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Office of Civilian Radioactive Waste Management

INTEGRATED INTERFACE CONTROL DOCUMENT, VOLUME 1

HIGH-LEVEL RADIOACTIVE WASTE AND U.S. DEPARTMENT OF ENERGY AND NAVAL SPENT NUCLEAR FUEL TO THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM

DOE/RW-0511

Revision 4, ICN 1

August 2008

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Washington, DC 20585

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CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM
Integrated Interface Control Document, Volume 1

High-Level Radioactive Waste and U.S. Department of Energy and Naval Spent Nuclear Fuel to the Civilian Radioactive Waste Management System

Revision 4, ICN 1

August 2008

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Having completed the technical review under procedure LP-6.1Q-OCRWM and management review and approval under procedure LP-PMC-009-OCRWM and by the Level 1 Change Control Board, the Integrated Interface Control Document, Volume 1, Revision 4, ICN 1 is approved for release.

David S. Rhodes for   8-20-08

Paul G. Harrington
Director
Office of the Chief Engineer
Office of Civilian Radioactive Waste Management
U.S. Department of Energy

Date

CHANGE HISTORY

Revision Number	Interim Change No.	Effective Date	Description of Change
0	0	05/14/1999	Initial issue
1	0	04/09/2002	Broadened the scope of the document to allow addressing interfaces other than just mechanical and envelope interfaces. Incorporated updated information on MGR facility and disposal container, canister, and transportation system designs. Incorporated information removed from the *Waste Acceptance System Requirements Document* (DOE/RW-0351) that was deemed interface information. Captured high-level radioactive waste (HLW) canister information that was accumulated during development of DOE/RW-0351. Transferred responsibility for the transport.
2		08/18/06	Deleted reference to the Regional Servicing Contractor and use of heavy-haul trucks; replaced "disposal container" with "waste package;" updated procedure references and other references; revised the text for latest organizational titles; differentiated between assumptions and requirements; added sections on interfaces for transportation casks, transporters, and handling skids; added section on return to service requirements; added section and table for division of responsibilities between the MGR and NNPP for ancillary equipment; added section for Nevada Rail interfaces; and revised figures to delete heavy-haul transporter and incorporate updated notes and dimensional interface information. Specific changes for Revision 2 are as follows: Added responsibility statement regarding controlled document use and maintenance. The disclaimer statement was changed to "intended use." The Activity Plan was added. Acronyms and abbreviations were moved from Appendix A to follow the table of contents. The Purpose and Scope statements were revised to eliminate duplication. Section 2, Scope, was further modified to define the four suites of 24-in. diameter disposable HLW canisters, and Figures 1 and 2 were deleted. Minor edits were made to Section 3; Section 4 was modified slightly to include a statement regarding Q-list items together with a more precise definition of "established fact."

Revision Number	Interim Change No.	Effective Date	Description of Change
			Section 5 was renamed "Assumptions and Requirements," and requirements were clarified and listed separately. Section 6 was modified to remove references to the 1998 interface control document, the 2001 MGR Description Document, and the 1999 Classification of the MGR Canister Transfer System document. Section 7 was expanded from 3 subsections to 6 subsections, adding interfaces for transportation casks, transporters, and handling skids. Minor edits were made to Section 8. Section 9 was rewritten and expanded to include cask conditions for return to service and providing separate NNPP cask and cask ancillary equipment interface information and NNPP cask interfaces with Nevada Rail and the MGR. A new responsibility assignment table between the MGR and NNPP for ancillary equipment was also added to Section 9. Section 10 was modified to address "DOE SNF Standardized Canisters" instead of the "National Spent Nuclear Fuel Program," and subsections were rewritten to address the standardized canister concept. In Section 11, descriptions of other canister options considered but not pursued by DOE were removed, descriptive details of single-element-sized disposable canisters were reduced, and description of multi-element disposable canisters was removed. In Section 12, terminology was changed from "Disposal Container" to "Waste Package." Section 13 was modified to clarify the descriptions of HLW canisters and the vitrified plutonium waste form. Section 14 was modified to combine procedures into Section 14.2 and to update the reference list. Acronyms and Abbreviations were removed from Appendix A, which was retained as "Reserved." References were reviewed and updated as appropriate. Figures in Appendices B and C were updated in accordance with revised and updated reference citations. Figure C-17 was replaced with the final Navy canister information. Details for possible use of repair caps were added to Figures C-20 and C-21. The Hanford HLW canister length was corrected in Figure C-21. Figures C-29 and C-30 for West Valley canister handling interfaces were added.

Revision Number	Interim Change No.	Effective Date	Description of Change
3		01/30/07	Revised the document to incorporate relevant aspects of the current Yucca Mountain Project conceptual design material flow; update handling interfaces for the new naval M-290 transportation system, including schematic details and bounding parameters in Figures C-1 and C-3; and simplify the U.S. Department of Energy (DOE) spent nuclear fuel (SNF) canister numbering convention in Note 15, Figures C-4, C-5, C-9, and C-10. Specific changes for Revision 3 include updating the facility names for consistency with conceptual design; revising discussions of DOE-owned fuel of commercial origin, including changing boiling water reactor (BWR) and pressurized water reactor (PWR) SNF interfaces from waste packages to transportation, aging, and disposal (TAD) canisters; clarifying discussions of Idaho National Laboratory (INL) high-level radioactive waste (HLW) canisters; and adding thermal limits for DOE SNF and HLW. Changes regarding the naval M-290 transportation system include designating the Initial Handling Facility (IHF) as the only repository facility to handle the naval M-290 cask; specifying a handling limit of one naval canister in the IHF; adding a 6-week turnaround time to process up to six naval cask shipments at the IHF; removing ancillary equipment lists and responsibilities that pertained to the prior naval cask design, and adding surface facility design and operational requirements to meet criticality, time-temperature, and structural requirements for naval canisters. Figure B-12 was revised as a placeholder for West Valley Demonstration Project (WVDP) HLW interfaces with the Civilian Radioactive Waste Management System (CRWMS) transportation cask. Figure B-13 was added as a placeholder for multicanister overpack (MCO) interfaces with the CRWMS transportation cask.

Revision Number	Interim Change No.	Effective Date	Description of Change
			Figures C-7, C-8, C-16, C-19, C-24, C-25, and C-27 were revised to the most current waste package design information. Figures C-27 and C-28 were revised as placeholders for BWR and PWR SNF interfaces with TAD canisters. Technical inputs and procedural references were updated and revised. "MGR" was changed to "repository" throughout the document. Numerous minor editorial changes were also made.
4		03/10/08	Revised the document to incorporate additional requirements primarily pertaining to the receipt, handling, and emplacement of naval spent nuclear fuel canisters. Updated the naval railroad transportation system and transporter (Figure C-1), the NNPP transportation cask (Figure C-2), and the naval SNF canister interfaces (Figure C-6). Added Table 2, Division of Responsibility between the Repository and Naval Nuclear Propulsion Program for Ancillary Equipment for M-290 Cask Handling. Added several design and operational requirements for naval spent nuclear fuel canister criticality control, thermal performance, and structural performance. Added Table 3 and Figure 1 summarizing DOE-EM and NNPP canister repository interface information. Added Tables 4 and 5 containing bounding values for gamma and neutron fluxes on the surface of the naval spent nuclear fuel canister. Replaced 30 figures in Revision 3 of IICD-1 with a new Table A-1 in Appendix A and nine new figures in Appendix C. Updated text and references for currency throughout.

