

WCS Consolidated Interim Storage
Facility System
Safety Analysis Report

(Public Version)

Docket Number 72-1050

Revision 0

Table of Contents

1.	INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	1-1
1.1	Introduction.....	1-2
1.2	General Description of Installation.....	1-4
1.2.1	Location and Site Characteristics.....	1-4
1.2.2	Principal Design Criteria.....	1-4
1.2.3	Facility Descriptions.....	1-5
1.2.4	Materials To Be Stored.....	1-6
1.2.5	Waste Products Generated During Operations.....	1-6
1.3	General Description of Systems and Operations.....	1-7
1.3.1	WCS Interim Storage Facility Systems.....	1-7
1.3.2	WCS Interim Storage Facility Operations.....	1-9
1.4	Analysis of Operations.....	1-10
1.4.1	Normal Operations – Dose Assessment.....	1-10
1.4.2	Normal Operations – Establishment of the Controlled Area (Site) Boundary.....	1-10
1.4.3	Accident Analysis.....	1-10
1.4.4	Safety Management.....	1-12
1.5	Identification of Agents and Contractors.....	1-13
1.6	Material Incorporated by Reference.....	1-14
1.6.1	NUHOMS® Systems.....	1-14
1.6.2	NAC International Systems.....	1-14
1.7	References.....	1-16
2.	SITE CHARACTERISTICS.....	2-1
2.1	Geography and Demography of Site Selected.....	2-2
2.2	Nearby Industrial, Transportation and Military Facilities.....	2-4
2.3	Meteorology.....	2-5
2.3.1	Regional Climatology.....	2-5
2.3.2	Local Meteorology.....	2-5
2.3.3	On-Site Meteorological Measurement Program.....	2-8

2.3.4	Diffusion Estimates.....	2-9
2.4	Surface Hydrology	2-11
2.4.1	Hydrologic Description.....	2-11
2.4.2	Floods.....	2-13
2.4.3	Probable Maximum Flood on Streams and Rivers	2-15
2.4.4	Potential Dam Failures (Seismically Induced)	2-15
2.4.5	Probable Maximum Surge and Seiche Flooding	2-15
2.4.6	Probable Maximum Tsunami Flooding	2-15
2.4.7	Ice Flooding	2-15
2.4.8	Flooding Protection Requirements	2-15
2.4.9	Environmental Acceptance of Effluents	2-15
2.5	Subsurface Hydrology	2-17
2.5.1	Salt Dissolution and Sink Holes	2-21
2.6	Geology And Seismology	2-22
2.6.1	Basic Geologic and Seismic Information	2-22
2.6.2	Vibratory Ground Motion.....	2-24
2.6.3	Surface Faulting.....	2-26
2.6.4	Stability of Subsurface Materials.....	2-28
2.6.5	Slope Stability.....	2-29
2.6.6	Volcanism	2-29
2.7	Summary Of Site Conditions Affecting Construction And Operating Requirements	2-30
2.8	References.....	2-31
Attachment A	Meteorological Data from WCS On-Site Weather Stations	A-1
Attachment B	Flood Plain Report.....	B-1
Attachment C	Boring Logs.....	C-1
Attachment D	Seismic Hazard Evaluation for WCS CISF.....	D-1
Attachment E	Geotechnical Investigation for WCS CISF.....	E-1
Attachment F	Evaluation of Halite Dissolution in the Vicinity of Waste Control Specialists Disposal Site, Andrews County, TX.....	F-1

3.	PRINCIPAL DESIGN CRITERIA	3-1
3.1	Stored Materials.....	3-2
3.2	Classification of WCS Interim Storage Facility Structures, Systems and Components.....	3-3
3.2.1	Cask Handling Building and Equipment	3-3
3.2.2	Storage Systems and Pads.....	3-3
3.2.3	Security and Administration Building	3-4
3.2.4	Receiving Area.....	3-4
3.3	Design Criteria for WCS CISF ITS Structures, Systems and Components	3-5
3.3.1	Structural.....	3-5
3.3.2	Thermal	3-7
3.3.3	Confinement.....	3-7
3.3.4	Radiological Protection.....	3-7
3.3.5	Nuclear Criticality Safety	3-8
3.3.6	Decommissioning	3-9
3.3.7	Material Handling, Storage, and Retrieval Capability.....	3-9
3.3.8	Satisfaction of ALARA Goals	3-9
3.4	Design Criteria for Transportable Storage Casks and Cask/Canister Systems	3-11
3.5	Design Criteria for Other Structures, Systems, and Components Subject to NRC Approval.....	3-12
3.5.1	Important to Physical Protection of Facility and Materials	3-12
3.5.2	Conventional Quality	3-12
3.6	Performance Requirements	3-14
3.6.1	Receipt Rate Capability	3-14
3.6.2	SNF and GTCC Waste Receiving Mode	3-14
3.6.3	Storage Capacity	3-14
3.6.4	Facility Service Life.....	3-14
3.7	Summary of WCS Interim Storage Facility Principle Design Criteria.....	3-15
3.8	References.....	3-16

4.	OPERATING SYSTEMS.....	4-1
4.1	Installation Design	4-2
4.1.1	Location and Layout of Facility.....	4-2
4.1.2	Principle Features.....	4-2
4.1.3	Control Room and Control Area.....	4-5
4.2	Spent Fuel Handling Systems	4-6
4.2.1	Cask Handling Building.....	4-6
4.2.2	Storage Area.....	4-8
4.3	Other Operating Systems	4-9
4.3.1	Heating, Ventilation and Air Conditioning (HVAC) Systems	4-9
4.3.2	Electrical System	4-9
4.3.3	Compressed Air Supply Systems.....	4-9
4.3.4	Water Supply Systems	4-9
4.3.5	Wastewater Systems	4-9
4.3.6	Communication and Alarm Systems	4-10
4.3.7	Fire Protection.....	4-10
4.3.8	Maintenance Systems.....	4-10
4.3.9	Cold Chemical Systems	4-10
4.3.10	Radiation Monitoring Systems	4-10
4.4	Operation Support Systems	4-11
4.4.1	Storage Overpack Thermal Monitoring System	4-11
4.5	Analytical Sampling.....	4-12
4.5.1	Liquid Radioactive Waste Sampling	4-12
4.5.2	Solid Radwaste Sampling	4-12
4.5.3	Gaseous Radioactive Waste Sampling.....	4-12
4.6	Transportation Cask Repair and Maintenance	4-13
4.7	Physical Protection.....	4-14
4.7.1	Introduction.....	4-14
4.7.2	Security System Functions.....	4-14
4.7.3	Physical Protection Plan Components	4-14
4.8	References.....	4-16

5.	OPERATING PROCEDURES.....	5-1
5.1	Description of Operations	5-2
5.1.1	Receiving and Dispatch Operations for All Cask/Canister Systems	5-2
5.1.2	NUHOMS® Systems.....	5-3
5.1.3	NAC Systems.....	5-4
5.2	References.....	5-5
6.	WASTE CONFINEMENT AND MANAGEMENT.....	6-1
6.1	On-Site Waste Sources	6-2
6.1.1	Gaseous Wastes	6-2
6.1.2	Liquid Wastes	6-2
6.1.3	Sanitary Wastes.....	6-3
6.1.4	Solid Wastes.....	6-3
6.2	Off-Gas Treatment and Ventilation.....	6-4
6.3	Liquid Waste Treatment and Retention.....	6-5
6.3.1	Cask Handling Building.....	6-5
6.3.2	Conventional Waste Water Systems.....	6-5
6.3.3	Sanitary Waste Systems.....	6-6
6.4	Solid Wastes.....	6-7
6.4.1	Collection and Packaging	6-7
6.4.2	Storage/Disposal Facility	6-7
6.5	Radiological Impact of Normal Operations Summary.....	6-8
6.6	References.....	6-9
7.	INSTALLATION DESIGN AND STRUCTURAL EVALUATION	7-1
7.1	Descriptions of Systems, Structures and Components	7-2
7.2	Confinement SSCs	7-3
7.3	Pool and Pool Confinement Facilities	7-4
7.4	Reinforced Concrete Structures – Important To Safety	7-5
7.5	Cask Handling Building	7-6
7.5.1	Canister Transfer System.....	7-6
7.5.2	Vertical Cask Transporter (VCT)	7-29

7.6	Other Structures, Systems, and Components Subject to NRC Approval	7-31
7.6.1	Storage Pads	7-31
7.6.2	Settlement and Soil Liquefaction	7-56
7.6.3	Soil Structure Interaction	7-65
7.6.4	NITS Storage Pads	7-69
7.7	References	7-71
8.	THERMAL EVALUATION	8-1
8.1	Thermal Design Criteria and Features	8-2
8.1.1	Criteria	8-2
8.1.2	Features	8-2
8.2	Stored Material Specifications	8-3
8.3	Thermal Assessment	8-4
8.4	Thermal Analysis	8-5
8.5	References	8-6
9.	RADIATION PROTECTION	9-1
9.1	Ensuring That Occupational Radiation Exposures Are ALARA	9-2
9.1.1	Policy Considerations	9-2
9.1.2	Design Considerations	9-2
9.1.3	Operational Considerations	9-4
9.2	Radiation Sources	9-5
9.2.1	Characterization of Sources	9-5
9.2.2	Airborne Radioactive Material Sources	9-7
9.3	Radiation Protection Design Features	9-9
9.3.1	Installation Design Features	9-9
9.3.2	Access Control	9-9
9.3.3	Shielding	9-9
9.3.4	Ventilation	9-10
9.3.5	Area Radiation and Airborne Radioactivity Monitoring System	9-10
9.4	Estimated On-Site Collective Dose Assessment	9-11
9.4.1	Radiation Dose Rate Within the Controlled Area	9-11

9.4.2	Doses to Workers	9-13
9.5	Radiation Protection Program During Operation.....	9-14
9.5.1	Organization and Functions	9-14
9.5.2	Equipment, Instrumentation and Facilities	9-14
9.5.3	Procedures.....	9-15
9.6	Doses to Off-Site Public	9-17
9.6.1	Site Boundary Dose	9-17
9.6.2	Effluent and Environmental Monitoring Program	9-17
9.6.3	Maximum Off-Site Annual Dose	9-18
9.6.4	Liquid Releases.....	9-18
9.7	References.....	9-19
10.	CRITICALITY EVALUATION	10-1
10.1	Criticality Design Criteria and Features	10-2
10.1.1	Criteria	10-2
10.1.2	Features	10-2
10.2	Stored Material Specifications.....	10-4
10.3	Criticality Assessment	10-5
10.4	Criticality Analysis.....	10-6
10.5	References.....	10-7
11.	CONFINEMENT EVALUATION	11-1
11.1	Confinement Design Characteristics.....	11-2
11.2	Confinement Monitoring.....	11-3
11.3	Potential Release Source Term	11-4
11.4	Confinement Analysis.....	11-5
11.5	Protection of Stored Materials from Degradation.....	11-6
11.6	References.....	11-7
12.	ACCIDENT ANALYSIS	12-1
12.1	Off-Normal Events.....	12-2
12.2	Accidents.....	12-3
12.2.1	Canister Transfer System Fire Accident.....	12-3
12.3	References.....	12-6

13.	CONDUCT OF OPERATIONS	13-1
13.1	Organizational Structure	13-2
13.1.1	Corporate Organization.....	13-3
13.1.2	Operating Organization, Management, and Administrative Control System.....	13-7
13.1.3	Personnel Qualification Requirement	13-11
13.1.4	Liaison With Outside Organizations.....	13-15
13.2	Pre-Operational Testing and Operation.....	13-16
13.2.1	Administrative Procedures for Conducting Test Program.....	13-16
13.2.2	Test Program Description	13-16
13.2.3	Test Discussion	13-19
13.3	Training Program	13-20
13.3.1	Program Description	13-20
13.3.2	Retraining Program.....	13-28
13.3.3	Administration and Records	13-28
13.4	Facility Operations.....	13-29
13.4.1	Facility Procedures.....	13-29
13.4.2	Facility Records	13-32
13.4.3	Facility Review and Audit Program	13-34
13.4.4	Modifications to Facilities and Equipment.....	13-34
13.4.5	Employee Concerns Program	13-36
13.5	Emergency Response Planning.....	13-37
13.6	Decommissioning Plan.....	13-40
13.6.1	WCS CISF Decommissioning Plan	13-40
13.6.2	Cost of Decommissioning.....	13-40
13.6.3	Decommissioning Facilitation	13-40
13.6.4	Recordkeeping for Decommissioning.....	13-40
13.7	Physical Security and Safeguards Contingency Plans.....	13-41
13.8	References.....	13-43
B 2.0	SAFETY LIMITS (SLs).....	14-1
B 3.0	LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY.....	14-2
B 3.0	SURVEILLANCE REQUIREMENT (SR) APPLICABILITY.....	14-6
B.3.1	RADIATION PROTECTION	14-11
B.3.2	NAC-MPC SYSTEM Integrity.....	14-13

B.3.3	NAC-UMS SYSTEM Integrity.....	14-18
B.3.4	MAGNASTOR SYSTEM Integrity.....	14-24
15.	MATERIALS EVALUATION	15-1
15.1	Material Selection	15-2
15.1.1	ITS Storage Pads.....	15-2
15.1.2	Canister Transfer System.....	15-2
15.1.3	Vertical Cask Transporter.....	15-2
15.1.4	Canisters and Storage Overpacks.....	15-2
15.2	Applicable Codes and Standards.....	15-4
15.2.1	Canisters.....	15-4
15.2.2	Storage Overpacks	15-5
15.2.3	Transfer Casks for Vertical Systems.....	15-6
15.3	Material Properties.....	15-7
15.3.1	ITS Storage Pads.....	15-7
15.3.2	Canister Transfer System.....	15-7
15.3.3	Vertical Cask Transporter	15-9
15.4	References.....	15-11

