U.S. Department of Energy
Office of Civilian Radioactive Waste Management

QA: QA

CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM REQUIREMENTS DOCUMENT (CRD)

DOE/RW-0406

Revision 8, ICN 0

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

Document Number: DOE/RW-0406/A00000000-00811-1708-0003
Document Title: Civilian Radioactive Waste Management System Requirements Document

Rev/DCN 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.	Misc.
Rev. 02 December 1995	BCP-00-94-0005	General revision to incorporate the Program Approach.	All
Rev. 02, DCN 01 June 1996	BCP-00-96-0002	Provides notice to users on MPC Policy Change, i.e., The CRWMS will accept and accommodate a variety of cask/canister systems for commercial SNF 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 QARD (DOE/RW-0333). Some items may be identified as To Be Verified or To Be Determined.	Misc.
Rev. 02, DCN 02 December 1996	BCP-00-96-0005	Revision to incorporate BCP-00-96-0005 "Incorporate DOE SNF in Baseline." Also addresses management guidance from BCP-00-96-0009 Rev. 1 "Technical Baseline Streamlining."	6 to 9a, 13, 18, 18a, 20, 20a, 24, 26, 27, 27a, 28, 30, 31, 35 to 45d, 52, 55, 55a, 62, 66, 68, 68a, 81, 88 to 99a, 105, 113 to 115a, 119 to 123a, 127, 156, 157, 161
Rev. 03 November 1996	BCP-00-96-0009	Streamlines the CRD to include only Program-level requirements. The Waste Acceptance System Requirements Document (SRD), Storage SRD and Transportation SRD are transferred to the WAST Project (the Mined Geologic Disposal System Requirements Document was previously transferred to YMSCO by BCP-01-96-0047). Custodian requirements (e.g., DOE SNF) will be transferred from the	All

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		WASRD to the CRD in the next revision of the CRD.	
Rev. 04 May 1998	BCP-00-98-0004	Incorporates Producer/Custodian (DOE SNF, HLW, Navy SNF) requirements and the Hanford 15 ft. canister.	Misc.
Rev. 05 January 1999	BCP-00-99-0001	Incorporates Immobilized Plutonium Waste Form (IPWF) and mixed oxide SNF into the HLW requirements. Incorporates the signed MOA for Acceptance of DOE SNF and HLW as well as naval SNF. Incorporates for planning purposes expanded repository capacities. Defines the Level 0 Scope Baseline. Incorporates the repository closure policy. Incorporates DOE SNF in Government-managed Nuclear Material.	Misc.
Rev. 05, DCN 01 May 2000	BCP-00-99-0004 BCP-00-99-0006 BCP-00-99-0007 B-00-2000-0004	Incorporates requirements to comply with Interim Regulatory Guidance, solar power requirement, repository closure as early as 30 years after emplacement of the last waste package, and repository thermal constraints. Adds definitions of terms used in new requirements.	9, 14, 14a, 14b, B-3, B-8, B-9, B-10, B-11
Rev. 05, DCN 02 December 2000	B-00-2000-0009	Updates inventory of nuclear materials and incorporates it as design basis for SR in a new requirement 3.2.1.H. Modifies MGR requirement 3.4.A accordingly. Removes planning considerations 2.4.C and 2.4.D. Also revises/expands a footnote to Table 1 under requirement 3.2.1.B to recognize that NNPP has requested increased ramp-up receipt rates for naval SNF.	5, 6, 10, 12, 13, 14, 14a
Rev. 05, DCN 03 March 2001	N/A	Adds a footnote to Table 1 under requirement 3.2.1.B to clarify: "The rates in this schedule are targets only and do not create any binding legal obligation on the Department of Energy."	10
Rev. 05, DCN 04 June 2001	B-00-2001-0001	Modifies requirement 3.4.C to incorporate the flexible design concept as established by Baseline Change Proposal (BCP)B-00-2001-0001, *Update Technical Requirements in the Program, Project and Contractor Baselines to Support the Flexible Operating Concept*. Clarifies requirement 3.2.1.B to differentiate design flexibility from operational flexibility.	10, 14, 14a
Rev. 05, DCN 05 May 2002	ATI-2002-005	Eliminates Planning Consideration 2.4.N and revises regulatory requirement 3.1.1.C to reflect 10 CFR Part 63, 40 CFR Part 197, and 10 CFR Part 963. Deletes requirement 3.2.1G and revises all relevant definitions in the Glossary section for consistency with 10 CFR Part 63. This DCN also replaces/deletes the text in requirements 3.5 (CISF Element	vii, viii, ix, 1, 2, 5, 6, 7, 9, 12, 13, 14a, 15, 16, 17, 18, A-4, A-5, B1, B-4, B-5, B-6,

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		Requirements), 3.6.3 (CISF External Interface Requirements), and 3.6.5.2 (Waste Acceptance and Transportation – CISF Interface Requirements) with 'reserved" and in other sections with "if approved".	B-7, B-8, B-9, B-10, B-11
Rev. 06 September 2004	PMA-2004-010	Updates the definition of Level 0 Scope Baseline in Section 2.5. Streamlines Section 1 by deleting unnecessary sections. Separates Waste Acceptance and Transportation elements for consistency with OCRWM reorganization. Deletes Planning Considerations section, and when appropriate, elevates some to requirements. Incorporates a new Programmatic Requirements section. Updates and streamlines requirements, reallocating requirements to related system elements sections when appropriate. Incorporates and updates requirements on physical protection of SNF and HLW, cost reduction practices, compliance with Integrated Interface Control Document, compliance with National Environmental Policy Act, and compliance with DOE Orders. Revises provisions on emplacement inventory, efficient energy management, and repository thermal ranges. Deletes 10 CFR Part 72 compliance, rock temperature and cladding temperature requirements. Deletes Centralized Interim Storage Requirements and Interface Requirements in their entirety. Updates Table 1 to reflect the recent DOE decision on Immobilized Plutonium Waste Form (IPWF) disposal and the target receipt rates for naval SNF.	Misc.