Revision Number	Interim Change No.	Effective Date	Description of Change
4	1	08/22/2008	Deleted requirements 10.3.2.2.1 and 10.3.2.2.2 in their entirety; incorporated a new provision 10.3.2.2.1; and renumbered requirement 10.3.2.2.3 to 10.3.2.2.2.

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ACRONYMS AND ABBREVIATIONS

Acronyms

AAR	Association of American Railroads
ASME	American Society of Mechanical Engineers
BSC	Bechtel SAIC Company
BWR	boiling water reactor
CFR	Code of Federal Regulations
CHLW	commercial high-level radioactive waste
CLC	center location canister
CRCF	Canister Receipt and Closure Facility
CRD	*Civilian Radioactive Waste Management System Requirements Document*
CRWMS	Civilian Radioactive Waste Management System
DHLW	defense high-level radioactive waste
DOE	U.S. Department of Energy
DOE-EM	DOE Office of Environmental Management
DOE-RW	DOE Radioactive Waste (Office of Civilian Radioactive Waste Management)
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
FDR	Final Design Report
FR	Federal Register
HLW	high-level radioactive waste
IHF	Initial Handling Facility
IICD	*Integrated Interface Control Document*
IICD-1	*Integrated Interface Control Document, Volume 1: High-Level Radioactive Waste and U.S. Department of Energy and Naval Spent Nuclear Fuel to the Civilian Radioactive Waste Management System*
IICD-2	*Integrated Interface Control Document, Volume 2: Waste Acceptance, Transportation, and Monitored Geologic Repository System Elements*
INL	Idaho National Laboratory
ISF	Idaho Spent Fuel Project
LWT	legal-weight truck
M&O	management and operating contractor
MCO	multicanister overpack
MGR	monitored geologic repository
MOA	Memorandum of Agreement

ACRONYMS AND ABBREVIATIONS (Continued)

NNPP	Naval Nuclear Propulsion Program
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
NYSERDA	New York State Energy Research and Development Authority
OCRWM	Office of Civilian Radioactive Waste Management
OLC	outside location canister
OWT	overweight truck
PWR	pressurized water reactor
QA	quality assurance
QARD	*Quality Assurance Requirements and Description*
REMY	Rail Equipment Maintenance Yard
SAR	safety analysis report
SNF	spent nuclear fuel
SRS	Savannah River Site
TAD	transportation, aging, and disposal
TBD	to be determined
TMI	Three Mile Island
WASRD	*Waste Acceptance System Requirements Document*
WCO	Waste Custodian Organization
WVDP	West Valley Demonstration Project

Abbreviations

°C	Celsius
cm^2	centimeter squared
dpm	disintegrations per minute
°F	Fahrenheit
ft	foot
ft/min	feet per minute
in.	inch
kg	kilogram
lb	pound

ACRONYMS AND ABBREVIATIONS (Continued)

MeV	megaelectron volt
mm	millimeters
mrem	millirem
MTHM	metric tons of heavy metal
N/A	not applicable
y/cm^2-s	gamma rays per square centimeter per second

1. PURPOSE

The *Integrated Interface Control Document* (IICD) is a multivolume document that records design-level agreements between the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) and other parties. Volume 1 of the IICD (IICD-1)—*Integrated Interface Control Document, Volume 1: High-Level Radioactive Waste and U.S. Department of Energy and Naval Spent Nuclear Fuel to the Civilian Radioactive Waste Management System*—records and implements those program-level agreements between OCRWM and both the DOE Office of Environmental Management (EM) and the Naval Nuclear Propulsion Program (NNPP). These interface agreements are associated with the OCRWM acceptance, shipment, receipt, and handling of spent nuclear fuel (SNF) owned or managed by the DOE (referred to as DOE SNF in this document), naval SNF, and high-level radioactive waste (HLW) to and by the Civilian Radioactive Waste Management System (CRWMS). Although naval SNF is also a form of DOE SNF, it will be referred to separately as naval SNF in this document.

Although a disposal contract with the State of New York has not yet been established for the West Valley Demonstration Project (WVDP) HLW, it is included in this document to ensure correct interfaces once the disposal contract has been established. The OCRWM *Quality Assurance Requirements and Description* (QARD) (DOE 2007a) refers to these EM sites (such as WVDP) and NNPP as waste custodian sites, as they are the current custodians of the SNF and HLW. It should be noted that the interfaces with the Waste Custodian Organizations (WCOs), with the exception of the NNPP, start at the WCO site, since the casks and transporters used to ship SNF and HLW from these sites are provided by OCRWM. Physical interfaces with the NNPP for receipt of naval SNF include the interchange point at Caliente and the repository site entry gate. Although Nevada Rail planning is not complete, an interface at Caliente might involve, for example, replacing the commercial carrier locomotive and crew with those provided by the contracted carrier for the Nevada Rail Line. Naval SNF casks and transporters used to ship naval SNF to the repository are provided by the NNPP.

IICD-1 records design-level agreements on controlled parameters for mechanical, dimensional, and other interfaces between (1) transporters (i.e., rail cars, legal-weight trucks (LWTs), and overweight trucks (OWTs)); transportation casks; canisters of DOE and naval SNF; uncanistered or canistered DOE-owned SNF of commercial origin; and canisters of HLW and (2) repository structures, systems, and components. IICD-1 also records agreements between OCRWM, EM, and NNPP on each organization's responsibilities for controlling its side of the physical interfaces. IICD-1 was prepared based on the OCRWM and EM and OCRWM and NNPP relationships that are defined in the Memoranda of Agreement (MOAs) with their respective organizations (DOE 2007b; Bowman and Itkin 2000). These memoranda are further discussed in Section 6.

These agreements establish design input for—and ultimately constrain—the designs of transporters, transportation casks, and canisters that are developed, obtained, or used by manufacturers, waste generators, shippers, OCRWM, EM, or NNPP. These agreements also establish design input for the design and construction of the repository facilities and systems. These agreements do not constitute formal design criteria, but they do establish constraints and input for design solutions on each side of the specified interfaces.

The initial issuance and subsequent changes to IICD-1 are the responsibility of OCRWM, with concurrence by EM and NNPP as ad hoc members of the OCRWM Program Change Control Board. All participating offices within EM, NNPP, and OCRWM (1) may propose changes and (2) shall abide by the agreements documented within IICD-1.