Appendix A NUHOMS[®]-MP187 Cask System

A.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	A.1-1
A.2. SITE CHARACTERISTICS.....	A.2-1
A.3. PRINCIPLE DESIGN CRITERIA	A.3-1
A.3.1 SSCs Important to Safety	A.3-2
A.3.1.1 FO-, FC-, FF- DSCs.....	A.3-2
A.3.1.2 Horizontal Storage Module.....	A.3-2
A.3.1.3 NUHOMS [®] Basemat and Approach Slab.....	A.3-2
A.3.1.4 NUHOMS [®] Transfer Equipment	A.3-2
A.3.2 Spent Fuel to Be Stored	A.3-4
A.3.2.1 FO-, FC-DSC	A.3-4
A.3.2.2 FF-DSC	A.3-4
A.3.3 Design Criteria for Environmental Conditions and Natural Phenomena.....	A.3-5
A.3.3.1 Tornado Wind and Tornado Missiles	A.3-5
A.3.3.2 Water Level (Flood) Design	A.3-5
A.3.3.3 Seismic Design.....	A.3-5
A.3.3.4 Snow and Ice Loading	A.3-6
A.3.3.5 Lightning.....	A.3-6
A.3.4 Safety Protection Systems	A.3-7
A.3.4.1 General.....	A.3-7
A.3.4.2 Structural.....	A.3-7
A.3.4.3 Thermal	A.3-8
A.3.4.4 Shielding/Confinement/Radiation Protection	A.3-8
A.3.4.5 Criticality	A.3-8
A.3.4.6 Material Selection	A.3-9
A.3.4.7 Operating Procedures.....	A.3-9
A.3.5 References.....	A.3-10

A.4. OPERATING SYSTEMS.....	A.4-1
A.4.1 Concrete Pad Structures	A.4-2
A.4.1.1 Operating Functions.....	A.4-2
A.4.1.2 Design Description.....	A.4-2
A.4.1.3 Safety Considerations	A.4-4
A.4.2 Cask Storage System.....	A.4-5
A.4.2.1 Operating Function	A.4-5
A.4.2.2 Design Description.....	A.4-5
A.4.2.3 Safety Considerations	A.4-5
A.4.3 Cask Transporter System.....	A.4-6
A.4.3.1 Operating Function	A.4-6
A.4.3.2 Design Description.....	A.4-6
A.4.3.3 Safety Considerations	A.4-6
A.4.4 Storage Module Thermal Monitoring System.....	A.4-7
A.4.5 References.....	A.4-8
A.5. OPERATING PROCEDURES.....	A.5-1
A.5.1 Procedures for Receiving the Transport Cask and Transfer to the HSM	A.5-2
A.5.1.1 Receipt of the Loaded NUHOMS® -MP187 Cask.....	A.5-2
A.5.1.2 Transfer to the HSM	A.5-3
A.5.1.3 Monitoring Operations.....	A.5-5
A.5.2 Procedures for Retrieval and Off-Site Shipment.....	A.5-6
A.5.2.1 DSC Retrieval from the HSM.....	A.5-6
A.5.3 References.....	A.5-8
A.6. WASTE CONFINEMENT AND MANAGEMENT.....	A.6-1
A.7. STRUCTURAL EVALUATION.....	A.7-1
A.7.1 Discussion.....	A.7-2
A.7.2 Summary of Mechanical Properties of Materials	A.7-4
A.7.3 Structural Analysis of MP187 Cask with a Canister (Transfer Configuration).....	A.7-5
A.7.3.1 Normal and Off-Normal Conditions.....	A.7-5

A.7.3.2	Accident Conditions.....	A.7-6
A.7.3.3	Load Combinations (Volume I of [A.7-4]).....	A.7-6
A.7.4	Structural Analysis of HSM Model 80 with a Canister (Storage Configuration).....	A.7-8
A.7.4.1	Normal and Off-Normal Conditions.....	A.7-9
A.7.4.2	Accident Conditions.....	A.7-9
A.7.4.3	Load Combinations.....	A.7-10
A.7.5	Seismic Reconciliation of the MP187 Cask, Canisters, and HSM Model 80.....	A.7-11
A.7.5.1	MP187 Cask.....	A.7-11
A.7.5.2	Canisters.....	A.7-12
A.7.5.3	HSM Model 80	A.7-13
A.7.6	Thermal Stress Reconciliation of the MP187 Cask System Components.....	A.7-14
A.7.6.1	Reconciliation of WCS CISF Environmental Ambient Conditions with Environmental Ambient Conditions in the Standardized NUHOMS® UFSAR	A.7-14
A.7.6.2	Reconciliation of WCS CISF Environmental Ambient Conditions with Environmental Ambient Conditions in the Rancho Seco ISFSI FSAR	A.7-14
A.7.7	Conclusions of the Structural Analysis.....	A.7-15
A.7.8	References.....	A.7-16
A.8.	THERMAL EVALUATION.....	A.8-1
A.8.1	Discussion.....	A.8-2
A.8.2	Summary of Thermal Properties of Materials.....	A.8-3
A.8.3	Ambient Conditions at the WCS CISF	A.8-4
A.8.3.1	Ambient Temperature Specification at WCS CISF	A.8-4
A.8.3.2	Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [A.8-3].....	A.8-4
A.8.4	Thermal Analysis of HSM Model 80 with FO/FC/FF DSCs.....	A.8-5
A.8.4.1	Qualification of the HSM Model 80 for Storage of Canisters	A.8-5
A.8.4.2	Thermal Model of Rancho Seco HSM and Canisters.....	A.8-5
A.8.4.3	Rancho Seco HSM Thermal Model Results	A.8-5
A.8.4.4	Evaluation of HSM Model 80 Performance with a Canister	A.8-6

A.8.5	Thermal Analysis of MP187 Cask with FO/FC/FF DSCs.....	A.8-7
A.8.5.1	Thermal Model MP187 Cask with FO/FC/FF DSCs.....	A.8-7
A.8.5.2	MP187 Cask Thermal Model Results.....	A.8-7
A.8.5.3	Accident Conditions.....	A.8-7
A.8.5.4	Evaluation of MP187 Cask Performance.....	A.8-7
A.8.6	References.....	A.8-8
A.9.	RADIATION PROTECTION	A.9-1
A.9.1	Radiation Protection Design Features	A.9-2
A.9.2	Occupational Exposure Evaluation.....	A.9-3
A.9.2.1	Analysis Methodology.....	A.9-3
A.9.2.2	Dose Assessment	A.9-3
A.9.3	References.....	A.9-5
A.10.	CRITICALITY EVALUATION	A.10-1
A.10.1	Discussion and Results.....	A.10-2
A.10.2	Package Fuel Loading.....	A.10-4
A.10.3	Model Specification.....	A.10-5
A.10.4	Criticality Calculation	A.10-6
A.10.5	Critical Benchmark Experiments.....	A.10-7
A.10.6	References.....	A.10-8
A.11.	CONFINEMENT EVALUATION	A.11-1
A.11.1	Confinement Boundary	A.11-2
A.11.2	Potential Release Source Term.....	A.11-3
A.11.3	Confinement Analysis.....	A.11-4
A.11.3.1	Methodology.....	A.11-4
A.11.3.2	Specific Activities for Release.....	A.11-5
A.11.3.3	Leakage Rates	A.11-5
A.11.3.4	Atmospheric Dispersion Coefficients.....	A.11-6
A.11.3.5	Dose Computations.....	A.11-6
A.11.4	References.....	A.11-9

A.12.ACCIDENT ANALYSIS	A.12-1
A.12.1 Off-Normal Operations	A.12-2
A.12.1.1 Off-Normal Transfer Loads	A.12-2
A.12.1.2 Off-Normal HSM Storage Events (Extreme Temperatures)	A.12-2
A.12.1.3 Off-Normal Release of Radionuclides.....	A.12-2
A.12.2 Postulated Accident	A.12-3
A.12.2.1 Blockage of Air Inlets/Outlets	A.12-3
A.12.2.2 Drop Accidents	A.12-3
A.12.2.3 Earthquakes.....	A.12-4
A.12.2.4 Lightning.....	A.12-4
A.12.2.5 Fire and Explosion	A.12-4
A.12.2.6 Flood	A.12-5
A.12.2.7 Tornado Wind and Missiles	A.12-5
A.12.3 References.....	A.12-6

Appendix B

Standardized Advanced NUHOMS® System

B.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	B.1-1
B.2. SITE CHARACTERISTICS.....	B.2-1
B.3. PRINCIPLE DESIGN CRITERIA	B.3-1
B.3.1 SSCs Important to Safety	B.3-2
B.3.1.1 24PT1 DSC	B.3-2
B.3.1.2 Horizontal Storage Module.....	B.3-2
B.3.1.3 NUHOMS® Basemat and Approach Slab.....	B.3-2
B.3.1.4 NUHOMS® Transfer Equipment	B.3-3
B.3.2 Spent Fuel to Be Stored	B.3-4
B.3.3 Design Criteria for Environmental Conditions and Natural Phenomena.....	B.3-5
B.3.3.1 Tornado Wind and Tornado Missiles	B.3-5
B.3.3.2 Water Level (Flood) Design	B.3-5
B.3.3.3 Seismic Design.....	B.3-5
B.3.3.4 Snow and Ice Loading	B.3-6
B.3.3.5 Lightning.....	B.3-6
B.3.4 Safety Protection Systems	B.3-7
B.3.4.1 General.....	B.3-7
B.3.4.2 Structural.....	B.3-7
B.3.4.3 Thermal	B.3-8
B.3.4.4 Shielding/Confinement/Radiation Protection	B.3-8
B.3.4.5 Criticality	B.3-8
B.3.4.6 Material Selection	B.3-9
B.3.4.7 Operating Procedures.....	B.3-9
B.3.5 References.....	B.3-10
B.4. OPERATING SYSTEMS.....	B.4-1
B.4.1 Concrete Pad Structures	B.4-2
B.4.1.1 Operating Functions.....	B.4-2

B.4.1.2	Design Description.....	B.4-2
B.4.1.3	Safety Considerations	B.4-4
B.4.2	Cask Storage System.....	B.4-5
B.4.2.1	Operating Function	B.4-5
B.4.2.2	Design Description.....	B.4-5
B.4.2.3	Safety Considerations	B.4-5
B.4.3	Cask Transporter System.....	B.4-6
B.4.3.1	Operating Function	B.4-6
B.4.3.2	Design Description.....	B.4-6
B.4.3.3	Safety Considerations	B.4-6
B.4.4	Storage Module Thermal Monitoring System.....	B.4-7
B.4.5	References.....	B.4-8
B.5.	OPERATING PROCEDURES.....	B.5-1
B.5.1	Procedures for Loading the DSC and Transfer to the AHSM	B.5-2
B.5.1.1	Receipt of the Loaded NUHOMS®-MP187 Cask.....	B.5-2
B.5.1.2	Transfer to the AHSM	B.5-3
B.5.1.3	Monitoring Operations.....	B.5-5
B.5.2	Procedures for Retrieval and Off-Site Shipment.....	B.5-6
B.5.2.1	DSC Retrieval from the AHSM.....	B.5-6
B.5.3	References.....	B.5-8
B.6.	WASTE CONFINEMENT AND MANAGEMENT.....	B.6-1
B.7.	STRUCTURAL EVALUATION.....	B.7-1
B.7.1	Discussion.....	B.7-3
B.7.2	Summary of Mechanical Properties of Materials	B.7-4
B.7.3	Structural Evaluation of MP187 Transfer Cask with Canister (Transfer Configuration at WCS CISF).....	B.7-5
B.7.3.1	Evaluation of MP187 Cask Loaded with a Canister.....	B.7-5
B.7.3.2	Evaluation of the Canister in the MP187 Transfer Cask	B.7-6
B.7.4	Structural Analysis of AHSM with a Canister (Storage Configuration).....	B.7-7

B.7.5	Seismic Reconciliation of the Advanced NUHOMS® 24PT1 DSC and AHSM Storage Components and the MP187 Transfer Cask.....	B.7-8
B.7.6	Thermal Stress Reconciliation of the Standardized Advanced NUHOMS® System Components.....	B.7-9
B.7.6.1	Reconciliation of WCS CISF Environmental Ambient Conditions with Environmental Ambient Conditions used for the AHSM Analyses in the Standardized Advanced NUHOMS® UFSAR	B.7-9
B.7.6.2	Reconciliation of WCS CISF Environmental Ambient Conditions with Environmental Ambient Conditions used for the Canister Analysis in the Standardized Advanced NUHOMS® UFSAR	B.7-9
B.7.7	Conclusions of the Structural Analysis	B.7-10
B.7.8	Alternate Cask Stability and Missile Penetration Evaluation of the MP187 Cask (On-Site Transfer Configuration)	B.7-11
B.7.8.1	Assumptions.....	B.7-11
B.7.8.2	Material Properties.....	B.7-11
B.7.8.3	Design Criteria	B.7-11
B.7.8.4	Methodology	B.7-12
B.7.8.5	Design Input Loads & Data	B.7-14
B.7.8.6	Tornado & Seismic Loads Analysis - Stability Evaluations.....	B.7-16
B.7.8.7	Tornado Wind and Missile Analysis - Stress Evaluations.....	B.7-19
B.7.8.8	Tornado Missile Analysis - Penetration Evaluations.....	B.7-20
B.7.8.9	Summary of Results.....	B.7-22
B.7.9	References.....	B.7-23
B.8.	THERMAL EVALUATION.....	B.8-1
B.8.1	Discussion.....	B.8-2
B.8.2	Summary of Thermal Properties of Materials.....	B.8-3
B.8.3	Specification for Components.....	B.8-4
B.8.4	Ambient Conditions at the WCS CISF	B.8-5
B.8.4.1	Ambient Temperature Specification at WCS CISF	B.8-5
B.8.4.2	Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the AHSM Thermal Evaluation from ANUH UFSAR [B.8-1] for Storage Conditions	B.8-5

