NEI 07-03.

GGNS SUP 12.4-1

APPENDIX 12CC DOSES TO CONSTRUCTION WORKERS HISTORICAL INFORMATION

Radiological dose estimates to construction workers at Unit 3 construction locations on the Grand Gulf site resulting from the operation of Unit 1, a boiling-water reactor nuclear plant, are provided herein.

12CC.1 SITE LAYOUT

Figure 1.1-201 provides the layout and arrangement of the Unit 3 plant structures. Figure 2.4.1-201, Sheet 8, provides the layout of the site, including Unit 1 structures, and their location with respect to Unit 3 structures, and Figure 2.4.1-202 shows the relative location of the liquid effluent discharge to the location of the Unit 3 intake embayment.

12CC.2 RADIATION SOURCES

Construction workers on the Unit 3 site could be exposed to direct radiation, and to liquid and to gaseous radioactive effluents emanating from the routine operation of Unit 1. Radiation dose to construction workers will be due mostly to skyshine from the nitrogen-16 (N-16) source present in the operating Unit 1 main turbine steam cycle. However, exposure from the Unit 1 condensate water storage tank (CST), the dry fuel storage facility, and from airborne effluents from Unit 1 are also considered.

The N-16 activity present in the reactor steam in the main steam lines, turbines, and moisture separators provides an air-scattered radiation dose contribution to locations outside the Unit 1 structures as a result of the high energy gamma rays which it emits as it decays. An additional gamma source from the radioactivity in the condensate water storage tank volume is considered.

Unit 1 releases airborne effluents via four gaseous effluent release points to the environment. These are the radwaste building vent, the turbine building vent, the containment vent, and the auxiliary building vent. The mechanical vacuum pump exhausts to the turbine building vent, and the offgas system exhausts to the radwaste building vent (Reference 12CC-201, Section 11.3.3.2). The normal gaseous radiological effluent releases are obtained from Unit 1 Annual Radioactive Effluent Release Reports (ARERR). These reports for the years 2000 through 2003 were compared and the most limiting annual airborne radionuclide releases determined. The composite releases are given in Table 12CC-201.

Unit 1 releases radioactive liquid effluents via the radwaste discharge pipe which are diluted by mixing with the cooling tower blowdown flow of approximately 11,000 gpm (Reference 12CC-201, Section 11.2.3.2). These effluents are released directly to the Mississippi River via an underground pipe from the Unit 1 site to the river. Construction activities for Unit 3, at the river, would primarily be upstream of the Unit 1 release point for liquid effluents (See Figure 2.4.1-202). As stated in the GGNS Annual Radiological Environmental Operating Reports

(AREOR) for 2002 (Reference 12CC-204) surface water and fish samples each were collected from two locations and analyzed for gamma radionuclides and tritium. Gamma radionuclides and tritium remained undetectable in the upstream and downstream Mississippi River water sample locations, and GGNS did not detect any gamma radionuclides in fish samples. Because of the undetectable levels of radionuclides upstream of the Unit 1 release point, Unit 3 workers would receive a negligibly low dose from construction activities at the intake location. In addition, gamma emitting radionuclides and tritium were undetectable in a downstream sample collected during a Unit 1 liquid radwaste discharge. Other waterborne pathways considered for the general population such as shoreline activities and swimming are not applicable to construction workers. Therefore, there would be minimal (if any) impact to construction workers from radioactivity contained in liquid effluents. This source term is not considered further.

12CC.3 MEASURED RADIATION DOSE RATES AND AIRBORNE CONCENTRATIONS

Radiological monitoring data obtained from the AREOR for the years 2000, 2001, and 2002 (References 12CC-202 through 12CC-204) were used to assess any potential radiological impact on construction workers due to the operation of Unit 1 from direct radiation sources. These results are summarized in Table 12CC-203. The normal gaseous radiological effluent releases are obtained from Unit 1 ARERRs for the years 2000 through 2003 (References 12CC-205 through 12CC-208).

12CC.3.1 Airborne-Related Dose

The doses to Unit 3 construction workers due to the annual, normal, gaseous effluent releases from Unit 1 are calculated in accordance with the suggested models and assumptions of RG 1.109. Individual worker doses are calculated for the following exposure pathways: external exposure to airborne activity in the released plume, external exposure to deposited activity on the ground, and inhalation of airborne activity in the released plume.

The guidance on acceptable models and necessary input data provided in RG 1.111 is utilized in the calculation of annual average relative concentration, χ/Q, and annual average relative deposition, D/Q, for gaseous effluent routine releases from Unit 1. The χ/Q and D/Q values for the closest boundary of the Unit 3 construction areas from the existing Unit 1 containment centerline are determined. The closest construction worker distance from the Unit 1 containment centerline is the Unit 3 powerblock area (Figure 2.4.1-201), the area of the most significant construction activity; this distance is approximately 256 m (841 ft). For conservatism, a value of 240 m is used in the χ/Q evaluation. Calculation of atmospheric dispersion and deposition values at this minimum distance is conservative for this application. Radioactive decay and dry deposition are also considered. The limiting χ/Q value for this evaluation is 1.10E-04 sec/m^3 in the WSW direction.

The GASPAR II computer code was used to determine the annual gaseous effluent release doses to the construction workers. GASPAR II provides doses expressed in terms of whole body and thyroid, whereas the acceptance criteria given in 10 CFR 20.1201 and 10 CFR 20.1301 are expressed in terms of Total Effective Dose Equivalent (TEDE). In order to compare GASPAR doses with acceptance criteria expressed in terms of TEDE, the thyroid dose is multiplied by 0.03 and the product added to the whole body dose per the instruction provided in RG 1.183. The doses are also adjusted for the actual time the construction workers will be on site by multiplying by a ratio of hours worked per year (assumed to be 2080 hours) to total number of hours in a year. Adjusted annual individual worker doses from airborne effluents by pathway are presented in Table 12CC-202. The total dose to an individual construction worker from Unit 1 operational airborne effluents is 1.5E-03 mSv (0.15 mrem) TEDE.

12CC.3.3 Direct Radiation Dose

12CC.3.3.1 Radiation Sources Other than Unit 1 ISFSI

The doses to Unit 3 construction workers from direct radiation from contained radioactive sources within the Unit 1 facility are primarily determined based on the gamma doses reported in GGNS AREORs. Thermoluminescent dosimeters (TLDs) are used to measure ambient gamma radiation levels at many locations surrounding Unit 1. The TLDs on the protected area (PA) boundary surrounding the plant were used in determining the construction worker dose due to direct radiation from the Unit 1 facility from sources including the main turbine steam cycle, condensate storage tank and other potential sources. These TLDs are closer to Unit 1 than the Unit 3 construction areas; therefore, external whole body (gamma) dose results obtained from them conservatively bound the construction worker dose. Protected area boundary TLD gamma dose results were obtained from the AREORs for the years 2000, 2001, and 2002. These results are summarized in Table 12CC-203. The majority of the construction work is expected to be done to the west of Unit 1 in the Unit 3 powerblock and cooling tower areas. From Table 12CC-203, it can be seen that the protected area TLD readings on the west side of Unit 1 (M-63, M-64, M-65, M-74, M-76, M-77 and M-81) are significantly lower than other TLD readings. Given these factors, it is reasonable to use an average of all of the PA TLD data to determine external whole body dose for all Unit 3 construction areas. The three years of quarterly PA TLD data given in Table 12CC-203 are averaged and then multiplied by four to determine an annual average whole body dose of 1.56 mSv/yr (156 mrem/yr). Considering an exposure period of 2080 hours per year, the adjusted annual average whole body dose associated with direct radiation to Unit 3 construction workers from Unit 1 is 0.371 mSv/yr (37.1 mrem/yr).

12CC.3.3.2 Direct Radiation Dose from the Unit 1 ISFSI

The Grand Gulf independent spent fuel storage installation (ISFSI) is located on the north side of the Unit 1 site and inside the protected area fence. The facility is being constructed in two phases. Phase 1 holds 48 casks and was made operational in 2007; four casks are loaded every 18 months, resulting in a fully loaded Phase 1 installation in approximately 2018. The need for the second phase of the ISFSI will be considered in the future. Dose rates associated with a completely loaded Phase 1 array are considered conservative for use when considering Unit 3 construction worker dose.

The calculated near field gamma dose rate associated with a completely loaded Phase 1 ISFSI array varies from 0.04 to 1.0E-03 mSv/hr (4 to 0.1 mrem/hr) within the confines of the ISFSI fences. In general, the PA fence dose rate is well below 0.02 mSv/hr (2 mrem/hr) except at the north end of the ISFSI. The minimum distance from the ISFSI to the closest Unit 3 construction area is estimated to be more than 114 m (375 ft) based on Figure 2.4.1-201. For conservatism, a distance of 100 m is used. Neglecting attenuation, a 4 mrem/hr dose rate within the confines of the ISFSI is reduced to 4.0E-06 mSv/hr (4.0E-04 mrem/hr) at 100 m from the facility.

Considering an exposure period of 2080 hours per year, the maximum dose to a construction worker associated with the ISFSI is 8.0E-03 mSv/yr (0.8 mrem/yr).

12CC.4 CONSTRUCTION WORKER DOSE ESTIMATES

Summing the doses determined above, the annual dose to construction workers in the Unit 3 construction areas as a result of radiation from the operating plant is 0.38 mSv/yr (38 mrem/yr) TEDE. Based on an exposure period of 2080 hours per year the maximum one hour dose occurring as a result of radiation from Unit 1 is 1.8E-04 mSv (1.8E-02 mrem) TEDE. These doses are bounded by the 10 CFR 20.1301 individual dose limit of 1 mSv/yr (100 mrem/yr) TEDE and the 0.02 mSv/hr (2 mrem/hr) TEDE limit. The collective annual dose to the 3150 member workforce is 1.2 person-Sv (120 person-rem) TEDE. The construction worker doses for Unit 3 are bounded by the 10 CFR 20 limits and the design objective of 10 CFR 50 Appendix I limits.

The annual dose to an individual construction worker from the direct and airborne pathways is compared to the dose criteria in 10 CFR 20.1301 and 40 CFR 190 in Table 12CC-204 and Table 12CC-205, respectively. Comparison of the construction worker occupational dose to 10 CFR 20.1201 criteria is provided in Table 12CC-206. Annual dose to an individual is summarized in Table 12CC-207. Table 12CC-208 shows that the doses also meet the design objectives of 10 CFR 50, Appendix I, for gaseous effluents.

12CC.5 REFERENCES

12CC-201 Grand Gulf Nuclear Station Unit 1 Updated Final Safety Analysis Report, June 2007

12CC-202 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for 2000, April 16, 2001 (ADAMS Accession No. ML011090118)

12CC-203 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for 2001, April 24, 2002 (ADAMS Accession No. ML021200537)

12CC-204 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for 2002, April 15, 2003 (ADAMS Accession No. ML031120162)

12CC-205 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2000 – December 31, 2000, April 2, 2001 (ADAMS Accession No. ML011020305)

12CC-206 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2001 – December 31, 2001, April 16, 2002 (ADAMS Accession No. ML021150807)

12CC-207 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2002 – December 31, 2002, April 15, 2003 (ADAMS Accession No. ML031120183)

12CC-208 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2003 – December 31, 2003, April 28, 2004 (ADAMS Accession No. ML041260554)

TABLE 12CC-201
UNIT 1 ANNUAL GASEOUS RELEASES

GGNS SUP 12.4-1

Nuclide	Ci/yr	Nuclide	Ci/yr	Nuclide	Ci/yr
Ar-41	9.75E-01	Xe-138	8.30E-01	Cs-137	0.00E+00
Kr-85m	3.16E+00	I-131	1.60E-03	Fe-59	0.00E+00
Kr-87	1.36E-01	I-132	8.28E-05	Mn-54	3.79E-06
Kr-88	2.10E+00	I-133	2.21E-03	Ru-106	3.61E-06
Xe-133	2.23E+01	I-135	4.68E-04	Sr-89	3.08E-06
Xe-133m	5.98E-02	Co-58	1.48E-06	Zn-65	1.77E-06
Xe-135	2.15E+01	Co-60	1.23E-05	H-3	1.05E+02
Xe-135m	1.17E+01	Cr-51	3.28E-05		

TABLE 12CC-202
ADJUSTED ANNUAL INDIVIDUAL DOSE (mrem (mSv)) SUMMARY BY PATHWAY

GGNS SUP 12.4-1

PATHWAY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	WHOLE BODY
PLUME	7.72E-02 (7.72E-04)	7.72E-02 (7.72E-04)	7.72E-02 (7.72E-04)	7.72E-02 (7.72E-04)	7.72E-02 (7.72E-04)	7.81E-02 (7.81E-04)	1.51E-01 (1.51E-03)	7.72E-02 (7.72E-04)
GROUND	2.34E-04 (2.34E-06)	2.34E-04 (2.34E-06)	2.34E-04 (2.34E-06)	2.34E-04 (2.34E-06)	2.34E-04 (2.34E-06)	2.34E-04 (2.34E-06)	2.75E-04 (2.75E-06)	2.34E-04 (2.34E-06)
INHALATION	6.24E-02 (6.24E-04)	5.13E-05 (5.13E-07)	6.24E-02 (6.24E-04)	6.27E-02 (6.27E-04)	8.24E-02 (8.24E-04)	6.24E-02 (6.24E-04)	6.24E-02 (6.24E-04)	6.24E-02 (6.24E-04)
TOTAL	1.40E-01 (1.40E-03)	7.75E-02 (7.75E-04)	1.40E-01 (1.40E-03)	1.40E-01 (1.40E-03)	1.60E-01 (1.60E-03)	1.41E-01 (1.41E-03)	2.14E-01 (2.14E-03)	1.40E-01 (1.40E-03)
TEDE								1.45E-01 (1.45E-03)
COLLECTIVE DOSE								4.56E+02 (4.56E+04)

TABLE 12CC-203
EXTERNAL WHOLE BODY (GAMMA) DOSE FROM PROTECTED AREA BOUNDARY TLDS

GGNS SUP 12.4-1

TLD Station Number	Annual Mean Dose (mrem/qtr (mSv/qtr)) 2000	2001	2002
M-61	64.6 (0.646)	54.7 (0.547)	53.9 (0.539)
M-62	86.7 (0.867)	75.5 (0.755)	78.2 (0.782)
M-63	16.7 (0.167)	16.3 (0.163)	17.1 (0.171)
M-64	21.9 (0.219)	19.8 (0.198)	19.6 (0.196)
M-65	18.1 (0.181)	17.3 (0.173)	16.8 (0.168)
M-66	23.2 (0.232)	20.1 (0.201)	20.4 (0.204)
M-67	23.8 (0.238)	20.9 (0.209)	19.4 (0.194)
M-68	97.9 (0.979)	82.2 (0.822)	82.6 (0.826)
M-69	123.7 (1.237)	106.1 (1.061)	101.5 (1.015)
M-70	112.5 (1.125)	95.8 (0.958)	96.5 (0.965)
M-71	31.6 (0.316)	25.0 (0.25)	22.1 (0.221)
M-72	22.3 (0.223)	19.2 (0.192)	17.2 (0.172)
M-74	10.9 (0.109)	9.9 (0.099)	10.1 (0.101)
M-76	16.8 (0.168)	14.9 (0.149)	13.7 (0.137)
M-77	10.2 (0.102)	9.7 (0.097)	8.5 (0.085)
M-81	9.7 (0.097)	10.2 (0.102)	8.4 (0.084)
Average	43.2 (0.432)	37.4 (0.374)	36.6 (0.366)

TABLE 12CC-204
COMPARISON OF CONSTRUCTION WORKER PUBLIC DOSE TO 10 CFR 20.1301 CRITERIA

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limits	Estimated Dose
Whole body dose equivalent	100 mrem (1 mSv)	38 mrem (0.38 mSv)
Maximum dose rate in any hour	2 mrem/hr (0.02 mSv/hr)	1.8E-02 mrem/hr (1.8E-04 mSv/hr)

TABLE 12CC-205
COMPARISON OF CONSTRUCTION WORKER PUBLIC DOSE FROM GASEOUS EFFLUENT DISCHARGES TO 40 CFR 190 CRITERIA

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limits	Evaluated Dose
Whole body dose	25 mrem (0.25 mSv)	0.14 mrem (1.4E-03 mSv)
Thyroid doses	75 mrem (0.75 mSv)	0.16 mrem (1.6E-03 mSv)
Any Other Organ dose	25 mrem (0.25 mSv)	0.14 mrem (1.4E-03 mSv)

Note:

1. 10 CFR 20 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

TABLE 12CC-206
COMPARISON OF CONSTRUCTION WORKER OCCUPATIONAL DOSE TO 10 CFR 20.1201 CRITERIA

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limit	Evaluated Dose
Whole body dose	5 rem (0.05 Sv)	3.8E-02 rem (3.8E-04 Sv)
Thyroid dose	50 rem (0.50 Sv)	3.8E-02 rem (3.8E-04 Sv)
Dose to the eye	15 rem (0.15 Sv)	3.8E-02 rem (3.8E-04 Sv)
Dose to skin or extremities	50 rem (0.50 Sv)	3.8E-02 rem (3.8E-04 Sv)

TABLE 12CC-207
ANNUAL CONSTRUCTION WORKER DOSES

GGNS SUP 12.4-1

	Annual Dose (mrem (mSv))		
	Whole Body	Critical Organ (Thyroid)	TEDE
Direct radiation	37.9 (0.379)	37.9 (0.379)	39.04 (0.39)
Gaseous effluents	0.14 (1.4E-03)	0.16 (1.6E-03)	0.145 (1.45E-03)
Total	38.04 (0.38)	38.06 (0.381)	39.19 (0.392)

Note:

1. A weighting factor of 0.03 is applied to the thyroid dose, which when added to the whole body dose gives the indicated TEDE dose (RG 1.183).

TABLE 12CC-208
COMPARISON WITH 10 CFR 50 APPENDIX I CRITERIA FOR EFFLUENT DOSES

GGNS SUP 12.4-1

	Annual Dose (mrem (mSv))	
	Annual Limit	Estimated Dose
Whole body dose from gaseous effluents	5 (0.05)	0.14 (1.4E-03)
Skin dose from gaseous effluents	15 (0.15)	0.21 (2.1E-03)

CHAPTER 13 CONDUCT OF OPERATIONS

The introductory paragraph of this chapter of the referenced DCD is incorporated by reference with no departures or supplements.

13.1 ORGANIZATIONAL STRUCTURE OF APPLICANT

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

DCD Section 13.1.1, COL Information, is renumbered in this FSAR section to 13.1.4 for administrative purposes to allow section numbering to be consistent with RG 1.206.

Replace the first paragraph with the following.

GGNS COL 13.1-1-A

The organizational structure is described in this section and is consistent with the Human System Interface (HSI) design assumptions used in the design of the ESBWR as described in DCD Chapter 18. The organizational structure is consistent with the ESBWR Human Factors Engineering (HFE) design requirements and complies with the requirements of 10 CFR 50.54 (i) through (m).

This section describes organizational positions of a nuclear power station and owner/applicant corporations and associated functions and responsibilities. The position titles used in the text are generic and describe the function of the position. Table 13.1-201 is a cross-reference to site-specific position titles. Appendix 13AA contains organizational structure historical information.

13.1.1 MANAGEMENT AND TECHNICAL SUPPORT ORGANIZATION

Entergy has over 30 years of experience in the design, construction, and operation of nuclear generating stations. Entergy operates and/or manages multiple nuclear plants across the south, central, and northeast portions of the United States.

Regional corporate offices provide support for the nuclear stations. This support includes executive level management to provide strategic and financial support for plant initiatives, coordination of functional efforts division wide, and functional level management in areas such as training, security, emergency planning, and engineering analysis. Executives, managers, and staff in corporate positions support functions at multiple nuclear plant sites within the corporation. These functions are generally applicable to each site such that standardization and efficiency are accomplished in these areas. The specific needs of each nuclear plant are addressed appropriately.

Figure 13.1-203 provides a high-level illustration of the corporate organization. More detailed charts and position descriptions, including qualification requirements and staffing numbers for corporate support staff, are maintained in corporate offices.

13.1.1.1 Design, Construction, and Operating Responsibilities

The chief executive officer, nuclear operations has overall responsibility for functions involving planning, design, construction, and operation. Line responsibilities for those functions are assigned to the executives in charge of nuclear operations, engineering and technical services, and planning, development, and oversight who maintain direct control of nuclear plant activities. The first priority and responsibility of each member of the nuclear staff throughout the life of the plant is nuclear safety. Decision making for station activities is performed in a conservative manner with expectations of this core value regularly communicated to appropriate personnel by management interface, training, and station directives.

Lines of authority and communication are clearly and unambiguously established to enable the understanding of the various project members, including contractors, that utility management is in charge and directs the project.

Key executive and corporate management positions, functions, and responsibilities are discussed in Section 13.1.1.3.1. The corporate organization is shown in Figure 13.1-203. The management and technical support organization for design, construction, and preoperational activities is addressed in Appendix 13AA for future designation as historical information.