OCRWM, EM, NNPP, and their contractors responsible for systems developed to contain and transport DOE SNF, naval SNF, or HLW must follow these agreements to ensure that casks and canisters conform to the design constraints described in IICD-1 to ensure handling compatibility with the repository surface facilities. OCRWM and its contractors shall adhere to these agreements to ensure that repository surface facilities can receive and unload transportation casks and canisters provided by EM and NNPP and that disposable canisters can be loaded into waste packages for emplacement in the repository subsurface facilities.

Volume 2 of the IICD (IICD-2) (DOE 2007c) is focused on commercial SNF. IICD-2 will contain programmatic, design-level interfaces between internal elements of the CRWMS, namely, the Waste Acceptance element, the Transportation element, and the Repository element. IICD-2 is not applicable to naval SNF, because NNPP is responsible for the transportation of naval SNF to the repository. IICD Volumes 1 and 2 are intended, together, to capture all relevant program-level interfaces.

2. SCOPE

IICD-1 contains mechanical and dimensional interfaces associated with transportation system interfaces, including the designs of transporters; transportation system casks; canistered SNF and HLW; uncanistered SNF; interface parameters such as bounding weights, centers of gravity, and radiation and flux limits for various components; and structures, systems, and components within the repository surface facilities and waste packages. Mechanical interfaces include DOE or NNPP component contact with the repository facilities components, such as disposable naval SNF canister-lifting bolt holes and the repository facility lifting-fixture bolts. IICD-1 does not address specific requirements related to OCRWM's waste acceptance criteria.

Unopened disposable canisters are placed directly into waste packages. Internal canister configuration and criticality details of disposable canisters, although necessary for analyses supporting the repository safety case and License Application, are not interfaces included in the scope of IICD-1. Likewise, disposable canister contents are also not interfaces included in the scope of IICD-1. However, certain repository design and operational restrictions, such as canister wall temperature limits for DOE standardized SNF canisters (Section 10.1.3) and moderator controls for naval canisters (Section 10.3.2.1), are included because their safety analyses are predicated upon these requirements and limitations being implemented.

IICD-1 includes agreements between OCRWM and EM (DOE 2007b), and between OCRWM and NNPP (Bowman and Itkin 2000) that define which organization is responsible for controlling its side of the interface.. Interface agreements also define responsibilities for providing specific equipment.

Typical interface parameters documented in IICD-1 address:

1. Transporter dimensions and other limits.
2. Transportation system items, including personnel barriers, impact limiters, and hold-down feature dimensions and other limits.
3. Transportation system cask, lid, and lifting-fixture dimensions and other limits.
4. Canister and lifting-fixture dimensions.
5. Centers of gravity.
6. Transportation cask radiation and flux limits.
7. Thermal properties and limits.
8. Cask cavity sampling system.

As designs mature, additional interface requirements will be included in future revisions of this document.

The HLW and DOE SNF canisters are referred to in terms of nominal values. Their actual dimensions can be found in Table A-1 in Appendix A and on the figures in Appendices B (Figures B-1 to B-13) and C (Figures C-1 to C-9) of this document. For example, the Hanford HLW canister has a nominal length of 15 ft, when its actual maximum length is 176.82 in. (14.74 ft), as listed in Table A-1, I-21.

IICD-1 addresses the known and agreed-upon suite of disposable DOE SNF canisters (Assumptions 4, 6, 7, and 8 in Section 5.2):

1. 18 in. diameter by 10 ft long SNF canister
2. 18 in. diameter by 15 ft long SNF canister
3. 24 in. diameter by 10 ft long SNF canister
4. 24 in. diameter by 15 ft long SNF canister
5. Hanford multicanister overpack (MCO) canister
6. Short naval SNF canister
7. Long naval SNF canister.

In addition to the disposable DOE SNF canisters listed above, DOE SNF of commercial origin having handling features interchangeable with either boiling water reactor (BWR) or pressurized water reactor (PWR) fuel assemblies and known to have no defects might be shipped to the repository as bare fuel within a transportation cask for placement in a disposable canister at the repository. The DOE SNF of commercial origin might also be shipped to the repository within a disposable DOE SNF canister.

IICD-1 also includes interface information on the following suite of disposable HLW canisters, which have been specified by their respective sites:

1. 24-in.-diameter by 10 ft long HLW canister from the Savannah River Site (SRS) Defense Waste Processing Facility (DWPF) containing vitrified borosilicate HLW glass

2. 24-in.-diameter by 10 ft long vitrified plutonium waste form HLW canister from SRS containing plutonium in lanthanide borosilicate glass in cans

3. 24-in.-diameter by 10 ft long HLW canister from the WVDP containing vitrified borosilicate HLW glass

4. 24-in.-diameter by 15 ft long HLW canister from the Hanford Site River Protection Project's Waste Treatment Plant containing vitrified borosilicate glass.

The canisters to be used for the Idaho National Laboratory (INL) HLW have not been specified, but they are considering the use of existing canisters such as the DWPF HLW canister, the DOE SNF standardized canisters of various sizes, or the large naval SNF canister. Since all of these existing canisters are already addressed in IICD-1, the interfaces with the repository are already established. Once a canister(s) for the INL HLW has been selected, that information will be added to a future revision of IICD-1. The canisters of commercial HLW being stored at the WVDP in the State of New York have been included in the repository baseline; however, contracts to send and receive the HLW have not been negotiated. The WVDP canister details, including handling interfaces, are included in IICD-1 to ensure the correct interfaces, especially the fit of these HLW canisters within the waste packages.

Transportation systems and the transporters must use public roadways and commercial railways from the SNF and HLW WCO sites to the repository. Although transportation strategies are being developed to get the SNF and HLW to the repository, the interfaces between the WCO sites and the roadways and railways are not currently well defined. These interfaces will be included in a future revision of IICD-1.

Transportation systems and transporters interface with the WCO sites and repository site entry gates and facility doors, including the building bay areas. Transportation casks interface with the WCO sites and repository standardized equipment and fixtures, such as crane lifting fixtures; cask carts; waste handling area doors; manipulator tools; and vent, drain (if used), and sampling equipment. Canisters interface with the crane lifting fixtures, temporary staging areas, and the appropriate waste packages that will be used to contain and isolate HLW and DOE and naval SNF during emplacement in the repository subsurface facility. Identified responsibilities include the party that provides specific equipment.

IICD-1 does not represent OCRWM acceptance of HLW and DOE and naval SNF and associated equipment as part of the repository safety analysis demonstrating compliance with U.S. Nuclear Regulatory Commission (NRC) performance objectives. Although agreements made within IICD-1 do not guarantee final OCRWM acceptance of HLW and DOE and naval SNF, abiding by these agreements during the development of transportation systems and canisters and the design of the repository surface facilities and waste packages will reduce the risk of incompatibility between the packaged wastes and the repository.