B.8.4.3	Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [B.8-4] for Transfer Conditions	B.8-5
B.8.5	Thermal Analysis of AHSM with 24PT1 DSC for Storage Conditions.....	B.8-6
B.8.5.1	Thermal Model of the AHSM with 24PT1 DSC	B.8-6
B.8.5.2	AHSM Thermal Model Results	B.8-6
B.8.5.3	Evaluation of AHSM Performance with 24PT1 DSC	B.8-7
B.8.5.4	NUHOMS®-24PT1 DSC Basket Model Results	B.8-7
B.8.6	Thermal Analysis of MP187 Transfer Cask with 24PT1 DSC for Transfer Conditions.....	B.8-8
B.8.6.1	Evaluation of MP187 Cask Performance.....	B.8-9
B.8.7	References.....	B.8-10
B.9.	RADIATION PROTECTION	B.9-1
B.9.1	Radiation Protection Design Features	B.9-2
B.9.2	Occupational Exposure Evaluation.....	B.9-3
B.9.2.1	Analysis Methodology	B.9-3
B.9.2.2	Dose Assessment	B.9-3
B.9.3	References.....	B.9-5
B.10.	CRITICALITY EVALUATION	B.10-1
B.10.1	Discussion and Results.....	B.10-2
B.10.2	Package Fuel Loading.....	B.10-3
B.10.3	Model Specification.....	B.10-4
B.10.4	Criticality Calculation	B.10-5
B.10.5	Critical Benchmark Experiments.....	B.10-6
B.10.6	References.....	B.10-7
B.11	CONFINEMENT EVALUATION.....	B.11-1
B.11.1	Confinement Boundary	B.11-2
B.11.2	Requirements for Normal Conditions of Storage	B.11-3
B.11.3	Confinement Requirements for Hypothetical Accident Conditions.....	B.11-4
B.11.4	References.....	B.11-5

B.12. ACCIDENT ANALYSIS	B.12-1
B.12.1 Off-Normal Operations	B.12-2
B.12.1.1 Off-Normal Transfer Loads	B.12-2
B.12.1.2 Extreme Ambient Temperatures	B.12-2
B.12.1.3 Off-Normal Release of Radionuclides	B.12-3
B.12.2 Postulated Accident	B.12-4
B.12.2.1 Blockage of Air Inlet/Outlets	B.12-4
B.12.2.2 Drop Accidents	B.12-4
B.12.2.3 Earthquakes	B.12-5
B.12.2.4 Lightning	B.12-6
B.12.2.5 Fire and Explosion	B.12-6
B.12.2.6 Flood	B.12-7
B.12.2.7 Tornado Wind and Missiles	B.12-8
B.12.3 References	B.12-9

Appendix C

Standardized NUHOMS®-61BT System

C.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	C.1-1
C.2. SITE CHARACTERISTICS.....	C.2-1
C.3. PRINCIPLE DESIGN CRITERIA	C.3-1
C.3.1 SSCs Important to Safety	C.3-2
C.3.1.1 61BT-DSCs.....	C.3-2
C.3.1.2 Horizontal Storage Module.....	C.3-2
C.3.1.3 NUHOMS® Basemat and Approach Slab.....	C.3-2
C.3.1.4 NUHOMS® Transfer Equipment	C.3-2
C.3.2 Spent Fuel to Be Stored	C.3-4
C.3.3 Design Criteria for Environmental Conditions and Natural Phenomena.....	C.3-5
C.3.3.1 Tornado Wind and Tornado Missiles	C.3-5
C.3.3.2 Water Level (Flood) Design	C.3-5
C.3.3.3 Seismic Design.....	C.3-5
C.3.3.4 Snow and Ice Loading	C.3-6
C.3.3.5 Lightning.....	C.3-6
C.3.4 Safety Protection Systems	C.3-7
C.3.4.1 General.....	C.3-7
C.3.4.2 Structural.....	C.3-7
C.3.4.3 Thermal	C.3-7
C.3.4.4 Shielding/Confinement/Radiation Protection	C.3-8
C.3.4.5 Criticality	C.3-8
C.3.4.6 Material Selection	C.3-8
C.3.4.7 Operating Procedures.....	C.3-9
C.3.5 References.....	C.3-10
C.4. OPERATING SYSTEMS.....	C.4-1
C.4.1 Concrete Pad Structures	C.4-2
C.4.1.1 Operating Functions.....	C.4-2

C.4.1.2	Design Description.....	C.4-2
C.4.1.3	Safety Considerations	C.4-4
C.4.2	Cask Storage System.....	C.4-5
C.4.2.1	Operating Function	C.4-5
C.4.2.2	Design Description.....	C.4-5
C.4.2.3	Safety Considerations	C.4-5
C.4.3	Cask Transporter System.....	C.4-6
C.4.3.1	Operating Function	C.4-6
C.4.3.2	Design Description.....	C.4-6
C.4.3.3	Safety Considerations	C.4-6
C.4.4	Storage Module Thermal Monitoring System.....	C.4-7
C.4.5	References.....	C.4-8
C.5.	OPERATING PROCEDURES.....	C.5-1
C.5.1	Procedures for Loading the DSC and Transfer to the HSM	C.5-2
C.5.1.1	Receipt of the Loaded NUHOMS [®] -MP197HB Cask	C.5-2
C.5.1.2	Transfer to the HSM	C.5-3
C.5.1.3	Monitoring Operations.....	C.5-5
C.5.2	Procedures for Unloading the DSC	C.5-6
C.5.2.1	DSC Retrieval from the HSM.....	C.5-6
C.5.3	References.....	C.5-8
C.6.	WASTE CONFINEMENT AND MANAGEMENT.....	C.6-1
C.7.	STRUCTURAL EVALUATION.....	C.7-1
C.7.1	Discussion.....	C.7-3
C.7.2	Summary of Mechanical Properties of Materials	C.7-4
C.7.3	Seismic Reconciliation of the 61BT DSC, HSM Model 102, and MP197HB Cask.....	C.7-5
C.7.3.1	HSM Model 102	C.7-5
C.7.3.2	MP197HB Transfer Cask.....	C.7-5
C.7.3.3	61BT DSC.....	C.7-6
C.7.4	Reconciliation of Thermal Loads for the 61BT DSC in the HSM Model 102 and MP197HB Cask	C.7-8

C.7.5	Structural Analysis of 61BT DSC (Storage and Transfer)	C.7-9
C.7.5.1	Normal Loads (Storage in HSM Model 102 and Transfer in MP197HB Cask).....	C.7-10
C.7.5.2	Off-Normal Loads.....	C.7-11
C.7.5.3	Accident Loads	C.7-11
C.7.6	Structural Analysis of HSM Model 102 with 61BT DSC (Storage Configuration)	C.7-14
C.7.6.1	Normal Loads.....	C.7-14
C.7.6.2	Off-Normal Loads.....	C.7-15
C.7.6.3	Accident Loads	C.7-15
C.7.6.4	Load Combinations.....	C.7-17
C.7.7	Structural Analysis of MP197HB Cask as On-Site Transfer Cask	C.7-18
C.7.7.1	General Information.....	C.7-18
C.7.7.2	Normal and Off-Normal Conditions.....	C.7-22
C.7.7.3	Accident Conditions.....	C.7-26
C.7.7.4	MP197HB Cask Stability and Missile Penetration Analyses	C.7-28
C.7.8	References	C.7-41
C.8.	THERMAL EVALUATION	C.8-1
C.8.1	Discussion	C.8-2
C.8.2	Summary of Thermal Properties of Materials	C.8-3
C.8.3	Specification for Neutron Absorber Thermal Conductivity	C.8-4
C.8.4	Thermal Analysis of HSM Model 102 with 61BT DSC for Storage Conditions	C.8-5
C.8.4.1	Ambient Temperature Specification at WCS CISF	C.8-5
C.8.4.2	Thermal Model of HSM Model 102 with 61BT DSC	C.8-5
C.8.4.3	HSM Model 102 and 61BT DSC Thermal Model Results	C.8-6
C.8.4.4	Evaluation of 61BT DSC Storage in HSM Model 102.....	C.8-6
C.8.5	Thermal Analysis of MP197HB Cask with 61BT DSC for Transfer Operations	C.8-7
C.8.5.1	Thermal Model of MP197HB Cask with 61BT DSC	C.8-7
C.8.5.2	MP197HB Cask Thermal Model Results	C.8-8
C.8.5.3	Evaluation of MP197HB Cask Performance	C.8-11

C.8.6	References.....	C.8-12
C.9.	RADIATION PROTECTION	C.9-1
C.9.1	Radiation Protection Design Features	C.9-2
C.9.2	Occupational Exposure Evaluation.....	C.9-3
	C.9.2.1 Analysis Methodology	C.9-3
	C.9.2.2 Dose Assessment	C.9-3
C.9.3	References.....	C.9-5
C.10.	CRITICALITY EVALUATION	C.10-1
C.10.1	Discussion and Results.....	C.10-2
C.10.2	Package Fuel Loading.....	C.10-3
C.10.3	Model Specification.....	C.10-4
C.10.4	Criticality Calculation	C.10-5
C.10.5	Critical Benchmark Experiments.....	C.10-6
C.10.6	References.....	C.10-7
C.11	CONFINEMENT EVALUATION.....	C.11-1
C.11.1	Confinement Boundary	C.11-2
C.11.2	Requirements for Normal Conditions of Storage	C.11-3
C.11.3	Confinement Requirements for Hypothetical Accident Conditions.....	C.11-4
C.11.4	References.....	C.11-5
C.12.	ACCIDENT ANALYSIS.....	C.12-1
C.12.1	Off-Normal Operations	C.12-2
	C.12.1.1 Off-Normal Transfer Loads	C.12-2
	C.12.1.2 Extreme Ambient Temperatures	C.12-2
	C.12.1.3 Off-Normal Release of Radionuclides.....	C.12-3
C.12.2	Postulated Accident	C.12-4
	C.12.2.1 Blockage of Air Inlets/Outlets	C.12-4
	C.12.2.2 Drop Accidents	C.12-5
	C.12.2.3 Earthquakes.....	C.12-5
	C.12.2.4 Lightning.....	C.12-6

C.12.2.5 Fire and Explosion	C.12-7
C.12.2.6 Flood	C.12-8
C.12.2.7 Tornado Wind and Missiles	C.12-8
C.12.2.8 Reduced HSM Air Inlet and Outlet Shielding	C.12-9
C.12.3 References	C.12-11

Appendix D

Standardized NUHOMS®-61BTH Type 1 System

D.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	D.1-1
D.2. SITE CHARACTERISTICS.....	D.2-1
D.3. PRINCIPLE DESIGN CRITERIA	D.3-1
D.3.1 SSCs Important to Safety	D.3-2
D.3.1.1 61BTH-DSCs (Type 1).....	D.3-2
D.3.1.2 Horizontal Storage Module.....	D.3-2
D.3.1.3 NUHOMS® Basemat and Approach Slab.....	D.3-2
D.3.1.4 NUHOMS® Transfer Equipment	D.3-2
D.3.2 Spent Fuel to Be Stored	D.3-4
D.3.3 Design Criteria for Environmental Conditions and Natural Phenomena.....	D.3-5
D.3.3.1 Tornado Wind and Tornado Missiles	D.3-5
D.3.3.2 Water Level (Flood) Design	D.3-5
D.3.3.3 Seismic Design.....	D.3-5
D.3.3.4 Snow and Ice Loading	D.3-6
D.3.3.5 Lightning.....	D.3-6
D.3.4 Safety Protection Systems	D.3-7
D.3.4.1 General.....	D.3-7
D.3.4.2 Structural.....	D.3-7
D.3.4.3 Thermal	D.3-7
D.3.4.4 Shielding/Confinement/Radiation Protection	D.3-8
D.3.4.5 Criticality	D.3-8
D.3.4.6 Material Selection	D.3-8
D.3.4.7 Operating Procedures.....	D.3-9
D.3.5 References.....	D.3-10
D.4. OPERATING SYSTEMS.....	D.4-1
D.4.1 Concrete Pad Structures	D.4-2
D.4.1.1 Operating Functions.....	D.4-2

D.4.1.2	Design Description.....	D.4-2
D.4.1.3	Safety Considerations	D.4-4
D.4.2	Cask Storage System.....	D.4-5
D.4.2.1	Operating Function	D.4-5
D.4.2.2	Design Description.....	D.4-5
D.4.2.3	Safety Considerations	D.4-5
D.4.3	Cask Transporter System.....	D.4-6
D.4.3.1	Operating Function	D.4-6
D.4.3.2	Design Description.....	D.4-6
D.4.3.3	Safety Considerations	D.4-6
D.4.4	Storage Module Thermal Monitoring System.....	D.4-7
D.4.5	References.....	D.4-8
D.5.	OPERATING PROCEDURES.....	D.5-1
D.5.1	Procedures for Loading the DSC and Transfer to the HSM	D.5-2
D.5.1.1	Receipt of the Loaded NUHOMS®-MP197HB Cask	D.5-2
D.5.1.2	Transfer to the HSM	D.5-3
D.5.1.3	Monitoring Operations.....	D.5-5
D.5.2	Procedures for Unloading the DSC	D.5-6
D.5.2.1	DSC Retrieval from the HSM.....	D.5-6
D.5.3	References.....	D.5-8
D.6.	WASTE CONFINEMENT AND MANAGEMENT.....	D.6-1
D.7.	STRUCTURAL EVALUATION.....	D.7-1
D.7.1	Discussion.....	D.7-3
D.7.2	Summary of Mechanical Properties of Materials	D.7-4
D.7.3	Seismic Reconciliation of the Canister, HSM Model 102, and MP197HB Cask.....	D.7-5
D.7.3.1	HSM Model 80 and Model 102	D.7-5
D.7.3.2	MP197HB Cask as On-Site Transfer Cask.....	D.7-9
D.7.3.3	61BTH Type 1 DSC.....	D.7-9
D.7.4	Reconciliation of Thermal Loads for the Canister in the HSM Model 102 and in the MP197HB Cask.....	D.7-12