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Rev. 07 March 2006	PMA-2006-006	Updates the Programmatic Requirements section (3.1) by specifically requesting compliance with DOE O 413.3 and associated manual (3.1.1.C, 3.1.1.H). Updates Programmatic Requirements section by specifically requesting compliance with DOE O 413.3 (3.1.1.C), configuration control board procedures (3.1.1.D), and existing memoranda of agreement (3.1.2.D). Revises timetable for conducting "bottoms-up" Total System Life Cycle Cost Assessment (3.1.1.G). Adds new requirement 3.1.1.J to require the development of a System Startup Plan. Incorporates vitrified Plutonium as waste form to be accepted at the repository. (3.2.1.A). Requests use of NRC-reviewed and accepted technology (3.1.1.F). Describes preliminary target receipt rates and system operating conditions (3.2.1.B). Expands the types of storage and transportation technologies to be accommodated at the repository (3.2.1.F, 3.4.F). Requires compliance with accepted NRC standards and guides, DOE Orders, and sometimes industry codes (3.2.1.K). Breaks up Section 3.3 (Waste Acceptance and Transportation Elements Requirements) into two separate sections (Waste Acceptance (3.3) and Transportation (3.4). Incorporates new Transportation Element requirements 3.4.E (truck and rail capability). Updates MGR Element Requirements section by incorporating new requirement 3.5.C (phased modular design and construction), revising 3.5.E (to require permanent closure to occur at least 50 years from completion of waste emplacement), and 3.5.G (initiation of emplacement during the first year of MGR operations). Updates and streamlines Appendix A (Glossary, Acronyms/Abbreviations) and the reference sections 4.1 (Documents Cited) and 4.2 (Codes, Standards, Regulations, Procedures, and Directives).	ii-v, vii-ix, 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, A-3, A-6, A-8, A-9, A-10, Back Cover Page

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Rev. 08	PMA-2007-008	Revises Section 1.2 to clarify role of IICD Volumes 1 and 2. Deletes the description of CRWMS functions no longer applicable (Sec. 1.3.2). Incorporates Sections 3.1.1.A.1-3 to reflect recent updates to DOE's Acquisition Strategy. Reflects the cancellation of the *Civilian Radioactive Waste Management Major System Management Policy*, DOE/RW-0528 (Sec. 2.2 and 3.1.1.C), cancellation of the Configuration Control Board (3.1.1.D), and issuance of DOE O 413.3A (Sec. 1.2, 2.2, 3.1.1.C, and 3.1.1.G). Deletes references to DOE/RW-0562 and LP-PMC-009 in 3.1.1.A. Updates cited reference in 3.1.1.E. Transfers text in 3.1.1.F into new requirement 3.2.1.M. Updates 3.1.2.E to reflect new worker safety and health requirements. Expands 3.1.2.D and 3.3.A.2 with references to EM/RW and NNPP/RW MOAs. Expands 3.2.1.B, 3.4.E, 3.5.C, and Appendix A to reflect the "Initial Operating Capability" and "Full Operating Capability" concepts established in DOE's decision on Partial Approval of Revised Alternative Selection and Cost Range (CD-1) for the Yucca Mountain Project. Expands 3.2.1.C.2 with reference to OCRWM's canister-based approach policy. Adds footnote to CRD 3.2.1.B.3.b to reflect the revised inventory of naval SNF canisters to be accepted at the repository. Updates cited references in 3.1.1.A, 3.1.1.G, and Sec. 4). Links 3.2.1.C.1 to 3.2.2.1.B and 3.2.1.C.2 for completeness. Incorporates minor editorial changes in 3.2.1.E, 3.2.1.F, and 3.2.1.K. Revises 3.2.1.G to reflect the CRWMS's capability to open transportation casks, DPCs, and TADs. Separates "radioactive" from "mixed waste" in 3.2.1.J. Revises 3.2.1.K to expand scope to all applicable regulations. Creates 3.1.2.H (to require compliance with all applicable requirements) and 3.2.1.L (to address interface agreements between CRWMS elements). Revises 3.3.A.3 for clarity. Transfers 3.5.F and 3.5.G to 3.5.E and 3.5.F to correct ordering sequence. Updates or deletes unnecessary definitions/abbreviations from Appendix A.	All

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1. INTRODUCTION

1.1 IDENTIFICATION

This document specifies the top-level requirements for the Civilian Radioactive Waste Management System (CRWMS). The document is referred to herein as the CRD, for **C**RWMS **R**equirements **D**ocument.

1.2 PURPOSE

The CRD addresses the requirements of Department of Energy (DOE) Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, by providing the Secretarial Acquisition Executive (Level 0) scope baseline and the Program-level (Level 1) technical baseline. The Secretarial Acquisition Executive approves the Office of Civilian Radioactive Waste Management's (OCRWM) critical decisions and changes against the Level 0 baseline; and in turn, the OCRWM Director approves all changes against the Level 1 baseline. This baseline establishes the top-level technical scope of the CRMWS and its three system elements, as described in section 1.3.2. The organizations responsible for design, development, and operation of system elements described in this document must therefore prepare subordinate project-level documents that are consistent with the CRD. Changes to requirements will be managed in accordance with established change and configuration control procedures.