3. PRESENTATION FORMAT

Section 4 of IICD-1 describes the quality assurance (QA) program under which the IICD-1 was generated, the qualification of parameter data, and the types of source documents used. Section 4 does not discuss individual source documents that are listed in the references (Section 14).

Section 5 identifies the requirements and assumptions used to develop the controlled interfaces in IICD-1.

Section 6 of IICD-1 identifies related documents that are important in defining the scope and content of IICD-1.

Section 7 identifies transportation system interfaces with the WCO and repository facilities. The figures provided in Appendices B and C include the maximum dimensions of the transporter envelope and the minimum dimensions for facility gate or door envelopes. Notes on the figures provide limiting values for transporter weights and centers of gravity, and material requirements, if applicable or available. The figures in Appendices B and C also identify the mechanical interfaces between the transporter connections and the site prime mover connections.

Section 8 identifies the interfaces between the transportation system packaging items (including personnel barriers, impact limiters, and hold-down features) and the surface facilities. Figures provided in Appendices B and C also contain notes on other interface parameters.

Section 9 identifies interfaces between the transportation system cask and the surface facilities, including transportation system cleanliness requirements for return shipments and transportation system cask interfaces with both WCO facilities and repository surface handling facilities. It also identifies division of NNPP and repository responsibility for ancillary equipment, NNPP transportation system cask interfaces with the repository surface handling facilities, and NNPP transportation system cask interfaces with Nevada Rail. The systems included are those known to date for the shipment of the naval SNF canisters. Other systems have not been developed in sufficient detail to provide interface controls. Figures in Appendices B and C provide the known and identified transportation system casks as precursors to identification of the interfaces.

Section 10 identifies the interfaces between the disposable canisters of DOE and naval SNF and the repository surface facilities and systems. This section includes the four sizes of disposable standardized SNF canisters being developed by DOE, the Hanford MCO, and the disposable NNPP short and long SNF canisters. This section also identifies the interfaces between the disposable canisters and the waste packages into which they will be inserted. Appendix A, Table A-1 and the figures provided in Appendices B and C include the maximum dimensions of the disposable canisters, reference dimensions for interface with their respective waste packages, and mechanical handling interfaces for the canisters. Notes on the figures provide limiting values for canister weights and centers of gravity, materials of construction, and other interface parameters.

Section 11 is reserved.

Section 12 identifies the interfaces between the DOE-owned, commercial-origin fuel and the repository surface facilities and the disposable canister into which they will be loaded and then emplaced. This section identifies the maximum SNF assembly envelopes by nuclear plant SNF type and current location.

Section 13 identifies the interfaces between the disposable HLW canisters and the repository surface facilities and systems. Appendix A, Table A-1 and the figures provided in Appendix C document the HLW interfaces.

Section 14 lists the references.

4. QUALITY ASSURANCE

The OCRWM QA program applies to this document. Interface control agreements recorded in this document support the development of repository facility and waste package designs. IICD-1 identifies critical interfaces or parameters among items on the repository *Q-List* (BSC 2005a). Regarding the *Q-List* (BSC 2005a), the QARD (DOE 2007a), and various procedures referenced in this section and throughout the document, the latest version will be used when implementing requirements contained herein. The WCO sites effectively comply with the latest version of the QARD as long as they have completed the matrix evaluations of newer versions and have shown there is no impact.

Repository surface facility design items were analyzed and received a QA classification in *Classification of the MGR Canister Transfer System* (CRWMS M&O 1999a). The QA classifications were also conducted for the DOE SNF, HLW, and naval SNF waste packages (CRWMS M&O 1999b, 1999c, and 1999d, respectively). The results of the classification analysis were used in the *Q-List* (BSC 2005a). Permanent items identified during further development of the repository surface facility designs will also be analyzed and classified. The current analysis does not include items at the component level necessary for IICD-1. IICD-1 will not address the classifications of these component-level items at this time.

IICD-1 describes design inputs for quality-affecting items; thus, IICD-1 is a quality-affecting document. This document was developed in accordance with LP-3.36Q-OCRWM, *CRWMS Technical Requirements Documents and Integrated Interface Control Documents Preparation and Approval.* The specific activities involved with the production of this document meet the applicable requirements of *Quality Assurance Requirements and Description* (DOE 2007a). Specific activities involved with the review of this document have been performed in accordance with LP-6.1Q-OCRWM, *Document Review.*

Many design inputs identified in IICD-1 are preliminary in that they are bounding space envelopes that will be satisfied when the designs are completed, such as for the naval SNF transportation system. These preliminary inputs are only generally identified in IICD-1 and will require subsequent confirmation (or superseding inputs) as the transportation systems, disposable canisters, and repository surface facility and waste package designs evolve toward final design. IICD-1 does not directly support OCRWM construction, fabrication, or procurement activities.

Source documents for transportation systems identified in IICD-1 include safety analysis reports (SARs), final design reports (FDRs), preliminary design reports, and published industry documents. The SARs and FDRs for transportation systems developed by commercial enterprises to support the License Application to the NRC were developed under an NRC-approved QA program and are considered valid input. The SARs and FDRs developed by DOE contractors to support certification by a DOE Headquarters certifying officer were developed under a DOE QA program that was not NRC approved, and information taken from these is considered existing data. These existing data as used in IICD-1 do not directly affect the resolution of safety or waste isolation issues and are not used for manufacturing, procurement of hardware, inspection of manufactured items, or assembly; therefore, they do not require tracking as "to be verified" information. Information accepted by the scientific and engineering community as established fact (e.g., engineering handbooks and density tables) (DOE 2007a) is considered accepted and requires no further qualification. Codes, standards, and regulations listed in Section 14.2 are generally accepted by the scientific and engineering community and require no further qualification.

Transportation systems, disposable canisters, and associated documentation for shipping HLW, DOE SNF, and naval SNF to the repository will be developed by OCRWM and DOE-EM under a QA program that meets the requirements of the QARD (DOE 2007a), as agreed to in the MOA between the respective organizations (DOE 2007b, Section IV). OCRWM has reviewed and found the NNPP QA Program to be acceptable for work conducted by, and under the direction of, the NNPP. The requirements of the NNPP QA Program shall continue to be defined and administered solely by the NNPP in accordance with the statutory requirements of Presidential Executive Order 12344, enacted as Public Law 98-525 (42 USC 7158), and Public Law 106-65 (50 USC 2406). Data generated in accordance with the requirements of the NNPP QA Program and used to support the acceptance of naval SNF for storage or disposal is considered qualified data (Bowman and Itkin 2000, Section IV and Appendix E).

5. ASSUMPTIONS

The current repository surface facilities and waste package designs are not finalized. A definitive list of transporters and transportation systems to be received at the repository does not currently exist; transportation strategies are being developed for this future activity. Operational scenarios may differ from the current concepts of operations (CRWMS M&O 1997). This section identifies assumptions applicable to interfaces addressed in IICD-1.

