

Office of Civilian Radioactive Waste Management



***Transportation
System Requirements
Document***

Revision 5

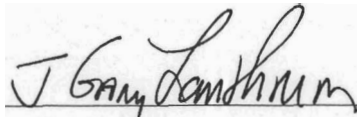
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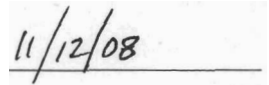
Date: November 12, 2008

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Having determined completion of technical review under procedure LP-6.1.Q-OCRWM and compliance with requirements in accordance with LP-PMC-009-OCRWM, *Program Change Control*, the change to the baseline document is approved for release.



J. Gary Lanthrum, Director
Office of Logistics Management



Date

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
PROGRAM BASELINE CHANGE CONTROL BOARD
REVISION/CHANGE RECORD

Document Number: DOE/RW-0425/D00000000-00811-1708-00002

Document Title: Transportation System Requirements Document

Revision Number/ Date	BCP Number	Revision/Change Description	Pages Affected
Rev. 01 March 1994	BCP-00-94-0001	Incorporates the Multi-Purpose Canister (MPC) concept into the CRWMS technical baseline.	All
Rev. 01 DCN 01 May 1995	BCP-00-94-0005	Resolves issues needed for the procurement of the MPC system. Also incorporates the collocation of the Cask Maintenance Facility at the MGDS. Additional changes were made to address CAR HQ-93-031.	viii, 16, 17, 18, 36, 37, 38, 39, 40, 44, 46, 47, 53, 55, 56, 93, 94, 96, 161, 167
Rev. 02 December 1995	BCP-00-94-0005	General revision to incorporate BCP-00-94-000 "Implementation of the Program Approach"	All
Rev. 02 DCN 01 June 1996	BCP-00-96-0002	Provides Notice to Users on MPC Policy In accordance with the BCP-00-96-0002, MPC Policy Change, approved January 31, 1996, by the Program Baseline Change Control Board, OCRWM will no longer lead the development efforts of the multipurpose canister (MPC). Therefore, the CRWMS will need to provide additional flexibility to accept and accommodate a variety of cask/canister systems for commercial spent nuclear fuel. General cask/canister performance definitions and requirements that define necessary system capabilities to accommodate SNF received in canisters with single-, dual-, or triple-purpose application will need to be maintained in the technical baseline, including systems which involve the handling and repackaging of uncanistered spent nuclear fuel. Accordingly, all readers and implementers of the Program-level technical baseline (i.e., the CRWMS Requirements Document and the four System Requirements Documents) are hereby notified that, until the next planned revision of the technical baseline is completed, the following policy will be used as the basis for technical planning. This administrative change shall be designated as Revision 2 Document Change Notice. (DCN) 1. The CRWMS will accept and accommodate a variety of	Addendum, see following

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		cask/canister systems for commercial spent nuclear fuel which are currently available or are being developed. These may be individual spent fuel assemblies; or single, dual, or triple purpose cask or canister systems. The existing MPC design, if deployed, will be in accordance with the MPC procurement specification. Until specific canister or cask systems are developed, certified, and licensed, interface requirements affecting the designs of CRWMS structures, systems, and components must be adequately documented and controlled in accordance with the OCRWM Quality Assurance Requirements and Description document (DOE/RW-0333). Some items may be identified as To Be Verified or To Be Determined.	
Rev. 03 November 2004	BCP-ONT-2005-0021, Rev. 0	Updates the TSRD to conform to the current Civilian Radioactive Waste Management System Requirements Document (CRD) Revision 6. Deletes references to obsolete facilities and equipment. Revises ONT Program (Level-2) requirements to be less prescriptive and more performance or function based. Reformats document to reflect ONT transportation sub-elements. Revises glossary and list of acronyms/ abbreviations to reflect terms used in document.	All
Rev 04 October 2006	BCP-OLM-2006-0011, Rev. 0	Updates the TSRD to reflect Program direction changes of CRD Revision 7. Updates the TRSD to include detailed requirements as a result of a regulatory analysis to determine, when possible, which specific parts of each regulation apply to each specific requirement. Also removes some requirements more appropriate to lower level requirements documents. Also removes programmatic requirements and non-design affecting operational requirements.	All
Rev 05 2008	TBD	Updates the TSRD to reflect program direction changes of CRD Revision 8, additional program decisions, and additional derived requirements from functional analysis. Per CRD Revision 8, update reflects selection of the Caliente route and compliance with the Integrated Interface Control Document (IICD), Volume 2. Also reflects baseline of Cask Maintenance Facility (CMF) (vice Fleet Maintenance Facility (FMF)) and Rail Equipment Maintenance Yard (REMY) (vice End of Line (EOL) Facility), derived requirement of Nevada Rail Line design life, and additional derived requirements resulting from	All

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		functional analysis of approved requirements, using the approved Transportation Concept of Operations (CONOPS). None of the changes apply to other CRWMS elements or external systems.	

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1 SCOPE

The Nuclear Waste Policy Act of 1982 (NWPA), as amended, authorized the DOE to develop and manage a Federal system for the disposal of Spent Nuclear Fuel (SNF) and High-Level Radioactive Waste (HLW). The Office of Civilian Radioactive Waste (OCRWM) was created to manage acceptance, transportation and disposal of SNF and HLW in a manner that protects public health, safety, and the environment; enhances national and energy security; and merits public confidence.

The mission of the Transportation System is to transport loaded casks of SNF and HLW safely and securely from origin sites to the Monitored Geologic Repository (MGR) at Yucca Mountain. The OCRWM Transportation System is a “closed-loop” operational system originating with shipment planning and dispatch from the Cask Maintenance Facility (CMF). Initially, new empty casks and transporters depart from the CMF for pre-arranged origin sites, where they are loaded, then shipped to the MGR, unloaded, and returned to the CMF for maintenance, reassembly, inventory, inspection, and preparation for a new shipment. This document establishes the Transportation System Level 2 requirements for the U.S. Department of Energy’s (DOE’s) Civilian Radioactive Waste Management System. These requirements are derived from the Civilian Radioactive Waste Management System Requirements Document (CRD), the Integrated Interface Control Document (IICD) Volume 1 and the Integrated Interface Control Document (IICD) Volume 2. The Transportation System Requirements Document (TSRD) was developed in accordance with LP-3.36Q-OCRWM, *CRWMS Requirements Documents and Integrated Interface Control Documents preparation and Approval*.

Revision 5 of this document incorporates the requirements of CRD, Revision 8 and identifies requirements for the current phase of the Transportation System. As plans for Transportation subsystems mature, more detailed requirements will be identified in subsequent revisions to this document.

2 REQUIREMENTS IMPLEMENTATION

This section identifies the types and hierarchy of requirements taken into consideration in determining what requirements are applicable to the Transportation System.

2.1 Level 2 Requirements

Level 2 requirements are the responsibility of DOE and are passed down through contracts or procurement specifications to operating contractors and vendors of facilities, supplies and services. Level 2 requirements in the context of the TSRD drive the design of Transportation System components and/or facilities. Level 2 requirements are critical to achieving the Office of Logistics Management (OLM) mission and traceability will be maintained throughout the process of requirement(s) flow down (derivation or decomposition) and implementation.

2.2 Focus on Design-Affecting Requirements

The TSRD, Revision 5 focuses on the system (design-affecting) requirements for the Transportation System. Programmatic and operational requirements, including some requirements in previous TSRD revisions, are tracked separately, but are not discussed in this document. Programmatic requirements (e.g., DOE Order 413.1A, Management Control Program requirements) do not affect system design and will be included in the OLM Performance Management Plan. Purely operational requirements (e.g., requirements for shipment pre-notification or preparation of Site Campaign Plans) will be included in the Transportation Operations Plan. Design-affecting requirements that are derived from operational requirements (e.g., emergency communications, equipment and space needed for inspections, and space in facilities, including secure space, for maintaining documentation) will remain in the TSRD.

The TSRD includes 4 types of system (design-affecting) requirements that form the system model of the Transportation System:

- Functional requirements describe what the Transportation System must do without prescribing how the function will be accomplished. These requirements are usually descriptive and are verified by the summation of the associated performance requirements. For example, “The Transportation System shall be designed to transport commercial SNF; DOE SNF; vitrified defense HLW, including a vitrified plutonium waste form; and vitrified commercial HLW, in accordance with the NWPA and implementing regulations.”
- Performance requirements are quantifiable and individually verifiable. For example, “In Year 1 of operation: 400 MTHM of commercial SNF and HLW; 66 DOE SNF canisters; and 193 DHLW canisters; In Years 2 through 4, on a cumulative basis: 3,800 MTHM of commercial SNF and HLW; 257 DOE SNF canisters; and 1,143 DHLW canisters; and In Year 5, to satisfy full operating capability: 3,000 MTHM of commercial SNF and HLW; 179 DOE SNF canisters; and 763 DHLW canisters.”
- Design constraint requirements impose limitations under which the system is required to operate or exist. For example, “The Transportation System shall comply with applicable parts of 29 CFR 1910 ” (Occupational Health and Safety).
- Interface requirements define how the Transportation System is required to interact with external systems (e.g., the MGR) or how subsystems within the Transportation System interact. For example, “Transportation casks shall have characteristics within the limits given in the column labeled "Purchasing" in Table 1 of IICD Volume 2.

2.3 Precedence of Requirements

The order of precedence for requirements for the TSRD is:

- Federal laws and Executive Orders;
- Federal agency and departmental regulations and Orders;
- State and Tribal laws;
- Local ordinances; and
- National and international standards.

2.4 Assumptions

There are no assumptions in TSRD, Revision 5.

2.5 TSRD Structure

The TSRD is organized as follows:

Section 1: Scope - Provides an overview of the system and program background.

Section 2: Requirements Implementation - Provides a list of Government and non Government documents that are referenced in the TSRD.

Section 3: System Requirements - Provides functional, performance and constraint requirements for the Transportation System including requirements specific to (allocated to) the Cask System, Cask Maintenance Facility, Nevada Rail Line (NRL), Nevada Rail (NR) Facilities and Yards, Rolling Stock, Cask Rail Car, Rail Escort Vehicle, Buffer Rail Car, Cask Trailer, Transportation Operations Center and System Internal and External Interfaces.

Section 4: Quality Engineering Provisions - Describes the verification methods for assuring that requirements have been met.

Section 5: Notes - Includes acronyms, abbreviations, and glossary.

Appendix A: Requirements Traceability Matrix - Provides traceability from each requirement to its source in either the CRD or IICD Volume 2.

Appendix B: TBR/TBD Table – Lists requirements that must be revised or determined in the future.

Appendix C: References - Includes a list of CRWMS documents cited as well as laws, regulations, DOE Orders, and codes and standards that form the basis of requirements contained in the TSRD.

3 SYSTEM REQUIREMENTS

The OCRWM Transportation System is comprised of the infrastructure needed to transport SNF and HLW from multiple origin sites to the MGR for disposal. The Transportation System infrastructure consists of: Transportation Casks; Transportation Operations Center; Cask Maintenance Facility; Rolling Stock, which includes Cask Rail Car, Rail Escort Vehicle, Buffer Rail Car, Cask Trailer; Nevada Rail Line and Nevada Rail (NR) Facilities and Yards. Figure 2 shows the Transportation System physical architecture within the context of the larger CRWMS architecture. Systems external to the Transportation System include: Waste Acceptance and the Monitored Geologic Repository at the CRWMS architecture level; and, Operating Environment and Origin Site at the CRWMS context level. Operating Environment includes: Nuclear Regulatory Commission (NRC), Local Authority, State Authority, Tribal Authority, Department of Homeland Security (DHS), Federal Bureau of Investigation (FBI), Public Information Office (PIO), National Weather Service (NWS), Naval Nuclear Propulsion Program (NNPP), Commercial Rail Line, Commercial Truck Line/Carrier, DOE Transportation Tracking and Communications System (TRANSCOM), Coast Guard, DOE Emergency Operations Center, DOE Regional Coordinating Office and the Natural Environment. Section 3.2.1.1 lists the level 2 requirements for the overall system.

