3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT AND SYSTEMS

This chapter of the U.S. EPR FSAR is incorporated by reference, with the departures and supplements described in the following sections.

3.1 COMPLIANCE WITH NUCLEAR REGULATORY COMMISSION GENERAL DESIGN CRITERIA

This section of the U.S. EPR FSAR is incorporated by reference, with the supplements described in the following sections.

3.1.1 OVERALL REQUIREMENTS

3.1.1.1 Criterion 1 – Quality Standards and Records

No departures or supplements.

3.1.1.1.1 U.S. EPR Compliance

The U.S. EPR FSAR includes the following COL Item in Section 3.1.1.1.1:

> A COL applicant that references the U.S. EPR design certification will identify the site-specific QA Program Plan that demonstrates compliance with GDC 1.

This COL Item is addressed as follows:

{The QA Program is provided in UniStar Nuclear Topical Report No. UN-TR-06-001-A, Quality Assurance Program Description, (QAPD) (UniStar, 2007) as described in Chapter 17.}

The QAPD is applicable to the siting, design, fabrication, construction (including pre-operational testing), operation (including testing), maintenance and modification of the facility. The QAPD demonstrates compliance with GDC 1.

3.1.1.2 Criterion 2 – Design Bases for Protection Against Natural Phenomena

No departures or supplements.

3.1.1.3 Criterion 3 – Fire Protection

No departures or supplements.

3.1.1.4 Criterion 4 – Environmental and Missile Design Bases

No departures or supplements.

3.1.1.5 Criterion 5 – Sharing of Structures, Systems, and Components

No departures or supplements.

3.1.1.5.1 U.S. EPR Compliance

{NMP3NPP shares the following structures, systems, and components with Nine Mile Point (NMP) Unit 1 and Unit 2:

- Off-site transmission system – The NMP3NPP substation is electrically connected with the existing NMP Unit 1 and Unit 2 through a 345 kV substation that is separately and independently owned and operated, and that is part of the transmission network. While the off-site transmission system connects NMP3NPP and NMP Unit 1 and Unit 2, NMP3NPP has on-site AC and DC systems that are dedicated to its use. The off-site AC power sources are described in more detail in Section 8.2, and the on-site power sources are described in Section 8.3.

- Potable water system - The NMP3NPP potable water system is cross-tied (via a normally closed valve) to the NMP Unit 2 potable (i.e., domestic water) water system. The potable water system described in Section 9.2.4 and shown on Figure 9.2-1.

- Meteorological tower – The meteorological tower provides meteorological data to NMP Unit 1 and Unit 2 and NMP3NPP to support operational and emergency response purposes. It is described in more detail in Section 2.3.3.

- Emergency Operations Facility (EOF) – The EOF is described in more detail in Part 5 of the COL application.

The structures, systems, and components are designed such that an accident in one unit would not impair their ability to perform their function for any other unit.}

3.1.2 PROTECTION BY MULTIPLE FISSION PRODUCT BARRIERS

No departures or supplements.

3.1.3 PROTECTION AND REACTIVITY CONTROL SYSTEMS

No departures or supplements.

3.1.4 FLUID SYSTEMS

No departures or supplements.

3.1.5 REACTOR CONTAINMENT

No departures or supplements.

3.1.6 FUEL AND REACTIVITY CONTROL

No departures or supplements.

3.1.7 REFERENCES

{**UniStar, 2007.** Letter from R. M. Krich, UniStar Nuclear, to U. S. Nuclear Regulatory Commission, UniStar Nuclear, NRC Project No. 746, Submittal of the Published UniStar Topical Report No. UN-TR-06-001-A, 'Quality Assurance Program Description,' Revision 0, dated April 9, 2007.}

3.2 CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPONENTS

This section of the U.S. EPR FSAR is incorporated by reference, with the supplements described in the following sections.

3.2.1 SEISMIC CLASSIFICATION

The U.S. EPR FSAR includes the following COL Item in Section 3.2.1:

> A COL applicant that references the U.S. EPR design certification will identify the seismic classification of applicable site-specific SSCs that are not identified in U.S. EPR FSAR Table 3.2.2-1.

This COL Item is addressed as follows:

The seismic classifications for applicable site-specific structures, systems, and components (SSCs) are provided in Table 3.2-1.

{U.S. EPR FSAR Section 3.2.1 states: "The seismic classification of the U.S. EPR SSCs uses the following categories: Seismic Category I, Seismic Category II, radwaste seismic, conventional seismic, and non-seismic." As described in Section 3.2.1.2, NMP3NPP utilizes an additional seismic classification: Seismic Category II-SSE. This classification is applicable to Fire Protection SSCs that support equipment required to achieve safe shutdown following a seismic event.}

3.2.1.1 Seismic Category I

No departures or supplements.

3.2.1.2 Seismic Category II

{In addition to the Seismic Category II classification defined in U.S. EPR FSAR Section 3.2.1, NMP3NPP utilizes a seismic classification of Seismic Category II-SSE. This designation is utilized to address Fire Protection SSCs that are required to remain functional during and following a seismic event to support equipment required to achieve safe shutdown in accordance with Regulatory Guide 1.189 (NRC, 2007). Sections 3.7.2.8 and 3.7.3.12 discuss the methods for analysis of these components.

Some SSCs that perform no safety-related function could, if they failed under seismic loading, prevent or reduce the functional capability of a Seismic Category I SSC, Seismic Category II-SSE SSC, or cause incapacitating injury to main control room occupants during or following an SSE. These non-safety-related SSCs are classified as Seismic Category II.

SSCs classified as Seismic Category II are designed to withstand SSE seismic loads without incurring a structural failure that permits deleterious interaction with any Seismic Category I SSC or Seismic Category II-SSE SSC, or that could result in injury to main control room occupants. The seismic design criteria that apply to Seismic Category II SSCs are addressed in Section 3.7.}

3.2.1.3 Radwaste Seismic

No departures or supplements.

3.2.1.4 Conventional Seismic

No departures or supplements.

3.2.1.5 Non-Seismic

No departures or supplements.

3.2.2 SYSTEM QUALITY GROUP CLASSIFICATION

The U.S. EPR FSAR includes the following COL Item in Section 3.2.2:

> A COL applicant that references the U.S. EPR design certification will identify the quality group classification of site-specific SSCs that are not identified in this table (U.S. EPR FSAR Table 3.2.2-1).

This COL Item is addressed as follows:

The quality group classification of site-specific SSCs is provided in Table 3.2-1.

3.2.3 REFERENCES

{**NRC, 2007.** Fire Protection for Nuclear Power Plants, Regulatory Guide 1.189, Revision 1, U.S. Nuclear Regulatory Commission, March 2007.}

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
(Page 1 of 9)

KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
Table 3.2.2-1 of the U.S. EPR FSAR contains the following conceptual design information for the SM, SN, Cranes, Hoists, and Elevators category for: UKE, Access Building, and UBZ, Buried Conduit Duct Bank.							
[[UKE	Access Building	NS-AQ	N/A	CS	No	UKE	
UBZ	Buried Conduit Duct Bank	S	N/A	I	Yes	UBZ]]	
The U.S. EPR FSAR descriptions provided in U.S. EPR FSAR Table 3.2.2-1 regarding the SM, SN, Cranes, Hoists, and Elevators category for: UKE, Access Building, and UBZ, Buried Conduit Duct Bank are applicable to NMP3NPP, and are incorporated by reference.							
PE, PEB, PED UHS Makeup Water System							
30GFA10AP001 30GFA20AP001 30GFA30AP001 30GFA40AP001	UHS Makeup Water Pumps for Train 1, Train 2, Train 3, and Train 4	S	C	I	Yes	UPB	ASME III
30GFA10AP001 30GFA20AP001 30GFA30AP001 30GFA40AP001	UHS Makeup Water Pump Motors (30 PED 10/20/30/40/ AH001)	S	C	I	Yes	UPB	IEEE/NEMA
Piping	Piping to Cooling Tower	S	C	I	Yes	UPB, UZT	ASME III
30GFA10AA005 30GFA10AA006 30GFA20AA005 30GFA20AA006 30GFA30AA005 30GFA30AA006 30GFA40AA005 30GFA40AA006	Discharge Strainer	S	C	I	Yes	UPB	ASME III
30GFA10AA201 30GFA10AA011 30GFA10AA020 30GFA20AA201 30GFA20AA011 30GFA20AA020 30GFA30AA201 30GFA30AA011 30GFA30AA020 30GFA40AA201 30GFA40AA011 30GFA40AA020	Isolation Valves (including discharge MOVs and test bypass valves)	S	C	I	Yes	UPB/ UZT	ASME III/IEEE

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
(Page 2 of 9)

KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
30GFA10AA001 30GFA10AA002 30GFA10AA009 30GFA10AA010 30GFA10AA251 30GFA10AA101 30GFA10AA252 30GFA10AA013 30GFA10AA030 30GFA10AA601 30GFA10AA501 30GFA20AA001 30GFA20AA002 30GFA20AA009 30GFA20AA010 30GFA20AA251 30GFA20AA101 30GFA20AA252 30GFA20AA013 30GFA20AA030 30GFA20AA601 30GFA20AA501 30GFA30AA001 30GFA30AA002 30GFA30AA009 30GFA30AA010 30GFA30AA251 30GFA30AA101 30GFA30AA252 30GFA30AA013 30GFA30AA030 30GFA30AA601 30GFA30AA501 30GFA40AA001 30GFA40AA002 30GFA40AA009 30GFA40AA010 30GFA40AA251 30GFA40AA101 30GFA40AA252 30GFA40AA013 30GFA40AA030 30GFA40AA601 30GFA40AA501	Isolation Valves for Equipment and Sample Lines	S	C	I	Yes	UPB	ASME III/IEEE

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
(Page 3 of 9)

KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
30GFA10CL001 30GFA10CP001 30GFA10CF001 30GFA20CL001 30GFA20CP001 30GFA20CF001 30GFA30CL001 30GFA30CP001 30GFA30CF001 30GFA40CL001 30GFA40CP001 30GFA40CF001	I&C Equipment in UHS Makeup Intake Structure	S	C	I	Yes	UPB	ASME III/IEEE
	Traveling Water Screens and Associated Equipment	NS	D	II	No	UPB	
30GFB10AT001 30GFB20AT001 30GFB30AT001 30GFB40AT001	Traveling Water Screens						
30GFB10AP001 30GFB20AP001 30GFB30AP001 30GFB40AP001	Pumps						
30GFB10AA201 30GFB20AA201 30GFB30AA201 30GFB40AA201	Check Valves						
30GFB10AA2513 0GFB10AA252 30GFB10AA255 30GFB20AA2513 0GFB20AA252 30GFB20AA255 30GFB30AA2513 0GFB30AA252 30GFB30AA255 30GFB40AA2513 0GFB40AA252 30GFB40AA255	Other Valves						
30GFB10CP001 30GFB20CP001 30GFB30CP001 30GFB40CP001	I&C Equipment						
	Ventilation Equipment	S	C	I	Yes	UPB	ASME III/ASME AG-1
30SAH10AA001 30SAH20AA001 30SAH30AA001 30SAH40AA001	Motorized Damper						

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
(Page 4 of 9)

KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
30SAH10AA002 30SAH20AA002 30SAH30AA002 30SAH40AA002	Motorized Damper						
30SAH10AN001 30SAH20AN001 30SAH30AN001 30SAH40AN001	Air Supply Fan						
30SAH10CT001 30SAH20CT001 30SAH30CT001 30SAH40CT001	Remote Temperature Detector						
30SAH10AH001 30SAH20AH001 30SAH30AH001 30SAH40AH001	Duct Heater						
30SAH10AA201 30SAH20AA201 30SAH30AA201 30SAH40AA201	Backdraft Damper						
Piping and Valves for UHS Pumphouse HVAC	Ventilation Equipment	S	C	I	Yes	UPB	ASME III / ASME AG-1
Misc. Piping	Miscellaneous Piping	NS	D	II	No		ASME B31.1
	UHS Makeup Water Intake Structure between column lines 1 and 5, and A and 20’ North of D	S	C	I	Yes	UPB	ANSI/HI 9.8/ACI 349/ ANSI/AISC N690
	UHS Makeup Water Intake Forebay Structure Between Lines 1 and 8, and North of Column Line D, Including two 20’x22’ Extension and Including Grade Slab at Elevation 270’-0” and Between Column Lines 1 and 8	S	C	I	Yes	UPB	ANSI/HI 9.8/ACI 349/ ANSI/AISC N690
	UHS Tunnel Structures Including Intake and Discharge Tunnels	S	C	I	Yes	UPB	ANSI/HI 9.8/ACI 349/ ANSI/AISC N690
	UHS Encasement Structures Connecting UHS Makeup Water Intake Structure with UHS Cooling Towers	S	C	I	Yes	UPB	ANSI/HI 9.8/ACI 349/ ANSI/AISC N690
	UHS Makeup Water Intake Structure Between Column Lines 5 and 8, and Above Grade Elevation 270’-0”	NS	D	II	No	UPB	AISC 13th Edition
	Steel Enclosure Structure for Trash Racks	NS	D	II	No	UPB	AISC 13th Edition
Electrical Equipment	UHS Makeup Water System Electrical Distribution System Equipment	S	C	I	Yes	UPB	IEEE/NEMA

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
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KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
Electrical Conduits	Electrical Conduits in Encasement Structure Connecting UHS Makeup Water Intake Structure with Cooling Towers	S	C	I	Yes	UPB/ UQB/ UZT	IEEE/ACI 349/NEC
PA, PAA, PAB, PAC, PAS Circulating Water System							
	Circulating Water Cooling Tower	NS	E	CS	No	URA	IBC
	Circulating Water Pump Building	NS	E	CS	No	UQA	IBC
30PAS10/20/30 AP 001	Circ Water Pumps	NS	E	NSC	No	UQA	ASME B31.1/ANSI/HI 2.3
	Circ Water Pump Ventilation Equipment and Ductwork	NS	E	NSC	No	UQA	IEEE/NEMA
30PAS10/20/30 AH 001	Circ Water Pump Motors	NS	E	NSC	No	UQA	IEEE/NEMA
30PAA10/20/30 AT001	Removable Screens	NS	E	NSC	No	UQA	
	Circ Water Piping	NS	E	NSC	No	UQA/ UZT/ UMA/ URA	ASME B31.1/AWWA
	Circ Water Valves	NS	E	NSC	No	UQA/ UZT/ UMA/ URA	AWWA/ASME B31.1/IEEE
	Instrumentation and Controls in Circ Water Piping	NS	E	NSC	No		AWWA/ASME B31.1
	Cooling Tower Basin	NS	E	CS	No	URA	IBC
30PAS10/20/30 AP 001	Circ Water Makeup Pumps	NS	E	NSC	No	UPE	ASME B31.1/ANSI/HI 2.3
	Circulating Water Makeup Intake Structure	NS	E	CS	No	UPE	IBC
30PAS10/20/30 AH 001	Circ Water Makeup Pump Motors	NS	E	NSC	No	UPE	IEEE/NEMA
	Circ Water Makeup Piping	NS	E	NSC	No	UPE/ UZT	AWWA/ ASME B31.1
	Circ Water Chemical Treatment Piping	NS	E	NSC	No	UQA	AWWA/ASME B31.1
	Circ Water Cooling Tower Blowdown Piping	NS	E	NSC	No	UQA/ UZT	AWWA/ ASME B31.1
	Circ Water Bypass Piping	NS	E	NSC	No	URA/ UZT	AWWA/ASME B31.1
	Traveling Screens	NS	E	NSC	No	UPE	
	Makeup piping Valves	NS	E	NSC	No		AWWA/ASME B31.1
	Instrumentation and Controls in Makeup Piping	NS	E	NSC	No	UPE/ UZT	IEEE
	Removable Trash Screen / Drive	NS	E	NSC	No		
	Circ Water System Electrical Distribution Equipment	NS	E	NSC	No	UQA	IEEE/NEMA

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
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KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
	Circ Water Makeup Pump and Raw Water Pump Ventilation Equipment and Ductwork	NS	E	NSC	No	UPE	IEEE/NEMA
GW Raw Water System, includes Essential Service Water Normal Makeup Supply							
	RWSS Pumps/ Motors	NS	E	NSC	No	UPE	ASME B31.1/NEMA/ANSI
	RWSS Strainers/Motors	NS	E	NSC	No	UPE	NEMA/ANSI
	RWSS Valves	NS	E	NSC	No	UPE/ UQB/ UZT	ASME B31.1
	Raw Water System Piping	NS	E	NSC	No	UPE/ UQB/ UZT	ASME B31.1
	RWSS Instrumentation and Controls	NS	E	NSC	No	UPE/ UQB	ASME Section VIII
	RWSS Electrical Distribution Equipment	NS	E	NSC	No	UPE	IEEE/NEMA
GR Sanitary Waste Water System, including Waste Water Treatment Facility							
	Waste Water Treatment Facility	NS	E	CS	No	UGV	IBC
	Debris Tank	NS	E	CS	No	UZT	AWWA/IBC
	Macerating Pumps/Motors	NS	E	NSC	No	UZT	ASME B31.1/ANSI/NEMA
	Aeration Chamber	NS	E	NSC	No	UZT	
	Aeration Blower	NS	E	NSC	No	UZT	
	Underground Piping	NS	E	NSC	No	UZT	ASME B31.1
	Sewage Treatment System Piping	NS	E	NSC	No	UVG/ UZT	ASME B31.1
	Sewage System Electrical Distribution Equipment	NS	E	NSC	No	UGV	IEEE/NEMA
Security Access Facility, including Warehouse							
USU	Storage / Warehouse	NS	E	CS	No	USU	IBC
UYF	Security Access Building	NS	E	CS	No	UYF	IBC
	Security Access Electrical Distribution Equipment	NS	E	NSC	No	UYF	IEEE/NEMA
Central Gas Supply Building							
UTG	Central Gas Supply Bldg	NS	E	CS	No	UTG	IBC
	Piping	NS	E	NSC	No	UTG	ASME B31.1
	Valves	NS	E	NSC	No	UTG	ASME B31.1
	Compressed Gas Tanks	NS	E	NSC	No	UTG	DOT Standard
	Central Gas Supply Electrical Distribution Equipment	NS	E	NSC	No	UTG	IEEE/NEMA
GK, GKB Potable Water System							
	Piping	NS	E	NSC	No		ASME B31.1
	Valves	NS	E	NSC	No		ASME B31.1
	Tanks	NS	E	CS	No		AWWA /ASME VIII/IBC
	Pump/Motors	NS	E	NSC	No		ASME B31.1/ANSI/NEMA

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
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KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
	Potable Water System Electrical Distribution Equipment	NS	E	NSC	No		IEEE/NEMA
SGA, SGA1, SGC, SGAO, SGE, SGM Fire Water Supply System							
	Fire Water Distribution System, including valves and hydrants, Balance of Plant (Not providing Safe Shutdown Earthquake Protection)	NS-AQ	D	NSC	No	USG/ UZT/ UPQ/ UST/ UTG	NFPA
	Fire Water Distribution System, including valves and hydrants, Balance of Plant (Safe Shutdown Equipment Protection following SSE)	NS-AQ	D	II-SSE	Yes	USG/ UZT/ UPB	NFPA/ANSI/ASME B31.1
	Fire Protection Distribution System including valves and hydrants Seismic Category I Structures (Not Providing Safe Shutdown Equipment Protection following SSE)	NS-AQ	D	II	No		NFPA/ANSI/ASME B31.1
	Fire Water Storage Tanks and Fire Protection Building	NS-AQ	D	II-SSE	Yes	USG/ UZT	NFPA/ANSI/ASME B31.1/IBC
	Diesel Engine Driven Pumps and Drivers and subsystems, including diesel fuel oil supply	NS-AQ	D	II-SSE	Yes	USG	NFPA/ANSI/ASME B31.1
	Electric Motor Driven Pump and Driver	NS-AQ	D	NSC	No	USG	NFPA/ANSI/ASME B31.1
	Ventilation Equipment	NS-AQ	D	II-SSE	Yes	USG	NFPA / ASME B31.1 / ASME AG-1
	Jockey Pump and driver	NS-AQ	D	NSC	No	USG	NFPA/ANSI/ASME B31.1/NEMA
	Fire Protection Makeup Piping and Valves (From Demineralized Water System)	NS-AQ	D	NSC	No	UZT	NFPA
Fire Suppression Systems							
	Fire Suppression Systems for Site Specific Buildings other than UHS Makeup Water Intake Structure, and Fire Protection Building	NS-AQ	D	NSC	No		NFPA
	Fire Suppression Systems for UHS Makeup Water Intake Structure, and Fire Protection Building	NS-AQ	D	II	No	UPB, UQA	NFPA/ANSI/ASME B31.1
Other Site-Specific Structures							
	Switchgear Building	NS	E	CS	No	UBA	IBC
	Turbine Building	NS	E	CS	No	UMA	IBC
	Grid Systems Control Building	NS	E	CS	No	UAC	IBC
	Meteorlogical Tower	NS	E	NSC	No	UZT	

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
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KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
	Electrical Duct Banks traversing from the Safeguards Buildings to the Four Essential Service Water Buildings and Both Emergency Power Generating Buildings	S	C	I	Yes	UJK/ UZT/ UQB/ UBP	IEEE/ACI-349/NEC
	Electrical Duct Banks traversing from the Safeguards Buildings to the Switchgear Building	NS	E	CS	No	UJK/ UZT/ UBA	IEEE/NEC
	Electrical Duct Banks traversing from the Emergency Auxiliary Transformers to the Safeguard Buildings	NS	E	CS	No	UBE/ UZT/ UJK	IEEE/NEC
	Electrical Duct Banks traversing from the Switchgear Building to the Circulating Water Pump Building, Cooling Tower, Switchyard Control House, Site Specific Auxiliary Transformer, Sewage Treatment Plant, and CW Makeup Water Intake Structure	NS	E	CS	No	UBA/ UZT/ UPQ/ UQA/ URA/ UAC/ UAA/ UGV/ UPE	IEEE/NEC

Table 3.2-1—{Classification Summary for Site-Specific SSCs}
(Page 9 of 9)

KKS System or Component Code	System or Component Description	Safety Classification (Note 1)	Quality Group Classification	Seismic Category (Note 2)	10CFR50 Appendix B Program	Location (Note 3)	Comments/ Commercial Code
	Electrical Duct Banks traversing between miscellaneous buildings	NS	E	CS	No	UZT	IEEE/NEC

Notes:

1. As defined in U.S. EPR FSAR Section 3.2.1, the US EPR safety classifications, as supplemented by the UniStar Quality Assurance Program Description (QAPD) classifications, are:
S- Safety-related (UniStar QAPD classification - QA Level 1)
NS- Non-safety-related (UniStar QAPD classification - QA Level 3)
NS-AQ- Supplemented Grade (UniStar QAPD classification - QA Level 2)
2. As defined in Section 3.2.1 and U.S. EPR FSAR Section 3.2.1, the Seismic Classifications are:
I – Seismic Category I CS - Commercial Seismic
II – Seismic Category II NSC - Non-Seismic
II-SSE – Seismic Category II Fire Protection structures, systems, and components that are required to remain functional during and following a safe shutdown earthquake to support equipment required to achieve safe shutdown. The following Fire Protection structures, systems, and components are required to remain functional during and after a seismic event: 1) Fire Water Storage Tanks; 2) Fire Protection Building; 3) Diesel driven fire pumps and their associated subsystems and components, including the diesel fuel oil system; 4) Critical support systems for the Fire Protection Building, i.e., ventilation; and 5) The portions of the fire water piping system and components (including isolation valves) which supply water to the stand pipes in buildings that house the equipment required for safe shutdown of the plant following an SSE. Manual actions may be required to isolate the portion of the Fire Protection piping system that is not qualified as Seismic Category II-SSE.
3. Locations are defined below:

KKS Designator	Location
UAA	Switchyard
UAC	Grid System Control House
UBA	Switchgear Building
UBE	Auxiliary Power Transformers
UBP	Emergency Power Generating Building
UGV	Sewage Treatment Plant Building
UJK	Safeguard Buildings Electrical
UMA	Turbine Building
UPB	UHS Makeup Water Intake Structure
UPE	Circulating Water Makeup Intake Structure
UQB	Essential Service Water Pump Building
UQA	Circulating Water Pump Building
URA	Cooling Tower Structure
USG	Fire Water Storage Tanks and Fire Protection Building
UST	Workshop & Warehouse Building
USU	Storage / Warehouse
UTG	Central Gas Supply Building
UYF	Security Access Building
UZT	Outdoor Area

3.3 WIND AND TORNADO LOADINGS

This section of the U.S. EPR FSAR is incorporated by reference, with the supplements described in the following sections.

The U.S. EPR FSAR includes the following COL Item in Section 3.3:

> A COL applicant that references the U.S. EPR design certification will determine site-specific wind and tornado design parameters and compare these to the standard plant criteria. If the site-specific wind and tornado parameters are not bounded, then the COL applicant will evaluate the design for site-specific wind and tornado events and demonstrate that these loadings will not adversely affect the ability of safety-related structures to perform their safety functions during or after such events.

This COL Item is addressed as follows:

Table 2.0-1 provides a comparison of the wind and tornado parameters for the U.S. EPR FSAR design and the site-specific values.

{The U.S. EPR FSAR design wind and tornado parameters bound the site-specific wind and tornado parameters. Additional discussion regarding the derivation of the site-specific wind and tornado parameters is provided in Section 2.3.1. Seismic Category I structures are designed to withstand the effects of wind and tornado loadings. Wind and tornado parameters in U.S. EPR FSAR Table 2.1-1 are used for design of Seismic Category I structures for NMP3NPP.}

3.3.1 WIND LOADINGS

The U.S. EPR FSAR includes the following COL Item in Section 3.3.1:

> A COL applicant that references the U.S. EPR design certification will demonstrate that failure of site-specific structures or components not included in the U.S. EPR standard plant design, and not designed for wind loads, will not affect the ability of other structures to perform their intended safety functions.

This COL Item is addressed as follows:

A discussion of site-specific structures not designed for wind or tornado loadings is provided in Section 3.3.2.3.

3.3.1.1 Design Wind Velocity

{No departures or supplements.}

3.3.1.2 Determination of Applied Wind Forces

{No departures or supplements.}

3.3.1.2.1 Note on Values Used

No departures or supplements.

3.3.2 TORNADO LOADINGS

The U.S. EPR FSAR includes the following COL Item in Section 3.3.2:

A COL applicant that references the U.S. EPR design certification will demonstrate that failure of site-specific structures or components not included in the U.S. EPR standard plant design, and not designed for tornado loads, will not affect the ability of other structures to perform their intended safety functions.

This COL Item is addressed as follows:

A discussion of site-specific structures not designed for wind or tornado loadings is provided in Section 3.3.2.3.

3.3.2.1 Applicable Tornado Design Parameters

{No departures or supplements.}

3.3.2.2 Determination of Tornado Forces on Structures

No departures or supplements.

3.3.2.3 Effect of Failure of Structures or Components Not Designed for Tornado Loads

{Non-safety-related structures located on the site i.e., within the protected area boundary and not included in U.S. EPR FSAR Section 3.3.2.3 include:

- Fire Protection Water Tanks
- Fire Protection Building
- Workshop and Warehouse Building
- Central Gas Supply Building
- Security Access Facility
- Switchgear Building
- Miscellaneous Structures in the Transformer and Switchyard Areas
- Grid System Control Building
- Circulating Water System Cooling Tower
- Circulating Water System Pump Building
- Makeup Water Intake Structure (between column lines 5 and 8, and above grade elevation 270’-0”
- Circulating Water System Retention Basin
- Meterological Tower
- Structure for Demineralized Water Tanks

These non-safety-related structures are miscellaneous steel and concrete structures, which are not designed for high wind and tornado loadings. However, the Fire Protection Water Tanks and the Fire Protection Building are designated as Seismic Category II-SSE structures, and are designed to remain functional during and following a design basis seismic event. These structures are not located directly adjacent to safety-related structures. Thus, their collapse from high winds or tornado loadings would not result in an impact interaction with any safety-related structure. Missiles generated by the collapse of these structures during high wind or tornado loadings are enveloped by the design basis tornado missile loads described in U.S. EPR FSAR Section 3.5.1.4. Non-safety related portions of the Makeup Water Intake Structure are designed such that they will not result in an impact interaction that would reduce the functional capability of the safety related portion of the Makeup Water Intake Structure.}

3.3.3 REFERENCES

{No departures or supplements.}

3.4 WATER LEVEL (FLOOD) DESIGN

This section of the U.S. EPR FSAR is incorporated by reference with the departures and supplements as described in the following sections.

Seismic Category I structures, systems and components (SSCs) can withstand the effects of flooding due to natural phenomena or onsite equipment failures without losing the capability to perform their safety-related functions. The maximum flood and ground water elevations for the U.S. EPR are shown in U.S. EPR FSAR Table 2.1-1 and Table 2.0-1.

{The U.S. EPR FSAR flood and ground water design elevations bound the NMP3NPP site-specific elevations or otherwise calculations have been performed to demonstrate that these loadings will not adversely affect the ability of safety-related structures to perform their safety functions during or after such events.}

3.4.1 INTERNAL FLOOD PROTECTION

No departures or supplements.

3.4.2 EXTERNAL FLOOD PROTECTION

{The U.S. EPR design requires ground water to be at least 3.3 ft (1 m) below grade. The ground water level in the Oswego Sandstone in the NMP3NPP Nuclear Island area ranges between 5.0 ft (1.5 m) and 15.0 ft (4.6 m) below proposed grade of 270 ft (82.3 m), and is therefore bounded by the U.S. EPR design for all safety-related structures.

U.S. EPR FSAR Section 3.8.5.4 describes the methods and procedures used to evaluate static and dynamic effects of ground water on structures.

The U.S. EPR FSAR requires the Probable Maximum Flood (PMF) elevation to be 1 ft (0.3 m) below finished yard grade. As discussed in Section 2.4.3, this requirement envelopes the NMP3NPP maximum flood level for all safety-related structures.}

3.4.3 ANALYSIS OF FLOODING EVENTS

3.4.3.1 Internal Flooding Events

{No departures or supplements.}

3.4.3.2 External Flooding Events

The U.S. EPR FSAR includes the following COL Item in Section 3.4.3.2:

> A COL applicant that references the U.S. EPR design certification will confirm the potential site-specific external flooding events are bounded by the U.S. EPR design basis flood values or otherwise demonstrate that the design is acceptable.

This COL Item is addressed as follows:

{U.S. EPR FSAR Section 3.4.3.2 states: "The Seismic Category I structures are not designed for dynamic effects associated with external flooding (e.g., wind, waves, currents) because the design basis flood level is below the finished yard grade." The design of the NMP3NPP safety-related structures is consistent with this statement.}

3.4.3.3 Reactor Building Flooding Analysis

No departures or supplements.

3.4.3.4 Safeguard Buildings Flooding Analysis

No departures or supplements.

3.4.3.5 Fuel Building Flooding Analysis

No departures or supplements.

3.4.3.6 Nuclear Auxiliary Building Flooding Analysis

No departures or supplements.

3.4.3.7 Radioactive Waste Building Flooding Analysis

No departures or supplements.

3.4.3.8 Emergency Power Generating Buildings Flooding Analysis

No departures or supplements.

3.4.3.9 Essential Service Water Pump Buildings and Essential Service Water Cooling Tower Structures Flooding Analysis

No departures or supplements.

3.4.3.10 Ultimate Heat Sink Makeup Water Intake Structure Flooding Analysis

The U.S. EPR FSAR includes the following COL Item in Section 3.4.3.10:

> A COL applicant that references the U.S. EPR design certification will perform a flooding analysis for the ultimate heat sink makeup water intake structure based on the site-specific design of the structure and the flood protection concepts provided herein.

This COL Item is addressed as follows:

{The flooding analysis for the UHS Makeup Water Intake Structure considered both external and internal flooding. Internal flooding of the UHS Makeup Water Intake Structure is described in FSAR Sections 3.4.1 and 3.4.3.1, and the external flooding events are described in FSAR Sections 3.4.2 and 3.4.3.2. Flood protection measures for the UHS Makeup Water Structure are described in Section 2.4.10.

Additionally, FSAR Section 3.8.5.4.6 and Section 3E.4.1 provide descriptions for the governing internal flooding load conditions (i.e., flooding of a single interior cell, with stop logs down and surrounding cells empty). The analysis included evaluation of both external and internal hydrostatic and hydrodynamic lateral pressure loads.}

3.4.3.11 Permanent Dewatering System

The U.S. EPR FSAR includes the following COL Item in Section 3.4.3.11:

> A COL applicant that references the U.S. EPR design certification will define the need for a site-specific permanent dewatering system.

This COL Item is addressed as follows:

{As described in FSAR Section 2.4.12.5, a permanent ground water dewatering system is not needed for the NMP3NPP facility.}

3.4.4 ANALYSIS PROCEDURES

No departures or supplements.

3.4.5 REFERENCES

{No departures or supplements.}

3.5 MISSILE PROTECTION

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.5.1 MISSILE SELECTION AND DESCRIPTION

No departures or supplements.

3.5.1.1 Internally Generated Missiles Outside Containment

No departures or supplements.

3.5.1.2 Internally Generated Missiles Inside Containment

No departures or supplements.

3.5.1.2.1 Credible Internally Generated Missile Sources Inside Containment

No departures or supplements.

3.5.1.2.2 Non-Credible Internally Generated Missile Sources Inside Containment

No departures or supplements.

3.5.1.2.3 Missile Prevention and Protection Inside Containment

The U.S. EPR FSAR includes the following COL Item in Section 3.5.1.2.3:

> A COL applicant that references the U.S. EPR design certification will describe controls to confirm that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall establish plant procedural controls to ensure that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or restrained to prevent it from becoming a missile.

3.5.1.3 Turbine Missiles

The U.S. EPR FSAR includes the following COL Item in Section 3.5.1.3:

> A COL applicant that references the U.S. EPR design certification will confirm the evaluation of the probability of turbine missile generation for the selected turbine generator, P_1, is less than 1E-4 for turbine generators favorably oriented with respect to containment.

This COL Item is addressed as follows:

The turbine-generator design consists of a HP/IP turbine stage with three LP turbines as described in U.S. EPR FSAR Section 10.2. A turbine missile analysis has been developed for the selected turbine design. The analysis considers stress corrosion cracking (SCC), brittle fracture and destructive overspeed as potential failure mechanisms. The analysis also addresses inspection intervals in regard to the probability of failure. The turbine missile analysis calculates the probability of turbine rotor failure consistent with the guidance in Regulatory Guide 1.115 (NRC, 1977) and in NUREG-0800 Section 3.5.1.3 (NRC, 2007b). The analysis includes charts on missile generation probabilities versus service time for the HP/IP and LP turbine rotors.

The probability of reaching destructive overspeed is largely dictated by the probability of failure of the governing and overspeed protection system. Turbine overspeed protection is described in U.S. EPR FSAR Section 10.2. The steam turbine has two independent valves in series on each steam inlet with failsafe hydraulic actuators. These valves are tripped by the redundant overspeed protection system.

The inspection requirements for the turbine rotors during major overhauls ensure that indications of SCC will be detected. The turbine rotor inspection program is described in U.S. EPR FSAR Section 10.2 and is consistent with the turbine manufacturer's recommended inspection intervals required to meet the calculated failure probability of the turbine rotor.

The turbine missile analysis demonstrates that the probability of turbine rotor failure resulting in an ejection of the turbine rotor (or internal structure) fragments through the turbine casing, P_1, is less than 1E-4 for a favorably oriented turbine with respect to the containment.

The turbine missile analysis is available for review.

The U.S. EPR FSAR also includes the following COL Item in Section 3.5.1.3:

> A COL applicant that references the U.S. EPR design certification will assess the effect of potential turbine missiles from turbine generators within other nearby or co-located facilities.

This COL Item is addressed as follows:

{As described in Tables 3.5-3, 3.5-4, and 3.5-5 of the FSAR for NMP Unit 2 (UniStar, 2006), the probability of turbine missile generation and ejection for NMP Unit 1 and Unit 2, and the James A. Fitzpatrick Nuclear Power Plant (JAFNPP) are all less than 1E-7/year, and therefore below the threshold value of 1E-4 described in Regulatory Guide 1.115 (NRC, 1977) on both an individual and combined basis. Therefore, NMP3NPP safety-related SSCs are adequately protected from potential turbine missiles originating from NMP Unit 1 and Unit 2, and the JAFNPP.}

3.5.1.4 Missiles Generated by Tornadoes and Extreme Winds

The U.S. EPR FSAR includes the following COL Item in Section 3.5.1.4:

> A COL applicant that references the U.S. EPR design certification will evaluate the potential for other missiles generated by natural phenomena, such as hurricanes and extreme winds, and their potential impact on the missile protection design features of the U.S. EPR.

This COL Item is addressed as follows:

All Seismic Category I structures that make up the U.S. EPR standard design meet the most stringent Region I tornado intensity requirements of Regulatory Guide 1.76 (NRC, 2007a). The associated tornado wind speeds (230 mph (103 m/s) maximum) represent an exceedance frequency of 1E-07 per year. Region I tornado missile parameters are reflected in U.S. EPR FSAR Table 3.5-1 and are used in the standard design of all Seismic Category I structures.

{The NMP3NPP site is located in Oswego County, New York. Using Regulatory Guide 1.76, Figure 1, this site lies in tornado intensity Region I. The associated wind speeds represent an exceedance frequency of 1E-07 per year. The U.S. EPR standard utilized the Region I wind speed and resulting missile spectrum. Thus, the acceptance criteria in Regulatory Guide 1.76 is met for the NMP3NPP site.

Regulatory Guide 1.76 (NRC, 2007a) does not address extreme winds such as hurricane winds or the missiles associated with such winds. Therefore, additional site-specific wind conditions were considered as follows:

Summarizing from FSAR Section 2.3.1, the following meteorological data is specific to the NPMP3NPP site and provides a site-specific comparative justification for the use of the tornado design-basis missile spectrum for other potentially extreme high wind conditions:

- Annually, New York has a relatively low number of tornados compared to much of the contiguous United States. From 1950 to 1995, the annual average number of tornados is six, with an annual average of strong-violent tornados (F2-F5) of one, for the same time period. Based on National Weather Service meteorological data from January 1, 1950 to March 31, 2007, there has been eight tornados reported in Oswego County with estimated minimum and maximum Fujita damage scales ranging from F0 to F3, respectively. This equates to estimated wind speeds ranging from 73 mph (117 km/hr) to a maximum of 206 mph (331 km/hr).

- National Hurricane Center statistics listed 36 tropical storms and hurricanes that have passed within 100 miles (161 km) of Oswego, New York during the period of 1876 to 2006. Of those storms there was one category 1 hurricane and with recorded wind speeds of 65 knot (120 km/hr). The remaining 35 storms consist of nine tropical storms, three tropical depressions and 23 extra tropical storms.

- A review of all recorded cases of high winds (winds greater than 50 knots (93 km/hr)) from National Climatic Data Center's Storm Events database from July 24, 1975 to March 31, 2007 for Oswego County, New York, found 68 high wind events with wind speeds ranging from 50 to 70 knots (93 km/hr to 130 km/hr, respectively). There were five storm events recorded with wind speeds greater than 75 mph (121 km/hr) but less than 124 mph (200 km/hr) during the period from January 1, 1977 to August 31, 2007.

By comparison of the site specific meteorological data with the estimated strongest wind speed classifications for tornados, it is reasonable to conclude that the Region I missile spectrum from RG 1.76 is a conservative representation of those that could be generated by the less intense extreme wind conditions anticipated at the NMP3NPP site.}

The U.S. EPR FSAR also includes the following COL Item in Section 3.5.1.4:

> For sites with surrounding ground elevations that are higher than plant grade, a COL applicant that references the U.S. EPR design certification will confirm that automobile missiles cannot be generated within a 0.5 miles radius of safety-related SSCs that would lead to impact higher than 30 ft above plant grade.

This COL Item is addressed as follows:

The tornado missile spectrum requirements provided in Regulatory Guide 1.76 (NRC, 2007a) describe three design-basis missiles; a pipe, sphere, and automobile. The pipe and sphere missiles are assumed to impact applicable structures at all elevations. The automobile missile is to be considered at all altitudes less than 30 ft (9.1 m) above all grade levels within 0.5 miles (0.8 km) of the plant structures.

Category I structures within the Nuclear Island (NI) base mat which include the Reactor, Fuel, and Safeguard Buildings (SB) 2 and 3 are protected by being housed in independent hardened structures. Walls and roof slabs of the hardened structures are designed of heavily reinforced concrete that envelopes the Region I tornado missile spectrum requirements. SB 1 and 4 are not enclosed in hardened structures, due to the system redundancy provided by SB 2 and 3. Although SB 1 and 4 are not housed in an independent hardened structure, they are constructed of heavily reinforced concrete and all wall and roof slab sections meet the minimum acceptable tornado missile barrier guidance identified in NUREG-0800, Section 3.5.3 (NRC, 2007b).

Likewise, the U.S. EPR standard design of all Category I structures outside the NI base mat are constructed of reinforced concrete and all wall and roof slabs meet the Region I design-basis missile spectrum, including the automobile missile guidance of Regulatory Guide 1.76 (NRC, 2007a) for all structural elevations. {An exception to the previous statement is that for the Essential Service Water Cooling Tower and pump structures, the automobile missile impact is considered on all wall elements at all elevations, but not the roof slab located at 96 ft (29.3 m) above grade.

The highest elevation within the 0.5 mile (0.8 km) radius at NMP3NPP is at an approximate elevation of 324 ft (98.8 m). Adding the 30 ft (9.1 m) requirement, all elements below elevation 354 ft (107.9 m) require evaluation of the automobile missile. Normal grade elevation at the Essential Service Water Cooling Tower and pump structures is approximately 270 ft (82.3 m). Therefore, structural elements less than 84 ft (25.6 m) high require automobile missile evaluation. The height of the Essential Service Water Cooling Tower and pump structures is approximately 96 ft (29.3 m). Hence, the roof slabs on these structures do not require automobile missile evaluation. On this basis, the site-specific conditions are conservatively enveloped for all required elevations.

Thus, by the standard U.S. EPR meeting the Region I tornado missile spectrum requirements for all Category I structures, the site-specific conditions at NMP3NPP are in compliance with all Regulatory Guide 1.76 (NRC, 2007a) tornado missile requirements.}

3.5.1.5 Site Proximity Missiles (Except Aircraft)

The U.S. EPR FSAR includes the following COL Item in Section 3.5.1.5:

> A COL applicant that references the U.S. EPR design certification will evaluate the potential for site proximity explosions and missiles generated by these explosions for their potential impact on missile protection design features.

This COL Item is addressed as follows:

In accordance with Regulatory Guide 1.206 (NRC, 2007c), the following missile sources have been considered and are discussed in Section 2.2:

- Train explosions
- Truck explosions

- Ship or barge explosions
- Industrial facilities
- Pipeline explosions
- Military facilities

Section 2.2 evaluates the effects of potential accidents in the vicinity of the site from present and projected industrial, transportation, and military facilities and operations. Each transportation mode and facility was evaluated with regard to the effects from potential accidents relating to explosions, flammable vapor clouds (delayed ignition), and toxic chemicals (vapors or gases), including liquid spills. Evaluation acceptance criteria for these hazards are in accordance with Regulatory Guides 1.91 and 1.78 (NRC, 1978a and NRC, 2001, respectively).

{From FSAR Section 2.2, none of the potential site-specific external event hazards evaluated (aircraft hazards are discussed below) resulted in an unacceptable affect important to the safe operation of NMP3NPP**.** This conclusion is substantiated by each potential external hazard being screened based on applicable regulatory guidance or the hazard contribution to core damage frequency (CDF) was deemed to be less than 1E-6 per year.}

3.5.1.6 Aircraft Hazards

The U.S. EPR FSAR includes the following COL Item in Section 3.5.1.6:

> A COL applicant that references the U.S. EPR design certification will evaluate site-specific aircraft hazards and their potential impact on plant SSCs.

This COL Item is addressed as follows:

In accordance with Regulatory Guide 1.70 (NRC, 1978b), Regulatory Guide 1.206 (NRC, 2007c), and NUREG-0800, Section 3.5.1.6 (NRC, 2007b), the risks due to aircraft hazards should be sufficiently low. Furthermore, aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) (CFR, 2008) with a probability of occurrence greater than an order of magnitude of 1E-7 per year should be considered in the design of the plant.

Section 2.2 describes the site-specific aircraft and airway hazard evaluations. {The NMP3NPP plant-to-airport distance and level of airport operations meet NUREG-0800 Section 3.5.1.6 Aircraft Hazards criteria (NRC, 2007b) and no impact frequency calculation or additional design-basis criteria is necessary or provided to address site-specific aircraft hazards for NMP3NPP.}

3.5.2 STRUCTURES, SYSTEMS, AND COMPONENTS TO BE PROTECTED FROM EXTERNALLY GENERATED MISSILES

No departures or supplements.

3.5.3 BARRIER DESIGN PROCEDURES

No departures or supplements.

3.5.4 REFERENCES

{**CFR, 2008.** Contents of Construction Permit and Operating License Applications; Technical Information, Title 10, Code of Federal Regulations, Part 50.34, U.S. Nuclear Regulatory Commission, February 2008.

NRC, 1977. Protection Against Low-Trajectory Turbine Missiles, Regulatory Guide 1.115, Revision 1, U.S. Nuclear Regulatory Commission, July 1977.

NRC, 1978a. Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants, Regulatory Guide 1.91, Revision 1, U.S. Nuclear Regulatory Commission, February 1978.

NRC, 1978b. Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition), Regulatory Guide 1.70, Revision 3, U.S. Nuclear Regulatory Commission, November 1978.

NRC, 2001. Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release, Regulatory Guide 1.78, Revision 1, U.S. Nuclear Regulatory Commission, December 2001.

NRC, 2007a. Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, Regulatory Guide 1.76, Revision 1, U.S. Nuclear Regulatory Commission, March 2007.

NRC, 2007b. Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG-0800, U.S. Nuclear Regulatory Commission, March 2007.

NRC, 2007c. Combined License Applications for Nuclear Power Plants (LWR Edition), Regulatory Guide 1.206, Revision 0, U.S. Nuclear Regulatory Commission, June 2007.

UniStar, 2006. Final Safety Analysis Report for Nine Mile Point Unit 2, Revision 17, October 2006.}

3.6 PROTECTION AGAINST DYNAMIC EFFECTS ASSOCIATED WITH POSTULATED RUPTURE OF PIPING

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.6.1 PLANT DESIGN FOR PROTECTION AGAINST POSTULATED PIPING FAILURES IN FLUID SYSTEMS OUTSIDE OF CONTAINMENT

The U.S. EPR FSAR includes the following COL Item in Section 3.6.1:

> A COL applicant that references the U.S. EPR design certification will perform the pipe break hazards analysis and reconcile deviations in the as-built configuration to this analysis.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall perform a pipe break hazard analysis as part of the piping design. It is used to identify postulated break locations and layout changes, support design, whip restraint design, and jet shield design. The final design for these activities shall be completed prior to fabrication and installation of the piping and connected components. The as-built reconciliation of the pipe break hazards analysis shall be completed prior to fuel load.

3.6.2 DETERMINATION OF RUPTURE LOCATIONS AND DYNAMIC EFFECTS ASSOCIATED WITH THE POSTULATED RUPTURE OF PIPING

No departures or supplements.

3.6.2.1 Criteria Used to Define Break and Crack Location and Configuration

The U.S. EPR FSAR includes the following COL Item in Section 3.6.2.1:

> A COL applicant that references the U.S. EPR design certification will perform the pipe break hazards analysis and reconcile deviations in the as-built configuration to this analysis.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall perform a pipe break hazard analysis as part of the piping design. It is used to identify postulated break locations and layout changes, support design, whip restraint design, and jet shield design. The final design for these activities shall be completed prior to fabrication and installation of the piping and connected components. The as-built reconciliation of the pipe break hazards analysis shall be completed prior to fuel load.