13.1.1.2 Technical Support for Operations

Before beginning preoperational testing the site executive in charge of plant management establishes the organization of managers, functional managers, supervisors, and staff sufficient to perform required functions for support of safe plant operation. These functions include the following:

- Nuclear, mechanical, structural, electrical, thermal-hydraulic, metallurgical and material, and instrumentation and controls (I&C) engineering
- Plant chemistry
- Health physics
- Fueling and refueling operations support
- Maintenance support
- Operations support

- Quality Assurance
- Training
- Safety review
- Fire protection
- Emergency organization
- Outside contractual assistance

In the event that station personnel are not qualified to deal with a specific problem, the services of qualified individuals within the company or an outside consultant are engaged. Figure 13.1-201 illustrates the management and technical support organizations supporting operation of the plant. Section 13.1.1.3.2 provides descriptions of responsibilities and authorities of management positions for organizations providing technical support. Table 13.1-201 shows the estimated number of positions required for each function.

Unit 3 shares its site with Unit 1. Multiple layers of protection are provided to preserve unit integrity including organization. Organizationally, operators and other shift members are assigned to a specific unit. Physical separation of units helps to minimize wrong-unit activities. In addition, station procedures and programs provide operating staff with methods to minimize human error including tagging programs, procedure adherence requirements, and training.

13.1.1.2.1 Engineering

The site engineering department consists of system engineering, design engineering, and engineering programs. These groups are responsible for performing the classical design activities as well as providing engineering expertise for programs, such as inservice inspection/inservice testing (ISI/IST), fire protection, snubbers, and valves. Corporate engineering provides support for engineering projects, safety and engineering analysis, and nuclear fuels engineering. They are responsible for probabilistic safety assessment and other safety issues, plant system reliability analysis, performance and technical support, core management, and periodic reactor testing.

Each of the site engineering groups has a functional manager who reports to the manager in charge of engineering on site or to managers and executives in corporate engineering and technical services.

The engineering organization is responsible for:

- Support of plant operations in the engineering areas of mechanical, structural, electrical, thermal-hydraulic, metallurgy and materials, electronic, instrument and control, and fire protection. Priorities for support activities are established based on input from the plant manager with emphasis on issues affecting safe operation of the plant.

- Support of procurement, chemical and environmental analysis and maintenance activities in the plant as requested by the plant manager.
- Performance of design engineering of plant modifications.
- Maintaining the design basis by updating the record copy of design documents as necessary to reflect the actual as-built configuration of the plant.
- Accident and transient analyses.
- Human Factors Engineering design process.

Reactor engineering, part of system engineering, provides technical assistance in the areas of core operations, core thermal limits, and core thermal hydraulics.

Engineering work may be contracted to and performed by outside companies in accordance with the quality assurance program.

Engineering resources are shared between units. A single management organization oversees the engineering work associated with the station units.

13.1.1.2.2 Safety Review

Review and audit activities are addressed in the Quality Assurance Program Description (QAPD).

Oversight of safety review of station programs, procedures, and activities is performed by a plant safety review committee, a corporate safety review committee, and the Nuclear Safety Assurance (NSA) organization. NSA is responsible for corrective actions and assessments. The manager in charge of NSA reports to the site executive in charge of plant management.

Personnel resources of the NSA organization are shared between units. A single management organization oversees the NSA organization for the station units.

13.1.1.2.3 Quality Assurance

Safety-related activities associated with the operation of the plant are governed by quality assurance (QA) direction established in Chapter 17 and the QAPD. QA is a function of the QA Department and includes:

- General quality assurance indoctrination and training for the nuclear station personnel.

- Maintenance of the QAPD.
- Coordinating the development of audit schedules.
- Audit, surveillance, and evaluation of Nuclear Division suppliers.
- Quality control (QC) inspection/testing activities.

QA/QC management is independent of the station management line organization. The manager of QA reports to the corporate stationed director of oversight.

Personnel resources of the QA organization are shared between units. A single management organization oversees the QA group for the station units.

13.1.1.2.4 Chemistry

A chemistry program is established to monitor and control the chemistry of various plant systems such that corrosion of components and piping is minimized and radiation from corrosion by-products is kept to levels that allow operations and maintenance staff to maintain radiation doses as low as reasonably achievable (ALARA).

The functional manager in charge of chemistry is responsible to the plant manager for maintaining chemistry programs and for monitoring and maintaining the water chemistry of plant systems. The staff of the chemistry department consists of laboratory technicians, support personnel, and supervisors who report to the functional manager in charge of chemistry.

Personnel resources of the chemistry organization are shared between units. A single management organization oversees the chemistry group for the station units.

13.1.1.2.5 Radiation Protection

A radiation protection (RP) program is established to protect the health and welfare of the surrounding public and personnel working at the plant. The RP program is described in Chapter 12.

The RP department is staffed by radiation protection technicians, support personnel, and supervisors who report to the functional manager in charge of radiation protection. To provide sufficient organizational freedom from operating pressures the manager in charge of radiation protection reports directly to the plant manager.

Personnel resources of the RP organization are shared between units. A single management organization oversees RP for both units.

13.1.1.2.6 Fueling and Refueling Support

The function of fueling and refueling is performed by a combination of personnel from various departments including operations, maintenance, radiation protection, engineering, and reactor technology vendor or other contractor staff. Initial fueling is a function of the startup management organization discussed in Appendix 13AA. Refueling operations are a function of the outage management organization. The functional manager in charge of outages is responsible for planning and scheduling outages and for refueling support and reports to the manager in charge of planning, scheduling, and outages.

Personnel resources of the outage management organization are shared between units. A single management organization oversees the outage management department work associated with the station units.

13.1.1.2.7 Training

The training department is responsible for providing training programs that are established, maintained, and implemented in accordance with applicable plant administrative directives, regulatory requirements, and company operating policies so that station personnel can meet the performance requirements of their jobs in operations, maintenance, technical support, and emergency response. The training department's responsibilities encompass operator initial license training, requalification training, and plant staff training as well as the plant access training (general employee training) course and radiation worker training. To provide for independence from operating pressures the manager of training reports to the corporate stationed executive in charge of training and development. Nuclear plant training programs are described in Section 13.2.

Personnel resources of the training department are shared between units. A single management organization provides oversight of station training activities.

13.1.1.2.8 Maintenance Support

In support of maintenance activities, planners, schedulers, and parts specialists prepare work packages, acquire proper parts, and develop procedures that provide for the successful completion of maintenance tasks. Maintenance tasks are integrated into the station schedule for evaluation of operating or safe shutdown risk elements and to provide for efficient and safe performance. Functional managers in charge of planning and scheduling report to the manager in charge of planning, scheduling, and outages.

Personnel of the planning and scheduling organizations are shared between units. A single management organization oversees the function of maintenance support for the station units.

13.1.1.2.9 Operations Support

The operations support function is provided under the direction of the manager in charge of operations. Operations support includes the following programs:

- Operations procedures
- Operations surveillances
- Equipment tagging preparation

13.1.1.2.10 Fire Protection

The station is committed to maintaining a fire protection program as described in Section 9.5.1. The site executive in charge of plant management has overall responsibility for the Fire Protection Program. Assigning the responsibilities at that level provides the authority to obtain the resources and assistance necessary to meet Fire Protection Program objectives, resolve conflicts, and delegate appropriate responsibility to fire protection staff. Fire protection for the facility is organized and administered by the engineer in charge of fire protection. The engineer in charge of fire protection, is responsible for development and implementation of the fire protection program including development of fire protection procedures, site personnel and fire brigade training, and inspections of fire protection systems and functions. The engineer in charge of fire protection reports to the functional manager in charge of engineering programs. Functional descriptions of position responsibilities are included in appropriate procedures. Station personnel are responsible for adhering to the fire protection/prevention requirements detailed in Section 9.5.1. The site executive in charge of plant management has the lead responsibility for overall site fire protection during construction of new units. The fire brigade is described in Section 13.1.2.1.5.

Personnel resources of the fire protection organization are shared between units. A single management organization oversees the fire protection group for the station units.

13.1.1.2.11 Emergency Organization

The emergency organization is a matrix organization composed of personnel who have the experience, training, knowledge, and ability necessary to implement actions to protect the public in the case of emergencies. Managers and station personnel assigned positions in the emergency organization are responsible for supporting the emergency preparedness organization and emergency plan as required. The staff members of the emergency planning organization administer and orchestrate drills and training to maintain qualification of station staff members and develop procedures to guide and direct the organization's response to an emergency. The functional manager in charge of emergency preparedness reports to the corporate executive in charge of emergency planning. The site emergency plan organization is described in the Emergency Plan.

Resources of the emergency planning group are shared between units. A single management organization oversees the emergency planning group for both station units.

13.1.1.2.12 Outside Contractual Assistance

Contract assistance with vendors and outside suppliers is provided by the materials, procurement, and contracts organization. The functional manager in charge of materials, procurement, and contracts reports to the corporate senior manager in charge of materials, purchasing, and contracts.

Resources of the materials, procurement, and contracts organization are shared between units. A single management organization oversees the materials, procurement, and contracts group for both station units.

13.1.1.3 Organizational Arrangement

13.1.1.3.1 Executive/Management Organization

Executive management is ultimately responsible for execution of activities and functions for Unit 3. Executive management establishes expectations such that a high level of quality, safety, and efficiency is achieved in aspects of plant operations and support activities through an effective management control system and an organization selected and trained to meet the above expectations. A high-level chart of the corporate organization is shown in Figure 13.1-203. The executives with direct line of authority for activities associated with the design, construction, and operation of the plant are shown in Figure 13.1-201. Responsibilities of those executives are specified below.

13.1.1.3.1.1 Chief Executive Officer, Nuclear

The chief executive officer, nuclear (CEO) is the chief nuclear officer and has the ultimate responsibility for the safe and reliable operation of each nuclear station owned and/or operated by the utility. It is the responsibility of the CEO to provide guidance and direction such that safety-related activities under his/her direction including engineering, construction, operations, operations support, maintenance, and planning are performed following the guidelines of the quality assurance program. The CEO delegates authority and responsibility for the operation and support of the site through executives in charge of nuclear operations, engineering and technical services, and planning, development, and oversight, and other executive staff in the nuclear generation branch of the corporation. The CEO has no ancillary responsibilities that might detract attention from nuclear safety matters.

13.1.1.3.1.2 Executive in Charge of Nuclear Operations

The executive in charge of nuclear operations is responsible for the operation of all nuclear plants owned and/or managed by the utility. The executive in charge of nuclear operations maintains direct control of nuclear plant operations through a regional senior executive and the site executive in charge of plant management. The executive in charge of nuclear operations is also responsible for the support functions of emergency planning, training and development, and security. The executive in charge of nuclear operations reports to the CEO, nuclear.

13.1.1.3.1.3 Executive in Charge of Engineering and Technical Services

The executive in charge of engineering and technical services is responsible for the engineering activities associated with the nuclear plants in the system and for technical services such as licensing, information technology, and materials, procurement, and contracts. He performs this function through executives and managers who are responsible for the functions and programs discussed in Section 13.1.1.2.1. The executive in charge of engineering and technical services reports to the CEO, nuclear.

13.1.1.3.1.4 Executive in Charge of Planning, Development, and Oversight

The executive in charge of planning, development, and oversight is responsible for ensuring that regulatory requirements associated with the combined operating license are implemented, establishing the necessary licensing framework for the site, and maintaining lines of communication with the regulatory commission during pre- and post-combined operating license application phase and up through the construction phase of the plant, and for oversight and quality assurance throughout the life of the plant. The direct reports of the executive in charge of planning, development, and oversight include executives and managers responsible for construction, new plant licensing, and quality assurance. The executive in charge of planning, development, and oversight reports to the CEO, nuclear.

13.1.1.3.1.5 Site Executive in Charge of Plant Management

The site executive in charge of plant management reports to the executive in charge of nuclear operations through a regional senior executive. The site executive in charge of plant management is directly responsible for management and direction of activities associated with the efficient, safe, and reliable operation of the nuclear station, except for those functions delegated to the executive in charge of engineering and technical services and the executive in charge of planning, development, and oversight. The site executive in charge of plant management is assisted in management and technical support activities by the plant manager and manager in charge of nuclear safety assurance. The site executive in charge of plant management is responsible for the site fire protection program through the engineer in charge of fire protection. See Section 13.1.1.2.10.

13.1.1.3.1.6 Manager in Charge of Nuclear Support

The manager in charge of nuclear support is responsible for providing a corporate contact point and assistance in the plant staff areas of operations, chemistry, radwaste, maintenance, and radiation protection. He is also responsible for overseeing the site coordinators of operating experience. The manager in charge of nuclear support reports to the senior executive in charge of nuclear operations via corporate support management.

13.1.1.3.1.7 Manager in Charge of Nuclear Fuels

The manager in charge of nuclear fuels is responsible for providing nuclear fuel and related business and technical support consistent with the operational needs of plant. The manager in charge of nuclear fuels is assisted by an engineering staff and reports directly to the CEO, nuclear.

13.1.1.3.2 Site Organization

13.1.1.3.2.1 Manager in Charge of Engineering

The manager in charge of engineering is the on-site lead position for engineering and reports to the senior executive in charge of engineering and technical services via corporate engineering management. The manager in charge of engineering is responsible for engineering activities related to design engineering, system engineering, and programs and components as described in Section 13.1.1.2.1. The manager in charge of engineering directs functional managers responsible for each of the engineering areas noted above.

13.1.1.3.2.1.1 Functional Manager in Charge of System Engineering

The functional manager in charge of system engineering supervises a technical staff of engineers and other engineering specialists and coordinates their work with that of other groups. System engineering staff includes reactor engineering as discussed in Section 13.1.1.2.1. The functional manager in charge of system engineering reports to the manager in charge of engineering and is responsible for providing direction and guidance to system engineers as follows:

- Monitoring the efficiency and proper operation of balance of plant and reactor systems.
- Planning programs for improving equipment performance, reliability, or work practices.
- Conducting operational tests and analyzing the results.
- Identification of plant spare parts for cognizant systems.

13.1.1.3.2.1.2 Functional Manager in Charge of Design Engineering

The functional manager in charge of design engineering reports to the manager in charge of engineering and is responsible for:

- Resolution of design issues.
- On-site development of design related change packages and plant modifications.
- Implementation of effective project management methods and procedures, including cost controls, for implementation of modifications and construction activities.
- Management of contractors who may perform modification or construction activities.
- Maintaining configuration control program.

13.1.1.3.2.1.3 Functional Manager in Charge of Engineering Programs

The functional manager in charge of engineering programs reports to the manager in charge of engineering and is responsible for programs such as:

- Materials engineering
- Performance/ISI engineering
- Valve engineering
- Maintenance rule tracking and trending
- Piping erosion corrosion
- In-service testing
- Fire protection

13.1.1.3.2.1.4 Functional Manager in Charge of Projects

The functional manager in charge of projects reports to the senior executive in charge of engineering and technical services through corporate project management and is responsible for:

- Development of maintenance programs and specifications of selected plant equipment.

- Planned upgrades to equipment such as turbine rotors and major component replacement.
- Implementation of effective project management of contractors.

13.1.1.3.2.1.5 Functional Manager in Charge of Probabilistic Safety Assessment

The functional manager in charge of probabilistic safety assessment (PSA), a corporate-located position, reports to the corporate-located manager of fuels and analysis and is responsible for PSA studies for maintenance activities, outage management planning, and other activities requiring probabilistic safety analysis. The functional manager in charge of PSA provides guidance and direction to a site-located PSA engineer.

13.1.1.3.2.2 Manager in Charge of Nuclear Safety Assurance

The manager in charge of nuclear safety assurance is responsible for corrective actions and assessments and reports to the site executive in charge of plant management.

13.1.1.3.2.2.1 Functional Manager in Charge of Corrective Actions and Assessments

The responsibilities of the functional manager in charge of corrective actions and assessments include establishing processes and procedures to facilitate identification and correction of conditions adverse to quality and implement corrective actions. The functional manager in charge of corrective actions and assessments reports to the manager in charge of nuclear safety assurance.

13.1.1.3.2.3 Functional Manager in Charge of Plant Licensing

The functional manager in charge of plant licensing is responsible for providing a coordinated focus for interface with the NRC, and for technical direction and administrative guidance to the licensing staff for the following activities:

- Developing licensee event reports (LERs) and responding to notices of violations.
- Preparing/submitting license amendments and updating the FSAR.
- Tracking commitments and answering generic letters.
- Analyzing operating experience data and monitoring industry issues.
- Preparing the station for special NRC inspections, interfacing with NRC inspectors, and interpreting NRC regulations.

- Maintaining the licensing basis.

The functional manager in charge of plant licensing reports to the senior executive in charge of engineering and technical services through corporate licensing management.

13.1.1.3.2.4 Functional Manager in Charge of Emergency Preparedness

The functional manager in charge of emergency preparedness is responsible for:

- Coordinating and implementing the plant emergency response plan with state and local emergency plans.
- Developing, planning, and executing emergency drills and exercises.
- Emergency action level development.
- NRC reporting associated with 10 CFR 50.54(q).

The functional manager in charge of emergency preparedness reports to the senior executive in charge of nuclear operations through the corporate emergency planning and support management.

13.1.1.3.2.5 Functional Manager in Charge of Training

The functional manager in charge of training is responsible for training programs at the site required for the safe and proper operation and maintenance of the plant as described in Section 13.1.1.2.7. The functional manager in charge of training supervises a staff of training supervisors who coordinate the development, preparation, and presentation of training programs for nuclear plant personnel and reports through corporate-training and development and support management to the executive in charge of nuclear operations.

13.1.1.3.2.6 Functional Manager in Charge of Materials, Procurement, and Contracts

The functional manager in charge of materials, procurement, and contracts (MP&C) is responsible for providing sufficient and proper materials to support the material needs of the plant and performing related activities including:

- Procedure development
- Materials storage
- Supply system database maintenance
- Meeting quality assurance and internal audit requirements

The functional manager in charge of MP&C is also responsible for site purchasing. The functional manager in charge of MP&C reports to the senior executive in charge of engineering and technical services via corporate materials, procurement, and contracts management.

13.1.1.3.2.7 Functional Manager in Charge of Security

The functional manager in charge of security is responsible for:

- Implementation and enforcement of security directives, procedures, and instructions received from appropriate authorities.
- Day-to-day supervision of the security guard force.
- Administration of the security program.

The functional manager in charge of security reports to the senior executive in charge of nuclear operations via corporate security and support management.

13.1.1.3.2.8 Functional Manager in Charge of Quality Assurance

The functional manager in charge of QA is responsible for those functions listed in Section 13.1.1.2.3. The functional manager in charge of QA reports to the senior executive in charge of planning, development, and oversight via corporate oversight management.

13.1.1.4 Qualifications of Technical Support Personnel

The managers and supervisors in the technical support organizations meet the qualification requirements in education and experience for those described in ANSI/ANS-3.1 (Reference 13.1-201) as endorsed and amended by RG 1.8. The qualification and experience requirements of headquarters staff is established in corporate policy and procedure manuals.

13.1.2 OPERATING ORGANIZATION

13.1.2.1 PLANT ORGANIZATION

The plant management, technical support, and plant operating organizations are shown in Figure 13.1-201. The on-shift operating organization is presented in Figure 13.1-202 which shows those positions requiring NRC licenses. Additional personnel are required to augment normal staff during outages.

Nuclear plant employees are responsible for reporting problems with plant equipment and facilities. They are required to identify and document equipment problems in accordance with the QA program. QA program requirements as they apply to the operating organization are described in the QAPD. Administrative procedures or standing orders include:

- Establishment of a quality assurance program for the operational phase.
- Preparation of procedures necessary to carry out an effective quality assurance program. See Section 13.5 for a description of the station procedure program.
- A program for review and audit of activities affecting plant safety. See the QAPD for a description of station review and audit programs.
- Programs and procedures for rules of practice as described in Section 5.2 of ANSI/ANS-3.2 (Reference 13.1-203).

Managers and supervisors within the plant operating organization are responsible for establishing goals and expectations for their organization and to reinforce behaviors that promote radiation protection. Specifically, managers and supervisors are responsible for the following, as applicable to their position within the plant organization:

- Interface directly with radiation protection staff to integrate radiation protection measures into plant procedures and design documents and into the planning, scheduling, conduct, and assessment of operations and work.
- Notify radiation protection personnel promptly when radiation protection problems occur or are identified, take corrective actions, and resolve deficiencies associated with operations, procedures, systems, equipment, and work practices.
- Train site personnel on radiation protection, and provide periodic retraining, in accordance with 10 CFR Part 19 so that they are properly instructed and briefed for entry into restricted areas.
- Periodically observe and correct, as necessary, radiation worker practices.
- Support radiation protection management in implementing the radiation protection program.
- Maintain exposures to site personnel ALARA.