5.1 BASIC ASSUMPTIONS

The following basic assumptions are applicable to all interfaces addressed in IICD-1:

1. All dimensions are measured at a temperature of 70°F ± 8°F unless otherwise specified.

2a. Repository surface facilities design is based on receiving transportation system casks in a horizontal orientation, rotating casks to a vertical orientation (either while still on their conveyance or after removal from their conveyance), and then handling the casks while in the vertical orientation. After removing the transportation cask from the transporter, this vertical-handling concept includes moving and lifting transportation casks, removing canisters from transportation casks, and loading canisters into waste packages.

2b. Repository surface facilities design is also based on receiving casks transporting uncanistered DOE-owned SNF of commercial origin in a horizontal orientation. The casks are rotated to a vertical orientation, and then handling of the casks occurs while they are in a vertical orientation. After removing the transportation casks from the transporter, this vertical-handling concept includes moving and lifting transportation casks; removing DOE-owned, commercial-origin fuels from transportation casks; and loading DOE-owned, commercial-origin fuel assemblies into disposable canisters for subsequent placement into waste packages.

5.2 SPECIFIC ASSUMPTIONS

The following specific assumptions were used to develop IICD-1:

1. While heavy-haul trucks may be used to move transportation casks to a railhead for shipment to the repository, they will not be used within the State of Nevada. This is consistent with the DOE Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV (69 FR 18557):

    > In particular, the Department has decided to select the mostly rail scenario analyzed in the Final Environmental Impact Statement (EIS) as the transportation mode both on a national basis and in the State of Nevada. Under the mostly rail scenario, the Department would rely on a combination of rail, truck, and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 MTHM of spent nuclear

fuel and high-level radioactive waste, with most of the spent nuclear fuel and high-level radioactive waste being transported by rail.

2. Only rail will be used to ship naval transportation casks to the repository. This is consistent with the DOE Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV (69 FR 18557), as quoted in Assumption 1 above.

3. Rail transportation casks acquired by DOE for use in the CRWMS will be delivered to the repository on intermodal handling skids. To fulfill the DOE preference for shipping nuclear waste by rail, the transportation skid allows pickup and delivery of rail transportation casks at locations lacking railroad tracks, such as some commercial nuclear reactors and independent spent fuel storage installations, using, for example, heavy haul trucks. Although this performance specification does not strictly apply to EM casks and transportation, it is intended not to rule out possible use of cask systems procured for commercial nuclear reactors and independent spent fuel storage installations at EM sites. Truck casks will be delivered without handling skids.

4. The HLW and DOE SNF, except possibly for some DOE-owned SNF of commercial origin, will be shipped in disposable canisters by rail as the preferred method of shipment. The HLW and EM SNF may also be shipped by truck. This is consistent with the DOE Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV (69 FR 18557), as quoted in Assumption 1 above.

5. Development and use of transportation systems generally include a provision for handling equipment and tools. OCRWM and EM will pursue (with the repository) standardization of the transporters and transportation systems handling equipment, including trunnions and tools, to lower radiological doses received during manual handling operations and to achieve higher throughput rates than would result without standardization.

6. The contents of SNF canisters will not require handling at the repository, because the canisters are sealed and ready for disposal prior to shipment. As a precautionary measure, internal configuration details of the canister contents will be included with the SNF data package provided by EM to OCRWM to assess handling capability during off-normal events.

7. A welded cover will be installed over the top of the mechanical closure before the Hanford MCO is shipped to the repository (See Figure C-5). During shipping, the MCO may have a temporary fixture to ensure that the MCO survives hypothetical transportation accidents. If present, this fixture would be removed at the repository before the MCO is placed in a waste package.

8. Both the long and short naval SNF canisters are disposable canisters that will be shipped to the repository with welded covers/lids in accordance with acceptance criteria contained in the *Waste Acceptance System Requirements Document* (WASRD) (DOE 2007d) and the *Naval Nuclear Propulsion Program Technical Baseline Compliance Document, Revision 2 S5G Only* (NNPP 2006).

9. A total 1,464 Fort Saint Vrain reactor SNF assemblies stored in 244 dedicated carbon steel canisters at a facility in Colorado and an additional 744 assemblies stored at the INL (Denney 1998, Attachment 1) will be removed from the carbon steel canisters and repackaged into the 18-in.-diameter DOE standardized SNF canisters. Fort Saint Vrain carbon steel canisters are not interfaces in IICD-1. This is in accordance with acceptance criteria contained in Section 4.2.3, "Determination of Which SNF and HLW Are to be Canistered," Part A, "DOE-Managed SNF," of the WASRD (DOE 2007d).

10. The Three Mile Island-2 (TMI-2) debris canisters will be placed into the 18 in. diameter standardized canisters. The TMI-2 canisters are not interfaces in IICD-1. This is in accordance with acceptance criteria contained in Section 4.2.3, "Determination of Which SNF and HLW Are to be Canistered," Part A, "DOE-Managed SNF," of the WASRD (DOE 2007d).

11. Uncanistered DOE-owned SNF of commercial origin and DOE canisters will be required to meet OCRWM acceptance criteria, as documented in the WASRD (DOE 2007d). The reference repository surface facility design will handle canisters of DOE and naval SNF and uncanistered DOE-owned SNF of commercial origin.

12. Shippingport PWR-Core 2 blanket SNF stored at DOE's Hanford Reservation is packaged into MCOs and is handled as DOE-owned SNF.

13. Nonstandard, consolidated commercial SNF assemblies are packaged into standardized canisters prior to disposition to facilitate handling, storage, and disposal.

14. The INL Materials and Fuels Complex is treating sodium-bonded DOE SNF in an electrometallurgical treatment process and placing the resultant canned material waste forms into the DOE standardized SNF canisters. The DOE standardized SNF canister interfaces are addressed in IICD-1. This material, owned by the DOE Office of Nuclear Energy, is not currently in the repository baseline.

15. All disposable canisters received containing naval and DOE SNF will have been evaluated to demonstrate that they meet applicable disposability requirements for disposable canisters.

These assumptions assist in establishing the interfaces necessary to develop the repository surface facility designs that otherwise result from the preliminary facility design, transportation system information, and facility operations. Further development of the strategy for transporting SNF and HLW to the repository may change these assumptions. Determination of which transporters and transportation systems will be received at the repository for DOE or naval SNF may also change these assumptions. IICD-1 will be revised as these assumptions are solidified and the transportation system and repository surface facility designs mature.

6. RELATED DOCUMENTATION

The *Civilian Radioactive Waste Management System Requirements Document (CRD)* (DOE 2007e) specifies top-level requirements for the CRWMS. Specifically, Section 3.1.2-D of the CRD states that all CRWMS elements shall be capable of accepting, transporting, and disposing of DOE HLW and SNF and of accepting and disposing of naval SNF from the Producer/Custodian site to the repository.