3.6.2.2 Guard Pipe Assembly Design Criteria

No departures or supplements.

3.6.2.3 Analytical Methods to Define Forcing Functions and Response Models

No departures or supplements.

3.6.2.4 Dynamic Analysis Methods to Verify Integrity and Operability

No departures or supplements.

3.6.2.5 Implementation of Criteria Dealing with Special Features

3.6.2.5.1 Pipe Whip Restraints

The U.S. EPR FSAR includes the following COL Item in Section 3.6.2.5.1:

> A COL applicant that references the U.S. design certification will provide diagrams showing the final as-designed configurations, locations, and orientations of the pipe whip restraints in relation to break locations in each piping system.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall provide the diagrams showing the final as-designed configurations, locations, and orientations of the pipe whip restraints in relation to break locations in each piping system prior to fabrication and installation of the piping system.

3.6.2.5.2 Structural Barrier Design

No departures or supplements.

3.6.2.5.3 Evaluation of Pipe Rupture Environmental Effects

No departures or supplements.

3.6.2.6 References

No departures or supplements.

3.6.3 LEAK-BEFORE-BREAK EVALUATION PROCEDURES

The U.S. EPR FSAR includes the following COL Item in Section 3.6.3:

> A COL applicant that references the U.S. EPR design certification will confirm that the design LBB analysis remains bounding for each piping system and provide a summary of the results of the actual as-built, plant-specific LBB analysis, including material properties of piping and welds, stress analyses, leakage detection capability, and degradation mechanisms.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall confirm that the design Leak-Before-Break (LBB) analysis remains bounding for each piping system. A summary of the results of the actual as-built, plant-specific LBB analysis, including material properties of piping and welds, stress analyses, leakage detection capability, and degradation mechanisms will be provided prior to fuel load.

3.7 SEISMIC DESIGN

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.7.1 SEISMIC DESIGN PARAMETERS

{Section 3.7.1 describes the reconciliation of the site-specific seismic parameters for NMP3NPP and demonstrates that these parameters are enveloped by the Certified Seismic Design Response Spectra (CSDRS) (anchored at 0.3 g Peak Ground Acceleration (PGA)) and the 10 generic soil profiles used in the U.S. EPR FSAR.

3.7.1.1 Design Ground Motion

The GMRS for NMP3NPP, which were developed using RG 1.165 (NRC, 1997) and RG 1.208 (NRC, 2007a), are bounded by the CSDRS at all frequencies, including the high frequency region of the ground response spectra. Therefore, the CSDRS used in the design of the U.S. EPR are applicable to NMP3NPP.

3.7.1.1.1 Design Ground Motion Response Spectra.

Seismic Reconciliation of CSDRS and GMRS for the Nuclear Island Common Base Mat, Emergency Power Generating Buildings, and the Essential Service Water Buildings:

The GMRS for the horizontal direction in the free-field at the foundation level of the Nuclear Island Common Basemat structure has a peak ground acceleration of 0.073g. A comparison of the GMRS with the 0.3g EUR-based CSDRS curves are shown in Figure 3.7-1 and Figure 3.7-2. These figures show that all three 0.3g CSDRS curves completely envelop the NMP3NPP GMRS in the horizontal and vertical directions. Appendix S of 10 CFR Part 50 requires that the horizontal component of the SSE ground motion in the free-field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least 0.1g. The minimum horizontal SSE ground motion for NMP3NPP is defined as the envelope of the GMRS and the set of CSDRS curves anchored at 0.1g peak ground acceleration (see Figure 3.7-3 and Figure 3.7-4).

The vertical SSE ground motion is the same as the vertical GMRS.

The NMP3NPP seismic design parameters are enveloped by the CSDRS and the generic site soil profiles used in the certified design as described below (except as noted):

1. The PGA for the GMRS is 0.073g and 0.057g (based on the spectral amplitude at 100 Hz) in the horizontal and vertical directions, respectively, which is less than 0.3g, the PGA for the CSDRS.

2. The Nuclear Island Common Basemat is founded on top of the Oswego Sandstone Rock formation with a low-strain, best-estimate shear wave velocity of approximately 5,900 fps. Since this shear wave velocity is greater than 1,000 fps, the NMP3NPP NI is founded on competent material as defined in SRP 3.7.1.

3. The FIRS for the NI Common Basemat structure is defined at the bottom of the basemat at approximately 40 feet below grade. This depth is also where the GMRS, which is enveloped by the U.S. EPR standard plant CSDRS, is defined. Therefore, the FIRS is equal to the GMRS and is also enveloped by the CSDRS.

4. The FIRS for both the Emergency Power Generating Buildings (EPGB) and the Essential Service Water Buildings (ESWB) are enveloped by the CSDRS.

5. Horizontal soil layering is confirmed for the NMP3NPP site-specific soil.

6. The average shear wave velocity of LB profile is 1,746 m/s or 5,730 ft/s (average of 87 layers plus half-space defined in Table 3.7-2). The average shear wave velocity of 80 layers plus half-space for the BE profile shown in Table 3.7-1 is 2,196 m/s or 7,204 ft/s. Finally, for the UB case, the average shear wave velocity of 66 layers plus half-space is 2,703 m/s or 8,867 ft/s (Table 3.7-3). The three NMP3NPP soil profiles are bounded by US EPR Standard Plant FSAR soil profiles 5u (uniform profile with shear wave velocity of 5,249 ft/s) and 5a (uniform profile with shear wave velocity of 13,123 ft/s). However, the actual NMP3NPP profiles have some variations in the soil layering at the site (approximately from -20m to -40m depth below the NI common basemat) from that of the generic soil profiles considered in US EPR Design Certification (DC) (See Figure 3.7-5 to Figure 3.7-7) . The layering is most visible near the 4.88m (16ft) thick Pulaski C1 rock formation (depth -32.5m to -37.4m) whose Vs values are slightly lower than the Vs values of rock formations above and below. In view of such variations, confirmatory soil-structure interaction (SSI) analyses are performed to demonstrate that the site-specific in-structure response spectra (ISRS) at representative locations of the Nuclear Island (NI) Common Basemat Structures resulting from the combination of input ground motion with the site-specific soil profile are bounded by the corresponding ISRS for the certified design.

   The characteristics of the site related to EPGB and ESWB structures fall within the site parameters for the US EPR FSAR and the site is acceptable without requiring further SSI analysis.

7. A comparison of the FIRS (or GMRS) for the NI Common Basemat Structures with the CSDRS is shown in Figure 3.7-1 and Figure 3.7-2 for the horizontal and vertical directions, respectively. This comparison shows that the CSDRS is significantly greater than the FIRS. A comparison of the NMP3NPP soil profiles with those considered in the certified design is shown in Figure 3.7-5 to Figure 3.7-7. From this comparison, it is less clear that the certified design is bounding. Although it is apparent that the NMP3NPP average shear wave velocities are bounded by the certified design, the soil layer thickness and variations in shear wave velocities between -20m and -40m depth below NI basemat are different. Confirmatory analyses are performed to demonstrate that the site-specific ground motion coupled with the site-specific soil profiles are bounded by the certified design.

The confirmatory SSI analyses are performed for the NI Common Basemat Structures using the methodology consistent with Design Certification. A brief description of the analyses follow:

Confirmatory Soil Structure Interaction (SSI) Analyses

Soil Profiles

Table 3.7-1 through Table 3.7-3 show the strain-compatible Best Estimate (BE), Lower Bound (LB) and Upper Bound (UB) soil cases, respectively, used in the confirmatory SSI analysis for the NI Common Basemat Structures.

Ground Motion

The ground motions are defined as outcrop motions at the NI Common Basemat level.

A comparison of the ground motion (GMRS/FIRS) for the NI with the CSDRS is shown in Figure 3.7-1 and Figure 3.7-2.

SSI Analysis

The same SSI model and methodology used for Design Certification is used for the confirmatory analyses, except that OBE structural damping is used since it is unlikely that the 0.07g (horizontal direction) PGA motion will result in high enough stress levels to justify the use of SSE damping levels.

Confirmatory SSI analyses for three strain-compatible soil cases, namely NMP3NPP BE, LB, and UB, were performed using NMP3NPP GMRS motion with 0.07g and 0.05g PGA in the horizontal and vertical directions, respectively, as seismic input. The new GMRS values are 0.073g and 0.057g PGA in the horizontal and vertical directions, respectively. Since the increase in GMRS values across the entire frequency range is less than 10% and the available margins for the ISRS previously generated are much higher than 10%, a new confirmatory SSI analysis is not necessary.

Response spectra for 5% damping in the three directions are generated at the following key locations:

- Reactor Building Internal Structure at Elev. 5.15m and 19.5m
- Safeguard Building 1 at Elev. 8.1m and 21.0m
- Safeguard Building 2/3 at Elev. 8.1m and 15.4m
- Safeguard Building 4 at Elev. 21.0m
- Containment Building at Elev. 37.6m and 58.0m

A comparison of the 5% damped peak-broadened ISRS for the NMP3NPP BE, LB, and UB soil cases with the corresponding peak broadened Design Certification ISRS show that the certified design bounds the NMP3NPP seismic demands by a large margin. See Figure 3.7-8 through Figure 3.7-34. Therefore, the NMP3NPP site-specific seismic parameters are bounded by the U.S. EPR results.

Foundation Input Response for Site-Specific Buildings

Site specific GMRS and FIRS have been developed for the UHS Makeup Water Intake Structure. The GMRS and FIRS spectra are bounded by the Certified Seismic Design Response Spectra (CSDRS) for hard conditions normalized to 0.3 g Peak Ground Acceleration (PGA) at all frequencies, including the high frequency region of the ground response spectra. The CSDRS for hard conditions normalized to 0.3 g PGA is applicable to the following site-specific structures:

- UHS Makeup Water Intake
- UHS Tunnels

- UHS Encasement

Figure 9.2-4 and Figure 9.2-5 provide plan and section views of the UHS Makeup Water Intake, Structure. The Seismic Category I UHS Makeup Water Intake Structure is located approximately 60 ft (18.29 m) from the Lake Ontario shore. The bottom of the UHS Makeup Water Intake Structure base mat is located 47.58 ft (14.5 m) below the grade elevation 270 ft-0 in (82.3 m).

The UHS Tunnels connect the UHS Makeup Water Intake Structure to the Intake/ Discharge Shaft Outlets projecting above the lake bottom. The top elevations of the vertical portion of the UHS Tunnels at the UHS Makeup Water Intake Structure connection are located 44.58 ft (13.59 m) below the grade elevation 270 ft-0 in (82.3 m). The bottom elevations of the horizontal portion of the UHS Tunnels are located approximately 131 ft (39.93/m) below the grade elevation 270 ft-0 in (82.3 m). The top of the vertical UHS Tunnel Intake Structure Shaft projecting above the lake bottom is located 41 ft (12.5 m) below the grade elevation 270 ft-0 in (82.3 m). The top of the vertical UHS Tunnel Discharge Structure Shafts projecting above the lake bottom are located 66 ft (20.12 m) below the grade elevation 270 ft-0 in (82.3 m).

The UHS Encasement Structure connects the UHS Makeup Water Intake Structure to the Cooling Towers. The top of the UHS Encasement bottom slab is located at elevation 248′ 0″ (75.59 m).

3.7.1.1.2 Design Ground Motion Time History

No departures or supplements.

3.7.1.2 Percentage of Critical Damping Values

No departures or supplements.

3.7.1.3 Supporting Media for Seismic Category I Structures

The U. S. EPR FSAR Section 3.7.1.3 is incorporated by reference with the following supplemental information.

The supporting media for the NI Common Basemat Structures for the seismic analysis is shown in Figure 3.7-5 through Figure 3.7-7. The variation in shear wave velocity is addressed in a site-specific confirmatory soil-structure interaction analysis, demonstrating that the site-specific supporting media are bounded by the analyses for the certified design.

For the UHS Makeup Water Intake and Tunnel Structures, soil and rock layer properties, including shear and compression wave velocities are based on geotechnical data. Shear wave velocity for the rock layer supporting the UHS Makeup Water Intake and Tunnel Structures is 13,500 ft/s to 5,900 ft/s (1,798m/s). The compression wave velocity range is to 14,500 ft/sec (4,420 m/sec).

The UHS Makeup Water Intake Structure foundation is situated at elevation 225′6″(68.7m). The UHS Makeup Water Intake Structure substructure rests on a reinforced concrete base mat, at elevation 225′5″(68.7m). The size of the base mat is 112 ft x 162 ft (34.1 m x 49.4 m). The UHS Makeup Water Intake Structure superstructure floor slab is partially supported by the walls of the substructure and is partially supported on the backfill layer. The footprint of the floor slab supported on the backfill material is 32 ft x 162 ft (9.8 m x 49.4 m).

Site geology is discussed further in FSAR Section 2.5.

3.7.1.4 References

NRC, 1997. Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion, Regulatory Guide 1.165, Revision 0, U.S. Nuclear Regulatory Commission, March 1997.

NRC, 2007a. A Performance-Based Approach to Define the Site Specific Earthquake Ground Motion, Regulatory Guide 1.208, Revision 0, U.S. Nuclear Regulatory Commission, March 2007.}

3.7.2 SEISMIC SYSTEM ANALYSIS

The U.S. EPR FSAR includes the following COL Item in Section 3.7.2:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific seismic response is within the parameters of Section 3.7 of the U.S. EPR standard design.

This COL Item is addressed as follows:

{The site-specific seismic parameters for NMP3NPP were evaluated and confirmed to be bounded by the U.S. EPR Standard Design as discussed in COL FSAR Section 3.7.1.1.

3.7.2.1 Seismic Analysis Methods

No departures or supplements.

3.7.2.1.1 Time History Analysis Method

No departures or supplements.

3.7.2.1.2 Response Spectrum Method

No departures or supplements.

3.7.2.1.3 Complex Frequency Response Analysis Method

No departures or supplements.

3.7.2.1.4 Equivalent Static Load Method of Analysis

The UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures are analyzed using the equivalent static method. The acceleration values from CSDRS are used based on the frequency of the structures in horizontal and vertical direction. Table 3.7-4 provides tabulation of seismic accelerations used in the seismic analysis of the UHS Makeup Water Intake Structure. Seismic accelerations for UHS Tunnel and Encasement Structures correspond to ground acceleration of 0.3 x g.

3.7.2.2 Natural Frequencies and Response Loads

For the UHS Makeup Water Intake Structure, the dominant frequencies, as defined in ASCE 4-98 (ASCE, 1998), associated with the two orthogonal directions and a vertical direction are as shown in Table 3.7-5. The frequencies for UHS Makeup Water Intake Structure are associated with 40 modes, including mass participation factors in each of the three orthogonal directions.

3.7.2.3 Procedures Used for Analytical Modeling

Equipment, components, and piping systems associated with the UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures are lumped into the supporting structure mass. Each Seismic Category I structure is considered to be independent because of a gap between adjacent structures.

3.7.2.3.1 Seismic Category I Structures – Nuclear Island Common Basemat

No departures or supplements.

3.7.2.3.2 Seismic Category I Structures – Not on Nuclear Island Common Basemat

The UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures are Seismic Category I structures situated outside the bounds of the NI.

The UHS Makeup Water Intake is a reinforced concrete shear wall structure supported by a reinforced concrete base mat. Sections 3E.4 of Appendix 3E provides a more detailed description of the UHS Makeup Water Intake Structure, while plan and section views used as the basis for the finite element model are provided in Figure 9.2-4 and Figure 9.2-5.

A finite element model of the UHS Makeup Water Intake Structure is created in GT STRUDL to accurately represent the structure as well as facilitate subsequent structural design. Reinforced concrete base mat, floor and roof slabs as well as the shear walls of the UHS Makeup Water Intake Structure are modeled using plate elements, which capture both in-plane and out-of-plane effects from the applied loads. Figure 3E.4-6 and Figure 3E.4-7 depict the finite element mesh for the UHS Makeup Water Intake Structure.

The finite element analysis is based on the un-cracked condition for all walls. However, the analysis for the reinforcement requirements including moments and forces due to the differential temperature effects are based on the cracked section properties. The thickness of the reinforced concrete divider walls is due in large part to non-seismic requirements, i.e., the required overall weight to overcome buoyancy and the required section for the temporary maintenance condition with a single cell empty, stop logs in place and a design water level of 28.58 ft (8.71 m) above the top of the base mat as explained further in Section 3E.4 of Appendix 3E. The thickness of the exterior walls is governed by the shear forces from the applied lateral loads.

It is not anticipated that the cracking of the 3.5 ft (1.07 m) reinforced concrete shear walls will significantly impact the seismic analysis. This will be confirmed during detailed engineering.

The equivalent static loads are applied to the 3D finite element model to determine axial forces and bending moments in the reinforced concrete structural elements.

Dynamic response of the contained water mass is considered in accordance with ASCE 4-98 (ASCE, 1998), Section 3C.5.4.2.

The detailed descriptions of the UHS Tunnels and UHS Encasement Structures including analysis methodology are provided in Section 3E.4 of Appendix 3E.

3.7.2.3.3 Seismic Category II Structures

In addition to the Seismic Category II classification defined in U.S. EPR FSAR Section 3.2.1 NMP3NPP utilizes a seismic classification of Seismic Category II-SSE. This designation is utilized to address Fire Protection SSC that are required to remain functional during the following a seismic event to support equipment required to achieve safe shutdown in accordance with Regulatory Guide 1.189 (NRC, 2007b). Section 3.7.2.8 and Section 3.7.3.12 discuss the methods for analysis of these components.

Some SSC's that perform no safety-related function could, if they failed under seismic loading, prevent or reduce the functional capability of a Seismic Category I SSC, Seismic Category II-SSE SSC, or cause incapacitating injury to main control room occupants during or following an SSE. These non-safety-related SSCs are classified as Seismic Category II.

3.7.2.3.4 Conventional Seismic (CS) Structures

No departures or supplements.

3.7.2.4 Soil-Structure Interaction

Site-specific structures addressed in this section include the UHS Makeup Water Intake Structure and UHS Makeup Water Intake Tunnel.

The seismic analysis of these structures is performed assuming a fixed base at the top of the rock. The rock is treated analytically as a homogeneous material comprising an entire elastic half-space. Seismic effects on the UHS Makeup Water Intake Structure are determined by a time history analysis in accordance with the requirements of ASCE 4-98 (ASCE, 1998) and ASCE Standard 4098 (ASCE, 1986). The control input motion for the time history analysis is applied at the bottom of the base mat of the UHS Makeup Water Intake Structure and UHS Makeup Water Intake Tunnels. The acceleration levels at the convective frequencies associated with sloshing effects are expected to be low. Therefore, the convective forces are anticipated to be minimal relative to the impulsive and seismic inertia forces of the reinforced concrete walls.

During detailed design, it will be confirmed that the convective forces have a negligible impact on both overall design of the structure and component design. The information on the properties of backfill material is obtained from the Final Safety Analysis Report for NMP Unit 2 since, depending on the backfill source location, the properties of the backfill material could be similar to those in NMP Unit 2 areas. The backfill material properties will be confirmed during the final design stage. Since the UHS Makeup Water Intake Structure and UHS Makeup Water Intake Tunnel structures are not located in the vicinity of other structures, no structure-to-structure effects need to be considered.

3.7.2.5 Development of Floor Response Spectra

Site-specific structures addressed in this section include the UHS Makeup Water Intake Structure and UHS Makeup Water Intake Tunnel.

The seismic analysis of these Seismic Category I structures considered all modes whose frequencies are less than 33 cps. However, if a structure had only one or two modes with a natural frequency below 33 cps, then the three lowest modes were used. The Seismic Category I structures are supported by continuous base mats; therefore, relative displacement of supports is not a consideration. Nonlinear responses are not considered since the Seismic Category I structures are designed to remain elastic.

3.7.2.6 Three Components of Earthquake Motion

An equivalent static load analysis via the finite element model is performed for two horizontal and a vertical seismic accelerations to determine forces and moments for structural component design of the UHS Makeup Water Intake Structure.

3.7.2.7 Combination of Modal Responses

The SRSS procedure for combining the responses due to three components of the earthquake is used in accordance with Regulatory Guide 1.92, Rev. 2 (NRC, 2006) instead of 100-40-40 combination method to achieve better optimization of the design.}

3.7.2.8 Interaction of Non-Seismic Category I Structures with Seismic Category I Systems

The U.S. EPR FSAR includes the following COL Item and conceptual design information in Section 3.7.2.8:

> A COL applicant that references the U.S. EPR design certification will provide the site-specific separation distances for the Access Building and Turbine Building.
>
> [[The separation gaps between the AB and SBs 3 and 4 are 0.98 ft and 1.31 ft, respectively (see Figure 3B-1).]]
>
> [[The separation between the TB and NI Common Basemat Structures is approximately 30 ft (see Figure 3B-1).]]

The COL Item and the conceptual design information are addressed as follows:

The conceptual design information identified above is incorporated by reference.

The U.S. EPR FSAR includes the following COL Item and conceptual design information in Section 3.7.2.8:

> A COL applicant that references the U.S. EPR design certification will provide the seismic design basis for the sources of fire protection water supply for safe plant shutdown in the event of a SSE.
>
> **[[Fire Protection Storage Tanks and Buildings]]**
>
> [[The Fire Protection Storage Tanks and Buildings are classified as Conventional Seismic Structures.]]
>
> [[The fire protection storage tanks and building are designed to provide system pressure integrity under SSE loading conditions. Seismic load combinations are developed in accordance with the requirements of ASCE 43-05 using a limiting acceptance condition for the structure characterized as essentially elastic behavior with no damage (i.e., Limit State D) as specified in the Standard.]]

The COL Item and conceptual design information are addressed as follows:

Refer to Section 3.2.1 and U.S. EPR FSAR Section 3.2.1 for the definition of seismic classifications used in this Section. In addition, Section 3.2.1 categorizes Fire Protection SSC into two categories:

1. SSC that must remain functional during and after an SSE (i.e., Seismic Category II-SSE); and

2. SSC that must remain intact after an SSE without deleterious interaction with Seismic Category I or Seismic Category II-SSE (i.e., Seismic Category II).

Fire Protection SSC required to remain functional during and following a safe shutdown earthquake to support safe shutdown of the plant following a design basis seismic event are designated as Seismic Class II-SSE. The following Fire Protection structures, systems, and components are required to remain functional during and after a seismic event:

1. Fire Water Storage Tanks;

2. Fire Protection Building;

3. Diesel driven fire pumps and their associated sub systems and components, including the diesel fuel oil system;

4. Critical support systems for the Fire Protection Building, i.e., ventilation; and

5. The portions of the fire water piping system and components (including isolation valves) which supply water to the stand pipes in buildings that house the equipment required for safe shutdown of the plant following an SSE.

Manual actions may be required to isolate the portion of the Fire Protection piping system that is not qualified as Seismic Category II-SSE.

U.S. EPR FSAR Section 3.7.2.8 addresses the interaction of the following Non-Seismic Category I structures with Seismic Category I structures:

- Vent Stack
- Nuclear Auxiliary Building
- Access Building
- Turbine Building
- Radioactive Waste Processing Building
- Fire Water Storage Tanks and Fire Protection Building

{The following Seismic Category II, Seismic Category II-SSE and conventional seismic SSC identified in Table 3.2-1 could also potentially interact with Seismic Category I SSC:

- Buried and aboveground Seismic Category II and Seismic Category II-SSE Fire Protection SSC, other than those addressed in the U.S. EPR FSAR.
- Conventional Seismic Switchgear Control Building
- Conventional Seismic Grid Systems Control Building

- Portions of the UHS Makeup Water Intake Structure that are designed as a Conventional Seismic Structure

The portion of the UHS Makeup Water Intake Structure designed as a Conventional Seismic Structure is separated from the Seismic Category I portion of the UHS Makeup Water Intake Structure by 12 in (30.5 cm). This gap that is considered sufficient to prevent any adverse interactions based on the inspection of lateral displacements.

The buried Seismic Category II-SSE Fire Protection SSC identified in Table 3.2-1 are seismically analyzed using the design response spectra identified in Section 3.7.1.1.1 for use in the analysis of the Seismic Category I site-specific buried utilities. The analysis of the buried Seismic Category II-SSE fire protection SSC shall confirm they remain functional during and following an SSE in accordance with NRC Regulatory Guide 1.189. (NRC, 2007) Section 3.7.3.12 further defines the methodology for the analysis of buried Fire Protection piping. Seismic Category II-SSE buried piping is an embedded commodity that by its nature does not significantly interact with aboveground Seismic Category I SSC.

The above ground Seismic Category II and Seismic Category II-SSE Fire Protection SSC identified in Table 3.2-1 are seismically analyzed utilizing the appropriate design response spectra. The analysis of the aboveground Seismic Category II-SSE fire protection SSC shall confirm they remain functional during and following an SSE in accordance with NRC Regulatory Guide 1.189 (NRC, 2007b).

The Conventional Seismic Switchgear Building, which is located adjacent to the conventional seismic Turbine Building, is analyzed using the same methodology as that employed for the Turbine Building.

The Conventional Seismic Grid Systems Control Building is located in the Switchyard area. As such, it is not located in the proximity of any Seismic Category I structures and, therefore, cannot interact with Seismic Category I structures.

3.7.2.9 Effects of Parameter Variations on Floor Response Spectra

No departures or supplements.

3.7.2.10 Use of Constant Vertical Static Factors

No departures or supplements.

3.7.2.11 Method Used to Account for Torsional Effects

For the UHS Makeup Water Intake Structure and UHS Makeup Water Intake Tunnel, accidental torsion is considered in accordance with ASCE 4-98 (ASCE, 1998). In order to account for accidental torsion, the additional torsional moment due to the eccentricity is added to the gross torsional moment obtained from the dynamic analysis of the mathematical model. During the dynamic analysis state, the inertia force at each mass is considered to be applied at the center of mass. However, since the center of rigidity does not coincide with the center of mass, the torsional moment is introduced. This moment is then distributed to the structural walls for assessment.

3.7.2.12 Comparison of Responses

Multiple seismic analysis methods were not employed for the UHS Makeup Water Intake Structure, as such, a comparison of responses is not applicable.

3.7.2.13 Methods for Seismic Analysis of Category I Dams

No departures or supplements.

3.7.2.14 Determination of Dynamic Stability of Seismic Category I Structures

FSAR Section 3.8.5 provides specific details related to both overturning and sliding stability for the UHS Makeup Water Intake Structure for the extreme environment SSE and tornado events.

3.7.2.15 Analysis Procedure for Damping

The Seismic Category I portion of the UHS Makeup Water Intake Structure consists of reinforced concrete elements. The enveloping 5% CSDRS is used in accordance with the provisions of that allow 5 percent damping value. The analysis of composite modal damping is not necessary.

3.7.2.16 References

ASCE, 1998. Seismic Analysis of Safety-Related Nuclear Structure and Commentary, ASCE 4-98, American Society of Civil Engineers, 1998, including 2001.01.01 Edition.

ASCE, 1986. Seismic Analysis of Safety-Related Nuclear Structures and Commentary, ASCE Standard 4098, American Society of Civil Engineers, September 1986.

NRC, 2006. Combining Modal Responses and Spatial Components in Seismic Response Analysis, Regulatory Guide 1.92, Revision 2, U.S. Nuclear Regulatory Commission, July, 2006.

NRC, 1973. Damping Values for Seismic Design of Nuclear Power Plants, Regulatory Guide 1.61, Revision 0, U.S. Nuclear Regulatory Commission, 1973.

NRC, 1977. Protection Against Low-Trajectory Turbine Missiles, Regulatory 1.115, Revision 1, U.S. Nuclear Regulatory Commission, 1977

NRC, 2007a. A Performance Based Approach to Define the Site-Specific Earthquake Ground Motion, Regulatory Guide 1.208, U.S. Nuclear Regulatory Commission, 2007.

NRC, 2007b. Fire Protection for Nuclear Power Plants, Regulatory Guide 1.189, Revision 1, U.S. Nuclear Regulatory Commission, March 2007.}

3.7.3 SEISMIC SUBSYSTEM ANALYSIS

No departures or supplements.

3.7.3.1 Seismic Analysis Methods

No departures or supplements.

3.7.3.2 Determination of Number of Earthquake Cycles

No departures or supplements.

3.7.3.3 Procedures Used for Analytical Modeling

{Equipment, components, and piping systems associated with the UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures are lumped into the supporting structure mass.}

3.7.3.4 Basis for Selection of Frequencies

{For equipment associated with the UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures, the natural frequencies of components are calculated. If the natural frequency of the component falls within the broadened peak of the response spectrum curve, then it is designed to withstand the peak acceleration.}

3.7.3.5 Analysis Procedure for Damping

{For equipment associated with the UHS Makeup Water Intake, UHS Tunnels, and UHS Encasement Structures, the equivalent static load method of analysis is used when the natural frequency of the equipment is not determined. If the equipment can be adequately represented by a single degree of freedom system, then the applied inertia load is equal to the mass of the equipment multiplied by the peak value of the response spectrum curve. If the equipment requires more than one degree of freedom for an adequate representation, then a factor of 1.5 is applied to the peak of the response spectrum curve.}

3.7.3.6 Three Components of Earthquake Motion

No departures or supplements.

3.7.3.7 Combination of Modal Responses

No departures or supplements.

3.7.3.8 Interaction of Other Systems with Seismic Category I Systems

No departures or supplements.

3.7.3.9 Multiple-Supported Equipment and Components with Distinct Inputs

No departures or supplements.

3.7.3.10 Use of Equivalent Vertical Static Factors

No departures or supplements.

3.7.3.11 Torsional Effects of Eccentric Masses

No departures or supplements.

3.7.3.12 Buried Seismic Category I Piping, Conduits, and Tunnels

{For NMP3NPP, a buried duct bank refers to multiple PVC electrical conduits encased in reinforced concrete.

The seismic analysis and design of Seismic Category I buried reinforced concrete electrical duct banks is in accordance with IEEE 628-2001 (R2006) (IEEE, 2001), ASCE 4-98 (ASCE, 1986) and ACI 349-01(ACI, 2001), including supplemental guidance of Regulatory Guide 1.142 (NRC, 2001). The use of ACI 349-01, in lieu of ACI 349-97 (ACI, 1997) as invoked in Subsection 4.9.4.15 of IEEE 628-2001 (R2006) (IEEE, 2001), is to provide a consistent design basis with all other Seismic Category I structures.

Side walls of electrical manholes are analyzed for seismic waves traveling through the surrounding soil in accordance with the requirements of ASCE 4-98 (ASCE, 1986), including dynamic soil pressures.

Seismic Category I buried Essential Service Water Pipes and Seismic Category II and Seismic Category II-SSE buried Fire Protection pipe are analyzed for the effects of seismic waves traveling through the surrounding soil in accordance with the specific requirements of ASCE 4-98 (ASCE, 1986):

- ♦ Long, straight buried pipe sections, remote from bends or anchor points, are designed assuming no relative motion between the flexible structure and the ground (i.e. the structure conforms to the ground motion).
- ♦ The effects of bends and differential displacement at connections to buildings are evaluated using equations for beams on elastic foundations, and subsequently combined with the buried pipe axial stress.

For long straight sections of buried pipe, maximum axial strain and curvature are calculated per equations contained in ASCE 4-98 (ASCE, 1986). These equations reflect seismic wave propagation and incorporate the material's modulus of elasticity to determine the corresponding maximum axial and bending stresses. The procedure combines stresses from compression, shear and surface waves by the square root of the sum of the squares (SRSS) method. Maximum stresses for each wave type are then combined using the SRSS method. Subsequently, seismic stresses are combined with stresses from other loading conditions, e.g., long-term surcharge loading.

For straight sections of buried pipe, the transfer of axial strain from the soil to the buried structure is limited by the frictional resistance developed. Consequently, axial stresses may be reduced by consideration of such slippage effects, as appropriate.

The seismic analysis of bends of buried pipe is based on the equations developed for beams on elastic foundations. Specifically, the transverse leg is assumed to deform as a beam on an elastic foundation due to the axial force in the longitudinal leg. The spring constant at the bend depends on the stiffness of the longitudinal and transverse legs as well as the degree of fixity at the bend and ends of the legs.

Seismic analysis of restrained segments of buried pipe utilizes guidance provided in Appendix VII, Procedures for the Design of Restrained Underground Piping, of ASME B31.1-2004 (ASME, 2004).

Buried piping and conduits for the UHS Encasement Structure are further discussed in FSAR Section 3.7.1.1 and 3.8.4.4.5, and the UHS Tunnel Structure is discussed in FSAR Sections 3.7.1.1 and 3.8.4.4.7. Detailed descriptions of the UHS Tunnel and UHS Encasement Structures, including design methodology, are provided in Section 3E.4 of Appendix 3E.}

3.7.3.13 Methods for Seismic Analysis of Category I Concrete Dams

The U.S. EPR FSAR includes the following COL Item in Section 3.7.3.13:

> A COL applicant that references the U.S. EPR design certification will provide a description of methods for seismic analysis of site-specific Category I concrete dams, if applicable.

This COL Item is addressed as follows:

{Seismic Category I dams will not be utilized at NMP3NPP.}

3.7.3.14 Methods for Seismic Analysis of Aboveground Tanks

No departures or supplements.

3.7.3.15 References

{**ACI, 1997.** Code Requirements for Nuclear Safety-Related Concrete Structures, ACI 349-97, American Concrete Institute, 1997.

ACI, 2001. Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary on Code Requirements for Nuclear Safety-Related Concrete Structures, ACI 349-01/349-R01, American Concrete Institute, 2001.

ASCE, 1986. Seismic Analysis of Safety-Related Nuclear Structures and Commentary, ASCE 4-98, American Society of Civil Engineers, September 1986.

ASME, 2004. Procedures for the Design of Restrained Underground Piping, Appendix VII, Power Piping, ASME B31.1-2004, American Society of Mechanical Engineers, 2004.

IEEE, 2001. IEEE Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations, IEEE 628-2001, IEEE, 2001.

NRC, 2001. Safety-Related Concrete Structures for Nuclear Power Plants (Other Than Reactor Vessels and Containments), Regulatory Guide 1.142, U.S. Nuclear Regulatory Commission, November 2001.}

3.7.4 SEISMIC INSTRUMENTATION

No departures or supplements.

3.7.4.1 Comparison with NRC Regulatory Guide 1.12

No departures or supplements.

3.7.4.2 Location and Description of Instrumentation

The U.S. EPR FSAR includes the following COL Item in Section 3.7.4.2:

> A COL applicant that references the U.S. EPR design certification will determine whether essentially the same seismic response from a given earthquake is expected at each of the units in a multi-unit site or instrument each unit. In the event that only one unit is instrumented, annunciation shall be provided to each control room.

This COL Item is addressed as follows:

{NMP3NPP is a single unit, U.S. EPR facility. It is sufficiently distant from the existing NMP Unit 1 and Unit 2 and the JAFNPP that seismic response from the existing units will not affect NMP3NPP, and the seismic response of NMP3NPP will not affect these other units. Annunciation of the seismic instrumentation for NMP3NPP will be provided in the NMP3NPP main control room.}

3.7.4.2.1 Field Mounted Sensors

The U.S. EPR FSAR includes the following COL Item in Section 3.7.4.2.1:

A COL applicant that references the U.S. EPR design certification will determine if a suitable location exists for the free-field acceleration sensor. The mounting location must be such that the effects associated with surface features, buildings, and components on the recordings of ground motion are insignificant. The acceleration sensor must be based on material representative of that upon which the Nuclear Island (NI) and other Seismic Category I structures are founded.

This COL Item is addressed as follows:

{The free-field acceleration sensor is located on the base mat of the Fire Protection Building, which is a small rectangular structure, located within the protected area and situated on plant grade. The centerline of the Radioactive Waste Processing Building, the nearest significant structure, is approximately two of its plan dimensions from the Fire Protection Building. The centerline of the NI Common base mat is approximately two of its equivalent diameters from the Fire Protection Building. This location is sufficiently distant from nearby structures that they have no significant influence on the recorded free-field seismic motion.

In addition, the plan dimensions of the Fire Protection Building are small enough that its base mat will not have a significant filtering effect on the free-field motion. This area of the plant is also a quiet zone in that turbine-induced ground vibration will not significantly affect the free-field sensor

The Fire Protection Building design is designed as a Seismic Category II structure, such that the free-field acceleration sensor is protected from damage and adverse interaction during a seismic event. Seismic load combinations for the Fire Protection Building are developed in accordance with requirements of ASCE 43-05 (ASCE, 2005) using a limiting acceptance condition for the structure characterized as essentially elastic behavior with no damage (i.e., Limit State D, as specified in the Standard). The Fire Protection Building is supported on material representative of that upon which the NI Common base mat Structures and other Seismic Category I structures are founded.

The sensor location is protected from accidental impact but is readily accessible for surveillance, maintenance, and repair activities. The sensor is rigidly mounted in alignment with the orthogonal axes assumed for seismic analysis. The free-field acceleration sensor location is sufficiently distant from radiation sources that there is no occupational exposure expected during normal operating modes, which is consistent with ALARA.}

3.7.4.2.2 System Equipment Cabinet

No departures or supplements.

3.7.4.2.3 Seismic Recorder(s)

No departures or supplements.

3.7.4.2.4 Central Controller

No departures or supplements.

3.7.4.2.5 Power Supplies

No departures of supplements.

3.7.4.3 Control Room Operator Notification

No departures or supplements.

3.7.4.4 Comparison with Regulatory Guide 1.166

Post-earthquake actions and an assessment of the damage potential of the event using the EPRI-developed OBE Exceedance Criteria follow the guidance of EPRI reports NP-5930 (EPRI, 1988) and NP-6695 (EPRI, 1989), as endorsed by the U.S. Nuclear Regulatory Commission in Regulatory Guide 1.166 (NRC, 1997a) and Regulatory Guide 1.167 (NRC, 1997b). OBE Exceedance Criteria is based on a threshold response spectrum ordinate check and a CAV check using recorded motions from the free-field acceleration sensor. If the respective OBE ground motion is exceeded in a potentially damaging frequency range or significant plant damage occurs, the plant must be shutdown following plant procedures.

3.7.4.5 Instrument Surveillance

No departures or supplements.

3.7.4.6 Program Implementation

No departures or supplements.

3.7.4.7 References

{**ASCE, 2005.** Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities, ASCE 43-05, American Society of Civil Engineers, January 2005.

EPRI, 1988. A Criterion for Determining Exceedance of the Operating Basis Earthquake, NP-5930, Electric Power Research Institute, July 1988.

EPRI, 1989. Guidelines for Nuclear Plant Response to an Earthquake, NP-6695, Electric Power Research Institute, December 1989.

NRC, 1997a. Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-Earthquake Actions, Regulatory Guide 1.166, Revision 0, U. S. Nuclear Regulatory Commission, March 1997.

NRC, 1997b. Restart of a Nuclear Power Plant Shut Down by a Seismic Event, Regulatory Guide 1.167, New. O, V.S. Nuclear Regulatory Commission, March, 1977.}

Table 3.7-1—{NMP3NPP Best Estimate Soil Modeling}

(Page 1 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m³)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
1	2.51	25.76	1981	4361	0.0041	0.0014	0.37	158	-2.51
2	2.51	25.76	1981	4361	0.0041	0.0014	0.37	158	-5.01
3	2.51	25.76	1981	4361	0.0041	0.0014	0.37	158	-7.52
4	3.96	25.76	2012	4429	0.0041	0.0014	0.37	102	-11.48
5	3.96	25.76	2012	4429	0.0042	0.0014	0.37	102	-15.44
6	3.66	26.39	2012	4573	0.0041	0.0014	0.38	110	-19.10
7	3.35	26.39	2195	4988	0.0041	0.0014	0.38	131	-22.45
8	3.35	26.39	2195	4988	0.0041	0.0014	0.38	131	-25.81
9	3.35	26.39	2195	4988	0.0043	0.0014	0.38	131	-29.16
10	3.35	26.39	2195	4988	0.0043	0.0014	0.38	131	-32.51
11	2.44	26.39	1768	4018	0.0046	0.0015	0.38	145	-34.95
12	2.44	26.39	1768	4018	0.0046	0.0015	0.38	145	-37.39
13	3.35	26.39	2042	4642	0.0044	0.0015	0.38	122	-40.74
14	3.35	26.39	2042	4642	0.0044	0.0015	0.38	122	-44.10
15	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-47.64
16	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-51.19
17	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-54.74
18	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-58.28
19	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-61.83
20	3.55	26.23	2134	4850	0.0045	0.0015	0.38	120	-65.38
21	3.55	26.23	2134	4850	0.0046	0.0015	0.38	120	-68.92
22	3.55	26.23	2134	4850	0.0046	0.0015	0.38	120	-72.47
23	3.55	26.23	2134	4850	0.0046	0.0015	0.38	120	-76.02
24	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-79.56
25	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-83.11
26	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-86.66
27	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-90.20
28	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-93.75
29	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-97.30
30	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-100.84
31	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-104.39
32	3.55	26.23	2134	4850	0.0047	0.0016	0.38	120	-107.94
33	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-111.48
34	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-115.03
35	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-118.58
36	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-122.12
37	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-125.67
38	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-129.22
39	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-132.76
40	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-136.31
41	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-139.86
42	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-143.40
43	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-146.95
44	3.55	26.23	2134	4850	0.0048	0.0016	0.38	120	-150.50
45	3.55	26.23	2134	4850	0.0049	0.0016	0.38	120	-154.05
46	3.55	26.23	2134	4850	0.0049	0.0016	0.38	120	-157.59
47	3.55	26.23	2134	4850	0.0049	0.0016	0.38	120	-161.14

Table 3.7-1—{NMP3NPP Best Estimate Soil Modeling}
(Page 2 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m³)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
48	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-164.70
49	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-168.25
50	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-171.81
51	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-175.37
52	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-178.92
53	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-182.48
54	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-186.04
55	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-189.60
56	3.56	26.23	2286	5196	0.0048	0.0016	0.38	129	-193.15
57	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-196.71
58	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-200.27
59	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-203.82
60	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-207.38
61	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-210.94
62	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-214.50
63	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-218.05
64	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-221.61
65	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-225.17
66	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-228.72
67	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-232.28
68	3.56	26.23	2286	5196	0.0049	0.0016	0.38	129	-235.84
69	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-239.77
70	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-243.71
71	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-247.64
72	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-251.58
73	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-255.51
74	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-259.45
75	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-263.38
76	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-267.32
77	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-271.25
78	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-275.19
79	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-279.12
80	3.93	26.36	2379	5408	0.0048	0.0016	0.38	121	-283.06
Half-space		26.57	2528	4818	0.0049	0.0016	0.31		

Table 3.7-2—{NMP3NPP Lower Bound Soil Estimate}

(Page 1 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m^3)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
1	2.51	25.76	1585	3489	0.0054	0.0018	0.37	126	-2.51
2	2.51	25.76	1585	3489	0.0054	0.0018	0.37	126	-5.01
3	2.51	25.76	1585	3489	0.0054	0.0018	0.37	126	-7.52
4	1.98	25.76	1609	3543	0.0054	0.0018	0.37	162	-9.50
5	1.98	25.76	1609	3543	0.0054	0.0018	0.37	162	-11.48
6	1.98	25.76	1609	3543	0.0055	0.0018	0.37	162	-13.46
7	1.98	25.76	1609	3543	0.0055	0.0018	0.37	162	-15.44
8	1.83	26.39	1609	3658	0.0059	0.0020	0.38	176	-17.27
9	1.83	26.39	1609	3658	0.0059	0.0020	0.38	176	-19.10
10	2.24	26.39	1756	3991	0.0059	0.0020	0.38	157	-21.34
11	2.24	26.39	1756	3991	0.0059	0.0020	0.38	157	-23.57
12	2.24	26.39	1756	3991	0.0059	0.0020	0.38	157	-25.81
13	2.24	26.39	1756	3991	0.0060	0.0020	0.38	157	-28.04
14	2.24	26.39	1756	3991	0.0060	0.0020	0.38	157	-30.28
15	2.24	26.39	1756	3991	0.0060	0.0020	0.38	157	-32.51
16	1.63	26.39	1414	3215	0.0065	0.0022	0.38	174	-34.14
17	1.63	26.39	1414	3215	0.0065	0.0022	0.38	174	-35.76
18	1.63	26.39	1414	3215	0.0065	0.0022	0.38	174	-37.39
19	2.24	26.39	1634	3714	0.0065	0.0022	0.38	146	-39.63
20	2.24	26.39	1634	3714	0.0065	0.0022	0.38	146	-41.86
21	2.24	26.39	1634	3714	0.0065	0.0022	0.38	146	-44.10
22	3.55	26.23	1707	3880	0.0059	0.0020	0.38	96	-47.64
23	3.55	26.23	1707	3880	0.0059	0.0020	0.38	96	-51.19
24	3.55	26.23	1707	3880	0.0059	0.0020	0.38	96	-54.74
25	3.55	26.23	1707	3880	0.0060	0.0020	0.38	96	-58.28
26	3.55	26.23	1707	3880	0.0060	0.0020	0.38	96	-61.83
27	3.55	26.23	1707	3880	0.0060	0.0020	0.38	96	-65.38
28	3.55	26.23	1707	3880	0.0061	0.0020	0.38	96	-68.92
29	3.55	26.23	1707	3880	0.0061	0.0020	0.38	96	-72.47
30	3.55	26.23	1707	3880	0.0061	0.0020	0.38	96	-76.02
31	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-79.56
32	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-83.11
33	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-86.66
34	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-90.20
35	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-93.75
36	3.55	26.23	1707	3880	0.0062	0.0021	0.38	96	-97.30
37	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-100.84
38	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-104.39
39	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-107.94
40	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-111.48
41	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-115.03
42	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-118.58
43	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-122.12
44	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-125.67
45	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-129.22
46	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-132.76
47	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-136.31

Table 3.7-2—{NMP3NPP Lower Bound Soil Estimate}
(Page 2 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m^3)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
48	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-139.86
49	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-143.40
50	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-146.95
51	3.55	26.23	1707	3880	0.0064	0.0021	0.38	96	-150.50
52	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-154.05
53	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-157.59
54	3.55	26.23	1707	3880	0.0063	0.0021	0.38	96	-161.14
55	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-164.70
56	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-168.25
57	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-171.81
58	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-175.37
59	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-178.92
60	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-182.48
61	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-186.04
62	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-189.60
63	3.56	26.23	1829	4157	0.0063	0.0021	0.38	103	-193.15
64	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-196.71
65	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-200.27
66	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-203.82
67	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-207.38
68	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-210.94
69	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-214.50
70	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-218.05
71	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-221.61
72	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-225.17
73	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-228.72
74	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-232.28
75	3.56	26.23	1829	4157	0.0064	0.0021	0.38	103	-235.84
76	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-239.77
77	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-243.71
78	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-247.64
79	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-251.58
80	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-255.51
81	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-259.45
82	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-263.38
83	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-267.32
84	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-271.25
85	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-275.19
86	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-279.12
87	3.93	26.36	1903	4326	0.0063	0.0021	0.38	97	-283.06
Half-space		26.57	2023	3854	0.0068	0.0023	0.31		

Table 3.7-3—{NMP3NPP Upper Bound Soil Modeling}

(Page 1 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m^3)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
1	2.51	25.76	2477	5452	0.0032	0.0011	0.37	198	-2.51
2	2.51	25.76	2477	5452	0.0032	0.0011	0.37	198	-5.01
3	2.51	25.76	2477	5452	0.0032	0.0011	0.37	198	-7.52
4	3.96	25.76	2515	5536	0.0032	0.0011	0.37	127	-11.48
5	3.96	25.76	2515	5536	0.0033	0.0011	0.37	127	-15.44
6	3.66	26.39	2515	5716	0.0033	0.0011	0.38	138	-19.10
7	3.35	26.39	2743	6235	0.0033	0.0011	0.38	164	-22.45
8	3.35	26.39	2743	6235	0.0033	0.0011	0.38	164	-25.81
9	3.35	26.39	2743	6235	0.0034	0.0011	0.38	164	-29.16
10	3.35	26.39	2743	6235	0.0034	0.0011	0.38	164	-32.51
11	2.44	26.39	2210	5023	0.0037	0.0012	0.38	181	-34.95
12	2.44	26.39	2210	5023	0.0037	0.0012	0.38	181	-37.39
13	3.35	26.39	2553	5802	0.0036	0.0012	0.38	152	-40.74
14	3.35	26.39	2553	5802	0.0036	0.0012	0.38	152	-44.10
15	5.32	26.23	2667	6062	0.0031	0.0010	0.38	100	-49.42
16	5.32	26.23	2667	6062	0.0031	0.0010	0.38	100	-54.74
17	5.32	26.23	2667	6062	0.0032	0.0011	0.38	100	-60.06
18	5.32	26.23	2667	6062	0.0032	0.0011	0.38	100	-65.38
19	5.32	26.23	2667	6062	0.0032	0.0011	0.38	100	-70.70
20	5.32	26.23	2667	6062	0.0032	0.0011	0.38	100	-76.02
21	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-81.34
22	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-86.66
23	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-91.98
24	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-97.30
25	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-102.62
26	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-107.94
27	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-113.26
28	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-118.58
29	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-123.90
30	5.32	26.23	2667	6062	0.0033	0.0011	0.38	100	-129.22
31	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-134.54
32	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-139.86
33	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-145.18
34	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-150.50
35	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-155.82
36	5.32	26.23	2667	6062	0.0034	0.0011	0.38	100	-161.14
37	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-166.47
38	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-171.81
39	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-177.15
40	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-182.48
41	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-187.82
42	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-193.15
43	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-198.49
44	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-203.82
45	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-209.16
46	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-214.50
47	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-219.83

Table 3.7-3—{NMP3NPP Upper Bound Soil Modeling}
(Page 2 of 2)

Layer No.	Layer Thk. (m)	Wt. Density (kN/m³)	S-Wave Vel. (m/s)	P-Wave Vel. (m/s)	S-Damp Ratio	P-Damp Ratio	Poisson's Ratio	Freq Pass (Hz)	Depth (m)
48	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-225.17
49	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-230.50
50	5.34	26.23	2804	6374	0.0034	0.0011	0.38	105	-235.84
51	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-241.74
52	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-247.64
53	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-253.55
54	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-259.45
55	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-265.35
56	5.90	26.36	2804	6374	0.0034	0.0011	0.38	95	-271.25
57	5.90	26.36	2804	6374	0.0035	0.0012	0.38	95	-277.16
58	5.90	26.36	2804	6374	0.0035	0.0012	0.38	95	-283.06
59	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-288.96
60	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-294.86
61	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-300.77
62	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-306.67
63	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-312.57
64	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-318.47
65	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-324.38
66	5.90	26.57	2804	5344	0.0038	0.0013	0.31	95	-330.28
Half-space		26.70	2804	5344	0.0038	0.0013	0.31		

Table 3.7-4—{UHS Makeup Water Intake Structure Accelerations for Equivalent Static Analysis}

Component	SSE (X-Direction, g)			SSE (X-Direction, g)			SSE (X-Direction, g)		
	Ax	Az	Ay	Ax	Az	Ay	Ax	Az	Ay
Base Mat El. 225′-5″ (68.71 m)	0.79	0.30	0.30	0.30	0.30	0.79	0.30	0.30	0.79
Grade Slab El. 273′-0″ (83.21 m)	0.79	0.30	0.30	0.30	0.30	0.79	0.30	0.30	0.79
Roof Slab El. 302′-0″ (92.05 m)	0.79	0.30	0.30	0.30	0.30	0.79	0.30	0.30	0.79

Note: X-Direction, Z-Direction and Y-Direction in GT STRUDL model relate to plant East-West, North-South, and Vertical, respectively.