13.1.2.1.1 Plant Manager

The plant manager reports to the site executive in charge of plant management, is responsible for overall safe operation of the plant, and has control over those on-site activities necessary for safe operation and maintenance of the plant including the following:

- Operations

- Maintenance and modification
- Chemistry and radiochemistry
- Outage management

Additionally, the plant manager has overall responsibility for occupational and public radiation safety. Radiation protection responsibilities of the plant manager are consistent with the guidance in RG 8.8 and RG 8.10 including the following:

- Provide management radiation protection policy throughout the plant organization.
- Provide an overall commitment to radiation protection by the plant organization.
- Interact with and support the manager in charge of radiation protection on implementation of the radiation protection program.
- Support identification and implementation of cost-effective modifications to plant equipment, facilities, procedures, and processes to improve radiation protection controls and reduce exposures.
- Establish plant goals and objectives for radiation protection.
- Maintain exposures to site personnel ALARA.
- Support timely identification, analysis, and resolution of radiation protection problems (e.g., through the plant corrective action program).
- Provide training to site personnel on radiation protection in accordance with 10 CFR Part 19.
- Establish an ALARA Committee with delegated authority from the plant manager that includes, at a minimum, the managers in charge of operations, maintenance, engineering, and radiation protection to help provide for effective implementation of line organization responsibilities for maintaining worker doses ALARA.

The line of succession of authority and responsibility for overall operations in the event of unexpected events of a temporary nature is:

1. Site executive in charge of plant management
2. Manager in charge of operations
3. Manager in charge of plant maintenance

4. Assistant manager in charge of operations

As described in Section 13.1.2.1.2.4, the manager in charge on-shift is the plant manager's direct representative for the conduct of operations. The succession of authority includes the authority to issue standing or special orders as required.

13.1.2.1.1.1 Manager in Charge of Maintenance

Maintenance of the plant is performed by the maintenance department mechanical, electrical, and I&C disciplines. The functions of this department are to perform preventive and corrective maintenance, equipment testing, and implement modifications as necessary. The manager in charge of plant maintenance is responsible for the performance of preventive and corrective maintenance and modification activities required to support operations, including compliance with applicable standards, codes, specifications, and procedures. The manager in charge of plant maintenance reports to the plant manager and provides direction and guidance to the maintenance discipline functional managers and maintenance support staff.

13.1.2.1.1.2 Maintenance Discipline Functional Managers

The functional managers of each maintenance discipline (mechanical, electrical, I&C, and support) are responsible for maintenance activities within their discipline including plant modifications. They provide guidance in maintenance planning and craft supervision. They establish the necessary manpower levels and equipment requirements to perform both routine and emergency type maintenance activities, seeking the services of others in performing work beyond the capabilities of the plant maintenance group. Each discipline functional manager is responsible for liaison with other plant staff organizations to facilitate safe operation of the station. These functional managers report to the manager in charge of plant maintenance.

13.1.2.1.1.3 Maintenance Discipline Supervisors

The maintenance discipline supervisors (mechanical, electrical, and I&C) supervise maintenance activities, assist in the planning of future maintenance efforts, and guide the efforts of the craft within their discipline. The maintenance discipline supervisors report to the appropriate maintenance discipline functional managers.

13.1.2.1.1.4 Manager in Charge of Planning, Scheduling, and Outages

The manager in charge of planning, scheduling, and outages (PS&O) is responsible for those functions described in Sections 13.1.1.2.6 and 13.1.1.2.8. The manager in charge of P&SO safely fulfills the responsibilities of planning and scheduling all plant work through a staff which includes a functional manager in each area of planning, scheduling, and outages. The manager in charge of P&SO reports to the plant manager.

13.1.2.1.1.5 Functional Manager in Charge of Radiation Protection

The functional manager in charge of radiation protection has the direct responsibility for providing adequate protection of the health and safety of personnel working at the plant and members of the public during activities covered within the scope and extent of the license. Radiation protection responsibilities of the functional manager in charge of radiation protection are consistent with the guidance in RG 8.8 and RG 8.10. They include:

- Managing the radiation protection organization.
- Establishing, implementing, and enforcing the radiation protection program.
- Providing radiation protection input to facility design and work planning.
- Tracking and analyzing trends in radiation work performance and taking necessary actions to correct adverse trends.
- Supporting the plant emergency preparedness program and assigning emergency duties and responsibilities within the radiation protection organization.
- Delegating authority to appropriate radiation protection staff to stop work or order an area evacuated (in accordance with approved procedures) when, in his or her judgment, the radiation conditions warrant such an action and such actions are consistent with plant safety.

The functional manager in charge of radiation protection reports to the plant manager and is assisted by the supervisors in charge of radiation protection.

13.1.2.1.1.6 Supervisor in Charge of Radiation Protection

The supervisors in charge of radiation protection are responsible for carrying out the day-to-day operations and programs of the radiation protection department as listed in Section 13.1.1.2.5. Supervisors in charge of radiation protection report to the functional manager in charge of radiation protection.

13.1.2.1.1.7 Radiation Protection Technicians

Radiation protection technicians (RPTs) directly carry out responsibilities defined in the radiation protection program and procedures. In accordance with technical specifications, an RPT is on site whenever there is fuel in the vessel.

The following are some of the duties and responsibilities of the RPTs:

- In accordance with authority delegated by the manager in charge of radiation protection, stop work or order an area evacuated (in accordance with approved procedures) when, in his or her judgment, the radiation conditions warrant such an action and such actions are consistent with plant safety.

- Provide coverage and monitor radiation conditions for jobs potentially involving significant radiation exposure.
- Conduct surveys, assess radiation conditions and establish radiation protection requirements for access to and work within restricted, radiation, high radiation, very high radiation, airborne radioactivity areas, and areas containing radioactive materials.
- Provide control over the receipt, storage, movement, use, and shipment of licensed radioactive materials.
- Review work packages, proposed design modifications, and operations and maintenance procedures to facilitate integration of adequate radiation protection controls and dose-reduction measures.
- Review and oversee implementation of plans for the use of process or other engineering controls to limit the concentrations of radioactive materials in the air.
- Provide personnel monitoring and bioassay services.
- Maintain, prescribe, and oversee the use of respiratory protection equipment.
- Perform assigned emergency response duties.

13.1.2.1.1.8 Functional Manager in Charge of Chemistry

The functional manager in charge of chemistry is responsible for development, implementation, and direction and coordination of the chemistry, radiochemistry and nonradiological environmental monitoring programs. This area includes overall operation of the hot lab, cold lab, emergency off-site facility lab, and non-radiological environmental monitoring. The functional manager in charge of chemistry is responsible for the development, administration, and implementation of procedures and programs which provide for effective compliance with environmental regulations. The functional manager in charge of chemistry reports to the plant manager and directly supervises the chemistry supervisors and chemistry technicians as assigned.

13.1.2.1.1.9 Supervisor of Radwaste/Rad Material Control

The supervisor of radwaste/rad material control is responsible for development, implementation, direction, and coordination of the radwaste program. The supervisor of radwaste/rad material control reports to the manager in charge of radiation protection.

13.1.2.1.2 Operations Department

All operations activities are conducted with safety of personnel, the public, and equipment as the overriding priority. The operations department is responsible for:

- Operation of station equipment.
- Monitoring and surveillance of safety- and nonsafety-related equipment.
- Fuel loading.
- Providing the nucleus of emergency and fire-fighting teams.

The operations department maintains sufficient licensed and senior licensed operators to staff the control room continuously using a crew rotation system. The operations department is under the authority of the manager in charge of operations, who through the assistant manager in charge of shift operations directs the day-to-day operation of the plant.

Specific duties, functions, and responsibilities of key shift members are discussed in Sections 13.1.2.1.2.4 through 13.1.2.1.2.8 and in plant administrative procedures and the technical specifications. The minimum shift staffing requirements are shown in Table 13.1-202. This table reflects the staffing and qualifications assumed in Topical Report ESBWR HFE Staffing and Qualifications, NEDO-33266 (Reference 13.1-204). This table is updated to reflect changes required upon issuance of the Result Summary Report of NEDO-33266. This table complies with the requirements of 10 CFR 50.54 (i) through (m).

Some resources of the operations organization are shared between units. Administrative and support personnel perform their duties on either unit. Additional operations staff is required to fill the on-shift staffing requirements of the additional units. To operate or supervise the operation of more than one unit, an operator (SRO or RO) must hold an appropriate, current license for each unit. A single management organization oversees the operations group for the station units. See Table 13.1-201 for the estimated number of staff in the operations department.

The operations support section is staffed with sufficient personnel to provide support activities for the operating shifts and overall operations department. The following is an overview of the operations organization.

13.1.2.1.2.1 Manager in Charge of Operations

The manager in charge of operations has overall responsibility for the day-to-day operation of the plant. The manager in charge of operations reports to the plant manager and is assisted by the assistant managers in charge of shift operations, operations support, and operations training. The manager in charge of operations or the assistant manager of shift operations is SRO licensed.

13.1.2.1.2.2 Assistant Manager in Charge of Operations-Shift

The assistant manager in charge of operations-shift, under the direction of the manager in charge of operations, is responsible for:

- Shift plant operations in accordance with the operating license, technical specifications, and written procedures.
- Providing supervision of operating shift personnel for operational shift activities including those of emergency and fire-fighting teams.
- Coordinating with the assistant manager in charge of operations support and other plant staff sections.
- Verifying that nuclear plant operating records and logs are properly prepared, reviewed, evaluated, and turned over to the assistant manager in charge of operations support.

The assistant manager in charge of operations-shift is assisted in these areas by the managers in charge on-shift who direct the operating shift personnel. The assistant manager in charge of operations-shift reports to the manager in charge of operations and in the absence of the manager in charge of operations or assistant manager in charge of operations-support may assume the duties and responsibilities of either of these positions.

13.1.2.1.2.3 Assistant Manager in Charge of Operations-Support

The assistant manager in charge of operations-support, under the direction of the manager in charge of operations, is responsible for:

- Directing and guiding plant operations support activities in accordance with the operating license, technical specifications, and written procedures.
- Providing supervision of operating support personnel, for operations support activities, and coordination of support activities.
- Providing for nuclear plant operating records and logs to be turned over to the nuclear records group for maintenance as quality assurance records.

The assistant manager in charge of operations-support is assisted by the supervisors of work management, radwaste operations, operations procedures group, and other support personnel. In the absence of the manager in charge of operations or assistant manager in charge of operations-shift, the assistant manager in charge of operations-support may assume the duties and responsibilities of either of these positions.

13.1.2.1.2.4 Assistant Manager in Charge of Operations-Training

The assistant manager in charge of operations-training is responsible for coordination of training for new operations personnel, for personnel preparing for licensing, and miscellaneous training requirements not covered or addressed by the normal operations training programs. The assistant manager in charge of operations-training reports to the manager in charge of operations.

13.1.2.1.2.5 Manager in Charge On-Shift

The manager in charge on-shift is a licensed senior reactor operator (SRO) responsible for the control room command function, and is the plant manager's direct management representative for the conduct of operations. As such, the manager in charge on-shift has the responsibility and authority to direct the activities and personnel on-site as required to:

- Protect the health and safety of the public, the environment, and personnel on the plant site.
- Protect the physical security of the plant.
- Prevent damage to site equipment and structures.
- Comply with the operating license.

The manager in charge on-shift retains this responsibility and authority until formally relieved of operating responsibilities by a licensed SRO. Additional responsibilities of the manager in charge on-shift include:

- Directing nuclear plant employees to report to the plant for response to potential and real emergencies.
- Seeking the advice and guidance of the shift technical advisor and others in executing his duties whenever in doubt as to the proper course of action.
- Promptly informing responsible supervisors of significant actions affecting their responsibilities.
- Participating in operator training, retraining, and requalification activities from the standpoint of providing guidance, direction, and instruction to shift personnel.

The manager in charge on-shift is assisted in carrying out the above duties by the supervisors in charge on shift and the operating shift personnel. The manager in charge on-shift reports to the assistant manager in charge of operations-shift. If the individual filling this position is qualified, the manager in charge on-shift position may serve as a dual role SRO/STA position.

13.1.2.1.2.6 Supervisor On-Shift, Control Room

The supervisor on-shift, control room is a licensed SRO. The primary function of the supervisor on-shift, control room is to administratively support the manager in charge on-shift such that the “command function” is not overburdened with administrative duties and to supervise the licensed and non-licensed operators in carrying out the activities directed by the manager in charge on-shift. Other duties include:

- Being aware of maintenance and testing performed during his/her shift.
- Shutting down the reactor if conditions warrant this action.
- Informing the manager in charge on-shift and other station management in a timely manner of conditions which may affect public safety, plant personnel safety, plant capacity or reliability, or cause a hazard to equipment.
- Initiating immediate corrective action as directed by the manager in charge on-shift in any upset situation until assistance, if required, arrives.
- Participating in operator training, retraining, and requalification activities from the standpoint of providing guidance, direction, and instruction to shift personnel.

The supervisor on-shift, control room reports directly to the manager in charge on-shift. If the individual filling this position is qualified, the supervisor on-shift, control room position may serve as a dual role SRO/STA position.

13.1.2.1.2.7 Supervisor On-Shift, Field

The supervisor on-shift, field is a licensed SRO. The primary function of the supervisor on-shift, field is to directly supervise any activities being performed in the plant, or which could affect the safe operation of the plant, by non-licensed personnel outside of the control room. These activities include but are not limited to:

- Valve lineups
- Equipment tagging
- Surveillances or other testing activities
- Building rounds
- Maintenance activities

The supervisor on-shift, field reports directly to the manager in charge on-shift. If the individual filling this position is qualified, the supervisor on-shift, field position may serve as a dual role SRO/STA position.

13.1.2.1.2.8 Supervisor On-Shift, Work Control

The supervisor on-shift, work control is a licensed SRO. The primary function of the supervisor on-shift, work control is to review and authorize maintenance, surveillance, or other work or testing activities being performed in the plant. The responsibilities of the supervisor on-shift, work control include keeping the manager on shift and other operations personnel informed of activities for which they need to be cognizant, verifying that work and testing is safe and appropriate for the existing conditions of the plant, and tracking the work and testing to provide assurance that any limiting conditions for operation or other requirements will not be exceeded. If the individual filling this position is qualified, the supervisor on-shift, work control position may serve as a dual role SRO/STA position.

13.1.2.1.2.9 Reactor Operator

The reactor operators (RO) are licensed reactor operators and normally report to the supervisor in charge on-shift or manager in charge on-shift. They are responsible for routine plant operations and performance of major evolutions at the direction of the manager/supervisor in charge on-shift. The RO duties include:

- Monitoring control room instrumentation.
- Responding to plant or equipment abnormalities in accordance with approved plant procedures.
- Directing the activities of non-licensed operators.
- Documenting operational activities, plant events, and plant data in shift logs.
- Initiating plant shutdowns, scrams, or other compensatory actions when observation of plant conditions indicates a nuclear safety hazard exists or when approved procedures so direct.

Whenever there is fuel in the reactor vessel, at least one reactor operator is in the control room monitoring the status of the unit at the main control panel. The RO assigned to the main control panel is designated the “operator at the controls” and conducts monitoring and operating activities in accordance with the guidance set forth in RG 1.114, which is further described in Section 13.1.2.1.3.

13.1.2.1.2.10 Non-Licensed Operator

The non-licensed operators perform routine duties outside the control room as necessary for continuous, safe plant operation including:

- Assisting in plant startup, shutdown, surveillance, and emergency response by manually or remotely changing equipment operating conditions, placing equipment in service, or securing equipment from service at the direction of the reactor operator.
- Performing assigned tasks in procedures and checklists such as valve manipulations for plant startup or data sheets on routine equipment checks, and making accurate entries according to the applicable procedure, data sheet, or checklist.
- Assisting in training of new employees and for improvement and upgrading of their own performance by participating in the applicable sections of the training program.

13.1.2.1.2.11 Shift Technical Advisor

The station is committed to meeting NUREG-0737 TMI Action Plan item I.A.1.1 for shift technical advisors. The Shift Technical Advisor (STA) reports directly to the manager in charge on-shift and provides advanced technical assistance to the operating shift complement during normal and abnormal operating conditions. The STA's responsibilities are detailed in plant administrative procedures as required by TMI Action Plan I.A.1.1 and NUREG-0737 Appendix C. These responsibilities include:

- Activities to monitor core power distribution and critical parameters.
- Activities to assist the operating shift with technical expertise during normal and emergency conditions.
- Evaluation of technical specifications, special reports, and procedural issues.

The STA is to primarily contribute to maximizing safety of operations by independently observing plant status and advising shift supervision of conditions that could compromise plant safety. During transients or accident situations the STA independently assesses plant conditions and provides technical assistance and advice to mitigate the incident and minimize the effect on personnel, the environment, and plant equipment.

A senior reactor operator on shift who meets the qualifications for the combined SRO/STA position specified by Option 1 of Generic Letter 86-04 (Reference 13.1-202) may also serve as the STA. If this option is used for a shift, then the separate STA position may be eliminated for that shift.

13.1.2.1.2.12 Engineer in Charge of Fire Protection

The engineer in charge of fire protection and his staff are responsible for the following:

- Fire protection program requirements, including consideration of potential hazards associated with postulated fires, knowledge of building layout, and system design.
- Post-fire shutdown capability.
- Design, maintenance, surveillance, and quality assurance of fire protection features (e.g., detection systems, suppression systems, barriers, dampers, doors, penetration seals and fire brigade equipment).
- Fire prevention activities (administrative controls and training).
- Fire brigade organization and training.
- Pre-fire planning including review and updating of pre-fire plans at least every two years.

The engineer in charge of fire protection reports to the functional manager in charge of engineering programs for direction in formulating, implementing, and assessing the effectiveness of the fire protection program. The site executive in charge of plant management has ultimate responsibility for fire protection of the plant. Additionally, the engineer in charge of fire protection works with the assistant manager in charge of operations support to coordinate activities and program requirements with the operations department. In accordance with RG 1.189, the engineer in charge of fire protection is a graduate of an engineering curriculum of accepted standing and has completed not less than six years of engineering experience, three of which were in a responsible position in charge of fire protection engineering work.

13.1.2.1.3 Conduct of Operations

Station operations are controlled and/or coordinated through the control room. Maintenance activities, surveillances, and removal from/return to service of structures, systems, and components affecting the operation of the plant may not commence without the authority of senior control room personnel. The rules of practice for control room activities, as described by administrative procedures, which are based on RG 1.114, address the following:

- Position/placement of operator at the controls workstation and the expected area of the control room where the supervisor/manager in charge on shift should spend the majority of his time.
- Definition and outline of “surveillance area” and requirement for continuous surveillance by the operator at the controls.
- Relief requirements for operator at the controls and the supervisor/ manager in charge on shift.

In accordance with 10 CFR 50.54:

- Reactivity controls may be manipulated only by licensed operators and senior operators except as allowed for training under 10 CFR Part 55.
- Apparatus and mechanisms other than controls which may affect reactivity or power level of the reactor shall be operated only with the consent of the operator at the controls or the manager/supervisor in charge on-shift.
- During operation of the facility in modes other than cold shutdown or refueling, a senior operator shall be in the control room and a licensed operator or senior operator shall be present at the controls.

13.1.2.1.4 Operating Shift Crews

Plant administrative procedures implement the required shift staffing. These provisions establish crews with sufficient qualified plant personnel to man the operational shifts and be readily available in the event of an abnormal or emergency situation. The objective is to operate the plant with the required staff and to develop work schedules that minimize overtime for plant staff members who perform safety-related functions. Work hour limitations and shift manning requirements defined by TMI Action Plan I.A.1.3 are retained in station procedures. When overtime is necessary, the provisions in the technical specifications and the plant administrative procedures apply. Shift crew staffing plans may be modified during refueling outages to accommodate safe and efficient completion of outage work in accordance with the proceduralized work hour limitations.

The minimum composition of the operating shift crew is contingent upon the unit operating status. Position titles, license requirements and minimum shift manning for various modes of operation are contained in Technical Specifications, administrative procedures, and Table 13.1-202. Figure 13.1-202 illustrates a typical operating organization based on operating experience and exceeds minimum shift requirements in some cases.

13.1.2.1.5 Fire Brigade

GGNS COL 9.5.1-10-H

The station is designed and the fire brigade organized to be self sufficient with respect to fire fighting activities. The fire brigade is organized to deal with fires and related emergencies that could occur. It consists of a fire brigade leader and a sufficient number of team members to be consistent with the equipment that must be put in service during a fire emergency. A sufficient number of trained and physically qualified fire brigade members are available on site during each shift. The fire brigade consists of at least five members on each shift. Members of the fire brigade are knowledgeable of building layout, and system design. The assigned fire brigade members for any shift do not include the manager in charge on shift nor any other members of the minimum shift operating crew necessary for safe shutdown of the unit, nor does it include any other personnel required for other essential functions during a fire emergency. Fire brigade members for a shift are designated in accordance with established procedures at the beginning of the shift. The fire brigade responds to fire emergencies in both Unit 1 and Unit 3.