Section 3.2.1-H of the CRD requires that the CRWMS design shall comply with the agreements established under IICD-1 to ensure:

1. Compatibility of DOE-owned SNF and HLW waste forms with repository surface facility interfaces, including canister-handling interfaces

2. Compatibility between transportation equipment and transported items with mechanical interfaces and envelope interfaces.

Section 3.2.1-I of the CRD states that "[t]he 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."

Section 3.3-C of the CRD further states that "[a]cceptance 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 [Nuclear Waste Policy Act]." Appendix A, Table A-1, I-30 through I-33 and Figure C-9 of IICD-1 provide details on WVDP canister interfaces. IICD-1 satisfies these requirements as they apply to interfaces between EM and OCRWM and NNPP and OCRWM.

The Memorandum of Agreement for Acceptance of Department of Energy Spent Nuclear Fuel and High-Level Radioactive Waste (DOE 2007b) documents the responsibilities of each organization relative to the packaging, transportation, and disposal of DOE SNF and HLW. Section V.E.3 of the Memorandum of Agreement (DOE 2007b) identifies responsibilities for controlling IICD-1 by including EM as an ad hoc member of the OCRWM Program Baseline Change Control Board for changes to the OCRWM and EM interface documents (IICD-1). Roles and responsibilities, include OCRWM's responsibility to design, certify, and acquire the transportation system for transportation of DOE SNF and HLW.

The Memorandum of Agreement for Acceptance of Naval Spent Nuclear Fuel (Bowman and Itkin 2000) exists between NNPP and OCRWM. IICD-1 documents the responsibilities of each organization relative to the packaging, transportation, and disposal of naval SNF. The subagreement on the "Naval SNF Technical Baseline" (Bowman and Itkin 2000, Appendix C) identifies responsibilities for controlling this IICD through ad hoc member participation in the OCRWM Program Change Control Board for initial issuance and changes to the OCRWM/NNPP interface documents (IICD-1).

7. TRANSPORTATION SYSTEM INTERFACES WITH WASTE CUSTODIAN ORGANIZATIONS AND REPOSITORY FACILITIES

Transportation systems consist of rail cars, skids, casks, impact limiters, personnel barriers, and hold-down equipment. Transportation cask systems (the cask and impact limiters) are designed, NRC certified, and fabricated in accordance with 10 CFR Part 71.

7.1 GENERAL TRANSPORTER INFORMATION

Transporters are rail or truck vehicles that will be used to move casks to the repository and are required to meet all applicable federal and state transportation regulations. Truck transporters will meet the U.S. Department of Transportation and other affected state (including Nevada) departments of transportation LWT requirements.

The U.S. Department of Transportation and the State of Nevada Department of Transportation regulations contain requirements that the loaded transporter must meet. The loaded transporter refers to the transporter vehicle, its load (i.e., the skid, cask, impact limiters, and personnel barriers), and the auxiliary equipment provided on the transporter.

OCRWM is currently developing concepts for providing transportation services for transporting HLW and DOE SNF to the repository. The transporter information provided in this section provides input for design of the repository surface facilities.

Empty transportation casks on transporters will be delivered to the DOE sites and brought into various facilities for loading. The transportation casks will be removed from the transporter, loaded with DOE SNF canisters, DOE-owned SNF of commercial origin, and/or HLW canisters and replaced on the transporters. The loaded transporters will then be shipped to the repository. Loaded transporters will be received at the repository and brought into various facilities for preparing and removing the transportation system cask from the transporter. The onsite transportation infrastructure connects the offsite transportation system infrastructure with the onsite facilities necessary to receive SNF and HLW.

Transportation responsibilities are provided in the MOAs for DOE SNF and HLW (DOE 2007b) and for naval SNF (Bowman and Itkin 2000). OCRWM will provide transportation casks, transporters, and transportation services for DOE SNF and HLW, whereas the NNPP will provide its own casks and transportation to the repository.

7.2 TRANSPORTATION CASKS

Preliminary bounding information on cask dimensions and weights is provided in Figure B-4 for the CRWMS transportation system cask for HLW and DOE SNF and in Figure C-2 and I-3 in Table A-1 for the naval SNF canister rail transportation cask.

Figure B-1 shows the bounding information regarding the CRWMS LWT transportation system, which includes the cask, trailer, and prime mover. The overall maximum system weight is 80,000 lb. The weight and dimensions of the truck cask alone are not currently known.

7.3 TRANSPORTERS

Transportation casks shipped to the repository by rail will be delivered on a flatbed or a drop-center railcar; only railcars bearing loaded casks or intended to receive unloaded casks will enter the geologic repository operations area. Maximum dimensions of the railcars to be used for design purposes are presented in Table 1. These values presented were obtained by reviewing the "Heavy Duty Flat Cars" section of *The Car and Locomotive Cyclopedia of American Practices* (Kratville 1997) for flat cars with a 200-ton capacity in lieu of established envelope dimensions. These enveloping values will be updated as knowledge of conveyance characteristics mature.

As noted in Section 7.2, Figure B-1 shows information regarding the CRWMS LWT transportation system, which includes the cask, trailer, and prime mover. For the LWT transporter, only the maximum trailer length and width are known (in accordance with 23 CFR Part 658).

Table 1. Envelope Values

Characteristic	Maximum Value
Railcar width	128 in. (AAR 1992, Plate F)
Railcar outside length, estimated	90 ft
Railcar deck height above rails	Not currently available
Flatbed trailer width	102 in. (23 CFR 658.15)
Flatbed trailer length	48 ft (23 CFR 658.13)
Flatbed trailer deck height	Not currently available

AAR = Association of American Railroads

7.4 HANDLING SKID

The concept of a removable handling skid will support commercial SNF shipments to the repository. As of this revision to IICD-1, no agreements are established for use of a handling skid for HLW and DOE SNF shipments.

Standard skid-lifting points will be specified that will facilitate transfer of the supported casks between conveyances and cask transfer trolley. The skid to be developed may include other features that facilitate cask handling (e.g., the capability to support cask rotation between horizontal and vertical orientations and stowage of removed impact limiters). Arrangements for support of the casks on the skid and other capabilities will be customized to suit the specific cask design being delivered. Casks will be attached to skids in a horizontal orientation. The cask and skid will be mounted on the railcar such that the major axis of the cask aligns with the direction of travel. Additional details on the handling skid design will be made available as they are developed.

7.5 TRANSPORTER AND WASTE CUSTODIAN ORGANIZATION FACILITY INTERFACES

Envelope interfaces for the loaded transporter with WCO facilities are provided in the figures in Appendix B.

The maximum envelope for a loaded LWT transporter that will be accommodated by EM sites for their SNF and HLW is shown as an interface in Figure B-1. The envelope for a loaded railroad transporter for EM sites for their SNF and HLW is shown as an interface on Figure B-2. The maximum envelope for a loaded OWT transporter that will be accommodated by EM sites for their SNF and HLW will be shown as an interface in Figure B-3. Naval SNF will not be shipped using LWT or OWT transporters, as discussed in Section 5.2, Assumption 2.