The CRD establishes requirements for the design, development, and operation of the CRWMS. It specifically addresses the top-level governing laws and regulations (e.g., *Nuclear Waste Policy Act* (NWPA), 10 Code of Federal Regulations (CFR) Part 63, 10 CFR Part 71, etc.) along with specific policy, performance requirements, interface requirements, and system architecture. The CRD shall be used as a vehicle to incorporate specific changes in technical scope or performance requirements that may have significant program implications. Such may include changes to the program mission, changes to operational capability, and high visibility stakeholder issues.

The CRD uses a systems approach to: 1) identify key functions that the CRWMS must perform, 2) allocate top-level requirements derived from statutory, regulatory, and programmatic sources, and 3) define the basic elements of the system architecture and operational concept. Project-level documents address CRD requirements by further defining system element functions, decomposing requirements into significantly greater detail, and developing designs of system components, facilities, and equipment.

The CRD addresses the identification and control of functional, physical, and operational boundaries both internal and external to the CRWMS. The CRD establishes requirements to control key interfaces external to the CRWMS in the *Integrated Interface Control* Document, Volume 1 (DOE/RW-0511). Interfaces among CRWMS program elements are documented in the *Integrated Interface Control Document, Volume 2* (DOE/RW-0572).

The Program has developed a change management process consistent with DOE Order 413.3A. Changes to the Secretarial Acquisition Executive and Program-level baselines must be approved by a Program Baseline Change Control Board. Specific thresholds have been established for identifying technical, cost, and schedule changes that require approval.

The CRWMS continually evaluates system design and operational concepts to optimize performance and/or cost. The Program has developed systems analysis tools to assess potential enhancements to the physical system and to determine the impacts from cost saving initiatives, scientific and technological improvements, and engineering developments. The results of systems analyses, if appropriate, are factored into revisions to the CRD.

1.3 SYSTEM OVERVIEW

The mission and waste management concept of the system and system elements are described in this section.

1.3.1 CRWMS Mission

The NWPA assigned the U.S. Department of Energy (DOE) the mission to develop and operate an integrated waste management system for acceptance, transportation, and disposal of Spent Nuclear Fuel (SNF) and High-Level Radioactive Waste (HLW). The NWPA also established the Office of Civilian Radioactive Waste Management (RW) to carry out that mission. RW, in turn, is developing the CRWMS as the operational and physical system capable of performing the integrated management system functions. The mission of the CRWMS is to manage and dispose of SNF and HLW in a manner that protects health, safety and the environment; enhances national and energy security; and merits public confidence.

The CRWMS is developing a monitored geologic repository (MGR) at Yucca Mountain, Nevada—a site recommended by the President and approved by Congress in July 2002. A license application for the MGR is being developed to dispose of 70,000 metric tons of SNF and HLW, as authorized by the NWPA, Section 114(d). Projections of SNF and HLW that are expected to be generated indicate that significantly more than 70,000 metric tons will require geologic disposal.

Although RW has analyzed the impacts of disposal of more than 70,000 metric tons in a single repository, RW will request a license from the Nuclear Regulatory Commission for emplacement of only 70,000 metric tons. In accordance with the Nuclear Waste Policy Act, the Secretary of Energy will report to Congress on the need for a second repository between January 1, 2007, and January 1, 2010. The report will consider the total projected future inventory of SNF and HLW, the physical capacity of the first repository site at Yucca Mountain, and the capabilities of existing and future waste form development technologies.

1.3.2 Waste Management System Concept

The mission of the CRWMS is accomplished by three system elements: Waste Acceptance, Transportation, and Monitored Geologic Repository. These system elements work in conjunction with each other to fulfill a variety of functional and performance requirements intended to make the transportation and disposal of SNF and HLW in a geologic medium safe, environmentally acceptable, and cost effective. The CRWMS will provide appropriately documented conformance verification, accountability, and traceability of the SNF and HLW from initial acceptance to final closure of the MGR.

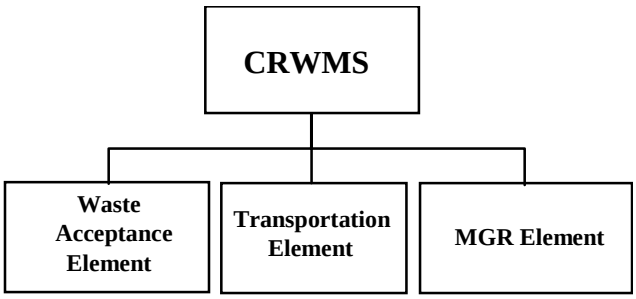

Figure 1. CRWMS Architecture

The responsibilities of each element are summarized below:

- The Waste Acceptance element is the primary interface with Purchasers (non-Federal entities who have entered into a contractual agreement with DOE), Custodians (government entities possessing SNF considered candidate for disposal), and Producers (generators of HLW). The element establishes the waste acceptance and waste form requirements; manages the contract/agreement process; accepts title to the waste; and maintains records of CRWMS capacity, SNF/HLW quantities, location and characteristics.