13.1.3 QUALIFICATIONS OF NUCLEAR PLANT PERSONNEL

13.1.3.1 QUALIFICATION REQUIREMENTS

GGNS COL 13.1-1-A

Qualifications of managers, supervisors, operators, and technicians of the operating organization meet the qualification requirements in education and experience for those described in ANSI/ANS-3.1 (Reference 13.1-201) as endorsed and amended by RG 1.8. For operators and SROs these requirements are modified in Section 13.2.

13.1.3.2 QUALIFICATIONS OF PLANT PERSONNEL

Resumes and/or other documentation of qualification and experience of initial appointees to appropriate management and supervisory positions are available for review by regulators upon request after position vacancies are filled.

13.1.4 COL INFORMATION

13.1-1-A Organizational Structure

GGNS COL 13.1-1-A

This COL item is addressed in Sections 13.1.1 through 13.1.3 and Appendix 13AA.

13.1.5 REFERENCES

13.1-201 American Nuclear Society, “American National Standard for Selection, Qualification, and Training of Personnel for Nuclear Power Plants,” ANSI/ANS-3.1.

13.1-202 U.S. Nuclear Regulatory Commission, “Generic Letter 86-04, Policy Letter, Engineering Expertise on Shift”.

13.1-203 American Nuclear Society, “American National Standard for Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants,” ANSI/ANS-3.2.

13.1-204 General Electric Company, “ESBWR HFE Staffing and Qualifications Plan,” NEDO-33266, Revision 1, January, 2007.

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 1 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
Executive management	chief executive officer	(n/a)	CEO Entergy Nuclear Operations	1	0
	senior executive, nuclear operations	(n/a)	Senior Vice President, Entergy Nuclear Operations	1	0
	senior executive, planning, development, and oversight	(n/a)	President, Planning, Development, and Oversight	1	0
	senior executive, engineering and technical services	(n/a)	Senior Vice President, Engineering and Technical Services	1	0
Nuclear support	executive, operations support	(n/a)	Vice President, Operations Support	1	0
Site management	executive	(n/a)	Site Vice President	1	0
	plant manager	4.2.1	General Manager, Plant Operations	1	0

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 2 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
Engineering	executive	(n/a)	Vice President, Engineering	1	0
	manager	4.2.4	Director, Engineering	1	0
projects	functional manager	4.3.9	Manager, Projects	1	0
	projects engineer	4.4.10	Project Manager	5	2
system engineering	functional manager	4.3.9	Manager, System Engineering	1	0
	system engineer	4.6.1	System Engineer	39	12
design engineering	functional manager	4.3.9	Manager, Design Engineering	1	0
	design engineer	4.6 - staff engineer	Design Engineer	33	8
safety and engineering analysis	functional manager	4.3.9	Manager, Fuels and Analysis	1	0
	analysis engineer	4.6 - staff engineer	Engineer, Nuclear Analysis	2	1

GGNS COL
13.1-1-A

TABLE 13.1-201 (Sheet 3 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
engineering programs	functional manager	4.3.9	Manager, Programs and Components	1	0
	programs engineer	4.6 - staff engineer	Engineer, Code Programs	16	5
reactor engineering	functional manager	4.3.9	Supervisor, Reactor Engineering	1	0
	reactor engineer	4.6 - staff engineer	Engineer, Reactor	5	2
Maintenance	manager	4.2.3	Manager, Maintenance	1	0
instrumentation and control	functional manager	4.3.4	Superintendent, I&C	1	0
	supervisor	4.4.7	Supervisor, I&C	8	2
	technician	4.5.3.3	Technician, I&C	47	17
mechanical	functional manager	4.3.6	Superintendent, Mechanical	1	0

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 4 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
	supervisor	4.4.9	Supervisor, Mechanical	8	2
	technician	4.5.7.2	Mechanic	52	20
electrical	functional manager	4.3.5	Superintendent, Electrical	1	0
	supervisor	4.4.8	Supervisor, Electrical	8	2
	technician	4.5.7.1	Electrician	40	15
support	functional manager	4.3	Superintendent, Support	1	0
Operations	manager	4.2.2	Manager, Operations	1	0
operations, plant	functional manager	4.3.8	Assistant Manager, Operations - Shift	2	1
operations, admin	functional manager	4.3.8	Assistant Manager, Operations - Support	1	0
operations, training	functional manager	4.3.8	Assistant Manager, Operations - Training	2	1
operations, (on-shift)	functional manager	4.4.1	Shift Manager	12	6

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 5 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
	supervisor	4.4.2	Supervisor, Control Room	12	6
	supervisor	4.4.2	Supervisor, Work Control	12	6
	supervisor	4.4.2/ 4.6.2	Supervisor, Field / STA	12	6
	licensed operator	4.5.1	Control Room Operator	36	18
	non-licensed operator	4.5.2	Auxiliary Operator	64	25
Operations - rad waste	supervisor	4.4	Operations Specialist	2	1
Fire protection	supervisor	4.4	Fire Protection Engineer	3	1
Radiation protection	functional manager	4.3.3	Manager, Radiation Protection	1	0
	supervisor	4.4.6	Radiation Protection Supervisor	6	1

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 6 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
	technician	4.5.3.2	Radiation Protection Technician	40	10
	ALARA specialist	(n/a)	ALARA Specialist	6	3
	decon technician	(n/a)	Decon Technician	10	5
Chemistry	functional manager	4.3.2	Superintendent Chemistry	1	0
	supervisor	4.4.5	Chemistry Supervisor	8	4
	technician	4.5.3.1	Chemistry Technician	20	10
Nuclear safety assurance	manager	4.2	Director, Nuclear Safety Assurance	1	0
licensing	functional manager	4.3	Manager, Plant Licensing	1	0
	licensing engineer	(n/a)	Licensing Engineer, Licensing Specialist	8	3
corrective action	functional manager	4.3	Manager, Corrective Action and Assessments	1	0

TABLE 13.1-201 (Sheet 7 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

GGNS COL 13.1-1-A

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
	corrective action engineer	(n/a)	corrective action engineer	4	1
emergency preparedness	functional manager	4.3	Manager, Emergency Planning	1	0
	EP planner	(n/a)	EP Planner	3	0
Training	functional manager	4.3.1	Manager, Training	1	0
	supervisor ops trng	4.4.4	Superintendent, Operations Training	3	1
	supervisor, simulator	4.4.4	Superintendent, Simulator & Training Support	1	0
	ops training instructor	4.5.4	Ops Training Instructor	22	9
	supervisor tech staff trng	4.4.4	Superintendent, Tech Training	1	0
	supervisor maint trng	4.4.4	Superintendent, Maintenance Training	1	0
	tech staff/maint instructors	4.5.4	Tech Staff/Maint Instructor	13	4

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 8 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
Purchasing, and contracts	functional manager	4.3	Manager, Procurement and Contracts	1	0
Security	functional manager	4.3	Manager, Security	1	0
Planning and scheduling and outage	manager	4.3	Manager, Planning, Scheduling, & Outages	1	0
	functional manager	4.3	Manager, Outage	2	1
	functional manager	4.3	Superintendent, Online Maintenance Scheduling	1	0
	functional manager	4.3	Supervisor, Planning	1	0
Quality assurance	functional manager	4.3.7	Manager, Quality Assurance	1	0
	QA auditor	4.5.6	QA Auditor	8	2
	QC inspector	4.5.5	See Note 5	0	0

GGNS COL 13.1-1-A

TABLE 13.1-201 (Sheet 9 of 9)
GENERIC POSITION / SITE-SPECIFIC POSITION CROSS REFERENCE

Nuclear Function	Function Position - ANSI/ANS-3.1 section reference		Entergy/GGNS Position	Estimated Positions for Site	Estimated positions added for Unit 3
Startup testing	supervisor	4.4.12	Startup Testing Supervisor	N/A	1
	startup test engineer	(n/a)	Startup Test Engineer	N/A	6
	supervisor	4.4.11	Preop Testing Supervisor	N/A	1
	preop test engineer	(n/a)	Preop Test Engineer	N/A	20

Notes:

1. This table represents post-commercial operations.
2. During construction, preoperational testing, and startup testing some of the shared staff depicted here will be augmented with additional personnel to minimize impact on the existing unit.
3. Estimated positions are evaluated and numbers adjusted when additional staffing requirements are identified.
4. Startup testing staff are reassigned to other duties following start of commercial operation.
5. Maybe be filled by qualified individuals who serve in other positions.

GGNS COL 13.1-1-A

TABLE 13.1-202
MINIMUM ON-DUTY OPERATIONS SHIFT ORGANIZATION FOR ONE ESBWR

Unit Shutdown	1 SM (SRO)
	1 RO
	2 NLO
Unit Operating*	1 SM (SRO)
	1 SRO
	2 RO
	2 NLO

Notes:

1. In addition, one Shift Technical Advisor (STA) is assigned per shift during plant operation in modes other than cold shutdown or refueling. A shift manager or another SRO on shift, who meets the qualifications for the combined Senior Reactor Operator/Shift Technical Advisor (SRO/STA) position, as specified by Option 1 of Generic Letter 86-04 (Reference 13.1-202), the commission's policy statement on engineering expertise on shift, may also serve as the STA. If this option is used for a shift, then the separate STA position may be eliminated for that shift.

2. In addition to the minimum shift organization above, during refueling a licensed senior reactor operator or senior reactor operator limited (fuel handling only) is required to directly supervise any core alteration activity.

3. A shift manager/supervisor shall be on site at all times when unit is loaded with fuel.

4. A radiation protection technician shall be on site at all times where there is fuel in a reactor.

5. A chemistry technician shall be on site during plant operation in modes other than cold shutdown or refueling.

* Operating modes other than cold shutdown or refueling.

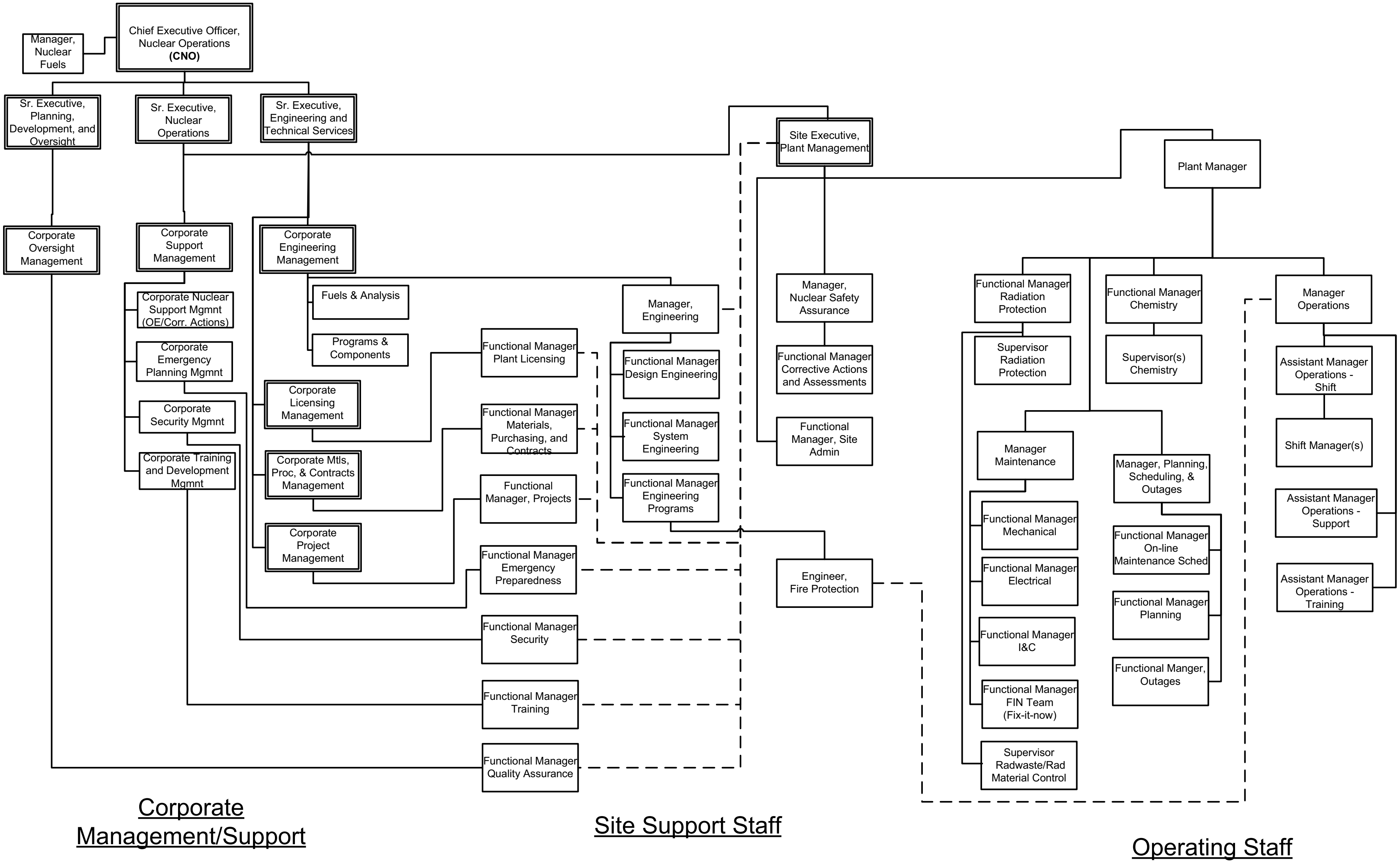
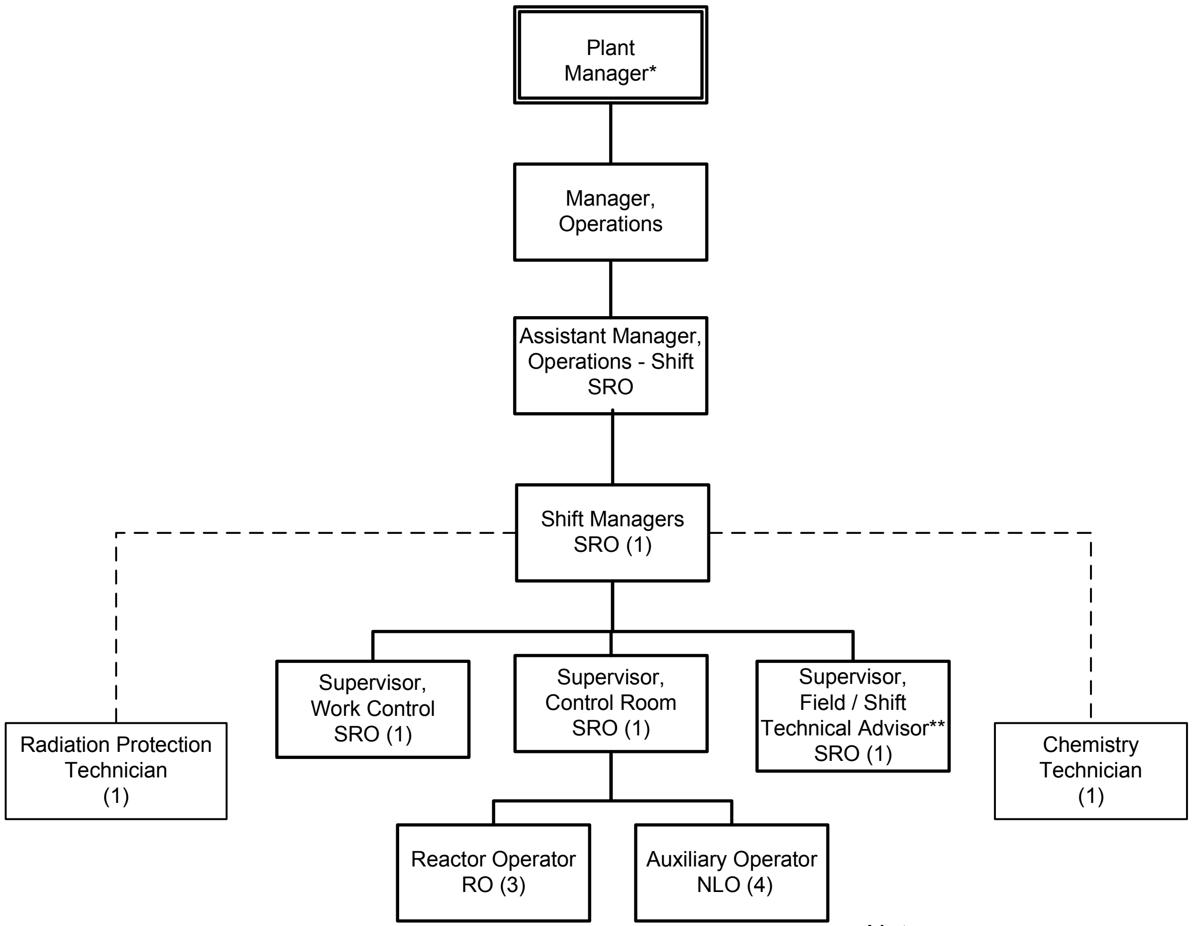


Figure 13.1-201. Nuclear Organization



Notes
1) * position SRO-qualified
2) ** may be met by on-shift combined SRO/STA
3) SRO – licensed senior reactor operator
4) RO – licensed reactor operator
5) NLO – non-licensed operator
6) Shift Manning – 5 shifts (minimum)
7) (No.) - estimated number of positions per shift
8) Minimum shift staffing requirements are in Table 13.1-202

GGNS COL 13.1-1-A

Figure 13.1-202. Shift Operations

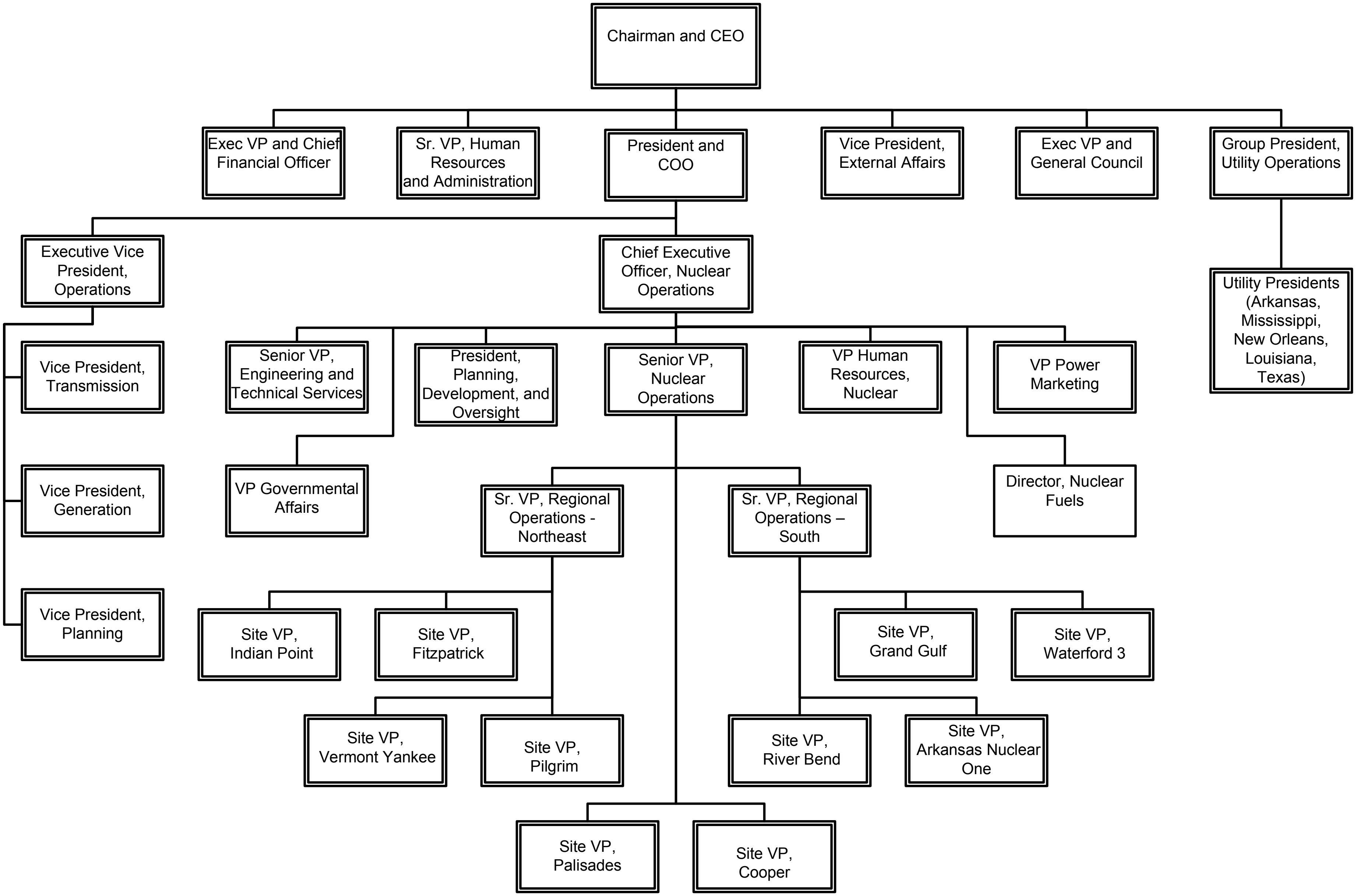


Figure 13.1-203. Entergy Nuclear, Corporate Organization

13.2 TRAINING

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

Add the following as introductory material under Section 13.2.