Table 3.7-5—{UHS Makeup Water Intake Superstructure Natural Frequencies and Mass Participation}

Mode	Frequency (Hz)			X-Dir Mass Participation (%)	Cumulative X-Dir Participation (%)	Y-Dir Mass Participation (%)	Cumulative Y-Dir Participation (%)	Z-Dir Mass Participation (%)	Cumulative Z-Dir Participation (%)
	X-Dir	Y-Dir	Z-Dir						
1	11.23	6.65	18.98	43.30	43.30	1.53	1.53	2.16	2.16
2	15.07	11.23	21.01	16.09	59.40	0.21	1.75	0.00	2.16
3	17.68	19.55	24.08	0.13	59.53	0.13	1.87	0.23	2.39
4	17.76	25.76	25.97	2.24	61.77	0.04	1.92	59.90	62.29
5	17.97	27.71	27.71	0.03	61.79	0.50	2.41	0.00	62.29
6	18.32	28.61	29.31	0.12	61.91	0.00	2.41	0.24	62.53
7	18.51	29.17	31.51	0.00	61.91	4.72	7.13	0.28	62.81
8	18.94	29.94	32.55	1.02	62.93	0.02	7.15	0.99	63.80
9	20.27	30.81	35.21	1.29	6421	0.57	7.73	0.92	64.71
10	21.34	32.11	35.40	0.09	64.30	0.02	7.74	0.02	64.73
11	21.81	34.20	36.49	0.01	64.31	28.08	35.82	3.50	68.24
12	22.41	35.42	37.91	0.92	65.24	0.19	36.01	0.75	68.98
13	22.96	35.50	39.86	0.04	65.28	2.17	38.18	0.20	69.18
14	23.10	36.03	41.64	0.01	65.28	0.98	39.16	0.12	69.30
15	23.95	36.57	44.17	0.00	65.29	1.31	40.48	0.00	69.31
16	24.45	37.26	45.17	0.01	65.29	4.40	44.88	0.43	69.73
17	25.06	38.48	45.40	0.00	65.3	0.08	44.96	0.00	69.73
18	25.14	38.79	46.76	0.06	65.36	0.01	44.97	0.45	70.18
19	25.22	39.03	47.69	0.19	65.55	0.37	45.34	0.89	71.07
20	25.49	39.85	48.81	0.04	65.59	0.00	45.34	0.06	71.13
21	25.63	40.17	51.63	0.00	65.59	0.01	45.34	0.09	71.22
22	25.68	41.58	51.72	0.07	65.66	0.17	45.51	0.41	71.63
23	26.11	43.19	52.94	0.00	65.66	0.02	45.53	0.13	71.77
24	26.14	43.93	53.83	0.00	65.66	0.10	45.63	0.29	72.06
25	26.92	44.72	55.15	0.72	66.38	1.77	47.40	0.13	72.19
26	27.74	45.79	56.00	0.85	67.23	5.82	53.21	0.10	72.29
27	28.22	46.29	56.03	1.28	68.52	2.31	55.52	0.01	72.29
28	28.62	47.74	55.74	2.01	70.53	0.44	55.96	0.00	72.30
29	29.47	49.25	57.00	1.53	72.06	0.00	55.96	0.00	72.30
30	29.79	49.60	57.25	0.09	72.15	0.26	56.22	0.00	72.30
31	29.92	49.81	58.07	0.07	72.22	1.72	57.94	0.00	72.30
32	30.78	50.01	61.04	0.06	72.27	1.35	59.29	0.80	73.10
33	33.15	50.57	62.3	2.23	74.50	2.95	62.25	0.63	73.73
34	34.26	51.67	63.19	0.13	74.63	0.10	62.35	0.12	73.84
35	34.83	52.24	63.89	0.25	74.88	0.48	62.82	0.01	73.85
36	35.79	52.47	64.47	2.13	77.01	4.09	66.91	0.00	73.86
37	35.97	53.20	66.13	0.00	77.01	0.53	67.45	0.12	73.97
38	36.10	53.70	67.22	0.27	77.28	0.52	67.97	0.57	74.54
39	37.19	54.22	68.22	1.17	78.45	0.62	68.59	0.33	74.87
40	38.12	54.77	70.02	0.04	78.49	0.08	68.68	0.00	74.87

Figure 3.7-1—{Comparison of NMP3NPP GMRS and EUR CSDRS, 5% Damping (Horizontal)}

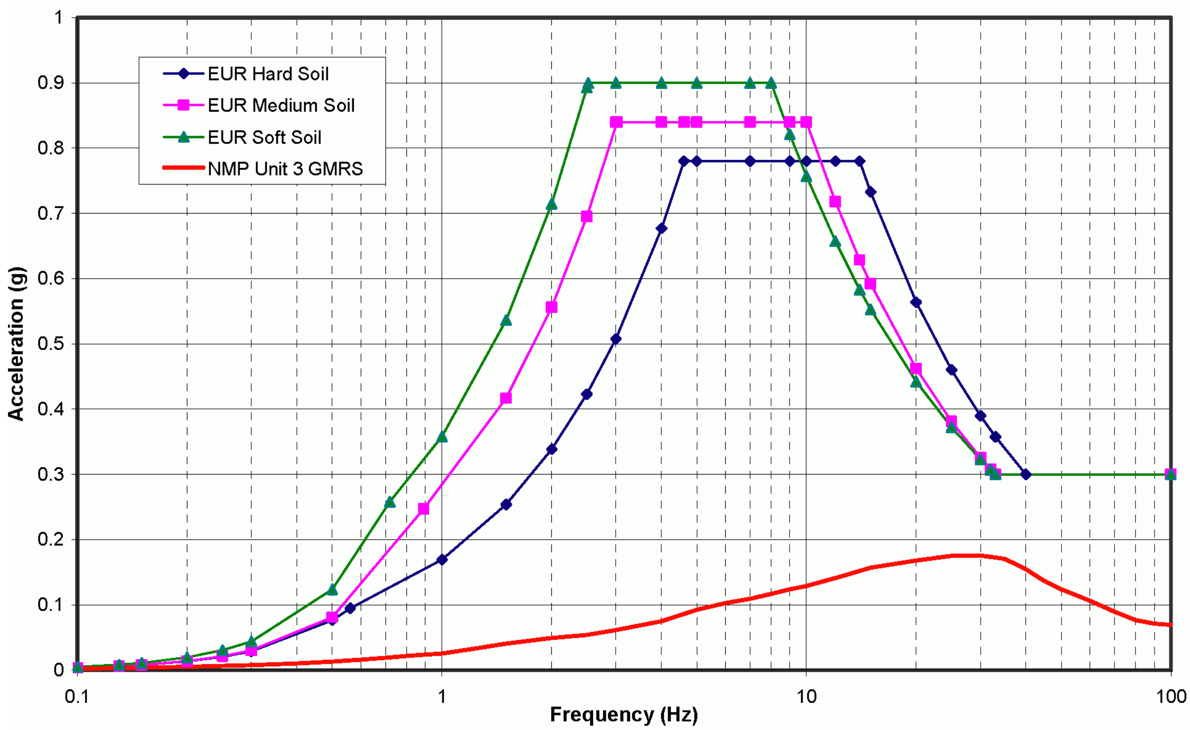


Figure 3.7-2—{Comparison of NMP3NPP GMRS and EUR CSDRS, 5% Damping (Vertical)}

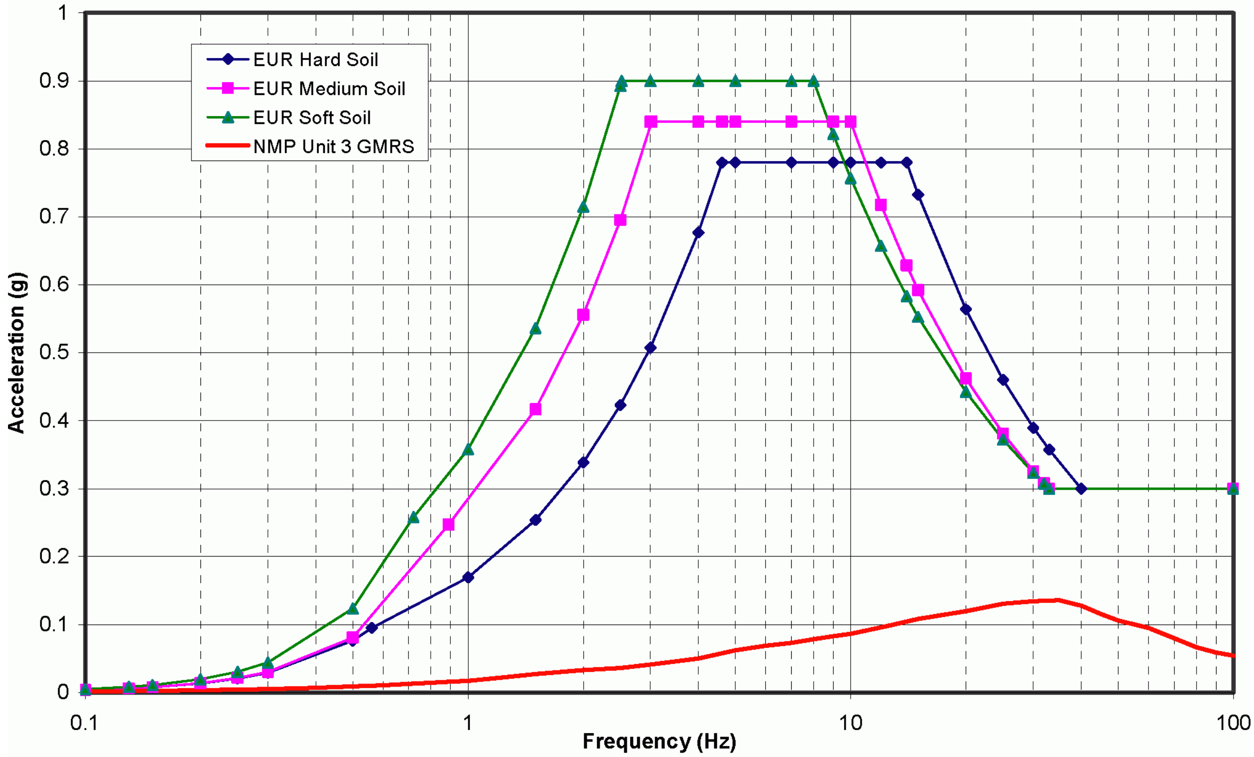


Figure 3.7-3—{NMP3NPP Horizontal SSE Ground Motion and CSDRS Anchored to 0.1g PGA}

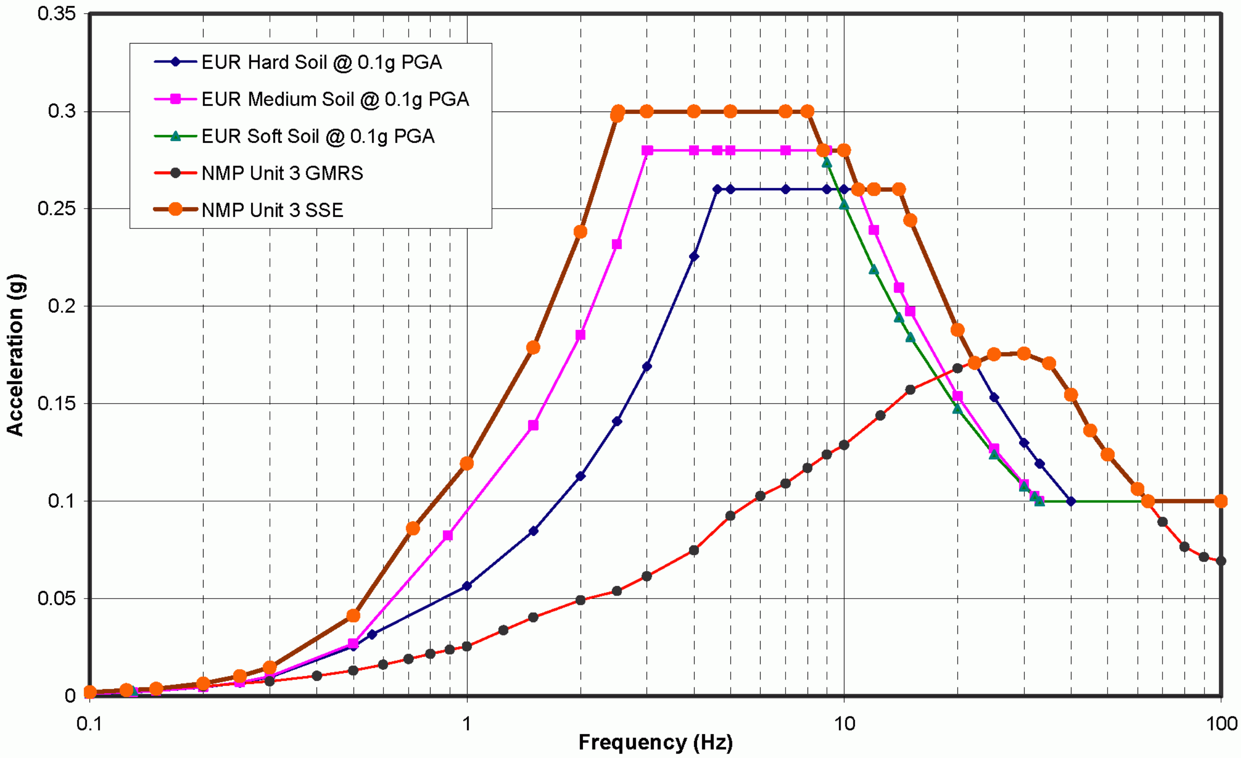


Figure 3.7-4—{NMP3NPP Horizontal SSE Ground Motion and CSDRS Anchored to 0.1g PGA (Low Frequencies)}

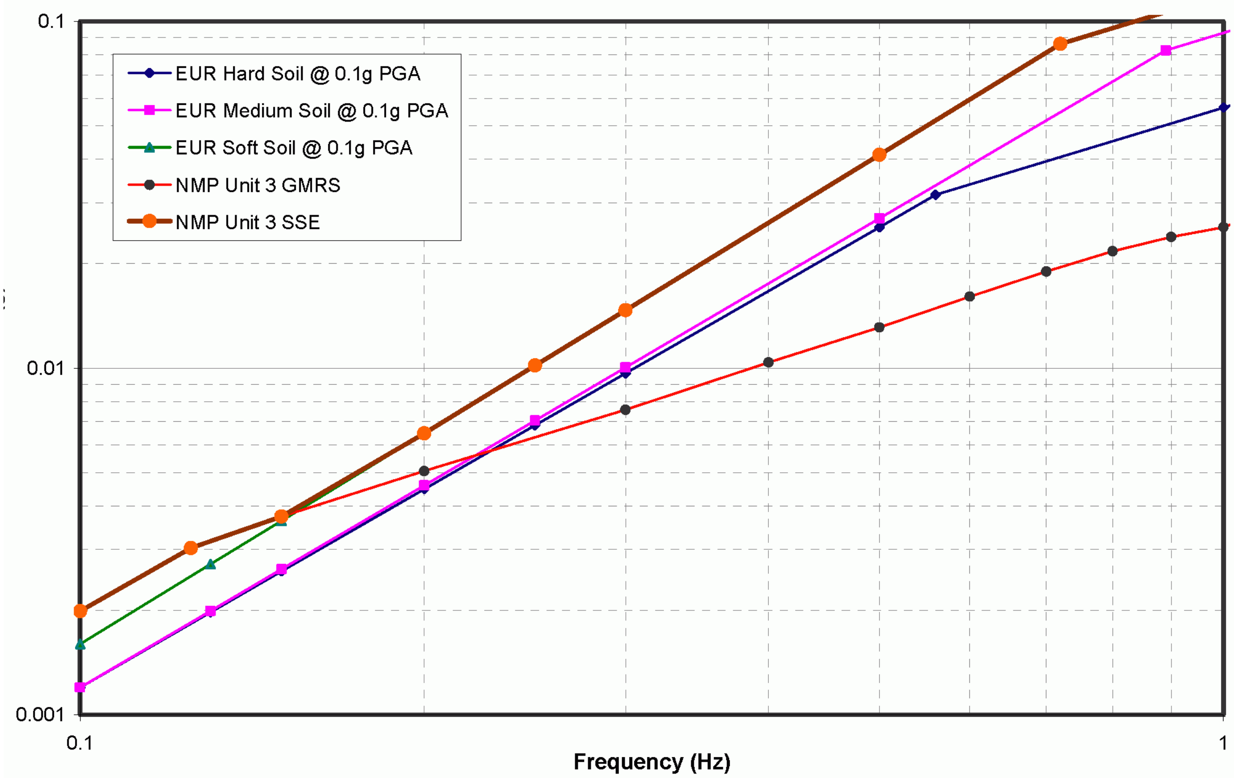


Figure 3.7-5—{Strain-Compatible Site Profile for NMP3NPP}

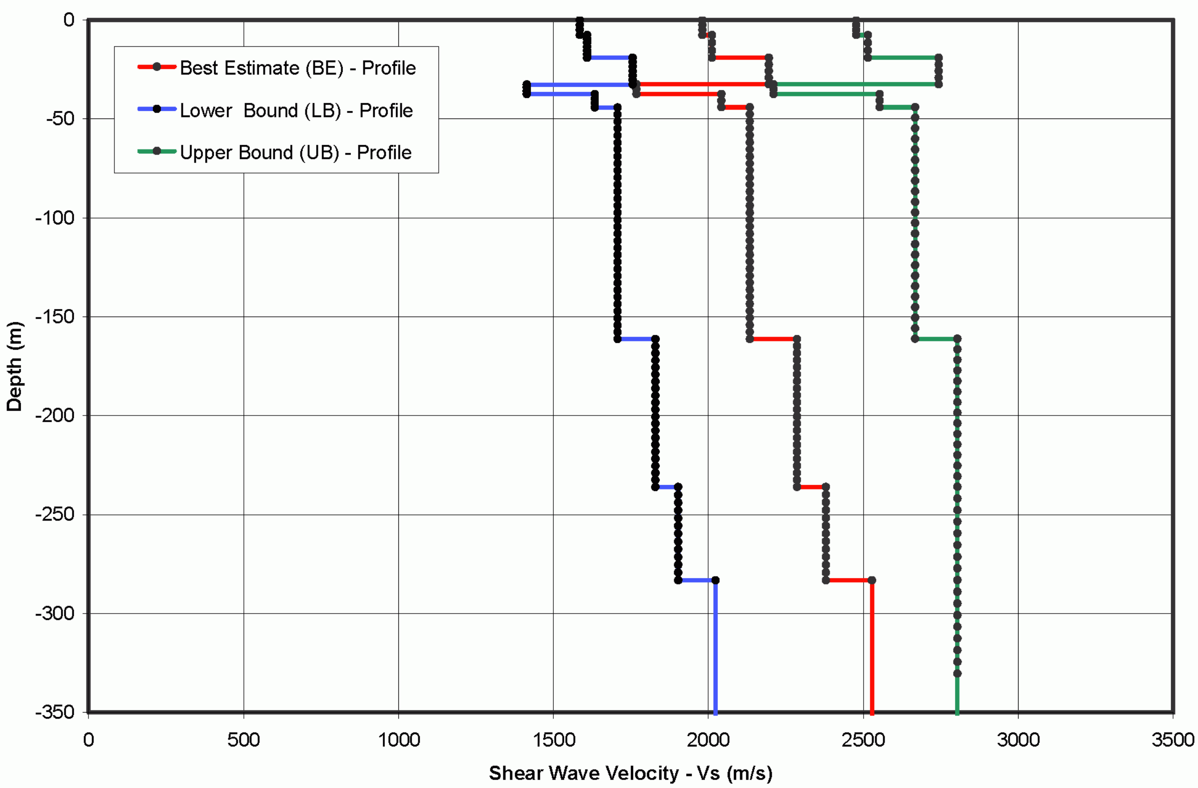


Figure 3.7-6—{EPR DC Soil Cases (Uniform) vs. NMP3NPP Soil Cases for SSI Analysis}

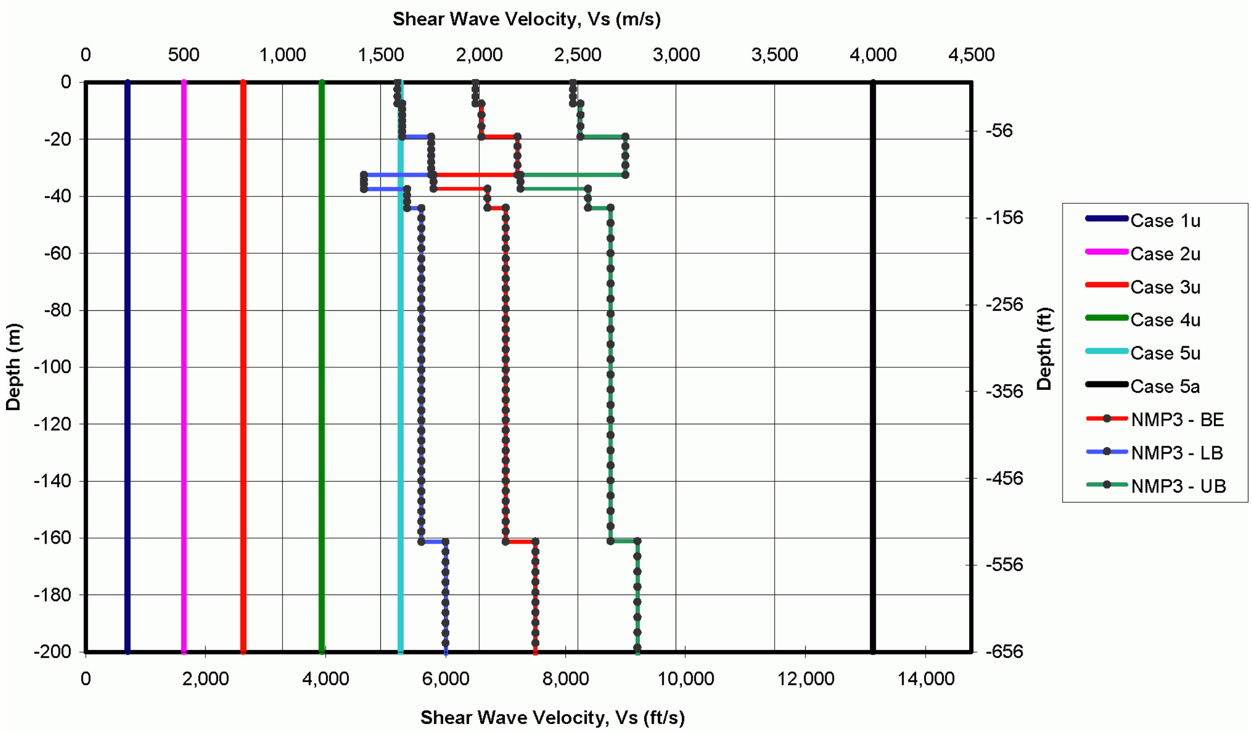


Figure 3.7-7—{EPR DC Soil Cases (Layered) vs. NMP3NPP Soil Cases for SSI Analysis}

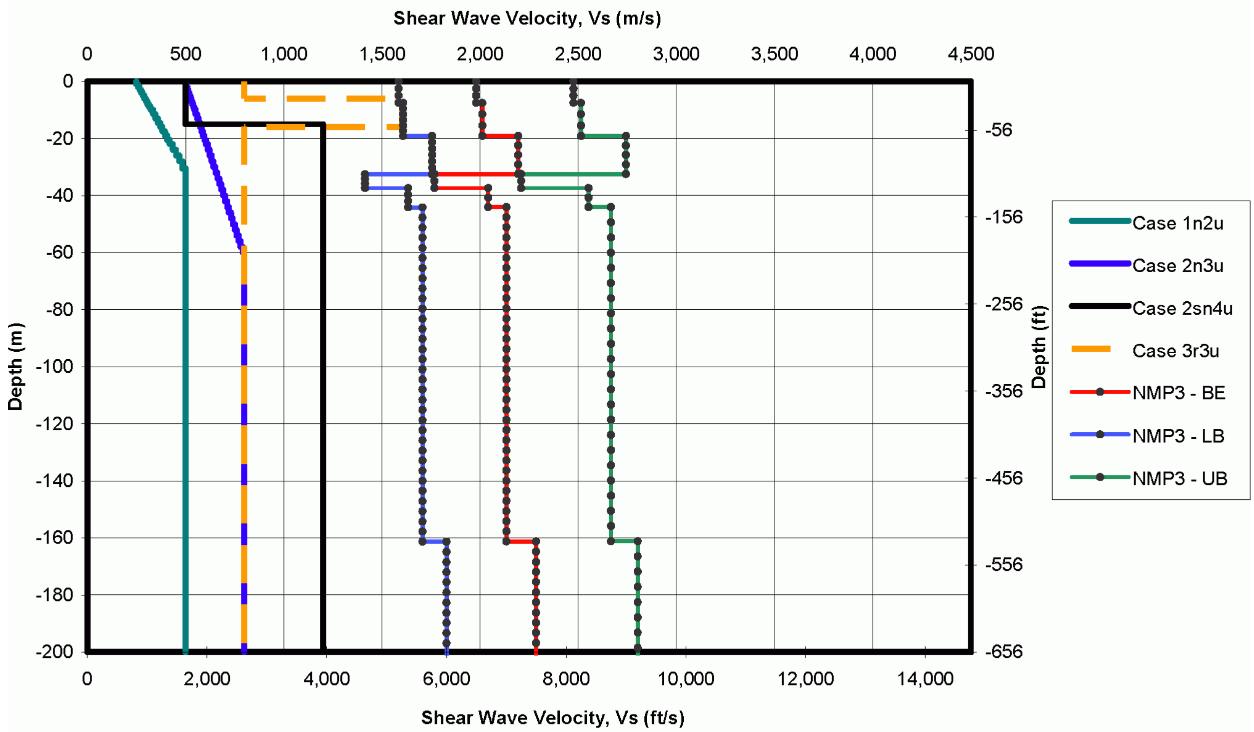


Figure 3.7-8—{Reactor Bldg Internal Structure, Elev. 5.15m, X (E-W) Direction, 5% Damping}

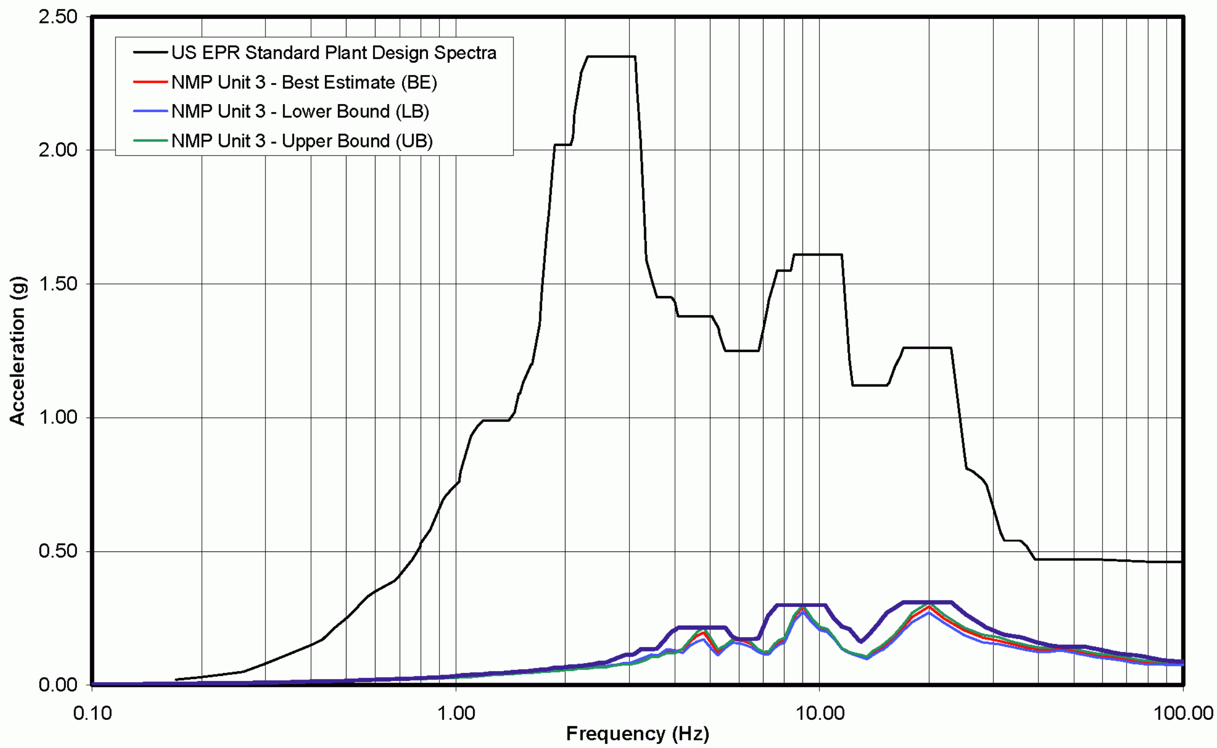


Figure 3.7-9—{Reactor Bldg Internal Structure, Elev. 5.15m, Y (N-S) Direction, 5% Damping}

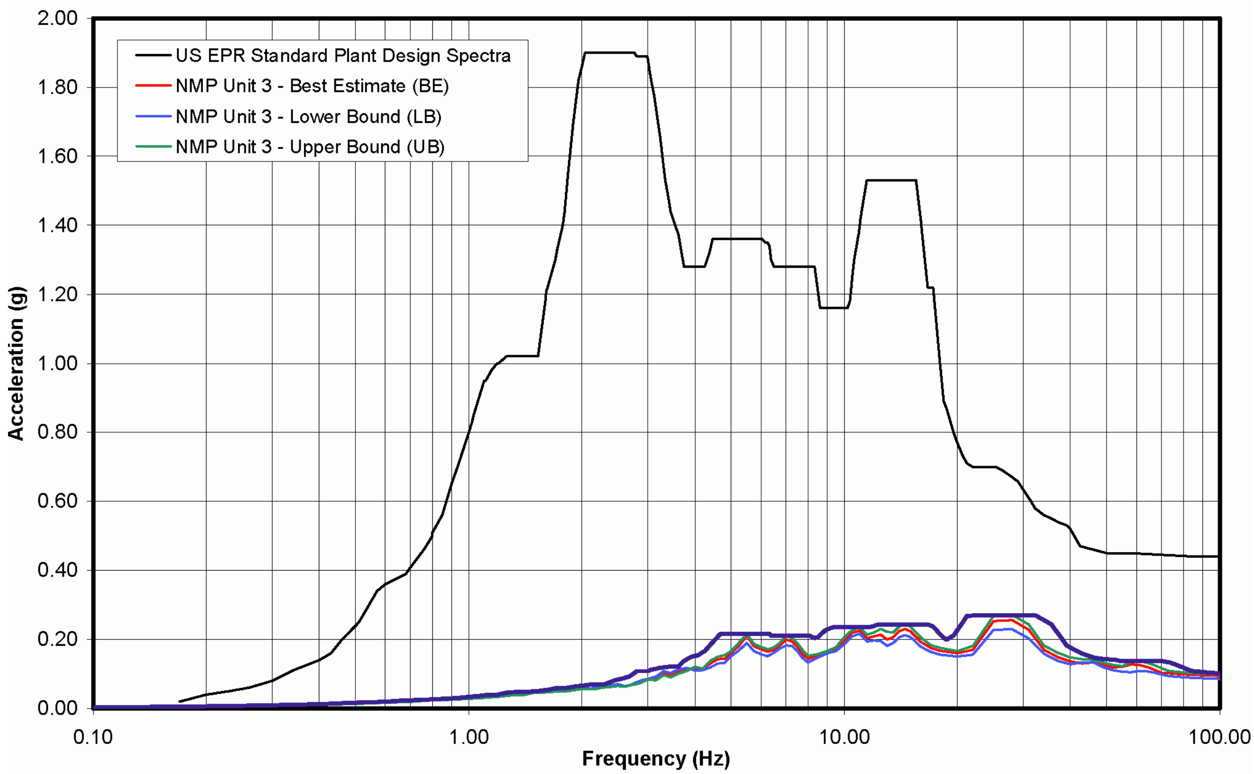


Figure 3.7-10—{Reactor Bldg Internal Structure, Elev. 5.15m, Z (Vert) Direction, 5% Damping}

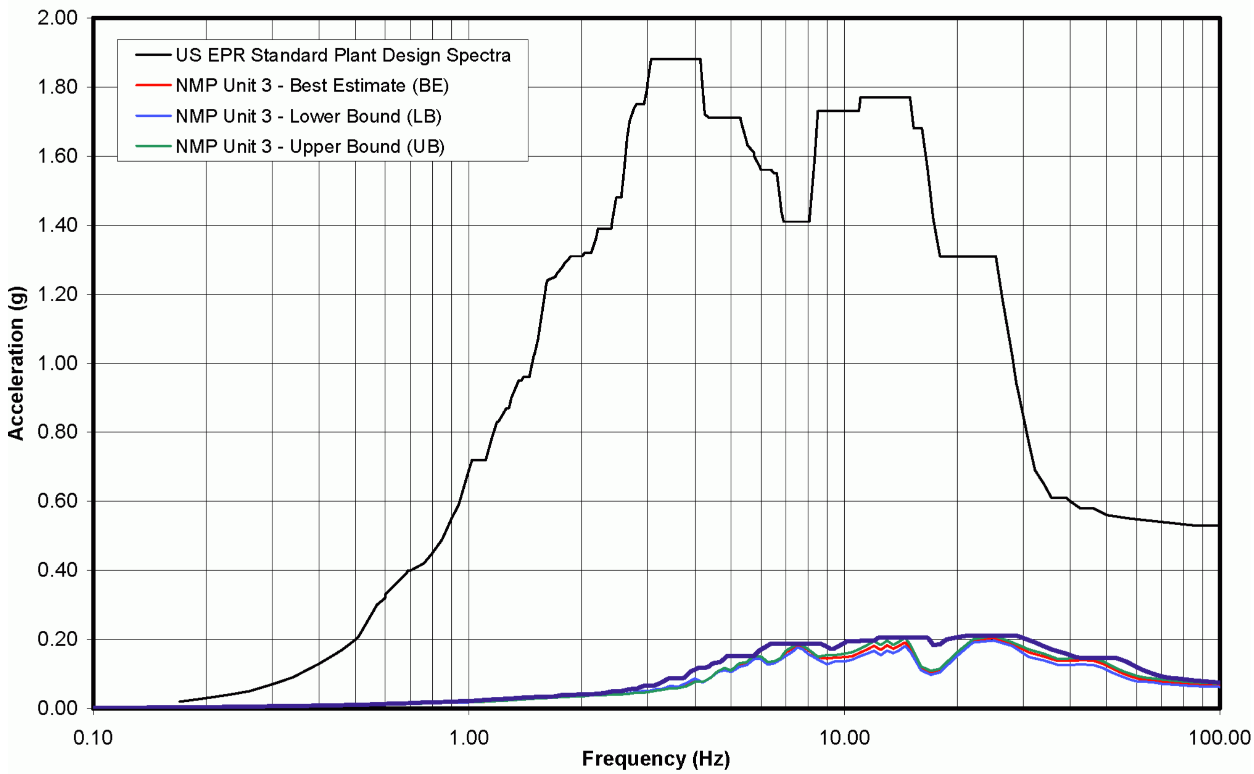


Figure 3.7-11—{Reactor Bldg Internal Structure, Elev. 19.5m, X (E-W) Direction, 5% Damping}

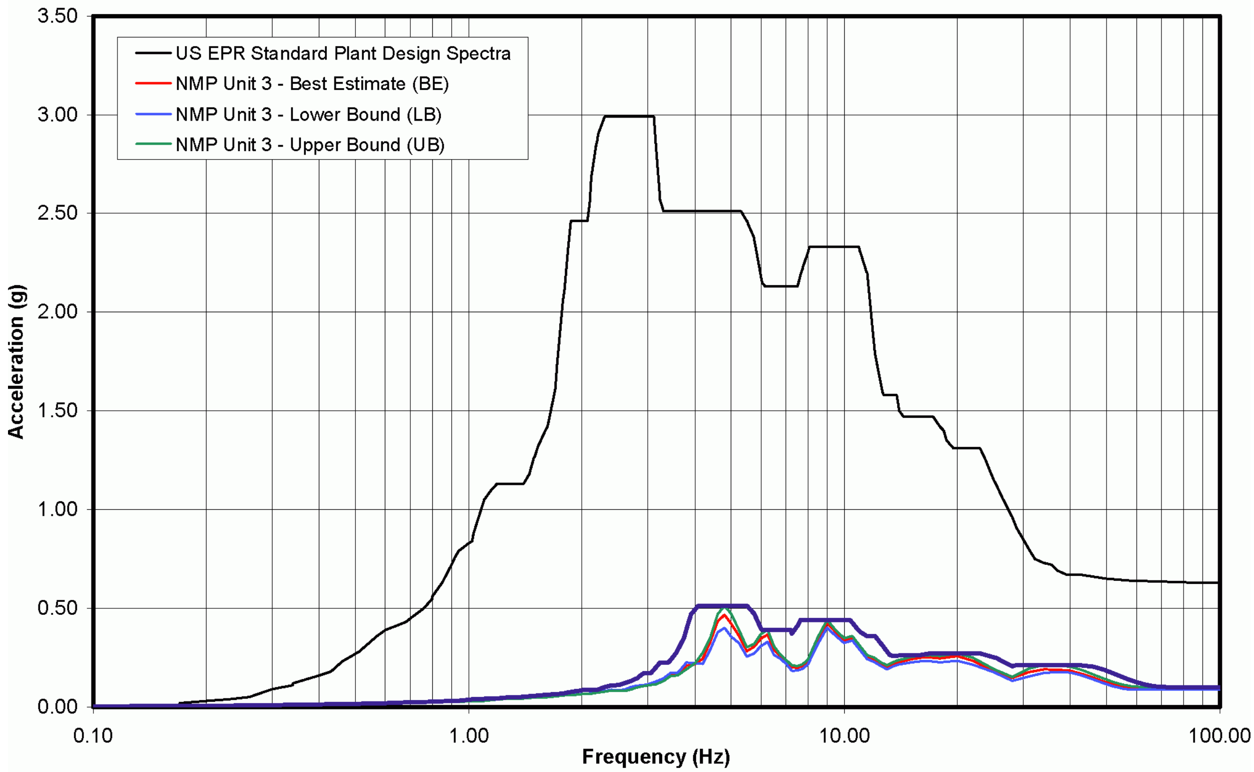


Figure 3.7-12—{Reactor Bldg Internal Structure, Elev. 19.5m, Y (N-S) Direction, 5% Damping}

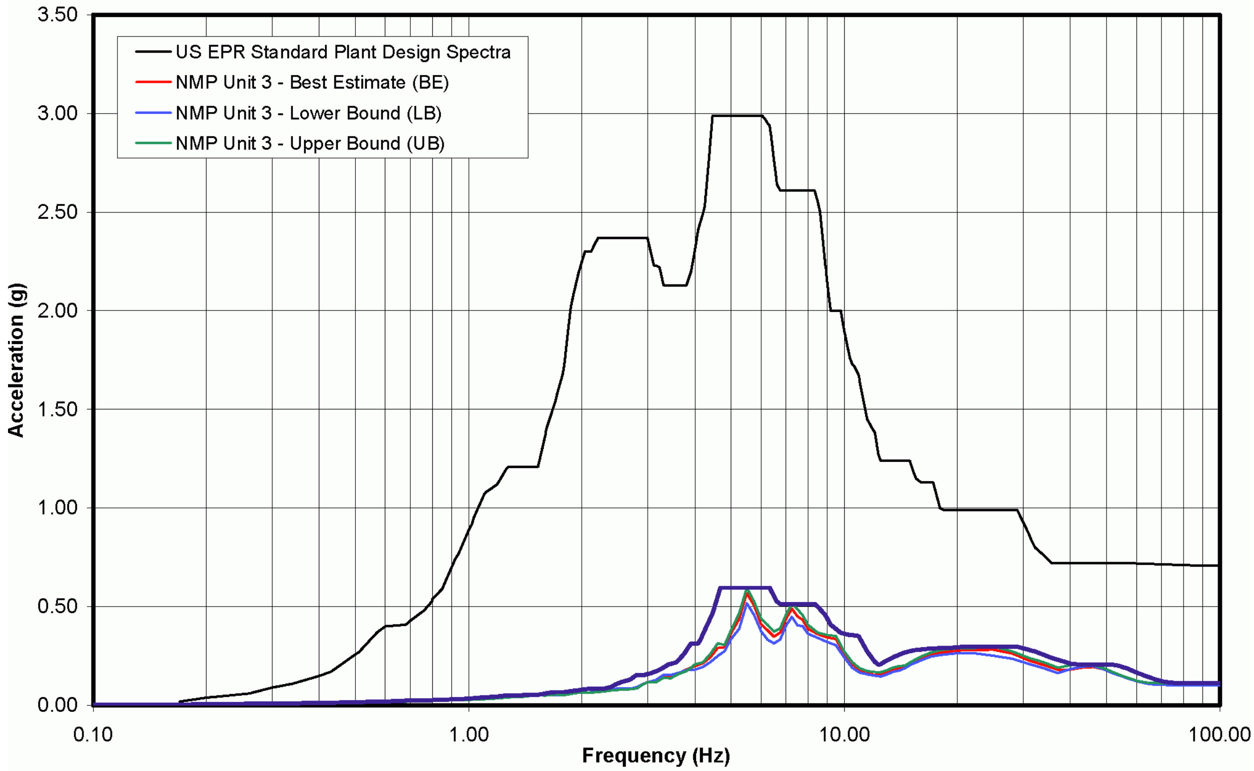


Figure 3.7-13—{Reactor Bldg Internal Structure, Elev. 19.5m, Z (Vert) Direction, 5% Damping}