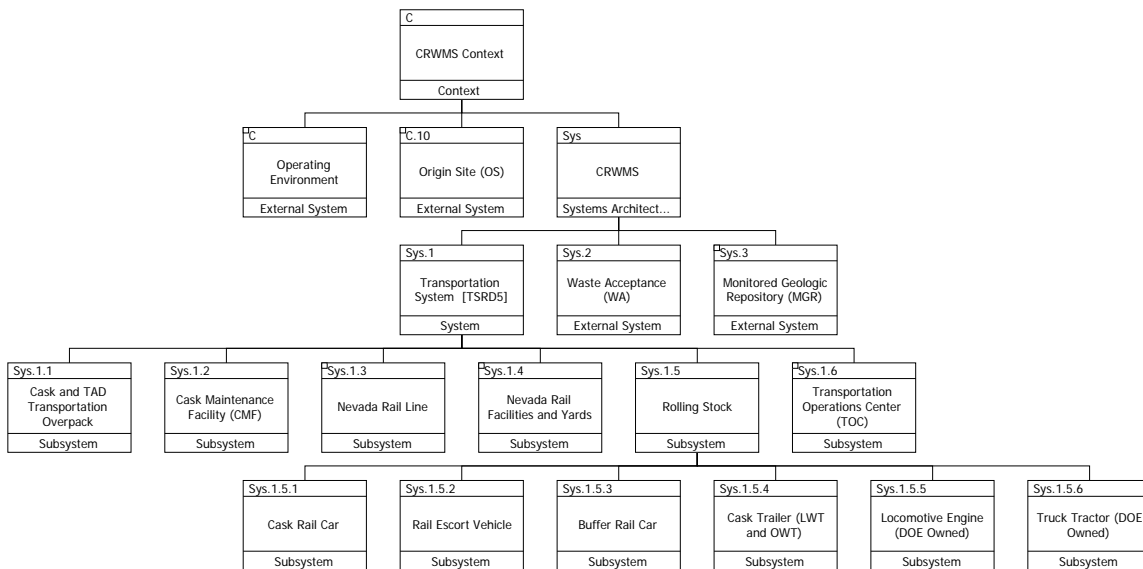


Figure 1 Transportation System Physical Architecture within CRWMS and External Systems Context

3.1 Transportation System Description

Cask and TAD Transportation Overpack The transportation **Cask** is the approved packaging, which shall be used to transport SNF and HLW to the MGR. A cask is a container for the packaging and/or shipment of SNF or HLW. A cask system is a cask and associated equipment such as impact limiters, tie-down devices and personnel barriers, tools and ancillary equipment necessary to ensure compliance with NRC requirements contained in 10 CFR 71. The transportation casks provide a robust, sealed, shielded package, ensure criticality control, and manage heat rejection from the SNF and HLW during shipment. Several models of cask systems will be necessary to package the various SNF types and HLW designated for transport and to accommodate the infrastructure capabilities at the origin sites. The **TAD Transportation Overpack** is a structural component used to hold and protect the TAD Canister so that

the combination meets the NRC requirements for its application. There are several types of overpacks: one for transportation, 10 CFR Part 71; one for transfer, 10 CFR Part 72; one for storage, 10 CFR Part 72. The cask and TAD Transportation Overpack may be transported by multiple modes, i.e., rail, truck, or barge. Section 3.2.1.1.1 lists the Level 2 requirements for Cask and TAD Transportation Overpack subsystem.

Cask Maintenance Facility (CMF) The Cask Maintenance Facility is the primary cask storage, maintenance, repair, test, inspection, assembly, staging, and dispatch facility for the Transportation System. The CMF receives new casks and monitors used casks in a low-level radiological area. Low-level radiological work performed at the CMF is in a distinct area separate from non-radiological maintenance work. Non-contaminated equipment is kept separate from contaminated equipment in accordance with “start-clean/stay-clean” practices. Cask maintenance and cask recertification are performed at the CMF in authorized low-level radiological work areas. The CMF is comprised of general and specialized maintenance buildings and secure, accessible yards for rolling stock and cask trailers. There are work stations for crews, areas for tools, and storage for surplus equipment, spare parts, and contaminated and uncontaminated casks and auxiliary equipment. The CMF may include training facilities where personnel may be trained on the maintenance, testing and inspection of casks and rolling stock as well as on operation of Transportation System equipment and facilities. Section 3.2.1.1.2 lists the Level 2 requirements for the CMF subsystem.

Nevada Rail Line (NRL) The NRL connects the Union Pacific rail line to the MGR and to Nevada Rail Facilities and Yards. The primary purpose of the NRL is transport spent nuclear fuel (SNF) and high-level radioactive waste (HLW) to the GROA located at Yucca Mountain, Nevada. Section 3.2.1.1.3 lists the Level 2 requirements for the NRL subsystem.

Nevada Rail (NR) Facilities and Yards The NR Facilities and Yards includes the Union Pacific Rail Road (UPRR) interchange, Staging Yard, Maintenance of Way Headquarters, Maintenance of Way Track, and the Rail Equipment Maintenance Yard, and other facilities. Section 3.2.1.1.4 lists the Level 2 requirements for the Nevada Rail Facilities and Yards. Section 3.2.1.1.4 lists the Level 2 requirements for the NRL subsystem.

Rolling Stock Rail and Truck Rolling Stock will be acquired to transport SNF and HLW to the MGR. Rail rolling stock is defined as locomotives, cask cars, buffer cars, and rail escort vehicles. Truck rolling stock is defined as truck tractors and trailers, and highway escort vehicles. To transport waste by rail, OCRWM acquires and provides cask and buffer cars as well as rail escort vehicles to the rail carriers for use and resupply. The cask cars will be designed to carry SNF and HLW in casks certified by the NRC. The rail escort vehicle will house and support the crew and equipment for multiple-day assignments, providing security during the transport of SNF and HLW. Buffer cars will be used to separate loaded cask cars from the crew-bearing locomotives and rail escort vehicles. There will be a minimum of two buffer cars and one rail escort vehicle per shipment.. To transport waste by truck, OCRWM acquires and provides highway escort vehicles and truck trailers. Regulatory compliant truck trailers will haul overweight truck or legal weight truck casks. Truck casks move directly to the MGR rather than through the REMY Rail Yard. Other transport equipment, such as heavy haul transporters or barges, is supplied as needed by qualified commercial contractors. Section 3.2.1.1.5 lists the Level 2 requirements for the rolling stock subsystem.

Transportation Operations Center The Transportation Operations Center manages normal, off-normal and emergency transportation operations involving interfaces with multiple entities. The Transportation Operations Center plans and schedules shipments, directs the dispatch of transportation assets from the CMF to origin sites, maintains real-time en route centralized tracking and control of shipments, secures shipments, and coordinates communications about shipments. Section 3.2.1.1.6 lists the Level 2 requirements for the Transportation Operations Center subsystem.

Internal Communication Interface Real-time communication is required with: Federal agencies; States; Tribes; commercial rail and truck control centers; and other OCRWM elements. Communications provide information on dispatch, shipment progress, security and safety conditions, and support the deployment necessary repair equipment, provisions, or emergency assistance to shipments en route. Communications are secure as well as open, reliable and compatible with capabilities of other organizations. Hardware and software designs and configurations are compatible across OCRWM. Section 3.2.2 lists the Level 2 requirements for external and internal interfaces.

3.2 Requirements

3.2.1 Functional Requirements

3.2.1.1 Transportation System

- a. **Compliance with NWPA [was System 3.2.1.1.a]** The Transportation System shall be designed to transport commercial SNF; DOE SNF; vitrified defense HLW, including a vitrified plutonium waste form; and vitrified commercial HLW, in accordance with the NWPA and implementing regulations.
- b. **SNF and HLW Transportation Rates [was System 3.2.1.1.b]** The Transportation System shall be capable of transporting SNF and HLW by rail at the following rates:
 - In Year 1 of operation: 400 MTHM of commercial SNF and HLW; 66 DOE SNF canisters; and 193 DHLW canisters;
 - In Years 2 through 4, on a cumulative basis: 3,800 MTHM of commercial SNF and HLW; 257 DOE SNF canisters; and 1,143 DHLW canisters; and
 - In Year 5, to satisfy full operating capability: 3,000 MTHM of commercial SNF and HLW; 179 DOE SNF canisters; and 763 DHLW canisters.
- c. **Cask Handling and Transportation Capability [was System 3.2.1.1.c]** The Transportation System shall be capable of transporting NRC-certified (10 CFR 71) transportation casks, including the following general types:
 - Single-Purpose Casks
 - Canister Casks (Transport, Aging and Disposal Canister and Dual-Purpose Canister)
 - Transportable Storage Casks
 - HLW Casks
 - Specialty Casks
- d. **Waste Transportation Modes [was System 3.2.1.1.d]** The Transportation System shall be capable of transporting waste by rail, truck and barge.
- e. **Test, Inspection, Maintenance Functionality [was System 3.2.1.1.e]** The Transportation System shall be designed to permit periodic testing, inspection, and maintenance.
- f. **Hardware and Software Compatibility Requirements [was System 3.2.1.1.f]** The Transportation System computer hardware and software systems shall be compatible with other CRWMS elements.
- g. **Security Escort Vehicle for Physical Protection [was System 3.2.1.1.g]** All shipments shall include a security escort vehicle to ensure physical protection of SNF and HLW in transit.

- h. **Interfaces [was System 3.2.1.1.h]** Transportation System Interfaces with EM and NNPP shall comply with IICD, Vol. 1, Section 9.6, *Transportation System, Cask, and Nevada Rail Interfaces*.
- i. **Communication Equipment Compatibility [was Comm 3.2.1.1.6.a]** The Transportation System shall have communication equipment that is compatible with other elements of CRWMS.
- j. **Communications Equipment Independent Power Sources [was Comm 3.2.1.1.6.b]** All communications equipment required for security, including off-site equipment, shall remain operable from independent power sources in the event of loss of primary power.
- k. **Communications Equipment Security [was Comm 3.2.1.1.6.d]** The Transportation System communications equipment shall meet the requirements of DOE Order 470.4, Section A, Chapter 12.

3.2.1.1.1 Cask and TAD Transportation Overpacks

- a. **Cask Suitable for Use [was Cask 3.2.1.1.1.a]** Casks shall be suitable for use at the origin sites, in compliance with 10 CFR 961, Article 4(B)2.
- b. **Cask Maximum Weight [was Cask 3.2.1.1.1.c]** The maximum combined weight of the loaded transportation cask and skid with its lifting fixtures, personnel barrier, and impact limiters shall not exceed TBD-1.
- c. **Cask Personnel Barriers [was Cask 3.2.1.1.1.d]** Cask personnel barriers used to create a “closed transport vehicle” shall comply with 49 CFR 173.403.
- d. **Cask Personnel Barriers Physical Interfaces [was Cask 3.2.1.1.1.e]** Cask personnel barriers shall have the characteristics listed in Section 3.1.12 of the IICD, Volume 2.
- e. **Transportation Cask Bounding Characteristics [was Cask 3.2.1.1.1.f]** Transportation casks shall have characteristics within the limits given in the column labeled "Purchasing" in Table 1 of IICD Volume 2.
- f. **Skid Handling Characteristics [was Cask 3.2.1.1.1.g]** Each rail cask specific skid shall have the handling characteristics listed in Section 3.1.11.1 of the IICD, Volume 2.
- g. **Tamper Indicating Devices [was Cask 3.2.1.1.1.h]** Each package and/or transporter shall be equipped with a device or numbered seal in compliance with 10 CFR 71.43(a) that indicates that the package has not been tampered with since its acceptance.
- h. **TAD Transportation Overpacks [NEW]** The size and weight of the loaded transportation overpack shall be limited to the characteristics provided in Table 3.2-1 of the Transportation, Aging and Disposal Canister System Performance Specification, Revision 0.
- i. **Cask/Cask Skid-to-Cask Rail Car Interface [NEW]** The Cask/Cask Skid interface, including loaded or unloaded cask, with cask rail car shall be in accordance with TBD-2 bounding characteristics.

3.2.1.1.2 Cask Maintenance Facility

- a. **Cask Inspection and Maintenance [was FMF 3.2.1.1.2.a]** The CMF shall be capable of testing, inspecting, and maintaining NRC-certified transportation casks in accordance with 10 CFR 71.
- b. **Spare Parts and Equipment Storage [was FMF 3.2.1.1.2.b]** The CMF shall be designed to handle, store, ship, clean, and preserve materials and equipment to be used in packaging to prevent damage or deterioration in compliance with 10 CFR 71.127.

- c. **Provision of Campaign Kits to Origin Sites [was FMF 3.2.1.1.2.c]** The CMF shall provide technical information, special tools, equipment, lifting trunnions, spare parts and consumables needed to use and perform incidental maintenance on the cask(s) to the origin sites in compliance with 10 CFR 961, Article 4(B)2.
- d. **Rail Escort Vehicle Maintenance [was FMF 3.2.1.1.2.g]** The CMF shall be capable of conducting routine external maintenance only on the REV car in accordance with the manufacturer's maintenance requirements. [Note: Maintenance requiring entrance to the interior of the REV, or maintenance on any of the physical protection measures of the REV will only be conducted at the REV manufacturer facility.]
- e. **Storage of Cask Inventory [was FMF 3.2.1.1.2.h]** The CMF shall have the capability to store TBD-3 % of the cask inventory.
- f. **Transportation Package Decontamination [was FMF 3.2.1.1.2.k]** Surfaces of transportation packages shall be decontaminated to levels required by 49 CFR 173.443.
- g. **Rail and Truck Rolling Stock Decontamination [was FMF 3.2.1.1.2.l]** The CMF shall be capable of decontaminating Rail and Truck Rolling Stock in compliance with 49 CFR 173.443(c).
- h. **Low Level and Mixed Radioactive Waste Storage (CMF) [was FMF 3.2.1.1.2.m, NRL 3.2.1.1.3.a]** The CMF shall be designed to minimize, handle and store low-level and mixed radioactive waste generated at those facilities in accordance with requirements of DOE Order 435.1, *Radioactive Waste Management*.
- i. **Radioactive Waste Management (CMF) [was FMF 3.2.1.1.2.n and NRL 3.2.1.1.3.b]** Radioactive waste generated at the CMF shall be managed in accordance with DOE M435.1-1, *Radioactive Waste Management Manual*.
- j. **Hazardous Waste Management [was FMF 3.2.1.1.2.o]** If the CMF generates hazardous waste as identified by 40 CFR 261.3 the waste shall be managed in compliance with the applicable provisions of 40 CFR 262.
- k. **Railroad Noise Emission (CMF) [was FMF 3.2.1.1.2.s, NRL 3.2.1.1.3.f]** The CMF design shall comply with 49 CFR Section 210.
- l. **Handling and Lifting Equipment Capability [was FMF 3.2.1.1.2.v]** The CMF handling and lifting equipment shall be capable of moving and lifting the cask system or components weighing up to TBD-4 pounds.
- m. **Fire Protection -- General Facility Design [was FMF 3.2.1.1.2.w]** The CMF shall incorporate all requirements of Chapter 5 "General Facility Design" of National Fire Protection Association Standard 801 *Standard for Fire Protection for Facilities Handling Radioactive Materials*.
- n. **Fire Protection -- Systems and Equipment [was FMF 3.2.1.1.2.x]** The CMF shall incorporate all applicable requirements of Chapter 6, "General Fire Protection Systems and Equipment", of National Fire Protection Association Standard 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*.
- o. **Fire Protection -- Hot Cells, Caves, Glove Boxes, and Hoods [was FMF 3.2.1.1.2.y]** The CMF shall incorporate all applicable requirements of Section 7.4 "Hot Cells, Caves, Glove Boxes, and Hoods" of Chapter 7, "Special Hazards in Nuclear Facilities", of National Fire Protection Association Standard 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*.
- p. **Cask Spacer Removal [was FMF 3.2.1.1.2.z]** The CMF shall have the capability to remove and install fuel spacers in casks.