D.7.5	Structural Analysis of Canister (Storage and Transfer).....	D.7-13
D.7.5.1	Normal Loads (Storage in HSM Model 102 and Transfer in MP197HB Cask).....	D.7-14
D.7.5.2	Off-Normal Loads.....	D.7-15
D.7.5.3	Accident Loads	D.7-15
D.7.6	Structural Analysis of HSM Model 102 with Canister (Storage Configuration).....	D.7-18
D.7.7	Structural Analysis of MP197HB Cask as On-Site Transfer Cask.....	D.7-19
D.7.8	References.....	D.7-20
D.8.	THERMAL EVALUATION.....	D.8-1
D.8.1	Discussion.....	D.8-2
D.8.2	Summary of Thermal Properties of Materials.....	D.8-3
D.8.3	Specification for Components.....	D.8-4
D.8.4	Thermal Analysis of HSM Model 102 with Canister for Storage Conditions.....	D.8-5
D.8.4.1	Ambient Temperature Specification at WCS CISF	D.8-5
D.8.4.2	Thermal Model of HSM Model 102 with 61BTH Type 1 DSC	D.8-5
D.8.4.3	HSM Model 102 Thermal Model Results.....	D.8-6
D.8.4.4	61BTH Type 1 DSC Thermal Model Results.....	D.8-6
D.8.4.5	Evaluation of the 61BTH Type 1 DSC Storage in HSM Model 102.....	D.8-6
D.8.5	Thermal Analysis of MP197HB Cask with Canister for Transfer Operations	D.8-7
D.8.5.1	Thermal Model of MP197HB TC with 61BTH Type 1 DSC.....	D.8-7
D.8.5.2	MP197HB TC Thermal Model Results (Normal and Off-Normal Conditions):	D.8-8
D.8.5.3	MP197HB Cask and 61BTH Type 1 DSC Thermal Analysis (Accident Conditions).....	D.8-9
D.8.5.4	Evaluation of MP197HB TC Performance	D.8-11
D.8.6	References.....	D.8-12
D.9.	RADIATION PROTECTION	D.9-1
D.9.1	Radiation Protection Design Features	D.9-2
D.9.2	Occupational Exposure Evaluation.....	D.9-3

D.9.2.1	Analysis Methodology	D.9-3
D.9.2.2	Dose Assessment	D.9-3
D.9.3	References	D.9-5
D.10.	CRITICALITY EVALUATION	D.10-1
D.10.1	Discussion and Results.....	D.10-2
D.10.2	Package Fuel Loading.....	D.10-3
D.10.3	Model Specification.....	D.10-4
D.10.4	Criticality Calculation	D.10-5
D.10.5	Critical Benchmark Experiments.....	D.10-6
D.10.6	References.....	D.10-7
D.11	CONFINEMENT EVALUATION	D.11-1
D.11.1	Confinement Boundary	D.11-2
D.11.2	Requirements for Normal Conditions of Storage	D.11-3
D.11.3	Confinement Requirements for Hypothetical Accident Conditions.....	D.11-4
D.11.4	References.....	D.11-5
D.12.	ACCIDENT ANALYSIS	D.12-1
D.12.1	Off-Normal Operations	D.12-2
D.12.1.1	Off-Normal Transfer Loads	D.12-2
D.12.1.2	Extreme Ambient Temperatures	D.12-2
D.12.1.3	Off-Normal Release of Radionuclides.....	D.12-3
D.12.2	Postulated Accident	D.12-4
D.12.2.1	Blockage of Air Inlets/Outlets	D.12-4
D.12.2.2	Drop Accidents	D.12-5
D.12.2.3	Earthquakes.....	D.12-6
D.12.2.4	Lightning.....	D.12-6
D.12.2.5	Fire and Explosion	D.12-7
D.12.2.6	Flood	D.12-8
D.12.2.7	Tornado Wind and Missiles	D.12-8
D.12.2.8	Reduced HSM Air Inlet and Outlet Shielding	D.12-9
D.12.3	References.....	D.12-11

Appendix E NAC-MPC

E.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	E.1-1
E.2. SITE CHARACTERISTICS.....	E.2-1
E.3 PRINCIPAL DESIGN CRITERIA	E.3-1
E.3.1 Yankee Rowe MPC and Connecticut Yankee MPC	E.3-2
E.3.1.1 Design Criteria for Environmental Conditions and Natural Phenomena	E.3-2
E.3.1.2 Safety Protection Systems.....	E.3-6
E.3.1.3 Decommission Considerations.....	E.3-8
E.3.2 La Crosse MPC	E.3-9
E.3.2.1 Design Criteria for Environmental Conditions and Natural Phenomena	E.3-10
E.3.2.2 Safety Protection Systems.....	E.3-12
E.3.2.3 Decommissioning Considerations	E.3-14
E.3.3 References.....	E.3-15
E.4 OPERATING SYSTEMS.....	E.4-1
E.4.1 Yankee Rowe MPC and Connecticut Yankee MPC	E.4-2
E.4.1.1 Transportable Storage Canister and Baskets.....	E.4-2
E.4.1.2 Vertical Concrete Cask	E.4-2
E.4.1.3 Transfer Cask	E.4-3
E.4.1.4 Ancillary Equipment.....	E.4-4
E.4.1.5 Storage Pad	E.4-5
E.4.2 La Crosse MPC	E.4-6
E.4.2.1 Transportable Storage Canister and Baskets.....	E.4-6
E.4.2.2 Vertical Concrete Cask	E.4-6
E.4.2.3 Transfer Cask	E.4-7
E.4.2.4 Ancillary Equipment.....	E.4-8
E.4.2.5 Storage Pad	E.4-9
E.4.3 References.....	E.4-10

E.5	OPERATING PROCEDURES.....	E.5-1
E.5.1	Yankee Rowe MPC and Connecticut Yankee MPC.....	E.5-2
E.5.1.1	Loading the Vertical Concrete Cask.....	E.5-2
E.5.1.2	Transport and Placement of the Vertical Concrete Cask.....	E.5-4
E.5.1.3	Removal of the Transportable Storage Canister from the Vertical Concrete Cask.....	E.5-5
E.5.1.4	Receiving the NAC-STC Transport Cask and Unloading the Transportable Storage Canister.....	E.5-6
E.5.2	La Crosse MPC.....	E.5-9
E.5.2.1	Loading the Vertical Concrete Cask.....	E.5-9
E.5.2.2	Transport and Placement of the Vertical Concrete Cask.....	E.5-10
E.5.2.3	Removal of the Transportable Storage Canister from the Vertical Concrete Cask.....	E.5-11
E.5.2.4	Receiving the NAC-STC Transport Cask and Unloading the Transportable Storage.....	E.5-12
E.5.3	References.....	E.5-13
E.6	WASTE CONFINEMENT AND MANAGEMENT.....	E.6-1
E.7	STRUCTURAL EVALUATION.....	E.7-1
E.7.1	Yankee Rowe MPC and Connecticut Yankee MPC.....	E.7-2
E.7.1.1	Structural Design.....	E.7-2
E.7.1.2	Weights and Centers of Gravity.....	E.7-2
E.7.1.3	Mechanical Properties of Materials.....	E.7-2
E.7.1.4	Chemical and Galvanic Reactions.....	E.7-2
E.7.1.5	Positive Closure.....	E.7-2
E.7.1.6	Lifting Devices.....	E.7-2
E.7.1.7	NAC-MPC Components Under Normal Operating Loads.....	E.7-2
E.7.1.8	Cold.....	E.7-3
E.7.1.9	Fuel Rods.....	E.7-3
E.7.1.10	Coating Specifications.....	E.7-3
E.7.2	La Crosse MPC.....	E.7-4
E.7.2.1	Structural Design.....	E.7-4
E.7.2.2	Weights and Centers of Gravity.....	E.7-4
E.7.2.3	Mechanical Properties of Materials.....	E.7-4

E.7.2.4	Chemical and Galvanic Reactions	E.7-4
E.7.2.5	Positive Closure	E.7-4
E.7.2.6	Lifting Devices.....	E.7-4
E.7.2.7	MPC-LACBWR Components Under Normal Operating Loads	E.7-4
E.7.2.8	Fuel Rods	E.7-4
E.7.2.9	Canister Closure Weld Evaluation.....	E.7-5
E.7.2.10	Coating Specifications	E.7-5
E.7.3	References.....	E.7-6
E.8	THERMAL EVALUATION.....	E.8-1
E.8.1	Connecticut Yankee MPC, Yankee Rowe MPC, and La Crosse MPC	E.8-2
E.8.1.1	Maximum Average Yearly Ambient Temperature	E.8-2
E.8.1.2	Maximum Average 3-Day Ambient Temperature	E.8-2
E.8.1.3	Maximum Extreme 3-Day Ambient Temperature Range.....	E.8-2
E.8.2	References.....	E.8-3
E.9	RADIATION PROTECTION	E.9-1
E.9.1	Yankee Rowe MPC and Connecticut Yankee MPC.....	E.9-2
E.9.1.1	Yankee-MPC System Shielding Discussion and Results	E.9-2
E.9.1.2	CY-MPC System Shielding Discussion and Results	E.9-6
E.9.2	LaCrosse MPC	E.9-9
E.9.2.1	Shielding Discussion and Results for the MPC-LACBWR Storage System.....	E.9-9
E.9.3	References.....	E.9-13
E.10	CRITICALITY EVALUATION	E.10-1
E.10.1	Connecticut Yankee MPC.....	E.10-3
E.10.1.1	CY-MPC System Criticality Discussion and Results	E.10-3
E.10.2	Yankee Rowe MPC	E.10-5
E.10.2.1	Yankee-MPC System Criticality Discussion and Results	E.10-5
E.10.3	LaCrosse MPC	E.10-7
E.10.3.1	MPC-LACBWR System Criticality Discussion and Results.....	E.10-7
E.10.4	References.....	E.10-10

E.11 CONFINEMENT EVALUATION	E.11-1
E.11.1 Yankee Rowe MPC and Connecticut Yankee MPC	E.11-2
E.11.1.1 Confinement Boundary	E.11-2
E.11.1.2 Requirements for Normal Conditions of Storage	E.11-2
E.11.1.3 Confinement Requirements for Hypothetical Accident Conditions	E.11-2
E.11.2 LaCrosse MPC	E.11-3
E.11.2.1 Confinement Boundary	E.11-3
E.11.2.2 Requirements for Normal Conditions of Storage	E.11-3
E.11.2.3 Confinement Requirements for Hypothetical Accident Conditions	E.11-3
E.11.3 References	E.11-4
E.12 ACCIDENT ANALYSIS	E.12-1
E.12.1 Yankee Rowe MPC and Connecticut Yankee MPC	E.12-2
E.12.1.1 Off-Normal Events.....	E.12-2
E.12.1.2 Accidents.....	E.12-2
E.12.1.3 Concrete Cask Non-Mechanistic Tip-Over Analysis	E.12-4
E.12.2 La Crosse MPC	E.12-17
E.12.2.1 Off-Normal Events.....	E.12-17
E.12.2.2 Accidents.....	E.12-17
E.12.2.3 Concrete Cask Non-Mechanistic Tip-Over Analysis	E.12-18
E.12.3 References	E.12-29

Appendix F NAC-UMS

F.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	F.1-1
F.2. SITE CHARACTERISTICS.....	F.2-1
F.3 PRINCIPAL DESIGN CRITERIA	F.3-1
F.3.1 Maine Yankee.....	F.3-2
F.3.1.1 Design Criteria for Environmental Conditions and Natural Phenomena	F.3-2
F.3.1.2 Safety Protection Systems.....	F.3-5
F.3.1.3 Decommissioning Considerations	F.3-7
F.3.2 References.....	F.3-8
F.4 OPERATING SYSTEMS	F.4-I
F.4.1 Maine Yankee.....	F.4-2
F.4.1.1 Transportable Storage Canister and Baskets.....	F.4-2
F.4.1.2 Vertical Concrete Cask	F.4-2
F.4.1.3 Transfer Cask	F.4-3
F.4.1.4 Auxiliary Equipment.....	F.4-4
F.4.2 References.....	F.4-6
F.5 OPERATING PROCEDURES.....	F.5-1
F.5.1 Maine Yankee.....	F.5-2
F.5.1.1 Loading the Vertical Concrete Cask	F.5-2
F.5.1.2 Transport and Placement of the Vertical Concrete Cask	F.5-4
F.5.1.3 Removal of the Transportable Storage Canister from the Vertical Concrete Cask	F.5-5
F.5.1.4 Receiving the NAC-UMS Transport Cask and Unloading the Transportable Storage	F.5-6
F.5.2 References.....	F.5-10

F.6. WASTE CONFINEMENT AND MANAGEMENT.....	F.6-1
F.7 STRUCTURAL EVALUATION.....	F.7-1
F.7.1 Maine Yankee.....	F.7-2
F.7.1.1 Structural Design	F.7-2
F.7.1.2 Weights and Centers of Gravity.....	F.7-2
F.7.1.3 Mechanical Properties of Materials	F.7-2
F.7.1.4 Chemical and Galvanic Reactions	F.7-2
F.7.1.5 Positive Closure	F.7-2
F.7.1.6 Lifting Devices.....	F.7-3
F.7.1.7 NAC-UMS Components Under Normal Operating Conditions	F.7-3
F.7.1.8 Cold.....	F.7-3
F.7.1.9 Fuel Rods	F.7-3
F.7.1.10 Coating Specifications	F.7-4
F.7.2 References.....	F.7-5
F.8 THERMAL EVALUATION.....	F.8-1
F.8.1 Maine Yankee.....	F.8-2
F.8.1.1 Maximum Average Yearly Ambient Temperature	F.8-2
F.8.1.2 Maximum Average 3-Day Ambient Temperature	F.8-2
F.8.1.3 Maximum Extreme 3-Day Ambient Temperature	F.8-2
F.8.2 References.....	F.8-3
F.9 RADIATION PROTECTION	F.9-1
F.9.1 Maine Yankee.....	F.9-2
F.9.1.1 NAC-UMS System Shielding Discussion	F.9-2
F.9.1.2 NAC-UMS System Shielding Radiation Sources.....	F.9-3
F.9.1.3 NAC-UMS System Shielding Analysis and Results	F.9-4
F.9.2 References.....	F.9-6
F.10 CRITICALITY EVALUATION	F.10-1
F.10.1 Maine Yankee.....	F.10-3
F.10.1.1 NAC-UMS System Criticality Discussion.....	F.10-3
F.10.1.2 NAC-UMS System Criticality Analysis and Results.....	F.10-4