7.6 TRANSPORTER AND REPOSITORY FACILITY INTERFACES

Interfaces for the transporter with the repository facilities would be similar to those discussed in Section 7.5 (Figures B-1, B-2, and B-3 in Appendix B). The maximum envelope for a loaded railroad transporter that must be accommodated by the repository for naval SNF is shown as an interface on Figure C-1, which is interface I-1 in Table A-1. The height and width dimensions are from *Manual of Standards and Recommended Practices*, Plate F (AAR 1992, p. C-255). Swing-out at the ends and center of the car also meets the requirements of AAR Plate F (AAR 1992). Future revisions of IICD-1 will include the minimum radius for the OWT. The maximum envelope for a loaded, OWT transporter that may be accommodated by the repository security gates and generic building doors and setbacks will be shown as an interface on Figure B–3. The dimensions for the OWT transporter are not yet available. Repository auxiliary equipment and parking area interfaces are currently bounded by the repository designs for the generic building doors and setbacks and are not shown separately.

8. TRANSPORTATION SYSTEM PACKAGING ITEMS TO SURFACE FACILITY INTERFACES

This section defines the transportation system packaging equipment to be provided with the transportation casks and transporters for transporting HLW and DOE and naval SNF. The transportation system packaging information in this section provides input for design at the EM sites and the repository.

8.1 PERSONNEL BARRIERS

Personnel barriers are cages generally placed around the transportation system cask body and between the impact limiters to restrict personnel access to the cask surface. Personnel barriers will be included as part of the OCRWM and NNPP transportation systems, as applicable. They are removed and reinstalled at the EM or NNPP facilities to facilitate cask loading. Personnel barriers are removed or retracted from around the cask in surface facilities at the repository. Personnel barrier details, such as fastener and lifting connection dimensions for transportation systems to be used to ship HLW and DOE and naval SNF, are not currently available based on the stage of transportation system design or specification. Since personnel barrier details are not currently available, interface parameters are not included at this time.

8.2 IMPACT LIMITERS

Impact limiters are energy-absorbing cylindrical, conical, or domed structures affixed at the ends of the transportation system casks during shipment. They will be included as part of the transportation system by OCRWM or NNPP, as applicable. The impact limiters are removed and reinstalled, as required, at the EM or NNPP facilities following cask loading. Impact limiter details, such as fastener and lifting connection dimensions for transportation systems to be used to ship HLW and DOE and naval SNF, are not currently available based on the stage of transportation system design or specification. Since impact limiter details are not currently available, only interface bounding dimensions for impact limiters are shown on Figures B-4 and C-2.

8.3 HOLD-DOWN FEATURES

Hold-down features are used to restrain the movement of the cask. They may consist of straps circling the cask body that are bolted to the skid or pillow blocks or clamps that are bolted around the cask trunnions. The hold-down features will be included as part of the transportation system by OCRWM or NNPP, as applicable. The hold-down features are removed and reinstalled at the EM or NNPP facilities to facilitate cask loading. The hold-down feature details, such as fastener and lifting connection dimensions for transportation systems to be used to ship HLW and DOE and naval SNF, are not currently available based on the stage of transportation system design or specification. Since hold-down feature details are not currently available, interface parameters are not included at this time.

9 TRANSPORTATION SYSTEM CASK TO SURFACE FACILITY INTERFACES

9.1 TRANSPORTATION SYSTEM CASK INFORMATION

The Memorandum of Agreement between DOE-RW and DOE-EM (DOE 2007b) specifies that the OCRWM Transportation element shall be responsible for the design, NRC certification, and fabrication of the transportation cask system for DOE SNF canisters, uncanistered DOE SNF, and HLW in accordance with 10 CFR Part 71. DOE-EM will be responsible for providing DOE-RW with DOE SNF and HLW characterization data of sufficient quality to support the design, NRC certification, and fabrication of the transportation cask system for DOE SNF canisters, uncanistered DOE SNF, and HLW in accordance with 10 CFR Part 71.

The Memorandum of Agreement for Acceptance of Naval Spent Nuclear Fuel (Bowman and Itkin 2000) between the NNPP and DOE-RW specifies that NNPP shall be responsible for the design, NRC certification, and fabrication of the transportation casks for naval SNF in accordance with 10 CFR Part 71.

9.2 CASK CONDITIONS FOR RETURN TO SERVICE

Casks will conform to all applicable provisions of the Certificate of Compliance.

Casks will conform to U.S. Department of Transportation requirements for the packaging and transportation of Class 7 (radioactive) materials in accordance with 49 CFR 173, Subpart I (49 CFR 173.401 through 49 CFR 173.477).

The interior of unloaded casks shall be visually inspected prior to closure and shall be free of debris and other foreign material to the extent practicable.

Transportation casks and transporters will be prepared for return to service in accordance with radiation level limitations specified in 49 CFR 173.441.

In accordance with 10 CFR 71.87(i), the level of nonfixed radioactive contamination on the external surfaces of each transportation cask shall be as low as reasonably achievable.

The accessible external surfaces of the cask, impact limiters, personnel barrier, tie-down, transport frame, and transport vehicle shall be surveyed prior to shipment from the repository for removable radiological contamination in accordance with 49 CFR 173.443(a).

Hand wiping or another acceptable method that will not spread removable contamination will be used to remove localized contamination before any automatic washing.

Appropriate radioactive materials labels, and placards will be provided and installed before a vehicle departs the repository in accordance with 49 CFR 172, Subpart F.

9.2.1 Casks Used to Transport Sealed Canisters

To the extent possible, casks used to transport sealed canisters will be used exclusively for sealed canister transport to minimize internal cask radiological contamination and will not be used to transport uncanistered (bare) SNF.

Operations at the repository unloading facility will be conducted in such a manner as to limit the potential for cross-contaminating NNPP transportation casks and transport railcars. In addition to the requirements of 10 CFR 71.87(i) and 49 CFR 173.443, NNPP casks and transport railcars shall be returned only after external and internal radiological survey results show no more than 1,000 disintegrations per minute (dpm)/100 cm^2 for nonfixed beta- and gamma-emitting radionuclide contamination and 110 dpm/100 cm^2 for all alpha-emitting radionuclide contamination (NNPP 2006). The procedure used to conduct the return radiological survey and the equipment and methods used for decontamination—should decontamination be required—will be finalized after NNPP and OCRWM have reached a mutual agreement.

For all other casks used to transport sealed canisters from EM sites, and in accordance with 10 CFR 71.87(i), the level of nonfixed radioactive contamination on the external surfaces of each transportation cask shall be within the limits specified in 49 CFR 173.443(a). Internal nonfixed radioactive contamination shall not exceed wipe limits of 22,000 dpm/100 cm^2 for beta- and gamma-emitting radionuclides and 2,200 dpm/100 cm^2 for alpha-emitting radionuclides (DOE 1996).