STD SUP 13.2-1 Training programs are addressed in Appendix 13BB. Implementation milestones are addressed in Section 13.4.

13.2.1 REACTOR OPERATOR TRAINING

Replace the second sentence of the second paragraph with the following.

GGNS COL 13.2-1-A Descriptions of the training program and licensed operator requalification program for reactor operators and senior reactor operators are addressed in Appendix 13BB. A schedule showing approximate timing of initial licensed operator training relative to fuel loading is addressed in Section 13.1. Requalification training is implemented in accordance with Section 13.4.

13.2.2 TRAINING FOR NON-LICENSED PLANT STAFF

Replace the second sentence of the second paragraph with the following.

STD COL 13.2-2-A A description of the training program for non-licensed plant staff is addressed in Appendix 13BB. A schedule showing approximate timing of initial training for non-licensed plant staff relative to fuel load is addressed in Section 13.1.

13.2.5 COL INFORMATION

13.2-1-A Reactor Operator Training

GGNS COL 13.2-1-A This COL item is addressed in Section 13.2.1 and Appendix 13BB.

13.2-2-A Training for Non-Licensed Plant Staff

STD COL 13.2-2-A This COL item is addressed in Section 13.2.2 and Appendix 13BB.

13.3 EMERGENCY PLANNING

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

Replace the fifth and sixth paragraphs with the following.

STD COL 13.3-1-A As addressed in the emergency plan, the TSC is provided with reliable voice and data communication with the MCR and Emergency Operations Facility (EOF) and reliable voice communications with the Operational Support Center (OSC), NRC, and state and local operations centers.

The OSC communications system has at least one dedicated telephone extension to the control room, and one dedicated telephone extension to the TSC, and one telephone capable of reaching on-site and off-site locations, as a minimum.

Replace the second sentence in the seventh paragraph with the following.

STD COL 13.3-3-A Supplies are provided in the service building adjacent to the main change rooms for decontamination of on-site individuals.

13.3.2 EMERGENCY PLAN

STD COL 13.3-1-A 13.3-2-A 13.3-3-A The emergency plan, prepared in accordance with 10 CFR 52.79(d), is maintained as a separate document.

13.3.3 COL INFORMATION

13.3-1-A Identification of OSC and Communication Interfaces with Control Room and TSC

STD COL 13.3-1-A This COL item is addressed in Section 13.3 and in Emergency Plan Sections II-F and II-H.

13.3-2-A Identification of EOF and Communication Interfaces with Control Room and TSC

STD COL 13.3-2-A This COL item is addressed in Section 13.3 and in Emergency Plan Sections II-F and II-H.

13.3-3-A Decontamination Facilities

STD COL 13.3-3-A This COL item is addressed in Section 13.3 and in Emergency Plan Section II-J.

13.4 OPERATIONAL PROGRAM IMPLEMENTATION

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

Replace this section with the following.

STD COL 13.4-1-A
STD COL 13.4-2-A

Table 13.4-201 lists each operational program, the regulatory source for the program, the associated implementation milestone(s), and the section of the FSAR in which the operational program is fully described as required by RG 1.206, Combined License Applications for Nuclear Power Plants (LWR edition).

13.4.1 COL INFORMATION

13.4-1-A Operation Programs

STD COL 13.4-1-A

This COL Item is addressed in Section 13.4.

13.4-2-A Implementation Milestones

STD COL 13.4-2-A

This COL Item is addressed in Section 13.4.

13.4.2 REFERENCES

13.4-201 American Society of Mechanical Engineers (ASME), “Boiler and Pressure Vessel Code (B&PVC), Rules for Inservice Inspection of Nuclear Power Plant Components,” BPVC Section XI.

13.4-202 American Society of Mechanical Engineers (ASME), “Code for the Operation and Maintenance of Nuclear Power Plants,” OM Code.

STD COL 13.4-1-A

STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 1 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
1.	Inservice Inspection Program	10 CFR 50.55a(g)	5.2.4 6.6 DCD 3.8.1.7.3 3.9.3.7.1 (3)(e)	Prior to commercial service	10 CFR 50.55a(g); ASME XI 2001 IWA 2430(b) (Reference 13.4-201)
2.	Inservice Testing Program	10 CFR 50.55a(f)	3.9.6 5.2.4 6.6 3.9.3.7.1(3)(e)	After generator online on nuclear heat	10 CFR 50.55a(f); ASME OM Code (Reference 13.4-202)
3.	Environmental Qualification Program	10 CFR 50.49(a)	3.11	Prior to fuel load	License Condition
4.	Preservice Inspection Program	10 CFR 50.55a(g)	5.2.4 6.6 DCD 3.8.1.7.3 3.9.3.7.1 (3)(e)	Completion prior to initial plant startup	10 CFR 50.55a(g); ASME Code Section XI IWB/ IWC/IWD-2200(a) (Reference 13.4-201)
5.	Reactor Vessel Material Surveillance Program	10 CFR 50.60 10 CFR 50, Appendix H	DCD 5.3.1	Prior to fuel load	License Condition
6.	Preservice Testing Program	10 CFR 50.55a(f)	3.9.6 5.2.4 3.9.3.7.1(3)(e)	Prior to fuel load	License Condition
7.	Containment Leakage Rate Testing Program	10 CFR 50.54(o) 10 CFR 50, Appendix J	DCD 6.2.6	Prior to fuel load	10 CFR Part 50, Appendix J Option B - Section III.a

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 2 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
8.	Fire Protection Program	10 CFR 50.48	9.5.1.15	Prior to fuel receipt for elements of the Fire Protection Program necessary to support receipt and storage of fuel on-site. Prior to fuel load for elements of the Fire Protection Program necessary to support fuel load and plant operation	License Condition

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 3 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
9.	Process and Effluent Monitoring and Sampling Program:				
	Radiological Effluent Technical Specifications/Standard Radiological Effluent Controls	10 CFR 20.1301 and 20.1302 10 CFR 50.34a 10 CFR 50.36a 10 CFR 50, Appendix I, Section II and IV	11.5.4.6	Prior to fuel load	License Condition
	Off-site Dose Calculation manual	Same as above	11.5.4.5 11.5.4.8	Prior to fuel load	License Condition
	Radiological Environmental Monitoring Program	Same as above	11.5.4.5	Prior to fuel load	License Condition
	Process Control Program	10 CFR 20.1301 and 20.1302 10 CFR 50.34a 10 CFR 61.55 and 61.56 10 CFR 71	11.4.2.3	Prior to fuel load	License Condition

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 4 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
10.	Radiation Protection Program	10 CFR 20.1101	12.5	Prior to initial receipt of by-product, source, or special nuclear materials (excluding Exempt Quantities as described in 10 CFR 30.18) for those elements of the Radiation Protection (RP) Program necessary to support such receipt Prior to fuel receipt for those elements of the RP Program necessary to support receipt and storage of fuel on-site Prior to fuel load for those elements of the RP Program necessary to support fuel load and plant operation Prior to first shipment of radioactive waste for those elements of the RP Program necessary to support shipment of radioactive waste	License Condition

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 5 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
11.	Non Licensed Plant Staff Training Program	10 CFR 50.120	13.2.2	18 months prior to scheduled fuel load	10 CFR 50.120(b)
12.	Reactor Operator Training Program	10 CFR 55.13 10 CFR 55.31 10 CFR 55.41 10 CFR 55.43 10 CFR 55.45	13.2.1	18 months prior to scheduled fuel load	License Condition
13.	Reactor Operator Requalification Program	10 CFR 50.34(b) 10 CFR 50.54(i) 10 CFR 55.59	13.2	Within 3 months after issuance of an operating license or the date the Commission makes the finding under 10 CFR 52.103(g)	10 CFR 50.54(i-1)

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 6 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
14.	Emergency Planning	10 CFR 50.47 10 CFR 50, Appendix E	13.3	Full participation exercise conducted within 2 years prior to the scheduled date for initial loading of fuel.	10 CFR Part 50, Appendix E, Section IV.F.2.a (ii)
				On-site exercise conducted within 1 year prior to the schedule date for initial loading of fuel	10 CFR Part 50, Appendix E, Section IV.F.2.a(ii)
				Applicant's detailed implementing procedures for its emergency plan submitted at least 180 days prior to the scheduled date for initial loading of fuel	10 CFR Part 50, Appendix E, Section V

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 7 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
15.	Security Program:	10 CFR 50.34(c)			
	Physical Security Program	10 CFR 73.55 10 CFR 73.56 10 CFR 73.57	13.6	Prior to fuel receipt	License Condition
	Safeguards Contingency Program	10 CFR 50.34(d) 10 CFR Part 73, Appendix C	13.6	Prior to fuel receipt	License Condition
	Training and Qualification Program	10 CFR Part 73, Appendix B	13.6	Prior to fuel receipt	License Condition
	Fitness for Duty Program (Construction - Mgt & Oversight personnel)	10 CFR Part 26, Subparts A-H, N, and O	13.7	Prior to on-site construction of safety- or security-related SSCs	License Condition
	Fitness for Duty Program (Construction - Workers & First Line Supv.)	10 CFR Part 26 Subpart K	13.7	Prior to on-site construction of safety- or security-related SSCs	License Condition
	Fitness for Duty Program (Operation)	10 CFR Part 26	13.7	Prior to fuel receipt	License Condition

STD COL 13.4-1-A
STD COL 13.4-2-A

TABLE 13.4-201 (Sheet 8 of 8)
OPERATIONAL PROGRAMS REQUIRED BY NRC REGULATIONS

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
16.	Quality Assurance Program - Operation	10 CFR 50.54(a) 10 CFR Part 50, Appendix A (GDC 1) 10 CFR Part 50, Appendix B	17.5	30 days prior to scheduled date for initial loading of fuel	10 CFR 50.54(a)(1)
17.	Maintenance Rule	10 CFR 50.65	17.6	Prior to fuel load authorization per 10 CFR 52.103(g)	10 CFR 50.65(a)(1)
18.	Motor-Operated Valve Testing	10 CFR 50.55a(b)(3)(ii)	3.9.6	Prior to fuel load	License Condition
19.	Initial Test Program	10 CFR 50.34 10 CFR 52.79(a)(28)	14.2	Prior to the first construction test being conducted for the Construction Test Program 60 days prior to the scheduled date of the first preoperational test for the Preoperational Test Program 60 days prior to the scheduled date of initial fuel loading for the Startup Test Program	License Condition

13.5 PLANT PROCEDURES

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

STD SUP 13.5-1

This section describes the administrative and operating procedures that the operating organization (plant staff) uses to conduct the routine operating, abnormal, and emergency activities in a safe manner.

STD SUP 13.5-2

The QAPD describes procedural document control, record retention, adherence, assignment of responsibilities and changes.

STD SUP 13.5-3

Procedures are identified in this section by topic, type, or classification in lieu of the specific title, and represent general areas of procedural coverage.

STD SUP 13.5-4

Procedures are developed prior to fuel load to allow sufficient time for plant staff familiarization and to allow NRC staff adequate time to review the procedures and to develop operator licensing examinations.

Regulatory and industry guidance for the appropriate format, content and typical activities delineated in written procedures is implemented as appropriate. Examples include but are not limited to:

GGNS COL 13.5-4-A

- RG 1.33, “Quality Assurance Program Requirements (Operation)”
- ANSI/ANS 3.2, “Administrative Control and Quality Assurance for the Operational Phase of Nuclear Power Plants” (DCD Reference 13.5-2)

GGNS SUP 13.5-1

- ASME NQA-1, “Quality Assurance Requirements for Nuclear Facility Applications” (Reference 13.5-202)

STD SUP 13.5-5

The format and content of procedures are controlled by administrative procedure(s). Procedures are organized to include the following components, as necessary:

- Title Page
- Table of Contents
- Scope and Applicability
- Responsibilities
- Prerequisites
- Precautions and Limitations
- Main Body
- Acceptance Criteria
- Check-off Lists
- References
- Attachments and Data Sheets

STD SUP 13.5-6

Each procedure is sufficiently detailed for an individual to perform the required function without direct supervision, but does not provide a complete description of the system or plant process. The level of detail contained in the procedure is commensurate with the qualifications of the individual normally performing the function.

STD SUP 13.5-7

Procedures are developed consistent with guidance described in DCD Section 18.9, Procedure Development, and with input from the human factors engineering process and evaluations.

The bases for procedure development include:

- Plant design bases
- System-based technical requirements and specifications
- Task analyses results
- Risk-important human actions identified in the HRA/PRA
- Initiating events considered in the Emergency Operating Procedures (EOPs), including those events in the design bases

- Generic Technical Guidelines (GTG) for EOPs

Procedure V&V includes the following activities, as appropriate:

- A review to verify they are correct and can be carried out.
- A final validation in a simulation of the integrated system as part of the V&V activities as described in DCD Section 18.11, Human Factors Verification and Validation.
- A verification of modified procedures for adequate content, format, and integration. The procedures are assessed through validation if a modification substantially changes personnel tasks that are significant to plant safety. The validation verifies that the procedures correctly reflect the characteristics of the modified plant and can be performed effectively to restore the plant.

STD SUP 13.5-8

Procedures for shutdown management are developed consistent with the guidance described in NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," to reduce the potential for loss of reactor coolant system (RCS) boundary and inventory during shutdown conditions. (Reference 13.5-203)

13.5.1 ADMINISTRATIVE PROCEDURES

Replace the first sentence of the first paragraph with the following.

STD SUP 13.5-9

This section describes administrative procedures that provide administrative control over activities that are important to safety for the operation of the facility.

Replace the second paragraph with the following.

STD COL 3.5-1-A

Administrative procedures are developed in accordance with the nominal schedule presented in Table 13.5-202.

GGNS SUP 13.5-2

Procedures outline the essential elements of the administrative programs and controls as described in ANSI/ANS 3.2 (DCD Reference 13.5-2) and the QAPD. These procedures are organized such that the program elements are prescribed in documents normally referred to as administrative procedures.

Administrative procedures contain adequate programmatic controls to provide effective interface between organizational elements. This includes contractor and owner organizations providing support to the station operating organization.

GGNS SUP 13.5-3

The plant procedure program complies with the applicable guidance of RG 1.33, "Quality Assurance Program Requirements (Operation)."

STD SUP 13.5-12

A procedure style (writer's) guide promotes the standardization and application of human factors engineering principles to procedures. The writer's guide establishes the process for developing procedures that are complete, accurate, consistent, and easy to understand and follow. The guide provides objective criteria so that procedures are consistent in organization, style, and content. The writer's guide includes criteria for procedure content and format including the writing of action steps and the specification of acceptable acronym lists and acceptable terms to be used.

STD SUP 13.5-13

Procedure maintenance and control of procedure updates are performed in accordance with the QAPD.

STD SUP 13.5-14

The administrative programs and associated procedures developed in the pre-COL phase are described in Table 13.5-201 (for future designation as historical information).

STD SUP 13.5-15

13.5.1.1 ADMINISTRATIVE PROCEDURES-GENERAL

This section describes those procedures that provide administrative controls with respect to procedures, including those that define and provide controls for operational activities of the plant staff.

STD SUP 13.5-16

Plant administrative procedures provide procedural instructions for the following:

- Procedures review and approval
- Procedure adherence
- Scheduling for surveillance tests and calibration

- Log entries
- Record retention
- Containment access
- Bypass of safety function and jumper control
- Communication systems
- Equipment control procedures - These procedures provide for control of equipment, as necessary, to maintain personnel and reactor safety, and to avoid unauthorized operation of equipment
- Control of maintenance and modifications
- Fire Protection Program procedures
- Crane Operation Procedures - Crane operators who operate cranes over fuel pools are qualified and conduct themselves in accordance with ANSI B30.2 (Chapter 2-3), “Overhead and Gantry Cranes” (Reference 13.5-201).
- Temporary changes to procedures
- Temporary procedure issuance and control
- Special orders of a temporary or self-canceling nature
- Standing orders to shift personnel including the authority and responsibility of the shift manager, senior reactor operator in the control room, control room operator and shift technical advisor
- Manipulation of controls and assignment of shift personnel to duty stations per the requirements of 10 CFR 50.54 (i), (j), (k), (l), and (m) including delineation of the space designated for the “At the Controls” area of the Control Room
- Shift relief and turnover procedures
- Fitness for Duty
- Control Room access
- Working hour limitations
- Feedback of design, construction, and applicable important industry and operating experience

- Shift Manager administrative duties
- Verification of correct performance of operational activities
- A vendor interface program that provides vendor information for safety-related components is incorporated into plant documentation

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STD SUP 13.5-17

13.5.2 OPERATING AND MAINTENANCE PROCEDURES

Replace the third paragraph with the following.

STD COL 13.5-2-A

Operating Procedures are developed in accordance with Section 13.5.2.1 and Maintenance Procedures are developed in accordance with Section 13.5.2.2.6.1.

Replace the fifth paragraph with the following.

GGNS COL 13.5-4-A

A Plant Operations Procedures Development Plan is established in accordance with Section 13.5.2.1.

Replace the second sentence of “Procedures for Calibration, Inspection and Testing” with the following.

STD COL 13.5-6-H

Surveillance procedures that cover safety-related logic circuitry are addressed in Section 13.5.2.2.6.3.

Replace the second paragraph with the heading “Procedures for Handling of Heavy Loads” with the following.

STD COL 13.5-5-A

The scope of procedures in the Plant Operating Procedures Development Plan is addressed in Section 13.5.2.1.

Replace the last sentence of Section 13.5.2 with the following.

STD COL 13.5-3-A

Emergency Procedures are developed in accordance with Section 13.5.2.1.4.

Add the following at the end of Section 13.5.2.

13.5.2.1 OPERATING AND EMERGENCY OPERATING PROCEDURES

STD COL 13.5-2-A

This section describes the operating procedures used by the operating organization (plant staff) to conduct routine operating, abnormal and emergency activities in a safe manner.

Operating procedures are developed at least six months prior to fuel load to allow sufficient time for plant staff familiarization and to allow NRC staff adequate time to review the procedures and to develop operator licensing examinations.

STD SUP 13.5-18

The classifications of operating procedures are:

- System Operating Procedures
- General Operating Procedures
- Abnormal (Off-Normal) Operating Procedures
- Emergency Operating Procedures
- Alarm Response Procedures

STD COL 13.5-2-A

The Plant Operating Procedures Development Plan establishes:

- A scope that includes those operating procedures defined below, which direct operator actions during normal, abnormal and emergency operations, and considers plant operations during periods when plant systems/equipment are undergoing test, maintenance or inspection.
- The methods and criteria for the development, V&V, implementation, maintenance and revision of procedures. The methods and criteria are in accordance with NUREG-0737 TMI Items I.C.1 and I.C.9.

STD COL 13.5-5-A

The following procedures are included in the scope of the Plant Operating Procedures Development Plan:

- System operating procedures
- General operating procedures

- Abnormal (off-normal) or alarm response procedures
- Procedures for combating emergencies and other significant events
- Procedures for maintenance and modification
- Procedures for radiation monitoring and control
- Fuel handling procedures
- Temporary procedures
- Procedures for handling of heavy loads

STD COL 13.5-5-A 13.5-6-H

- Procedures for calibration, inspection and testing

GGNS COL 13.5-4-A

Implementation of the Plant Operating Procedures Development Plan establishes:

- Procedures that are consistent with the requirements of 10 CFR Part 50 and the TMI requirements described in NUREG-0737 and Supplement 1 to NUREG-0737.
- Requirements that the procedures developed include, as necessary, the elements described in ANSI/ANS-3.2 (DCD Reference 13.5-2), as endorsed by RG 1.33.
- Bases for specifying plant operating procedures including:
  - Operator actions identified in the vendor's task analysis and PRA efforts in support of the design certification
  - Standardized plant emergency procedure guidelines
  - Consideration of plant-specific equipment selection and site specific elements such as the station water intake structure and the ultimate heat sink
- The definition of the methods through which specific operator skills and training needs, as may be considered necessary for reliable execution of the procedures, are identified and documented.
- Requirements that the procedures specified above are made available for the purposes of the Human Factors V&V described in GE Report NEDE-

33217P, ESBWR Man-Machine Interface System and Human Factors Engineering Implementation Plan (DCD Reference 13.5-1).

- Procedures for the incorporation of the results of operating experience and the feedback of pertinent information into plant procedures in accordance with the provisions of TMI Item I.C.5 (NUREG-0737).

STD SUP 13.5-19

13.5.2.1.1 System Operating Procedures

Instructions for energizing, filling, venting, draining, starting up, shutting down, changing modes of operation, returning to service following testing or maintenance (if not contained in the applicable procedure), and other instructions appropriate for operation of systems are delineated in system procedures.

System procedures contain check-off lists, where appropriate, which are prepared in sufficient detail to provide an adequate verification of the status of the system.