- The Transportation element is responsible for designing, acquiring, constructing, operating, and maintaining the infrastructure necessary to transport SNF and HLW from Purchaser/Custodian/Producer sites to the Monitored Geologic Repository. This element is also responsible for establishing the institutional relations with industry, States, tribes, and local governments needed to support the Transportation mission.
- The Monitored Geologic Repository element is responsible for designing, licensing, constructing, operating, and permanently closing the geologic repository at the Yucca Mountain site to emplace and isolate 70,000 metric tons of SNF and HLW.

The CRWMS architecture is influenced by supporting elements that ensure a systems approach is utilized in the development, evolution, and acquisition of the system elements. These supporting elements ensure that continued, ongoing enhancements are factored into all Program activities.

2. REQUIREMENTS IMPLEMENTATION

2.1 QUALITY ASSURANCE DOCUMENTATION

The requirements defined in Section 3 will be met by the engineering development of a variety of structures, systems, and components (SSCs). The appropriate classification of SSCs and the engineering documentation produced to meet the requirements are prepared in accordance with each system element's applicable quality assurance program.

2.2 CONFORMANCE VERIFICATION

Documentation will be produced for each system element that further defines and implements the requirements defined in Section 3 and will provide an explanation of how the requirements allocated to that element have been satisfied. The methods selected for conformance verification should be consistent with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets* and accompanying manual (DOE M 413.3-1).

2.3 REQUIREMENTS APPLICABILITY

Consistent with DOE HQ Order 250.1, *Civilian Radioactive Waste Management Facilities--Exemption from Departmental Directives,* and unless otherwise indicated in Section 3 of this document, whenever applicable Departmental requirements overlap or duplicate applicable requirements of the Nuclear Regulatory Commission (NRC) related to radiation protection, nuclear safety (including quality assurance), and safeguards and security of nuclear material, NRC requirements alone will apply to the design, construction, operation, and decommissioning of CRWMS facilities.

3. REQUIREMENTS

3.1 PROGRAMMATIC REQUIREMENTS

3.1.1 Policy Driven Requirements

This section identifies the requirements derived from Program policies.

A. The Level 0 Scope Baseline of the CRWMS shall be defined as "Construct a repository that is licensed by the NRC for the permanent disposal of 70,000 MTHM of high-level radioactive waste and spent nuclear fuel at the Yucca Mountain site. Acquire the transportation and waste acceptance systems and services needed to perform repository operations safely." The Level 0 Scope Baseline shall also reflect:

1. The Acquisition Strategy update approved in *Partial Approval of Revised Alternative Selection and Cost Range (CD-1) for the Yucca Mountain Project* (Sell 2006).
2. The Acquisition Strategy approved for the National Transportation Project (McSlarrow 2004) to procure casks from multiple vendors that have been designed and certified by the vendors and to develop, test, and competitively procure escort, buffer, and cask rail cars including support and maintenance facilities.
3. The Acquisition Strategy approved for the Nevada Transportation Project (McSlarrow 2004) to build a rail line on the approved Caliente route.

B. All subordinate Project-level documents prepared to address the design, acquisition, development, and operation of system elements shall be fully consistent with the *Civilian Radioactive Waste Management System Requirements Document* (DOE/RW-0406).

C. All CRWMS projects shall conduct their activities in accordance with the requirements in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets,* and accompanying manual.

D. All CRWMS elements shall manage changes to baselined configurations, requirements, work scope, costs, and schedules in accordance with the approval authority and thresholds specified in the appropriate Change Control procedures.

E. All CRWMS elements shall comply with the applicable principles of the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" (INFCIRC/546).

F. At least every two years, OCRWM shall conduct a "bottoms-up" Total System Life Cycle Cost Assessment with separate analyses for: a) the currently authorized legislative limit for the first repository and b) future inventories of SNF and HLW as projected by the Energy Information Administration, Office of Environmental

Management, Naval Reactors, and any other owner of SNF and HLW that requires geologic disposal.

G. All CRWMS organizations shall conduct, prior to a major critical decision milestone, independent cost estimating reviews consistent with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets* and accompanying manual. As part of these reviews, each organization shall assess the effectiveness of project management goals and develop approaches to integrate science, technology, and operational advancements into cost savings.

H. The CRWMS evaluation on the need for a second repository, in accordance with NWPA Section 161(b), shall consider the following factors: the total projected inventory of all spent nuclear fuel and high-level radioactive waste, the ability to expand the first repository, and potential alternative technologies for waste management.

I. CRWMS elements responsible for development of the MGR shall develop a System Startup Plan, consistent with requirements of the NWPA, Section 114(e)(1), as well as good engineering and operational practices.

3.1.2 Statutory or Regulatory Driven Requirements

This section identifies the primary requirements of the CRWMS as established by, or derived from, key Federal laws and regulations. According to these laws and regulations, all CRWMS elements shall:

A. Comply with the applicable provisions of 42 U.S.C. 10101 et seq., "The Nuclear Waste Policy Act of 1982", as amended.

B. Comply with the applicable provisions of 10 CFR Part 20, "Standards for Protection Against Radiation."

C. Comply with the provisions of 10 CFR Part 961, "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste."

D. Be capable of accepting, transporting, and disposing of DOE HLW and SNF from DOE EM sites in accordance with the EM/RW MOA (DOE 2007) and, of accepting and disposing naval SNF from NNPP in accordance with the NNPP/RW MOA (Bowman and Itkin 2000).