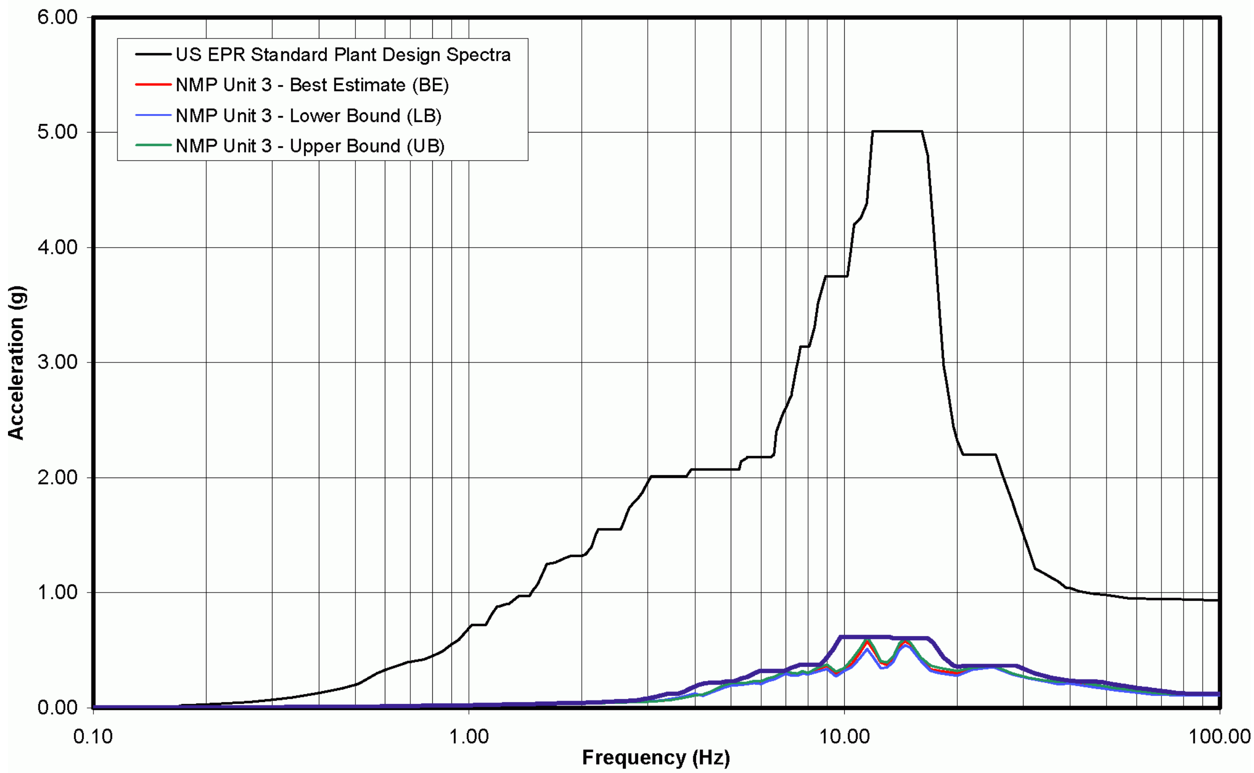


Figure 3.7-14—{Safeguard Building 1, Elev. 8.1m, X (E-W) Direction, 5% Damping}

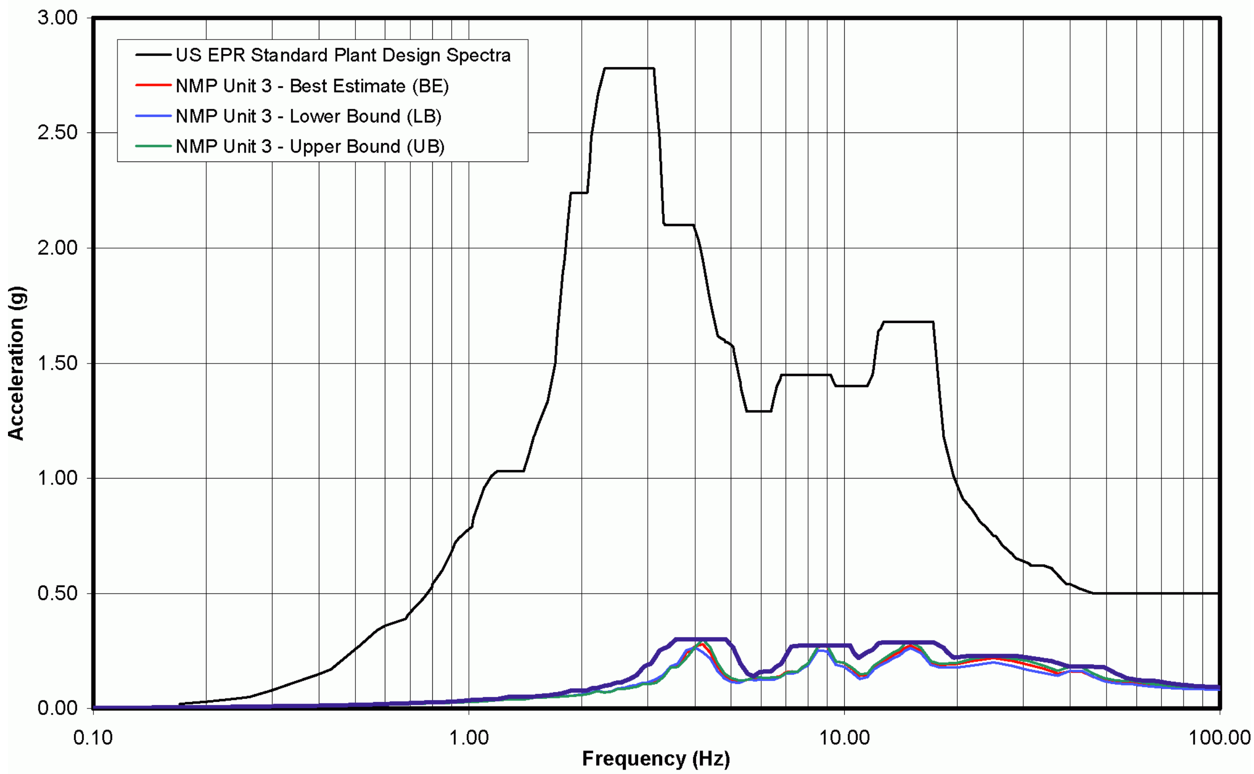


Figure 3.7-15—{Safeguard Building 1, Elev. 8.1m, Y (N-S) Direction, 5% Damping}

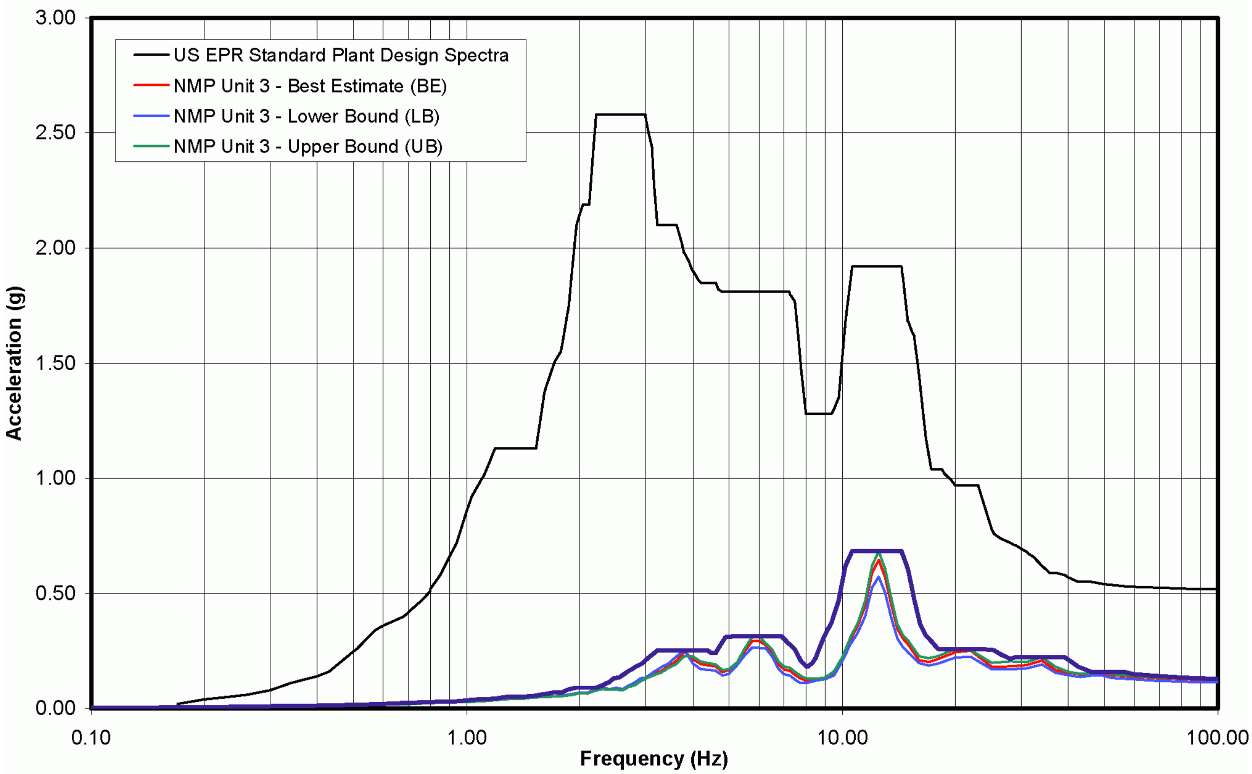


Figure 3.7-16—{Safeguard Building 1, Elev. 8.1m, Z (Vert) Direction, 5% Damping}

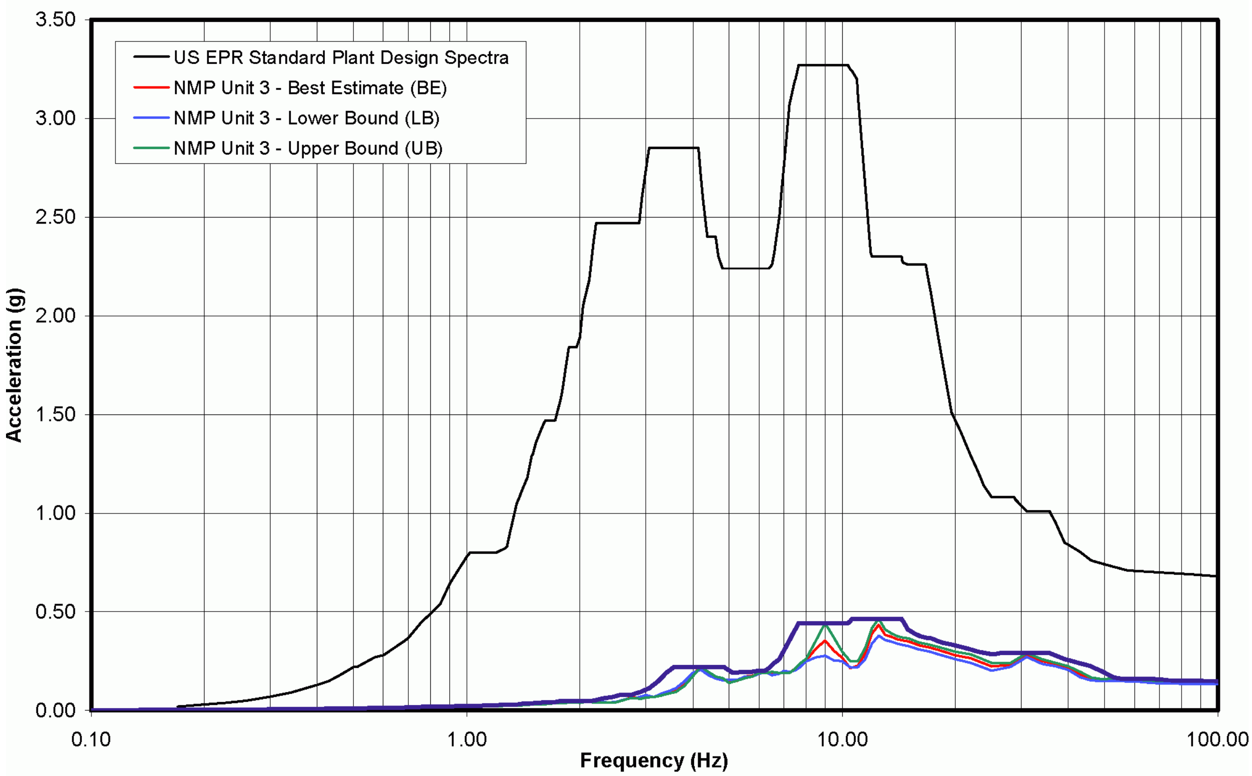


Figure 3.7-17—{Safeguard Building 1, Elev. 21.0m, X (E-W) Direction, 5% Damping}

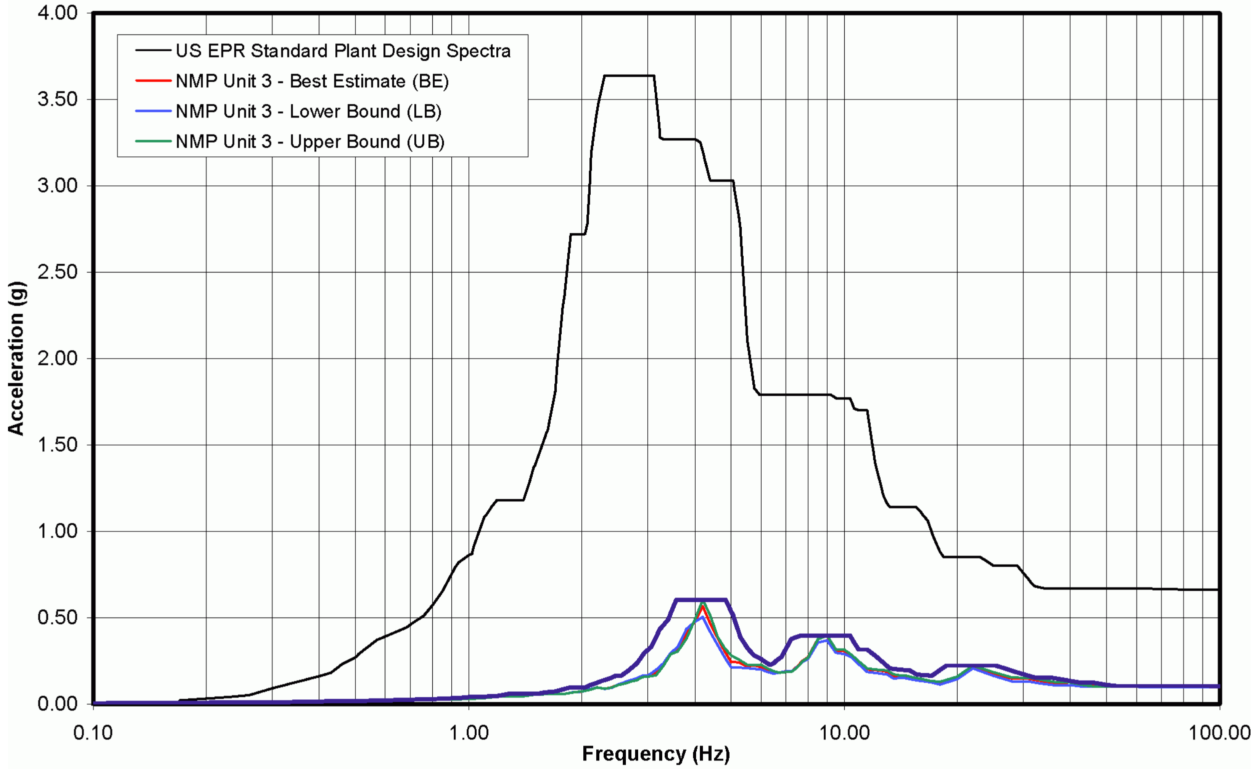


Figure 3.7-18—{Safeguard Building 1, Elev. 21.0m, Y (N-S) Direction, 5% Damping}

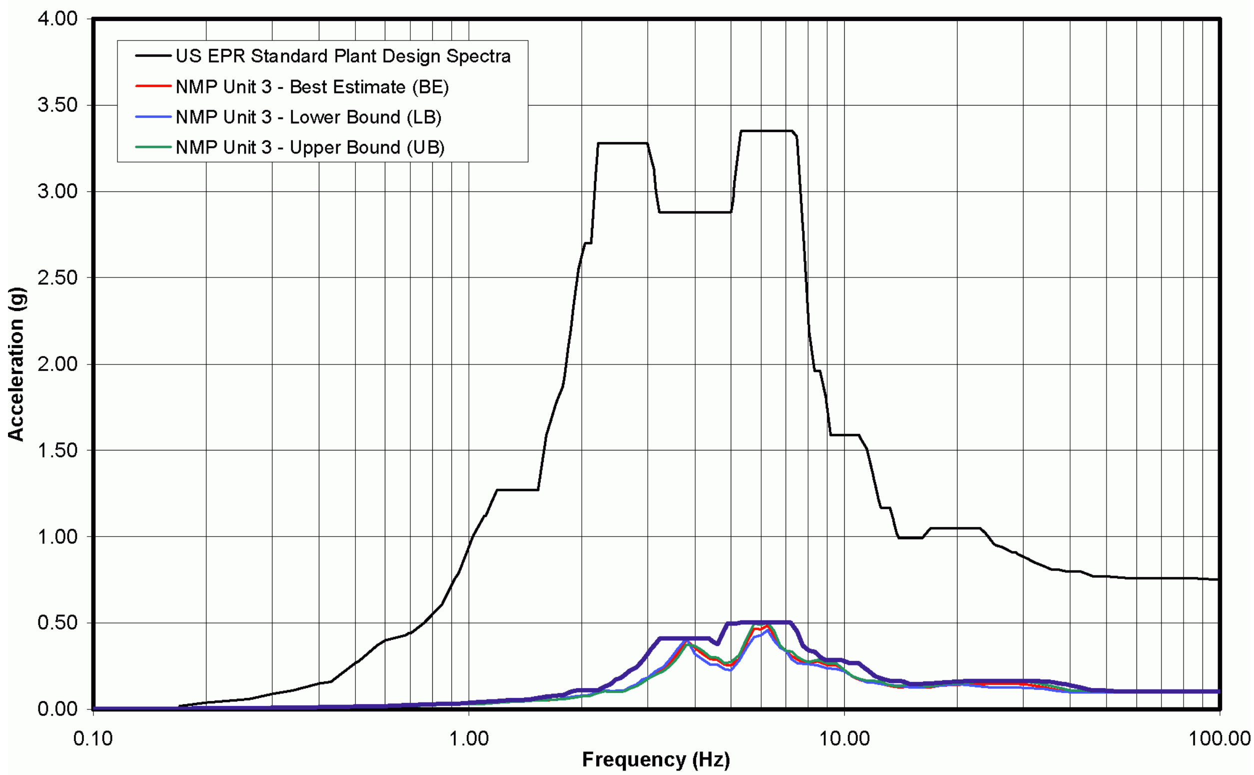


Figure 3.7-19—{Safeguard Building 1, Elev. 21.0m, Z (Vert) Direction, 5% Damping}

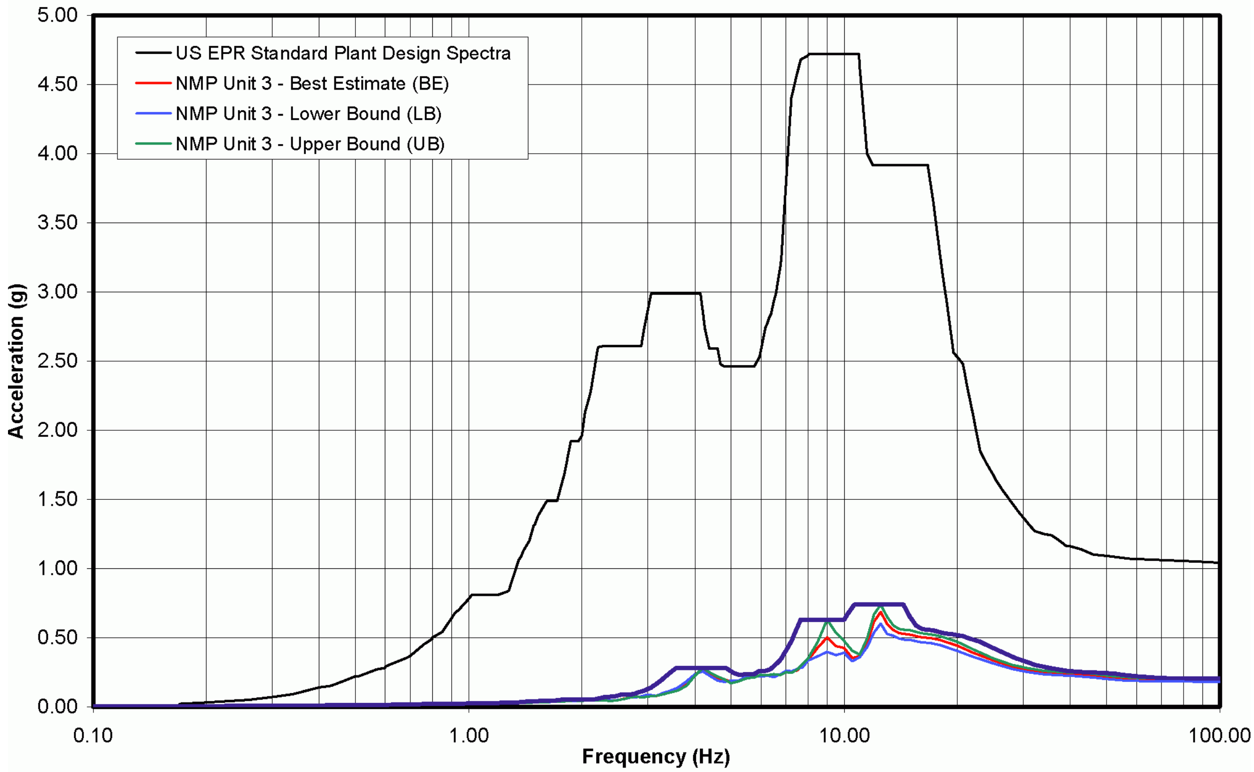


Figure 3.7-20—{Safeguard Building 2/3, Elev. 8.1m, X (E-W) Direction, 5% Damping}

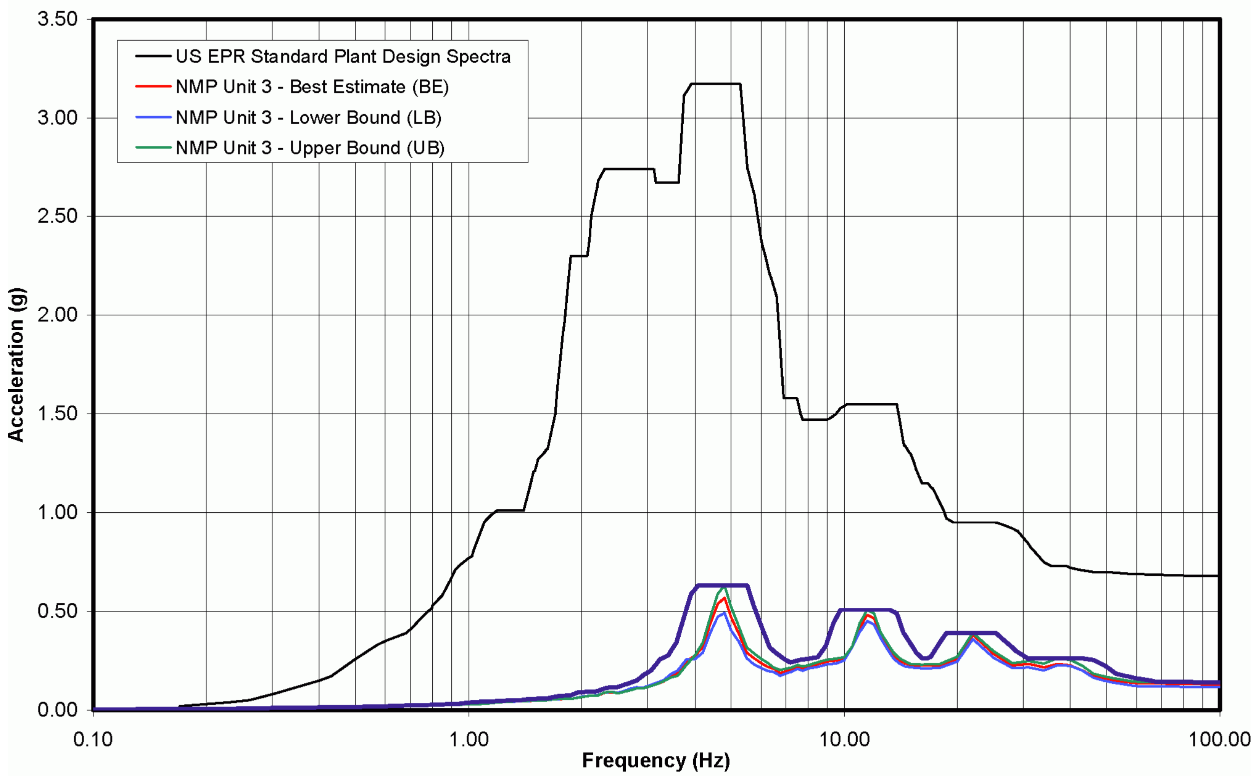


Figure 3.7-21—{Safeguard Building 2/3, Elev. 8.1m, Y (N-S) Direction, 5% Damping}

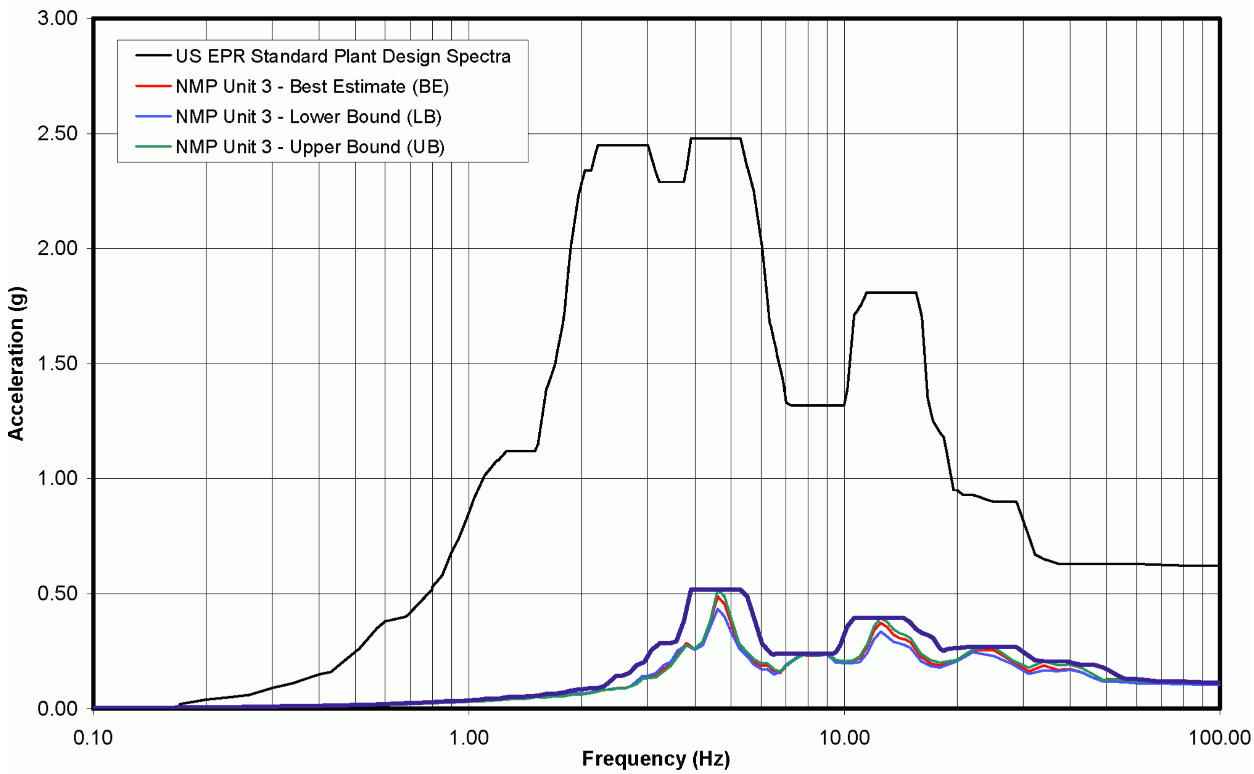


Figure 3.7-22—{Safeguard Building 2/3, Elev. 8.1m, Z (Vert) Direction, 5% Damping}

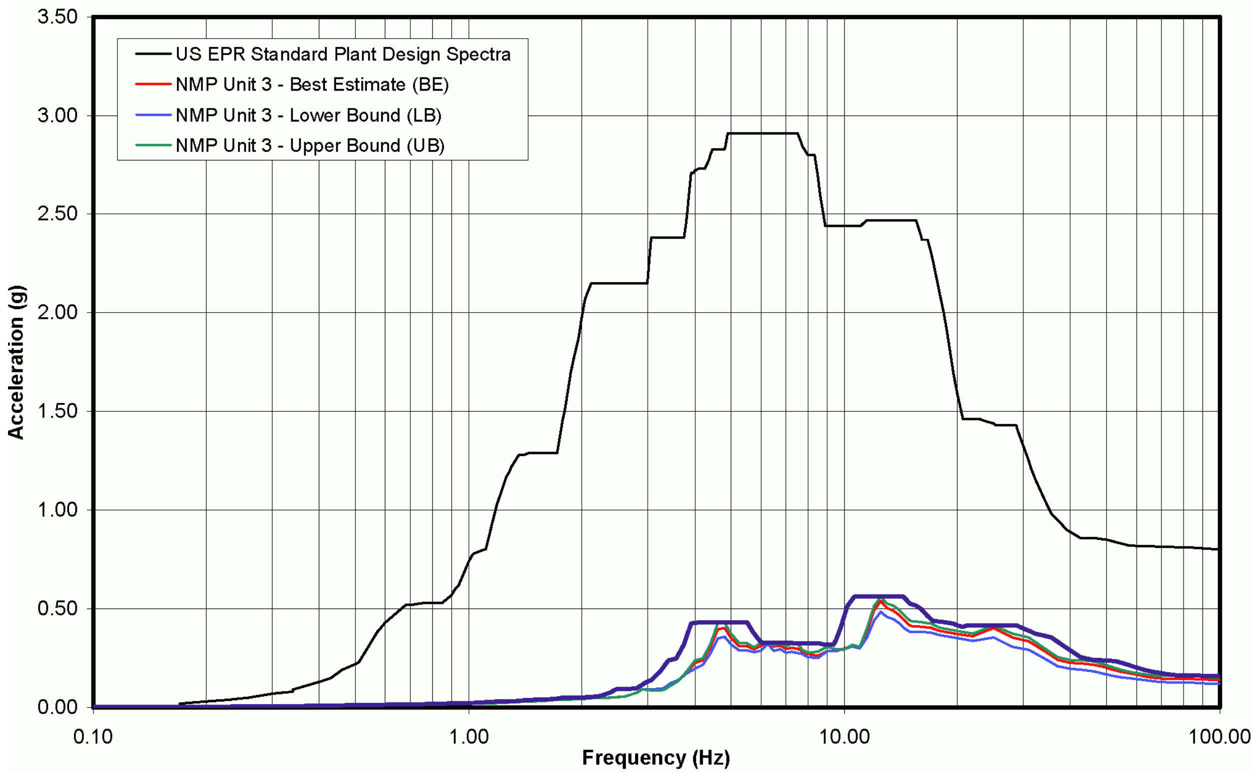


Figure 3.7-23—{Safeguard Building 2/3, Elev. 15.4m, X (E-W) Direction, 5% Damping}

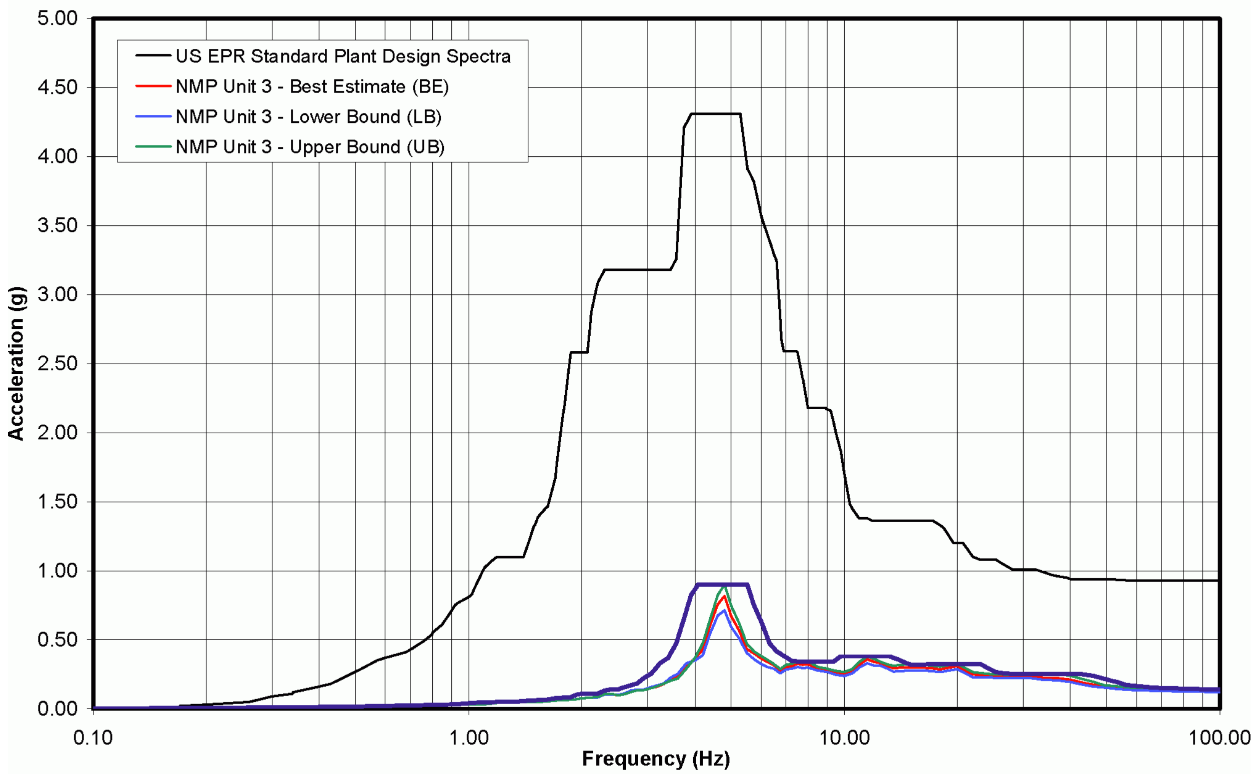


Figure 3.7-24—{Safeguard Building 2/3, Elev. 15.4m, Y (N-S) Direction, 5% Damping}

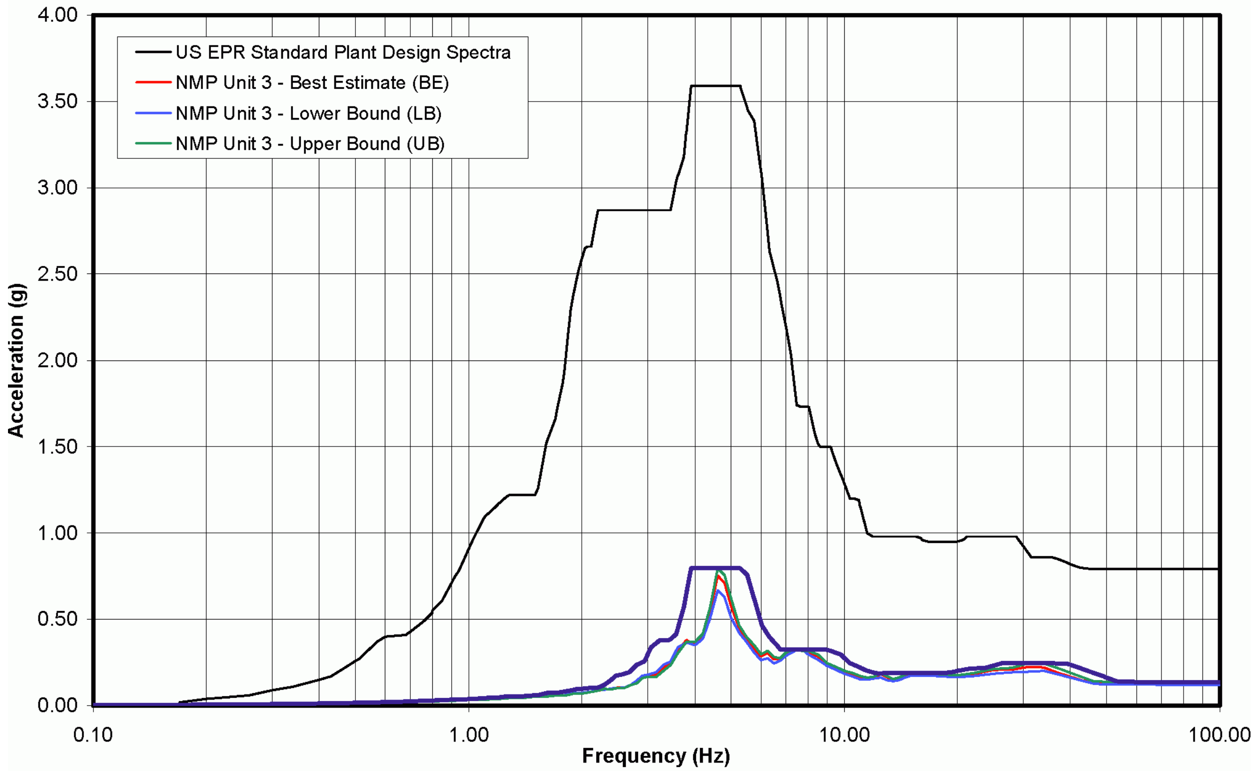


Figure 3.7-25—{Safeguard Building 2/3, Elev. 15.4m, Z (Vert) Direction, 5% Damping}

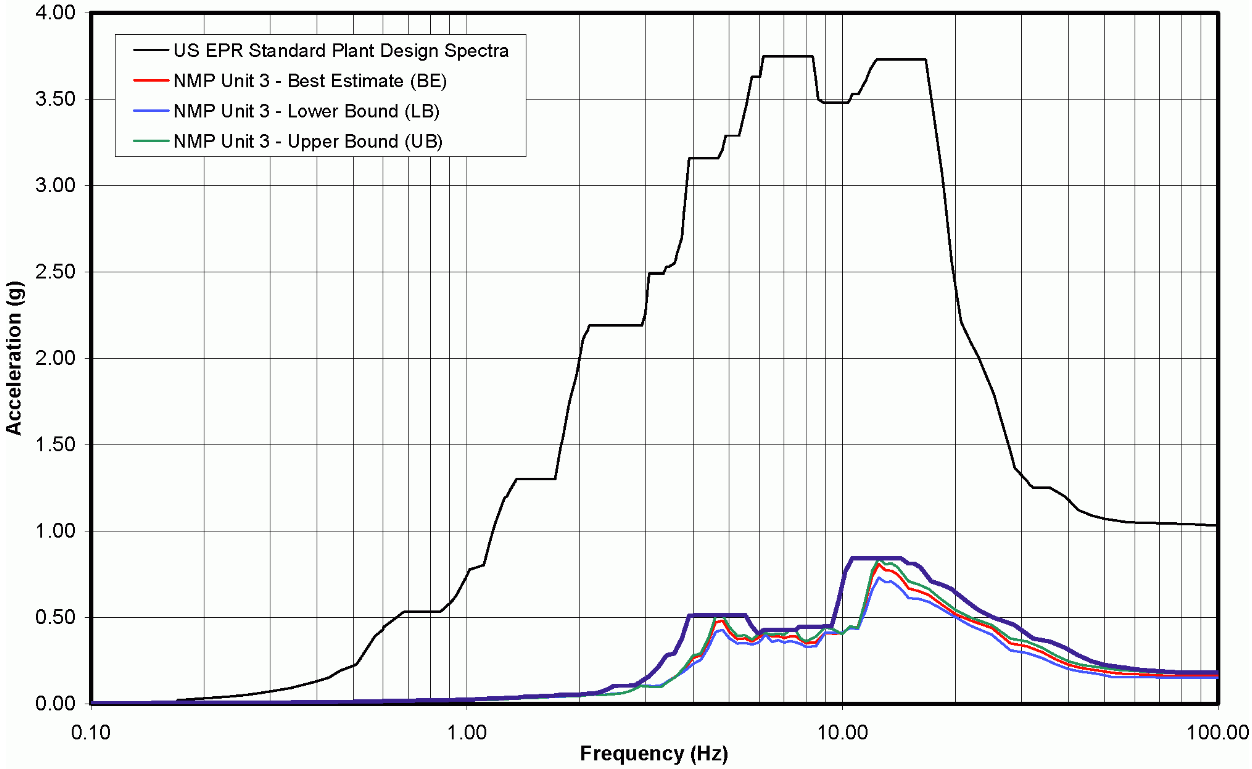


Figure 3.7-26—{Safeguard Building 4, Elev. 21.0m, X (E-W) Direction, 5% Damping}

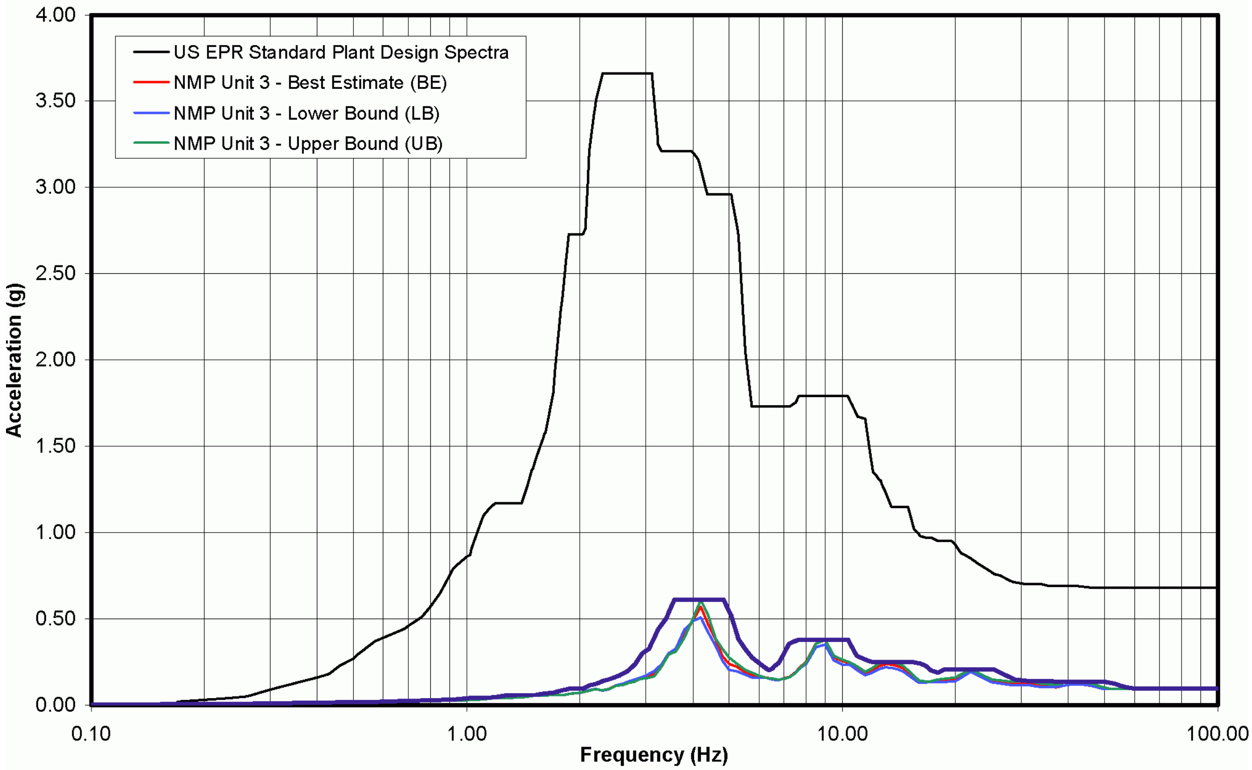


Figure 3.7-27—{Safeguard Building 4, Elev. 21.0m, Y (N-S) Direction, 5% Damping}

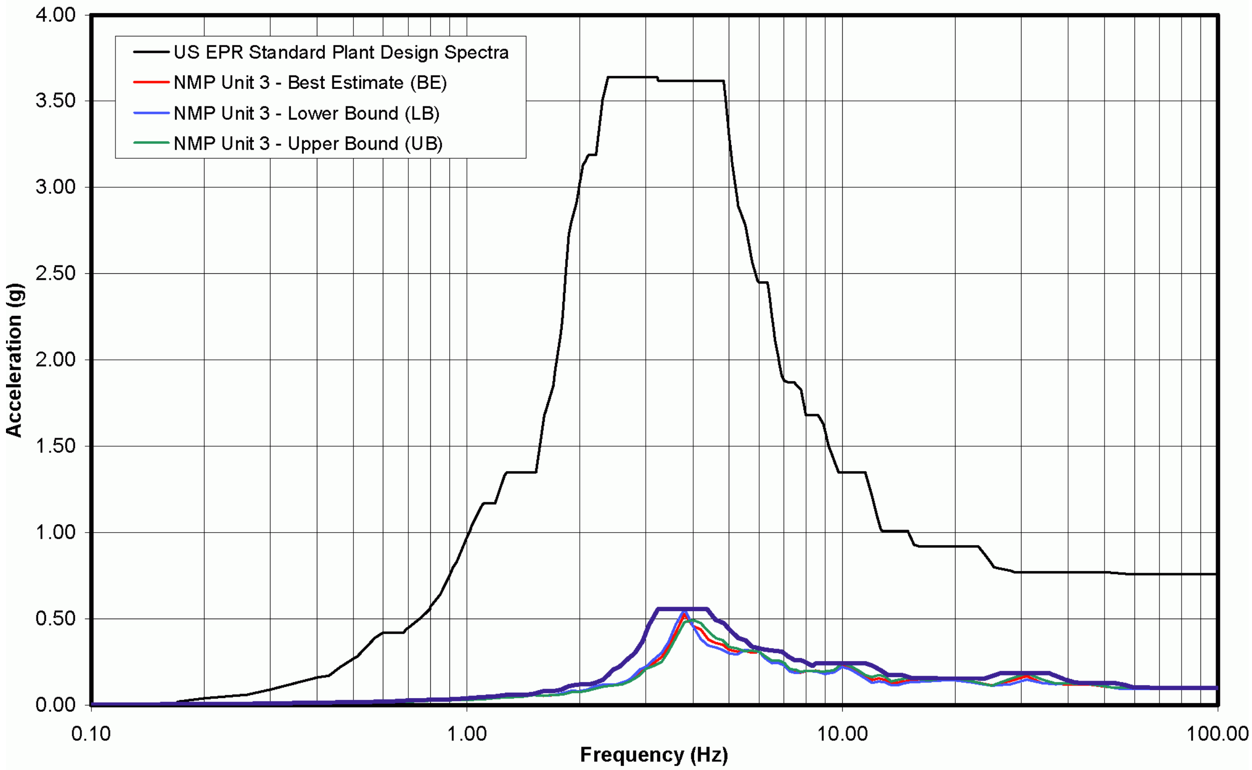


Figure 3.7-28—{Safeguard Building 4, Elev. 21.0m, Z (Vert) Direction, 5% Damping}