STD SUP 13.5-20

13.5.2.1.2 General Operating Procedures

General operating procedures provide instructions for performing integrated plant operations involving multiple systems such as plant startup and shutdown. These procedures provide a coordinated means of integrating procedures together to change the mode of plant operation or achieve a major plant evolution. Check-off lists are used for the purpose of confirming completion of major steps in proper sequence.

Typical types of general operating procedures are described as follows:

- Startup procedures provide instruction for starting the reactor from cold or hot conditions, establishing power operation, and recovery from reactor trips.

- Shutdown procedures guide operations during and following controlled shutdown or reactor trips, and include instructions for establishing or maintaining hot standby and safe or cold shutdown conditions, as applicable.

- Power operation and load changing procedures provide instruction for steady-state power operation and load changing.

STD SUP 13.5-21

13.5.2.1.3 Abnormal (Off-Normal) Operating Procedures

Abnormal operating procedures for correcting abnormal conditions are developed for those events where system complexity might lead to operator uncertainty. Abnormal operating procedures describe actions to be taken during other than routine operations, which if continued, could lead to either material failure, personnel harm, or other unsafe conditions.

Abnormal procedures are written so that a trained operator knows in advance the expected course of events or indications that identify an abnormal situation and immediate action to be taken.

GGNS SUP 13.5-4

13.5.2.1.4 Emergency Operating Procedures

EOPs are procedures that direct actions necessary for the operators to mitigate the consequences of transients and accidents that cause plant parameters to exceed reactor protection system or ESF actuation setpoints.

Emergency operating procedures include appropriate guidance for the operation of plant post-72 hour equipment, and are developed as appropriate per the guidance of:

- NUREG-0737,"Clarification of TMI Action Plan Requirements," Items I.C.1 and I.C.9
- ANSI/ANS-3.2 Section 5.3.12 and Appendix A10. (DCD Reference 13.5-2).

STD COL 13.5-3-A

The emergency operating procedure program (e.g., the procedures generation package [PGP]) describes the objectives of the emergency procedure development process, the program for developing EOPs and the required content of the EOPs.

The procedure development program, as described in the PGP for EOPs, is submitted to the NRC at least three months prior to the planned date to begin formal operator training on the EOPs. The PGP includes:

- GTGs, which are guidelines based on analysis of transients and accidents that are specific to the plant design and operating philosophy. The submitted documentation includes: a) identification of significant deviations from the generic guidelines (including identification of additional equipment beyond that identified in the generic guidelines), along with necessary engineering evaluations or analyses to support the adequacy of each deviation, and b) a description of the process used for identifying operator information and control requirements.

- A generic writer's guide (GWG) that details the specific methods used in preparing EOPs based on GTGs. The writer's guide contains objective criteria that require that the emergency procedures developed are consistent in organization, style, content and usage of terms.
- A description of the program for V&V of EOPs.
- A description of the program for training operators on EOPs.
- The objectives of the emergency procedure development.
- Discussion of any design change recommendations and/or negative implications that the current design may have on safe operation as noted during implementation of the emergency procedures development plan.

STD SUP 13.5-23

13.5.2.1.5 Alarm Response Procedures

Procedures are provided for annunciators (alarm signals) identifying the proper operator response actions to be taken. Each of these procedures normally contains: a) the meaning of the annunciator or alarm, b) the source of the signal, c) any automatic plant responses, d) any immediate operator action, and e) the long range actions. When corrective actions are very detailed and/or lengthy, the alarm response may refer to another procedure.

GGNS SUP 13.5-5

13.5.2.1.6 Temporary Procedures

Temporary procedures are issued during the operational phase only when permanent procedures do not exist for the following activities: to direct operations during testing, refueling, maintenance and modifications; to provide guidance in unusual situations not within the scope of the normal procedures; and to provide orderly and uniform operations for short periods when the plant, a system, or a component of a system is performing in a manner not covered by existing detailed procedures, or has been modified or extended in such a manner that portions of existing procedures do not apply.

Temporary operating procedures are developed under established administrative guidelines. They include designation of the period of time during which they may be used and adhere to ANSI/ANS 3.2 (DCD Reference 13.5-2) and Technical Specifications as applicable.

STD SUP 13.5-25

13.5.2.1.7 Fuel Handling Procedures

Fuel handling operations, including fuel receipt, identification, movement, storage, and shipment, are performed in accordance with written procedures. Fuel handling procedures address, for example, the status of plant systems required for refueling; inspection of replacement fuel and control rods; designation of proper tools; proper conditions for spent fuel movement and storage; proper conditions to prevent inadvertent criticality; proper conditions for fuel cask loading and movement; and status of interlocks, reactor trip circuits, and mode switches. These procedures provide instructions for use of refueling equipment, actions for core alterations, monitoring core criticality status, accountability of fuel, and partial or complete refueling operations.

STD SUP 13.5-26

13.5.2.2 MAINTENANCE AND OTHER OPERATING PROCEDURES

The QAPD provides guidance for procedural adherence.

STD SUP 13.5-27

13.5.2.2.1 Plant Radiation Protection Procedures

The plant radiation protection program is contained in procedures. Procedures are developed and implemented for such things as: maintaining personnel exposures, plant contamination levels, and plant effluents ALARA; monitoring both external and internal exposures of workers, considering industry-accepted techniques; performing routine radiation surveys; performing environmental monitoring in the vicinity of the plant; monitoring radiation levels during maintenance and special work activities; evaluating radiation protection implications of proposed modifications; and maintaining radiation exposure records of workers and others.

STD SUP 13.5-28

13.5.2.2.2 Emergency Preparedness Procedures

A discussion of emergency preparedness procedures can be found in the Emergency Plan. A list of implementing procedures is maintained in the Emergency Plan.

STD SUP 13.5-29

13.5.2.2.3 Instrument Calibration and Test Procedures

The QAPD provides a description of procedural requirements for instrumentation calibration and testing.

STD SUP 13.5-30

13.5.2.2.4 Chemistry Procedures

Procedures provided for chemical and radiochemical control activities include the nature and frequency of sampling and analyses; instructions for maintaining fluid quality within prescribed limits; the use of control and diagnostic parameters; and limitations on concentrations of agents that could cause corrosive attack, foul heat transfer surfaces or become sources of radiation hazards due to activation.

Procedures are also provided for the control, treatment, and management of radioactive wastes and control of radioactive calibration sources.

STD SUP 13.5-31

13.5.2.2.5 Radioactive Waste Management Procedures

Procedures for the operation of the radwaste processing systems provide for the control, treatment, and management of on-site radioactive wastes. These procedures are included in Section 13.5.2.1.1, System Operating Procedures.

STD SUP 13.5-32

13.5.2.2.6 Maintenance, Inspection, Surveillance, and Modification Procedures

STD COL 13.5-2-A

13.5.2.2.6.1 Maintenance Procedures

Maintenance procedures describe maintenance planning and preparation activities. Maintenance procedures are developed considering the potential impact on the safety of the plant, license limits, availability of equipment required to be operable, and possible safety consequences of concurrent or sequential maintenance, testing, or operating activities.

Maintenance procedures contain sufficient detail to permit the maintenance work to be performed correctly and safely. Procedures include provisions for conducting and recording results of required tests and inspections, if not performed and documented under separate test and inspection procedures. References are made to vendor manuals, plant procedures, drawings, and other sources, as applicable.

Instructions are included, or referenced, for returning the equipment to its normal operating status. Testing is commensurate with the maintenance that has been performed. Testing may be included in the maintenance procedure or be covered in a separate procedure.

Where appropriate sections of related documents, such as vendor manuals, equipment operating and maintenance instructions, or approved drawings with acceptance criteria, provide adequate instructions to provide the required quality of work, the applicable sections of the related documents are referenced in the procedure, or may, in some cases, constitute adequate procedures in themselves. Such documents receive the same level of review and approval as maintenance documents.

The preventive maintenance program, including preventive and predictive procedures, as appropriate, prescribes the frequency and type of maintenance to be performed. An initial program based on service conditions, experience with comparable equipment and vendor recommendations is developed prior to fuel loading. The program is revised and updated as experience is gained with the equipment. To facilitate this, equipment history files are created and maintained. The files are organized to provide complete and easily retrievable equipment history.

STD SUP 13.5-33

13.5.2.2.6.2 Inspection Procedures

The QAPD provides a description of procedural requirements for inspections.

13.5.2.2.6.3 Surveillance Testing Procedures

The QAPD provides a description of procedural requirements for surveillance testing. Surveillance testing procedures are written in a manner that adequately tests all portions of safety-related logic circuitry as described in Generic Letter 96-01, “Testing of Safety Related Logic Circuits.”

STD SUP 13.5-34

13.5.2.2.6.4 Modification Procedures

Plant modifications and changes to setpoints are developed in accordance with approved procedures. These procedures control necessary activities associated with the modifications such that they are carried out in a planned, controlled, and orderly manner. For each modification, design documents such as drawings, equipment and material specifications, and appropriate design analyses are developed, or the as-built design documents are utilized. Separate reviews are conducted by individuals knowledgeable in both technical and QA requirements to verify the adequacy of the design effort.

Proposed modification(s) that involve a license amendment or a change to Technical Specifications are processed as proposed license amendment request.

Plant procedures impacted by modifications are changed to reflect revised plant conditions prior to declaring the system operable and cognizant personnel who are responsible for operating and maintaining the modified equipment are adequately trained.

STD SUP 13.5-35

13.5.2.2.6.5 Heavy Load Handling Procedures

Procedures to control the handling of heavy loads are provided and meet the guidance of NUREG-0612, Section 5.1. These procedures include:

- Identification of required equipment
- Inspections and acceptance criteria required before movement of load
- The steps and proper sequence to be followed in handling the load
- Defining the safe load path
- Other special precautions

STD SUP 13.5-36

13.5.2.2.7 Material Control Procedures

The QAPD provides a description of procedural requirements for material control.

STD SUP 13.5-37

13.5.2.2.8 Security Procedures

A discussion of security procedures is provided in the Security Plan.

STD SUP 13.5-38

13.5.2.2.9 Refueling and Outage Planning Procedures

Procedures provide guidance for the development of refueling and outage plans, and as a minimum address the following elements:

- An outage philosophy which includes safety as a primary consideration in outage planning and implementation
- Separate organizations responsible for scheduling and overseeing the outage and provisions for an independent safety review team that would be assigned to perform final review and grant approval for outage activities
- Control procedures, which address both the initial outage plan and safety-significant changes to schedule
- Provisions that activities receive adequate resources

- Provisions that defense-in-depth during shutdown and margins are not reduced or provisions for an alternate or backup system must be available if a safety system or a defense-in-depth system is removed from service
- Provisions that personnel involved in outage activities are adequately trained including operator simulator training to the extent practicable, and training of other plant personnel, including temporary personnel, commensurate with the outage tasks they are to perform
- The guidance described in NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," to reduce the potential for loss of reactor coolant system boundary and inventory during shutdown conditions (Reference 13.5-203)

13.5.3 COL INFORMATION

13.5-1-A Administrative Procedures Development Plan

STD COL 13.5-1-A

This COL item is addressed in Section 13.5.1.

13.5-2-A Plant Operating Procedures Development Plan

STD COL 13.5-2-A

This COL item is addressed in Section 13.5.2.

13.5-3-A Emergency Procedures Development

STD COL 13.5-3-A

This COL item is addressed in Section 13.5.2

13.5-4-A Implementation of the Plant Procedures Plan

GGNS COL 13.5-4-A

This COL item is addressed in Section 13.5 and Section 13.5.2.

13.5-5-A Procedures Included in Scope of Plan

STD COL 13.5-5-A

This COL item is addressed in Section 13.5.2.

13.5-6-H Procedures for Calibration, Inspection and Testing

STD COL 13.5-6-H

This COL item is addressed in Section 13.5.2.

13.5.4 REFERENCES

13.5-201 American National Standards Institute, Overhead and Gantry Cranes, ANSI B30.2 - 2001.

13.5-202 American Society of Mechanical Engineers, Quality Assurance Requirements for Nuclear Facility Applications, NQA-1 - 1994.

13.5-203 Nuclear Utilities Management and Resources Council, Guidelines for Industry Actions to Assess Shutdown Management, NUMARC 91-06, December 1991.

13.5-204 General Electric Corporation, Licensing Topical Report ESBWR Human Factors Engineering Procedures Development Implementation Plan, NEDO-33274, Revision 2, March 2007.

STD SUP
13.5-39

TABLE 13.5-201
PRE-COL PHASE ADMINISTRATIVE PROGRAMS AND PROCEDURES

(This table is included for future designation as historical information.)

- Design/Construction Quality Assurance Program
- Reporting of Defects and Noncompliance,10 CFR Part 21 Program
- Construction License Fitness for Duty Programs, 10 CFR Part 26
- Design Reliability Assurance Program

STD COL 13.5-1-A

TABLE 13.5-202 (Sheet 1 of 2)
NOMINAL PROCEDURE DEVELOPMENT SCHEDULE

(This table is included for future designation as historical information.)

Category A: Controls

Group	Procedure Type	Preparation Milestone
1	Procedures review and approval	6 months before first license class
2	Equipment control procedures	18 months before fuel load
3	Control of maintenance and modifications	18 months before fuel load
4	Fire Protection procedures	1. 6 months before fuel receipt for elements of the program supporting fuel on-site 2. 6 months before fuel load for elements supporting fuel load and plant operation
5	Crane operation procedures	6 months before fuel receipt
6	Temporary changes to procedures	6 months before first license class
7	Temporary procedures	6 months before first license class
8	Special orders of a transient or self-canceling character	6 months before first license class

STD COL 13.5-1-A

TABLE 13.5-202 (Sheet 2 of 2) NOMINAL PROCEDURE DEVELOPMENT SCHEDULE

Category B: Specific Procedures

Group	Procedure Type	Preparation Milestone
1	Standing orders to shift personnel including the authority and responsibility of the shift supervisor, licensed senior reactor operator in the control room, control room operator, and shift technical advisor	6 months before first license class
2	Assignment of shift personnel to duty stations and definition of "surveillance area"	6 months before first license class
3	Shift relief and turnover	6 months before fuel load
4	Fitness for duty	1. Construction FFD program: 6 months before on-site construction of safety- or security-related SSCs 2. Operational FFD program: 6 months before fuel load
5	Control room access	6 months before fuel load
6	Limitations on work hours	6 months before fuel load
7	Feedback of design, construction, and applicable important industry and operating experience	6 months before fuel load
8	Shift supervisor administrative duties	6 months before fuel load
9	Verification of correct performance of operating activities	6 months before first license class

13.6 PHYSICAL SECURITY

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

13.6.2 SECURITY PLAN

Add the following paragraphs at the end of this section.

STD SUP 13.6-1 The Physical Security Plan during construction, including control of access to the new plant construction site, is consistent with NEI 03-12, Appendix F (Reference 13.6-201), which is currently under NRC review. Table 13.4-201 provides milestones for security program implementation.

GGNS ESP COL 13.6-1

The design requirements for protected area barriers are described in the Physical Security Plan. The barriers will be designed and located to support the security response strategy timelines. The specific designs for protected area barriers will be completed as part of detailed plant design before the milestone for Physical Security Plan implementation (Table 13.4-201).

13.6.4 REFERENCES

13.6-201 Nuclear Energy Institute, Security Measures During New Reactor Construction, NEI 03-12 Appendix F.

13.7 FITNESS FOR DUTY

STD SUP 13.7-1 The Fitness for Duty (FFD) Program is implemented and maintained in two phases: the construction phase program and the operating phase program. The construction phase program is consistent with NEI 06-06 (Reference 13.7-201), which is currently under NRC review. The construction phase program is implemented, as identified in Table 13.4-201, prior to on-site construction of safety- or security-related SSCs. The licensee commits to an operations phase program consistent with the pending revision to 10 CFR 26, when issued. The operations phase program is implemented prior to fuel receipt, as identified in Table 13.4-201.

The FFD Program is based on the pending revision of 10 CFR 26 because on-site construction activities subject to 10 CFR 26 are not scheduled to occur until after the new regulations take effect. A request for an exemption from the current 10 CFR 26 regulations is included in COLA Part 7.

13.7.1 REFERENCES

13.7-201 Nuclear Energy Institute (NEI) “Fitness for Duty Program Guidance for New Nuclear Power Plant Construction Sites,” NEI 06-06.

APPENDIX 13AA ORGANIZATIONAL STRUCTURE HISTORICAL INFORMATION

GGNS COL 13.1-1-A

13AA.1 DESIGN AND CONSTRUCTION RESPONSIBILITIES

It is anticipated that GE-Hitachi will engineer, procure, and construct the ESBWR. This includes all portions of the facility within the certified design. Section 1.4.3 provides detailed information regarding GE-Hitachi's past experience in design, development, and manufacturing of nuclear power facilities. Operating experience from design, construction, and operation of earlier GE BWRs is applied in the design, construction, and operation of the ESBWR as described in numerous locations throughout the DCD (e.g., DCD Sections 4.6.2.1.4, 5.3.1.1, 7.1.3.1.3).

A construction architect engineer (AE) provides the construction of the plant and additional design engineering for selected site-specific portions of the plant. The AE is selected based on experience and proven technical capability in nuclear construction projects or projects of similar scope and complexity.

Other design and construction activities are generally contracted to qualified suppliers of such services. Implementation or delegation of design and construction responsibilities is described in the sections below. Quality Assurance aspects are described in Chapter 17.

13AA.1.1 PRINCIPAL SITE-RELATED ENGINEERING WORK

The principal site engineering activities accomplished towards the construction and operation of the plant are:

a. Meteorology

Information concerning local (site) meteorological parameters is developed and applied by station and contract personnel to assess the impact of the station on local meteorological conditions. An on-site meteorological measurements program is employed by station personnel to produce data for the purpose of making atmospheric dispersion estimates for postulated accidental and expected routine airborne releases of effluents. A maintenance program is established for surveillance, calibration, and repair of instruments. More information regarding the study and meteorological program is found in Section 2.3.

b. Geology

Information relating to site and regional geotechnical conditions is developed and evaluated by utility and contract personnel to determine if geologic conditions could present a challenge to safety of the plant. Items of interest include geologic structure, seismicity, geological history, and ground-water conditions. During construction, foundations within the powerblock area are mapped or visually inspected and photographed. Section 2.5 provides details of these investigations.

c. Seismology

Information relating to seismological conditions is developed and evaluated by utility and contract personnel to determine if the site location and area surrounding the site is appropriate from a safety standpoint for the construction and operation of a nuclear power plant. Information regarding tectonics, seismicity, correlation of seismicity with tectonic structure, characterization of seismic sources, and ground motion are assessed to estimate the potential for strong earthquake ground motions or surface deformation at the site. Section 2.5 provides details of these investigations.

d. Hydrology

Information relating to hydrological conditions at the plant site and the surrounding area is developed and evaluated by utility and contract personnel. The study includes hydrologic characteristics of streams, lakes, shore regions, the regional and local groundwater environments, and existing or proposed water control structures that could influence flood control and plant safety. Section 2.4 includes more detailed information regarding this subject.

e. Demography

Information relating to local and surrounding area population distribution is developed and evaluated by utility and contract personnel. The data is used to determine if requirements are met for establishment of exclusion area, low population zone, and population center distance. Section 2.1 includes more detailed information regarding population around the plant site.

f. Environmental Effects

Monitoring programs are developed to enable the collection of data necessary to determine possible impact on the environment due to construction, startup, and operational activities and to establish a baseline from which to evaluate future environmental monitoring.

13AA.1.2 DESIGN OF PLANT AND ANCILLARY SYSTEMS

Responsibility for design and construction of systems outside the powerblock such as circulating water, service water, switchyard, and secondary fire protection systems are delegated to qualified contractors.

13AA.1.3 REVIEW AND APPROVAL OF PLANT DESIGN FEATURES

Design engineering review and approval is performed in accordance with the reactor vendor QA program and Section 17.1. The reactor vendor is responsible for design control of the powerblock. Design work is performed in accordance with the design and construction QA manual including the reviews necessary to verify the adequacy of the design. Verification is performed by competent individuals or groups other than those who performed the original design. Design issues arising during construction are addressed and implemented with notification and communication of changes to the manager in charge of engineering for review. As systems are tested and approved for turnover and operation, control of design is turned over to plant staff. The manager in charge of engineering, along with functional managers and staff, assumes responsibility for review and approval of modifications, additions, or deletions in plant design features, as well as control of design documentation, in accordance with the Operational QA Program. Design control becomes the responsibility of the manager in charge of engineering prior to loading fuel. During construction, startup, and operation, changes to human-system interfaces of control room design are approved using a human factors engineering evaluation addressed within DCD Chapter 18. See Figures 13.1-201 and 13AA-201 for reporting relationships.

13AA.1.4 SITE LAYOUT WITH RESPECT TO ENVIRONMENTAL EFFECTS AND SECURITY PROVISIONS

Site layout was considered when determining the expected environmental effects from construction.

The Physical Security Plan is designed with provisions that meet the applicable NRC regulations. Site layout was considered when developing the Security Plan.

13AA.1.5 DEVELOPMENT OF SAFETY ANALYSIS REPORTS

Information regarding the development of the Final Safety Analysis Report is found in Chapter 1.