- q. **Cask Reconfiguration [was FMF 3.2.1.1.2.aa]** The CMF shall have the capability to remove and install fuel assembly baskets for those casks that have removable baskets.
- r. **Radiological Survey (CMF) [was NRL 3.2.1.1.3.q]** The CMF shall comply with applicable provisions of 10 CFR 835.
- s. **Campaign Kit Assembly [NEW]** The CMF shall be capable of assembling and preparing campaign kits for transportation to Origin Sites by truck or rail.
- t. **Campaign Kit Assembly Rate [NEW]** The CMF shall be capable of assembling and preparing campaign kits for transportation to origin sites at a rate sufficient to meet the annual CRWMS SNF and HLW transportation rates specified in paragraph 3.2.1.1.b of TSRD rev 5.
- u. **Campaign Kit Component Radiological Inspection [NEW]** The CMF shall be capable of determining the non-fixed contamination level of campaign kit components.
- v. **Campaign Kit Packaging (CMF) [NEW]** The CMF shall be capable of packaging campaign kit components in accordance with 49 CFR subpart I.
- w. **Radiological Survey of Campaign Kit Transport Vehicle [NEW]** The CMF shall be capable of performing a radiological survey of transport vehicles used to transport campaign kits to and from origin sites.
- x. **Cask Assembly [NEW]** The CMF shall be capable of assembling and preparing transportation casks and overpacks for transportation to an Origin Site by rail or truck in accordance with the cask CoC.
- y. **Cask Assembly Rate [NEW]** The CMF shall be capable of assembling and preparing transportation casks and overpacks for transportation to origin sites at a rate sufficient to meet the annual CRWMS SNF and HLW transportation rates specified in paragraph 3.2.1.1.b of TSRD rev 5.
- z. **Convoy Assembly and Preparation at CMF [NEW]** The CMF shall be capable of assembling and preparing a truck convoy with unloaded casks and/or overpacks for safe shipment to an IMT or Origin Site.
- aa. **Cask Radiological Survey at CMF (truck) [NEW]** The CMF shall be capable of conducting a radiological survey for both radiation dose rates and non-fixed contamination of unloaded transportation casks attached to the cask trailer.
- ab. **Consist Assembly and Preparation at CMF [NEW]** The CMF shall be capable of preparing a pre assembled rail consist with unloaded casks and/or overpacks and other necessary safety and security equipment for shipment to an IMT or Origin Site.
- ac. **Cask Radiological Survey at CMF (rail) [NEW]** The CMF shall be capable of conducting a radiological survey for both radiation dose rates and non-fixed contamination of unloaded transportation casks attached to cask rail cars.
- ad. **Routine Cask Maintenance [NEW]** The CMF shall be capable of conducting cask maintenance in accordance with cask SAR and CoC.
- ae. **Security Escort Vehicle Storage [NEW]** The CMF shall be capable of storing the entire fleet of REV's in enclosed, secure space.
- af. **Security Escort Vehicle Servicing and Resupply [NEW]** The CMF shall be capable of servicing and resupplying REV's. [Note: Maintenance requiring entrance to the interior of the REV, or maintenance on any of the physical protection measures of the REV, will only be conducted at the REV manufacturer facility.]

ag. **CMF Communications Interface (internal)** [NEW] The CMF shall be capable of communications with the subsystems documented in Section 3.2.2.

3.2.1.1.3 Nevada Rail Line

a. **Train Assembly and Disassembly Provisions (NRL)** [was **NRL 3.2.1.1.3.c, FMF 3.2.1.1.2.p**] The NRL shall provide for yard locomotives or other car-movers to affect train assembly and disassembly involving placarded rail cars in compliance with 49 CFR 174.83.

b. **Brake System Safety Standards (NRL)** [was **Rolling Stock 3.2.1.1.4.a, NRL 3.2.1.1.3.d, FMF 3.2.1.1.2.q**] Locomotives used on the NRL shall comply with 49 CFR 232.

c. **Railroad Freight Car Safety Standards (NRL)** [was **NRL 3.2.1.1.3.e, FMF 3.2.1.1.2.r**] Railroad freight cars used on the NRL shall comply with all applicable provisions of 49 CFR 215.

d. **Railroad Noise Emission (NRL)** [was **NRL 3.2.1.1.3.f, FMF 3.2.1.1.2.s**] The NRL shall comply with 49 CFR Section 210.

e. **NRL Peaking Effects** [was **NRL 3.2.1.1.3.g**] The design and maintenance of the NRL shall make provision for non-normal and peaking effects in the movements of loaded and empty casks.

f. **NRL Shared Use** [was **NRL 3.2.1.1.3.h**] The NRL shall be designed so that shared use is not precluded.

g. **Cars and Loads Accommodation** [was **NRL 3.2.1.1.3.i**] The NRL shall be designed to accommodate the cars and loads that can be cleared by the main line carrier to the NRL in support of repository construction.

h. **Maintenance-of-Way** [was **NRL 3.2.1.1.3.j**] The NRL shall be designed on the basis that maintenance-of-way will be accomplished using on-track equipment in lieu of road equipment using a parallel service road.

i. **AREMA** [was **NRL 3.2.1.1.3.k**] The NRL shall be designed and maintained in accordance with appropriate sections of the American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

j. **Cask Recovery Equipment** [was **NRL 3.2.1.1.3.l**] The NRL shall be capable of recovering a cask should an incident occur during transport from the UPRR Interchange to the MGR.

k. **Railroad Workplace Safety** [was **NRL 3.2.1.1.2.m**] The NRL shall comply with all applicable provisions of 49 CFR 214.

l. **Railroad Communications** [was **NRL 3.2.1.1.3.o**] The NRL shall comply with 49 CFR 220.

m. **AAR MSRP (NRL)** [was **Rolling Stock 3.2.1.1.4.g, NRL 3.2.1.1.3.r**] The NRL shall meet the applicable requirements in all applicable standards within the AAR Manual of Standards and Recommended Practices (MSRP).

n. **AAR Field Manual of the Interchange Rules (NRL)** [was **Rolling Stock 3.2.1.1.4.h, NRL 3.2.1.1.3.s**] NRL shall meet the applicable requirements in AAR Field Manual of Interchange Rules.

o. **AAR Office Manual of the Interchange Rules** [was **Rolling Stock 3.2.1.1.4.i, NRL 3.2.1.1.3.t**] NRL shall meet the applicable requirements in AAR Office Manual of Interchange Rules.

p. **Track Safety Standards** [was **NRL 3.2.1.1.3.u**] NRL shall comply with all applicable provisions of 49 CFR 213.

- q. **NRL Clearance Requirements** [was **NRL 3.2.1.1.3.w**] The NRL shall be designed for operations within clearances defined by AAR MSRP S-2032-74, Equipment Diagram, Plate F, to accommodate NNPP rail cars and casks per IICD Volume 1, Revision 3, Figure C-1.
- r. **Nevada Transportation Lifetime** [NEW] NRL shall be planned, designed, constructed, operated, and maintained to ensure a 50-year life cycle.
- s. **NRL Approved Route** [NEW] The approved route for the NRL shall be within the caliente corridor.

3.2.1.1.4 Nevada Rail (NR) Facilities and Yards

- a. **Occupational Radiation Protection** [was **NRL 3.2.1.1.3.q**] NR Facilities and Yards shall comply with applicable provisions of 10 CFR 835.
- b. **Storage of Rolling Stock** [was **NRL 3.2.1.1.3.v**] NR Facilities and Yards shall have the capability to store TBD-5 rail cars.
- c. **Low Level and Mixed Radioactive Waste Storage (NR Facilities and Yards)** [was **NRL 3.2.1.1.3.a, FMF 3.2.1.1.2.m**] If applicable, NR Facilities and Yards shall be designed to minimize, handle and store low-level and mixed radioactive waste generated at those facilities in accordance with requirements of DOE Order 435.1, *Radioactive Waste Management*.
- d. **Radioactive Waste Management (NR Facilities and Yards)** [was **NRL 3.2.1.1.3.b, FMF 3.2.1.1.2.n**] If applicable, radioactive waste generated at NR Facilities and Yards shall be managed in accordance with DOE M435.1-1, *Radioactive Waste Management Manual*.
- e. **Rolling Stock Inspection and Maintenance** [was **FMF 3.2.1.1.2.d**] NR Facilities and Yards shall be capable of testing, inspecting, repairing and maintaining rolling stock.
- f. **Truck Rolling Stock Maintenance** [was **FMF 3.2.1.1.2.e**] NR Facilities and Yards shall have the capability to inspect, repair, and maintain truck tractors and trailers in compliance with 49 CFR 396.
- g. **Rail Rolling Stock Maintenance** [was **FMF 3.2.1.1.2.f**] NR Facilities and Yards shall have the capability to maintain rail rolling stock in accordance with AAR S-2043.
- h. **Storage of Rolling Stock Inventory** [was **FMF 3.2.1.1.2.i**] NR Facilities and Yards shall have the capability to store TBD-6 % of rolling stock inventory on storage tracks outside the support structure(s) / building(s).
- i. **Space for Consist Assembly** [was **FMF 3.2.1.1.2.j**] NR Facilities and Yards that assemble rail consists shall provide track space and switches, capable of assembling rail consists that are TBD-7 feet in length.
- j. **Locomotive Emissions** [was **FMF 3.2.1.1.2.t**] NR Facilities and Yards shall be capable of performing emission-related maintenance on government-owned locomotives in compliance with 40 CFR Part 92.211.
- k. **Truck Tractors** [was **FMF 3.2.1.1.2.u**] NR Facilities and Yards shall provide truck tractors to haul trailers.
- l. **Cask Rail Car Routine Maintenance** [NEW] NR Facilities and Yards shall be capable of conducting routine maintenance on the cask rail car in accordance with manufacturer's maintenance requirements.
- m. **Buffer Car Routine Maintenance** [NEW] NR Facilities and Yards shall be capable of conducting routine maintenance on the buffer rail car in accordance with manufacturer's maintenance requirements.

- n. **Locomotive Routine Maintenance [NEW]** NR Facilities and Yards shall be capable of conducting routine maintenance on the locomotive engine in accordance with manufacturer's maintenance requirements.
- o. **REMY Communications Interface [NEW]** NR Facilities and Yards shall be capable of communications with the subsystems contained in Section 3.2.2 of TSRD Rev 5.

3.2.1.1.5 Rolling Stock

- a. **Brake System Safety Standards (Rolling Stock) [was Rolling Stock 3.2.1.1.4.a, NRL 3.2.1.1.3.d, FMF 3.2.1.1.2.q]** Rail Rolling Stock shall comply with 49 CFR 232.
- b. **Transport of Campaign Kits to Origin Sites [was Rolling Stock 3.2.1.1.4.b]** Rolling stock shall be capable of transporting special tools, equipment, lifting trunnions, spare parts and consumables needed to use and perform incidental maintenance on the cask(s) to the origin sites, in compliance with 10 CFR 961, Article 4(B)2.
- c. **Conveyance Bounding Characteristics [was Rolling Stock 3.2.1.1.4.c]** Transportation rolling stock shall have characteristics within the limits given in Table 2 of the IICD, Volume 2.
- d. **Rail Rolling Stock Design and Fabrication [was Rolling Stock 3.2.1.1.4.d]** Rail Rolling Stock shall be designed and fabricated according to AAR Standard S-2043.
- e. **Security Escort Vehicle Design [was Rolling Stock 3.2.1.1.4.e]** The design of the Security Escort Vehicle shall comply with the applicable provisions of DOE Order 470.4, *Physical Protection*.
- f. **AAR MSRP (Rolling Stock) [was Rolling Stock 3.2.1.1.4.g, NRL 3.2.1.1.3.r]** All rail rolling stock shall meet the all applicable standards within the AAR Manual of Standards and Recommended Practices (MSRP).
- g. **AAR Field Manual of the Interchange Rules (Rolling Stock) [was Rolling Stock 3.2.1.1.4.h, NRL 3.2.1.1.3.s]** All rail rolling stock shall meet the applicable requirements in AAR Field Manual of Interchange Rules.
- h. **AAR Office Manual of the Interchange Rules (Rolling Stock) [was Rolling Stock 3.2.1.1.4.i, NRL 3.2.1.1.3.t]** All rail rolling stock shall meet the applicable requirements in AAR Office Manual of Interchange Rules.
- i. **Rail Clearance Requirements [was Rolling Stock 3.2.1.1.4.j]** Rail Rolling Stock shall be designed to operate within clearances defined by AAR MSRP S-2032-74, Equipment Diagram, Plate-F.
- j. **Railroad Safety Appliance Standards [was Rolling Stock 3.2.1.1.4.k]** Rail Rolling Stock shall comply with 49 CFR 231.
- k. **Rear End Marking Device [was Rolling Stock 3.2.1.1.4.l]** Rail Rolling Stock shall comply with 49 CFR 221.
- l. **Truck Safety [was Rolling Stock 3.2.1.1.4.m]** Truck Rolling Stock design shall comply with the federal motor vehicle safety regulations in 49 CFR 393.