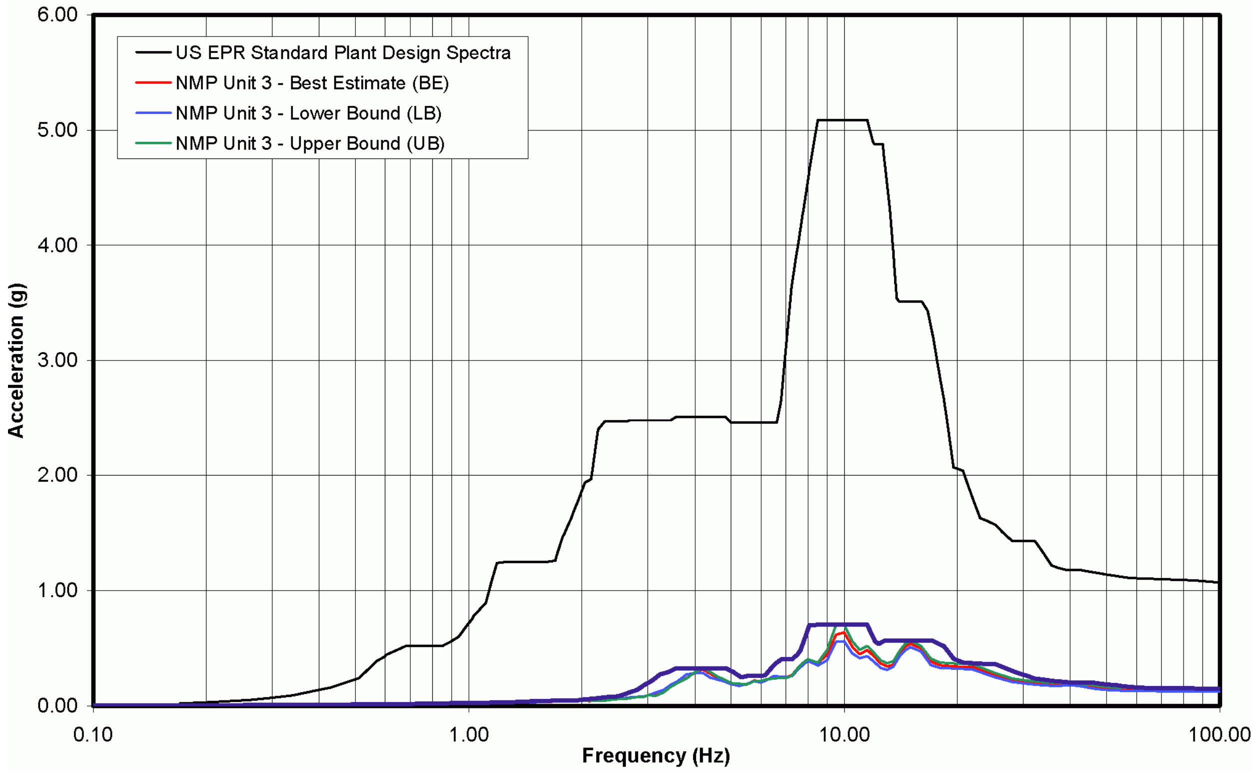


Figure 3.7-29—{Containment Building, Elev. 37.6m, X (E-W) Direction, 5% Damping}

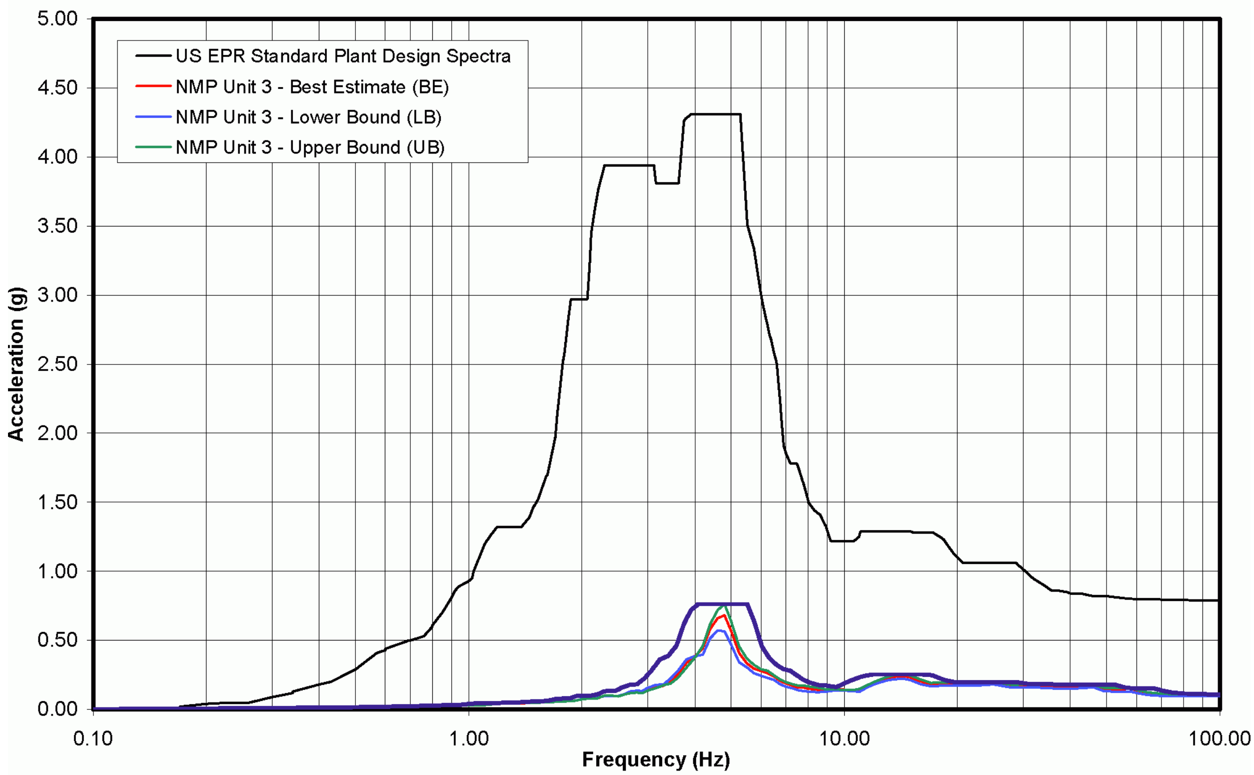


Figure 3.7-30—{Containment Building, Elev. 37.6m, Y (N-S) Direction, 5% Damping}

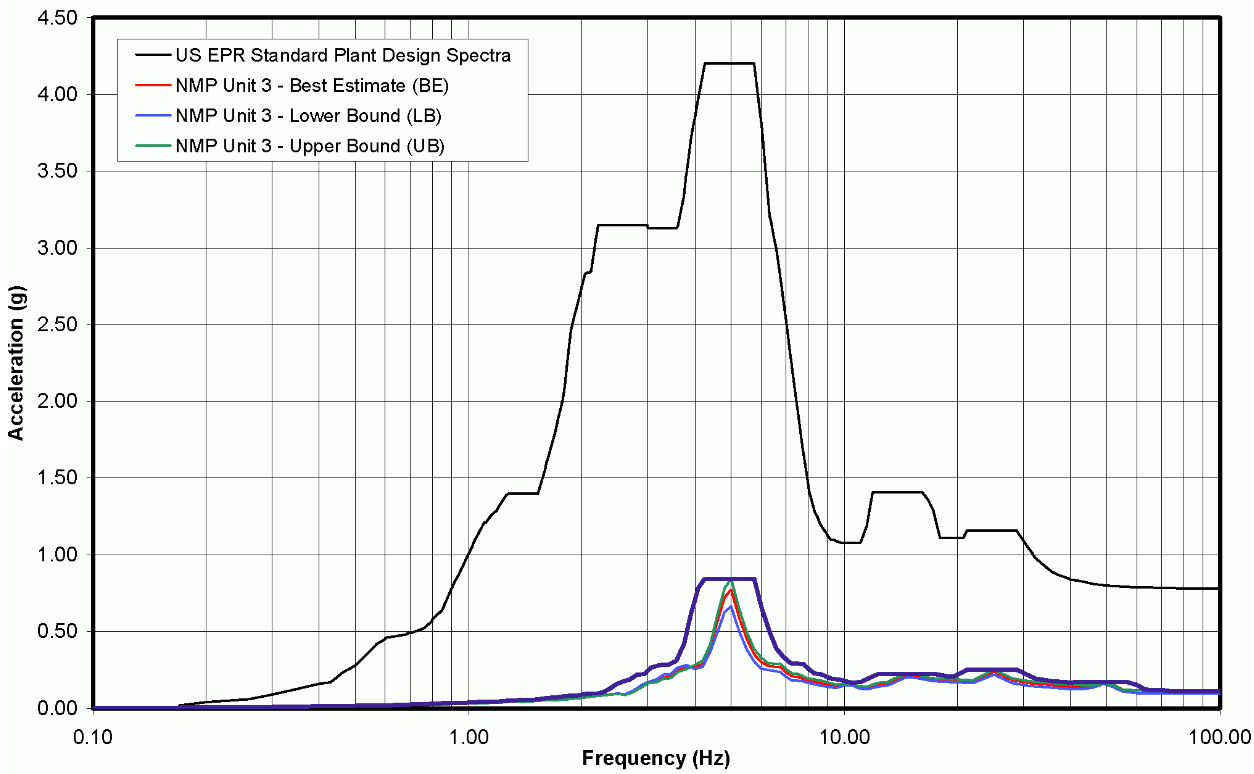


Figure 3.7-31—{Containment Building, Elev. 37.6m, Z (Vert) Direction, 5% Damping}

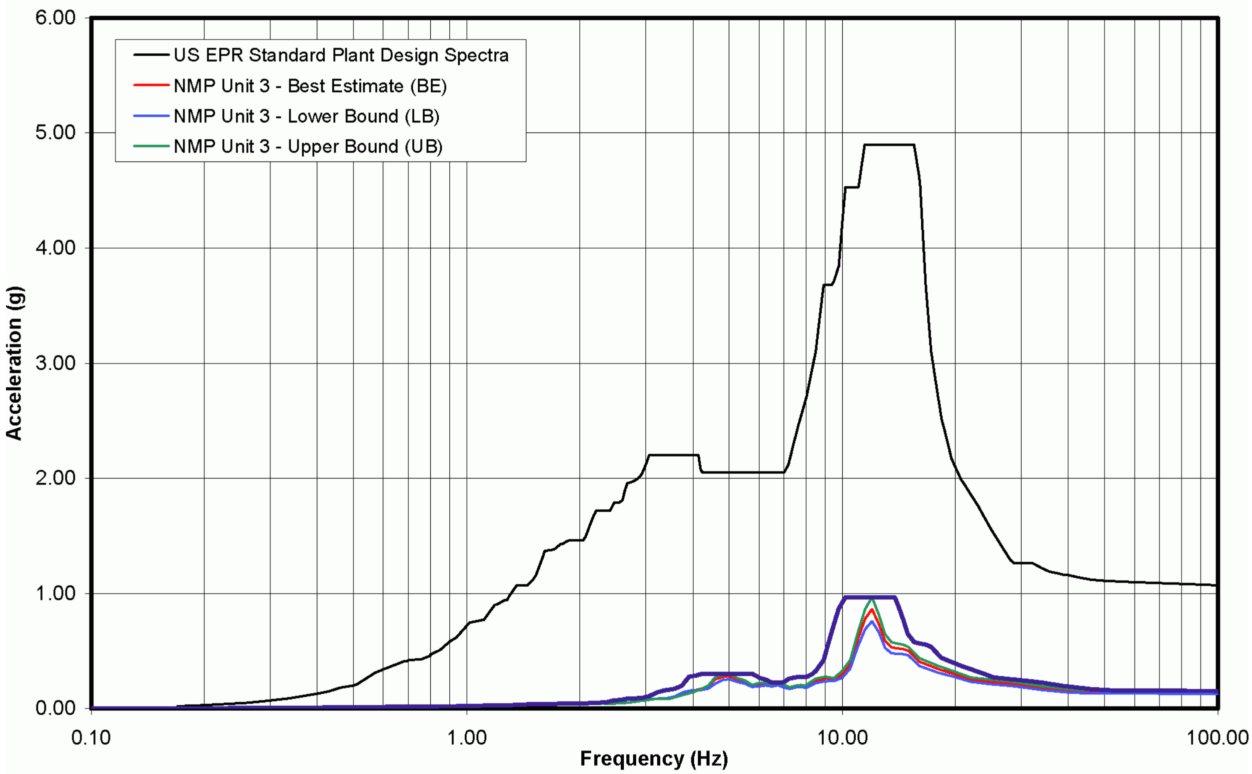


Figure 3.7-32—{Containment Building, Elev. 58.0m, X (E-W) Direction, 5% Damping}

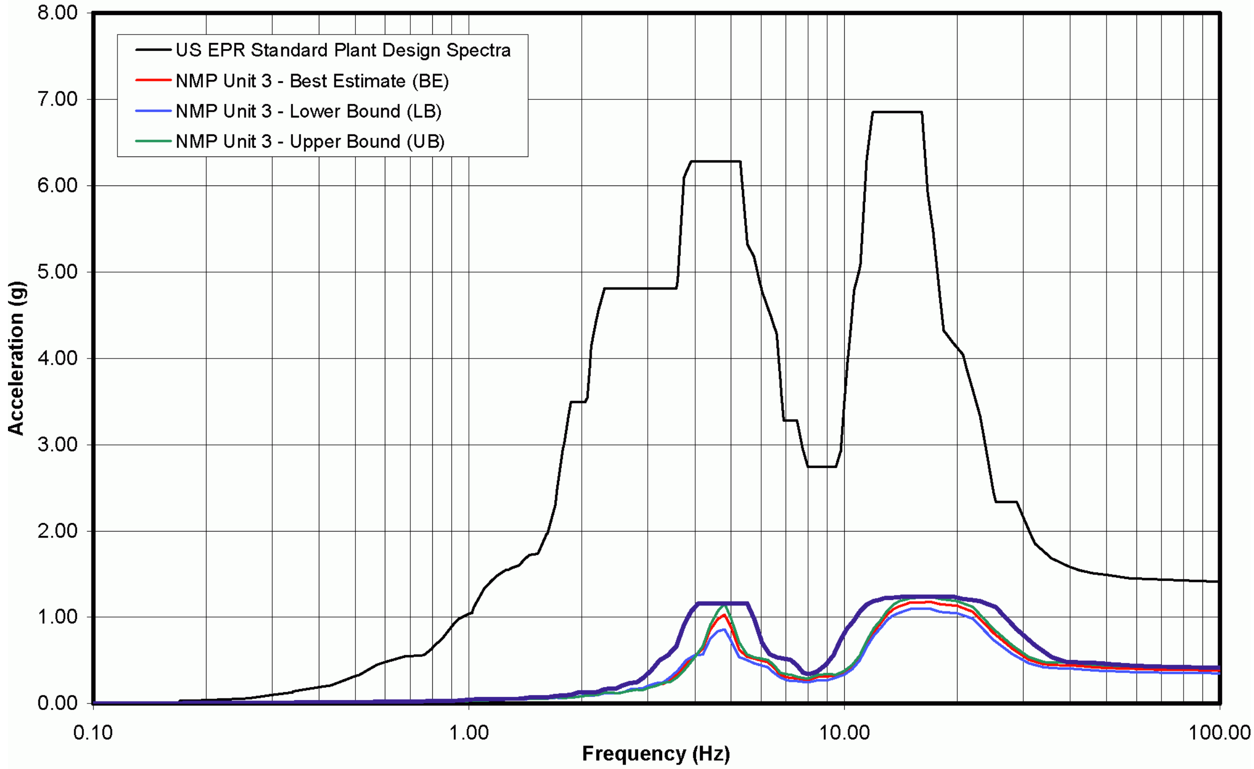


Figure 3.7-33—{Containment Building, Elev. 58.0m, Y (N-S) Direction, 5% Damping}

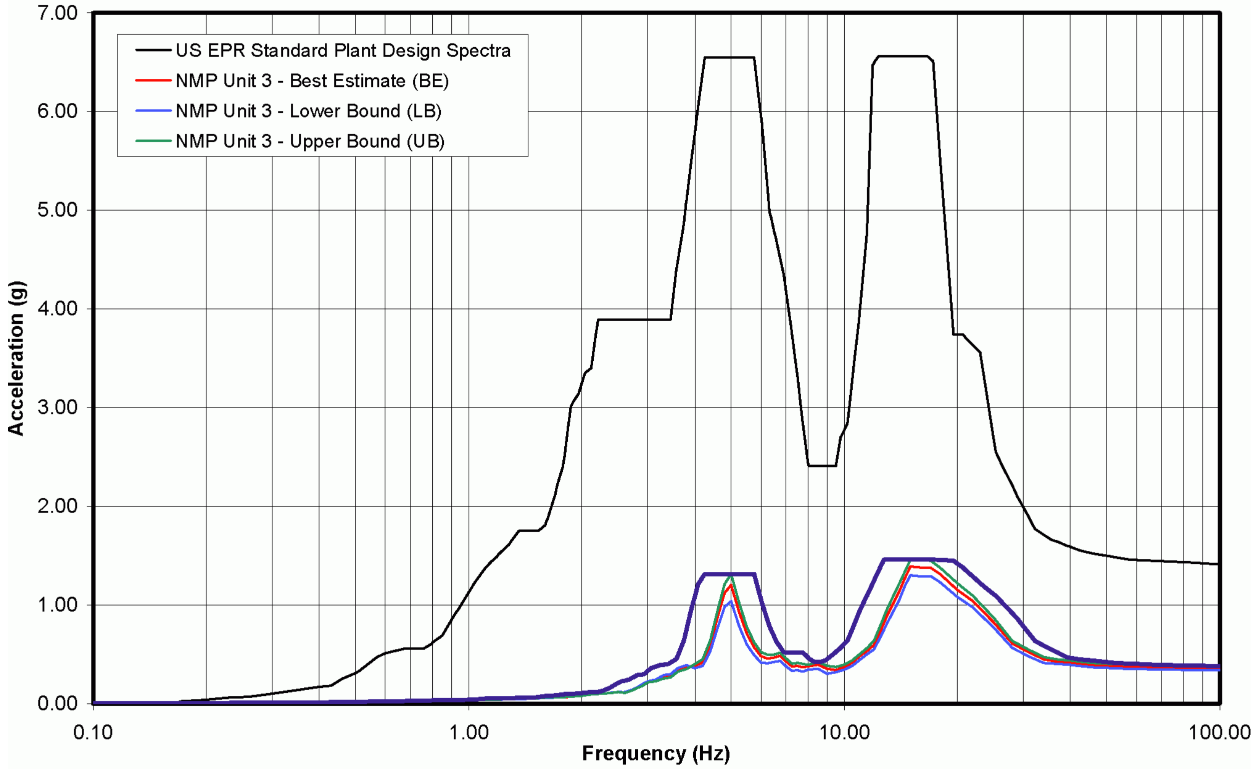
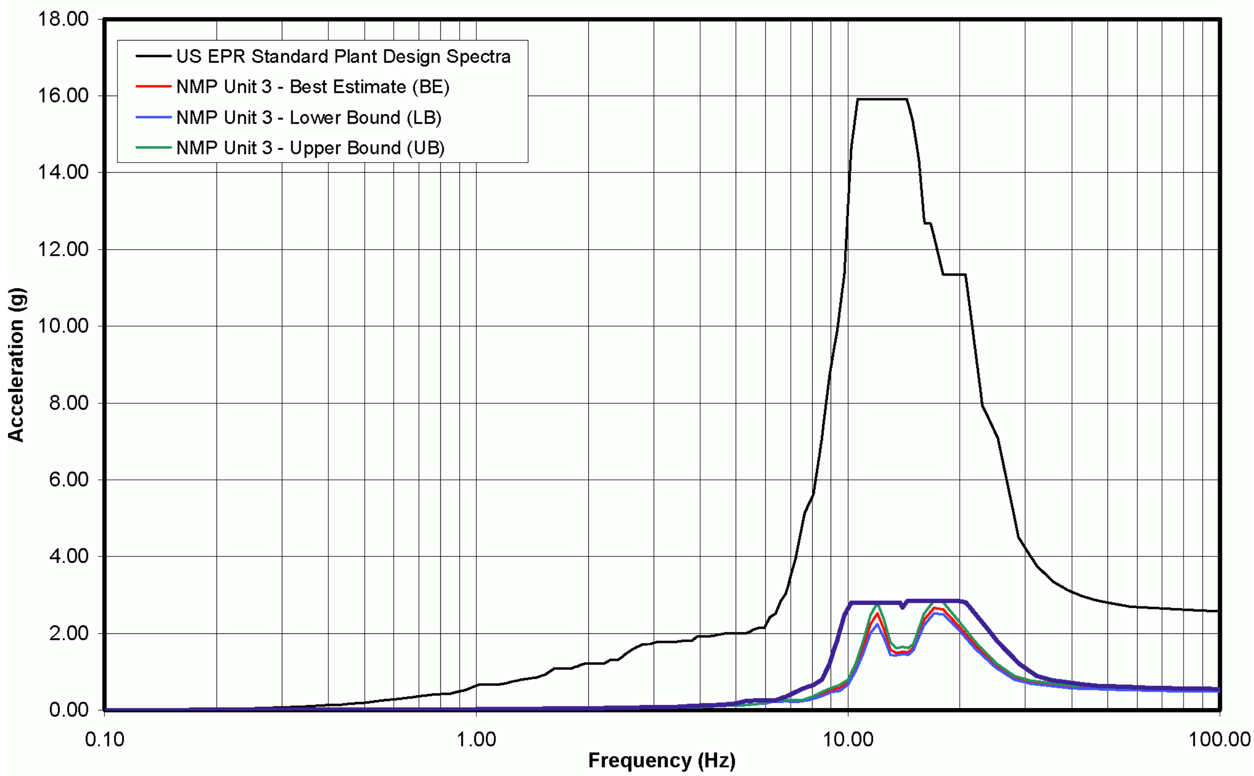


Figure 3.7-34—{Containment Building, Elev. 58.0m, Z (Vert) Direction,5% Damping}



3.8 DESIGN OF CATEGORY I STRUCTURES

This section of the U.S. EPR FSAR is incorporated by reference with the departures and supplements as described in the following sections.

3.8.1 CONCRETE CONTAINMENT

No departures or supplements.

3.8.1.1 Description of the Containment

No departures or supplements.

3.8.1.2 Applicable Codes, Standards, and Specifications

No departures or supplements.

3.8.1.3 Loads and Load Combinations

The U.S. EPR FSAR includes the following COL Item in Section 3.8.1.3:

> A COL applicant that references the U.S. EPR design certification will confirm that site-specific loads lie within the standard plant design envelope for the RCB, or perform additional analyses to verify structural adequacy.

This COL Item is addressed as follows:

{The Reactor Contaiment Building (RCB) design for NMP3NPP is the standard RCB design as described in the U.S. EPR FSAR without departures. Site-specific RCB design loads are confirmed to lie within the standard U.S. EPR design certification envelope. Relative site-specific seismic, Reactor Shield Building (RSB), and buoyancy conditions are addressed in Sections 3.7.2, 3.8.4, and 3.8.5, respectively.}

3.8.1.4 Design and Analysis Procedures

No departures or supplements.

3.8.1.5 Structural Acceptance Criteria

No departures or supplements.

3.8.1.6 Materials, Quality Control, and Special Construction Techniques

No departures or supplements.

3.8.1.6.1 Concrete Materials

No departures or supplements.

3.8.1.6.2 Reinforcing Steel and Splice Materials

No departures or supplements.

3.8.1.6.3 Tendon System Materials

No departures or supplements.

3.8.1.6.4 Liner Plate System and Penetration Sleeve Materials

No departures or supplements.

3.8.1.6.5 Steel Embedments

No departures or supplements.

3.8.1.6.6 Corrosion Retarding Compounds

No departures or supplements.

3.8.1.6.7 Quality Control

The QA program for this section is discussed in Section 3.1.1.1.1.

3.8.1.6.8 Special Construction Techniques

No departures or supplements.

3.8.1.7 Testing and Inservice Inspection Requirements

No departures or supplements.

3.8.2 STEEL CONTAINMENT

No departures or supplements.

3.8.3 CONCRETE AND STEEL INTERNAL STRUCTURES OF CONCRETE CONTAINMENT

3.8.3.1 Description of the Internal Structures

No departures or supplements.

3.8.3.2 Applicable Codes, Standards, and Specifications

No departures or supplements.

3.8.3.3 Loads and Load Combinations

The U.S. EPR FSAR includes the following COL Item in Section 3.8.3.3:

> A COL applicant that references the U.S. EPR design certification will confirm that site-specific loads lie within the standard design envelope for RB internal structures, or perform additional analyses to verify structural adequacy.

This COL Item is addressed as follows:

{The Reactor Building (RB) (i.e., the RCB) internal structural design is the standard design as described in the U.S. EPR FSAR without departures. Site-specific loads are confirmed to lie within the standard U.S. EPR design certification envelope. Relative site-specific conditions are addressed in Section 3.7.2.}

3.8.3.4 Design and Analysis Procedures

No departures or supplements.

3.8.3.5 Structural Acceptance Criteria

No departures or supplements.

3.8.3.6 Materials, Quality Control, and Special Construction Techniques

No departures or supplements.

3.8.3.7 Testing and Inservice Inspection Requirements

No departures or supplements.

3.8.4 OTHER SEISMIC CATEGORY I STRUCTURES

3.8.4.1 Description of the Structures

The U.S. EPR FSAR includes the following COL Items in Section 3.8.4:

> A COL applicant that references the U.S. EPR design certification will describe any differences between the standard plant layout and design of Seismic Category I structures required for site-specific conditions.
>
> A COL applicant that references the U.S. EPR design certification will address site-specific Seismic Category I structures that are not described in this section.

The COL Items are addressed as follows:

{The site-specific Seismic Category I structures for NMP3NPP are:

- Buried conduit and duct banks (Section 3.8.4.1.8)
- Buried pipe and pipe ducts (Section 3.8.4.1.9 and Section 3.8.4.4.5)
- UHS Makeup Water Intake Structure and Intake Tunnel (Section 3.8.4.1.11)
- UHS Encasement (Section 3.8.4.4.5)}

3.8.4.1.1 Reactor Shield Building and Annulus

No departures or supplements.

3.8.4.1.2 Fuel Building

No departures or supplements.

3.8.4.1.3 Safeguard Buildings

No departures or supplements.

3.8.4.1.4 Emergency Power Generating Buildings

No departures or supplements.

3.8.4.1.5 Essential Service Water Buildings

No departures or supplements.

3.8.4.1.6 Distribution System Supports

No departures or supplements.

3.8.4.1.7 Platforms and Miscellaneous Structures

No departures or supplements.

3.8.4.1.8 Buried Conduit and Duct Banks

The U.S. EPR FSAR includes the following COL Item and conceptual design information in Section 3.8.4.1.8:

> A COL applicant that references the U.S. EPR design certification will provide a description of Seismic Category I buried conduit and duct banks.
>
> [[Buried conduits are steel while conduits in encased duct banks may be poly-vinyl-chloride (PVC) or steel. Duct banks may be directly buried in the soil; encased in lean concrete, concrete, or reinforced concrete. Concrete or reinforced concrete encased duct banks will be used in heavy haul zones, under roadway crossings, or where seismic effects dictate the requirement. Encasement in lean concrete may be used in areas not subject to trenching or passage of heavy haul equipment, or where seismic effects on the conduit are not significant.]]

{This COL item is addressed as follows, and the conceptual design information is replaced with the site-specific information for NMP3NPP.

FSAR Figure 3.8-1 provides an overall site plan of the UHS Seismic Category I buried reinforced concrete encasement structures (UHS Encasement Structures) that house electrical conduits sharing common routes with UHS pipes.

As illustrated in FSAR Figure 3.8-1, the UHS Encasement Structure is a reinforced concrete structure located at the bottom of the open trench type excavation backfilled with lean concrete. The top of the UHS Encasement Structure bottom slab is located at elevation 248’ 0” (75.59 m).

The UHS Encasement Structures traverse from the UHS Makeup Water Intake Structure to the Cooling Towers.

There are two types of the UHS Encasement Structures, housing two and four electrical conduits respectively (Figure 3.8-1).

The UHS Makeup Water Intake Structure houses mechanical and electrical equipment. The electrical conduits located inside the UHS Encasement Structure provide power to the UHS equipment including UHS Makeup Water pumps.

The minimum distance between the top of the concrete of the top slab of the UHS Encasement Structure and the grade elevation shall not be less than 4’ (1.22 m).

The conduits are mounted to the underside portion of the top reinforced concrete slab of the UHS Encasement Structure. The grating platforms are provided on the top of interior divider reinforced concrete walls to be used as walkways for the personnel performing maintenance activities. The reinforced concrete divider walls provide adequate protection and separation requirements for the UHS pipes. The height of the UHS Encasement Structure of 7 ft (2.13 m) above the grating platforms provides adequate overhead space for personnel performing pipe maintenance.

Manholes are provided at the strategic locations to provide access to the interior of the UHS Encasement Structure for the personnel performing maintenance activities and to facilitate cable pulling and routing during the installation stage.}

3.8.4.1.9 Buried Pipe and Pipe Ducts

The U.S. EPR FSAR includes the following COL Item in Section 3.8.4.1.9:

> A COL applicant that references the U.S. EPR design certification will provide a description of Seismic Category I buried pipe and pipe ducts.

This COL Item is addressed as follows:

{FSAR Figure 3.8-1 provides an overall site plan of the UHS Encasement Structures that house UHS pipes sharing a common route with electrical conduits addressed in Section 3.8.4.1.8.

There are two types of the UHS Encasement Structures, housing two and four pipes respectively.

The detailed descriptions of the UHS Encasement Structures are provided in Section 3.8.4.1.8 and Section 3E.4 of Appendix 3E.

Fire protection piping traverses from the UHS Makeup Water Intake Structure to the vicinity of NI, where a loop is provided to all buildings. Fire protection pipes routed to Seismic Category I structures are classified as: 1) Seismic Category II designed to maintain its pressure boundary after an SSE event; and 2) Seismic category II-SSE designed to remain functional following SSE event.}

3.8.4.1.10 Masonry Walls

{No departures or supplements.}

3.8.4.1.11 {UHS Makeup Water Intake Structure and UHS Tunnels

This section is added as a supplement to U.S. EPR FSAR Section 3.8.4.1.

The Seismic Category I UHS Makeup Water Intake Structure is located in the vicinity of the Lake Ontario shoreline. It houses components associated with the UHS Makeup Water System, which provides emergency makeup water for the shutdown of the plant, following a design basis accident. Figure 3.8-1 provides a site plan for NMP3NPP, which shows the position of the UHS Makeup Water Intake Structure relative to the NI.

The UHS Makeup Water Intake Structure is a reinforced concrete structure 162 ft (49.38 m) long with two additional extensions 22 ft long (6.71m), one on each side (East and West), by 144 ft (43.89 m) wide overall by 32 ft (9.75 m) high. It consists of two portions: the lower portion of the structure below the grade (Substructure), and the upper portion of the structure above the grade (Superstructure).

The portion of the Substructure (Forebay) that is located north of column line “D” and between column lines “1” and “8” (Figure 9.2-4 and Figure 9.2-5) also includes two 22 ft (6.71 m) x 20 ft (6.1 m) extensions for tunnel shaft openings.

The three functional levels of the UHS Makeup Water Structure are located at:

- Elevation 225 ft 5 in (68.71 m): Top of concrete (TOC) for the 3 ft (0.91 m) thick base mat.
- Elevation 273 ft 0 in (83.21 m) TOC of the 3 ft (0.91 m) thick operating deck/ floor.
- Elevation 302 ft 0 in (92.05 m) TOC of the 2 ft (0.91 m) thick roof slab.

Functional components include UHS Makeup Water pumps, intake bar screens and traveling screens to preclude debris intake and stop logs to facilitate maintenance.

The UHS Makeup Water Intake Substructure exterior walls are 3.5 ft (1.07 m) thick and the interior substructure walls are 2 ft (0.61 m) thick. The exterior walls of the Superstructure are 2 ft (0.61 m) thick and the interior walls of the Superstructure are 1.5 ft (0.46 m) thick.

A Foundation Plan for the UHS Makeup Water Intake Structure at Elevation 225 ft 5 in (68.71 m) is provided as Figure 3E.4-1 of Section 3E.4 of Appendix 3E. This plan specifies the mat reinforcing steel and sections addressed in Section 3E.4.1.1 of Appendix 3E.

The Seismic Category I UHS Tunnel Structures are described in detail in Section 3E.4 of Appendix 3E.}

3.8.4.2 Applicable Codes, Standards, and Specifications

No departures or supplements.

3.8.4.3 Loads and Load Combinations

The U.S. EPR FSAR includes the following COL Item in Section 3.8.4.3:

> A COL applicant that references the U.S. EPR design certification will confirm that site-specific loads lie within the standard design envelope for other Seismic Category I structures, or perform additional analyses to verify structural adequacy.

This COL Item is addressed as follows:

{FSAR Table 2.0-1 provides a comparison of NMP3NPP site parameters to the parameters defining the basis of the U.S. EPR FSAR design loads. The seismic Category 1 structures identified in Section 3.8.4 for NMP3NPP are designed to the load conditions as described in the U.S. EPR FSAR without departures, with the exception of loads resulting from the site-specific soil densities described in Section 2.5.4.2 and seismic response spectra and soil profiles described in Section 3.7.1.

Site-specific load conditions are confirmed to lie within the standard U.S. EPR design certification envelope, except for the design loads resulting from the NMP3NPP soil densities described in Section 2.5.4.2 and seismic response spectra and soil profiles described in Section 3.7.1.

The site-specific soil densities exceed the acceptable limits specified in the U.S. EPR FSAR, Section 2.5.4.2. The site-specific soil densities and the impact on the Lateral Earth Pressure Loads have been evaluated and are found to be acceptable for the Nuclear Island Common Basemat Structures and the ESWB. The EPGB is a surface mounted structure with no walls below grade; hence no additional evaluation is required for Lateral Earth Pressure Loads.

Additional confirmatory evaluation for the site-specific response spectra and soil profiles are performed and confirm that the Other Seismic Category I Structures are acceptable for the NMP3NPP site.

Site-specific parameters related to structural evaluations of the UHS Makeup Water Intake, UHS Tunnels and UHS Encasement Structures are bounded by the parameters defined for the U.S. EPR. The site parameters evaluated include: precipitation, snow, seismic, fault displacement potential, minimum bearing capacity, minimum shear wave velocity, potential for liquefaction, slope failure potential, maximum differential settlement, maximum ground water, maximum flood, wind including an importance and gust factors, tornado, temperature and potential for water freezing in the UHS Makeup Water Intake Forebay Structure.}

3.8.4.3.1 Design Loads

{No departures or supplements}

3.8.4.3.2 Loading Combinations

{No departures or supplements}

3.8.4.4 Design and Analysis Procedures

No departures or supplements.

3.8.4.4.1 General Procedures Applicable to Other Seismic Category I Structures

No departures or supplements.

3.8.4.4.2 Reactor Shield Building and Annulus, Fuel Building, and Safeguard Buildings – NI Common Basemat Structure Other Seismic Category I Structures

No departures or supplements.

3.8.4.4.3 Emergency Power Generating Buildings

No departures or supplements.

3.8.4.4.4 Essential Service Water Buildings

No departures or supplements.

3.8.4.4.5 Buried Conduit and Duct Banks, and Buried Pipe and Pipe Ducts

The U.S. EPR FSAR includes the following COL Items in Section 3.8.4.4.5:

> A COL applicant that references the U.S. EPR design certification will describe the design and analysis procedures used for buried conduit and duct banks, and buried pipe and pipe ducts.
>
> A COL applicant that references the U.S. EPR design certification will use results from site-specific investigations to determine the routing of buried pipe and pipe ducts.
>
> A COL applicant that references the U.S. EPR design certification will perform geotechnical engineering analyses to determine if the surface load will cause lateral or vertical

displacement of bearing soil for the buried pipe and pipe ducts and consider the effect of wide or extra heavy loads.

The COL Items identified above are addressed as follows:

{The design of Seismic Category I UHS Encasement Structures demonstrates sufficient strength to accommodate:

- Strains imposed by seismic ground motion
- Static surcharge loads due to vehicular loads (AASHTO HS-20 AASHTO, 2002)
- Static surface surcharge loads during construction activities, e.g., for equipment laydown or material laydown
- Tornado missiles (falling automobile)
- Ground water effects

Terrain topography and the results from the NMP3NPP geotechnical site investigation will be used as design input to confirm the routing of buried UHS Encasement Structures in Figure 3.8-1.

The design of buried UHS Encasement Structures including bending and axial stresses, stresses as well as the expansion joints is discussed in Section 3E.4 of Appendix 3E.

The bands for steel reinforcement are open ended to mitigate magnetic effects on the electrical conduits. Distribution of the transverse and longitudinal steel reinforcement is sufficient to maintain the structural integrity of the reinforced concrete encasement for all imposed loads, in accordance with ACI 349-01 (ACI, 2001).}

3.8.4.4.6 Design Report

No departures or supplements.

3.8.4.4.7 {UHS Makeup Water Intake Structure and UHS Tunnels

This section is added as a supplement to U.S. EPR FSAR Section 3.8.4.4.

A GT STRUDL finite element model is created for the site specific UHS Makeup Water Intake Structure to:

- Provide accurate representation of the behavior and response of the structure to the applied design loads.
- Conduct the analysis of the structure including static and equivalent static load analysis.
- Provide output results for the design of critical reinforced concrete structural elements.

The finite element model consists of SBHQ6 plate elements representing the load carrying reinforced concrete walls and slabs, which are suitable for capturing both in-plane and out-of-plane effects from the corresponding applied loads.

FSAR Figure 3.8-2 depicts the finite element model used for the UHS Makeup Water Intake Structure.

The finite element model applied loads included dead loads, live loads, snow loads, equipment loads, soil pressure, hydrodynamic impulsive and convective pressures, tornado wind, tornado missiles, tornado depressurization, wind loads, wave forces and the impact of differential temperature.

The results from the GT STRUDL analysis are used to design reinforced concrete shear walls and slabs according to the provisions of ACI 349-01 (ACI, 2001) (with supplemental guidance of Regulatory Guide 1.142 (NRC, 2001)) and ASCE 4-98 (ASCE, 2001).

The evaluation of walls and roof slab above the grade and heavy duty steel grating in the Forebay Structure for the impact of tornado load parameters is performed by manual calculations.

The design aspects for the UHS Tunnel Structures are discussed in detail in Section 3E.4 of Appendix 3E.}

3.8.4.5 Structural Acceptance Criteria

The U.S. EPR FSAR includes the following COL Item in Section 3.8.4.5:

> A COL applicant that references the U.S. EPR design certification will confirm that site-specific conditions for Seismic Category I buried conduit, electrical duct banks, pipe, and pipe ducts satisfy the criteria specified in Section 3.8.4.4.5 and those specified in AREVA NP Inc., U.S. Piping Analysis and Support Design Topical Report.

This COL Item is addressed as follows:

Design of all safety-related, Seismic Category I buried electrical duct banks and pipe meet the requirements specified in U.S. EPR FSAR Section 3.8.4.4.5 and the Areva NP Topical Report ANP-10264(NP) (AREVA, 2006).

Acceptance criteria for the buried electrical duct banks are in accordance with IEEE 628-2001(R2006) (IEEE, 2001), ASCE 4-98 (ASCE, 1998){(ASCE, 2001)} and ACI 349-01 (ACI, 2001a), with supplemental guidance of Regulatory Guide 1.142 (NRC, 2001). The use of ACI 349-01, in lieu of ACI 349-97 (ACI, 1997) as invoked in Subsection 4.9.4.15 of IEEE 628-2001 (R2006), is to provide a consistent design basis with all other Seismic Category I structures.

{Acceptance criteria for the buried UHS Encasement Structures are identical to those for UHS Makeup Water Intake Structure.

Section 3E.4 of Appendix 3E provides the details for the following critical locations:

- Base mat of the UHS Makeup Water Intake Structure.
- Typical wall for the UHS Makeup Water Intake Structure.
- UHS Tunnels.
- UHS Encasement.}

3.8.4.6 Materials, Quality Control, and Special Construction Techniques

No departures or supplements.

3.8.4.6.1 Materials

{The required concrete compressive strength for the UHS Makeup Water Structure, UHS Tunnel Structures and UHS Encasement Structures is:

Concrete minimum compressive strength fc' = 5,000 psi (34.5 MPa) at 28 days.}

3.8.4.6.2 Quality Control

No departures or supplements.

3.8.4.6.3 Special Construction Techniques

{Special construction techniques are not to be used for the UHS Makeup Water Intake Structure, UHS Tunnel Structures and UHS Encasement Structures.}

3.8.4.7 Testing and Inservice Inspection Requirements

{Inservice inspection requirements pertaining to ground water chemistry and protective waterproof membrane will be finalized during detailed design.}

3.8.5 FOUNDATIONS

3.8.5.1 Description of the Foundations

The U.S. EPR FSAR includes the following COL Item in Section 3.8.5.1:

> A COL applicant that references the U.S. EPR design certification will describe site-specific foundations for Seismic Category I structures that are not described in this section.

This COL Item is addressed as follows:

{The foundation for the UHS Makeup Water Intake Structure is discussed in Section 3.8.5.1.4.}

3.8.5.1.1 Nuclear Island Common Basemat Structure Foundation Basemat

No departures or supplements.

3.8.5.1.2 Emergency Power Generating Buildings Foundation Basemats

No departures or supplements.

3.8.5.1.3 Essential Service Water Buildings Foundation Basemats

No departures or supplements.

3.8.5.1.4 {UHS Makeup Water Intake Structure Basemat

This section is added as a supplement to the U.S. EPR FSAR.

Plan and section details for the UHS Makeup Water Intake Structure basemat are provided in Figures 9.2-4 and 9.2-5.

The reinforced concrete UHS Makeup Water Intake Structure basemat is nominally 112 ft (34.14 m) by 162 ft (49.38 m) by 3 ft (0.91 m) thick. Heavily reinforced concrete shear walls and divider walls below grade elevation function as bearing walls to transfer vertical loads from the walls and slabs at and above grade elevation 270 ft-0 in (82.3 m) to the UHS Makeup Water Intake Structure basemat.}

3.8.5.2 Applicable Codes, Standards, and Specifications

No departures or supplements.

3.8.5.3 Loads and Load Combinations

{No departures or supplements.}

3.8.5.4 Design and Analysis Procedures

No departures or supplements.

3.8.5.4.1 General Procedures Applicable to Seismic Category I Foundations

No departures or supplements.

3.8.5.4.2 Nuclear Island Common Basemat Structure Foundation Basemat

No departures or supplements.

3.8.5.4.3 Emergency Power Generating Buildings Foundation Basemats

No departures or supplements.

3.8.5.4.4 Essential Service Water Buildings Foundation Basemats

No departures or supplements.

3.8.5.4.5 Design Report

No departures or supplements.

3.8.5.4.6 {UHS Makeup Water Intake Structure Basemat

This section is added as a supplement to U.S. EPR FSAR Section 3.8.5.4.

The analytical process is described in detail in Section 3E.4 of Appendix 3E. An isometric view of a segment of the GT STRUDL model, including the basemat, exterior walls and divider walls, is provided in Figure 3.8-2.

The finite element model representing the UHS Makeup Water Intake Structure basemat consists of SBHQ6 rectangular plate elements, each with six degrees of freedom. This element type is capable of capturing both in-plane and out-of-plane behavior.

During maintenance within the UHS Makeup Water Intake Structure, when stop logs are in place, the interior or exterior cells may be empty. This postulated scenario and the loads transferred from the divider walls to the UHS Makeup Water Intake Structure basemat is accounted for in the GT STRUDL analysis.}

3.8.5.5 Structural Acceptance Criteria

The U.S. EPR FSAR includes the following COL Item in Section 3.8.5.5:

> A COL applicant that references the U.S. EPR design certification will evaluate site-specific methods for shear transfer between the foundation basemats and underlying soil for soil parameters that are not within the envelope specified in Section 2.5.4.2.

This COL Item is addressed as follows:

{The U.S. EPR FSAR, Section 3.8.5.5, is incorporated by reference with the following supplemental information.

The Nuclear Island (NI) Common Basemat structure is founded on bedrock and the independent foundations of the Emergency Power Generating Buildings (EPGBs) and Essential Service Water Building (ESWBs) are founded on bedrock or concrete fill on top of bedrock that meet the requirements specified in U.S. EPR FSAR Section 2.5.4.2. Shear keys will be used as necessary to provide shear transfer from structure foundations to concrete fill.

Site-specific Seismic Category I structures, outside the standard U.S. EPR design, are founded on soil that meet the requirements specified in U.S. EPR FSAR, Section 2.5.4.2.

For the site specific UHS Makeup Water Intake Structure, the analysis considers shear transfer of loads from the base mat to the underlying soil via:

- Friction between the basemat and the mud mat.
- Friction between the mud mat and the underlying rock layer

Coefficient of friction at the concrete-rock interfaces is 0.6 which envelopes U.S. EPR FSAR value of 0.7.}

3.8.5.5.1 Nuclear Island Common Basemat Structure Foundation Basemat

{U.S. EPR FSAR, Section 2.5.4.2, states acceptable limits and ranges of soil properties underlying the foundation structure.

- The angle of internal friction for the underlying bedrock, in contact with the NI Common Basemat foundation, falls within the U.S. EPR FSAR limits.
- The sliding and overturning of the NI Common Basemat Structure, when subjected to a load combination with seismic loading, is within the U.S. EPR FSAR limits.
- The allowable bearing pressure of the bedrock underlying the NI Common Basemat is within the U.S. EPR FSAR limits.
- The settlement of the NI Common Basemat Structure is within the U.S. EPR FSAR limits.}

3.8.5.5.2 Emergency Power Generating Buildings Foundation Basemats

{The standard U.S. EPR FSAR Section 2.5.4.2 states acceptable limits and ranges of soil properties underlying the foundation structure.

- The angle of internal friction for the underlying bedrock, in contact with the EPGB basemat and concrete fill, falls within the U.S. EPR FSAR limits.
- The sliding and overturning of the EPGB, when subjected to a load combination with seismic loading, is within the U.S. EPR FSAR limits.
- The allowable bearing pressure of the bedrock, underlying the EPGB basemat and concrete fill, is within the U.S. EPR FSAR limits.
- The settlement of the EPGB structures is within the U.S. EPR FSAR limits.}

3.8.5.5.3 Essential Service Water Buildings Foundation Basemats

{The standard U.S. EPR FSAR Section 2.5.4.2 states acceptable limits and ranges of soil properties underlying the foundation structure.

- The angle of internal friction for the underlying bedrock, in contact with the ESWB basemat and concrete fill, falls within the U.S. EPR FSAR limits.
- The allowable bearing pressure of the bedrock, underlying the ESWB basemat and concrete fill, is within the U.S. EPR FSAR limits.
- The settlement of the ESWB structures is within the U.S. EPR FSAR limits.}

3.8.5.5.4 {UHS Makeup Water Intake Structure Basemat

Section 3E.4 of Appendix 3E provides details of the base mat design for the UHS Makeup Water Intake Structure.

Maximum soil bearing pressures under the UHS Makeup Water Intake Structure foundation are provided in Table 3.8-1. In the same table, calculated and allowable stability Factors of Safety (FS) are provided for the governing extreme environmental event (SSE) and normal design load combinations.

Differential settlements across the UHS Makeup Water Intake Structure basemat are within the U.S. EPR FSAR differential settlement criteria of 1/1200.

Section 3E.4 of Appendix 3E provides details of foundation bearing pressure and stability analysis of the UHS Makeup Water Intake Structure basemat.}

3.8.5.6 Materials, Quality Control, and Special Construction Techniques

No departures or supplements.

3.8.5.6.1 Materials

The U.S. EPR FSAR includes the following COL Item in Section 3.8.5.6.1:

> A COL applicant that references the U.S. EPR design certification will evaluate and identify the need for the use of waterproofing membranes and epoxy coated rebar based on site-specific ground water conditions.

This COL Item is addressed as follows:

{The U.S. EPR FSAR, Section 3.8.5.6.1, is incorporated by reference with the following supplemental information.

The static elevation of groundwater in the Oswego Sandstone is greater than 3.3 ft (1.0 m) below the proposed final grade elevation of the NI. The final grade elevation is expected to be 270 feet, which yields a maximum groundwater elevation at the NMP3NPP Nuclear Island of approximately 267 feet.

The Nuclear Island common basemat foundation is embedded approximately 40 feet below site grade as discussed in the U.S. EPR FSAR, therefore, approximately 37 feet of the reinforced concrete foundation is submerged in water. The Essential Service Water Buildings (ESWB) foundations are embedded approximately 22 ft below site grade and the Emergency Power Generator Building (EPGB) foundation is embedded approximately 5 ft below site grade, as discussed in the U.S. EPR FSAR. Therefore, approximately 19 ft of the reinforced concrete ESWB foundation is submerged in water, and approximately 2 feet of the reinforced concrete foundation of the EPGB foundation is submerged in water.

The maximum chloride content of 210 mg/L (ppm), detected at the vicinity of the NI of NMP3NPP site lies within the range of 0 to 500 ppm and is within limitations for non-aggressive groundwater.

The maximum sulfate content for groundwater tested at the NMP3NPP site is 240 mg/L (ppm). This falls between 0 and 1500 ppm, and the sulfate exposure in the groundwater is considered to be non-aggressive.

The pH range for the groundwater at the NMP3NPP site is between 6.66 and 12.22, which is considered to be neutral and non-aggressive. A site which has a groundwater pH value >5.5 has non-aggressive groundwater.

Based on these findings, there is no concern for an aggressive chemical attack due to groundwater at the NMP3NPP site. Therefore, the use of epoxy coated rebar and waterproofing membranes for the resistance of corrosive materials is not required for the NMP3NPP site.

For the UHS Makeup Water Intake Structure, the requirements related to waterproofing membrane/ barrier will be finalized during the detailed design.