13AA.1.6 REVIEW AND APPROVAL OF MATERIAL AND COMPONENT SPECIFICATIONS

Safety-related material and component specifications of structures, systems, and components designed by the reactor vendor are reviewed and approved in accordance with the reactor vendor quality assurance program and Section 17.1. Review and approval of items not designed by the reactor vendor are controlled for review and approval by Section 17.5 and the Quality Assurance Program Document.

13AA.1.7 PROCUREMENT OF MATERIALS AND EQUIPMENT

Procurement of materials during the construction phase is the responsibility of the reactor technology vendor and constructor. The process is controlled by the construction QA programs of these organizations. Oversight of the inspection and receipt of materials process is the responsibility of the manager in charge of quality assurance.

13AA.1.8 MANAGEMENT AND REVIEW OF CONSTRUCTION ACTIVITIES

Overall management and responsibility for construction activities is assigned to the site executive in charge of plant management. The Reactor Technology Vendor Site Manager and the constructor Site Manager are accountable to him for the construction activities for which they are responsible as shown in Figure 13AA-201. Monitoring and review of construction activities by utility personnel is a continuous process at the plant site. Contractor performance is monitored to provide objective data to utility management in order to identify problems early and develop solutions. Monitoring of construction activities verifies that contractors are in compliance with contractual obligations for quality, schedule, and cost. Monitoring and review of construction activities is divided functionally across the various disciplines of the utility construction staff (i.e., electrical, mechanical, I&C, etc.) and tracked by schedule based on system and major plant components/areas.

After each system is turned over to plant staff the construction organization relinquishes responsibility for that system. At that time, they will be responsible for completion of construction activities as directed by plant staff and available to provide support for start-up testing as necessary.

13AA.2 PREOPERATIONAL RESPONSIBILITIES

The plant manager, with the aid of those managers that report directly to the plant manager, is responsible to the site executive in charge of plant management for the activities required to transition the unit from the construction phase to the operational phase. These activities include turnover of systems from construction, preoperational testing, schedule management, procedure development for tests, fuel load, integrated startup testing, and turnover of systems to plant staff.

13AA.2.1 DEVELOPMENT OF HUMAN FACTORS ENGINEERING DESIGN OBJECTIVES AND DESIGN PHASE REVIEW OF PROPOSED CONTROL ROOM LAYOUTS

Human Factors Engineering design objectives are initially developed by the reactor vendor in accordance with DCD Chapter 18. As a collaborative team, personnel from the reactor vendor design staff and personnel including, licensed operators, engineers, and I&C technicians from owner and other organizations in the nuclear industry assess the design of the control room and man-machine interfaces to attain safe and efficient operation of the plant. See DCD Section 18.2 for additional details of HFE program management.

Modifications to the certified design of the control room or man-machine interface described in the DCD is reviewed per engineering procedures, as required by DCD Section 18.2, to evaluate the impact to plant safety. The manager in charge of engineering is responsible for the human factors engineering (HFE) design process and for the design commitment to HFE during construction and throughout the life of the plant as noted in Section 13.1.1.2.1. The HFE program is established in accordance with the description and commitments in DCD Chapter 18.

13AA.2.2 PREOPERATIONAL AND STARTUP TESTING

The manager in charge of startup is assigned responsibility for organizing and developing the preoperational and startup testing organization and reports to the plant manager. The preoperational and startup testing organization prepares procedures and schedules, and performs preoperational and startup testing. Personnel that staff the positions of the preoperational and startup testing organization consist of testing engineers, procedure writers, and planner/schedulers. The qualification requirements of testing engineers in the startup organization meet those established in ANSI/ANS-3.1 (Reference 13AA-201). Test engineers are responsible for integrated testing of systems to prove functionality of system design requirements. They provide guidance and supervision to procedure writers and communicate closely with operations personnel and other supporting staff to facilitate safe and efficient performance of preoperational and startup tests. The scope of testing to be accomplished is presented in Chapter 14. As systems are turned over from the constructor they are tested by component then by integrated system preoperational test. Sufficient numbers of personnel are assigned to perform preoperational and startup testing to facilitate safe and efficient implementation of the testing program. Plant-specific training provides instruction on the administrative controls of the test program. The startup test program provides data and experience. During the preoperational and startup testing phase the constructor and Reactor Vendor staff support, as necessary, the testing performed by the nuclear plant preoperational and startup testing staff. The manager in charge of startup is assisted in the area of preoperational testing by other station organizations and staff operations, plant maintenance, and engineering. Operations and technical staff are used as support in conducting the test program and in reviewing test results.

Procedures are written to describe organizational responsibilities and interfaces between staff, constructor, and reactor vendor, and to establish direction in writing, reviewing, and performing tests. See Figure 13AA-201 for the organization chart for preoperational and startup testing.

13AA.2.3 DEVELOPMENT AND IMPLEMENTATION OF STAFF RECRUITING AND TRAINING PROGRAMS

Staffing plans are developed based on operating plant experience with input from the reactor technology vendor as determined by Human Factors Engineering (DCD Section 18.6). These plans are developed under the direction and guidance of the site executive in charge of plant management, executive in charge of engineering and technical services, and executive in charge of operations support. Staffing plans are completed and manager level positions are filled prior to the start of preoperational testing. Personnel selected to be licensed reactor operators and senior reactor operators, along with other staff necessary to support the safe operation of the plant, are hired with sufficient time available to complete appropriate training programs and become qualified and licensed (if required) prior to fuel being loaded in the reactor vessel. See Figure 13AA-202 for an estimated timeline of hiring requirements for operator and technical staff relative to fuel load.

Because of the dynamic nature of the staffing plans and changes that occur over time, it is expected that specific numbers of personnel on site will change, Table 13.1-201 includes the initial estimated number of staff for selected positions (for the combined Unit 1 and 3 site) representative of staff during commercial operation. The table also includes estimated number of staff added to support operation of Unit 3. Recruiting of personnel to fill positions is the shared responsibility of the manager in charge of human resources and the various heads of departments.

The training program is described in Section 13.2.

13AA.3 REFERENCES

13AA-201 American Nuclear Society, “American National Standard for Selection, Qualification, and Training of Personnel for Nuclear Power Plants,” ANSI/ANS-3.1.

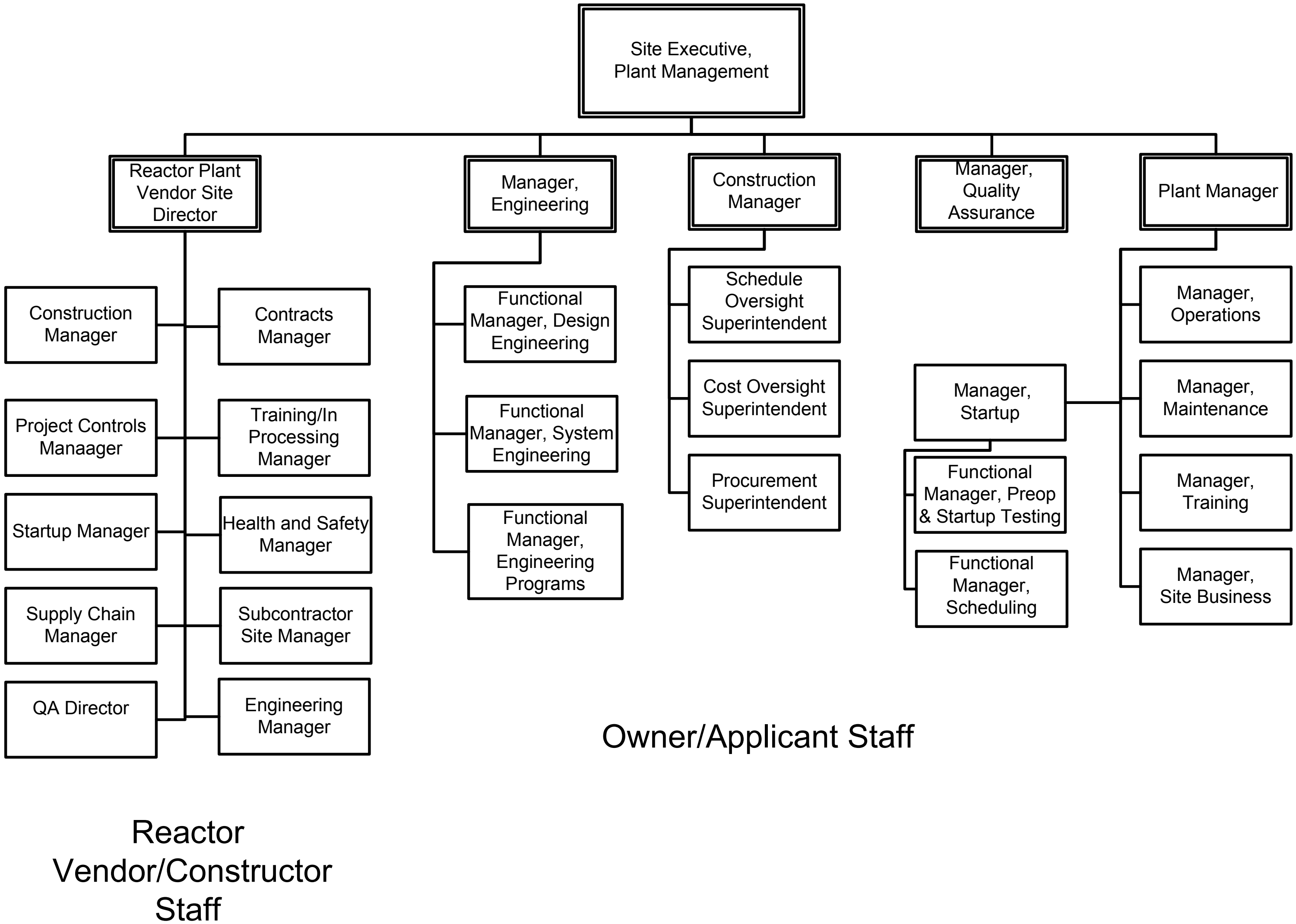

Figure 13AA-201. Construction Management Organization

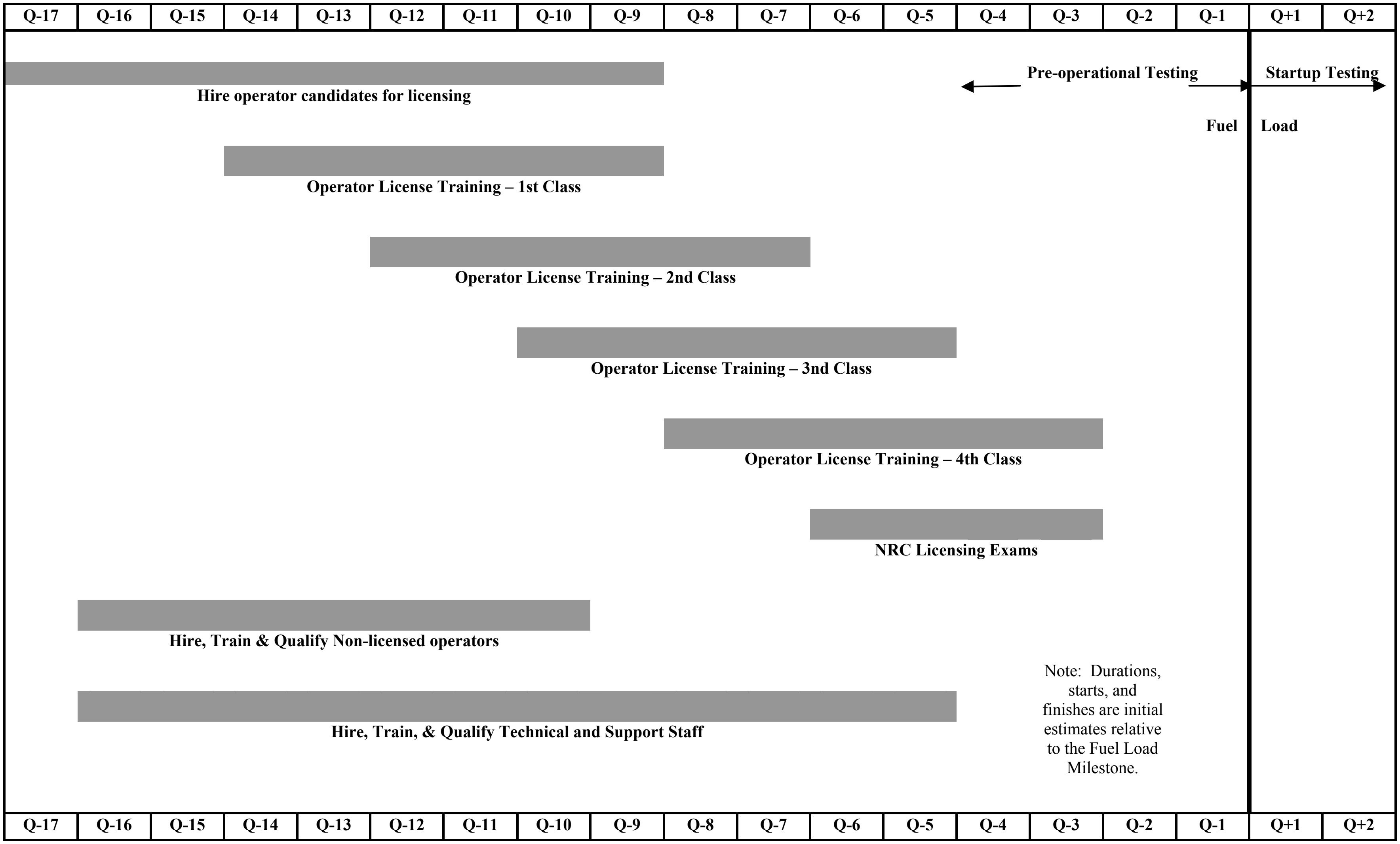

Figure 13AA-202. Nominal Plant Staff Hiring and Training Schedule

APPENDIX 13BB TRAINING PROGRAM

STD SUP 13.2-1
GGNS COL 13.2-1-A
STD COL 13.2-2-A

NEI 06-13-A (Reference 13BB-201), Technical Report on a Template for an Industry Training Program Description, is incorporated by reference with the following supplements.

Add the following information to NEI 06-13, as numbered.

13BB.1.1.3 Licensed Operator Training Program Prior to Commercial Operation

GGNS SUP 13.2-2
GGNS COL 13.2-1-A

Prior to initial commercial operation, licensed operator training is conducted early in the construction phase to support preoperational testing and cold and hot functional activities. Licensed operator training conducted prior to commercial operation is referred to as “cold” licensed operator training. Cold licensed operator training is conducted as described below.

Cold licensing of operators at a new plant provides the method for operations personnel to acquire the knowledge and experience required for licensed operator duties during the unique conditions of new plant construction.

Prior to commercial operation, plant experience requirements specified in RG 1.8 (Revision 3) and ANSI/ANS 3.1-1993 can not be met. Therefore, during cold license operator training, the Regulatory Position C.1.b of RG 1.8 (Revision 2) applies: cold license operator candidates will meet the training elements defined in ANSI/ANS 3.1 but are exempt from the experience requirements defined in ANSI/ANS 3.1. Alternate methods of gaining plant experience, in addition to those referenced in RG 1.8 and associated ANSI/ANS standards, are described in Section 1.1.3.2.

Approximately 18 months prior to expected fuel load, the NRC examination is administered for cold licensed operator candidates and includes a written examination, simulator examination, and in-plant job performance measures (JPMs). Sufficient operator licenses are obtained to support operational shifts prior to first fuel load.

The cold licensed operator training process terminates when the last licensed operator training class initiated during the plant construction/preoperational test phases has taken a scheduled NRC license examination or the plant becomes operational, whichever is later.

13BB.1.1.3.1 Licensed Operator Continuing Training Prior to Commercial Operation

The SAT process is utilized to determine continuing training needs for cold licensed operator candidates following completion of the initial phases of their training. Structured continuing training is provided to maintain the license candidates' knowledge and ability and includes topics related to plant modifications, construction, functional testing, and OE related to construction activities.

An accredited licensed operator requalification training program is implemented within 90 days following the issuance of the first NRC operator licenses. This facilitates maintaining the licensed operators' knowledge and ability and meets the milestone guidance related to the Reactor Operator Requalification Training Program provided in RG 1.206.

13BB.1.1.3.2 Licensed Operator Experience Requirements Prior to Commercial Operation

Each cold licensed operator candidate's operational experience is assessed prior to selection for a licensed training program; however, experience requirements are not required to be fully met prior to enrolling in an operator training program. In addition, total experience requirements and one year on-site experience requirements not fully met at the time of the licensed operator application submittal shall be met prior to issuing the individual's NRC operator license. Following satisfactory completion of an NRC license examination, the licensee notifies the NRC when the candidate's experience requirements are met.

Experience is gained anytime prior to fuel load by participating in construction and testing activities. Operational experience on a one-for-one basis is achieved during the construction and testing phases while performing one or more of the following tasks:

- Plant operating procedure development and verification
- Human engineering and task analysis verification
- Preoperational testing of plant systems
- Participating in the cold and hot functional testing program
- Acting as an operations classroom, simulator, or on-the-job (OJT) instructor

The above practical work assignments provide experience and fulfills the one year on-site experience requirement cited in RG 1.8 and the three month on-shift requirement cited in ANSI/ANS 3.1. On-site experience is also gained on a one-for-one basis at a nuclear reactor site of similar design (e.g., PWR or BWR).

An RO candidate who completes a site-specific non-licensed operator training program for critical non-licensed operator tasks and completes a site familiarization course designed on a systematic evaluation of site design features and operator site familiarization needs satisfies the one year on-site experience and six months as a non-licensed operator at the facility for which the license is sought requirements cited in RG 1.8.

A non-degreed SRO candidate who completes a combined RO and SRO course and completes a site familiarization course designed on a systematic evaluation of site design features and operator site familiarization needs satisfies the one year experience requirement as a licensed RO cited in RG 1.8.

For a degreed SRO, performing construction and testing activities described above on a one-for-one basis satisfies the six month on-site experience requirement as a staff engineer cited in RG 1.8.

An SRO candidate (degreed or non-degreed) who completes a plant referenced simulator course or an observation course at an operating reactor of similar design meets the special experience requirements related to at power and startup operations described in ANSI/ANS 3.1. These courses are based on a systematic analysis of the supervisory skill, knowledge, and ability required of a SRO. A systematic process to identify the objectives associated with experience gained at an operating facility coupled with high fidelity simulation provides assurance that the requisite knowledge, skill, and ability level has been achieved.

13BB.1.1.3.3 On-the-Job Training (OJT) Prior to Commercial Operation

Until equipment installation is sufficiently complete, viable alternatives for performance of in-plant JPMs are identified including, but not limited to, discussion, mock-ups, virtual presentations and part task simulation. Time spent in OJT training is counted as on-site and total nuclear power plant experience.

Until the plant becomes operational, viable alternatives for the main control room OJT (three months on-shift as an extra person) are identified including, but not limited to, preoperational testing activities, simulator time focused on crew operations, or dedicated observation time in the main control room of an operating nuclear power plant.

13BB.1.1.3.4 Plant-Referenced Simulation Facilities Prior to Commercial Operation

The initial phase of licensed operator simulator training is performed with a simulation facility modeled in accordance with the guidance of RG 1.149 and its associated ANSI/ANS standards as described below. The simulation facility is a high fidelity/quality training device and is maintained in accordance with the criteria of ANSI/ANS 3.5 1998, Appendix D.

Simulation models are updated as information concerning plant design and performance is obtained. These updates ensure the simulator is current with plant design and can be used as a reliable training tool.

The following provides a generic simulator training sequence indicating the use of part task/limited scope simulator and plant referenced simulator for licensed operator training. The actual sequence may vary depending on plant construction scheduling.

- Phase 1 (approximately 40 months prior to fuel load) - The part task/limited scope simulator is used to provide licensed operator training based on standardized design simulator modeling and operating procedures.

- Phase 2 (approximately 24 months prior to fuel load) - An ANSI/ANS 3.5 1998 plant referenced simulator is used in final phase of licensed operator initial training to perform reactivity manipulations and complete required NRC license candidate training.

- Phase 3 (approximately 18 months prior to fuel load) - An ANSI/ANS 3.5 1998 plant referenced simulator is used for performance of NRC operator initial license examinations.

Prior to conducting the simulator portion of licensed operator examination, the plant-referenced simulator response is tested and validated against plant design data to ensure the simulator meets the operational and testing criteria of 10 CFR 55.46 paragraph (c).

13BB.2 REFERENCES

13BB-201 Nuclear Energy Institute (NEI), “Technical Report on a Template for an Industry Training Program Description,” NEI 06-13-A.

CHAPTER 14 INITIAL TEST PROGRAM

14.1 INITIAL TEST PROGRAM FOR PRELIMINARY SAFETY ANALYSIS REPORTS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

14.2 INITIAL PLANT TEST PROGRAM FOR FINAL SAFETY ANALYSIS REPORTS

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

14.2.1.4 ORGANIZATION AND STAFFING

Add the following at the end of this section.