E. Comply with the applicable Worker Safety and Health requirements of 10 CFR Part 851 and DOE Orders.

F. Comply with applicable provisions of 10 CFR Part 75, "Safeguards on Nuclear Materials-Implementation of U.S./IAEA Agreement."

G. Ensure the physical protection of SNF and HLW while in their possession or custody within any facility or in transit, in accordance with all applicable safeguards and security requirements.

H. Review any applicable statutory, regulatory, and DOE requirement and determine its relevance and extent of implementation within the specific CRWMS element.

3.2 OVERALL SYSTEM-LEVEL REQUIREMENTS

3.2.1 Overall System Performance

A. The CRWMS shall be designed to accept, transport, and dispose of commercial SNF; DOE SNF; vitrified defense HLW (DHLW), including a vitrified plutonium waste form; and vitrified commercial HLW, in accordance with the NWPA and implementing regulations.

B. The CRWMS shall be capable of receiving SNF and HLW, mostly by rail, at the system operating conditions and receipt rates[1,2,3] specified below and in Section 3.2.1.C.

1. To satisfy the Initial Operating Capability, in the first year of operations, the CRWMS shall:
    a. Accept and receive 400 MTHM commercial SNF and HLW
    b. Accept and receive at least 3 naval SNF canisters
    c. Accept and receive 66 DOE SNF canisters and 193 DHLW canisters.
2. During years two through four of operations, the CRWMS shall cumulatively:
    a. Accept and receive, at least, 3,800 MTHM commercial SNF and HLW
    b. Accept and receive, at least, 15 naval SNF canisters
    c. Accept and receive, at least, 257 DOE SNF canisters and 1,143 DHLW canisters.

[1] The actual operational load is a function of the numbers, types and sizes of casks and canisters in which the SNF and HLW are accepted from the points of origin. Since these specific numbers will not be determined until Purchaser/Producer/Custodian agreements are reached and schedules are established, the receipt rates are estimated in terms of desired systems-level acceptance rates.

[2] The rates in this schedule are targets only and do not create any binding legal obligation on the Department of Energy.

[3] The preliminary target receipt rates for naval SNF, DOE SNF and HLW originate from the draft Integrated Acceptance Schedule (Huizenga 2001). The DOE Office of Environmental Management (EM), in coordination with the Naval Nuclear Propulsion Program, is currently revising the Integrated Acceptance Schedule. An updated version is expected to be available for use in CRWMS planning. The official target rates will be contained in the final Integrated Acceptance Schedule to be provided by EM and NNPP, and approved by OCRWM, at least 63 months prior to the planned year of delivery (EM/RW MOA, DOE 2007). For planning purposes, naval SNF is to be included among the earliest shipments to the repository. The rates provided in requirements 3.1.2.B and 3.2.1.C correspond to the projected maximum rates listed in the draft Integrated Acceptance Schedule; the actual rates will be determined based on a number of operational factors including commercial SNF receipt rates and thermal limits for emplacement.

3. To satisfy the Full Operating Capability, in the fifth year of operations, the CRWMS shall:
   a. Accept and receive 3,000 MTHM commercial SNF and HLW annually
   b. Accept and receive, at least, 15 naval SNF canisters annually[4,5]
   c. Accept and receive 179 DOE SNF canisters and 763 DHLW canisters annually.

C. The following conditions shall apply to achieving CRWMS capability identified in Section 3.2.1.B above:
   1. In the event that DOE determines that rail access to the MGR site will be unavailable to support system operating conditions and receipt rates, the acceptance rates specified in 3.2.1.B and 3.2.1.C.2 will not apply and will, instead, be based on the availability of truck transportation capability.
   2. In each year of operations, RW shall be capable of accepting, transporting, and disposing of commercial SNF where at least 90 percent of the SNF planned for acceptance that year is received in Transportation, Aging and Disposal (TAD) canisters and no more than 10 percent is received as uncanistered assemblies in a cask or a DPC. This condition meets the approved canister-based approach for handling commercial SNF at Yucca Mountain (Sell 2006).

D. The CRWMS shall accept 70,000 MTHM of SNF/HLW for disposal in the first repository as authorized by the NWPA, Section 114(d). The allocation, by waste type, is specified in Table 1.

Table 1. Amount of SNF/HLW To Be Accepted in First Repository (in MTHM)

Type	Amount
Commercial SNF and HLW	63,000
Defense HLW	4,667
DOE and naval SNF	2,333
Total	70,000

E. The CRWMS elements shall only accept, transport, and dispose of SNF or HLW that is approved by license or certificate granted by NRC under the NWPA. CRWMS facilities and equipment are not subject to the Treatment, Storage, and Disposal facility requirements under the Resource Conservation and Recovery Act.

[4] Naval Nuclear Propulsion Program activities can prepare up to 24 naval SNF canisters annually for shipment to the MGR. For CRWMS design purposes, this value should be used for maximum receipt rates of naval SNF canisters.
[5] A total of up to 400 naval SNF canisters, including 310 long naval SNF canisters and 90 short naval SNF canisters, are planned for disposal at the repository (Powers 2006).

F. The CRWMS elements and facilities shall be designed to accommodate Transportation, Aging and Disposal canisters; dual-purpose, DOE SNF Standardized, naval SNF, and HLW canisters; Multi-Canister Overpacks; and limited quantities of bare SNF assemblies.

G. CRWMS facilities shall be designed with the capability to open transportation casks to remove SNF and HLW, cut open TADs (for repair and remediation) and DPCs, handle the SNF and HLW, and manage the associated site-generated waste streams.