The minimum compressive strength (fc′) for UHS Makeup Water Intake Structure basemat is fc′ = 5,000 psi (34.5 MPa) at 28 days.}

3.8.5.6.2 Quality Control

No departures or supplements.

3.8.5.6.3 Special Construction Techniques

{No departures or supplements. Special construction techniques are not expected to be used for the UHS Makeup Water Intake Structure basemat.}

3.8.5.7 Testing and Inservice Inspection Requirements

The U.S. EPR FSAR includes the following COL Items in Section 3.8.5.7:

A COL applicant that references the U.S. EPR design certification will identify if any site-specific settlement monitoring requirements for Seismic Category I foundations are required based on site-specific soil conditions.

A COL applicant that references the U.S. EPR design certification will describe the program to examine inaccessible portions of below-grade concrete structures for degradation and monitoring of groundwater chemistry.

These COL Items are addressed as follows:

{The U.S. EPR FSAR, Section 3.8.5.7, is incorporated by reference with the following supplemental information.

Although settlement and differential settlement of foundations are not likely to affect the structures, systems, and components that make up the standard plant U.S. EPR, or the site-specific UHS Makeup Water Intake Structure, due to the robust design of all Seismic Category I structures, a site specific settlement monitoring program is required as a prudent measure of confirmation between expected or predicted settlement and actual field measured settlement values.

The settlement monitoring program employs conventional monitoring methods using standard surveying equipment and concrete embedded survey markers. Survey markers are embedded in the concrete structures during construction and located in conspicuous locations above grade for measurement purposes throughout the service life of the plant as necessary. Actual field settlement is determined by measuring the elevation of the marker relative to a reference elevation datum. The reference datum selected is located away from areas susceptible to vertical ground movement and loads. If field measured settlements are found to be trending greater than expected values, an evaluation will be conducted to ensure compliance with design basis requirements.

The settlement monitoring program satisfies the requirements for monitoring the effectiveness of maintenance specified in 10 CFR 50.65(a)(2)(CFR, 2008) and Regulatory Guide 1.160, C.1.5, (NRC, 1997) as applicable to structures.

The NMP3NPP groundwater monitoring program is established on the following basis:

Recorded baseline concentrations and pH values of all material chemical properties prior to start of excavation.

- Recorded concentrations and values of material chemical properties after backfill is completed and at six month intervals thereafter.
- One year post backfill:
    - If a no negative trend is identified, the inspection can be increased to once yearly.
    - If a negative trend is identified, potential groundwater remediation measures will be considered as indicated by the results of the inspection.

The NMP3NPP groundwater is considered to be non-aggressive. The in-service testing program will follow the non-aggressive soil/water intervals for inspecting normally inaccessible below-grade concrete walls and foundations. This interval calls for (1) examine the exposed portions of below-grade concrete for signs of degradation, when excavated for any reason, and (2) conduct periodic site monitoring of groundwater chemistry to confirm that the groundwater remains non-aggressive.

Waterproofing membrane/ barrier requirements for the UHS Makeup Water Intake Structure will be finalized during detailed design.}

3.8.6 REFERENCES

{**ACI, 1997.** Code Requirements for Nuclear Safety-Related Concrete Structures, ACI 349-97, American Concrete Institute, 1997.

ACI, 2001a. Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary on Code Requirements for Nuclear Safety-Related Concrete Structures, ACI 349-01/349-R01, American Concrete Institute, 2001.

AREVA, 2006. U. S. EPR Piping Analysis and Pipe Support Design, Revision 0, AREVA NP Inc., September 2006.

ASCE, 1998. Seismic Analysis of Safety-Related Nuclear Structures and Commentary, ASCE 4-98, American Society of Civil Engineers, 1998.

ASCE, 2001. Seismic Analysis of Safety-Related Nuclear Structures and Commentary, ASCE 4-98, including the 2001.01.01 edition, American Society of Civil Engineers, 2001.

CFR, 2008. Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, Title 10, Code of Federal Regulations, Part 50.65, 2008.

IEEE, 2001. Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations, IEEE 628-2001, IEEE, 2001.

NRC, 1997. Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, Regulatory Guide 1.160, Revision 2, U.S. Nuclear Regulatory Commission, March 1997.

NRC, 2001. Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments), Regulatory Guide 1.142, Revision 2, U.S. Nuclear Regulatory Commission, November 2001.}

Table 3.8-1—{Foundation Basemat Summary Table for the UHS Makeup Water Intake Structure}

	Bearing Pressure (Static)	Bearing Pressure (dynamic)	FS, SSE (Sliding)	FS, SSE (overturning)
Calculated Bearing Pressure	4.97 ksf	7.3 ksf	>2.0	>2.0
Allowable Bearing Pressure/ Required FS	20 ksf	20 ksf	2	2

Figure 3.8-1—{Schematic Site Plan of Seismic Category I Buried Utilities (Concrete Encasement)}

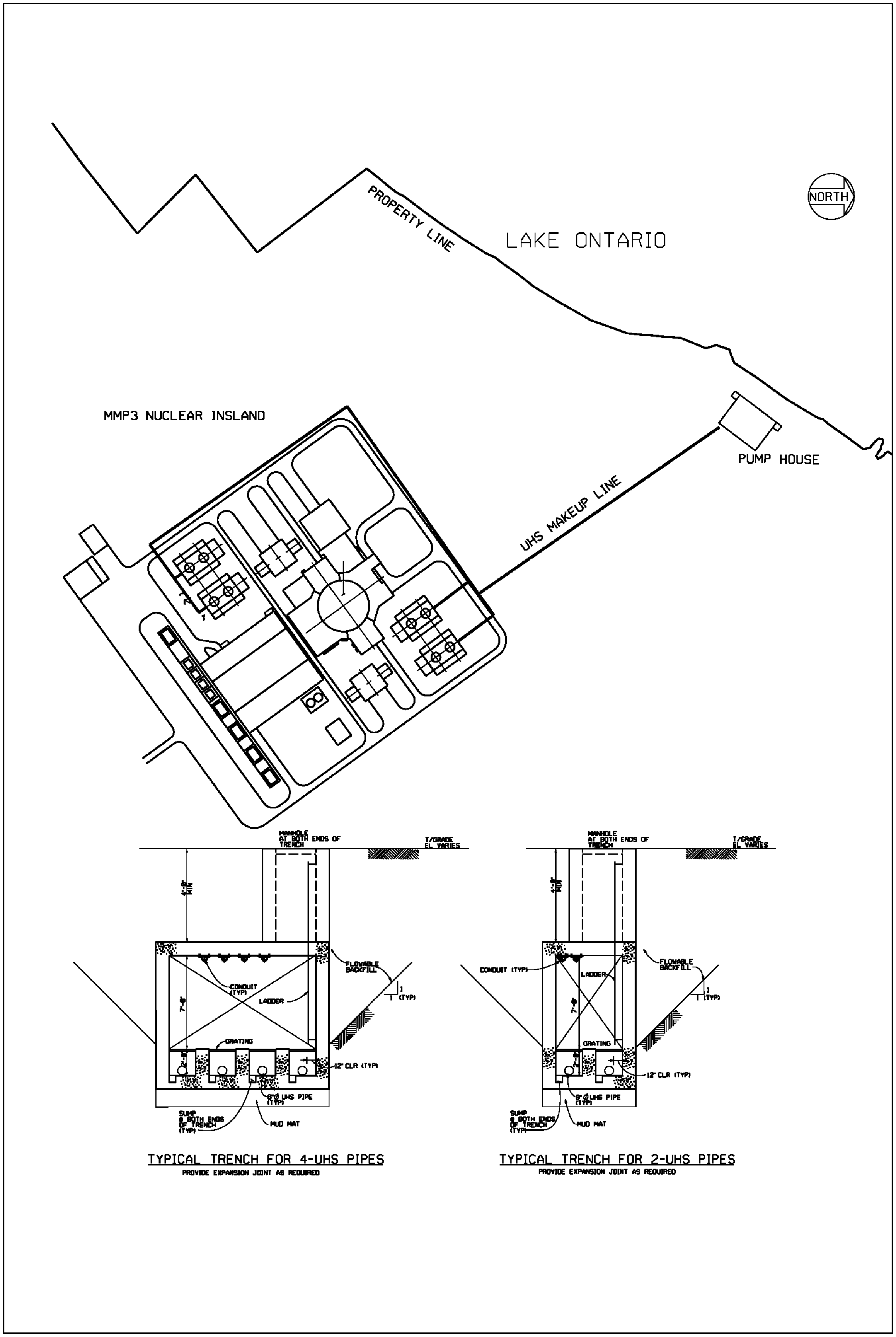
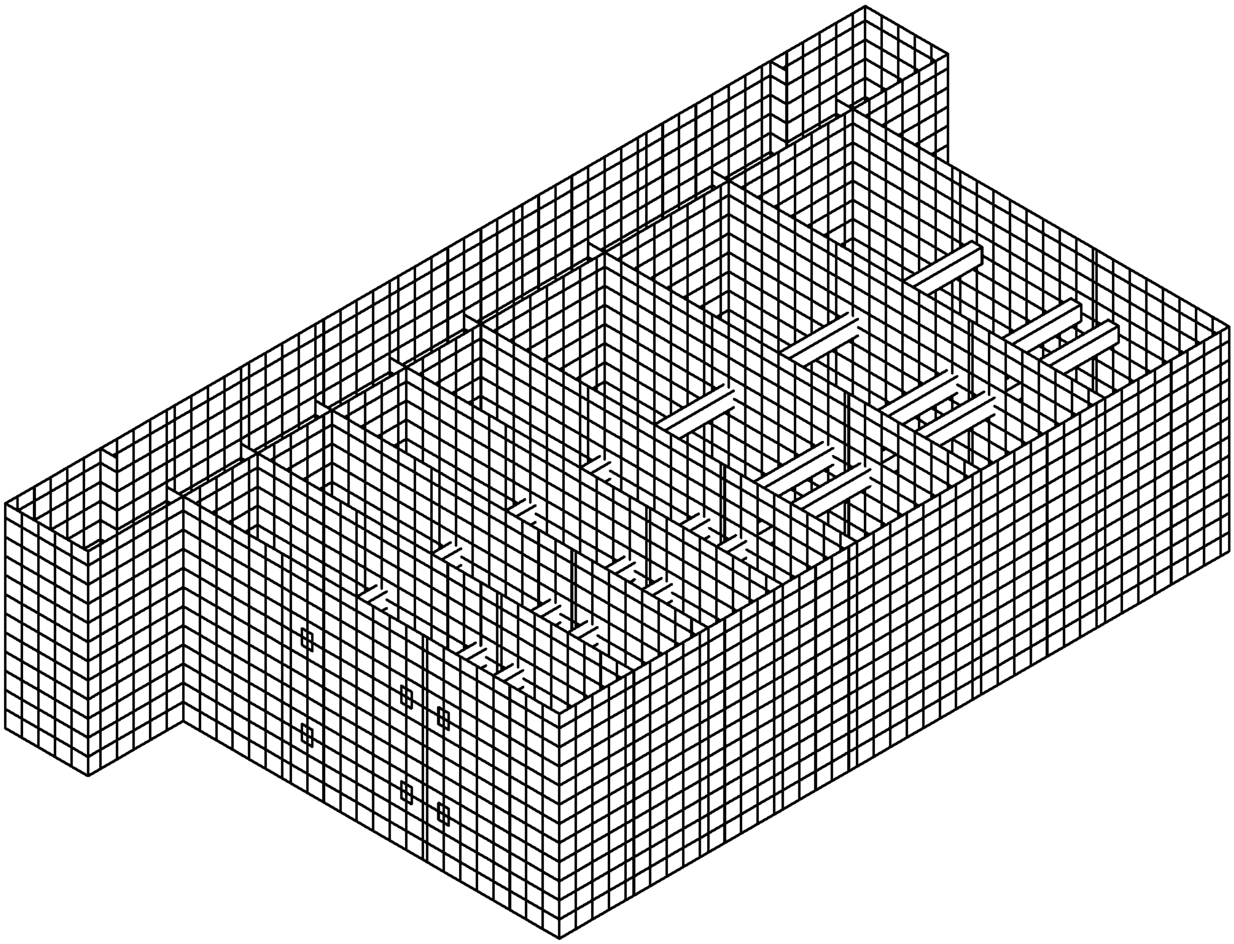


Figure 3.8-2—{Isometric Northeast View of the GT STRUDL Finite Element Model for the UHS Makeup Water Structure (partial view of basemat, exterior walls, interior divider walls and interior beams)}



3.9 MECHANICAL SYSTEMS AND COMPONENTS

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.9.1 SPECIAL TOPICS FOR MECHANICAL COMPONENTS

No departures or supplements.

3.9.1.1 Design Transients

No departures or supplements.

3.9.1.2 Computer Programs Used in Analyses

The U.S. EPR FSAR includes the following COL Items in Section 3.9.1.2:

> Pipe stress and support analysis will be performed by a COL applicant that references the U.S. EPR design certification.
>
> A COL applicant that references the U.S. EPR design certification will either use a piping analysis program based on the computer codes described in Section 3.9.1 and Appendix 3C or will implement an NRC-approved benchmark program using models specifically selected for the U.S. EPR.

These COL Items are addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall perform the required pipe stress and support analysis and shall utilize a piping analysis program based on the computer codes described in U.S. EPR FSAR Section 3.9.1 and U.S. EPR FSAR Appendix 3C.

3.9.1.3 Experimental Stress Analysis

No departures or supplements.

3.9.1.4 Considerations for the Evaluation of the Faulted Condition

No departures or supplements.

3.9.1.5 References

No departures or supplements.

3.9.2 DYNAMIC TESTING AND ANALYSIS OF SYSTEMS, COMPONENTS, AND EQUIPMENT

No departures or supplements.

3.9.2.1 Piping Vibration, Thermal Expansion, and Dynamic Effects

No departures or supplements.

3.9.2.2 Seismic Analysis and Qualification of Seismic Category I Mechanical Equipment

No departures or supplements.

3.9.2.3 Dynamic Response Analysis of Reactor Internals Under Operational Flow Transients and Steady-State Conditions

No departures or supplements.

3.9.2.4 Preoperational Flow-Induced Vibration Testing of Reactor Internals

The U.S. EPR FSAR includes the following COL Item in Section 3.9.2.4:

> A COL applicant that references the U.S. EPR design certification will submit the results from the vibration assessment program for the U.S. EPR RPV internals, in accordance with Regulatory Guide 1.20.

In addition, Section 3.9.2.4 of Regulatory Guide 1.206 (NRC, 2007b) requests the following information for COL applicants with a prototype reactor:

> For a prototype reactor, if the FIV testing of reactor internals is incomplete at the time the COL application is filed, the applicant should provide documentation describing the implementation program, including milestones, completion dates and expected conclusions.

The COL Item and Regulatory Guide 1.206 request are addressed as follows:

{The U. S. EPR FSAR designates the Reactor Pressure Vessel (RPV) internals as a prototype design in accordance with the guidance of Regulatory Guide 1.20 (NRC, 2007a). The NMP3NPP RPV internals are currently classified as the U.S. EPR prototype for RPV internals testing. However, should a comprehensive vibration assessment program for an EPR unit other than NMP3NPP be completed and approved by the U.S Nuclear Regulatory Commission prior to initiation of start-up testing at NMP3NPP, NMP3NPP will be reclassified as a non-prototype Category I RPV internals design and the associated experimental and/or analytical justification, including any required changes to the comprehensive vibration assessment program, will be provided to the U.S Nuclear Regulatory Commission for review and approval.

A methodology for the comprehensive vibration assessment program that the U.S. Nuclear Regulatory Commission considers acceptable for use is provided in Regulatory Guide 1.20 and shall be utilized at NMP3NPP. For NMP3NPP, performance of vibration testing during Hot Functional Testing, and associated field testing, shall be as described in U.S. EPR FSAR Section 3.9.2.4 and in accordance with the Hot Functional Testing milestone identified in U.S. EPR FSAR Figure 14.2-1.

The visual inspection plan of the comprehensive vibration assessment program to be used for the prototype RPV internals at NMP3NPP involves performance of visual inspections before and after the preoperational tests of the RPV internals. These visual examinations are concerned with the accessible areas of the RPV internals, and in particular the fastening devices, the bearings surfaces, the interfaces between the RPV internals parts that are likely to experience relative motions, and the inside of the RPV. The visual inspections of the lower and upper RPV internals shall be performed at NMP3NPP as described in U.S. EPR FSAR Tables 3.9.2-1 through 3.9.2-5.

The activities and milestones for implementation of the comprehensive vibration assessment program at NMP3NPP are as follows.

- A summary of the vibration analysis program, including a description of the vibration measurement and inspection phases, shall be provided to the U.S. Nuclear Regulatory Commission at least 120 days prior to initiation of Hot Functional Testing (i.e., 15 months prior to commercial operation).

- Visual inspections of the RPV internals shall be performed prior to initiation of Hot Functional Testing.

- Vibration testing shall be performed during Hot Functional Testing (i.e., 11 months prior to commercial operation).

- Visual inspections of the RPV internals shall be performed after completion of Hot Functional Testing.

- The preliminary and final comprehensive vibration assessment reports, which together summarize the results of the vibration analysis, measurement, and inspection programs (including correlation of analysis and test results), shall be submitted to the U.S. Nuclear Regulatory Commission at least 30 days prior to initial fuel loading (i.e., 9 months prior to commercial operation) and at least 30 days prior to initial criticality (i.e., 7 months prior to commercial operation), respectively. This schedule is within the Regulatory Guide 1.20 request to submit these reports within 60 and 180 days, respectively, following the completion of vibration testing.

These milestones are aligned with the milestones set forth in U. S. EPR FSAR Section 14.2 for the initial plant test program. The expected date for the start of commercial operation at NMP3NPP is December 31, 2016.}

3.9.2.5 Dynamic System Analysis of the Reactor Internals Under Faulted Conditions

No departures or supplements.

3.9.2.6 Correlations of Reactor Internals Vibration Tests with the Analytical Results

No departures or supplements.

3.9.2.7 References

{**NRC, 2007a.** Comprehensive Vibration Assessment Program for Reactor Internals during Preoperational And Initial Startup Testing, Regulatory Guide 1.20, Revision 3, U.S. Nuclear Regulatory Commission, March 2007.

NRC, 2007b. Combined License Applications for Nuclear Power Plants (LWR Edition), Regulatory Guide 1.206, Revision 0, U. S. Nuclear Regulatory Commission, June 2007.}

3.9.3 ASME CODE CLASS 1, 2, AND 3 COMPONENTS, COMPONENT SUPPORTS, AND CORE SUPPORT STRUCTURES

The U.S. EPR FSAR includes the following COL Item in Section 3.9.3:

> A COL applicant that references the U.S. EPR design certification will prepare the design specifications and design reports for ASME Class 1, 2, and 3 components, piping, supports, and core support structures that comply with and are certified to the requirements of Section III of the ASME Code.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall prepare the design specifications and design reports for ASME Class 1, 2, and 3 components that comply with and are certified to the requirements of Section III of the ASME Code (ASME, 2004). The design specifications shall be prepared prior to procurement of the components while the ASME code reports shall be prepared during as-built reconciliation of the systems and components conducted prior to fuel load.

3.9.3.1 Loading Combinations, System Operating Transients, and Stress Limits

The U.S. EPR FSAR includes the following COL Item in Section 3.9.3.1:

> A COL applicant that references the U.S. EPR design certification will provide a summary of the maximum total stress, deformation (where applicable), and cumulative usage factor values for each of the component operating conditions for ASME Code Class 1 components. For those values that differ from the allowable limits by less than 10 percent, the COL applicant will provide the contribution of each of the loading categories (e.g., seismic, pipe rupture, dead weight, pressure, and thermal) to the total stress for each maximum stress value identified in this range.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services shall provide a summary of the maximum total stress, deformation (where applicable), and cumulative usage factor values for each of the component operating conditions for ASME Code Class 1 components. For those values that differ from the allowable limits by less than 10 percent, Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services shall provide the contribution of each of the loading categories (e.g., seismic, pipe rupture, dead weight, pressure, and thermal) to the total stress for each maximum stress value identified in this range. This information shall be supplied prior to procurement of the ASME Code Class 1 components.}

3.9.3.1.1 Loads for Components, Component Supports, and Core Support Structures

The U.S. EPR FSAR includes the following COL Item in Section 3.9.3.1.1:

> As noted in ANP-10264(NP), should a COL applicant that references the U.S. EPR design certification find it necessary to route Class 1, 2, and 3 piping not included in the U.S. EPR design certification so that it is exposed to wind and tornadoes, the design must withstand the plant design-bases loads for this event.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall route Class 1, 2, or 3 piping not included in the U.S. EPR design certification in a manner so that it is not exposed to wind or tornadoes.

The U.S. EPR FSAR includes the following COL Items in Section 3.9.3.1.1:

> As noted in ANP-10264(NP), a COL applicant that references the U.S. EPR design certification will confirm that thermal deflections do not create adverse conditions during hot functional testing.

A COL applicant that references the U.S. EPR design certification will examine the feedwater line welds after hot functional testing prior to fuel loading and at the first refueling outage, in accordance with NRC Bulletin 79-13. A COL applicant that references the U.S. EPR design certification will report the results of inspections to the NRC, in accordance with NRC Bulletin 79-13.

These COL Items are addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall:

- Confirm that thermal deflections do not create adverse conditions during hot functional testing.
- Examine the feedwater line welds after hot functional testing prior to fuel loading and at the first refueling outage, and will report the results of the inspections to the U.S. Nuclear Regulatory Commission, in accordance with NRC Bulletin 79-13 (NRC, 1979).

3.9.3.1.2 Load Combinations and Stress Limits for Class 1 Components

No departures or supplements.

3.9.3.1.3 Load Combinations and Stress Limits for Class 2 and 3 Components

No departures or supplements.

3.9.3.1.4 Load Combinations and Stress Limits for Class 1 Piping

No departures or supplements.

3.9.3.1.5 Load Combinations and Stress Limits for Class 2 and 3 Piping

No departures or supplements.

3.9.3.1.6 Load Combinations and Stress Limits for Core Support Structures

No departures or supplements.

3.9.3.1.7 Load Combinations and Stress Limits for Class 1, 2 and 3 Component Supports

No departures or supplements.

3.9.3.1.8 Load Combinations and Stress Limits for Class 1, 2 and 3 Pipe Supports

No departures or supplements.

3.9.3.1.9 Piping Functionality

No departures or supplements.

3.9.3.2 Design and Installation of Pressure-Relief Devices

No departures or supplements.

3.9.3.3 Pump and Valve Operability Assurance

No departures or supplements.

3.9.3.4 Component Supports

No departures or supplements.

3.9.3.5 References

{**ASME, 2004.** Rules for Construction of Nuclear Facility Components, ASME Boiler and Pressure Vessel Code, Section III, The American Society of Mechanical Engineers, 2004 edition.

NRC, 1979. Cracking in Feedwater System Piping, NRC Bulletin 79-13, Revision 2, U.S. Nuclear Regulatory Commission, October 16, 1979.}

3.9.4 CONTROL ROD DRIVE SYSTEM

No departures or supplements.

3.9.5 REACTOR PRESSURE VESSEL INTERNALS

No departures or supplements.

3.9.6 FUNCTIONAL DESIGN, QUALIFICATION, AND INSERVICE TESTING PROGRAMS FOR PUMPS, VALVES, AND DYNAMIC RESTRAINTS

The U.S. EPR FSAR includes the following COL Items in Section 3.9.6:

> A COL applicant that references the U.S. EPR design certification will submit the PST program and IST program for pumps, valves, and snubbers as required by 10 CFR 50.55a.
>
> A COL applicant that references the U.S. EPR design certification will identify the implementation milestones and applicable ASME OM Code for the preservice and inservice examination and testing programs. These programs will be consistent with the requirements in the latest edition and addenda of the OM Code incorporated by reference in 10 CFR 50.55a on the date 12 months before the date for initial fuel load.

These COL Items are addressed as follows:

{The UHS Makeup Water System is a site-specific safety-related system that is subject to preservice testing (PST) and inservice testing (IST) program requirements identified in 10 CFR 50.55a (CFR, 2008). This system's pumps, valves and piping components included in these testing programs are provided in Table 3.9-1 and Table 3.9-2. There are no snubbers in the UHS Makeup Water System.}

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall submit the PST and IST programs prior to performing the tests and following the start of construction and prior to the anticipated date of commercial operation, respectively. The implementation milestones for these programs are provided in Table 13.4-1. These programs shall include the implementation milestones and applicable ASME OM Code (ASME, 2004b) and shall be consistent with the requirements in the latest edition and addenda of the OM Code incorporated by reference in 10 CFR 50.55a (CFR, 2008) on the date 12 months before the date for initial fuel load.

3.9.6.1 Functional Design and Qualification of Pumps, Valves, and Dynamic Restraints

{The UHS Makeup Water System, including the individual components and the UHS Makeup Water Intake Structure, are designed, manufactured, tested, and installed in such fashion as to ensure and facilitate actual demonstration of design basis performance.

Component design considerations include function and performance requirements that support the overall system performance, as well as materials of construction, wear tolerances, and configuration that are selected to assure accommodation of service limits and the required component longevity. In addition, provisions are designed in as necessary for measuring or examining component characteristics such as vibration, bearing temperatures, or pressure boundary thickness, using either permanent or temporary equipment, to demonstrate during actual operating conditions that they are within the design tolerances.

Component manufacturing is accomplished in accordance with quality program requirements that verify component physical and material requirements. Pre-approved performance test procedures are used by the manufacturer to demonstrate/verify that actual component capabilities meet design requirements.

The UHS Makeup Water System layout is completed with consideration of maintenance and repair efforts, parameters to be monitored during operation, and periodic inspection and testing. Accordingly, sufficient space is allocated around components, system test connections are accessible, and the test bypass line is designed specifically for demonstration of the system's maximum flow rate at design conditions as specified in the plant accident analyses. There are no snubbers incorporated into this system.

The UHS Makeup Water System pumps, valves and piping components will incorporate the necessary test and monitoring connections to demonstrate the capacity of the pumps and valves to perform their intended function through the full range of system differential pressures and flows at ambient temperatures and available voltages.

Particular attention will be given to flow-induced loading in functional design and qualification to degraded flow conditions to account for the presence of debris, impurities, and contaminants in the fluid system.}

3.9.6.2 Inservice Testing Program for Pumps

The U.S. EPR FSAR includes the following COL Items in Section 3.9.6.2:

> A COL applicant that references the U.S. EPR design certification will identify any additional site-specific pumps in Table 3.9.6-1 to be included within the scope of the IST program.

This COL Item is addressed as follows:

Table 3.9-1 identifies the additional site-specific pumps that are included within the scope of the IST program.

3.9.6.3 Inservice Testing Program for Valves

The U.S. EPR FSAR includes the following COL Items in Section 3.9.6.3:

> A COL applicant that references the U.S. EPR design certification will identify any additional site-specific valves in Table 3.9.6-2 to be included within the scope of the IST program.

This COL Item is addressed as follows:

Table 3.9-2 identifies the additional site-specific valves that are included within the scope of the IST program.

In addition, the following supplement to U.S. EPR FSAR Section 3.9.6.3 is provided:

{The UHS Makeup Water System Class 3 site-specific valves (motor-operated, manually-operated, check, safety, and relief valves) will be tested in accordance with ASME OM 2004 code, section ISTC (ASME, 2004b).}

3.9.6.3.1 Inservice Testing Program for Motor-Operated Valves

No departures or supplements.

3.9.6.3.2 Inservice Testing Program for Power-Operated Valves Other Than MOVs

{There are no power-operated valves in the UHS Makeup Water System, other than the MOVs.}

3.9.6.3.3 Inservice Testing Program for Check Valves

No departures or supplements.

3.9.6.3.4 Pressure Isolation Valve Leak Testing

No departures or supplements.

3.9.6.3.5 Containment Isolation Valve Leak Testing

{There are no Class 3 site-specific containment isolation valves in the UHS Makeup Water System.}

3.9.6.3.6 Inservice Testing Program for Safety and Relief Valves

No departures or supplements.

3.9.6.3.7 Inservice Testing Program for Manually Operated Valves

No departures or supplements.

3.9.6.3.8 Inservice Testing Program for Explosively Actuated Valves

{There are no Class 3 site-specific explosively actuated valves in the UHS Makeup Water System.}

3.9.6.4 Inservice Testing Program for Dynamic Restraints

The U.S. EPR FSAR includes the following COL Item in Section 3.9.6.4:

> A COL applicant that references the U.S. EPR design certification will provide a table identifying the safety-related systems and components that use snubbers in their support systems, including the number of snubbers, type (hydraulic or mechanical), applicable standard, and function (shock, vibration, or dual-purpose snubber). For snubbers identified as either a dual-purpose or vibration arrester type, the COL applicant shall indicate whether the snubber or component was evaluated for fatigue strength. Per ASME Code Section III, Subsection NF, the fatigue evaluation is not required for shock snubbers.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall provide a table identifying the safety-related systems and components that use snubbers in their support systems, including the number of snubbers, type (hydraulic or mechanical), applicable standard, and function (shock, vibration, or dual-purpose snubber). For snubbers identified as either a dual-purpose or vibration arrester type, {Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall denote whether the snubber or component was evaluated for fatigue strength. Per ASME Section III, Subsection NF (ASME, 2004a), the fatigue evaluation shall not be required for shock snubbers. This information shall be provided prior to installation of any of the snubbers.

{The UHS Makeup Water System does not incorporate snubbers in the system design.}

3.9.6.5 Relief Requests and Alternative Authorizations to the OM Code

No departures or supplements.

3.9.6.6 References

{**ASME, 2004a.** Rules for Construction of Nuclear Facility Components, ASME Boiler and Pressure Vessel Code, Section III, The American Society of Mechanical Engineers, 2004 edition.

ASME, 2004b. Code for Operation and Maintenance of Nuclear Power Plants, ASME OM Code, The American Society of Mechanical Engineers, 2004 edition.

CFR, 2008. Codes and Standards, Title 10, Code of Federal Regulations, Part 50.55a, U. S. Nuclear Regulatory Commission, 2008.}

Table 3.9-1—{Site-Specific Inservice Pump Testing Program Requirements}

Pump ID [8]	Description	Pump Type	ASME Code Class	ASME Code Group	Testing and Frequency [6, 9]				
					Rotational Speed [4]	Pump Discharge Pressure [2]	Differential Pressure	Flow Rate	Vibration [5]
30GFA10AP001	Ultimate Heat Sink (UHS) Makeup Water Pump for Train 1	Vertical Solid Shaft	3	B	N/A[1]	N/A	Q/2Y	Q/2Y	Q/2Y
30GFA20AP001	Ultimate Heat Sink (UHS) Makeup Water Pump for Train 2	Vertical Solid Shaft	3	B	N/A[1]	N/A	Q/2Y	Q/2Y	Q/2Y
30GFA30AP001	Ultimate Heat Sink (UHS) Makeup Water Pump for Train 3	Vertical Solid Shaft	3	B	N/A[1]	N/A	Q/2Y	Q/2Y	Q/2Y
30GFA40AP001	Ultimate Heat Sink (UHS) Makeup Water Pump for Train 4	Vertical Solid Shaft	3	B	N/A[1]	N/A	Q/2Y	Q/2Y	Q/2Y

Notes:

1. Pump is directly coupled to a constant speed synchronous or induction type driver.
2. Discharge pressure is a required parameter for positive displacement pumps only.
3. Variable speed pumps only.
4. Displacement or velocity.
5. Tests and their frequency are in accordance with the ASME OM code, Subsection ISTB.
6. The U. S. EPR subscribes to the Kraftworks Kennzeichen System (KKS) for coding and nomenclature of SSCs.
9. Group B pumps go through a Quarterly Group B Test Procedure (ISTB-5122) and biennially Comprehensive test (ISTB-5123).

Table 3.9-2—{Site-Specific Inservice Valve Testing Program Requirements}
(Page 1 of 5)

Valve Identification Number [1]	Description /Valve Function	Valve Type[2]	Valve Actuator [3]	ASME Code Class [4]	ASME OM Code Category [5]	Active/ Passive[6]	Safety Position [7]	Test Required [8]	Test Frequency [9]	Comments
30GFA10AA201	UHS Makeup Water Pump 1 Check Valve	CK	SA	3	C	P	O	ET PI	Q 2Y	
30GFA10AA011	UHS Makeup Water Pump 1 Discharge Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA002	UHS Makeup Water Train 1 Isolation Valve Upstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA009	UHS Makeup Water Train 1 Isolation Valve Downstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA001	UHS Makeup Water Train 1 Isolation Valve Upstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA010	UHS Makeup Water Train 1 Isolation Valve Downstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA030	UHS Makeup Water Pump 1 Min. Flow Recirculation Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA601	UHS Makeup Water Train 1 Sample Line Valve	GB	MA	3	A	A	C	ET PI	Q 2Y	
30GFA10AA251	UHS Makeup Water Train 1 Isolation Valve Upstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA10AA101	UHS Makeup Water Train 1 Flow Control Valve	GB	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA252	UHS Makeup Water Train 1 Isolation Valve Downstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA10AA013	UHS Makeup Water Train 1 Flow Control Valve Bypass Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA10AA020	UHS Makeup Water Train 1 Test Bypass Isolation Valve	BF	MO	3	A	A	C	ET PI	Q 2Y	
30GFA20AA201	UHS Makeup Water Pump 2 Check Valve	CK	SA	3	C	P	O	ET PI	Q 2Y	

Table 3.9-2—{Site-Specific Inservice Valve Testing Program Requirements}

(Page 2 of 5)

Valve Identification Number [1]	Description /Valve Function	Valve Type[2]	Valve Actuator [3]	ASME Code Class [4]	ASME OM Code Category [5]	Active/ Passive[6]	Safety Position [7]	Test Required [8]	Test Frequency [9]	Comments
30GFA20AA011	UHS Makeup Water Pump 2 Discharge Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA002	UHS Makeup Water Train 2 Isolation Valve Upstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA009	UHS Makeup Water Train 2 Isolation Valve Downstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA001	UHS Makeup Water Train 2 Isolation Valve Upstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA010	UHS Makeup Water Train 2 Isolation Valve Downstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA030	UHS Makeup Water Pump 2 Min. Flow Recirculation Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA601	UHS Makeup Water Train 2 Sample Line Valve	GB	MA	3	A	A	C	ET PI	Q 2Y	
30GFA20AA251	UHS Makeup Water Train 2 Isolation Valve Upstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA20AA101	UHS Makeup Water Train 2 Flow Control Valve	GB	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA252	UHS Makeup Water Train 2 Isolation Valve Downstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA20AA013	UHS Makeup Water Train 2 Flow Control Valve Bypass Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA20AA020	UHS Makeup Water Train 2 Test Bypass Isolation Valve	BF	MO	3	A	A	C	ET PI	Q 2Y	
30GFA30AA201	UHS Makeup Water Pump 3 Check Valve	CK	SA	3	C	P	O	ET PI	Q 2Y	
30GFA30AA011	UHS Makeup Water Pump 3 Discharge Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	

Table 3.9-2—{Site-Specific Inservice Valve Testing Program Requirements}
(Page 3 of 5)

Valve Identification Number [1]	Description /Valve Function	Valve Type[2]	Valve Actuator [3]	ASME Code Class [4]	ASME OM Code Category [5]	Active/ Passive[6]	Safety Position [7]	Test Required [8]	Test Frequency [9]	Comments
30GFA30AA002	UHS Makeup Water Train 3 Isolation Valve Upstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA009	UHS Makeup Water Train 3 Isolation Valve Downstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA001	UHS Makeup Water Train 3 Isolation Valve Upstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA010	UHS Makeup Water Train 3 Isolation Valve Downstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA030	UHS Makeup Water Pump 3 Min. Flow Recirculation Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA601	UHS Makeup Water Train 3 Sample Line Valve	GB	MA	3	A	A	C	ET PI	Q 2Y	
30GFA30AA251	UHS Makeup Water Train 3 Isolation Valve Upstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA30AA101	UHS Makeup Water Train 3 Flow Control Valve	GB	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA252	UHS Makeup Water Train 3 Isolation Valve Downstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA30AA013	UHS Makeup Water Train 3 Flow Control Valve Bypass Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA30AA020	UHS Makeup Water Train 3 Test Bypass Isolation Valve	BF	MO	3	A	A	C	ET PI	Q 2Y	
30GFA40AA201	UHS Makeup Water Pump 4 Check Valve	CK	SA	3	C	P	O	ET PI	Q 2Y	
30GFA40AA011	UHS Makeup Water Pump 4 Discharge Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA002	UHS Makeup Water Train 4 Isolation Valve Upstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	

Table 3.9-2—{Site-Specific Inservice Valve Testing Program Requirements}

(Page 4 of 5)

Valve Identification Number [1]	Description /Valve Function	Valve Type[2]	Valve Actuator [3]	ASME Code Class [4]	ASME OM Code Category [5]	Active/ Passive[6]	Safety Position [7]	Test Required [8]	Test Frequency [9]	Comments
30GFA40AA009	UHS Makeup Water Train 4 Isolation Valve Downstream of Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA001	UHS Makeup Water Train 4 Isolation Valve Upstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA010	UHS Makeup Water Train 4 Isolation Valve Downstream of Bypass Strainer	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA030	UHS Makeup Water Pump 4 Min. Flow Recirculation Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA601	UHS Makeup Water Train 4 Sample Line Valve	GB	MA	3	A	A	C	ET PI	Q 2Y	
30GFA40AA251	UHS Makeup Water Train 4 Isolation Valve Upstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA40AA101	UHS Makeup Water Train 4 Flow Control Valve	GB	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA252	UHS Makeup Water Train 4 Isolation Valve Downstream of Flow Control Valve	BF	MA	3	A	A	O	ET PI	Q 2Y	
30GFA40AA013	UHS Makeup Water Train 4 Flow Control Valve Bypass Valve	BF	MO	3	A	A	O	ET PI	Q 2Y	
30GFA40AA020	UHS Makeup Water Train 4 Test Bypass Isolation Valve	BF	MO	3	A	A	C	ET PI	Q 2Y	
Additional Valves	UHS Makeup Water System Additional Valves	Various	MA or MO	3	B	A/P	O/C	ET PI	5Y 2Y	See Note 10

Table 3.9-2—{Site-Specific Inservice Valve Testing Program Requirements}

Valve Identification Number [1]	Description /Valve Function	Valve Type[2]	Valve Actuator [3]	ASME Code Class [4]	ASME OM Code Category [5]	Active/ Passive[6]	Safety Position [7]	Test Required [8]	Test Frequency [9]	Comments

Notes:

1. The U. S. EPR subscribes to the Kraftworks Kennzeichen System (KKS) for coding and nomenclature of SSCs.
2. Valve Type:
   GB – Globe
   GT – Gate
   CK – Check
   RV – Relief
   RD – Rupture Disk
   DI – Diaphragm
   BF – Butterfly
   PL – Plug
3. Valve Actuator:
   MO – Motor-operated
   SO – Solenoid-operated
   AO – Air-operated
   HO – Hydraulic-operated
   SA – Self-actuated
   MA – Manual
   PA – Pilot-actuated
4. ASME Code Class as determined by quality groups from Regulatory 1.26
5. ASME Code Category A, B, C, D as defined in ASME OM Code 2004, Subsection ISTC-1300
6. ASME functional category as defined in ASME OM Code 2004, Subsection ISTC-1300
7. Valve safety function positions(s), specify both positions for valves that perform a safety function in both the open and closed positions. Valves are exercised to the position(s) required to fulfill their safety function(s). Check valve tests include both open and closed tests.
8. Required tests per ASME OM Code 2004, Subsection ISTC-3000
   LT – Leakage test per Table ISTC-3500-1 and ISTC-3600
   ET – Exercise test per Table ISTC-3500-1 and ISTC-3510, nominally every 3 months
   PI – Position indication verification per Table ISTC-3500-1 and ISTC-3700
   ST – Stroke time per test per ISTC-5000 (in conjunction with exercise test)
9. Test frequencies abbreviations per NUREG-1482, Revision 1:
   Q-Test performed once every 92 days
   CS – Test performed during cold shutdown, but not more frequently than once every 92 days
   RF – Test performed each refueling outage
   2Y – Test performed once every 2 years
   5Y – Test performed once every 5 years (per ASME OM, ISTC-3540)
   RV – Test relief valve at OM schedule.
10. Table entries for additional valves will be developed during detailed design engineering.

3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

{For NMP3NPP, seismic and dynamic qualification of site-specific mechanical and electrical equipment (identified in Table 3.10-1) includes equipment associated with the:

- UHS Makeup Water System, including the UHS Makeup Water Intake Structure; and
- Fire Protection System components that are required to protect equipment required to achieve safe shutdown following an earthquake, including the Fire Protection Building and Fire Water Storage Tanks.

Results of seismic and dynamic qualification of site-specific equipment by testing and/or analysis were not available at the time of submittal of the original COL application. Thus, in conformance with NRC Regulatory Guide 1.206 (NRC, 2007), a seismic qualification implementation program is provided. As depicted in Table 3.10-2, the qualification program will be implemented in five major phases.

Phase I (Seismic Qualification Methodology) involves the development of a summary table for site-specific equipment. This summary table shall:

- List site-specific equipment, along with the associated equipment identification number.
- Define the building in which each equipment is located, along with the equipment mounting elevation.
- Clarify whether the equipment is wall mounted, floor mounted, or line mounted.
- For mechanical equipment, identify if the equipment is active or passive.
- Provide a description of the intended mounting (e.g., skid mounted versus mounted directly on the floor, welded versus bolted, etc.).
- List the applicable In-Structure Response Spectra or, for line mounted equipment, the required input motion.
- Define operability and functionality requirements.
- Identify the acceptable qualification methods (i.e., analysis, testing, and/or a combination of both).
- Provide a requirement for environmental testing prior to seismic testing, when applicable.

The basis and criteria established in Phase I shall be used as technical input to the Phase II (Specification Development) technical requirements that will be provided to bidders. In addition, the specification will include the applicable seismic qualification requirements of the U.S. EPR FSAR which are incorporated by reference in this section (e.g., invoking industry standard IEEE 344).

The technical specification developed in Phase II shall also outline the requirements for the submittal (with each bidder's proposal) of either a detailed seismic qualification methodology or, for cases where seismic analysis and/or testing has previously been performed, the seismic qualification report. The seismic qualification methodology for each bidder shall be required to carry the overall methodology of Phase I to a much more detailed level. As examples, the detailed methodology shall be required to address:

- Which portions of the equipment will be qualified by analysis, testing and/or a combination of both, with technical justification.
- The technical justification when other than bi-axial, phase incoherent test input motions (or multiple input-motions in-phase and 180 degrees out-of-phase) are used for floor mounted equipment.

Early in the Procurement Phase, Phase III (Technical Bid Evaluations) shall be performed. The scope of Phase III will vary depending on whether the proposed seismic qualification for the specific piece of equipment will utilize analysis and/or testing performed previously. For each case where seismic qualification (by either analysis and/or testing) has not been performed, the detailed methodology shall be compared with the technical specification requirements. For each case where seismic qualification has been performed previously and the reports are submitted with the proposal, the Technical Bid Evaluation shall consist of a detailed review of the seismic qualification report, including a comparison of the detailed methodology employed versus the technical specification requirements. The technical review shall be performed expeditiously to mitigate the potential for anomalies (e.g., those pertaining to test equipment calibration) to be identified late in the Procurement cycle. When applicable, Requests for Clarification (RFC) shall be provided to the bidder for resolution of anomalies. If, after vendor clarification, the existing qualification report is determined to be insufficient technically, additional analysis and/or testing may be required.

During Phase IV (New Seismic Analysis and/or Testing), the supplier shall perform new analysis and/or testing, to either seismically qualify the equipment or, if a previously submitted qualification report is determined to be insufficient, to supplement the previously submitted seismic qualification. The analysis (or analysis portion of combined analysis and test seismic qualification) shall be reviewed in detail, to assure compliance with the technical specification requirements. Where testing is to be employed, a detailed review of the test procedure shall be performed at least one month prior to the test. New testing will be independently observed to assure conformance with the reviewed test procedure.

Phase V (Documentation of Results) shall consist of the preparation of a Seismic Qualification Data Package (SQDP) for each piece of equipment seismically qualified. As a minimum, the SQDP will include information required in the U.S. EPR FSAR, Appendix D, Attachment F.}

3.10.1 SEISMIC QUALIFICATION CRITERIA

3.10.1.1 Qualification Standards

The U.S. EPR FSAR includes the following COL Item in Section 3.10.1.1:

> A COL applicant that references the U. S. EPR design certification will identify any additional site-specific components that need to be added to the equipment list in Table 3.10-1.

This COL Item is addressed as follows:

A list of site-specific seismically and dynamically qualified mechanical, electrical, and instrumentation and control equipment is provided in Table 3.10-1. Table 3.10-1 also identifies the type of environment to which the equipment is subjected.

3.10.1.2 Performance Requirements for Seismic Qualification

No departures or supplements.

3.10.1.3 Acceptance Criteria

No departures or supplements.

3.10.1.4 Input Motion

{No departures or supplements.}

3.10.2 METHODS AND PROCEDURES FOR QUALIFYING MECHANICAL, ELECTRICAL AND I&C EQUIPMENT

The U.S. EPR FSAR includes the following COL Item in Section 3.10.2:

> If experience data are used to establish equipment qualification, a COL applicant that references the U. S. EPR design certification will document the qualification methodology and supporting data.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall not use experience data to establish equipment qualification.

3.10.2.1 Seismic Qualification of Electrical Equipment and Instrumentation

No departures or supplements.

3.10.2.2 Seismic Qualification of Active Mechanical Equipment

No departures or supplements.

3.10.2.3 Seismic Qualification of Non-Active Mechanical Equipment

No departures or supplements.

3.10.3 METHODS AND PROCEDURES FOR QUALIFYING SUPPORTS OF MECHANICAL AND ELECTRICAL EQUIPMENT AND INSTRUMENTATION

No departures or supplements.

3.10.4 TEST AND ANALYSIS RESULTS AND EXPERIENCE DATABASE

The U.S. EPR FSAR includes the following COL Item in Section 3.10.4:

> A COL applicant that references the U. S. EPR design certification will create and maintain the SQDP file during the equipment selection and procurement phase.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall create and maintain the SQDP file. This activity shall be initiated during the equipment selection and procurement phase. The SQDP file shall be maintained for the life of the plant.

The U.S. EPR FSAR also includes the following COL Item in Section 3.10.4:

If the seismic and dynamic qualification testing is incomplete at the time of the COL application, a COL applicant that references the U.S. EPR design certification will submit an implementation program, including milestones and completion dates, for NRC review and approval prior to installation of the applicable equipment.

This COL Item is addressed as follows:

The seismic and dynamic qualification implementation program, including milestones and completion dates, shall be developed and submitted for U.S. Nuclear Regulatory Commission approval prior to installation of the applicable equipment.