F.10.2	References.....	F.10-5
F.11	CONFINEMENT EVALUATION.....	F.11-1
F.11.1	Maine Yankee.....	F.11-2
	F.11.1.1 Confinement Boundary.....	F.11-2
	F.11.1.2 Confinement Requirements for Normal Conditions of Storage	F.11-2
	F.11.1.3 Confinement Requirements for Hypothetical Accident Conditions.....	F.11-3
F.11.2	References.....	F.11-4
F.12	ACCIDENT ANALYSIS.....	F.12-1
F.12.1	Maine Yankee.....	F.12-2
	F.12.1.1 Off-Normal Events.....	F.12-2
	F.12.1.2 Accidents.....	F.12-2
	F.12.1.3 Concrete Cask Non-Mechanistic Tip-Over Analysis	F.12-4
F.12.2	References.....	F.12-14

Appendix G NAC-MAGNASTOR

G.1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	G.1-1
G.2. SITE CHARACTERISTICS.....	G.2-1
G.3 PRINCIPAL DESIGN CRITERIA	G.3-1
G.3.1 Undamaged and Damaged PWR Fuel	G.3-2
G.3.1.1 Design Criteria for Environmental Conditions and Natural Phenomena	G.3-2
G.3.1.2 Safety Protection Systems.....	G.3-7
G.3.1.3 Decommissioning Considerations	G.3-8
G.3.2 References.....	G.3-9
G.4 OPERATING SYSTEMS.....	G.4-1
G.4.1 Undamaged and Damaged PWR Fuel	G.4-2
G.4.1.1 Transportable Storage Canister (TSC).....	G.4-2
G.4.1.2 Fuel Baskets	G.4-2
G.4.1.3 Concrete Cask	G.4-3
G.4.1.4 Transfer Cask	G.4-5
G.4.1.5 Damaged Fuel Can.....	G.4-5
G.4.1.6 Storage Pad	G.4-6
G.4.1.7 Auxiliary Equipment.....	G.4-6
G.4.2 References.....	G.4-7
G.5 OPERATING PROCEDURES.....	G.5-1
G.5.1 Undamaged and Damaged PWR Fuel	G.5-2
G.5.1.1 Transferring the TSC to the Concrete Cask.....	G.5-2
G.5.1.2 Transporting and Placing the Loaded Concrete Cask.....	G.5-5
G.5.1.3 Removing the Loaded TSC from a Concrete Cask.....	G.5-7
G.5.1.4 Receiving the MAGNATRAN Transport Cask and Unloading the Loaded TSC	G.5-8
G.5.2 References.....	G.5-13

G.6. WASTE CONFINEMENT AND MANAGEMENT.....	G.6-1
G.7 STRUCTURAL EVALUATION.....	G.7-1
G.7.1 Undamaged and Damaged PWR Fuel	G.7-2
G.7.1.1 Structural Design	G.7-2
G.7.1.2 Weights and Centers of Gravity.....	G.7-2
G.7.1.3 Materials	G.7-2
G.7.1.4 Chemical and Galvanic Reactions	G.7-2
G.7.1.5 Positive Closure	G.7-2
G.7.1.6 Lifting Devices.....	G.7-2
G.7.1.7 Normal Operating Conditions.....	G.7-2
G.7.1.8 Fuel Rods	G.7-2
G.7.2 References.....	G.7-3
G.8 THERMAL EVALUATION.....	G.8-1
G.8.1 Undamaged and Damaged PWR Fuel	G.8-2
G.8.1.1 Maximum Average Yearly Ambient Temperature	G.8-2
G.8.1.2 Maximum Average 3-Day Ambient Temperature	G.8-2
G.8.1.3 Maximum Extreme 3-Day Ambient Temperature Range.....	G.8-2
G.8.1.4 Thermal Performance Surveillance Requirements	G.8-2
G.8.2 References.....	G.8-3
G.9 RADIATION PROTECTION	G.9-1
G.9.1 Undamaged and Damaged PWR Fuel	G.9-3
G.9.1.1 Transfer Cask Shielding Discussion and Dose Results	G.9-3
G.9.1.2 Concrete Cask Shielding Discussion and Dose Results	G.9-5
G.9.1.3 Offsite Dose Discussion and Results	G.9-7
G.9.2 References.....	G.9-8
G.10 CRITICALITY EVALUATION	G.10-1
G.10.1 Undamaged and Damaged PWR Fuel	G.10-2
G.10.1.1 Undamaged Fuel Criticality Results	G.10-4
G.10.1.2 Damaged Fuel Criticality Results	G.10-5
G.10.2 References.....	G.10-6

G.11 CONFINEMENT EVALUATION	G.11-1
G.11.1 Undamaged and Damaged PWR Fuel	G.11-2
G.11.1.1 Confinement Boundary	G.11-2
G.11.1.2 Requirements for Normal Conditions of Storage	G.11-2
G.11.1.3 Confinement Requirements for Hypothetical Accident Conditions	G.11-2
G.11.2 References.....	G.11-3
G.12 ACCIDENT ANALYSIS	G.12-1
G.12.1 Undamaged and Damaged PWR Fuel	G.12-2
G.12.1.1 Off-Normal Events.....	G.12-2
G.12.1.2 Accidents and Natural Phenomena	G.12-3
G.12.1.3 Concrete Cask Non-Mechanistic Tip-Over Analysis	G.12-4
G.12.2 References.....	G.12-15

CHAPTER 1

INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION

Table of Contents

1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION.....	1-1
1.1 Introduction.....	1-2
1.2 General Description of Installation.....	1-4
1.2.1 Location and Site Characteristics.....	1-4
1.2.2 Principal Design Criteria.....	1-4
1.2.3 Facility Descriptions.....	1-5
1.2.4 Materials To Be Stored.....	1-6
1.2.5 Waste Products Generated During Operations.....	1-6
1.3 General Description of Systems and Operations.....	1-7
1.3.1 WCS Interim Storage Facility Systems.....	1-7
1.3.2 WCS Interim Storage Facility Operations.....	1-9
1.4 Analysis of Operations.....	1-10
1.4.1 Normal Operations – Dose Assessment.....	1-10
1.4.2 Normal Operations – Establishment of the Controlled Area (Site) Boundary.....	1-10
1.4.3 Accident Analysis.....	1-10
1.4.4 Safety Management.....	1-12
1.5 Identification of Agents and Contractors.....	1-13
1.6 Material Incorporated by Reference.....	1-14
1.6.1 NUHOMS® Systems.....	1-14
1.6.2 NAC International Systems.....	1-14
1.7 References.....	1-16

List of Tables

Table 1-1	Storage Systems at the WCS CISF	1-17
Table 1-2	Summary of WCS CISF Principal Design Criteria.....	1-18
Table 1-3	WCS CISF Facilities and Functions	1-21
Table 1-4	Table of Topical Reports (SARs) Incorporated by Reference.....	1-22
Table 1-5	Ground Surface DRS	1-25

List of Figures

Figure 1-1	WCS CISF Location	1-26
Figure 1-2	WCS CISF Site Layout.....	1-27
Figure 1-3	WCS CISF Site Overview	1-28
Figure 1-4	Site Location Map.....	1-29
Figure 1-5	10,000-Year Return Period Response Spectra (5% Damped)	1-30

1. INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION

This Safety Analysis Report (SAR) describes the design and forms the licensing basis for 10 CFR 72 [1-1], Subpart B facility license of the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) to be located in Andrews County, Texas.

The quality assurance (QA) program applicable to this design satisfies the requirements of 10 CFR 72, Subpart G and is described in the Waste Control Specialists LLC Quality Assurance Program Description [1-2]. To facilitate U.S. Nuclear Regulatory Commission (NRC) review of this application, this SAR has been prepared in compliance with the information and methods defined in Revision 0 of NRC NUREG-1567 [1-3].

This SAR describes a facility designed to accept commercial spent nuclear fuel and Greater-than-Class C (GTCC) waste contained in dual-purpose (transportation/storage) cask and canister systems that have been certified by the NRC for use at existing reactor sites. The WCS CISF will ultimately accommodate 40,000 metric tons Uranium or Mixed-Oxide, or metric tons heavy metal (MTHM), and will have a service life of at least 40 years. This initial SAR, however, is for phase 1 of the project, which is limited to 5,000 MTHM of storage in the same canisters and overpacks as those currently in use at several reactor sites in the United States.

This chapter provides a summary of the SAR. The following information included: (1) a general description of the WCS CISF; (2) a general description of the systems and operations; (3) analysis of the WCS CISF operations; (4) identification of agents and contractors; and (5) material incorporated into this SAR by reference.

1.1 Introduction

WCS currently operates two separate Low-Level Radioactive Waste (LLRW) disposal facilities at the Andrews County site, including the Texas Compact Disposal Facility.

The need for an interim storage facility for spent nuclear fuel arises as a result of the ongoing decades long search for a disposal solution for the nation's spent nuclear fuel. In 2012, the presidential-appointed Blue Ribbon Commission on America's Nuclear Future issued a report recommending that at least one interim storage facility be sited in the U.S., while a permanent disposal site is being developed.

Consistent with the recommendation of the Blue Ribbon Commission on America's Nuclear Future, the WCS CISF will provide dry storage capacity for canisterized spent nuclear fuel at the WCS site in the same storage overpack designs as those currently licensed and used at the original storage sites. WCS is seeking a license to operate an CISF for spent fuel and GTCC waste storage for 40 years in accordance with 10 CFR Part 72.

Construction of the WCS CISF is planned to start in September 2019 and operation is planned to begin in December 2020.

The WCS CISF will be located within the owner-controlled area of the WCS site which is operated by WCS. The site comprises approximately 14,000 acres in Andrews County, Texas. It is characterized by isolation from population centers, a sound foundation for structures, and favorable conditions of meteorology, seismology, and hydrology.

The proposed location of the CISF site within the WCS site is on the north west corner. Figure 1-1 shows the general location of the WCS CISF at the WCS site.

Spent nuclear fuel at the WCS CISF will be stored in cask systems that have been previously certified by the NRC. These cask systems include transportable canister-based storage systems. It is WCS's intent that all NRC certified dual-purpose (transportation/storage) or multi-purpose (transportation/storage/ disposal) cask systems be acceptable for use at the WCS CISF over time. For Phase I of the WCS CISF application, six (6) cask systems consisting of eleven (11) different canisters plus GTCC waste canisters stored in five (5) overpacks are proposed for storage at the WCS site. These cask systems are described in SARs that are docketed by the NRC. Table 1-1 provides a listing of the various cask systems proposed for storage at the WCS CISF.

NOTE: The cask systems listed in Table 1-1 were originally certified for 20 years. An application for License Renewal for the cask systems associated with CoC 1004 for an additional 40 years is currently being reviewed by the NRC. Work is also currently underway to develop an application for License Renewal for SNM-2510 for timely submittal to the NRC. The remaining cask systems in the WCS CISF License Application have not yet reached 20 years of time in service and therefore work has not yet begun to develop the applications for License Renewal for these systems. As these systems approach 20 years of service time, their applications for License renewal, including Aging Management Program (AMP) requirements, will be submitted to the NRC for review and approval. Any canisters stored at the WCS CISF will have been loaded under these previously approved NRC CoCs and licenses, and their “time in service” clock for triggering the implementation of required AMP activities will have begun at the time of loading for the each individual canister. Therefore, the AMP activities for any of the canisters stored at the site will be established and approved well in advance of license renewal for the site-specific license for the WCS CISF. Similarly, AMP activities for the storage overpacks at the WCS CISF will be established by their respective CoCs and licenses, but their “time in service” clocks will begin at the time of their loading at the WCS CISF. As the aging management activities associated with the individual CoCs and licenses under which the systems were originally loaded have not been approved at this time, a condition imposed on this license [1-4] is to incorporate the required aging management activities into this license within 120 days of the effective date of the renewal authorization of a given authorized cask system’s CoC or license, or within 120 days of the effective date of this license, whichever is later.

The canister-based cask systems require transfer of the canister from the transportation cask to the storage overpack. These transfers are performed in either the Cask Handling Building or the Storage Area, depending on the cask system design. All transfer and handling activities are accomplished in a dry mode using cask transfer equipment and WCS CISF structures, systems, and components (SSCs). The WCS CISF design, as presented in the SAR, does not employ a spent fuel pool or other bare fuel handling capability.

Chapter 3 identifies the important-to-safety (ITS) SSCs for the cask systems and the WCS CISF and those not-important-to-safety (NITS) SSCs that are necessary for the operation of the WCS CISF. Cask system SSCs are used to the maximum extent possible in the design of the WCS CISF and are described in the design and licensing basis documents associated with each cask system. The use of previously certified cask systems is an integral part of the WCS CISF design basis. The WCS CISF SSCs that are ITS include the Canister Transfer System in the Cask Handling Building and the storage pads for the vertical storage systems.

The physical, thermal, and radiological characteristics of the spent nuclear fuel (SNF) to be stored at the WCS CISF are defined in the respective cask system SARs.

1.2 General Description of Installation

The WCS CISF is designed as a stand-alone facility and consists of a Cask Handling Building, storage area, and support facilities. A site layout is provided in Figure 1-2, and a site overview is provided in Figure 1-3.

Other than the Canister Transfer System in the Cask Handling Building, storage systems and pads, there are no additional systems required for the safe storage of the canisters. The following ancillary systems are part of the WCS CISF: lighting, security systems including CCTV and intrusion detection, temperature monitoring, and lightning protection.

Because there is no waste generated during the storage phase, there are no gaseous, liquid, or solid radioactive waste treatment systems associated with the storage system. Likewise, heat removal is totally passive in the overpacks and no active cooling system is required. Therefore, there are no required Instrumentation and Control Systems for the WCS CISF.

1.2.1 Location and Site Characteristics

The WCS CISF facility is located approximately 32 miles west of the city of Andrews, Texas, and five miles east of the city of Eunice, New Mexico. The WCS CISF facility is located approximately one-half mile east of the Texas-New Mexico state boundary and one mile north of Texas Highway 176. It occupies parts of Section 16 and 17, Block A-29, Public School Land, Andrews County, Texas included in approximately 25 square miles of property (primarily in Texas with nominal acreage in New Mexico) owned by WCS LLC in northwestern Andrews County, Texas.