3.2.1.1.5.1 Cask Rail Car

- a. **Cask Rail Car Transportation of Loaded Casks to MGR/GROA Site [NEW]** The cask rail car shall be capable of transporting loaded transportation casks and overpacks from Origin Sites to the MGR/GROA.

- b. **Cask Rail Car-to-Cask/Cask Skid Interface [NEW]** The Cask Rail Car interface to Cask/Cask Skid combination, for loaded or unloaded cask, shall adhere to the TBD-8 bounding characteristics.
- c. **Cask Rail Car-to-Facility Interface (internal) [NEW]** The Cask Rail Car-to-Facility interface, including unloaded or loaded cask rail car interface with the CMF, REMY and NRL Staging Yard shall adhere to the TBD-9 bounding characteristics.

3.2.1.1.5.2 Rail Escort Vehicle

- a. **Rail Escort Vehicle-to-CMF Interface [NEW]** The REV-to-CMF interface with the CMF shall adhere to the TBD-10 bounding characteristics.
- b. **Rail Escort Vehicle Communications Interface (internal) [NEW]** The REV shall be capable of communications with the subsystems documented in Section 3.2.2.

3.2.1.1.5.3 Buffer Rail Car

- a. **Non-Placarded Rail Car Position [was Rolling Stock 3.2.1.1.4.f]** A buffer car shall be positioned between any cask railcar and any occupied car, including a security escort vehicle or locomotive, in compliance with 49 CFR 174.85(b).

3.2.1.1.5.4 Cask Trailer

- a. **Cask Trailer-to-Cask Interface [NEW]** The Cask Trailer-to-Cask interface, including cask trailer interface with loaded or unloaded cask, shall adhere to the TBD-11 bounding characteristics.

3.2.1.1.6 Transportation Operations Center

- a. **Continuity of Operations [was TOC 3.2.1.1.5.a]** The Transportation System shall have a back-up Transportation Operation Center, with full communications capability for redundancy in meeting its 24/7 management requirements.
- b. **Conduct of Operations [was TOC 3.2.1.1.5.b]** The Transportation Operations Center shall be capable of supporting end-to-end planning of all transportation operations to include security planning in accordance with DOE Order 460.2A, *Department Materials Transportation and Packaging Management* and DOE M 460.2-1, *Radioactive Transportation Practices Manual*.
- c. **Management and Emergency Response [was TOC 3.2.1.1.5.c]** The Transportation Operations Center facility shall be capable of managing normal, off-normal, and emergency operations in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System*, to include provisions for a distinct emergency operations center.
- d. **Communication Connectivity [was TOC 3.2.1.1.5.d]** The Transportation Operations Center shall have 24/7 connectivity required to the DOE Command Center, the CRWMS elements, other federal agencies, state and local governments, commercial rail and truck dispatch centers, and the shipment consists.
- e. **Command and Control Operations Spaces [NEW]** The TOC shall provide space to accommodate shipment command and control operations.
- f. **Planning and Administrative Operations Spaces [NEW]** The TOC shall provide space to accommodate shipment planning and administrative operations.
- g. **Shipment Progress [NEW]** The TOC shall be capable of monitoring shipment progress for all cask shipments.

h. **TOC Communications Interface (internal) [NEW]** The TOC shall be capable of communications with subsystems as documented in Section 3.2.2.

3.2.2 System Communication Interfaces

3.2.2.1 External Interfaces

TBD

3.2.2.2 Internal Interfaces

3.2.2.2.1 TOC - NRL/REMY

The TOC and REMY shall be capable of communicating at all times throughout shipment operations for the purpose of controlling and coordinating shipment activity.

3.2.2.2.2 TOC - UPRR Interchange

The TOC and UPRR Interchange shall be capable of communicating at all times throughout shipment operations for the purpose of controlling and coordinating shipment activity.

3.2.2.2.3 TOC - NRL/Staging Yard

The TOC and NRL Staging Yard shall be capable of communicating at all times throughout shipment operations for the purpose of controlling and coordinating shipment activity.

3.2.2.2.4 CMF - NRL/REMY

The CMF and the REMY shall be capable of communicating at all times throughout shipment operations for coordinating shipment operation and support activity between the two facilities.

3.2.2.2.5 TOC - CMF

The TOC and CMF shall be capable of communicating at all times throughout shipment operations for the purpose of controlling and coordinating shipment activity.

3.2.2.2.6 TOC - Locomotive (DOE Owned)

The TOC and NRL Locomotives shall be capable of communicating at all times throughout the shipment cycle for the purpose of controlling and coordinating shipment activity during normal, off-normal and emergency operations.

3.2.2.2.7 TOC - Truck Tractor (DOE Owned)

The TOC and Truck Tractor shall be capable of communicating at all times throughout the shipment cycle for the purpose of controlling and coordinating shipment activity during normal, off-normal and emergency operations.

3.2.2.2.8 TOC - REV

The TOC and REV shall be capable of communicating at all times throughout the shipment cycle for the purpose of controlling and coordinating shipment activity during normal, off-normal and emergency operations.

3.2.2.2.9 REV - Locomotive (DOE Owned)

The REV and NRL Locomotives shall be capable of communicating at all times throughout the shipment

cycle for the purpose of controlling and coordinating shipment activity during normal, off-normal and emergency operations.

3.2.3 System Quality Factors

3.2.3.1 Reliability

Reserved

3.2.3.2 Availability

Reserved

3.2.3.3 Maintainability

Reserved

3.2.3.4 Additional Quality Factors

Reserved

3.2.4 Environmental Conditions

a. **Natural Phenomena Hazards Mitigation Design Requirements [was System/Environmental Conditions 3.2.5.a]** New Transportation System facilities and facility modifications/additions shall be designed in accordance with applicable requirements Section 3.a of Chapter 4 "Natural Phenomena Hazards Mitigation" in DOE Order 420.1B, *Facility Safety*.

b. **Natural Phenomena Hazards Mitigation NPH Assessment [was System/Environmental Conditions 3.2.5.a]** An NPH assessment shall be performed for new facilities and facility modifications/additions in accordance with applicable requirements of Section 3.c of Chapter 4 "Natural Phenomena Hazards Mitigation" in DOE Order 420.1B, *Facility Safety*

c. **Compliance with Solid Waste Disposal Act [was System/Environmental Conditions 3.2.5.c]** Transportation System facilities shall manage and dispose of site-generated, solid, non-hazardous waste in compliance with the Solid Waste Disposal Act as implemented in the applicable Federal regulations, including 40 CFR 243 and 40 CFR 246.

3.3 Design Constraints

3.3.1 Materials

Reserved

3.3.2 Radiation Levels

a. **Occupational and Public Doses [was System/Radiation Levels 3.3.2.a]** The Transportation System shall be designed to limit occupational doses to ALARA, consistent with 10 CFR 835.

3.3.3 Nameplates and Product Marking

Reserved

3.3.4 Workmanship

Reserved

3.3.5 Interchangeability

Reserved

3.3.6 Safety

- a. **Fire Protection [was System/Safety 3.3.6.a]** Transportation System facility designs shall comply with the requirements in Section 3.a of Chapter 2, "Fire Protection", in DOE Order 420.1B, *Facility Safety*
- b. **Occupational Safety and Health Standards [was System/Safety 3.3.6.b]** The Transportation System shall comply with applicable parts of 10 CFR Part 851 and DOE Orders.
- c. **Emergency Management Program [was System/Safety 3.3.6.c]** The Transportation System shall meet the requirements of DOE Order 151.1C, *Comprehensive Emergency Management System*.

3.3.7 Human Engineering

Reserved

3.3.8 Radioactive Waste Control

- a. **Public Health and Safety [was System/Radioactive Waste Control 3.3.8.a]** The Transportation System shall comply with the applicable provisions of 42 U.S.C. 10101 et seq., *The Nuclear Waste Policy Act of 1982*, as amended.
- b. **Handling and Storage of Radioactive Waste [was System/Radioactive Waste Control 3.3.8.b]** Transportation facilities shall be designed to handle and store low-level and mixed radioactive waste generated at those facilities in accordance with requirements of DOE Order 435.1, *Radioactive Waste Management*.

3.3.9 System Security

- a. **Safeguards and Security Program [was System/System Security 3.3.9.a]** The Transportation System shall comply with DOE Order 470.4, *Safeguards and Security Program*.
- b. **Physical Protection [was System/System Security 3.3.9.b]** The Transportation System shall comply with the physical protection requirements of DOE M 470.4-2, *Physical Protection*.
- c. **Information Security [was System/System Security 3.3.9.c]** The Transportation System shall comply with the information security requirements of DOE M 470.4-4, *Information Security*.

3.3.10 Government Furnished Property Usage

Reserved

3.3.11 Facility Design to State Statutes and Codes

The Transportation System facilities shall comply with all applicable state statutes and codes concerning facility design.

3.3.12 Use of Industry Codes and Standards

- a. **Use of Standards in Design [was System/Use of Industry Codes and Standards 3.3.12.a]** In the absence of NRC or DOT regulations or DOE Orders, industry codes and standards shall be identified and used in the design and construction of the Transportation System and their selection

supported, in compliance with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*.

3.4 Documentation

a. **QA Records Storage [was System/Documentation 3.4.a]** The transportation system shall provide space for storage of vital records in compliance with DOE Order 243.1, *Records Management Program*, and 10 CFR 71.

3.5 Logistics

Reserved

3.6 Training

a. **Training Facilities [was System/Training 3.6.a]** The Transportation System shall have the capability to train personnel on operation and maintenance of facilities and equipment in compliance with DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*.

4 QUALITY ENGINEERING PROVISIONS

This section describes the methods that the Transportation System will use to demonstrate that requirements identified in the TSRD are effectively implemented.

Verifying conformance with requirements is part of the test and evaluation process. This process includes the development of test plans and procedures for all procured, constructed, and developed equipment, structures, and software consistent with their importance to safety. Implementation of plans and procedures will yield test reports and inspection results that will be used as documentation of conformance verification.

Plans must include a method and rationale to implement the assessment chosen, and must specify the methods to be used to document and report the findings of the assessment. Documentation will provide an explanation of how the requirements allocated to each subsystem have been satisfied. The methods selected for conformance verification will be consistent with the OCRWM Major System Management Policy.

METHODS

The methods of evaluation and verification to be used include:

Analysis. Analysis is the process of accumulating results and conclusions intended to verify that a requirement has been satisfied. Analytical verification of conformance may include compilation and interpretation of results of tests, demonstrations, and examinations of lower-level components of the system. Analysis may also include logical arguments, modeling, calculations, tradeoff studies, reports (design and/or tradeoff) and other relevant information to verify compliance with a requirement, when physical testing of a system is impracticable.

Inspection/Examination. Examination is the process of conducting careful observation and inspection, without use of special laboratory appliances and procedures, to verify conformance to specified requirements. Examination is a relatively direct method, involving, at most, simple physical manipulation or measurement. It is generally non-destructive and does not necessarily involve operation of the system being evaluated.

Test. Test is the quantitative process whereby data is collected, under controlled conditions, to document the performance of a product with respect to a standard. Manipulation and analysis of data derived from testing is an integral part of the method. Special instrumentation and scientific procedures are commonly employed. A test may be conducted in a laboratory or in the field (in situ).

Demonstration. Demonstration is the qualitative process of displaying or operating a system or item in or near its operational environment to verify conformance to requirements. It differs from testing in that it is generally a qualitative and direct determination of the performance of a function and is performed without special instrumentation or other special equipment.

The Verification Cross Reference Matrix (Table 2, Section 4.3) will show the planned verification method for each requirement listed in Section 3.2.