3.10.5 REFERENCES

{**NRC, 2007.** Combined License Applications for Nuclear Power Plants, Regulatory Guide 1.206, Revision 0, U.S. Nuclear Regulatory Commission, June 2007.}

Table 3.10-1—{Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}

(Page 1 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)	EQ Program Designation (Note 5)
Train 1						
Ultimate Heat Sink (UHS) Makeup System						
UHS makeup pump	M	M	ES	SI	S	Y (5)
UHS makeup pump discharge pressure transmitter	M	M	ES	SI		Y (5)
UHS makeup pump discharge line isolation check valve	M	M	ES	SI	S	Y (5)
UHS makeup line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump discharge line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump minimum flow line motorized valve	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup sample line manual globe valve						
UHS makeup line motorized isolation valve	M	M	ES	SI	S	Y (5)
UHS makeup line high point vent valve	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve upstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line motorized control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve downstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line flow element at basin	M	M	ES	SI	S	Y (5)
UHS makeup test bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
HVAC for Pump Room						
Supply Air Fan	M	M	ES	SI	S	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	Y (5) Y (6)
Outside Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Return Air control Damper	M	M	ES	SI	S	Y (5) Y (6)

Table 3.10-1—{Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}

(Page 2 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)	EQ Program Designation (Note 5)
Exhaust Air Backdraft Damper	M	M	ES	SI	S	Y (5)
Class 1E Emergency Power Supply						
480 V Disconnect Switch	M	M	ES	SI	S	Y (5)
480 V Power Dist & Control Panel	M	M	ES	SI	S	Y (5)
Train 2						
Ultimate Heat Sink (UHS) Makeup System						
UHS makeup pump	M	M	ES	SI	S	Y (5)
UHS makeup pump discharge pressure transmitter	M	M	ES	SI		Y (5)
UHS makeup pump discharge line isolation check valve	M	M	ES	SI	S	Y (5)
UHS makeup line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump discharge line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump minimum flow line motorized valve	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup sample line manual globe valve						
UHS makeup line motorized isolation valve	M	M	ES	SI	S	Y (5)
UHS makeup line high pt vent valve	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve upstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line motorized control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve downstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line flow element at basin	M	M	ES	SI	S	Y (5)
UHS makeup test bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
HVAC for Pump Room						

Table 3.10-1—{Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}

(Page 3 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)	EQ Program Designation (Note 5)
Supply Air Fan	M	M	ES	SI	S	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	Y (5) Y (6)
Outside Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Return Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Wxhaust Air Backdraft Damper	M	M	ES	SI	S	Y (5)
Class 1E Emergency Power Supply						
480 V Disconnect Switch	M	M	ES	SI	S	Y (5)
480 V Power Dist & Control Panel	M	M	ES	SI	S	Y (5)
Train 3						
Ultimate Heat Sink (UHS) Makeup System						
UHS makeup pump	M	M	ES	SI	S	Y (5)
UHS makeup pump discharge pressure transmitter	M	M	ES	SI		Y (5)
UHS makeup pump discharge line isol check valve	M	M	ES	SI	S	Y (5)
UHS makeup line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pp discharge line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump minimum flow line motorized valve	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup sample line manual globe valve						
UHS makeup line motorized isolation valve	M	M	ES	SI	S	Y (5)
UHS makeup line high pt vent valve	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve upstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line motorized control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve downstream of control valve at basin	M	M	ES	SI	S	Y (5)

Table 3.10-1—{Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}
(Page 4 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)	EQ Program Designation (Note 5)
UHS makeup bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line flow element at basin	M	M	ES	SI	S	Y (5)
UHS makeup test bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
HVAC for Pump Room						
Supply Air Fan	M	M	ES	SI	S	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	Y (5) Y (6)
Outside Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Return Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Exhaust Air Backdraft Damper	M	M	ES	SI	S	Y (5)
Class 1E Emergency Power Supply						
480 V Disconnect Switch	M	M	ES	SI	S	Y (5)
480 V Power Dist & Control Panel	M	M	ES	SI	S	Y (5)
Train 4						
Ultimate Heat Sink (UHS) Makeup System						
UHS makeup pump)	M	M	ES	SI	S	Y (5)
UHS makeup pump discharge pressure transmitter	M	M	ES	SI		Y (5)
UHS makeup pump discharge line isol check valve	M	M	ES	SI	S	Y (5)
UHS makeup line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pump discharge line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized strainer	M	M	ES	SI	S	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup pp minimum flow line motorized valve	M	M	ES	SI	S	Y (5) Y (6)
UHS makeup sample line manual globe valve						
UHS makeup line motorized isolation valve	M	M	ES	SI	S	Y (5)
UHS makeup line high point ent valve	M	M	ES	SI	S	Y (5)

Table 3.10-1—{Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}
(Page 5 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)	EQ Program Designation (Note 5)
UHS makeup line manual isolation valve upstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line motorized control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line manual isolation valve downstream of control valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
UHS makeup line flow element at basin	M	M	ES	SI	S	Y (5)
UHS makeup test bypass line motorized valve at basin	M	M	ES	SI	S	Y (5)
HVAC for Pump Room						
Supply Air Fan	M	M	ES	SI	S	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	Y (5) Y (6)
Outside Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Return Air control Damper	M	M	ES	SI	S	Y (5) Y (6)
Exhaust Air Backdraft Damper	M	M	ES	SI	S	Y (5)
Class 1E Emergency Power Supply						
480 V Disconnect Switch	M	M	ES	SI	S	Y (5)
480 V Power Dist & Control Panel	M	M	ES	SI	S	Y (5)

Notes:

EQ Environment (M= Mild, H= Harsh)
Radiation Environment Zone (M= Mild, H= Harsh)
ES (Engineered Safeguards) SI (Seismic I), SII (Seismic II)
Safety Class: S (Safety –Related) (i.e., QA Level I), NS-AQ (Supplemental Grade Non-Safety) (i.e., QA Level II), 1E (Class 1E)
Yes (1) i.e., Y(1) = Full EQ Electrical, Yes (2) = EQ Radiation Harsh-Electrical, Yes (3) = EQ Radiation Harsh-Consumables, Yes (4) = EQ for Consumables, Yes (5) = EQ Seismic, Yes (6) = EQ EMC

Table 3.10-2—Seismic Qualification Implementation Program

Phase	Scope Definition	Schedule
I	Seismic Qualification Methodology	Prior to Procurement
II	Specification Development	Prior to Procurement
III	Technical Bid Evaluations	Early in the Procurement Phase
IV	New Seismic Analysis and/or Testing (when required)	Prior to Initial Pre-operational Testing
V	Documentation of Results	Prior to Initial Pre-operational Testing

3.11 ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

The U.S. EPR FSAR includes the following COL Item in Section 3.11:

> A COL applicant that references the U.S EPR design certification will maintain the equipment qualification test results and qualification status file during the equipment selection, procurement phase and throughout the installed life in the plant.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall maintain the equipment qualification test results and qualification status file during the equipment selection, procurement phase and throughout the installed life in the plant.

3.11.1 EQUIPMENT IDENTIFICATION AND ENVIRONMENTAL CONDITIONS

No departures or supplements.

3.11.1.1 Equipment Identification

No departures or supplements.

3.11.1.1.1 Nuclear Island

No departures or supplements.

3.11.1.1.2 Balance of Plant (BOP) and Turbine Island (TI)

No departures or supplements.

3.11.1.1.3 Equipment Review and Screening

The U.S. EPR FSAR includes the following COL Item in Section 3.11.1.1.3:

> A COL applicant that references the U. S. EPR design certification will identify additional site-specific components that need to be added to the environmental qualification list in Table 3.11-1.

This COL Item is addressed as follows:

Table 3.11-1 provides the list of additional site-specific components to add to the equipment list in U.S. EPR FSAR Table 3.11-1. {It includes the safety-related and augmented quality items of the site-specific portion of the UHS Makeup Water System and Fire Protection System.} The cable types listed are typical of those which are anticipated to be utilized throughout the plant in safety-related applications, including those which are site-specific. However, the function and location related columns in the attached table entries are for site-specific applications only. The environmental qualification parameters shown in the attached table are based on the criteria described in U.S. EPR FSAR Section 3.11.

Regulatory Guide 1.131, “Qualification Tests of Electric Cables and Field Splices for Light-Water-Cooled Nuclear Power Plants” (NRC, 1977) endorses IEEE Std 383-1974, “Standard for Type Test of Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations”

(IEEE,1974). These documents contain guidance for the environmental qualification of Class 1E electric cables and field splices, and will be used in conjunction with Regulatory Guide 1.89 (NRC, 1984), as appropriate, for evaluating the environmental qualification of Class 1E electric cables and field splices for site-specific portions of {UHS Makeup Water System} and Fire Protection System. Site-specific safety-related cables and components will be procured in accordance with these standards and regulations as appropriate.

There are six primary types of cable: Medium voltage power, low voltage power, low voltage control, shielded instrumentation, thermocouple extension and fiber optic communication cable. Medium and low voltage power cables, low voltage control cables and shielded instrumentation cables will be rated at 90°C in accordance with ICEA Standards. Thermocouple extension cable is intended for measuring service and will employ insulation rated at 300 VAC minimum.

Fiber optic communication cable may be employed in the safety-related site-specific portion of the {UHS Makeup Water System}.

3.11.1.2 Definition of Environmental Conditions

No departures or supplements.

3.11.1.3 Equipment Operability Times

No departures or supplements.

3.11.2 QUALIFICATION TESTS AND ANALYSIS

No departures or supplements.

3.11.3 QUALIFICATION TEST RESULTS

The U.S. EPR FSAR includes the following COL Item in Section 3.11.3:

> If the equipment qualification testing is incomplete at the time of the COL application, a COL applicant that references the U. S. EPR design certification will submit an implementation program, including milestones and completion dates, for NRC review and approval prior to installation of the applicable equipment.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall develop and submit the equipment qualification testing program, including milestones and completion dates, prior to installation of the applicable equipment.

3.11.4 LOSS OF VENTILATION

No departures or supplements.

3.11.5 ESTIMATED CHEMICAL AND RADIATION ENVIRONMENT

No departures or supplements.

3.11.6 QUALIFICATION OF MECHANICAL EQUIPMENT

No departures or supplements.

3.11.7 REFERENCES

{**IEEE, 1974.** Standard for Type Test of Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations, IEEE Std 383-1974, IEEE, 1974.

NRC, 1977. Qualification Tests of Electric Cables and Field Splices and Connections for Light-Water-Cooled Nuclear Power Plants, Regulatory Guide 1.131, U.S. Nuclear Regulatory Commission, August 1977.

NRC, 1984. Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, Regulatory Guide 1.89, Revision 1, U.S. Nuclear Regulatory Commission, June 1984.}

Table 3.11-1—{Site-Specific Environmentally Qualified Electrical and I&C Equipment}
(Page 1 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)
Train 1								
Ultimate Heat Sink (UHS) Makeup System								
UHS makeup pump motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge pressure transmitter	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp minimum flow line motorized valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized control valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line flow element at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup test bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
HVAC for Pump Room								
Supply Air Fan motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Outside Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Return Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Class 1E Emergency Power Supply								
480 V Disconnect Switch	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
480 V Power Dist & Control Panel	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Site Specific Safety Related Electrical Power Cable Types								

Table 3.11-1—{Site-Specific Environmentally Qualified Electrical and I&C Equipment}
(Page 2 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)
Medium Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Control Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Shielded Instrumentation Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Thermocouple Extension Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Fiber Optic Communication Cable	M	M	ES	SE	S	1E	EMC	Y (5)
Train 2								
Ultimate Heat Sink (UHS) Makeup System								
UHS makeup pump (pp) motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge pressure transmitter	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp minimum flow line motorized valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized control valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line flow element at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup test bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
HVAC for Pump Room								
Supply Air Fan motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)

Table 3.11-1—{Site-Specific Environmentally Qualified Electrical and I&C Equipment}

(Page 3 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)
Outside Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Return Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Class 1E Emergency Power Supply								
480 V Disconnect Switch	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
480 V Power Dist & Control Panel	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Site Specific Safety Related Electrical Power Cable Types								
Medium Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Control Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Shielded Instrumentation Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Thermocouple Extension Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Fiber Optic Communication Cable	M	M	ES	SE	S	1E	EMC	Y (5)
Train 3								
Ultimate Heat Sink (UHS) Makeup System								
UHS makeup pump (pp) motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge pressure transmitter	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp minimum flow line motorized valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized control valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)

Table 3.11-1—{Site-Specific Environmentally Qualified Electrical and I&C Equipment}
(Page 4 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)
UHS makeup line flow element at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup test bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
HVAC for Pump Room								
Supply Air Fan motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Outside Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Return Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Class 1E Emergency Power Supply								
480 V Disconnect Switch	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
480 V Power Dist & Control Panel	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Site Specific Safety Related Electrical Power Cable Types								
Medium Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Control Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Shielded Instrumentation Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Thermocouple Extension Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Fiber Optic Communication Cable	M	M	ES	SE	S	1E	EMC	Y (5)
Train 4								
Ultimate Heat Sink (UHS) Makeup System								
UHS makeup pump (pp) motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge pressure transmitter	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup pp discharge line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve upstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Bypass line motorized isolation valve downstream of strainer motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)

Table 3.11-1—{Site-Specific Environmentally Qualified Electrical and I&C Equipment}

(Page 5 of 5)

Equipment Name/Description	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)
UHS makeup pp minimum flow line motorized valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized isolation valve motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line motorized control valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup line flow element at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
UHS makeup test bypass line motorized valve motor at basin	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
HVAC for Pump Room								
Supply Air Fan motor	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Electric Duct Heater	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Outside Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Return Air control Damper Actuator	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Class 1E Emergency Power Supply								
480 V Disconnect Switch	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
480 V Power Dist & Control Panel	M	M	ES	SI	S	1E	EMC	Y (5) Y (6)
Site Specific Safety Related Electrical Power Cable Types								
Medium Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Power Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Low Voltage Control Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Shielded Instrumentation Cable (600V)	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Thermocouple Extension Cable	M	M	ES	SE	S	1E	EMC	Y (5) Y (6)
Fiber Optic Communication Cable	M	M	ES	SE	S	1E	EMC	Y (5)

Notes:

1. EQ Environment (M= Mild, H= Harsh)
2. Radiation Environment Zone (M= Mild, H= Harsh)
3. ES (Engineered Safeguards) SI (Seismic I), SII (Seismic II)
4. Safety Class: S (Safety –Related) (i.e., QA Level I), NS-AQ (Supplemental Grade Non-Safety) (i.e., QA Level II), 1E (Class 1E)
5. Yes (1) i.e., Y(1) = Full EQ Electrical, Yes (2) = EQ Radiation Harsh-Electrical, Yes (3) = EQ Radiation Harsh-Consumables, Yes (4) = EQ for Consumables, Yes (5) = EQ Seismic, Yes (6) = EQ EMC

3.12 ASME CODE CLASS 1, 2, AND 3 PIPING SYSTEMS, PIPING COMPONENTS, AND THEIR ASSOCIATED SUPPORTS

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.12.1 INTRODUCTION

No departures or supplements.

3.12.2 CODES AND STANDARDS

No departures or supplements.

3.12.3 PIPING ANALYSIS METHODS

No departures or supplements.

3.12.4 PIPING MODELING TECHNIQUES

3.12.4.1 Computer Codes

No departures or supplements.

3.12.4.2 Dynamic Piping Model

The U.S. EPR FSAR includes the following COL Item in Section 3.12.4.2:

> A COL applicant that references the U.S. EPR design certification will perform a review of the impact of contributing mass of supports on the piping analysis following the final support design to confirm that the mass of the support is no more than ten percent of the mass of the adjacent pipe span.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall perform a review of the impact of contributing mass of supports on the piping analysis following the final support design to confirm that the mass of the support is no more than ten percent of the mass of the adjacent pipe span.

3.12.4.3 Piping Benchmark Program

The U.S. EPR FSAR includes the following COL Item in Section 3.12.4.3:

> As indicated in Section 5.3 of topical report ANP-10264 (NP), pipe and support stress analysis will be performed by the COL applicant that references the U.S. EPR design certification. If the COL applicant that references the U.S. EPR design certification chooses to use a piping analysis program other than those listed in Section 5.1 of the topical report, the COL applicant will implement a benchmark program using models specifically selected for the U.S. EPR.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall use piping analysis programs listed in Section 5.1 of the topical report ANP-10264(NP)(AREVA, 2006).

3.12.4.4 Decoupling Criteria

No departures or supplements.

3.12.5 PIPING STRESS ANALYSIS CRITERIA

3.12.5.1 Seismic Input Envelope versus Site-Specific Spectra

{The site-specific seismic response is within the parameters of U.S. EPR FSAR Section 3.7.2 as discussed in Section 3.7.2.}

3.12.5.2 Design Transients

No departures or supplements.

3.12.5.3 Loadings and Load Combinations

No departures or supplements.

3.12.5.4 Damping Values

No departures or supplements.

3.12.5.5 Combination of Modal Responses

No departures or supplements.

3.12.5.6 High-Frequency Modes

No departures or supplements.

3.12.5.7 Fatigue Evaluation for ASME Code Class 1 Piping

No departures or supplements.

3.12.5.8 Fatigue Evaluation of ASME Code Class 2 and 3 Piping

No departures or supplements.

3.12.5.9 Thermal Oscillations in Piping Connected to the Reactor Coolant System

No departures or supplements.

3.12.5.10 Thermal Stratification

No departures or supplements.

3.12.5.11 Safety Relief Valve Design, Installation, and Testing

No departures or supplements.

3.12.5.12 Functional Capability

No departures or supplements.

3.12.5.13 Combination of Inertial and Seismic Anchor Motion Effects

No departures or supplements.

3.12.5.14 Operating Basis Earthquake as a Design Load

No departures or supplements.

3.12.5.15 Welded Attachments

No departures or supplements.

3.12.5.16 Modal Damping for Composite Structures

No departures or supplements.

3.12.5.17 Minimum Temperature for Thermal Analyses

No departures or supplements.

3.12.5.18 Intersystem Loss-of-Coolant Accident

No departures or supplements.

3.12.5.19 Effects of Environment on Fatigue Design

No departures or supplements.

3.12.6 PIPING SUPPORT DESIGN CRITERIA

No departures or supplements.

3.12.7 REFERENCES

{**AREVA, 2006.** U. S. EPR Piping Analysis and Pipe Support Design, ANP-10264(NP), Revision 0, AREVA NP Inc., September, 2006.}

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

This section of the U.S. EPR FSAR is incorporated by reference with the supplements as described in the following sections.

3.13.1 DESIGN CONSIDERATIONS

No departures or supplements.

3.13.2 INSERVICE INSPECTION REQUIREMENTS

The U.S. EPR FSAR includes the following COL Item in Section 3.13.2:

> A COL applicant referencing the U.S. EPR design certification will submit the inservice inspection plan for ASME Class 1, Class 2, and Class 3 threaded fasteners to the NRC prior to performing the first inspection.

This COL Item is addressed as follows:

{Nine Mile Point 3 Project Company, LLC and UniStar Nuclear Operating Services} shall submit the inservice inspection plan for ASME Class 1, Class 2, and Class 3 threaded fasteners to the U.S. Nuclear Regulatory Commission prior to performing the first inspection.

3A CRITERIA FOR DISTRIBUTION SYSTEM ANALYSIS AND SUPPORT

This section of the U.S. EPR FSAR is incorporated by reference.

3B DIMENSIONAL ARRANGEMENT DRAWINGS

This section of the U.S. EPR FSAR is incorporated by reference.

3C REACTOR COOLANT SYSTEM STRUCTURAL ANALYSIS METHODS

{This section of the U.S. EPR FSAR is incorporated by reference.}

3D METHODOLOGY FOR QUALIFYING SAFETY-RELATED ELECTRICAL AND MECHANICAL EQUIPMENT

{This section of the U.S. EPR FSAR is incorporated by reference.}

3E CRITICAL SECTIONS FOR SAFETY-RELATED CATEGORY I STRUCTURES

This section of the U.S. EPR FSAR is incorporated by reference, with the following supplements.

The U.S. EPR FSAR contains the following COL item in Appendix 3E:

> A COL applicant that references the U.S. EPR design certification will address critical sections relevant to site-specific Seismic Category I structures.

This COL item is addressed as follows:

{Section 3E.4 of Appendix 3E provides the discussion regarding the critical sections of the site-specific Seismic Category I Structures:

- Ultimate Heat Sink (UHS) Makeup Water Intake Structure
- UHS Intake Tunnel
- UHS Encasement Structures}

3E.1 NUCLEAR ISLAND STRUCTURES

No departures or supplements.

3E.2 EMERGENCY POWER GENERATING BUILDINGS

No departures or supplements.

3E.3 ESSENTIAL SERVICE WATER BUILDINGS

No departures or supplements.

3E.4 {UHS MAKEUP WATER INTAKE, UHS TUNNEL, AND UHS ENCASEMENT STRUCTURES

This section is a supplement to U.S. EPR FSAR Appendix 3E.4

3E.4.1 Description of Critical Sections of the UHS Makeup Water Intake Structure

Plans and section views of the UHS Makeup Water Intake Structure are provided as Figure 9.2-4 and Figure 9.2-5. A general description is provided below:

The UHS Makeup Water Intake Structure is a reinforced concrete structure 162 ft (49.38 m) long with additional extensions on each side (East and West) that are 22 ft (6.71 m) long, 144 ft (43.89 m) wide, and 32 ft (9.75 m) high. The UHS Makeup Water Intake Structure consists of two portions: the lower portion of the structure below the grade (substructure) and the upper portion of the structure above the grade (superstructure).

The portion of the substructure (Forebay) that is located north of column line “D” and between column lines “1” and “8” also includes two 22 ft (6.71 m) by 20 ft (6.1 m) extensions for tunnel shaft openings. The three levels of the UHS Makeup Water Structure are located at:

- Elevation 225 ft-5 in (68.71 m): Top of concrete (TOC) for the 3 ft (0.91 m) thick base mat.
- Elevation 270 ft-0 in (82.3 m): TOC of the 3 ft (0.91 m) thick operating deck/ floor.

- Elevation 302 ft-0 in (92.05 m): TOC of the 2 ft (0.91 m) thick roof slab.

The UHS Makeup Water Intake Structure substructure exterior walls are 3.5 ft (1.07 m) thick and the interior substructure walls are 2 ft (0.61 m) thick. The exterior walls of the superstructure are 2 ft (0.61 m) thick and the interior walls of the superstructure are 1.5 ft (0.46 m) thick.

A Foundation Plan for the UHS Makeup Water Intake Structure at Elevation 225 ft-5 in (68.71 m) is provided as Figure 3E.4-1. This plan specifies the mat reinforcing steel and sections for the typical wall design addressed in Section 3E.4.1.2 (Figure 3E.4-4 and Figure 3E.4-5).

Design Criteria

The UHS Makeup Water Intake Structure is designed in accordance with the provisions of ACI 349-01/349-R01 (ACI, 2001) (as supplemented by Regulatory Guide 1.142 (NRC, 2001)), ACI 349-06 (ACI, 2006), ASCE/SEI 7-05 (ASCE, 2006) and ASCE 4-98 (ASCE, 2001). ASCE/SEI 7-05 applies to the load inputs. ASCE 4-98 applies to the design of hydrodynamic loads in compartments containing fluids (Impulsive and Convective modes). ACI 349-01/349-R01 applies to the impact of temperature gradient on the stresses in concrete walls and slabs. A shear reduction factor of 0.75 per ACI 349-06 (ACI, 2006) is utilized instead of value of 0.85 from ACI 349-01/349-R01 (ACI, 2001) and the U.S. EPR FSAR.

Loading includes dead loads (including equipment dead loads), live loads (including roof crane rated loads), construction loads, wind loads, snow, ice and rain on ice loads, pipe and cable tray loads, soil pressure, contingency loads, hydrostatic pressure, seismic response (including associated dynamic soil pressures, hydrodynamic impulsive pressures and hydrodynamic convective pressures), wave forces, the loads due to differential temperature tornado wind, tornado missiles, and tornado depressurization loads.

Governing load combinations from Table 3E.4-1 apply for critical section structural design.

Applicable Loadings, Computer Model, Analysis and Design Methods

The overall design of the UHS Makeup Water Intake Structure involves a two step analytical process:

- Equivalent Static Load Seismic analysis using GT STRUDL finite element model for applicable load cases and design load combinations including the extreme environmental (i.e., SSE seismic) events. The SSE seismic acceleration values are based on U.S.EPR hard condition ground response spectra normalized to 0.3 x g.

- Use of forces and moments, as obtained from the GT STRUDL output, for structural component design in accordance with the provisions of ACI 349-01/349-R01(ACI, 2001) (as supplemented by Regulatory Guide 1.142 (NRC, 2001)), ACI 349-06 (ACI, 2006), ASCE/SEI 7-05 (ASCE, 2006) and ASCE 4-98 (ASCE, 2001).

Isometric views of the GT STRUDL finite element model are provided as Figure 3E.4-6 and Figure 3E.4-7.

The UHS Makeup Water Intake Structure GT STRUDL finite element model is created using SBHQ6 plate elements, to accurately represent the structure and calculate both in-plane and out-of-plane effects from applied loads. The typical size of plate elements is 4 ft x 4 ft (1.22 m x 1.22 m).

Fixed supports are placed at the bottom nodes of the base mat.

SSE accelerations are applied to dead load, equipment load, 25 percent of live load and 75 percent of the design snow load.

Stability against both overturning and sliding of the UHS Makeup Water Intake Structure has been verified for all applicable load cases.

For the determination of steel reinforcement, computer program PC Column has been utilized to account for combined maximum factored moments and axial loads.

Maximum factored forces and moments per foot of wall are determined for the governing loading condition per the GT STRUDL finite element analysis results.

For the divider walls, a separate case has been considered to address postulated scenario, during maintenance condition, of a single compartment flooded and adjacent compartments empty with stop logs in place. The maximum forces and moments obtained from GT STRUDL finite element analysis are defined in the planar reference system presented in Figure 3E.4-9.

3E.4.1.1 Base Mat of the UHS Makeup Water Intake Structure

Description of the Critical Section and Computer Model

The critical section is selected for the 3 ft (0.91 m) thick reinforced concrete base mat for the UHS Makeup Water Intake Structure based on the maximum factored bending moments and corresponding axial loads obtained from GT STRUDL output (Table 3E.4-6). Located parallel to the Plant North direction, five reinforced concrete walls (three divider walls and two exterior walls) bear on the mat. Thus, vertical loads from the operating deck/floor slab and the superstructure are distributed to the base mat.

Sections showing required reinforcement are provided as Figure 3E.4-1. The associated finite element mesh for the base mat is provided as Figure 3E.4-8.

The reinforcement for other slabs such as the operating deck/ floor and roof slab are provided as Figure 3E.4-2 and Figure 3E.4-3, respectively. The demand tables for all loading conditions for roof and deck/floor slab are provided as Table 3E.4-4 and Table 3E.4-5, respectively.

Results of Critical Section Design

For all loading conditions, including the extreme environment events (i.e., SSE event), the base mat for the UHS Makeup Water Intake Structure is shown to have maximum static and dynamic soil bearing pressure of 4.97 ksf (237.88 kPa) and 7.32 ksf (350.27 kPa), respectively. These values are within the corresponding soil bearing capacity of 20 ksf (957.03 kPa), which is conservative since the actual minimum bearing capacity is 204 ksf (Table 2.0-1). For the extreme environmental events, Factors of Safety against overturning and sliding are greater than 2, whereas the Factor of Safety for buoyancy is 1.52. Thus, the required value of 1.1 is satisfied for all three conditions.

3E.4.1.2 Typical Wall for the UHS Makeup Water Intake Structure

Description of the Critical Section

Depicted in Figure 3E.4-4 and Figure 3E.4-5, the critical section is a 3.5 ft (1.07 m) thick, reinforced concrete exterior wall of the substructure portion of the UHS Makeup Water Intake Structure.

Results of Critical Section Design

The Demand Table for all loading conditions with the maximum factored forces and moments, is provided in Table 3E.4-2. The tabulated values represent the governing loads for any of the nominally 4 ft (1.22 m) square finite elements. For design, the governing values are averaged with the corresponding values of the adjacent plate elements.

Sections showing required reinforcement are provided as Figure 3E.4-4 and Figure 3E.4-5.

The reinforcement for other walls such as walls of the superstructure is provided as Figure 3E.4-4 and Figure 3E.4-5. The demand tables for all loading conditions for superstructure walls are provided as Table 3E.4-3.

The north wall of the Forebay portion of the UHS Makeup Water Intake Structure requires the tie-back type lateral supports embedded in the lean concrete backfill since the installation of lateral supports inside the Forebay structure is not feasible. The tie back details are provided as Figure 3E.4-10.

3E.4.2 Description of the UHS Tunnel Structure

The term UHS Tunnel Structures refers to two reinforced concrete tunnel structures that connect the UHS Makeup Water Intake Forebay to the Intake/ Discharge Shaft Structures that project above the lake bottom.

Each tunnel consists of three portions: vertical portion (forebay shaft) at the top Elevation 225 ft 5 in (68.71 m), horizontal portion (horizontal tunnel) at minimum bottom (invert) Elevation 139 ft 0 in (42.37 m), and vertical intake portion (shaft) projecting above the lake bottom. Tunnel "A" is a Discharge/ Intake Tunnel with one Intake Shaft projecting at lake bed Elevation 220′-0″ (67.06 m) and one Discharge Shaft projecting at lake bed Elevation 204′-0″ (62.18 m). Tunnel "B" is an Intake Tunnel with a single Intake shaft projecting at lake bed Elevation 220′-0″ (67.06 m) and no Discharge Shaft.

The Forebay Shaft, Horizontal Tunnel and Lake Intake/ Discharge Shafts are made of 15 ft (4.57 m) inside diameter reinforced concrete pipes with 12 in (0.3 m) thick walls.

The reinforcement details are shown as Figure 3E.4-12.

The Lake Intake Shaft Cover is a reinforced concrete slab in the shape of hexagon with the following dimensions: 27 ft 9 in (8.46 m) x 32 ft 0 in (9.75 m) x 9 ft 0 in (2.74 m), where the 27 ft 9 in (8.46 m) is a dimension between the flat sides of the hexagon and 9 ft 0 in (2.74 m) is the height of the hexagon.

The reinforcement for the Shaft Cover is provided as Figure 3E.4-13.

Design Criteria

The UHS Tunnel Structures are designed in accordance with the provisions of ACI 349-01/ ACI 349-R01 (ACI, 2001) (as supplemented by Regulatory Guide 1.142 (NRC, 2001)), ACI 349-06 (ACI, 2006), ASCE/SEI 7-05 (ASCE, 2007) and ASCE 4-98 (ASCE, 2001). ASCE/SEI 7-05 applies to the load inputs. The ASCE 4-98 applies to the evaluation of seismic stresses. The ACI 349-R01 applies to the impact of temperature gradient on the stresses in concrete walls and slabs.

Governing load combinations are provided as Table 3E.4-1.

3E.4.2.1 Description of the Critical Section

The critical section is located at the 90 degree bends. Expansion joints will be provided at both sides of the 90 degree bends to prevent local stress concentration.

Applicable Loadings, Analysis and Design Methods

The design of the UHS Tunnel Structure is based on the applied dead weight loads, hydrostatic surcharge loads, seismic loads due to compression and shear waves as well as loads due to the temperature differential.

The SSE seismic acceleration values are based on U.S.EPR hard condition ground response spectra normalized to 0.3 x g.

The tunnel structure including the portion at the location of 90 degree bends is evaluated as a beam on the elastic foundation.

Results of Critical Section Design

The reinforcement based on hoop, axial and bending stresses is provided as Figure 3E.4-12.

3E.4.3 Description of the UHS Encasement Structure

The UHS Encasement Structure is a reinforced concrete structure that connects the UHS Makeup Water Intake Structure to the Cooling Tower Structures. The encasement is located at the bottom of the open trench type excavation. The walls are 2 ft (0.61 m) thick, and the slabs are 3 ft (0.91 m) thick. The top of the bottom slab elevation is 248′-0″ (75.59 m). The total length of the concrete encasements including all branches is 3,435 ft (1,044 m).

Design Criteria

The UHS Encasement Structure is designed in accordance with the provisions of ACI 349-01/349-R01 (ACI, 2001) (as supplemented by Regulatory Guide 1.142 (NRC, 2001)), ACI 349-06 (ACI, 2006), ASCE/SEI 7-05 (ASCE, 2007) and ASCE 4-98 (ASCE, 2001). ASCE/SEI 7-05 applies to the load inputs. ASCE 4-98 applies to the evaluation of seismic stresses. ACI 349-01/349-R01 applies to the impact of temperature gradient on the stresses in concrete walls and slabs.

Governing load combinations provided as Table 3E.4-1 apply for critical section structural design.

3E.4.3.1 Description of the Critical Section

The critical section for the concrete encasement is located at the 90 degree bends. Expansion joints will be provided at both sides of the 90 degree bends to prevent local stress concentration.

Applicable Loadings, Analysis and Design Methods

The design of the UHS Encasement Structure is based on the applied dead weight loads, lateral static soil (backfill) loads, hydrostatic loads, flood loads, backfill overburden loads, surcharge loads, temperature differential loads, seismic loads due to compression and shear wave loads, dynamic backfill loads, hydrodynamic loads, dynamic lateral surcharge loads and the tornado missile loads (falling automobile impact).

The SSE seismic acceleration values are based on U.S. EPR hard condition ground response spectra normalized to 0.3 x g.

The UHS Encasement Structure including the portion at the location of 90 degree bends is evaluated as a beam on the elastic foundation.

Results of Critical Section Design

The reinforcement based on hoop, axial and bending stresses is provided in Figure 3E.4-11.

3E.4.4 References

ACI, 2001. Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, ACI 349-01/349-R01, American Concrete Institute, 2001.

ACI, 2006. Code Requirements for Nuclear Safety Related Concrete structures and Commentary, ACI 349-06, American Concrete Institute, 2006.

ASCE 2001. Seismic Analysis of Safety-Related Nuclear Structure and Commentary, including 2001.01.01 edition, ASCE 4-98, American Society of Civil Engineering, 2001.

ASCE, 2006. Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-05, American Society of Civil Engineering, 2006.

NRC, 2001. Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments), Regulatory Guide 1.142, Revision 2, U.S. Nuclear Regulatory Commission, November 2001.}

Table 3E.4-1—{Load Combinations for Seismic Category I Concrete}

Load Description		1	2	3	4	5
Dead	D	1.4	1.0	1.0	1.0	1.05
Live	L	1.7	1.0	1.0	1.0	1.3
Soil	H	1.7	1.0	1.0	1.0	1.3
Flood	F	x	1.0	1.0	1.0	x
Uplift Water Pressure	F_{up}	1.7	1.0	1.0	1.0	1.3
Wind	W	1.7	x	x	x	x
Piping & Cable Tray Loads	R_O	1.7	1.0	1.0	1.0	1.3
Temperature	T_O	1.7	1.0	1.0	1.0	1.05
Contingency	C_O	1.7	1.0	1.0	1.0	1.3
Seismic	E	x	1.0	x	1.0	x
Seismic Soil Loads	E_H	x	1.0	x	x	x
Story Inertia Force	F_{SIP}	x	1.0	x	1.0	x
Site-Specific Loads and Miscellaneous Loads	Q_O	x	1.0	x	1.0	x
Internal Hydrodynamic Loads	H_{DYN}	x	x	x	1.0	x
		Overturning Factor of Safety			1.5	
		Sliding Factor of Safety			1.5	
		Flotation Factor of Safety			1.1	

Table 3E.4-2—{Demand Table for the UHS Makeup Water intake Substructure Walls}

	Perimeter Walls Substructure - Edge Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	303.69	447.09	416.72	995.74	509.85	0.09
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	266.48	423.58	330.53	672.09	505.62	0.06
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	509.08	604.35	614.30	1195.56	948.76	0.10
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	192.52	263.32	281.25	672.15	299.90	0.06
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	192.59	263.48	281.19	671.96	299.12	0.06
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	435.19	444.24	564.96	1195.44	742.26	0.10
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	230.64	342.91	314.45	751.37	390.68	0.06
600	$(0.79) x g_x$	94.63	61.25	238.96	372.34	412.43	0.01
601	$(0.79) x g_z$	182.50	159.10	56.67	141.68	96.14	0.02
602	$(-0.70) x g_y$	128.82	60.10	142.17	339.58	130.51	0.03

	Perimeter Walls Substructure - Middle Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	143.62	56.51	355.19	643.99	509.85	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	117.70	49.50	312.10	609.27	505.62	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	220.01	109.96	504.59	989.69	870.74	0.00
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	94.00	34.81	202.91	367.92	299.90	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	93.26	34.51	202.39	366.34	299.12	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	195.57	94.97	394.89	746.77	664.24	0.00
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	110.33	43.19	271.88	492.93	390.68	0.00
600	$(0.79) x g_x$	67.93	51.20	190.27	372.34	359.04	0.00
601	$(0.79) x g_z$	40.85	18.80	17.13	65.31	29.38	0.00
602	$(-0.70) x g_y$	64.69	26.09	23.62	42.71	59.45	0.00

	Interior Walls Substructure - Edge Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	284.70	129.08	88.39	163.96	160.91	0.09
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	199.95	217.89	85.92	161.94	160.03	0.06
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	382.72	379.79	188.68	339.25	422.99	0.10
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	198.50	89.20	49.25	96.21	94.80	0.06
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	199.35	213.56	48.75	97.40	93.94	0.06
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	382.11	375.46	151.51	274.72	356.91	0.10
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	214.18	97.13	67.58	126.28	124.27	0.07
600	$(0.79) x g_x$	113.67	49.43	99.81	171.28	261.08	0.02
601	$(0.79) x g_z$	66.69	144.28	18.66	38.66	26.16	0.01
602	$(-0.70) x g_y$	126.63	54.33	15.77	24.71	17.41	0.03

Table 3E.4-3—{Demand Table for the UHS Makeup Water Intake Superstructure Walls}

	Perimeter Walls Superstructure - Edge Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	132.69	101.00	29.97	41.18	67.01	0.01
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	110.07	171.44	29.93	29.38	59.34	0.01
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	349.41	418.79	92.79	131.31	205.63	0.03
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	95.34	72.40	21.17	27.45	47.17	0.01
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	108.03	169.48	22.90	28.78	50.07	0.01
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	347.37	416.82	85.77	130.71	196.37	0.02
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	104.96	83.11	24.01	30.96	52.36	0.01
600	$(0.79) x g_x$	214.70	225.55	58.14	93.18	141.64	0.01
601	$(0.79) x g_z$	81.09	94.81	21.06	39.12	26.82	0.00
602	$(-0.70) x g_y$	67.92	36.28	11.30	13.27	24.94	0.00

	Perimeter Walls Superstructure - Middle Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	93.43	32.90	3.62	7.27	13.52	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	81.25	171.44	2.93	3.38	10.15	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	167.46	263.70	26.30	46.62	71.21	0.00
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	69.19	25.84	2.04	3.40	10.34	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	78.89	169.48	2.09	3.49	10.63	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	165.10	261.74	25.46	46.73	71.70	0.00
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	73.11	26.27	2.57	3.93	11.96	0.00
600	$(0.79) x g_x$	39.96	70.36	23.30	43.12	60.68	0.00
601	$(0.79) x g_z$	57.20	55.52	1.42	2.31	3.27	0.00
602	$(-0.70) x g_y$	50.64	21.89	0.95	2.22	6.00	0.00

	Interior Walls Superstructure - Edge Elements						
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	143.69	50.64	13.09	12.61	23.67	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	110.73	39.11	12.82	10.51	22.84	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	227.46	149.11	61.40	88.10	151.29	0.01
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	107.49	36.93	7.78	7.10	14.28	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	109.85	38.21	8.17	7.01	14.78	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	226.58	148.20	56.75	84.60	143.23	0.01
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	119.65	41.07	9.90	8.67	18.11	0.00
600	$(0.79) x g_x$	38.63	22.00	48.38	77.35	128.25	0.00
601	$(0.79) x g_z$	88.56	105.27	4.24	5.85	6.98	0.00
602	$(-0.70) x g_y$	65.51	23.09	1.14	1.75	2.00	0.00

Table 3E.4-4—{Demand Table for the UHS Makeup Water Intake Roof Slab}

Roof Slab - Edge Elements							
	Load Combinations	**Nx (kip)**	**Ny (kip)**	**Nz (kip)**	**Mx (kip-ft)**	**My (kip-ft)**	**Mz (kip-ft)**
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	11.62	11.55	18.99	18.02	47.41	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	7.36	7.83	16.57	15.75	40.44	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	96.77	96.04	28.61	26.28	66.58	0.01
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	7.54	6.62	16.59	15.94	40.55	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	6.12	8.29	16.57	15.79	40.78	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	95.53	96.50	28.60	26.32	66.92	0.01
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	8.96	8.10	19.73	18.96	47.98	0.00
600	$(0.79) \times g_x$	88.08	85.89	9.18	6.63	17.09	0.01
601	$(0.79) \times g_z$	14.91	19.53	2.38	3.74	2.93	0.00
602	$(-0.70) \times g_y$	3.46	4.79	7.41	7.27	19.56	0.00
Roof Slab - Middle Elements							
	Load Combinations	**Nx (kip)**	**Ny (kip)**	**Nz (kip)**	**Mx (kip-ft)**	**My (kip-ft)**	**Mz (kip-ft)**
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	8.37	8.72	5.66	9.50	28.94	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	4.58	6.77	5.03	6.82	25.84	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	48.41	72.24	7.90	10.01	37.94	0.00
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	4.11	5.69	4.90	6.64	25.81	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	3.14	5.28	4.93	6.85	25.88	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	46.97	70.75	7.80	10.03	37.97	0.00
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	5.08	7.26	5.74	7.89	30.89	0.00
600	$(0.79) \times g_x$	43.00	64.04	1.21	0.89	2.23	0.00
601	$(0.79) \times g_z$	8.40	13.38	0.35	0.27	0.45	0.00
602	$(-0.70) \times g_y$	1.28	2.57	2.58	3.04	11.88	0.00

Table 3E.4-5—{Demand Table for the UHS Makeup Water Intake Grade Slab}

Grade Slab- Edge Elements							
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	122.22	61.06	523.44	789.75	833.25	0.03
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	108.55	57.35	351.76	532.47	559.97	0.02
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	364.79	386.69	542.16	810.81	856.78	0.07
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	68.11	35.03	352.02	532.57	560.45	0.02
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	75.86	40.66	351.08	532.52	558.97	0.02
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	332.09	370.00	541.48	810.85	855.78	0.07
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	87.12	44.72	393.98	595.99	627.21	0.02
600	$(0.79) x g_x$	241.74	301.27	47.36	53.57	76.22	0.05
601	$(0.79) x g_z$	84.47	132.22	47.03	41.19	40.23	0.00
602	$(-0.70) x g_y$	9.03	14.84	178.32	270.01	284.02	0.01

Grade Slab - Middle Elements							
	Load Combinations	Nx (kip)	Ny (kip)	Nz (kip)	Mx (kip-ft)	My (kip-ft)	Mz (kip-ft)
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	122.22	61.06	133.86	235.88	125.37	0.00
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	108.55	57.35	92.03	164.94	86.20	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	345.17	285.59	171.81	298.53	171.53	0.01
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	68.11	35.03	97.58	171.52	92.10	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	75.86	40.66	97.12	171.89	91.36	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	312.47	268.91	176.90	305.48	176.69	0.01
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	87.12	44.72	101.65	180.36	95.62	0.00
600	$(0.79) x g_x$	220.93	200.55	21.04	28.29	43.39	0.01
601	$(0.79) x g_z$	84.47	108.47	21.45	34.91	20.58	0.00
602	$(-0.70) x g_y$	6.45	10.35	73.91	125.82	70.53	0.00

Table 3E.4-6—{Demand Table for the UHS Makeup Water Intake Foundation Base Mat}

	Foundation Base Mat - Edge Elements						
	Load Combinations	**Nx (kip)**	**Ny (kip)**	**Nz (kip)**	**Mx (kip-ft)**	**My (kip-ft)**	**Mz (kip-ft)**
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	252.12	211.50	264.72	235.50	407.56	0.04
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	222.46	186.26	184.76	164.50	349.98	0.04
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	534.52	501.82	388.35	430.64	633.55	0.10
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	142.61	121.88	185.57	165.11	253.66	0.03
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	138.11	118.79	184.97	164.53	253.97	0.03
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	450.16	434.35	388.56	430.67	537.54	0.09
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	190.04	159.75	198.98	177.02	311.99	0.03
600	$(0.79) \times g_x$	301.31	296.78	160.89	207.38	222.92	0.05
601	$(0.79) \times g_z$	78.65	104.73	25.80	41.82	36.22	0.03
602	$(-0.70) \times g_y$	20.16	23.17	122.06	161.47	171.50	0.00
	Foundation Base Mat - Middle Elements						
	Load Combinations	**Nx (kip)**	**Ny (kip)**	**Nz (kip)**	**Mx (kip-ft)**	**My (kip-ft)**	**Mz (kip-ft)**
100	$1.4D + 1.7(L + H + F_{up} + W + R_o + T_o + C_o)$	181.17	114.90	147.88	160.93	407.56	0.01
200	$D + L + H + F + F_{up} + R_o + T_o + C_o + E_H + F_{SIP} + Q_o$	157.54	96.00	120.47	134.58	349.98	0.00
201	$200 + (600^2 + 601^2 + 602^2)^{0.5}$	399.13	275.27	176.98	240.23	495.65	0.02
300	$D + L + H + F + F_{up} + R_o + T_o + C_o$	103.32	66.29	96.77	112.89	253.66	0.00
400	$D + L + H + F + F_{up} + R_o + T_o + C_o + F_{SIP} + Q_o + H_{DYN}$	98.93	62.94	97.36	112.38	253.97	0.00
401	$400 + (600^2 + 601^2 + 602^2)^{0.5}$	340.51	242.21	153.87	218.02	399.64	0.02
500	$1.05 (D + T_o) + 1.3(L + H + F_{up} + R_o + C_o$	136.64	86.81	113.23	121.06	311.99	0.00
600	$(0.79) \times g_x$	232.08	152.32	30.95	44.42	92.23	0.01
601	$(0.79) \times g_z$	65.92	94.05	11.94	38.56	28.07	0.01
602	$(-0.70) \times g_y$	12.48	9.49	45.75	87.75	109.21	0.00

Figure 3E.4-1—{Foundation Plan for the UHS Makeup Water Intake Structure at Elevation -225′-5″ (68.71 m)}

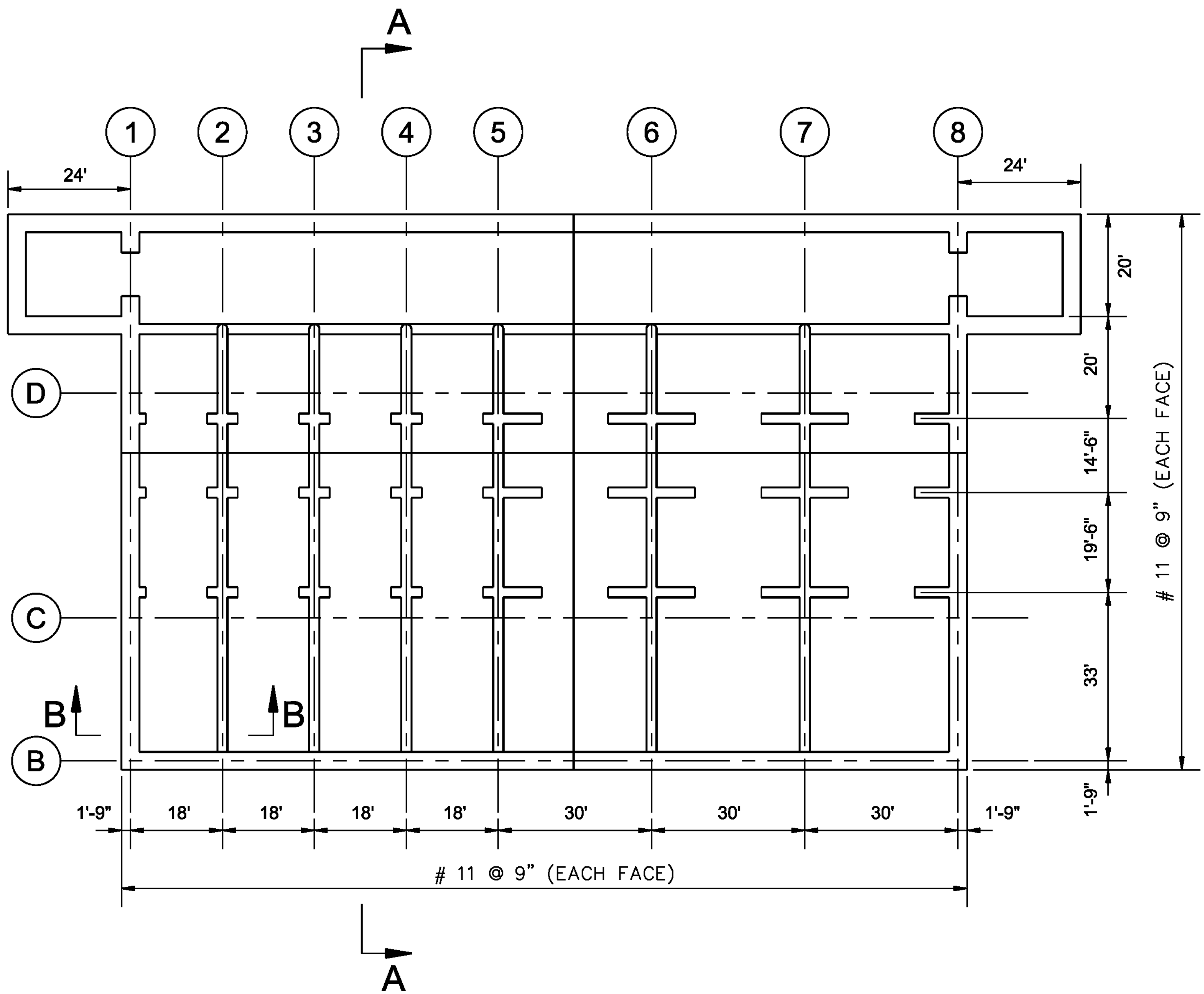


Figure 3E.4-2—{Grade Slab Plan for the UHS Makeup Water Intake Intake Structure at Elevation 270’-0” (82.30 m)}