The WCS facility is situated in an arid, isolated part of the state. Figure 1-4 shows the location of the facility with respect to known or easily identifiable landmarks. Figure 1-4, as supplemented by Figure 1-1, illustrates county boundaries, rail access, highways, and major roads.

The approximate coordinates of the site are 32° 27' 08" north latitude and 103° 03' 35" west longitude.

1.2.2 Principal Design Criteria

The WCS CISF principal design criteria are based on the site characteristics, the design criteria associated with the cask systems listed in Table 1-1 that have been previously certified by the NRC, and specific criteria required for the WCS CISF design.

The cask systems listed in Table 1-1 meet the WCS CISF design criteria. Table 1-2 provides a summary of the WCS CISF principal design criteria.

1.2.3 Facility Descriptions

The major facilities at the WCS CISF are the Cask Handling Building and the storage area. The Cask Handling Building is a steel building approximately 150 feet long by 150 feet wide by 75 feet high. The purpose of the Cask Handling Building is to receive and prepare for storage shipments of dual-purpose canister systems. It will also receive GTCC waste canisters for storage at the site. It is also designed to process canisters stored at the site for off-site shipment. The Cask Handling Building is designed to handle canisterized fuel only and does not have the capability to handle bare fuel. The Cask Handling Building is designed to withstand all normal operating loads and off-normal loads created by natural phenomena.

As Low As Reasonably Achievable (ALARA) principles are incorporated, to the maximum extent practical, throughout the facility design to reduce radiation exposure to facility personnel. Cranes/lifting devices for transferring the NUHOMS[®] transportation/transfer casks from the transportation skid to the transfer trailer/skid are designed to minimize the need for facility personnel to be near the loaded cask. This equipment is NITS as the lift heights of the loaded casks are maintained below 80 inches at all times after removal of the impact limiters. The analysis of bounding drop scenarios shows that a NUHOMS[®] transportation/transfer cask will maintain structural integrity of the DSC confinement boundary and maintain basket geometry from an 80 inch (from the bottom of the cask to the “ground”) drop. The ITS canister transfer system for the vertical transfer of canisters is remotely operated and the transfer equipment used to make the transfer to the storage overpacks is substantially identical to that used to transfer the canister into dry storage at the reactor facilities where the fuel was initially stored.

The storage area is a large area comprised of concrete storage pads and storage overpacks. The purpose of the storage area is to provide safe storage for the canisterized spent nuclear fuel in cask systems that were previously approved by the NRC. The pads and approach aprons are designed to meet the applicable requirements of these previously approved cask systems. The storage area will be constructed in phases, as necessary. Phase 1 is designed to accommodate approximately 5,000 MTHM of spent nuclear fuel and GTCC waste in approximately 470 storage overpacks.

The remainder of the WCS CISF facilities provide support functions such as administrative activities, fuel receipt, security and fire protection. Table 1-3 provides a list of the WCS CISF facilities and their functions. The facility locations are provided in Figure 1-2.

1.2.4 Materials To Be Stored

Only canisters that have been previously approved by the NRC to store and transport commercial light water (PWR and BWR) spent nuclear fuel and GTCC waste will be received at the WCS CISF. The controls for limiting the types and forms of spent nuclear fuel received at the WCS CISF are the same as those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [1-4]. The type, form and sources authorized for storage include:

- Canisterized spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.
- Uranium or Mixed-Oxide (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, and fuel debris, as allowed by Materials License SNM-2510, any amendment; Table 1-1c or Table 1-1j or Table 1-1t of Certificate of Compliance No. 1004, any amendment; Section 2.1 of Certificate of Compliance No. 1029, any amendment; Section B 2.1 of Certificate of Compliance No. 1025, and amendment; Section B 2.1 of Certificate of Compliance No. 1015, and amendment; Sections 1.0 and 2.0 of Certificate of Compliance No. 1031, any amendment, modified as described in paragraph 9 below.
- Canisterized GTCC Waste, non-fuel related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.
- GTCC waste, as activated metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.

Aging Management considerations for the canisters and storage overpacks are discussed in Section 11.5.

1.2.5 Waste Products Generated During Operations

As described in Chapter 6, there are minimal radioactive wastes generated at the WCS CISF. Gaseous and liquid wastes are not generated at the WCS CISF. Small volumes of solid radioactive waste may be produced from routine operations involving contamination surveys and decontamination activities involving incoming and outgoing transportation casks and equipment. Potential solid waste streams are collected and temporarily stored on site for processing and disposal at the WCS Federal Waste Disposal Facility (FWF).

1.3 General Description of Systems and Operations

A general description of the WCS CISF systems and operations is provided in this section. The systems described relate to the receipt, handling, transfer, and storage of canisterized spent nuclear fuel. In general, the same systems provide the corresponding function for canister retrieval and off site shipment operations.

1.3.1 WCS Interim Storage Facility Systems

The major systems for the WCS CISF include the following: Cask Off-Loading and Loading System in the Cask Handling Building, Canister Transfer System (for vertical systems) and Transfer Cask or Storage Overpack Carrier System. These systems are used to transfer canisterized spent nuclear fuel from transportation systems to storage overpacks and are used to retrieve canisters for off-site shipment.

1.3.1.1 Cask Off-Loading and Loading System

The purpose of the Cask Off-Loading and Loading System is to remove transportation casks from the cask railcars and to move transportation casks onto the railcars for shipment from the WCS CISF. Major components include two 130-ton capacity overhead bridge cranes and a Vertical Cask Transporter (VCT), which is also used to carry and position the loaded vertical concrete cask (VCC) to its storage pad position. The overhead bridge cranes and associated lifting fixtures are used to perform a horizontal transfer of the NUHOMS[®] transportation/transfer cask from the railcar (skid) onto the transfer skid for transfer operations. This transfer is performed without lifting the loaded NUHOMS[®] transportation/transfer cask above a height of 80" and these cranes are classified as NITS. The ITS VCT is used to upright transportation casks and place the cask under the Canister Transfer System for the vertical storage systems. The VCT is also used to collect the vertical transportation cask following loading with the Canister Transfer System and place/down end the transportation cask onto the railcar for offsite transport.

1.3.1.2 Canister Transfer System

For vertical systems, the ITS Canister Transfer System is used to transfer spent nuclear fuel and GTCC waste canisters from the uprighted transportation casks to vertical storage overpacks. Major components include a shielded transfer cask, mobile gantry crane and ancillary equipment used to move the canisters from the upright transportation cask to the vertical storage overpack. This system is not used with the NUHOMS[®] system.

1.3.1.3 Transfer Cask or Storage Overpack Carrier System

For NUHOMS[®] systems the purpose of this equipment is to transfer the cask out to the Horizontal Storage Module (HSM) and transfer the canister into the HSM or retrieval of same. For vertical systems, the purpose of this equipment is to upright the transportation cask and place it under the Canister Transfer System and to transfer the storage overpack from the transfer station to the storage pad and to return the overpack to the transfer station when the canister is to be shipped off-site. Major components for the NUHOMS[®] system include the transfer trailer, skid, skid positioning system, HSM/cask restraint system, hydraulic ram and alignment equipment. The major component for the vertical system is a VCT to move the cask from the transfer station to the storage pad.

1.3.1.4 Waste Management Systems

The WCS CISF does not have any major radioactive waste management systems. The only radioactive wastes generated are the result of residual quantities of radioactive contamination on the transportation casks. Solid wastes generated during the decontamination process are disposed of at the WCS FWF.

1.3.1.5 Off-Normal Recovery System

Recovery operations during off-normal conditions are provided by the WCS CISF, as necessary. Canisters that contain spent nuclear fuel and GTCC waste are sealed prior to shipment to the WCS site. Recovery of a suspect canister is accomplished by retrieving the overpack containing the suspect canister (vertical systems) or the canister itself (NUHOMS[®] systems) from the storage area and placing the canister into an empty transportation cask. This procedure applies to all of the canisters authorized for storage at the WCS CISF, since the transportation cask for each system provides confinement barriers that isolate any materials leaking from a canister this configuration can be considered safe storage until necessary actions are developed, approved by the US NRC and implemented to address the specific conditions. The WCS CISF Corrective Action Program is used to document suspect canisters and recovery actions.

1.3.1.6 Storage Pad

For the NUHOMS[®] systems the basemat and approach slabs are not relied upon to provide any safety function. There are no structural connections or other positive means to transfer shear between the modules and the foundation slab. The HSMs are not connected to the basemat. They resist horizontal forces by friction. Therefore, basemat and approach slabs are considered NITS and are designed, constructed, maintained, and tested as commercial-grade items.

The concrete storage pads loaded with NAC-MPC, NAC-UMS, and MAGNASTOR VCC systems meet the concrete storage pad properties presented in CoC No. 1025, Section B 3.4, CoC No. 1015, Section B 3.4, and CoC No. 1031, Sections 4.3.1 and 5.4, respectively. There are no structural connections or other positive means to transfer shear between the VCC systems and the slab. The VCC systems are not connected to the basemat, and resist horizontal forces by friction. The storage pads used for placement of NAC-MPC, NAC-UMS, and MAGNASTOR VCCs are classified as ITS, as identified in Chapter 3 and Chapter 7.

1.3.2 WCS Interim Storage Facility Operations

Loaded transportation casks containing spent fuel canisters are received via rail car. Security inspections and radiation surveys are performed in accordance with 10 CFR Part 71 and transportation cask CoC requirements.

The transportation casks are radiologically surveyed, impact limiters removed, their cavities are vented and tested, and they are decontaminated as necessary. Once receipt is completed under the provisions of 10 CFR Part 71, the cask is prepared to be removed from the railcar so that the canister can be transferred to the storage overpack. For NUHOMS[®] systems, the cask is lifted horizontally from the transportation skid and placed on the transfer trailer where it is readied to be transferred to the storage pad and its designated HSM. The canister/cask is then transferred to the storage pad where the canister is inserted into its HSM. For vertical systems, the transportation cask is uprighted, placed in the transfer station, and made ready such that the canister can be retrieved with a shielded transfer cask and the canister transferred to the storage overpack. Once the canister is transferred to the storage overpack, the overpack is then moved using the VCT out to the storage pad and placed in its designated location for storage.

For canister retrieval operations, the operational sequences for placing the canister into storage are reversed.

1.4 Analysis of Operations

This section provides a summary of the analyses performed for normal operations, off-normal and accident conditions.

1.4.1 Normal Operations – Dose Assessment

ALARA practices and dose reduction techniques are incorporated into the design of the WCS CISF. The receipt and transfer operations incorporate the ALARA principles and operational experience gained from the operations of these NRC licensed cask systems. The calculated operational exposures are very conservative, as the assumed dose rates on and around the transport/transfer casks are assumed to be for design basis transportation sources and the assumed dose rates on and around the storage overpacks are based on design basis source terms in the existing storage FSARs. These storage source terms, in most cases, are much higher than what can be accommodated by the transportation cask and therefore significant decay is required prior to shipment to the WCS CISF.

The maximum calculated occupational exposure for normal transfer operations is 232 person-rem when the 5,000 MTHM and GTCC waste canisters are placed into storage. Chapter 9 and its associated appendices provide a detailed evaluation of occupational exposures.

1.4.2 Normal Operations – Establishment of the Controlled Area (Site) Boundary

An analysis was performed to identify the location of the controlled area boundary to ensure compliance with 10 CFR 72.104 (a) (dose rate ≤ 25 mrem/yr). As noted above, the dose rates assumed on the surface of the storage overpacks are based on the design basis source terms in the licensed storage systems at the reactor sites.

The annual expected yearly dose at the nearest site boundary for the fully loaded (5,000 MTHM plus GTCC waste canisters) WCS CISF is $4.29\text{E-}5$ person-rem, including direct radiation (including skyshine) and contributions due to inhalation, submersion and ingestion from non-leak-tight containers. Chapters 9 and 11 and their associated appendices provide a detailed evaluation of site boundary exposures.

1.4.3 Accident Analysis

1.4.3.1 Safety Analysis Process

Chapter 12 and design specific appendices provide analysis for the off-normal and accident conditions for the approved storage systems. Chapter 12 defines the design basis events for each authorized cask system. The WCS CISF Technical Specifications [1-4] complete the design safety basis by defining the operational controls and limits placed on WCS CISF operations and lists the necessary administrative controls or programs established for the site. Chapter 14 provide the basis for the Technical Specifications.

1.4.3.2 Safety Analysis Methodology

The storage of spent nuclear fuel at the WCS CISF is based on the use of cask systems that have been previously certified by the NRC. The associated systems' storage FSARs and transportation SARs provide design basis information regarding radiological hazards for the individual systems to be used at the WCS CISF. The FSARs/SARs identify design basis events that are classified as either normal, off-normal or accidents for each approved system. Normal events include such operations as transportation package receipt, inspection, transfer of the canisters to the storage overpack and storage at the WCS CISF until ready to be transported off-site. Off-normal events are those events which are expected to occur with moderate frequency during transfer and storage operations. In general, the consequences of these events have no radiological safety implications and do not have a significant impact on ITS design functions. Accident conditions are those events that occur infrequently and could reasonably be expected to occur during the lifetime of the WCS CISF. These events include low probability design basis accidents which establish a conservative design basis for ITS SSCs. These events include natural phenomena such as earthquakes and tornados, and man-made events such as cask drop.

1.4.3.3 Results

For most of the accidents analyzed, there are no radiological consequences produced as a direct result of the event, and there are no impacts on ITS design functions. These negligible consequences are attributed primarily to the use of NRC approved storage systems and the implementation of operating controls and limits. However, recovery operations may involve some occupational exposure to personnel. The analyses results indicate that there are no credible accident scenarios for the WCS CISF which would result in a loss of confinement accident or a radiological release in excess of the radiological dose criterion of 10 CFR 72.106.

1.4.3.4 Technical Specifications

The WCS CISF Technical Specifications [1-4] define the operating controls and limits and the administrative controls. The Technical Specifications, including the relevant portions of the individual storage system Technical Specifications, provide defined operating limits and controls for each system for storage at the WCS CISF.