GGNS SUP 14.2-1 Section 13.1 and Appendix 13AA provide additional information regarding responsibilities, qualifications, and organization for implementing the pre-operational and startup testing program.

14.2.2.1 STARTUP ADMINISTRATION MANUAL

Replace the first two sentences with the following, and delete the last sentence in this section.

STD COL 14.2-1-H The Startup Administration Manual will be developed and made available for review 60 days prior to scheduled start of the preoperational test program.

14.2.2.2 TEST PROCEDURES

Replace the last two sentences in this section with the following.

STD COL 14.2-2-H Approved test procedures for satisfying the commitments of this section will be developed and available for review no later than 60 days prior to their intended use for preoperational tests and no later than 60 days prior to scheduled fuel loading for power ascension tests.

14.2.2.5 TEST RECORDS

Add the following at the end of this section.

STD SUP 14.2-2 Startup test reports are prepared in accordance with RG 1.16.

14.2.7 TEST PROGRAM SCHEDULE AND SEQUENCE

Replace the last paragraph with the following.

GGNS COL 14.2-3-H The detailed testing schedule will be developed and made available for review prior to actual implementation. The schedule may be updated and continually optimized to reflect actual progress and subsequent revised projections.

The implementation milestones for the Initial Test Program are provided in Section 13.4

14.2.9 SITE-SPECIFIC PREOPERATIONAL AND STARTUP TESTS

Replace the second and third paragraphs with the following.

GGNS COL 14.2-4-H This section describes the site specific pre-operational and initial startup tests not addressed in DCD Section 14.2.8.

Specific testing to be performed and the applicable acceptance criteria for each preoperational and startup test are documented in test procedures to be made available to the NRC approximately 60 days prior to their intended use for preoperational tests, and not less than 60 days prior to schedule fuel load for power ascension tests. Site-specific preoperational and startup tests are in accordance with the system specifications and associated equipment specifications for equipment in those systems provided by the licensee that are not part of the standard plant described in DCD Section 14.2.8. The tests demonstrate that the installed equipment and systems perform within the limits of these specifications.

14.2.9.1 SITE-SPECIFIC PREOPERATIONAL TESTS

Replace this section with the following.

14.2.9.1.1 Station Water System Pre-Operation Test

GGNS SUP 14.2-2 **Purpose**

The objective of this test is to verify proper operation of the SWS and its ability to supply design quantities and quality of water to the CIRC, PSWS cooling tower basin, MWS, and FPS.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. Electrical power, the CIRC, PSWS, MWS and FPS, instrument air, Chemical Storage and Transfer System, and other required interfacing systems are available, as needed, to support the specified testing.

General Test Methods and Acceptance Criteria

Performance is observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper operation of instrumentation and equipment in appropriate design combinations of logic and instrument channel trip;
- Proper functioning of instrumentation and alarms used to monitor system operation and availability;
- Proper operation of pumps, motors, and valves in all design operating modes;
- Proper operation of clarifiers;
- Proper system flow paths and flow rates, including pump capacity and discharge head;
- Proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;
- Proper operation of freeze protection methods and devices, where installed; and
- Acceptability of pump/motor vibration levels.

14.2.9.1.2 Cooling Tower Preoperational Test

Purpose

The objective of this test is to verify proper operation of the waste heat rejection portion of the CIRC (i.e., the mechanical draft cooling tower and basin.) Testing of the balance of the CIRC is addressed in DCD Section 14.2.8.1.50.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. Electrical power, the CIRC, SWS, Instrument Air System, Chemical Storage and Transfer System, and other required interfacing systems are available, as needed, to support the specific testing.

General Test Methods and Acceptance Criteria

Because of insufficient heat loads during the preoperational test phase, cooling tower performance evaluations are performed during the startup phase with the turbine generator on line.

Operation is observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper operation of instrumentation and equipment in appropriate design combinations of logic and instrument channel trip;
- Proper functioning of instrumentation and alarms used to monitor system operation and availability;
- Proper operation of pumps, fans, motors, and valves in all design operating modes;
- Proper system flow paths and flow rates, including pump capacity and discharge head;
- Proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;
- Proper operation of freeze protection methods and devices, where installed; and
- Acceptability of pump/motor vibration levels.

14.2.9.1.3 Personnel Monitors and Radiation Survey Instruments Preoperational test

Purpose

To verify the ability of the personnel monitors and radiation survey equipment to indicate and alarm normal and abnormal radiation levels.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. High radiation alarm setpoints have been properly established based on sensor location, background radiation level, expected radiation level and low occupation dose prior to the test. Indicator, power supplies, and sensor/converters have been calibrated according to vendor instructions.

General Test Methods and Acceptance Criteria

Operation is observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

- Proper functioning of indicators, annunciators, and audible alarms;
- Proper alarm at correct prescribed setpoints in response to high radiation and downscale/inoperative conditions; and
- Proper functioning and operation of the self-test feature for gross failure and loss of power detection.

14.2.9.1.4 Electrical Switchyard System Preoperational Test

Purpose

To verify the ability of the Electrical Switchyard system to provide a means for supplying AC power to plant on-site systems from the off-site sources.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. All the necessary permanently installed and test instrumentation have been calibrated and are operational. All interfacing systems and equipment required to support system operation are available, as needed, for the specified testing configurations.

General Test Methods and Acceptance Criteria

The capability of the Electrical Switchyard system to provide power to plant loads under various plant operating conditions and via normal and alternate paths will be demonstrated. Performance is observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper operation of initiating, transfer, and trip devices;
- Proper operation of relaying and logic;
- Proper operation of equipment protective devices, including permissive and prohibit interlocks;
- Proper operation of instrumentation and alarms used to monitor system and equipment status;
- Proper operation and load carrying capability of breakers, switchgear, transformers, and cables; and
- The capability to transfer between on-site and off-site power sources as per design.

14.2.9.2 SITE-SPECIFIC STARTUP TESTS

Replace this section with the following.

14.2.9.2.1 Cooling Tower Performance Test

GGNS SUP 14.2-3 **Purpose**

The objective of this test is to demonstrate acceptable performance of the waste heat rejection portion of the CIRC (i.e., the natural draft and the mechanical draft cooling towers and basins), particularly its ability to cool design quantities of circulating water to design temperature under expected operational load conditions.

Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and approved the initiation of testing. The plant is in the appropriate operational configuration for the scheduled testing. The necessary instrumentation is checked or calibrated.

Description

Power ascension phase testing of the waste heat rejection portions of the CIRC is necessary to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters are monitored in order to provide a verification of proper system flow balancing and performance of both the natural draft and mechanical draft cooling towers.

Criteria

System performance is consistent with design requirements.

14.2.10 COL INFORMATION

14.2-1-H

STD COL 14.2-1-H This COL Item is addressed in Section 14.2.2.1.

14.2-2-H

STD COL 14.2-2-H This COL Item is addressed in Section 14.2.2.2.

14.2-3-H

GGNS COL 14.2-3-H This COL Item is addressed in Section 14.2.7.

14.2-4-H

GGNS COL 14.2-4-H This COL Item is addressed in Section 14.2.9.

14.3 INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

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

14.3.8 OVERALL ITAAC CONTENT FOR COMBINED LICENSE APPLICATIONS

Replace the last paragraph with the following.

STD COL 14.3-1-A The requirements for inclusion of EP-ITAAC in a COLA are provided in 10 CFR 52.80(a). In SRM-SECY-05-0197, the NRC-approved generic EP-ITAAC for use in COL and ESP applications. This set of EP-ITAAC was considered in the development of the plant-specific EP-ITAAC, which are tailored to the ESBWR design. The plant-specific EP-ITAAC are included in a separate part of the COLA.

14.3.9 SITE-SPECIFIC ITAAC

Add the following paragraph at the end of this section.

STD COL 14.3-2-A The selection criteria and methodology provided in this section of the referenced DCD were utilized as the site-specific selection criteria and methodology for ITAAC. These criteria and methodology were applied to those site-specific (SS) systems that were not evaluated in the referenced DCD. The entire set of ITAAC for the facility, including DC-ITAAC, EP-ITAAC, PS-ITAAC, and SS-ITAAC, is included in a separate part of the COLA.

14.3.10 COL INFORMATION

14.3-1-A EP-ITAAC

STD COL 14.3-1-A This COL item is addressed in Section 14.3.8.

14.3-2-A Site-Specific ITAAC

STD COL 14.3-2-A This COL item is addressed in Section 14.3.9.

CHAPTER 15 SAFETY ANALYSES

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

15.3 ANALYSIS OF INFREQUENT EVENTS

15.3.10.5 RADIOLOGICAL CONSEQUENCES

Add the following sentence at the end of this section.

STD SUP 15.3-1 In addition, procedures discuss the use of nuclear instrumentation to aid in detecting a possible mislocated fuel bundle after fueling operations.

CHAPTER 16 TECHNICAL SPECIFICATIONS

16.0 INTRODUCTION

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

STD SUP 16.0-1 The Technical Specifications and the Technical Specification Bases are maintained as separate documents.

COL Information Item 16.0-1

STD COL 16.0-1 This COL Item is addressed in the Technical Specifications and Technical Specification Bases.

CHAPTER 17 QUALITY ASSURANCE

17.0 INTRODUCTION

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

Add the following after the last paragraph.

GGNS SUP 17.0-1 Quality Assurance (QA) activities beyond the scope of the certified design are discussed in Sections 17.1 through 17.6. Section 17.1 addresses QA activities that take place prior to the implementation of the Quality Assurance Program Description (QAPD). Sections 17.2 and 17.3 respond to DCD COL information items and reference Section 17.5. Section 17.4 responds to DCD COL information items and describes reliability assurance activities. Section 17.5 describes the QAPD that is applicable during the construction and operations phases. A description of the Maintenance Rule Program, which is based on the requirements in 10 CFR 50.65, is provided in Section 17.6.

The QAPD described in Section 17.5, is based on 10 CFR Part 50, Appendix B and 10 CFR Part 52, and the requirements of ASME NQA-1-1994, “Quality Assurance Requirements for Nuclear Facility Applications,” Parts I and II as specified in the QAPD.

17.1 QUALITY ASSURANCE DURING DESIGN

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

Insert the following information at the end of DCD Section 17.1.

GGNS SUP 17.1-1 Quality Assurance (QA) applied in the preparation of the Early Site Permit (ESP) is described in Part 5 of the Grand Gulf ESP Application.

GGNS COL 17.2-2-A Entergy is responsible for the establishment and execution of the quality assurance program during the design, construction and operations phases of Unit 3. Entergy may delegate and has delegated to others, such as NuStart Energy Development, LLC, Enercon Services, Inc., and GEH, the work of establishing and executing the quality assurance program, or any parts thereof, but retains responsibility for the quality assurance program.

Effective during combined license application (COLA) development, the NuStart Energy Development LLC (NuStart) QA Program and GE Nuclear Energy Quality Assurance Program Description (Reference 17.1-201) define the QA program requirements for design activities.

NuStart was created in part for the purpose of demonstrating the licensing process defined by 10 CFR Part 52. NuStart consists of multiple utilities including Entergy. NuStart contracted with Enercon Services Inc. to develop the Grand Gulf Nuclear Station Unit 3 COL application, including site characterization activities. The process of collection, review, and analysis of specific data for site characterization was performed under the Enercon QA Program and is described in the Enercon Quality Assurance Project Planning Document (Reference 17.1-201). NuStart maintains oversight for the activities performed under the COLA contract. Entergy exercises oversight through their NuStart participation, providing resources from their existing 10 CFR Part 50 Appendix B QA Program and the NuStart Quality Assurance Plan (Reference 17.1-202).

The Quality Assurance Program Description (QAPD) discussed in Section 17.5 will be phased in based on the stage of the project and will be fully implemented in accordance with Table 13.4-201. During the implementation period, the Entergy Corporate QA Manual (Reference 17.1-203) will be applicable unless the QAPD requirements have been implemented. The phased implementation/conversion commenced with submittal of this COL application.

17.1.25 REFERENCES

17.1-201 Enercon Services Inc., “Enercon Quality Assurance Project Planning Document,” QAPPD-NUSTART-001, Revision 5, July 2007.

17.1-202 NuStart Energy LLC, “NuStart Energy Project Instruction - Quality Assurance Plan,” PI-009, Revision 0.

17.1-203 Entergy Operations Inc., “Entergy Quality Assurance Program Manual,” Revision 16, April 2007.

17.2 QUALITY ASSURANCE DURING CONSTRUCTION AND OPERATIONS

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

Replace the first paragraph with the following.

GGNS COL 17.2-1-A The Quality Assurance Program in place during the construction and operations phases, including adapting the design to specific plant implementation, is described in Section 17.5.

17.2.1 COL INFORMATION

17.2-1-A QA Program for the Construction and Operations Phases

GGNS COL 17.2-1-A This COL item is addressed in Sections 17.2 and 17.5.

17.2-2-A QA Program for Design Activities

GGNS COL 17.2-2-A This COL Item is addressed in Sections 17.1 and 17.5.

17.3 QUALITY ASSURANCE PROGRAM DESCRIPTION

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

Replace the first and second sentences of this section with the following.

GGNS COL 17.3-1-A The Quality Assurance Program Description applicable to the combined license applicant is described in Section 17.5.

17.3.1 COL INFORMATION

17.3-1-A Quality Assurance Program Document

GGNS COL 17.3-1-A This COL Item is addressed in Sections 17.3 and 17.5.

17.4 RELIABILITY ASSURANCE PROGRAM DURING DESIGN PHASE

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

17.4.1 INTRODUCTION

STD COL 17.4-1-A

Replace the third paragraph and subsequent bulleted list with the following.

The objectives of reliability assurance during the operations phase are integrated into the Quality Assurance Program (Section 17.5), the Maintenance Rule (MR) Program (Section 17.6), and other operational programs. Specific reliability assurance activities are addressed within operational programs (e.g., maintenance rule, surveillance testing, inservice testing, inservice inspection, and quality assurance) and the maintenance programs.

The MR Program incorporates the following aspects of operational reliability assurance (refer to Section 17.6):

- Use of PRA importance measures, the expert panel process, and deterministic methods to determine the list of risk-significant SSCs
- Evaluation and maintenance of the reliability of risk-significant SSCs
- Monitoring the effectiveness of maintenance activities needed for operational reliability assurance
- Classifying, initially, as high-safety-significant, all SSCs that are in the scope of the design reliability assurance program (D-RAP), or applying expert panel review for any exceptions
- Use of historical data and industry operating experience on equipment performance as available
- Use of specific criteria to establish the level of performance or condition being maintained for SSCs within the scope of the MR Program; and use of monitoring to identify declining trends between surveillances and to minimize the likelihood of undetected performance or condition degradation to unacceptable levels, to the extent possible
- Use of maintenance programs to determine the nature and frequency of maintenance activities to be performed on plant equipment, including SSCs within the scope of the MR Program

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17.4.6 SSC IDENTIFICATION/PRIORITIZATION

STD COL 17.4-1-A

Add the following new paragraph at the end of this section.

The list of risk-significant SSCs will be confirmed via ITAAC (see DCD Tier 1, Table 3.6-1).

17.4.9 OPERATIONAL RELIABILITY ASSURANCE ACTIVITIES

STD COL 17.4-1-A

Replace the second paragraph with the following.

Refer to Section 17.4.1 for the implementation of reliability assurance during the operations phase.

17.4.10 OWNER/OPERATOR'S RELIABILITY ASSURANCE PROGRAM

STD COL 17.4-1-A

Replace the fifth bullet with the following.

- MR Program: The MR Program is described in Section 17.6.

Replace the last sentence in this section with the following.

Refer to Section 17.4.1 for the implementation of reliability assurance activities.

17.4.13 COL INFORMATION

17.4-1-A Operation Reliability Assurance Activities

STD COL 17.4-1-A

This COL Item is addressed in Sections 17.4.1, 17.4.6, 17.4.9, 17.4.10, and 17.6.

GGNS SUP 17.5-1

17.5 QUALITY ASSURANCE PROGRAM DESCRIPTION – DESIGN CERTIFICATION, EARLY SITE PERMIT, AND NEW LICENSE APPLICANTS

QA applied to the DC activities is described in DCD Section 17.1.

QA applied in the preparation of the ESP is described in Part 5 of the Grand Gulf ESP Application.

GGNS COL 17.2-1-A
GGNS COL 17.3-1-A

The Quality Assurance Program in place during the construction and operations phases is described in the Quality Assurance Program Description (QAPD), which is maintained as a separate document. This QAPD is based on NEI 06-14A, "Quality Assurance Program Description" (Reference 17.5-201).

GGNS COL 17.2-2-A

The Quality Assurance Program in place prior to implementation of the QAPD is described in Section 17.1.

The implementation milestones for the Operational Quality Assurance Program are provided in Section 13.4

17.5.1 REFERENCES

17.5-201 Nuclear Energy Institute (NEI), "Quality Assurance Program Description," NEI 06-14A.

STD COL 17.4-1-A

17.6 MAINTENANCE RULE PROGRAM

NEI 07-02, "Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52," (Reference 17.6-201) is incorporated by reference with the following supplemental information.

STD SUP 17.6-1

The text of the template provided in NEI 07-02 is generically numbered as "17.X." When the template is incorporated by reference into this section, numbering is changed from "17.X" to "17.6."

17.6.1.1 MAINTENANCE RULE SCOPING PER 10 CFR 50.65(B)

STD SUP 17.6-3

In Paragraph 17.6.1.1.b, replace "(DRAP - see FSAR Section 17.Y)" with the following.

(See Section 17.4)

17.6.3 MAINTENANCE RULE PROGRAM RELATIONSHIP WITH RELIABILITY ASSURANCE ACTIVITIES

Replace with the following.

STD SUP 17.6-2

Reliability during the operations phase is assured through the implementation of operational programs, i.e., the MR program (Section 17.6), the Quality Assurance Program (Section 17.5), the Inservice Inspection Program (Sections 3.9.3.7.1 (3)(e), 5.2.4, and 6.6, and DCD Section 3.8.1.7.3), and the Inservice Testing Program (Section 3.9.6, Section 5.2.4, Section 6.6, and Sections 3.9.3.7.1 (3)(e)), as well as the Technical Specifications Surveillance Requirements (Chapter 16), and the preventive maintenance program.

17.6.6 REFERENCES

17.6-201 Nuclear Energy Institute, "Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52," NEI 07-02.

CHAPTER 18 HUMAN FACTORS ENGINEERING

This chapter of the referenced DCD is incorporated by reference with no departures or supplements.

CHAPTER 19 PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENTS

19.1 INTRODUCTION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

19.2 PRA RESULTS AND INSIGHTS

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

19.2.3.2.4 Evaluation of External Event Seismic

Significant Core Damage Sequences of External Event Seismic

Replace the second and third sentences of the first paragraph with the following.

STD COL 19.2.6-1-H As-built SSC High Confidence Low Probability of Failure (HCLPF)s will be compared to those assumed in the ESBWR seismic margin analysis shown in DCD Table 19.2-4. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation will be analyzed to determine if any new vulnerabilities have been introduced. This comparison and analysis will be completed prior to fuel load.

19.2.6 COL INFORMATION

19.2.6-1-H Seismic High Confidence Low Probability of Failure Margins

STD COL 19.2.6-1-H This COL Item is addressed in Section 19.2.3.2.4.

19.3 SEVERE ACCIDENT EVALUATIONS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

19.4 PRA MAINTENANCE

This section of the referenced DCD is incorporated by reference with no departures or supplements.

19.5 CONCLUSIONS

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

GGNS SUP 19.5-1

In accordance with 10 CFR 52.79(a)(46), this report is required to contain a description of the plant-specific PRA and its results. As part of the development of the certified design PRA, site and plant specific information were reviewed to determine if any changes from the certified design PRA were warranted. This review included consideration of site-specific information such as site meteorological data and site-specific population distributions, as well as plant-specific design information that replaced conceptual design information described in the DCD. Section 1.8.5 was also reviewed to determine if there were any departures affecting the PRA results.

The review of site-specific information and plant-specific design information determined that: 1) the DCD PRA bounds site-specific and plant-specific design parameters and design features and 2) these parameters and features have no significant impact on the DCD PRA results and insights. Therefore, based on this review, it is concluded that there is no significant change from the certified design PRA. In that there are no significant changes from the certified design PRA, incorporation of DCD Chapter 19 into the FSAR satisfies the requirement of 10 CFR 52.79(a)(46) for a description of the plant-specific PRA and its results.

APPENDIX 19A REGULATORY TREATMENT OF NON-SAFETY SYSTEMS (RTNSS)

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 19ACM AVAILABILITY CONTROLS MANUAL

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 19B DETERMINISTIC ANALYSIS FOR CONTAINMENT PRESSURE CAPABILITY

This section of the referenced DCD is incorporated by reference with no departures or supplements.

APPENDIX 19C PROBABILISTIC ANALYSIS FOR CONTAINMENT PRESSURE FRAGILITY

This section of the referenced DCD is incorporated by reference with no departures or supplements.