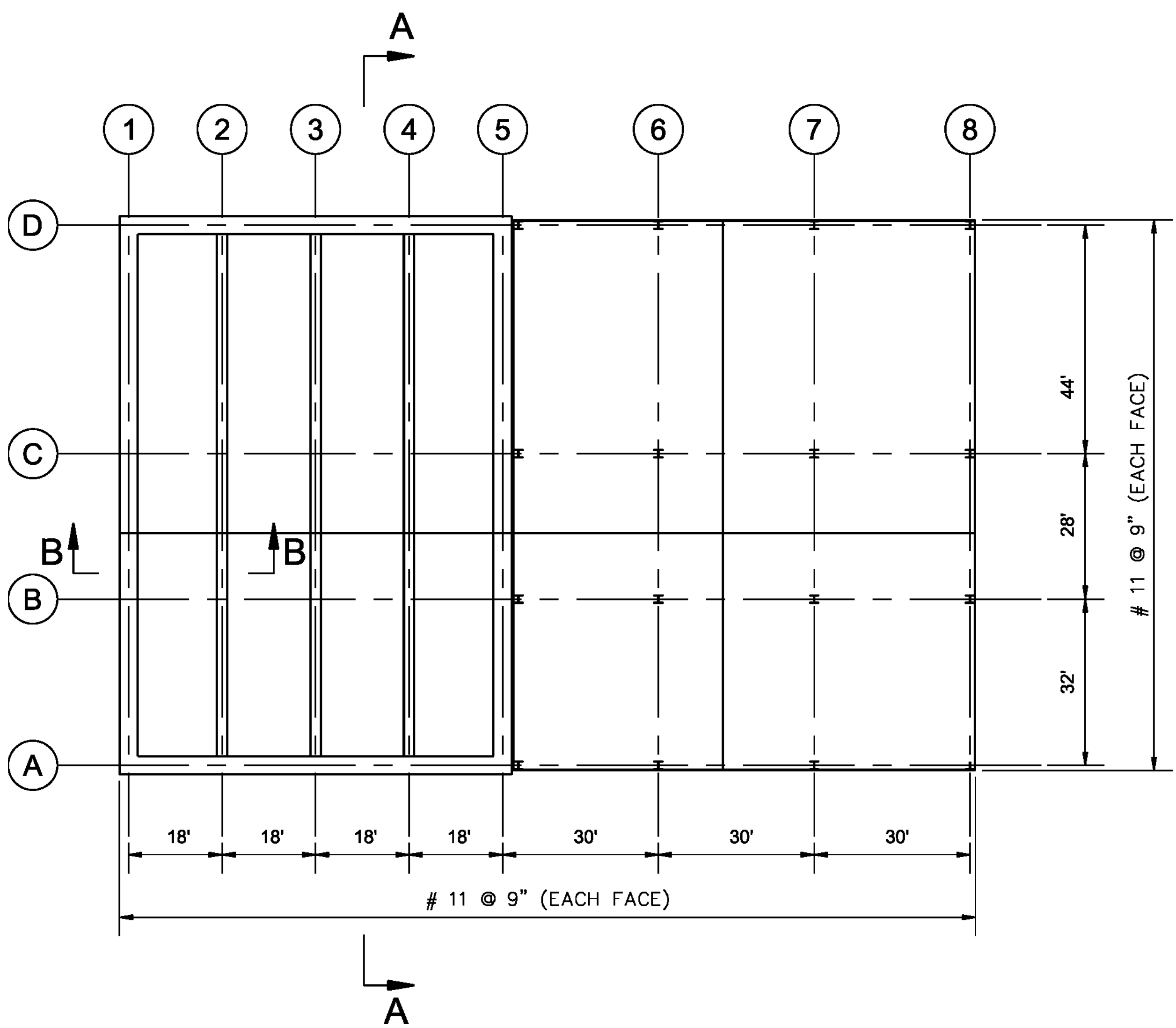


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Figure 3E.4-3—{Roof Slab Plan for UHS Makeup Water Intake Structure at Elevation 302’-0” (92.05m)}

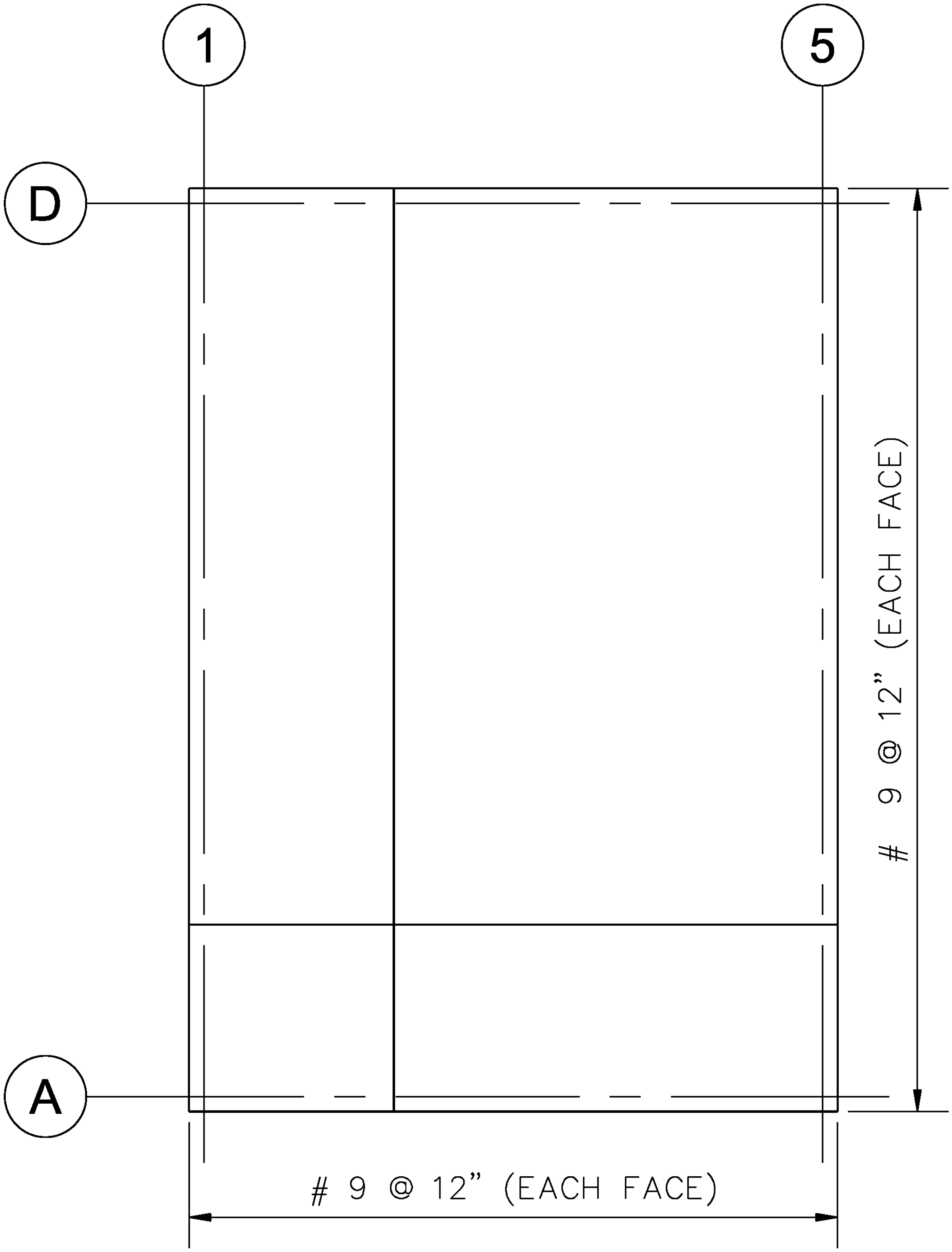

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Figure 3E.4-4—{Section A-A for the UHS Makeup Water Intake Structure}

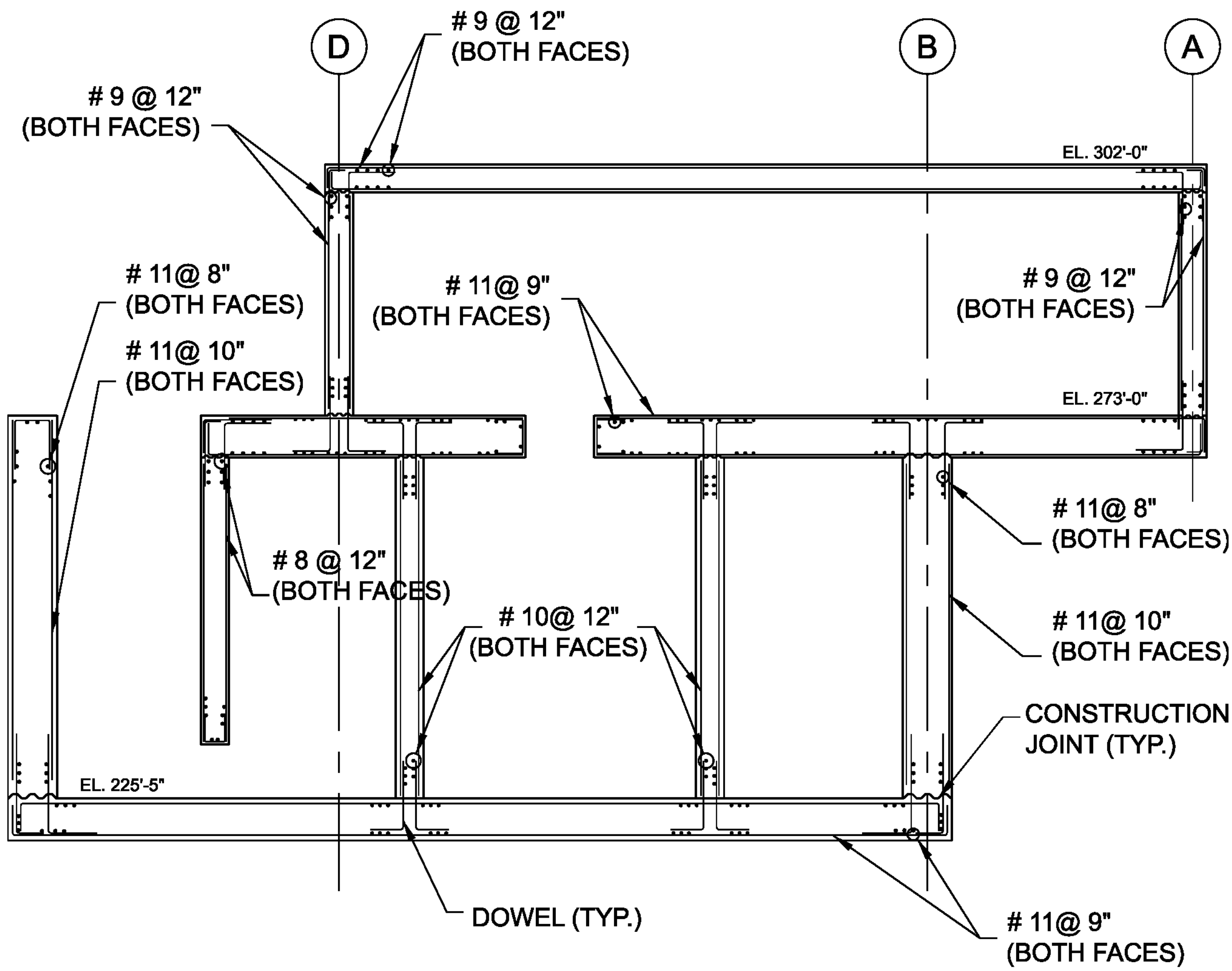

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Figure 3E.4-5—{Section A-A for the UHS Makeup Water Intake Structure}

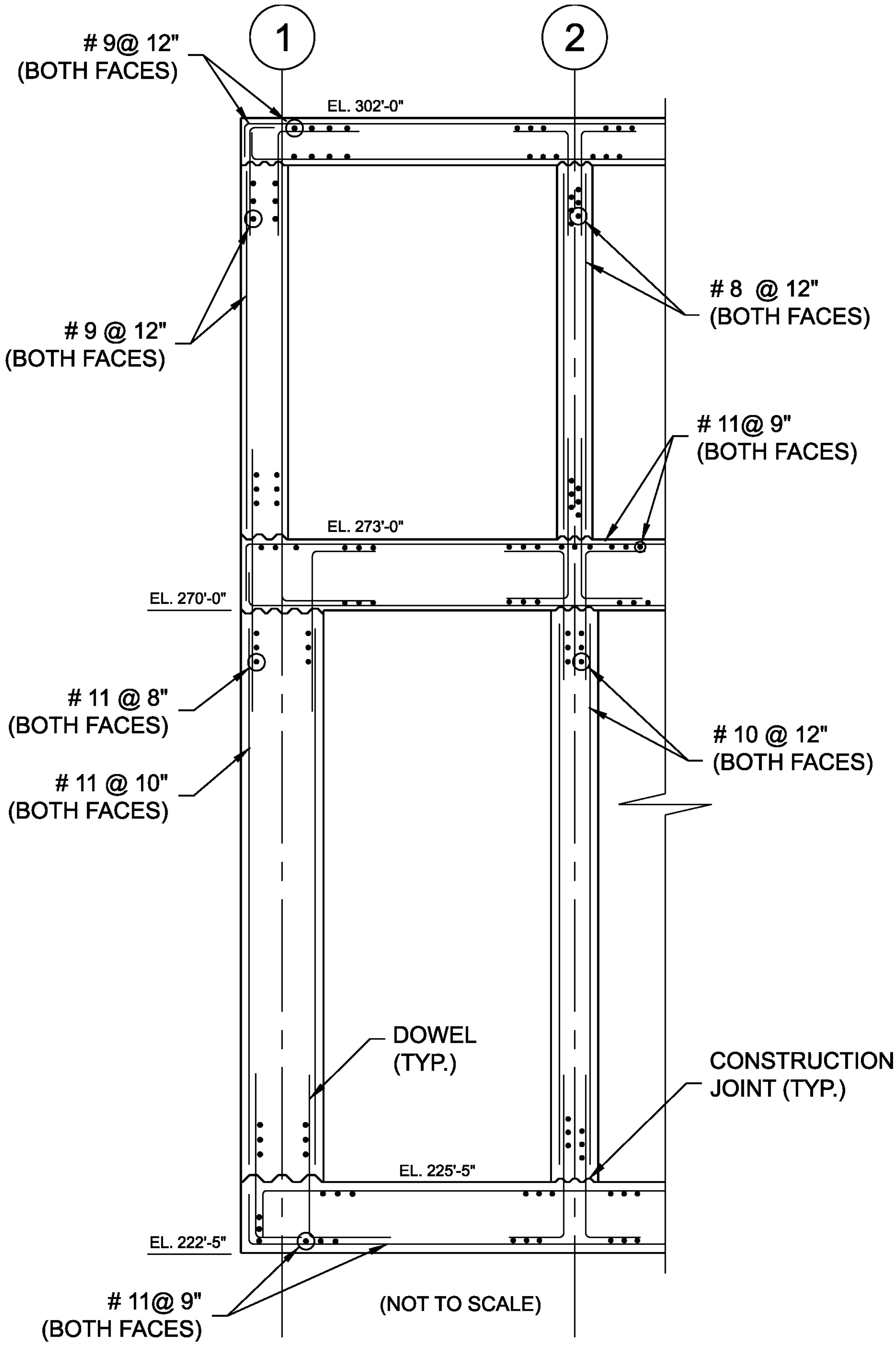


Figure 3E.4-6—{Isometric View Looking Southeast of the UHS Makeup Water Intake Structure}

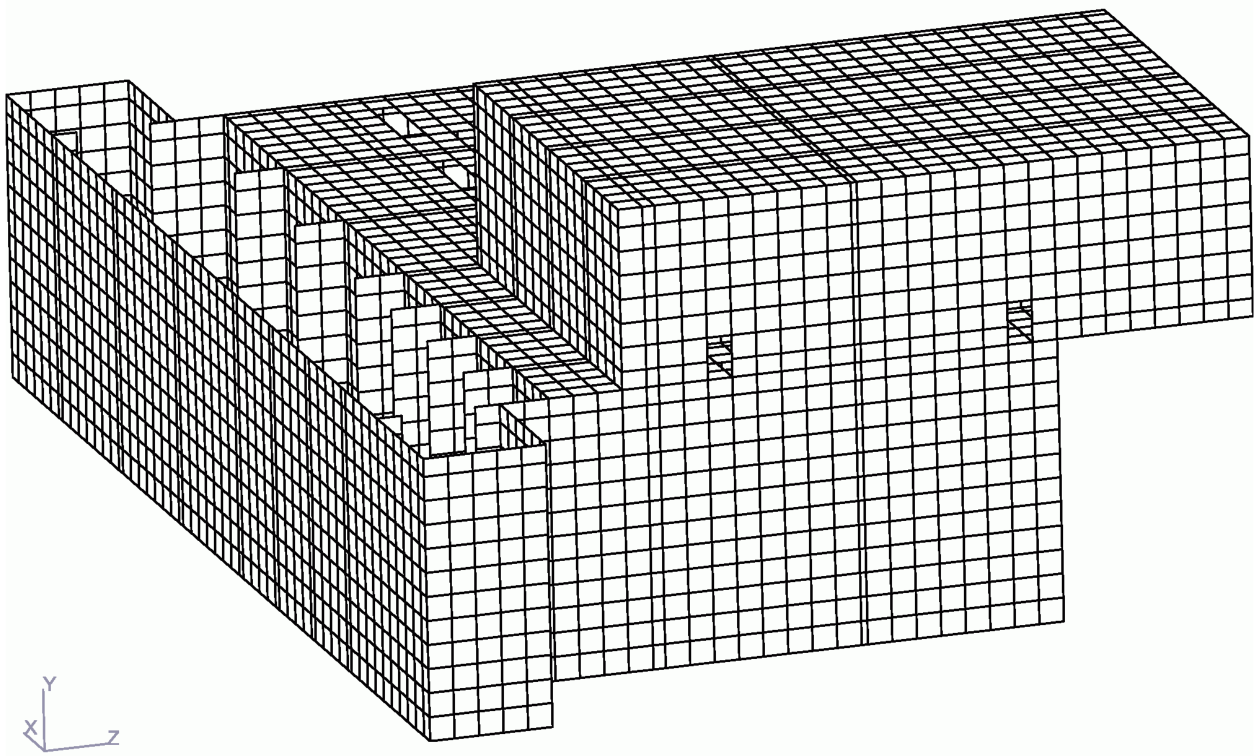


Figure 3E.4-7—{Isometric View Looking Northwest of the UHS Makeup Water Intake Structure}

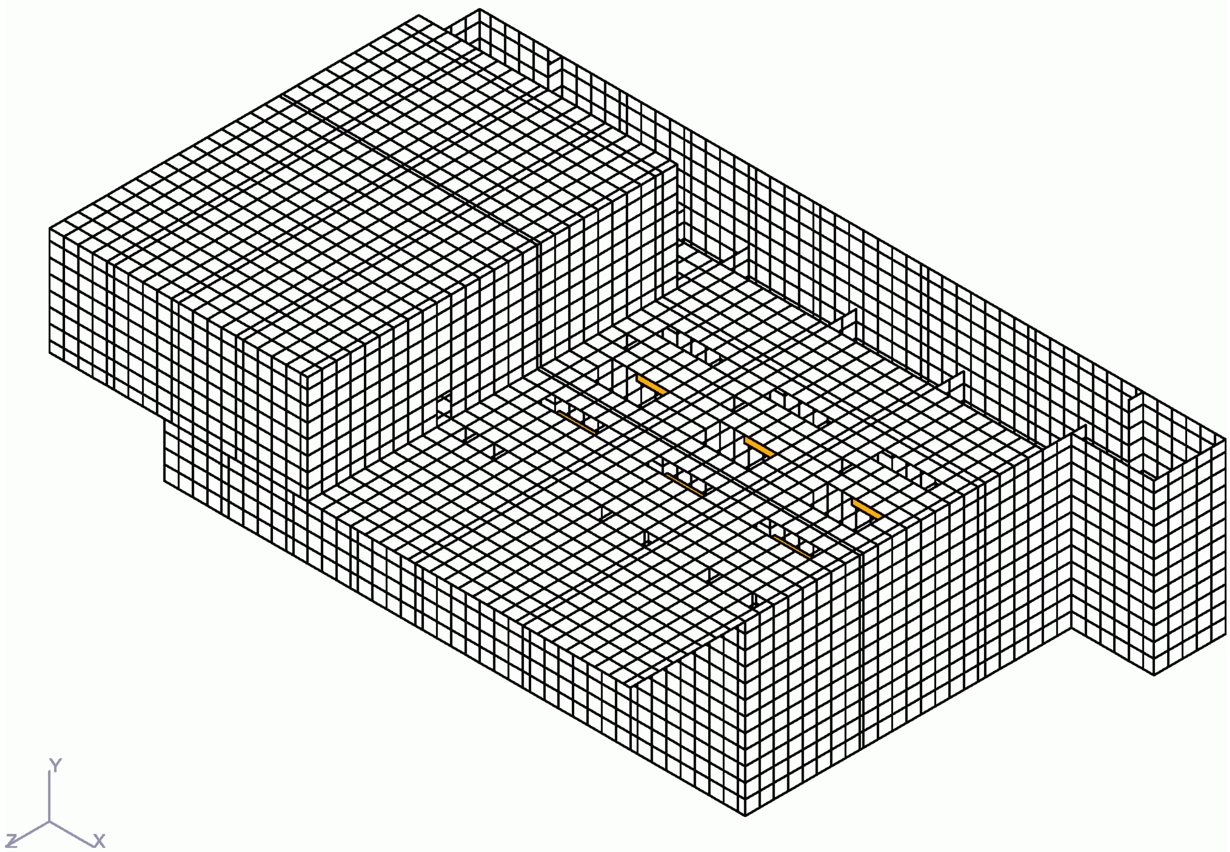


Figure 3E.4-8—{Foundation Base Mat Plan for the UHS Makeup Water Intake Structure at Elevation 225′-5″ (68.71 m)}

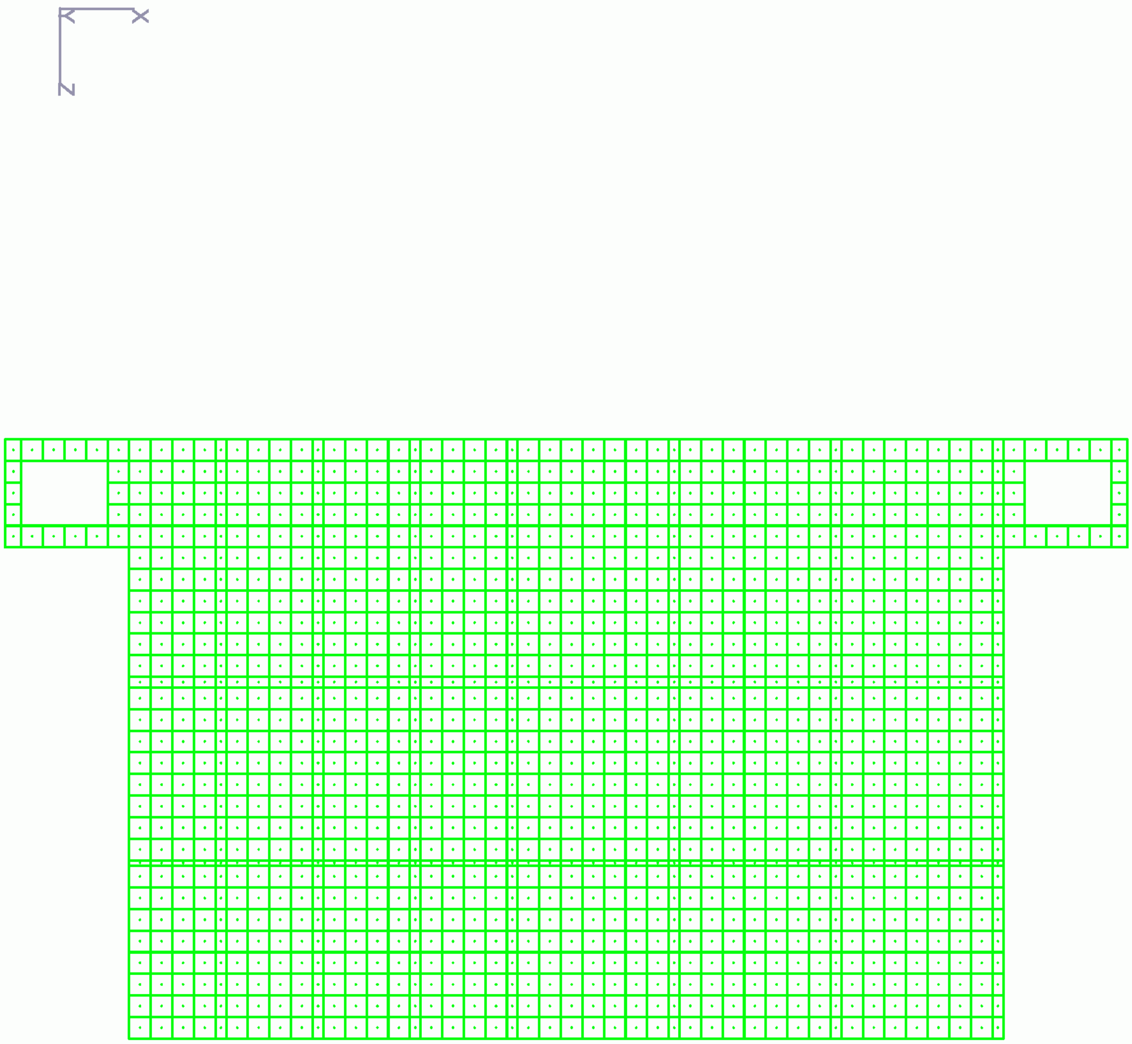
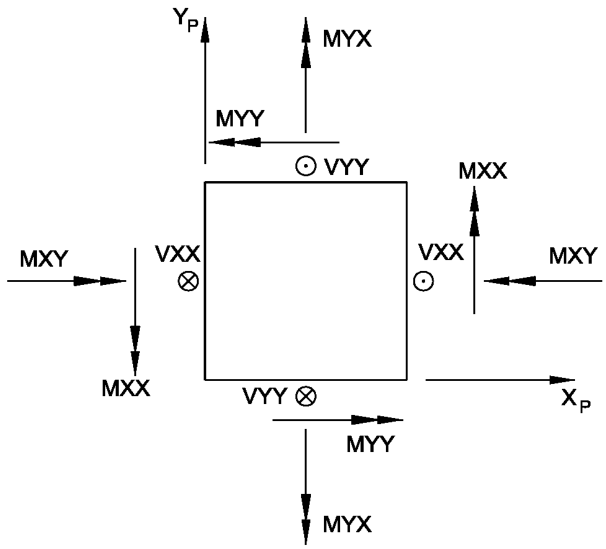
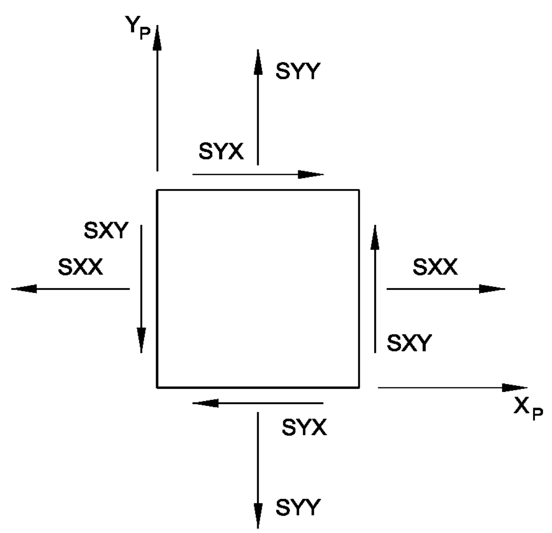


Figure 3E.4-9—{Positive Sign Convention for GT STRUDL Finite Element Analysis}



a) Plate Bending



b) Plane Stress/Strain

(a) The positive in-plane bending moment resultants MXX and MYY and the normal twisting moment MXY (units of moment/ length along the edge of the element), and the transverse shear force resultants VXX and VYY (units of force/ length along the edge of the element) for PLATE BENDING finite elements.

(b) the positive normal stresses SXX and SYY and the positive shear stress SXY (stress units of force/length^2 at the location on the element for which the stress is output) for PLANE STRESS and PLANE STRAIN finite elements.

Figure 3E.4-10—{UHS Makeup Water Intake Structure Tie Back System}

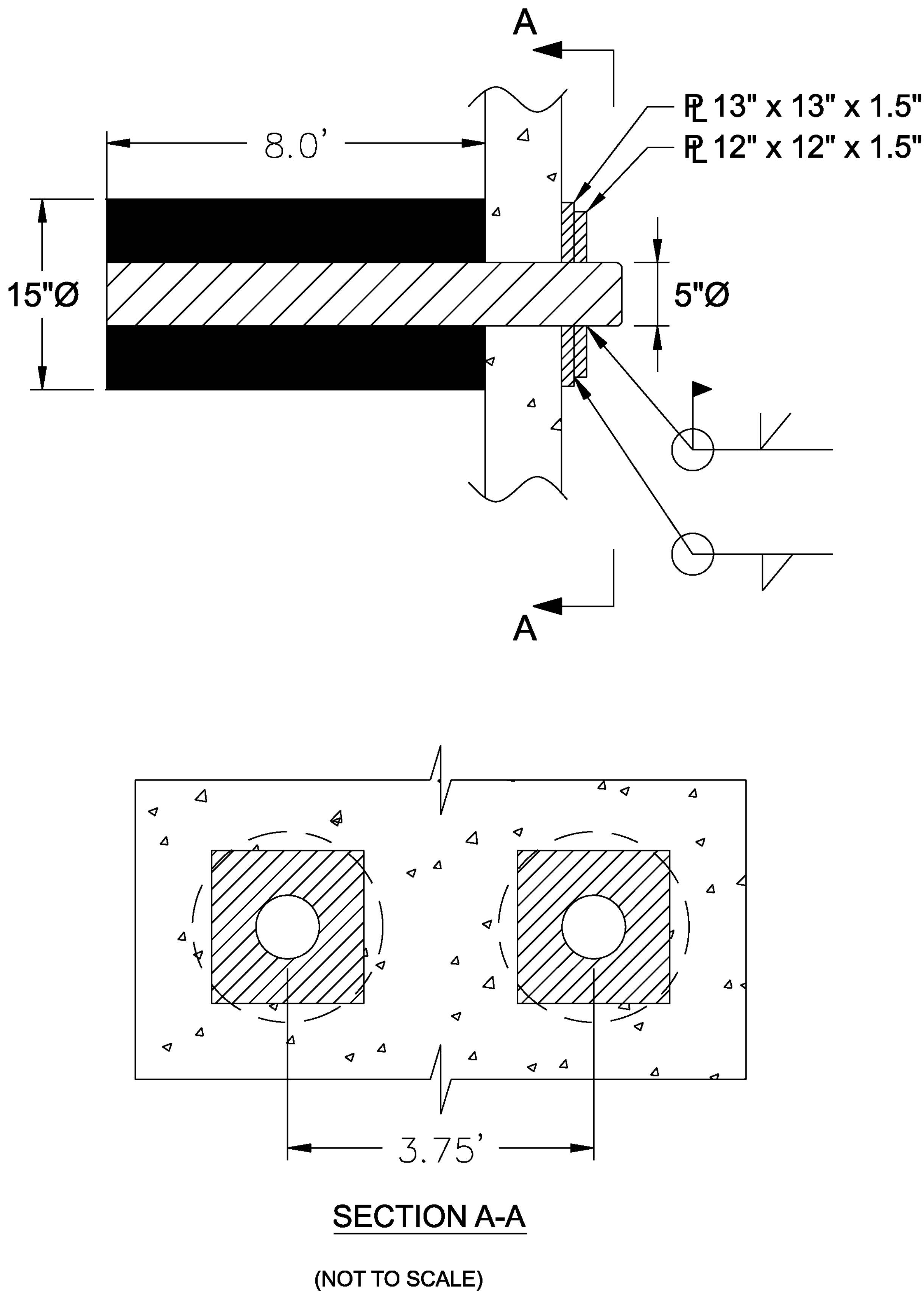
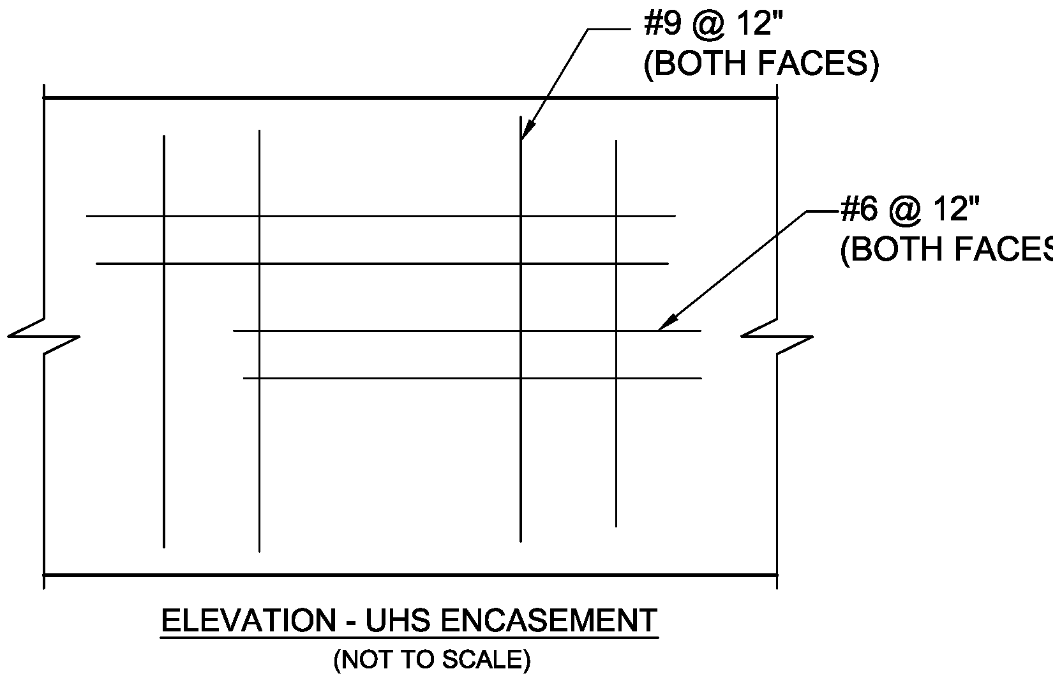


Figure 3E.4-11—{Underground - UHS Encasement}



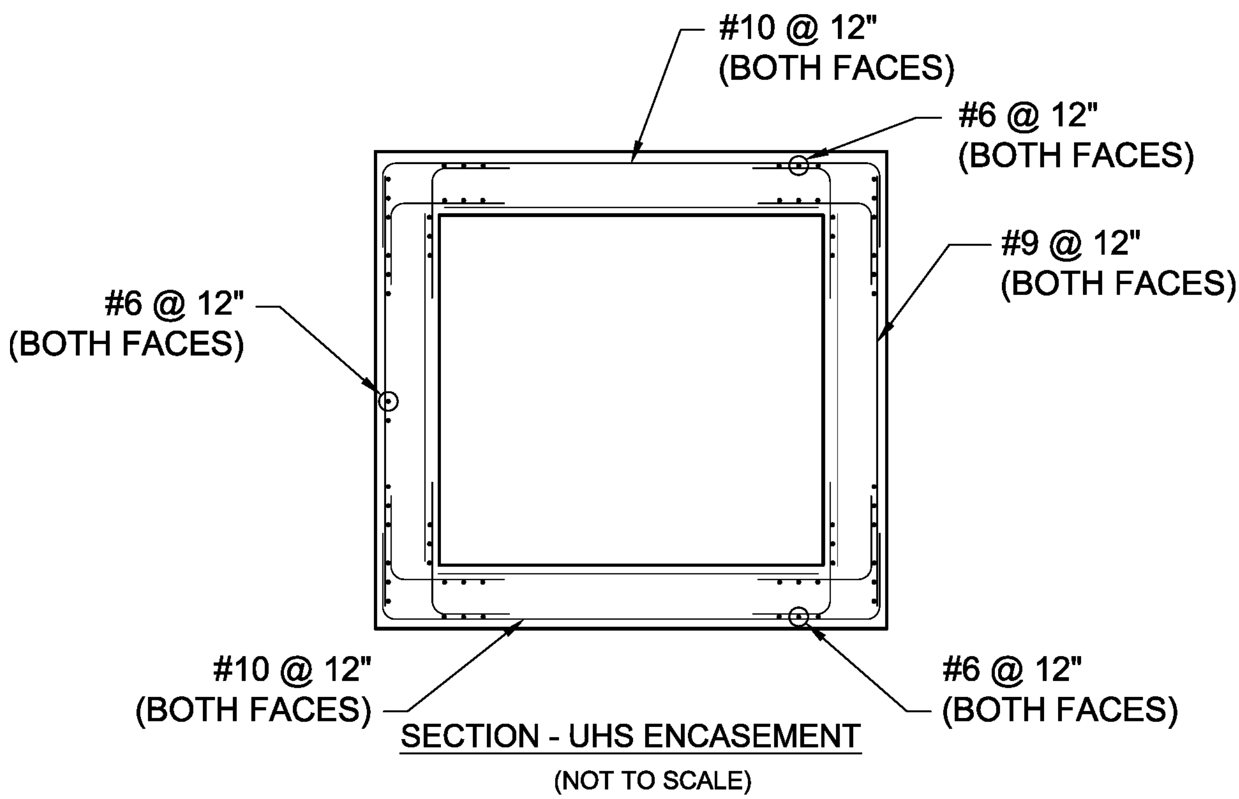
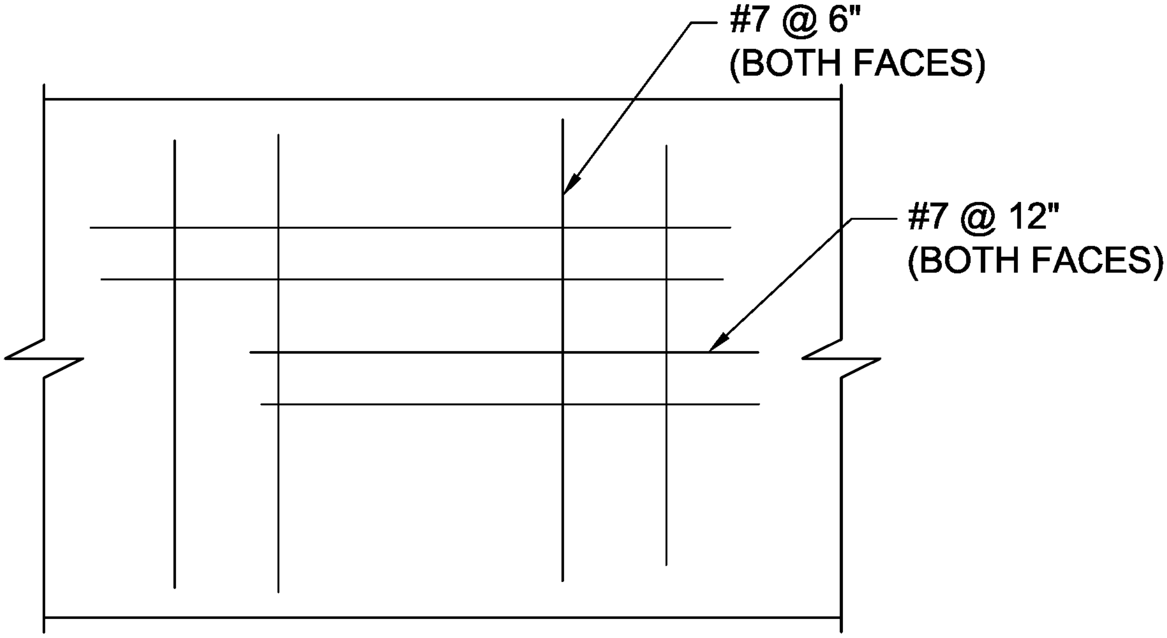
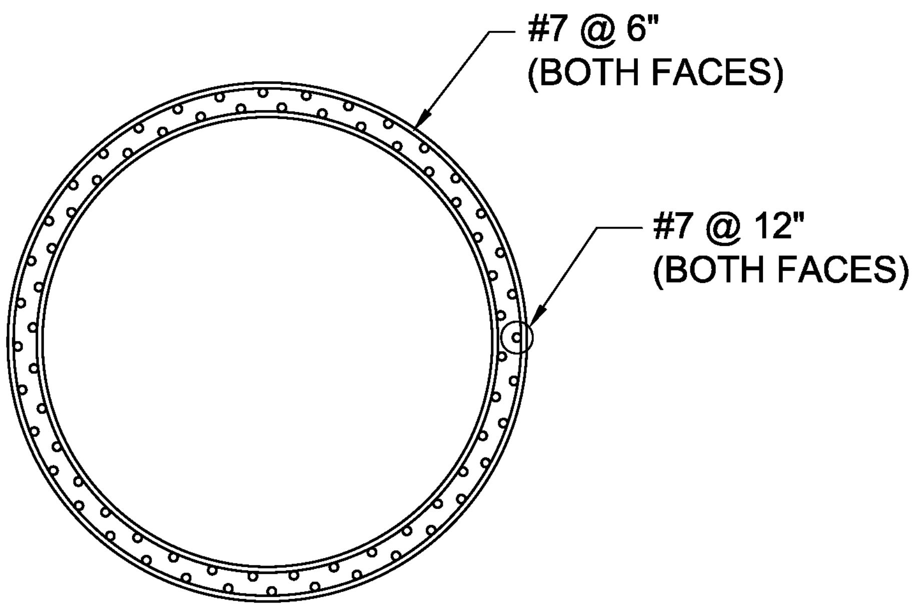


Figure 3E.4-12—{UHS Intake Tunnel for UHS Makeup Water Intake Structure}



ELEVATION - UHS INTAKE TUNNEL

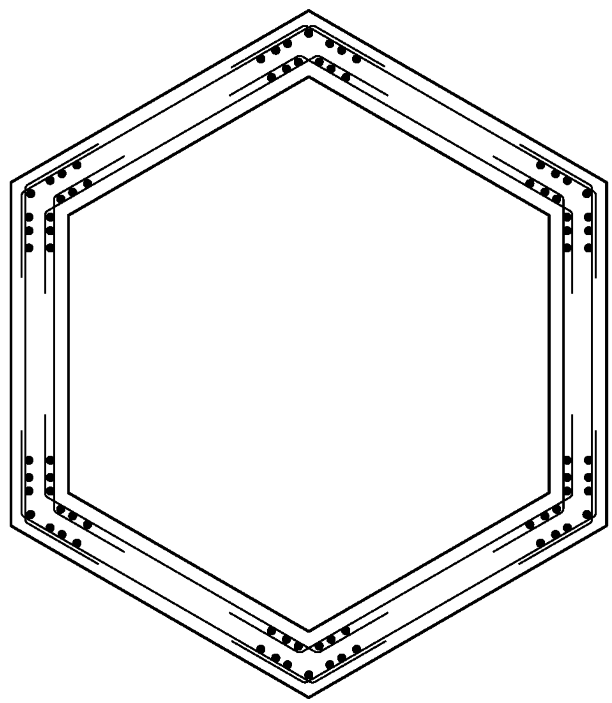
(NOT TO SCALE)



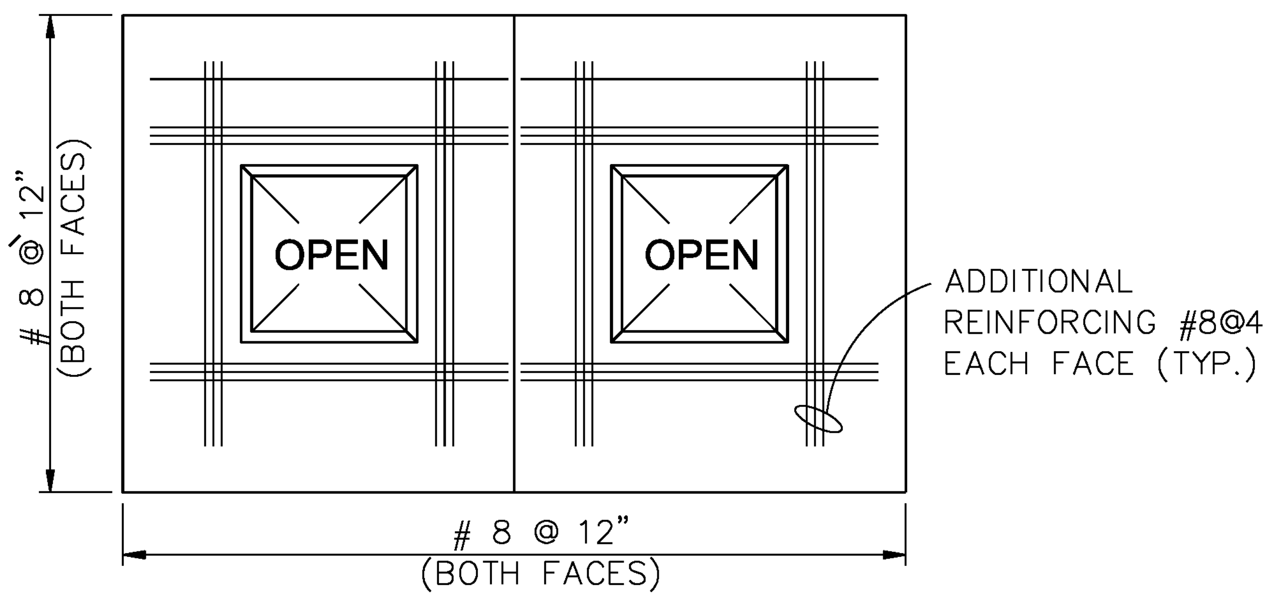
SECTION - UHS INTAKE TUNNEL

(NOT TO SCALE)

Figure 3E.4-13—{Cover for UHS Makeup Water Intake Structure}



PLAN - COVER FOR INTAKE STRUCTURE
(NOT TO SCALE)



ELEVATION - COVER FOR INTAKE STRUCTURE
(NOT TO SCALE)