H. The CRWMS design shall comply with the agreements established under the Integrated Interface Control Document, Volume 1 (DOE/RW-0511) to ensure:

1. Compatibility of HLW and DOE SNF waste forms with MGR surface facility interfaces, including canister handling interfaces, and
2. Compatibility between transportation equipment (e.g., transporters) and transported items (e.g., casks and canisters) with mechanical interfaces (e.g., cask handling skid equipment and facility lifting equipment) and envelop interfaces (e.g., canister dimensions and weights).

I. The CRWMS is responsible for the transportation of DOE SNF and HLW in casks certified by the NRC. NNPP is responsible for canistering and transporting naval SNF to the repository.

J. CRWMS facilities shall manage hazardous, nonhazardous, radioactive, and mixed wastes, if applicable, generated during on-site operations in a cost effective manner that meets or exceeds compliance with applicable regulations and protects the health and safety of the public, workers, and the environment consistent with DOE Order O 450.1, *Environmental Protection Program.*

K. All CRWMS structures, systems, and components shall be designed and fabricated in accordance with applicable codes, standards and guides, as appropriate, and applicable DOE Orders, with particular attention to those which incorporate system safety, human factors, reliability, availability, maintainability, habitability standards, and environmental protection. In the absence of appropriate NRC and DOE standards, applicable industry codes should be used.

L. The CRWMS design shall comply with the design-level agreements on physical, functional, and operational characteristics between CRWMS elements established under the *Integrated Interface Control Document*, Volume 2 (DOE/RW-0572), and the *Transportation, Aging, and Disposal Canister System Performance Specification* (DOE/RW-0585).

M. To the maximum extent practical, all CRWMS elements shall utilize proven commercial technology, including facilities and equipment previously reviewed and accepted by NRC, as appropriate, which will satisfy the intended function of any structure, system, or component.

3.3 WASTE ACCEPTANCE ELEMENT REQUIREMENTS

This section contains the requirements allocated to the Waste Acceptance Element.

A. The Waste Acceptance Element shall collect necessary information in support of CRWMS activities. The type of data required includes, but is not limited to, the following:

1. Contracts and Fees Information - Purchaser Contracts; Custodian and Producer Agreements and changes thereto; records of fee payments.
2. Planning and Scheduling Information - Delivery Commitment Schedules (DCS), DCS Exchanges, Final Delivery Schedules, integrated Acceptance Schedule developed in accordance with the EM/RW and NNPP/RW MOAs (DOE 2007; Bowman and Itkin 2000), Purchaser and Custodian SNF data, campaign schedules, acceptance, transportation, delivery, storage, and emplacement schedules, current projections of the full inventory of SNF and HLW expected to require disposal.
3. Operations Support Information - Characterization data for SNF and HLW. This data shall be sufficient to satisfy the loading safeguards verification requirements of 10 CFR Part 63.21(c)(4).
4. Safeguards and Security Information - Nuclear Material Transaction reports s (10 CFR Part 74.15(a)), Nuclear Material Balance reports (10 CFR Part 75.35(a)), and other information specifically agreed to (e.g., verification forms).

B. Waste Acceptance shall validate title and/or transfer of responsibility and custody documentation from the Purchasers/Producers/Custodians.

C. Acceptance of West Valley Demonstration Project (WVDP) Commercial High-Level Radioactive Waste (CHLW), presently owned by the New York State Energy Research and Development Authority **(**NYSERDA), is contingent upon NYSERDA executing an acceptance and disposal contract, and paying a fee as required under the NWPA.

3.4 TRANSPORTATION ELEMENT REQUIREMENTS

This section contains the requirements allocated to the Transportation Element of the CRWMS.

A. The Transportation Element shall comply with the applicable provisions 42 U.S.C. 4321 et seq., "The National Environmental Policy Act of 1969" as amended.

B. The Transportation Element shall comply with the applicable provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

C. The Transportation Element shall comply with the applicable provisions of DOT regulations as documented in Title 49 of the Code of Federal Regulations.

D. The Transportation Element shall comply with all applicable DOE Orders and Directives, including those in the areas of radiation protection, safeguards and security, physical protection, material control and accounting, contingency, and quality assurance.

E. The Transportation Element shall be capable of transporting NRC-certified transportation casks primarily by rail, and by truck, from the start of the CRWMS's Initial Operating Capability operations.

F. The Transportation Element shall be capable of transporting NRC-certified transportation casks (defined in Appendix A), including the following general types:

- Single-Purpose Casks
- Canister Casks (Transportation, Aging and Disposal Canister and Dual-Purpose Canister (DPC))
- Transportable Storage Casks
- HLW Casks
- Specialty Casks

3.5 MGR ELEMENT REQUIREMENTS

This section contains the requirements allocated to the MGR Element.

A. The MGR shall comply with the requirements of the Nuclear Regulatory Commission (10 CFR Part 63) and the Environmental Protection Agency (40 CFR Part 197).

B. The MGR shall be designed and constructed to accommodate emplacement of 70,000 MTHM of SNF and HLW, as specified in the Nuclear Waste Policy Act. The MGR shall not preclude, subject to approval of a license amendment, the ability to accept additional quantities of nuclear waste up to the projected inventory in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of SNF and HLW at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250).

C. The MGR surface and subsurface facilities shall be designed and constructed in phases, with an Initial Operating Capability phase that includes the facilities approved in the CD-1 update (Sell 2006) and that is capable of receiving the waste types listed in Section 3.2.1.A, at the rates specified in Section 3.2.1.B.