4.1 Responsibility for Inspection

Reserved

4.2 Special Tests and Examinations

Reserved

4.3 Requirements Cross Reference

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.2.1.1 Perform Transportation System Capability			
3.2.1.1.a Compliance with NWPA	Demonstration	System	
3.2.1.1.b SNF and HLW Transportation Rates	Analysis	Subsystem	
	Demonstration	Subsystem	
3.2.1.1.c Cask Handling and Transportation Capability	Demonstration	Subsystem	
3.2.1.1.d Waste Transportation Modes	Demonstration	Subsystem	
3.2.1.1.e Test, Inspection, Maintenance Functionality	Demonstration	Subsystem	
3.2.1.1.f Hardware and Software Compatibility Requirements	Demonstration	Subsystem	
3.2.1.1.g Security Escort Vehicle for Physical Protection	Inspection	Subsystem	
3.2.1.1.h Interfaces	Demonstration	Subsystem	
3.2.1.1.i Communication Equipment Compatibility	Demonstration	System	
3.2.1.1.j Communications Equipment Independent Power Sources	Demonstration	System	
3.2.1.1.k Communications Equipment Security	Demonstration	System	
3.2.1.1.1 Cask and TAD Transportation Overpacks			
3.2.1.1.1.a Cask Suitable for Use	Demonstration	System	
3.2.1.1.1.b Cask Maximum Weight	Demonstration	Subsystem	
3.2.1.1.1.c Cask Personnel Barriers	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.1.d Cask Personnel Barriers Physical Interfaces	Inspection	Subsystem	
	Demonstration	Subsystem	
3.2.1.1.1.e Transportation Cask Bounding Characteristics	Demonstration	Subsystem	
3.2.1.1.1.f Skid Handling Characteristics	Demonstration	Subsystem	
3.2.1.1.1.g Tamper Indicating Devices	Demonstration	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.2.1.1.1.h TAD Transportation Overpacks	Demonstration	Subsystem	
3.2.1.1.1.i Cask/Cask Skid-to-Cask Rail Car Interface	Demonstration	Subsystem	
3.2.1.1.2 Cask Maintenance Facility			
3.2.1.1.2.a Cask Inspection and Maintenance	Demonstration	Subsystem	
3.2.1.1.2.b Spare Parts and Equipment Storage	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.2.c Provision of Campaign Kits to Origin Sites	Demonstration	Subsystem	
3.2.1.1.2.d Rail Escort Vehicle Maintenance	Demonstration	Subsystem	
3.2.1.1.2.e Storage of Cask Inventory	Demonstration	Subsystem	
3.2.1.1.2.f Transportation Package Decontamination	Demonstration	Subsystem	
3.2.1.1.2.g Rail and Truck Rolling Stock Decontamination	Demonstration	Subsystem	
3.2.1.1.2.h Low Level and Mixed Radioactive Waste Storage (CMF)	Demonstration	Subsystem	
3.2.1.1.2.i Radioactive Waste Management (CMF)	Demonstration	Subsystem	
3.2.1.1.2.j Hazardous Waste Management	Demonstration	Subsystem	
3.2.1.1.2.k Railroad Noise Emission (CMF)	Demonstration	Subsystem	
3.2.1.1.2.l Handling and Lifting Equipment Capability	Demonstration	Subsystem	
3.2.1.1.2.m Fire Protection -- General Facility Design	Inspection	Subsystem	
3.2.1.1.2.n Fire Protection -- Systems and Equipment	Inspection	Subsystem	
3.2.1.1.2.o Fire Protection -- Hot Cells, Caves, Glove Boxes, and Hoods	Inspection	Subsystem	
3.2.1.1.2.p Cask Spacer Removal	Demonstration	Subsystem	
3.2.1.1.2.q Cask Reconfiguration	Demonstration	Subsystem	
3.2.1.1.2.r Radiological Survey (CMF)	Demonstration	Subsystem	
3.2.1.1.2.s Campaign Kit Assembly	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.2.t Campaign Kit Assembly Rate	Analysis	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
	Demonstration	Subsystem	
3.2.1.1.2.u Campaign Kit Component Radiological Inspection	Demonstration	Subsystem	
3.2.1.1.2.v Campaign Kit Packaging (CMF)	Demonstration	Subsystem	
3.2.1.1.2.w Radiological Survey of Campaign Kit Transport Vehicle	Demonstration	Subsystem	
3.2.1.1.2.x Cask Assembly	Demonstration	Subsystem	
3.2.1.1.2.y Cask Assembly Rate	Analysis	Subsystem	
	Demonstration	Subsystem	
3.2.1.1.2.z Convoy Assembly and Preparation at CMF	Demonstration	Subsystem	
3.2.1.1.2.aa Cask Radiological Survey at CMF (truck)	Demonstration	Subsystem	
3.2.1.1.2.ab Consist Assembly and Preparation at CMF	Demonstration	Subsystem	
3.2.1.1.2.ac Cask Radiological Survey at CMF (rail)	Demonstration	Subsystem	
3.2.1.1.2.ad Routine Cask Maintenance	Demonstration	Subsystem	
3.2.1.1.2.ae Security Escort Vehicle Storage	Demonstration	Subsystem	
3.2.1.1.2.af Security Escort Vehicle Servicing and Resupply	Demonstration	Subsystem	
3.2.1.1.2.ag CMF Communications Interface (internal)	Demonstration	Subsystem	
3.2.1.1.3 Nevada Rail Line			
3.2.1.1.3.a Train Assembly and Disassembly Provisions (NRL)	Inspection	Subsystem	
3.2.1.1.3.b Brake System Safety Standards (NRL)	Inspection	Subsystem	
3.2.1.1.3.c Railroad Freight Car Safety Standards (NRL)	Inspection	Subsystem	
3.2.1.1.3.d Railroad Noise Emission (NRL)	Demonstration	Subsystem	
3.2.1.1.3.e NRL Peaking Effects	Demonstration	Subsystem	
3.2.1.1.3.f NRL Shared Use	Demonstration	Subsystem	
3.2.1.1.3.g Cars and Loads Accommodation	Demonstration	Subsystem	
	Inspection	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.2.1.1.3.h Maintenance-of-Way	Demonstration	Subsystem	
3.2.1.1.3.i AREMA	Demonstration	Subsystem	
3.2.1.1.3.j Cask Recovery Equipment	Demonstration	Subsystem	
3.2.1.1.3.k Railroad Workplace Safety	Inspection	Subsystem	
3.2.1.1.3.l Railroad Communications	Demonstration	Subsystem	
3.2.1.1.3.m AAR MSRP (NRL)	Inspection	Subsystem	
3.2.1.1.3.n AAR Field Manual of the Interchange Rules (NRL)	Inspection	Subsystem	
3.2.1.1.3.o AAR Office Manual of the Interchange Rules	Inspection	Subsystem	
3.2.1.1.3.p Track Safety Standards	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.3.q NRL Clearance Requirements	Demonstration	Subsystem	
3.2.1.1.3.r Nevada Transportation Lifetime	Analysis	Subsystem	
3.2.1.1.3.s NRL Approved Route	Inspection	Subsystem	
3.2.1.1.4 Nevada Rail (NR) Facilities and Yards			
3.2.1.1.4.a Occupational Radiation Protection	Demonstration	Subsystem	
3.2.1.1.4.b Storage of Rolling Stock	Analysis	Subsystem	
	Demonstration	Subsystem	
3.2.1.1.4.c Low Level and Mixed Radioactive Waste Storage (NR Facilities and Yards)	Demonstration	Subsystem	
3.2.1.1.4.d Radioactive Waste Management (NR Facilities and Yards)	Demonstration	Subsystem	
3.2.1.1.4.e Rolling Stock Inspection and Maintenance	Demonstration	Subsystem	
3.2.1.1.4.f Truck Rolling Stock Maintenance	Demonstration	Subsystem	
3.2.1.1.4.g Rail Rolling Stock Maintenance	Demonstration	Subsystem	
3.2.1.1.4.h Storage of Rolling Stock Inventory	Analysis	Subsystem	
	Demonstration	Subsystem	
3.2.1.1.4.i Space for Consist Assembly	Demonstration	Subsystem	
3.2.1.1.4.j Locomotive Emissions	Demonstration	Subsystem	
3.2.1.1.4.k Truck Tractors	Inspection	Subsystem	
3.2.1.1.4.l Cask Rail Car Routine Maintenance	Demonstration	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.2.1.1.4.m Buffer Car Routine Maintenance	Demonstration	Subsystem	
3.2.1.1.4.n Locomotive Routine Maintenance	Demonstration	Subsystem	
3.2.1.1.4.o REMY Communications Interface	Demonstration	Subsystem	
3.2.1.1.5 Rolling Stock			
3.2.1.1.5.a Brake System Safety Standards (Rolling Stock)	Demonstration	Subsystem	
3.2.1.1.5.b Transport of Campaign Kits to Origin Sites	Demonstration	Subsystem	
3.2.1.1.5.c Conveyance Bounding Characteristics	Demonstration	Subsystem	
3.2.1.1.5.d Rail Rolling Stock Design and Fabrication	Inspection	Subsystem	
3.2.1.1.5.e Security Escort Vehicle Design	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.5.f AAR MSRP (Rolling Stock)	Inspection	Subsystem	
3.2.1.1.5.g AAR Field Manual of the Interchange Rules (Rolling Stock)	Inspection	Subsystem	
3.2.1.1.5.h AAR Office Manual of the Interchange Rules (Rolling Stock)	Inspection	Subsystem	
3.2.1.1.5.i Rail Clearance Requirements	Demonstration	Subsystem	
3.2.1.1.5.j Railroad Safety Appliance Standards	Demonstration	Subsystem	
3.2.1.1.5.k Rear End Marking Device	Inspection	Subsystem	
3.2.1.1.5.l Truck Safety	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.5.1 Cask Rail Car			
3.2.1.1.5.1.a Cask Rail Car Transportation of Loaded Casks to MGR/GROA Site	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.1.1.5.1.b Cask Rail Car-to-Cask/Cask Skid Interface	Demonstration	Subsystem	
3.2.1.1.5.1.c Cask Rail Car-to-Facility Interface (internal)	Demonstration	Subsystem	
3.2.1.1.5.2 Rail Escort Vehicle			
3.2.1.1.5.2.a Rail Escort Vehicle-to-CMF Interface	Demonstration	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.2.1.1.5.2.b Rail Escort Vehicle Communications Interface (interface)	Demonstration	Subsystem	
3.2.1.1.5.3 Buffer Rail Car			
3.2.1.1.5.3.a Non-Placarded Rail Car Position	Inspection	System	
3.2.1.1.5.4 Cask Trailer			
3.2.1.1.5.4.a Cask Trailer-to-Cask Interface	Demonstration	Subsystem	
3.2.1.1.6 TOC			
3.2.1.1.6.a Continuity of Operations	Demonstration	Subsystem	
3.2.1.1.6.b Conduct of Operations	Demonstration	Subsystem	
3.2.1.1.6.c Management and Emergency Response	Demonstration	Subsystem	
3.2.1.1.6.d Communication Connectivity	Demonstration	Subsystem	
3.2.1.1.6.e Command and Control Operations Spaces	Inspection	Subsystem	
3.2.1.1.6.f Planning and Administrative Operations Spaces	Inspection	Subsystem	
3.2.1.1.6.g Shipment Progress	Demonstration	Subsystem	
3.2.1.1.6.h TOC Communications Interface (internal)	Demonstration	Subsystem	
3.2.4.a Natural Phenomena Hazards Mitigation Design Requirements	Demonstration	Subsystem	
	Inspection	Subsystem	
3.2.4.b Natural Phenomena Hazards Mitigation NPH Assessment	Analysis	Subsystem	
	Demonstration	Subsystem	
3.2.4.c Compliance with Solid Waste Disposal Act	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.2.a Occupational and Public Doses	Analysis	Subsystem	
	Demonstration	Subsystem	
3.3.6.a Fire Protection	Inspection	Subsystem	
3.3.6.b Occupational Safety and Health Standards	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.6.c Emergency Management Program	Demonstration	Subsystem	
	Inspection	Subsystem	

Table 1 Verification Cross Reference Matrix

Name & Identifier	Verification		Special Tests & Examinations
	Method	Level	
3.3.8.a Public Health and Safety	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.8.b Handling and Storage of Radioactive Waste	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.9.a Safeguards and Security Program	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.9.b Physical Protection	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.9.c Information Security	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.11 Facility Design to State Statutes and Codes	Demonstration	Subsystem	
	Inspection	Subsystem	
3.3.12.a Use of Standards in Design	Demonstration	Subsystem	
	Inspection	Subsystem	
3.4.a QA Records Storage	Demonstration	Subsystem	
3.6.a Training Facilities	Inspection	Subsystem	
	Demonstration	Subsystem	

5 NOTES

5.1 Glossary

<u>Term</u>	<u>Definition</u>
Ancillary Equipment	Cask unique lifting yokes, bolting operators, leak-testing equipment, other components, testing and measuring instruments and fixtures for each cask system. Packaging for surface contaminated ancillary equipment. Transfer casks (used with canister-based systems).
As Low As is Reasonably Achievable	As Low As is Reasonably Achievable (ALARA) means the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this part, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable. Reference 10 CFR 835.
Bare Spent Nuclear Fuel	Bare spent nuclear fuel is uncanistered, individual spent nuclear fuel assemblies.
Campaign	Campaign is defined as the activities required to prepare for and execute a consecutive set of shipments from a given origin site over a fixed period of time.
Canister	Canister is the structure surrounding the waste form (e.g., HLW immobilized in borosilicate glass) that facilitates handling, storage, transportation, and/or disposal. A canister is a metal receptacle with the following purpose: (1) for solidified HLW, its purpose is a pour mold and (2) for SNF, it may provide structural support for intact SNF, loose rods, nonfuel components, or containment of radionuclides.