The administrative controls presented in this SAR include the organization and management structure, response plans, procedures, programs, controls, record keeping requirements, review and audit procedures, and reporting necessary to assure that the operations involved in the storage of canisterized spent nuclear fuel at the WCS CISF are performed in a safe manner.

The NRC approved transportation and storage system ITS design features include the transportation casks, canisters, storage units, and other equipment as specified in the previously NRC-approved CoC or site-specific materials license.

1.4.4 Safety Management

The WCS management policy and highest priority is to ensure that all operations are conducted safely. Implementation of this policy is made through a consolidated safety management program. This program entails radiation protection, conduct of operations, and quality assurance.

1.4.4.1 Radiation Protection Program

The radiation protection program ensures that all operations are performed in a manner that ensures occupational exposures are maintained within prescribed regulatory limits and are ALARA. ALARA considerations have been integrated into the design of the WCS CISF and incorporated into all operating procedures.

1.4.4.2 Conduct of Operations Program

The conduct of operations program ensures that the WCS CISF is operated in a professional and safe manner. Highlights of this program include the following:

- The WCS organization provides clear lines of responsibilities and ensures independence of organizations. This ensures WCS has an effective organization with appropriate oversight.
- WCS performs an extensive test program, including an operational readiness review, prior to beginning normal operations. The test program ensures that the WCS structures, systems, and components are operated in a dependable manner so as to perform their intended function.
- WCS maintains a systematic training program to ensure proficiency of all facility personnel.
- WCS maintains a formal procedure management program that ensures all ITS operations are performed using detailed written, approved, and controlled procedures.
- WCS has a detailed emergency preparedness program and conducts periodic drills and training. This ensures that WCS personnel are prepared to respond to emergencies as they arise.

1.4.4.3 Quality Assurance Program

The activities associated with the WCS CISF are governed by the applicable portions of the WCS QA program as described in Waste Control Specialists LLC Quality Assurance Program Description [1-2]. The WCS QA program is designed to meet the requirements of 10 CFR 72, Subpart G.

1.5 Identification of Agents and Contractors

WCS has overall responsibility for the engineering, design, licensing, and construction of the WCS CISF.

AREVA Inc. is the prime contractor for the design and operation of the WCS CISF. AREVA Inc. is also the prime contractor for the design and fabrication of the HSMs, and associated auxiliary systems for the NUHOMS[®] systems. AREVA Inc. is also the prime contractor for the NUHOMS[®] cask systems and is responsible for cask transportation licensing, fabrication, testing, and delineation of any cask specific requirements.

NAC International is the prime contractor for the design and fabrication of the NAC storage overpacks and ITS storage pads on which the NAC storage overpacks will be stored. NAC International is also the prime contractor for the NAC cask systems and is responsible for cask transportation licensing, fabrication, testing, and delineation of any cask specific requirements.

WCS and AREVA Inc. will also use various contractors for site preparation and construction, as necessary.

1.6 Material Incorporated by Reference

This section provides a list of the safety analysis reports incorporated by reference as part of the SAR. The list of the SAR sections that reference one or more of the below documents is provided in Table 1-4.

1.6.1 NUHOMS® Systems

1.6.1.1 Transportation SARs

AREVA TN Americas, "NUHOMS®-MP197 Transport Packaging Safety Analysis Report," Revision 17, USNRC Docket Number 71-9302.

AREVA TN Americas, "Safety Analysis Report for the NUHOMS®-MP187 Multi-purpose Cask," Revision 17, USNRC Docket Number 71-9255.

1.6.1.2 Storage SARs

"Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report," NRC Docket No. 72-11, Revision 4.

AREVA TN Americas, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," NRC Docket No. 72-1004, AREVA TN Americas Document No. NUH-003, Revision 14.

AREVA TN Americas, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," NRC Docket No. 72-1029, AREVA TN Americas Document No. ANUH-01.0150, Revision 6.

1.6.2 NAC International Systems

1.6.2.1 Transportation SARs

NAC International, "NAC-STC, NAC Storage Transport Cask Safety Analysis Report," Revision 17, USNRC Docket Number 71-9235.

NAC International, "Safety Analysis Report for the UMS® Universal Transport Cask," Revision 2, USNRC Docket Number 71-9270.

NAC International, "Safety Analysis Report for the MAGNATRAN Transport Cask," Revisions 12A, 14A, and 15A, USNRC Docket Number 71-9356.

1.6.2.2 Storage SARs

NAC International, "NAC Multipurpose Cask Final Safety Analysis Report," Revision 10, USNRC Docket Number 72-1025.

NAC International, "Final Safety Analysis Report for the UMS Universal Storage System," Revision 10, USNRC Docket Number 72-1015.

NAC International, "MAGNASTOR[®] Final Safety Analysis Report," Revision 7, USNRC Docket Number 72-1031.

1.7 References

- 1-1 Title 10, Code of Federal Regulations, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."
- 1-2 "Quality Assurance Program for Consolidated Interim Spent Fuel Storage Facility and the Packaging and Transport of Radioactive Materials," QAPD-400, Revision 0.
- 1-3 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.
- 1-4 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.
- 1-5 Reg Guide 1.76, "Design-Basis Tornado And Tornado Missiles For Nuclear Power Plants," Revision 1, March 2007.
- 1-6 NUREG-0800, Standard Review Plan, Section 3.3.1 "Wind Loading", 3.3.2 "Tornado Loads" and Section 3.5.1.4 "Missiles Generated by Tornado and Extreme Winds", Rev 3, March 2007.
- 1-7 NUREG-0800, Standard Review Plan, Section 3.5.1.4 "Missiles Generated by Natural Phenomena", Revision 2, July 1981.
- 1-8 WCS document "Environmental Report for the Consolidated Interim Storage Facility, Docket No. 72-1050," Revision 0.
- 1-9 Reg Guide 1.60. "Design Response Spectra for Seismic Design of Nuclear Power Plants," Revision 2, July 2014.
- 1-10 AECOM "Site Specific Seismic Hazzard Evaluation and Development of Seismic Design Ground Motions," Study Number WCS-12-05-100-001, Revision 0.

Table 1-1
Storage Systems at the WCS CISF

Cask System	NRC Docket No.	Canister	Overpack
NUHOMS [®] MP187 Cask System	71-9255 72-11 (SNM-2510)	FO-DSC	HSM (Model 80)
		FC-DSC	
		FF-DSC	
Advanced Standardized NUHOMS [®] System	71-9255 72-1029	NUHOMS [®] 24PT1	AHSM
Standardized NUHOMS [®] System	71-9302 72-1004	NUHOMS [®] 61BT	HSM Model 102
		NUHOMS [®] 61BTH Type 1	
NAC-MPC	71-9235 72-1025	Yankee Class	VCC
		Connecticut Yankee	
		LACBWR	
NAC-UMS	71-9270 72-1015	Classes 1 thru 5	VCC
MAGNASTOR	71-9356 72-1031	TSC1 thru TSC4	CC1 thru CC4

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Type of fuel	Commercial, light water reactor spent fuel	Normal	N/A
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal	See Table 1-1
Fuel Characteristics	Criteria as specified in previously approved CoCs and licenses for included systems	Normal	See Table 1-1
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident	Reg Guide 1.76 [1-5] NUREG-800[1-6]
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident	NUREG-800[1-7]
Floods	Flood height 1.1 in Water velocity 1.7 ft/s	Accident	Section 2.4.2.2
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRs) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident	AECON Study Number WCS-12-05-100-001[1-10]
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs For MPC and UMS Systems: Inlet and outlet vents blocked 24 hrs For MAGNASTOR Systems: Inlet vents blocked 58 hrs	Accident	N/A
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel For Vertical Systems: Equivalent fire 50 gallons of fuel	Accident	N/A

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches VCCs for MPC Systems: Drop height 6 inches VCCs for UMS and MAGNASTOR Systems: Drop height 24 inches	Accident	N/A
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal	NA
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident	N/A
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal	Section 2.3.2
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal	Section 2.3.2
Extreme Temperature	Maximum temperature 113°F	Accident	Section 2.3.2
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft ² Curved surface solar insolation 1474.7 BTU/day-ft ²	Normal	10 CFR Part 71
Snow and Ice	Snow Load 10 psf	Normal	Section 2.3.2.4
Dead Weight	Per design basis for systems listed in Table 1-1	Normal	N/A
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Operating Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Live Loads	Per design basis for systems listed in Table 1-1	Normal	N/A

Table 1-2
Summary of WCS CISF Principal Design Criteria
 (3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident	10 CFR 72.106
Radiological Protection	Public wholebody ≤ 25 mrem/yr ⁽¹⁾ Public thyroid ≤ 75 mrem/yr ⁽¹⁾ Public critical organ ≤ 25 mrem/yr ⁽¹⁾	Normal	10 CFR 72.104
Confinement	Per design basis for systems listed in Table 1-1	N/A	N/A
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	N/A
Decommissioning	Minimize potential contamination	Normal	10 CFR 72.130
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal	10 CFR 72.122(1)

Note:

1. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table 1-3
WCS CISF Facilities and Functions

Facility	Function
Cask Handling Building	Receive, inspect and prepare for storage, shipments of canisterized spent nuclear fuel and GTCC waste . Prepare canisterized spent nuclear fuel and GTCC waste stored at the site for off-site transport. Provide for cask and rail car light maintenance. All cask maintenance will be performed under the WCS CISF QAPD [1-2].
Storage Area	Provide location for safe storage of canisterized spent nuclear fuel and GTCC waste.
Security and Administration Building	Provide main operation center and armory for site security and emergency equipment; control personnel, rail and vehicle access to the WCS CISF facilities; and provide administrative functions related to transport, communication and tracking center/facility, training and visitor center.
Receiving Area	Location to perform DOT/NRC required inspections of arriving railcars

Table 1-4
Table of Topical Reports (SARs) Incorporated by Reference
(3 pages)

Chapter	Description	Applicable SARs (Docket Number)
01	INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION	Section 1.6 (1.6 Material Incorporated by Reference)
A.3	Appendix A.3 - Design Criteria for NUHOMS® MP187 System	72-11 71-9255
B.3	Appendix B.3 - Design Criteria for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
C.3	Appendix C.3 - Design Criteria for Standardized NUHOMS® System 61BT	72-1004 71-9255
D.3	Appendix D.3 - Design Criteria for Standardized NUHOMS® System 61BTH	72-1004 71-9255
E.3	Appendix E.3 - Design Criteria for NAC-MPC	72-1025
F.3	Appendix F.3 - Design Criteria for NAC-UMS	72-1015
G.3	Appendix G.3 - Design Criteria for NAC-MAGNASTOR	72-1031
A.4	Appendix A.4 - Operating Systems for NUHOMS® MP187 System	72-11
B.4	Appendix B.4 - Operating Systems for Advanced Standardized NUHOMS® System	72-1029
C.4	Appendix C.4 - Operating Systems for Standardized NUHOMS® System 61BT	72-1004
D.4	Appendix D.4 - Operating Systems for Standardized NUHOMS® System 61BTH	72-1004
E.4	Appendix E.4 - Operating Systems for NAC-MPC	72-1025
F.4	Appendix F.4 - Operating Systems for NAC-UMS	72-1015
G.4	Appendix G.4 - Operating Systems for NAC-MAGNASTOR	72-1031
A.7	Appendix A.7 - Structural Evaluation for NUHOMS® MP187 System	72-11 71-9255
B.7	Appendix B.7 - Structural Evaluation for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
C.7	Appendix C.7 - Structural Evaluation for Standardized NUHOMS® System 61BT	72-1004 71-9255
D.7	Appendix D.7 - Structural Evaluation for Standardized NUHOMS® System 61BTH	72-1004 71-9255
E.7	Appendix E.7 - Structural Evaluation for NAC-MPC	72-1025

Table 1-4
Table of Topical Reports (SARs) Incorporated by Reference
(3 pages)

Chapter	Description	Applicable SARs (Docket Number)
F.7	Appendix F.7 - Structural Evaluation for NAC-UMS	72-1015
G.7	Appendix G.7 - Structural Evaluation for NAC-MAGNASTOR	72-1031
A.8	Appendix A.8 - Thermal Evaluation for NUHOMS® MP187 System	72-11 71-9255
B.8	Appendix B.8 - Thermal Evaluation for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
C.8	Appendix C.8 - Thermal Evaluation for Standardized NUHOMS® System 61BT	72-1004 71-9255
D.8	Appendix D.8 - Thermal Evaluation for Standardized NUHOMS® System 61BTH	72-1004 71-9255
E.8	Appendix E.8 - Thermal Evaluation for NAC-MPC	72-1025
F.8	Appendix F.8 - Thermal Evaluation for NAC-UMS	72-1015
G.8	Appendix G.8 - Thermal Evaluation for NAC-MAGNASTOR	72-1031
A.9	Appendix A.9 - Radiation Protection for NUHOMS® MP187 System	72-11 71-9255
B.9	Appendix B.9 - Radiation Protection for Advanced Standardized NUHOMS® System	72-1029 71-9255
C.9	Appendix C.9 - Radiation Protection for Standardized NUHOMS® System 61BT	72-1004 71-9255
D.9	Appendix D.9 - Radiation Protection for Standardized NUHOMS® System 61BTH	72-1004 71-9255
E.9	Appendix E.9 - Radiation Protection for NAC-MPC	72-1025
F.9	Appendix F.9 - Radiation Protection for NAC-UMS	72-1015
G.9	Appendix G.9 - Radiation Protection for NAC-MAGNASTOR	72-1031
A.10	Appendix A.10 - Criticality Evaluation for NUHOMS® MP187 System	72-11
B.10	Appendix B.10 - Criticality Evaluation for Advanced Standardized NUHOMS® System	72-1029
C.10	Appendix C.10 - Criticality Evaluation for Standardized NUHOMS® System 61BT	72-1004
D.10	Appendix D.10 - Criticality Evaluation for Standardized NUHOMS® System 61BTH	72-1004
E.10	Appendix E.10 - Criticality Evaluation for NAC-MPC	72-1025