D. For the full range of operating conditions, the MGR shall be designed not to preclude permanent closure for up to 300 years from the start of waste emplacement.

E. The MGR shall ensure the physical protection of SNF and HLW received at the repository for disposal in accordance with the safeguards and security requirements in 10 CFR Part 63.21(b)(3), the applicable material control and accounting provisions of 10 CFR Part 63.78, the safeguards information protection provisions in 10 CFR Part 73.21, and any applicable interim compensatory measures issued by the NRC.

F. The MGR shall have the capability to initiate emplacement at the start of the Initial Operating Capability.

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APPENDIX A

DEFINITIONS

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DEFINITIONS

A.1 GLOSSARY

This section provides definitions of key terms used in the CRD. Rather than requirements, the purpose of these definitions is to ensure consistency when describing the CRWMS and its requirements.

Acceptance is the transfer of responsibility, custody, and physical possession of SNF or HLW from the Purchaser/Producer/ Custodian to the CRWMS.

Architecture is the physical system to be built, found, or selected to perform a function subject to its stated requirements.

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 purposes: (1) for solidified HLW, its purpose is a pour mold and (2) for SNF, it may provide structural support for SNF, loose rods, nonfuel components, or confinement of radionuclides.

Cask is a container for shipping or storing spent nuclear fuel and/or canistered high-level waste that meets all applicable regulatory requirements and is built to a design 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 Purchaser/Custodian sites to a CRWMS site.
2. **Canister Casks** - These transportation casks are for transporting canisters (TAD or DPC) containing SNF from Purchaser/Custodian sites to CRWMS sites and between CRWMS sites.
3. **Transportable Storage Casks** - These transportation casks are for storing uncanistered SNF at Purchaser sites, transporting SNF from Purchaser sites to a CRWMS facility, and possible aging of SNF at a CRWMS facility.
4. **HLW Casks** - These transportation casks are for transporting commercial and defense HLW from Producer 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.

Civilian Radioactive Waste Management System (CRWMS) is 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 (CHLW) is the high-level radioactive waste, as defined by NWPA 42 U.S.C. 10101(12), resulting from reprocessing spent nuclear fuel in a commercial facility.

Commercial Spent Nuclear Fuel is SNF resulting from operation of a commercial nuclear power reactor that is covered by a Standard Contract (10 CFR Part 961) at the time of acceptance. Commercial SNF includes nonfuel components as discussed in Appendix E of 10 CFR Part 961.

Conformance Verification is the process used to determine that systems comply with CRWMS requirements or to demonstrate that SNF and/or HLW are in accordance with CRWMS acceptance criteria.

Contract is the agreement set forth in 10 CFR Part 961.11 and any duly executed amendment or modification thereto.

Custodian means any government agency that possesses spent nuclear fuel that is eligible for disposal in the CRWMS.

Defense High-Level Radioactive Waste (DHLW) is the high-level radioactive waste, as defined by NWPA 42 U.S.C. 10101(12), resulting from reprocessing spent nuclear fuel in a defense facility.

Disposal is the emplacement of radioactive wastes in a geologic repository with the intent of leaving it there permanently (As defined in 10 CFR Part 63.2.)

DOE Spent Nuclear Fuel (DOE SNF) is SNF that is managed by DOE, and has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. DOE SNF includes, but is not limited to, production reactor SNF, research reactor SNF, naval SNF, and DOE SNF of commercial origin. DOE SNF of commercial origin is SNF managed by EM previously irradiated at civilian facilities and for which fees have been, or will be, paid under a standard contract with RW prior to MGR disposal.

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.

Full Operating Capability refers to the CRWMS development phase where all the repository facilities will be fully completed to meet the system performance requirements of section 3.2.1.B.3.

Function is a primary statement of purpose; it defines what a system or subsystem must accomplish to meet the system mission.

Geologic Repository is 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 Part 63.2.)

Government-Managed Nuclear Materials consists of both SNF (e.g., DOE SNF and naval SNF) and HLW (e.g., defense) that are in the custody of and will be accepted from a government agency.

Hazardous waste means any solid waste that exhibits certain characteristics, including corrosivity, ignitability, reactivity, or toxicity, or is specifically listed by the Environmental Protection Agency in its regulations under 40 CFR Part 264. EPA regulations under 40 CFR Part 261, et seq., implement the statutory provisions of the Resource Conservation and Recovery Act.

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 (Nuclear Waste Policy Act of 1982, as amended). HLW does not include the radioactive waste resulting from the reprocessing of spent nuclear fuel as defined in Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (PL108-375, October 28, 2004).

Initial Operating Capability refers to the ability of the CRWMS to receive and emplace High-Level Radioactive Waste and all types of spent nuclear fuel to meet the system performance requirements of section 3.2.1.B.1.

Interface Requirement means a requirement that applies to the inputs to, or outputs from, the function; or the physical connection or dependence between architectural items.

Interim compensatory measures are steps in the Orders issued by NRC in response to the September 11th terrorist incidents directing licensees to take immediate action until vulnerability studies are completed and further security enhancements can be determined. **Interim compensatory measures** are considered sensitive information and therefore are unavailable to the public.

Metric Tons of Heavy Metal (MTHM), as used in this document, refers to the quantity of heavy metal as used in NWPA.

Naval SNF is DOE SNF that is currently managed by NNPP, and is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. Naval SNF will be placed in sealed canisters designed specifically for storage, transportation, and disposal.