Cask

Cask is a container for shipping or storing SNF and/or canistered HLW that is certified by the NRC. The following types of casks are utilized by the CRWMS:

1. **Single-Purpose Casks** - These transportation casks are primarily intended for transporting uncanistered, standard and nonstandard SNF from origin sites to a CRWMS site.
2. **Canister Casks** - These transportation casks are for transporting canisters containing SNF from origin sites to CRWMS sites and between CRWMS sites.
3. **Transportable Storage Casks (TSCs)** - These transportation casks are for storing uncanistered SNF at origin sites and for transporting SNF from origin sites to CRWMS facilities.
4. **HLW Casks** - These transportation casks are for transporting commercial and defense HLW from origin sites to the MGR.
5. **Specialty Casks** - These transportation casks are for transporting nonstandard SNF, and/or fuel related hardware, and/or failed fuel from Purchaser/Custodian sites to the MGR

also

There are five major cask types expected to be used within the CRWMS: These are:

1. Rail Cask - CSNF in TAD canisters in accordance with the TAD canister specification (DOE 2007b)
2. Rail Cask - CSNF in dual-purpose canisters (DPCs) intended for vertical storage (e.g., Hi-Star-100, NAC-UMS, NAC-STC, TS-125)
3. Rail Cask - CSNF in DPCs intended for horizontal storage (e.g., NUHOMS MP-187 and MP-197)
4. Rail Cask - bare boiling water reactor or pressurized water reactor CSNF (e.g., in TN-68 or TN-32 casks)
5. Truck Cask, legal weight truck (LWT) or overweight truck (OWT) - bare CSNF (e.g., GA-4/9 or NAC-LWT).

[from IICD vol2, 3.1.2]

Cask Shipping Skid

A cask shipping skid is used to position casks for loading and shipment. It permits cask field transfer without removal of personnel barriers or impact limiters. Design allows intermodal transfer of casks and facilitates transfer of rail casks to the MGR.

Cask System	A cask system is a cask and associated components such as impact limiters, tie-down devices and personnel barriers, tools, and ancillary equipment necessary to ensure compliance with the package requirements of 10 CFR 71.
Certificate of Compliance	Certificate of Compliance (CoC) is a certificate approving for use, with identified limitations, a specific packaging for quantities of radioactive materials exceeding A1/A2 quantities as defined in 10 CFR 71 and 49 CFR 173. A CoC may be issued by the NRC, DOT, or DOE. As used in this document, CoC refers to a certificate issued by the NRC.
Civilian Radioactive Waste Management System	The composite of sites, facilities, systems, equipment, materials, information, activities, and personnel required to perform those activities necessary to manage spent nuclear fuel and high-level radioactive waste disposal.
Commercial High-Level Radioactive Waste	Commercial High-Level Radioactive Waste is the high-level radioactive waste, as defined by NWPA 42 USC §10101(12), resulting from reprocessing spent nuclear fuel in a commercial facility.
Custodian	Custodian means any government agency that possesses spent nuclear fuel that is eligible for disposal in the CRWMS.
Custody	Custody denotes the point at which OCRWM assumes responsibility and control of SNF from the Purchaser. As specified in the Standard Contract found in 10 CFR 961, custody is transferred to DOE at the Purchaser's facility. For HLW, custody will be defined in an MOA between OCRWM and the Producers.
Decommission	Decommission means to remove safely from service and reduce residual radioactivity to a level that permits: for land or facilities, release of the property for unrestricted use and termination of license; and for casks, release of the cask for appropriate disposal.
Dedicated Train	Dedicated train is a train that is dedicated to transporting a single commodity, such as loaded transportation casks during a given shipment regardless of any special conditions that may be placed on the train or the shipment.
Defense High-Level Radioactive Waste	Defense High-Level Radioactive Waste (DHLW) is the high-level radioactive waste, as defined by NWPA 42 USC §10101(12), resulting from reprocessing spent nuclear fuel in a defense facility.
Disposal	Disposal means the emplacement of radioactive waste in a geologic repository with the intent of leaving it there permanently. (As defined in 10 CFR 63.2)
DOE Office of Environmental Management	Office of Environmental Management

Dual-Purpose Canister	Dual-Purpose Canister (DPC) refers to a sealed, metallic container maintaining multiple SNF assemblies in a dry, inert environment and overpacked separately and uniquely for storage and transportation or storage and disposal.
Federal Waste Custodian	Federal Waste Custodian is the DOE field office site organization responsible for the management of SNF and HLW under the oversight of the Office of Environmental Management and SNF under the oversight of the Naval Nuclear Propulsion Program. For purposes of the WASRD, the Naval Nuclear Propulsion Program is the Federal Waste Custodian responsible for the management of naval SNF. [<i>Civilian Radioactive Waste Management System Waste Acceptance System Requirements Document Revision 5</i>]
Functional Interface	Functional interface is the interaction between functions, as in the flow of material or information between a sequence of activities.
Heavy Haul Transport	Heavy Haul Transport (HHT) is the process by which greater-than-legal-weight road shipments are transported. Such shipments are typically far in excess of the 40 ton legal-weight limit. The equipment utilized may include any combination of tractive force vehicles and equipment, including load cradles or trailers. Multiple axles are typically required to distribute the load, and each axle may be self-articulating and independently steerable.
High-Level Radioactive Waste	High-Level Radioactive Waste (HLW) means (1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.
Legal Weight Truck	Legal Weight Trucks must not exceed 34,000 pounds per dual axle or 17,000 pounds per single axle considering full fuel load, two drivers, loaded cask, and any additional road, tracking, or disabling equipment. Special permits are not required for legal weight truck shipments.
Licensed Material	Licensed material is source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the Nuclear Regulatory Commission. (As defined in 10 CFR 20.1003)

Licensee	Licensee is a person who is authorized to conduct activities under a license or construction permit issued by the Nuclear Regulatory Commission. (As defined in 10 CFR 2.4)
Loaded	Loaded means a cask or canister that (1) contains its intended complement of SNF assemblies, (2) the contents have been verified, and (3) has been closed and the DOE (OCRWM) approved tamper indicating seal is certified.
Locomotive	For cross-country shipments, commercial carriers provide locomotives. The NRL Staging Yard, REMY and the CMF will have switch engines or equivalent power sources to enable assembly and movement of trains and consists that are needed to support Transportation System operations.
Maintainability	Maintainability is the measure of the ability to perform maintenance on an item, on which maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair; that is, the ability of an item to be maintained.
Monitored Geologic Repository	Geologic Repository means a system that is intended to be used for, or may be used for, the disposal of radioactive wastes in excavated geologic media. A geologic repository includes the engineered barrier system and the portion of the geologic setting that provides isolation of the radioactive waste. (As defined in 10 CFR 63.2)
Monitored Geologic Repository (2)	One of the three major configuration items which are required to accomplish the functions of the CRWMS, the other two being Transportation System and Waste Acceptance.
Motive Support Equipment	Motive support equipment consists of the vehicle providing motive power to the transporter and other equipment needed to support movement of a transportation cask. Examples are locomotives, rail buffer cars, barges, cranes, heavy lift/haul tractors (trucks), and legal-weight trucks.
Nevada Rail Line	Nevada Rail – Those activities necessary to ensure that the transportation infrastructure in Nevada will support Transportation goals for the delivery of SNF and HLW to Yucca Mountain. This includes a railway line, supporting infrastructure, and supporting environmental work.
Off-Normal Occurrences	Off-normal occurrences are abnormal or unplanned events or conditions that adversely affect, potentially affect, or are indicative of degradation in, the safety, security, environmental or health protection performance or operation of a facility.

Operational Requirement	Operational requirements affect the planning, development and performance of transportation operations such as shipment scheduling and preparation of Site Campaign Plans.
Origin Site	Commercial and DOE sites are the “origin” or starting point of SNF and HLW shipments.
Overweight Truck	Overweight Truck is a truck cask subsystem, consisting of a tractor, semitrailer, and loaded cask, with a gross vehicle weight in excess of 80,000 pounds, but not more than 90,000 to 105,000 pounds depending on the particular state transited. Each state will issue a permit based on individual weight computation formulas.
Owner	Owner is any person who has title to spent nuclear fuel or high-level radioactive waste. (As defined in 10 CFR 961.3)
Package	Package is the packaging together with its radioactive contents as presented for transport. (As defined in 10 CFR 71.4)
Packaging	Packaging is the assembly of components necessary to ensure compliance with packaging requirements of 10 CFR 71. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging. (As defined in 10 CFR 71.4)
Physical System	Physical system means the Civilian Radioactive Waste Management System (CRWMS) consisting of the composite of the sites, and all facilities, systems, equipment, materials, information, activities, and the personnel required to perform those activities necessary to manage waste disposal.
Possession	Possession means the authority by a general NRC-issued license (e.g., carrier) to have or possess special nuclear material only, or the authority by a specific NRC-issued license (e.g., Purchaser, Geologic Repository) to have and to be held accountable for special nuclear material. Accountability transfers only between specific NRC licensees.
Producer	Producer is any generator of high-level radioactive waste resulting from atomic energy defense activities, nuclear fuel reprocessing, or any producer of vitrified commercial HLW.

Programmatic Requirement	Programmatic requirements provide the framework for system design development. Such requirements include those for planning, project execution, and acquisition of capital assets in compliance with applicable laws, regulations, and orders.
Protected Area	Protected area is any area encompassed by physical barriers and to which access is controlled. (As defined in 10 CFR 73.2)
Purchaser	Purchaser is any person, other than a Federal agency, who is licensed by the Nuclear Regulatory Commission to use a utilization or production facility under the authority of Sections 103 or 104 of the Atomic Energy Act of 1954 (42 USC §2133, 2134), or who has title to SNF or HLW and who has executed a contract or other contractual agreement with DOE. Purchaser SNF includes Government-owned SNF from commercial industry and civilian development programs.
Radioactive Mixed Waste	Radioactive mixed waste is waste containing both radioactive and hazardous components regulated by AEA and RCRA, respectively. The term "radioactive component" refers only to the actual radionuclides dispersed or suspended in the waste substance.
Radiological Sabotage	Radiological sabotage is any deliberate act directed against a site or transport in which an activity is conducted pursuant to the regulations in Title 10 of the Code of Federal Regulations, or against a component of such a site or transport, which could directly or indirectly endanger the public health and safety by exposure to radiation.
Rail Consist	The typical rail consist includes: a locomotive, a security escort vehicle, and one or more loaded cask rail cars separated from the locomotive and security escort vehicle by buffer rail cars.
Repository	Repository is synonymous with Geologic Repository.

Requirement

A statement that describes a characteristic or constraint that must be met for a system, product or process to be acceptable. Several types of requirements can be defined:

Operational - Affects the planning, development and performance of operations. Examples include shipment scheduling and preparation of Site Campaign Plans.

Programmatic - Provides the framework for system design development. Examples include requirements for planning, project execution, and acquisition of capital assets in compliance with applicable laws, regulations, and orders.

System - Affects the design of a system. Several kinds of system requirements can be defined:

Functional - Qualitatively describes what the system needs to do.

Performance - Quantitatively describes how well a function needs to perform (how fast, how far, how many).

Constraint - Describes conditions in which the system must operate (e.g., environmental, reliability, maintainability, and availability requirements).

Interface - Describes interactions between the system and its environment (external interface) or between system elements (internal interface).

Rolling Stock

Rolling Stock consists of the locomotives, cask cars, buffer cars, and security escort vehicles used in rail transport as well as the tractors, trailers and security escort vehicles used in truck transport.

Safeguards System

Safeguards system means an integrated system of physical protection, material accountability, and material control measures that will have capabilities for the protection (deter, prevent, detect, and respond) of special nuclear material (SNM and HLW) at fixed sites and in transit. In particular, it is a system designed to protect against acts of radiological sabotage and to prevent the theft of special nuclear material (SNM and HLW).

Security Escort Vehicle

Each SNM or HLW shipment is accompanied by the Transportation Security Force personnel assigned to provide continuous physical protection. For rail shipments, a security escort vehicle is a specially designed rail car intended to house the TSF for a week or more. For truck shipments, the security escort vehicle may be a van.

Shall	<i>Shall</i> designates the most important weighting level; that is, mandatory. Any deviations from these contractually imposed mandatory requirements require the approval of the <i>such and such</i> contracting officer, as well as the <i>other</i> contracting officer if the change affects interfaces for instruments being provided to <i>so and so</i> .
Shipment	Shipment is the movement of the properly prepared (loaded, unloaded, or empty) cask from one site to another and all associated regulatory activities.
Should	<i>Should</i> designates “requirements” which are requested, but are not mandatory. Unless required by other contract provisions, noncompliance with the <i>should</i> paragraphs does not require approval of the contracting officer, but does require technical substantiation.
Site Campaign Plan	<p>The Site Campaign Plan contains requirements and instructions for completing a shipment from an origin site. The Site Campaign Plan is uniquely developed for each origin site and will include as applicable the following data:</p> <ol style="list-style-type: none"> (1) type and number of rolling stock (cask rail cars, security cars, buffer cars, truck trailers...); (2) type and number of transportation casks; (3) type and number of TADs and transportation overpacks; (4) special handling equipment (campaign kit); (5) primary and alternative rail routes; (6) primary and alternative truck routes; (7) consist departure and arrival times; (8) cask/TAD system drop-off and pick-up schedules; (9) TSF personnel; (10) provisions for crew layovers; (11) communications plan; (12) security incident response information; (13) emergency response information; (14) pre notification requirements; (15) other.
Source Material	Source material means: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material. (As defined in 10 CFR 40.4)

Special Nuclear Material	Special nuclear material means (1) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the NRC, pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954 as amended, determines to be special nuclear material (does not include source material); or (2) any material artificially enriched by any of the foregoing (does not include source material). (As defined in 10 CFR 70.4)
Spent Nuclear Fuel	Spent nuclear fuel (SNF) is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. (As defined in NWPA 42 USC §10101(23) and 10 CFR 961.11).
Suitable for Use	Transportation casks in compliance with 10 CFR 961, Article 4(B)2.
System Element	A system element is one of three major configuration items that are required to accomplish the functions of the CRWMS. The three system elements are Waste Acceptance, Transportation, and Monitored Geologic Repository. This differs from the "project" that may be initiated by DOE to manage and control development of one or more system elements (e.g., the Yucca Mountain Project).
To Be Determined	To Be Determined (TBD) is used as a placeholder to identify information that is not yet defined.