Table 1-4
Table of Topical Reports (SARs) Incorporated by Reference
 (3 pages)

Chapter	Description	Applicable SARs (Docket Number)
F.11	Appendix F.10 - Criticality Evaluation for NAC-UMS	72-1015
G.11	Appendix G.10 - Criticality Evaluation for NAC-MAGNASTOR	72-1031
A.11	Appendix A.11 - Confinement Evaluation for NUHOMS® MP187 System	72-11
B.11	Appendix B.11 - Confinement Evaluation for Advanced Standardized NUHOMS® System	72-1029
C.11	Appendix C.11 - Confinement Evaluation for Standardized NUHOMS® System 61BT	72-1004
D.11	Appendix D.11 - Confinement Evaluation for Standardized NUHOMS® System 61BTH	72-1004
E.11	Appendix E.11 - Confinement Evaluation for NAC-MPC	72-1025
F.11	Appendix F.11 - Confinement Evaluation for NAC-UMS	72-1015
G.11	Appendix G.11 - Confinement Evaluation for NAC-MAGNASTOR	72-1031
A.12	Appendix A.12 - Accident Analyses for NUHOMS® MP187 System	72-11 71-9255
B.12	Appendix B.12 - Accident Analyses for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
C.12	Appendix C.12 - Accident Analyses for Standardized NUHOMS® System 61BT	72-1004 71-9255
D.12	Appendix D.12 - Accident Analyses for Standardized NUHOMS® System 61BTH	72-1004 71-9255
E.12	Appendix E.12 - Accident Analyses for NAC-MPC	72-1025
F.12	Appendix F.12 - Accident Analyses for NAC-UMS	72-1015
G.12	Appendix G.12 - Accident Analyses for NAC-MAGNASTOR	72-1031

Table 1-5
Ground Surface DRS

Period (sec)	Horizontal (g)	Vertical (g)
0.01	0.250	0.175
0.03	0.347	0.287
0.04	0.406	0.377
0.05	0.473	0.471
0.08	0.586	0.539
0.10	0.610	0.466
0.15	0.504	0.310
0.20	0.399	0.216
0.25	0.314	0.157
0.30	0.262	0.126
0.40	0.198	0.094
0.50	0.154	0.076
0.60	0.124	0.063
0.75	0.096	0.051
1.00	0.067	0.038
1.50	0.039	0.024
2.00	0.025	0.016
3.00	0.014	0.0088
4.00	0.0094	0.0063
5.00	0.0068	0.0047
7.52	0.0029	0.0020
10.00	0.0016	0.0011



Figure 1-1
WCS CISF Location



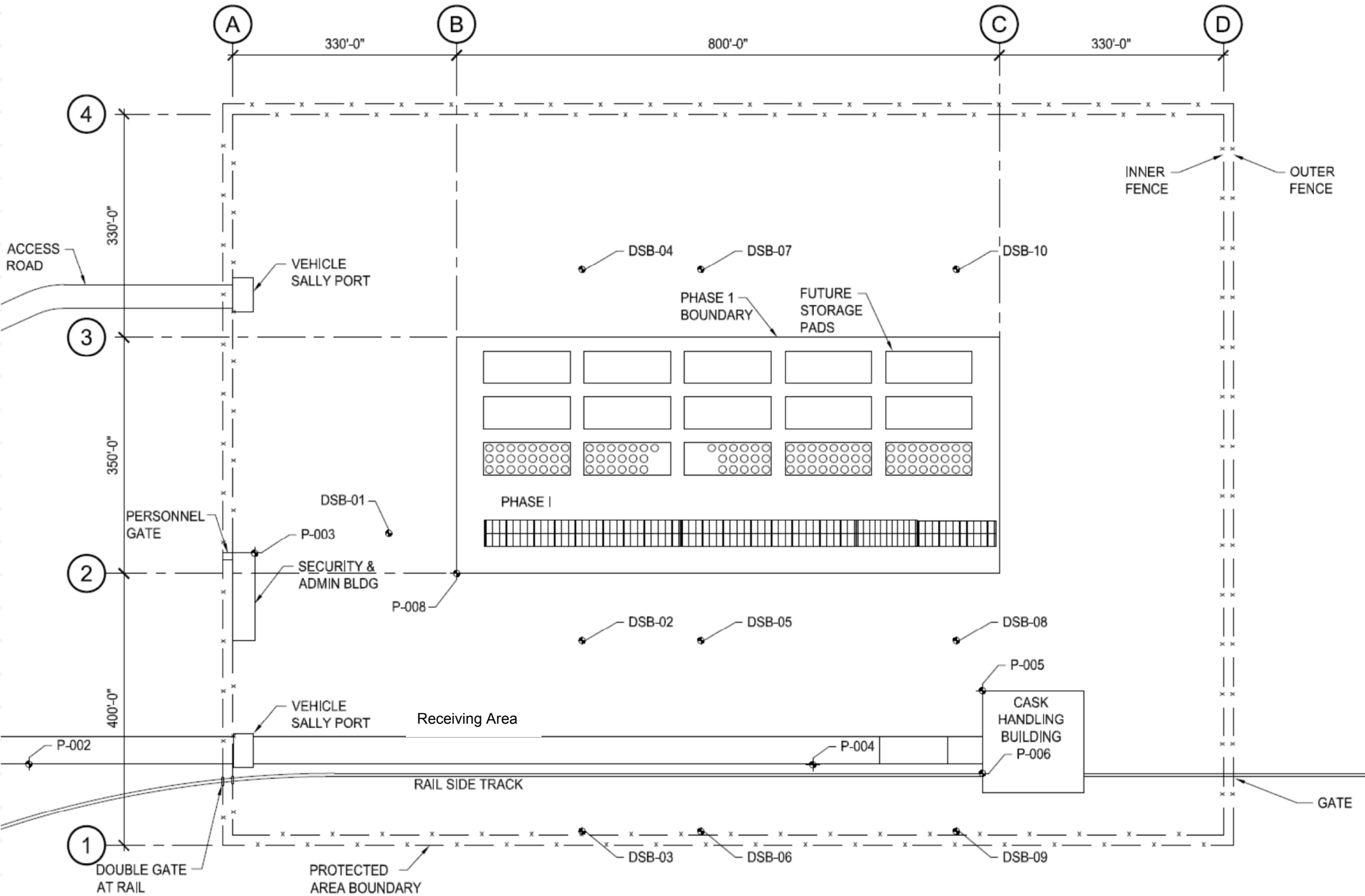


Figure 1-3
WCS CISF Site Overview

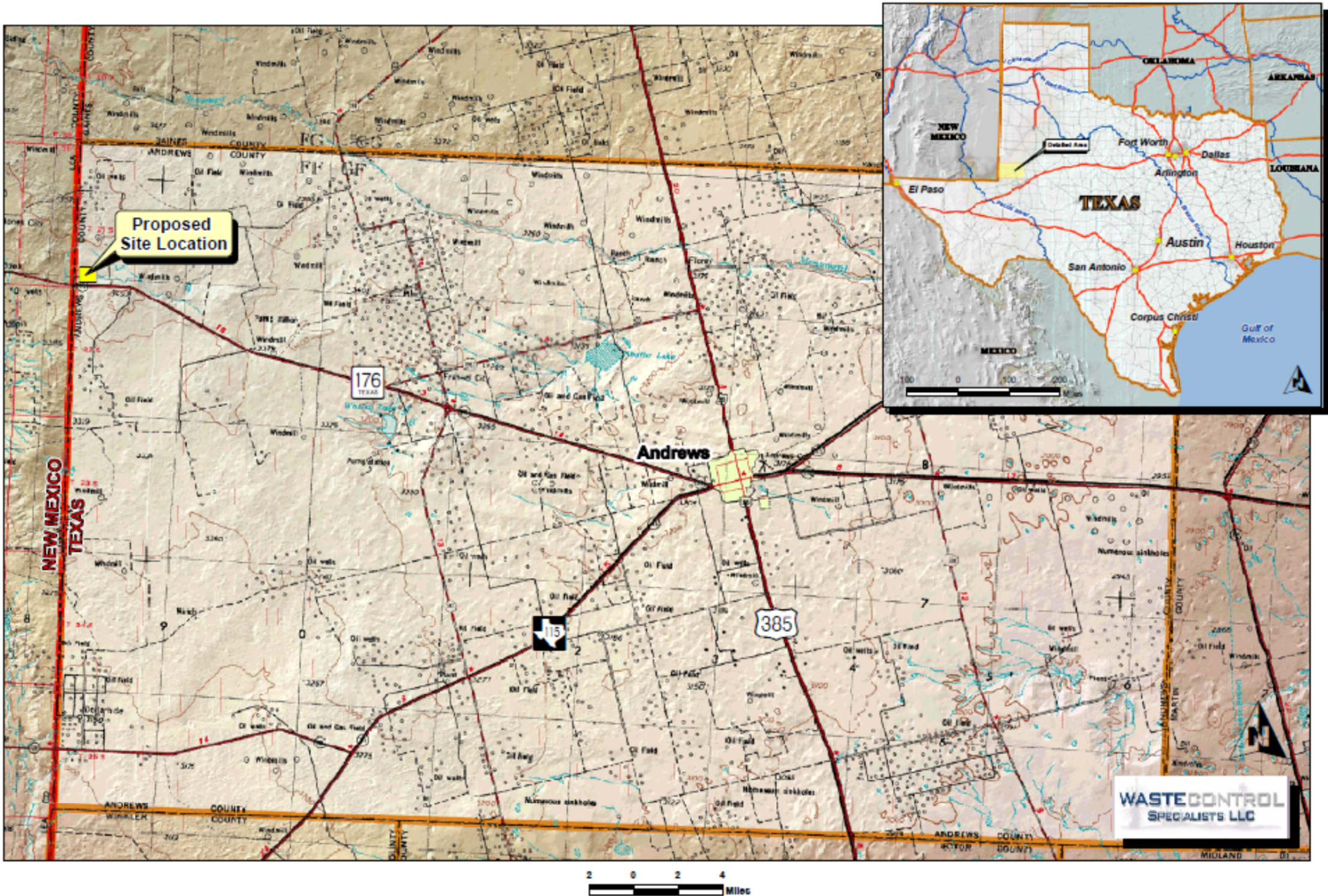


Figure 1-4
Site Location Map

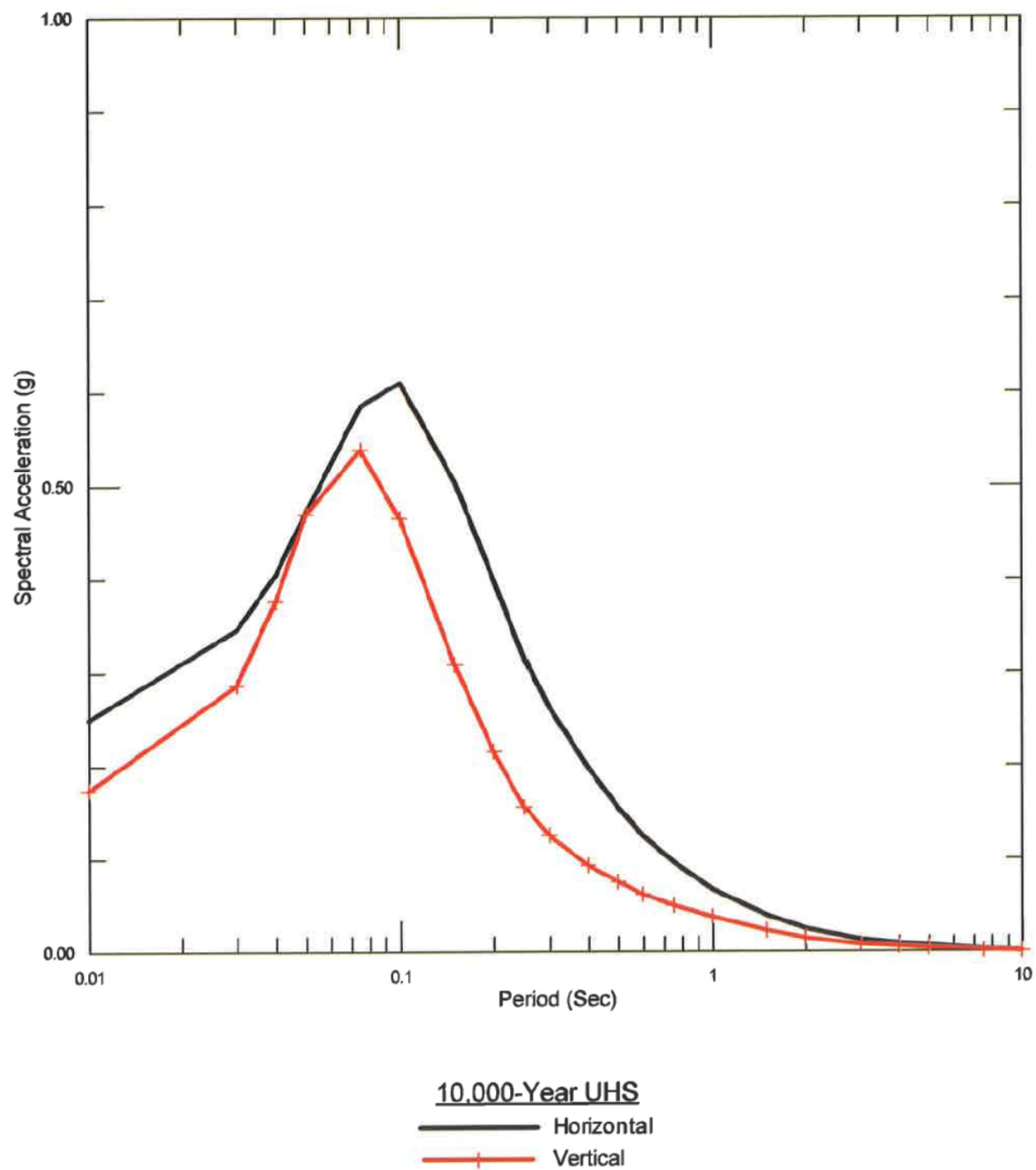


Figure 1-5
10,000-Year Return Period Response Spectra (5% Damped)