Overpack is a structural component used to hold and protect the Transport, Aging and Disposal canister or DPC 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. An overpack is designed for its particular use in conjunction with the Transport, Aging and Disposal canister or DPC.

Owner is any person who has title and/or responsibility and custody to spent nuclear fuel or high-level radioactive waste. (As defined in 10 CFR Part 961.3.)

Package is the packaging together with its radioactive contents as presented for transport. (As defined in 10 CFR Part 71.4.)

Packaging is the assembly of components necessary to ensure compliance with packaging requirements of 10 CFR Part 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 Part 71.4.)

Performance Requirement means a defined capability the CRWMS or one of its elements must have to accomplish its allocated functions.

Physical System means the CRWMS consisting of the composite of the sites, and all facilities, systems, equipment, materials, information, activities, and the personnel required to perform those activities comprising the “Dispose of Waste” function.

Producer is any generator of high-level radioactive waste resulting from atomic energy defense activities or any producer of vitrified commercial HLW who has executed an acceptance and disposal contract. For purposes of this document, WVDP, which has commercial HLW, will be considered a "Producer" only when an acceptance and disposal contract is executed.

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 .U.S.C 2133, 2134), or who has title to SNF or HLW and who has executed a contract or other contractual agreement with DOE

Repository is synonymous with geologic repository.

Requirement means those statements that describe a characteristic or constraint that must be met for a system, product, or process to be acceptable.

Safeguards Verification is the process used to demonstrate that for all special nuclear material (as defined in 10 CFR Part 70), appropriate safeguards are in place.

Shipment is the movement of the properly prepared (loaded, unloaded, or empty) cask from one site to another and all associated regulatory activities.

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 Part 70.4.)

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 U.S.C. 10101(23) and 10 CFR Part 961.11.)

Structures, Systems, and Components, or SSCs, is a general term that means the standard English definition of those individual words. In this document, if and when SSC is used in a way that requires any qualification, such as "important to safety" (as defined in 10 CFR Part 63.2, 63.111(b)(1) and 63.111 (b)(2)) or "important to waste isolation" (as defined in 10 CFR Part 63.2, 63.113 (b) and (c)), that qualifier will also be provided.

System Element refers to any of the three major systems required to accomplish the functions of the CRWMS. The three system elements are Waste Acceptance, Transportation, and MGR. This differs from the "project" that may be initiated by DOE to manage and control development of one or more system elements.

Technical Baseline is a configuration identification document, or set of such documents, that is formally designated and approved at a specific time. Within the CRWMS, technical baseline is composed of, and evolves through, the functional and technical requirements baseline that is presented in the CRD, the design requirements baseline, the final design baseline, and the as-built baseline.

Transportation Cask is a container for shipping spent nuclear fuel and/or high-level radioactive waste that meets all applicable regulatory requirements.

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.

Transporter is a cargo-carrying vehicle used for transportation of cargo. It includes semi-trailers, rail cars, intermodal transportation skids and equipment such as a tie-down components, personnel barriers, etc., needed to make the loaded cargo-carrying vehicle transport-ready.

Vitrified Plutonium Waste Form is a vitrification technology utilizing a lanthanide borosilicate (LaBS) glass for dispositioning excess weapons-useable plutonium that is not suitable for processing into mixed oxide fuel.

Waste Acceptance is the system element that manages the Accept Waste function that includes acceptance of SNF and HLW into the CRWMS from the Purchaser/ Custodian/Producer of such waste.

Waste Form is the radioactive waste materials and any encapsulating or stabilizing matrix . (As defined in 10 CFR Part 63.2.)

A.2 ACRONYMS AND ABBREVIATIONS

This section provides a listing of acronyms and abbreviations used in the CRD, along with their definitions.

B

BCP	Baseline Change Proposal
BWR	Boiling Water Reactor

C

CFR	Code of Federal Regulations
CHLW	Commercial High-Level Radioactive Waste
CRD	CRWMS Requirements Document
CRWMS	Civilian Radioactive Waste Management System

D

DCN	Document Change Notice
DCS	Delivery Commitment Schedule
DHLW	Defense High-Level Radioactive Waste
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPC	Dual Purpose Canister

E

EIS	Environmental Impact Statement
EM	DOE/Office of Environmental Management
EPA	U.S. Environmental Protection Agency

F

FR	Federal Register
FOC	Full Operating Capability

H

HLW	High-Level Radioactive Waste

I

IAEA	International Atomic Energy Agency
ICN	Interim Change Notice
IOC	Initial Operating Capability

M

MGR	Monitored Geologic Repository

MOA	Memorandum of Agreement
MTHM	Metric Tons of Heavy Metal

N

NNPP	Naval Nuclear Propulsion Program
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982
NYSERDA	New York State Energy Research and Development Authority

O

OCRWM	Office of Civilian Radioactive Waste Management

P

PWR	Pressurized Water Reactor

Q

QA	Quality Assurance
QARD	Quality Assurance Requirements and Description

R

RW	Office of Civilian Radioactive Waste Management

S

SNF	Spent Nuclear Fuel
SR	Site Recommendation
SRD	System Requirements Document
SSCs	Structures, Systems, and Components

T

TAD	Transport, Aging and Disposal Canister
TBD	To Be Determined

U

U.S.C.	United States Code

W

WASRD	Waste Acceptance System Requirements Document
WVDP	West Valley Demonstration Project

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