Alternative Definition:

The term “(TBD)”, which means “to be determined”, applied to a missing requirement means that the contractor should determine the missing requirement in coordination with the acquirer/client.

To Be Resolved/Refined/Reviewed

To Be Resolved (TBR) is used as a placeholder to identify a preliminary value that needs further coordination and approval.

Alternative Definition:

The term “(TBR)”, which means “to be refined/reviewed”, means that the requirement is subject to review for appropriateness by both contractors, and subject to revision. The contractor is liable for compliance with the requirement as if the “TBR” notation did not exist. The “TBR” merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a “TBR”.

To Be Specified	The term “(TBS)”, which means “to be specified”, means that the contractor will supply the missing information in the course of the contract. These serve as a placeholder for future requirements. The contractor is not liable for compliance with these “placeholder” requirements, as insufficient information is provided on which to base a design.
Tractor	Over the road tractors (semi-truck cabs) are used to transport cask trailers to and from origin sites. Tractors are provided as part of the highway carrier services.
Transportation Cask	Transportation cask is a container for shipping spent nuclear fuel and/or high-level radioactive waste that meets all applicable regulatory requirements. See Transportation Cask and Cask.
Transportation Overpacks (Casks)	<p>The terms transportation overpack and cask are synonymous. There are five major cask types expected to be used within the CRWMS: These are:</p> <ol style="list-style-type: none"> 1. Rail Cask - CSNF in TAD canisters in accordance with the TAD canister specification (DOE 2007b) 2. Rail Cask - CSNF in dual-purpose canisters (DPCs) intended for vertical storage (e.g., Hi-Star-100, NAC-UMS, NAC-STC, TS-125) 3. Rail Cask - CSNF in DPCs intended for horizontal storage (e.g., NUHOMS MP-187 and MP-197) 4. Rail Cask - bare boiling water reactor or pressurized water reactor CSNF (e.g., in TN-68 or TN-32 casks) 5. Truck Cask, legal weight truck (LWT) or overweight truck (OWT) - bare CSNF (e.g., GA-4/9 or NAC-LWT).
Transportation, Aging and Disposal	<p>[IICD vol2, 3.1.2]</p> <p>Transportation, Aging and Disposal (TAD) Canister is a multifunctional canister for commercial SNF assemblies which will accommodate transportation by DOE and aging (to reduce thermal output from SNF over time) at a suitable facility in NRC certified casks. The canister will be placed in a waste package for disposal in an NRC licensed repository. [CRD Rev 8]</p>
Transporter	Transporter is a cargo-carrying vehicle used for transportation of cargo. It includes semi-trailers, rail cars, intermodal transportation skids and equipment such as tie-down components, personnel barriers, etc., needed to make the loaded cargo-carrying vehicle transport-ready.

Truck Convoy	A truck convoy includes the cask trailer, a transport tractor (semi-truck cab), and a shipment security escort vehicle. Multiple truck shipments to or from a single origin site may be arranged as a convoy or sequentially to improve shipment schedules.
Unloaded Cask	An empty suitable for use Transportation Cask.
Unloaded Transportation Cask	Unloaded transportation cask is a cask that has been used for transporting waste, but does not physically contain SNF or HLW. This term normally describes a cask that has had the waste removed and may either be in contaminated or decontaminated condition. Decontaminated casks will still have residual contamination present.
Waste Acceptance	One of the three major configuration items which are required to accomplish the functions of the CRWMS, the other two being Transportation System and MGR.
Waste Acceptance System Requirements Document	Provides Level 2 requirements for the Waste Acceptance System.
Waste Form	Waste form is the radioactive waste materials and any encapsulating or stabilizing matrix. (As defined in 10 CFR 63.2)
Waste Handling Activities	Waste handling activities include receipt of waste, preparation of waste for storage or disposal, transfer of waste from one cask to another or to its place of emplacement, emplacement of waste, and retrieval of waste.
Waste Package	Waste package is the waste form and any containers, shielding, packing, and other absorbent materials immediately surrounding an individual waste container. (As defined in 10 CFR 63.2)
Will/May	<i>Will/may</i> designates the lowest weighting level. <i>Will or may</i> "requirements" designate intent and are often stated as examples of acceptable designs, items, and practices. Unless required by other contract provisions, noncompliance with the <i>will</i> or <i>may</i> paragraphs does not require approval of the contracting officer and does not require documented technical substantiation.
Yucca Mountain	Refers to the Monitored Geologic Repository.
Yucca Mountain Project Requirements Document	Provides Level 2 requirements for the Monitored Geologic Repository (MGR).

5.2 Acronyms and Abbreviations

Acronym

AAR

Definition

Association of American Railroads

ALARA	As Low As is Reasonably Achievable
AREMA	American Railway Engineering and Maintenance-of-Way Association
CFR	Code of Federal Regulations
CHLW	Commercial High-Level Radioactive Waste
CoC	Certificate of Compliance
CRD	Civilian Radioactive Waste Management System Requirements Document
CRWMS	Civilian Radioactive Waste Management System
DHLW	Defense High-Level Radioactive Waste
DOE	Department of Energy
DPC	Dual-Purpose Canister
EM	DOE Office of Environmental Management
EOL	End of Line
FMF	Fleet Management Facility
GROA	Geologic Repository Operating Area
HLW	High-Level Radioactive Waste
IICD	Integrated Interface Control Document
Kw	Kilowatt
LWT	Legal Weight Truck
MGR	Monitored Geologic Repository
MGR	Monitored Geologic Repository (2)
MSRP	Manual of Standards and Recommended Practices
MTHM	Metric Tons Heavy Metal
NNPP	Naval Nuclear Propulsion Program
NRC	Nuclear Regulatory Commission
NRL	Nevada Rail Line
NWPA	Nuclear Waste Policy Act
OCRWM	DOE Office of Civilian Radioactive Waste Management
SCP	Site Campaign Plan
SNF	Spent Nuclear Fuel
TAD	Transportation, Aging and Disposal
TBD	To Be Determined
TBR	To Be Resolved/Refined/Reviewed
TBS	To Be Specified
TSRD	Transportation System Requirements Document
UP	Union Pacific

WASRD
YMPRD

Waste Acceptance System Requirements Document
Yucca Mountain Project Requirements Document

10 APPENDIX A - REQUIREMENTS TRACEABILITY MATRIX

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.1.1	Transportation System	--				
3.2.1.1.a	Compliance with NWPA [was System 3.2.1.1.a]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.b	SNF and HLW Transportation Rates [was System 3.2.1.1.b]	--	--	3.2.1.B	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.c	Cask Handling and Transportation Capability [was System 3.2.1.1.c]	--	--	3.4.F	Transportation Element Requirements	CRD Rev 8
3.2.1.1.d	Waste Transportation Modes [was System 3.2.1.1.d]	--	--	3.4.E	Transportation Element Requirements	CRD Rev 8
3.2.1.1.e	Test, Inspection, Maintenance Functionality [was System 3.2.1.1.e]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.f	Hardware and Software Compatibility Requirements [was System 3.2.1.1.f]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.g	Security Escort Vehicle for Physical Protection [was System 3.2.1.1.g]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.h	Interfaces [was System 3.2.1.1.h]	--	--	9.6	Transportation System, Cask, and Nevada Rail Interfaces	IICD Vol 1, Rev 3
3.2.1.1.i	Communication Equipment Compatibility [was Comm	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	3.2.1.1.6.a]					
3.2.1.1.j	Communications Equipment Independent Power Sources [was Comm 3.2.1.1.6.b]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.k	Communications Equipment Security [was Comm 3.2.1.1.6.d]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.1	Cask and TAD Transportation Overpacks	--				
3.2.1.1.1.a	Cask Suitable for Use [was Cask 3.2.1.1.1.a]	--	--	3.1.2.C	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.1.b	Cask Maximum Weight [was Cask 3.2.1.1.1.c]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.1.c	Cask Personnel Barriers [was Cask 3.2.1.1.1.d]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.1.d	Cask Personnel Barriers Physical Interfaces [was Cask 3.2.1.1.1.e]	--	--	3.1.12	Personnel Barriers	IICD Vol 2, Rev 0
3.2.1.1.1.e	Transportation Cask Bounding Characteristics [was Cask 3.2.1.1.1.f]	--	--	3.1.1	Transportation Casks	IICD Vol 2, Rev 0
3.2.1.1.1.f	Skid Handling Characteristics [was Cask 3.2.1.1.1.g]	--	--	3.1.11.1	Handling Skid	IICD Vol 2, Rev 0
3.2.1.1.1.g	Tamper Indicating Devices [was Cask 3.2.1.1.1.h]	--	--	3.4.B	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.1.1.1.h	TAD Transportation Overpacks [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.1.i	Cask/Cask Skid-to-Cask Rail Car Interface [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.2	Cask Maintenance Facility	--				
3.2.1.1.2.a	Cask Inspection and Maintenance [was FMF 3.2.1.1.2.a]	--	--	3.4.B	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.b	Spare Parts and Equipment Storage [was FMF 3.2.1.1.2.b]	--	--	3.2.1.G	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.c	Provision of Campaign Kits to Origin Sites [was FMF 3.2.1.1.2.c]	--	--	3.1.2.C	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.2.d	Rail Escort Vehicle Maintenance [was FMF 3.2.1.1.2.g]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.e	Storage of Cask Inventory [was FMF 3.2.1.1.2.h]	--	--	3.2.1.B	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.f	Transportation Package Decontamination [was FMF 3.2.1.1.2.k]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.g	Rail and Truck Rolling Stock Decontamination [was FMF 3.2.1.1.2.l]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.1.1.2.h	Low Level and Mixed Radioactive Waste Storage (CMF) [was FMF 3.2.1.1.2.m, NRL 3.2.1.1.3.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.i	Radioactive Waste Management (CMF) [was FMF 3.2.1.1.2.n and NRL 3.2.1.1.3.b]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.j	Hazardous Waste Management [was FMF 3.2.1.1.2.o]	--	--	3.2.1.J	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.k	Railroad Noise Emission (CMF) [was FMF 3.2.1.1.2.s, NRL 3.2.1.1.3.f]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.l	Handling and Lifting Equipment Capability [was FMF 3.2.1.1.2.v]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.2.m	Fire Protection -- General Facility Design [was FMF 3.2.1.1.2.w]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.n	Fire Protection -- Systems and Equipment [was FMF 3.2.1.1.2.x]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.o	Fire Protection -- Hot Cells, Caves, Glove Boxes, and	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	Hoods [was FMF 3.2.1.1.2.y]					
3.2.1.1.2.p	Cask Spacer Removal [was FMF 3.2.1.1.2.z]	--	--	3.1.2.C	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.2.q	Cask Reconfiguration [was FMF 3.2.1.1.2.aa]	--	--	3.1.2.C	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.2.r	Radiological Survey (CMF) [was NRL 3.2.1.1.3.q]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.s	Campaign Kit Assembly [NEW]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.t	Campaign Kit Assembly Rate [NEW]	--	--	3.2.1.B	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.u	Campaign Kit Component Radiological Inspection [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.v	Campaign Kit Packaging (CMF) [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.w	Radiological Survey of Campaign Kit Transport Vehicle [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.x	Cask Assembly [NEW]	--	--	3.2.1.I	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.y	Cask Assembly Rate [NEW]	--	--	3.2.1.B	Overall System Level Requirements, Overall	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
					System Performance	
3.2.1.1.2.z	Convoy Assembly and Preparation at CMF [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.az	Cask Radiological Survey at CMF (truck) [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.ab	Consist Assembly and Preparation at CMF [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.ac	Cask Radiological Survey at CMF (rail) [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.ad	Routine Cask Maintenance [NEW]	--	--	3.4.B	Transportation Element Requirements	CRD Rev 8
3.2.1.1.2.ae	Security Escort Vehicle Storage [NEW]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.2.af	Security Escort Vehicle Servicing and Resupply [NEW]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.2.ag	CMF Communications Interface (internal) [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.3	Nevada Rail Line	--				
3.2.1.1.3.a	Train Assembly and Disassembly Provisions (NRL) [was NRL 3.2.1.1.3.c, FMF 3.2.1.1.2.p]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.b	Brake System Safety Standards (NRL) [was	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	Rolling Stock 3.2.1.1.4.a, NRL 3.2.1.1.3.d, FMF 3.2.1.1.2.q]					
3.2.1.1.3.c	Railroad Freight Car Safety Standards (NRL) [was NRL 3.2.1.1.3.e, FMF 3.2.1.1.2.r]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.d	Railroad Noise Emission (NRL) [was NRL 3.2.1.1.3.f, FMF 3.2.1.1.2.s]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.e	NRL Peaking Effects [was NRL 3.2.1.1.3.g]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.f	NRL Shared Use [was NRL 3.2.1.1.3.h]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.g	Cars and Loads Accommodation [was NRL 3.2.1.1.3.i]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.h	Maintenance-of-Way [was NRL 3.2.1.1.3.j]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.i	AREMA [was NRL 3.2.1.1.3.k]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.j	Cask Recovery Equipment [was NRL 3.2.1.1.3.l]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.k	Railroad Workplace Safety	--	--	3.4.C	Transportation Element	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	[was NRL 3.2.1.1.2.m]				Requirements	
3.2.1.1.3.l	Railroad Communications [was NRL 3.2.1.1.3.o]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.m	AAR MSRP (NRL) [was Rolling Stock 3.2.1.1.4.g, NRL 3.2.1.1.3.r]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.n	AAR Field Manual of the Interchange Rules (NRL) [was Rolling Stock 3.2.1.1.4.h, NRL 3.2.1.1.3.s]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.o	AAR Office Manual of the Interchange Rules [was Rolling Stock 3.2.1.1.4.i, NRL 3.2.1.1.3.t]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.3.p	Track Safety Standards [was NRL .3.2.1.1.3.u]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.3.q	NRL Clearance Requirements [was NRL 3.2.1.1.3.w]	--	--	AppC.PageC.1	Interfaces at the MGR	IICD Vol 1, Rev 3
3.2.1.1.3.r	Nevada Transportation Lifetime [NEW]	--	--	3.5.D	MGR Element Requirements	CRD Rev 8
3.2.1.1.3.s	NRL Approved Route [NEW]	--	--	3.1.1.A	Requirements, Programmatic Requirements, Policy Driven Requirements	CRD Rev 8
3.2.1.1.4	Nevada Rail (NR) Facilities	--				

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	and Yards					
3.2.1.1.4.a	Occupational Radiation Protection (REMY) [was NRL 3.2.1.1.3.q]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.b	Storage of Rolling Stock [was NRL 3.2.1.1.3.v]	--	--	3.2.1.B	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.4.c	Low Level and Mixed Radioactive Waste Storage (NR Facilities and Yards) [was NRL 3.2.1.1.3.a, FMF 3.2.1.1.2.m]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.d	Radioactive Waste Management (NR Facilities and Yards) [was NRL 3.2.1.1.3.b, FMF 3.2.1.1.2.n]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.e	Rolling Stock Inspection and Maintenance [was FMF 3.2.1.1.2.d]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.4.f	Truck Rolling Stock Maintenance [was FMF 3.2.1.1.2.e]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.g	Rail Rolling Stock Maintenance [was FMF 3.2.1.1.2.f]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.4.h	Storage of Rolling Stock Inventory [was FMF	--	--	3.2.1.B	Overall System Level Requirements, Overall	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	3.2.1.1.2.i]				System Performance	
3.2.1.1.4.i	Space for Consist Assembly [was FMF 3.2.1.1.2.j]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.j	Locomotive Emissions [was FMF 3.2.1.1.2.t]	--	--	3.4.A	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.k	Truck Tractors [was FMF 3.2.1.1.2.u]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.4.l	Cask Rail Car Routine Maintenance [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.m	Buffer Car Routine Maintenance [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.n	Locomotive Routine Maintenance [NEW]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.4.o	REMY Communications Interface [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.5	Rolling Stock	--				
3.2.1.1.5.a	Brake System Safety Standards (Rolling Stock) [was Rolling Stock 3.2.1.1.4.a, NRL 3.2.1.1.3.d, FMF 3.2.1.1.2.q]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.5.b	Transport of Campaign Kits to Origin Sites [was Rolling Stock 3.2.1.1.4.b]	--	--	3.1.2.C	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.5.c	Conveyance Bounding	--		3.1.10	Conveyances	IICD Vol 2, Rev

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
	Characteristics [was Rolling Stock 3.2.1.1.4.c]					0
3.2.1.1.5.d	Rail Rolling Stock Design and Fabrication [was Rolling Stock 3.2.1.1.4.d]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.e	Security Escort Vehicle Design [was Rolling Stock 3.2.1.1.4.e]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.2.1.1.5.f	AAR MSRP (Rolling Stock) [was Rolling Stock 3.2.1.1.4.g, NRL 3.2.1.1.3.r]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.g	AAR Field Manual of the Interchange Rules (Rolling Stock) [was Rolling Stock 3.2.1.1.4.h, NRL 3.2.1.1.3.s]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.h	AAR Office Manual of the Interchange Rules (Rolling Stock) [was Rolling Stock 3.2.1.1.4.i, NRL 3.2.1.1.3.t]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.i	Rail Clearance Requirements [was Rolling Stock 3.2.1.1.4.j]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.j	Railroad Safety Appliance Standards [was Rolling Stock 3.2.1.1.4.k]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.5.k	Rear End Marking Device [was Rolling Stock 3.2.1.1.4.l]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.1.1.5.1	Truck Safety [was Rolling Stock 3.2.1.1.4.m]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.5.1	Cask Rail Car	--				
3.2.1.1.5.1.a	Cask Rail Car Transportation of Loaded Casks to MGR/GROA Site [NEW]	--	--	3.4.F	Transportation Element Requirements	CRD Rev 8
3.2.1.1.5.1.b	Cask Rail Car-to-Cask/Cask Skid Interface [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.5.1.c	Cask Rail Car-to-Facility Interface (interface) [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.5.2	Rail Escort Vehicle	--				
3.2.1.1.5.2.a	Rail Escort Vehicle-to-CMF Interface [NEW]	--	--	3.2.1.H	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.5.2.b	Rail Escort Vehicle Communications Interface (internal) [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.1.1.5.3	Buffer Rail Car	--				
3.2.1.1.5.3.a	Non-Placarded Rail Car Position [was Rolling Stock 3.2.1.1.4.f]	--	--	3.4.C	Transportation Element Requirements	CRD Rev 8
3.2.1.1.5.4	Cask Trailer	--				
3.2.1.1.5.4.a	Cask Trailer-to-Cask Interface [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.1.1.6	Transportation Operations Center	--				
3.2.1.1.6.a	Continuity of Operations [was TOC 3.2.1.1.5.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.6.b	Conduct of Operations [was TOC 3.2.1.1.5.b]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.6.c	Management and Emergency Response [was TOC 3.2.1.1.5.c]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.6.d	Communication Connectivity [was TOC 3.2.1.1.5.d]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.6.e	Command and Control Operations Spaces [NEW]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.6.f	Planning and Administrative Operations Spaces [NEW]	--	--	3.2.1.A	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.2.1.1.6.g	Shipment Progress [NEW]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.1.1.6.h	TOC Communications Interface (internal) [NEW]	--	--	3.2.1.L	Overall System Performance	CRD Rev 8
3.2.4.a	Natural Phenomena Hazards Mitigation Design Requirements [was System/Environmental Conditions 3.2.5.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.2.4.b	Natural Phenomena Hazards Mitigation NPH Assessment [was System/Environmental Conditions 3.2.5.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.2.4.c	Compliance with Solid Waste Disposal Act [was System/Environmental Conditions 3.2.5.c]	--	--	3.2.1.J	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.3.2.a	Occupational and Public Doses [was System/Radiation Levels 3.3.2.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.3.6.a	Fire Protection [was System/Safety 3.3.6.a]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.3.6.b	Occupational Safety and Health Standards [was System/Safety 3.3.6.b]	--	--	3.1.2.E	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.3.6.c	Emergency Management Program [was System/Safety 3.3.6.c]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8
3.3.8.a	Public Health and Safety [was System/Radioactive Waste Control 3.3.8.a]	--	--	3.1.2.A	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.3.8.b	Handling and Storage of Radioactive Waste [was System/Radioactive Waste Control 3.3.8.b]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8

Table 2 Requirements Traceability Matrix

Requirement			Traceability			
Section Number	Section Title	PUID	PUID	Paragraph Number	Paragraph Title	Document Number
3.3.9.a	Safeguards and Security Program [was System/System Security 3.3.9.a]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.3.9.b	Physical Protection [was System/System Security 3.3.9.b]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.3.9.c	Information Security [was System/System Security 3.3.9.c]	--	--	3.1.2.G	Statutory or Regulatory Driven Requirements	CRD Rev 8
3.3.11	Facility Design to State Statutes and Codes [was System/Facility Design to State Statutes and Codes 3.3.11.a]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.3.12.a	Use of Standards in Design [was System/Use of Industry Codes and Standards 3.3.12.a]	--	--	3.2.1.K	Overall System Level Requirements, Overall System Performance	CRD Rev 8
3.4.a	QA Records Storage [was System/Documentation 3.4.a]	--	--	3.4.D	Transportation Element Requirements	CRD Rev 8

20 APPENDIX B - TBR/TBD TABLE

TBR/TBD Table

Number	Section Number	Requirement Name	Responsible Organization	Plan of Action/Schedule
TBD-1	3.2.1.1.1.b	Cask Maximum Weight	Waste Management Office	
TBD-2	3.2.1.1.1.i	Cask/Cask Skid-to-Cask Rail Car Interface		
TBD-3	3.2.1.1.2.e	Storage of Cask Inventory	Office of Logistics Management	Systems analysis will determine correct percentage
TBD-4	3.2.1.1.2.1	Handling and Lifting Equipment Capability	Waste Management Office	
TBD-5	3.2.1.1.4.b	Storage of Rolling Stock		
TBD-6	3.2.1.1.4.h	Storage of Rolling Stock Inventory		
TBD-7	3.2.1.1.4.i	Space for Consist Assembly	Office of Logistics Management	Systems analysis will determine maximum length of consist
TBD-8	3.2.1.1.5.1.b	Cask Rail Car-to-Cask/Cask Skid Interface		
TBD-9	3.2.1.1.5.1.c	Cask Rail Car-to-Facility Interface		
TBD-10	3.2.1.1.5.2.a	Rail Escort Vehicle-to-CMF Interface		
TBD-11	3.2.1.1.5.4.a	Cask Trailer-to-Cask Interface		

30 APPENDIX C - REFERENCES

References

The following documents form the basis of the TSRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents the TSRD, conflicts will be resolved through the Level 2 Change Control Board.

CRWMS Documents Cited

- | | | |
|---|---|--------------|
| 1 | Civilian Radioactive Waste Management System Requirements Document (CRD), Revision 8 | Sep 12, 2007 |
| 2 | Waste Acceptance System Requirements Document (WASR-D), DOE/RW-0351, revision 5. | May 31, 2007 |
| 3 | Civilian Radioactive Waste Management System, Integrated Interface Control Document, Volume 1, Rev. 3 | January 2007 |
| 4 | Civilian Radioactive Waste Management System, Integrated Interface Control Document, Volume 2, Rev 0 | July 2007 |
| 5 | Transportation, Aging and Disposal Canister System Performance Specification, Rev 0 | |

Statutes, Regulations, and Orders

42 USC 10101 et seq, The Nuclear Waste Policy Act of 1982
10 CFR 71, Packaging and Transportation of Radioactive Material
10 CFR 835, Occupational Radiation Protection
10 CFR 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste
29 CFR 1910, Occupational Safety & Health Standards
40 CFR Part 92, Control of Air Pollution from Locomotives and Locomotive Engines
40 CFR 243, Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 246, Source Separation for Materials Recovery Guidelines
40 CFR 261, Identification and Listing of Hazardous Waste
40 CFR 262, Standards Applicable to Generators of Hazardous Waste
49 CFR 173, Shippers - General Requirements for Shipments and Packagings
49 CFR 174, Carriage by Rail
49 CFR 210, Railroad Noise Emission Compliance Regulations
49 CFR 213, Track Safety Standards
49 CFR 214, Railroad Workplace Safety
49 CFR 215, Railroad Freight Car Safety Standards
49 CFR 220, Railroad Communications
49 CFR 221, Rear End Marking Device - Passenger, Commuter and Freight Trains
49 CFR 231, Railroad Safety Appliance Standards
49 CFR 232, Brake System Safety Standards for Freight and Other Non-Passenger Trains and Equipment; End-Of-Train Devices
49 CFR 393, Parts and Accessories Necessary for Safe Operation
49 CFR 396, Inspection Repair and Maintenance
DOE Order 151.1C, Comprehensive Emergency Management System
DOE Order 243.1, Records Management Program
DOE Order 413.3A, Program and Project Management for the Acquisition of Capital Assets
DOE Order 420.1B, Facility Safety
DOE Order 433.1, Maintenance Management Program for DOE Nuclear Facilities
DOE Order 435.1, Radioactive Waste Management
DOE Order 435.1-1, Radioactive Waste Management Manual
DOE Manual 460.2-1, Radioactive Transportation Practices Manual
DOE Order 460.2A, Department Materials Transportation and Packaging Management
DOE Order 470.4, Safeguards and Security Program
DOE Manual 470.4-2, Physical Protection
DOE Manual 470.4-4, Information Security

Codes and Standards

AAR Field Manual of the Interchange Rules

AAR Manual of Standards and Recommended Practices (MSRP)

AAR MSRP S-2028-91, Equipment Diagram, Plate-C

AAR Office Manual of the Interchange Rules

AAR S-2043 Performance Specification for Trains Used to Carry High Level Radioactive Material

AREMA Manual for Railway Engineering

National Fire Protection Association Standard 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*