9.2.2 Casks Used to Transport Bare SNF

For unloaded casks used to transport uncanistered (bare) SNF, internal contamination shall be characterized to determine the constituents, total radioactivity, and chemical form in accordance with 49 CFR 172.203.

Unloaded casks being returned to the transportation system will contain no more fissile material than is allowable under the requirements of 49 CFR 173.453(a).

9.3 TRANSPORTATION SYSTEM CASK AND WASTE CUSTODIAN ORGANIZATION INTERFACES

Since final design options and details for shipping canistered waste forms to the repository have not been selected, the cask-specific interfaces are not included in this revision of IICD-1. Interfaces are expected to include the following items:

- Cask interface with EM sites' crane capacities
- Cask interfaces with EM sites' cranes' lift heights, including removing casks from transporters and loading canisters into casks
- Cask trunnion interface with EM sites' yokes
- Cask trunnion off-set interface with EM sites' yoke clearances

- Cask size interface with EM sites' facility corridors and doors
- Cask lid bolts interface with EM sites' manipulators and bolting tools or devices
- Cask lid interface with EM sites' lifting fixtures
- Cask vent and drain connection interfaces (if used) with EM sites' equipment (e.g., sampling instrumentation)
- Cask body interface with EM sites' decontamination equipment.

9.4 NAVAL NUCLEAR PROPULSION PROGRAM TRANSPORTATION SYSTEM CASK AND REPOSITORY INTERFACES

The NNPP is developing a specific naval SNF transportation system for shipping the short and long naval SNF canisters to the repository (McKenzie 2007a, McKenzie 2007b). The naval railroad transportation system and transporter interfaces with the repository are shown in Figure C-1 and as I-1 in Table A-1. The conceptual naval SNF transportation system cask is shown on Figure C-2 and as I-3 in Table A-1. All dimensions and weights are preliminary but will bound future repository design activities. Additional interface cask design details for handling naval SNF at the repository are not currently available.

The Initial Handling Facility (IHF) is the only facility that provides an interface with the naval transportation system to unload naval SNF canisters from transportation casks at the repository (DOE 2006). The IHF is designed to receive, unload, and return to service up to six naval transportation casks within a 6-week period following arrival at the IHF.

9.4.1 Naval Nuclear Propulsion Program Cask Interfaces with the Repository

NNPP and repository physical interfaces are provided in Figures C-1, C-2, and C-6.

NNPP and repository physical interfaces include the following:

- Cask interface with repository crane capacities.
- Cask interfaces with repository crane lift heights, including for removing casks from transporters and removing canisters from casks for naval SNF and the repository cranes. This interface will be detailed following issuance of the naval cask specification.
- Cask uprighting equipment interface with repository crane.
- Cask size interface with repository facility corridors and doors.
- Cask lid bolts interface with repository manipulators and bolting tools or devices.
- Cask lid interface with repository lifting fixtures.

- Cask vent interfaces with repository equipment (e.g., sampling instrumentation).
- Cask body interface with repository decontamination equipment.

9.4.2 Naval Nuclear Propulsion Program Cask Ancillary Equipment Interfaces with the Repository

Reserved.

9.5 DIVISION OF NAVAL NUCLEAR PROPULSION PROGRAM AND REPOSITORY RESPONSIBILITY FOR ANCILLARY EQUIPMENT–NAVAL NUCLEAR PROPULSION PROGRAM CASK SYSTEM

Ancillary equipment comprises those tools, fixtures, stands, and other equipment needed to handle the cask and process its contents. Table 2 presents a list of ancillary equipment and the system element having responsibility for each item. Responsibility includes obtaining the item (making the build vs. buy decision) and training users.

Table 2. Division of Responsibility between OCRWM and NNPP for Ancillary Equipment for M-290 Cask Handling

Description of Ancillary Equipment or Item	Responsible Organization			
	OCRWM		NNPP	
	Design	P&C*	Design	P&C*
Railcar Securing Turnbuckles			✓	✓
Railcar Jack Stands			✓	✓
Cask Lifting Plate, Bail, and Pin			✓	✓
Cask Pivot Upending Stand and Adapter			✓	✓
Upending Station Floor Area	✓	✓		
Spent Fuel Canister Lifting Adapter for use with Canister Transfer Machine	✓	✓		
Cask Transfer Trolley Pedestal	✓	✓		
Miscellaneous Rigging	✓	✓		
Common Tools	✓	✓		

NOTES: * P&C = Procurement and construction or installation, as applicable. Note: This indicates the most likely assignment of responsibility. Final determination of responsibility will be made when facility and equipment designs are available.

9.6 TRANSPORTATION SYSTEM CASK AND NEVADA RAIL INTERFACES

Since the appropriate design options and details for the NNPP and OCRWM transportation cask system and Nevada Rail are not completed, specific interfaces are not included in this version of IICD-1. These transportation system information needs could apply to both the proposed Nevada Rail/National Transportation System interface at Caliente and the Nevada Rail/Rail Equipment Maintenance Yard (REMY) interface adjacent to the repository. This interface is listed using the identifier I-2 in Table A-1. Expected, but currently unavailable, interfaces to be documented in the future include the following items:

- Rail cars with additional information, including length over pulling faces, wheel spacing per truck and wheel spacing between trucks, spacing between truck pivots, distance over truck centers, light weight of rail cars, deck height, and maximum gross weight (actual load and rail car weight on rail).
- Configuration for the maximum number of casks shipped at one time and the train, including the number of locomotives, buffer cars, cask cars, and security escort cars, and including weight on rail, length over pulling faces, weight on rail (lb), and distance over truck centers.
- The REMY will be designed to provide car/locomotive turnaround to accommodate positioning orientation prior to entering the Cask Receipt Security Station.
- The REMY will include a spur track for parking the locomotive, cask rail cars (transporters), buffer cars, and escort car(s).
- The REMY will include lodging and crew change for escort personnel.
- Nevada Rail will furnish a road adjacent to the branch rail line from the REMY to the interface point with the site rail system near the Cask Receipt Security Station in support of security needs.
- Additional repository rail security and operational interfaces for transfer of SNF cognizance remain to be defined.

9.7 TRANSPORTATION CASK AND REPOSITORY INTERFACES

The CRWMS transportation system casks are described in Section 7.2. The truck cask is shown in Figure B-1, and the rail cask is shown in Figure B-4.

10. DISPOSABLE SNF CANISTERS TO REPOSITORY SURFACE FACILITY INTERFACES

The HLW and SNF received at the repository from EM, NNPP, and WVDP will be received in disposable canisters, with the possible exception of DOE-owned, commercial-origin fuel. Disposable canisters, including basket assemblies, meet postclosure geologic disposal requirements and are suitable for direct insertion into the waste packages. Disposable canisters eliminate the need for handling individual SNF assemblies at the repository. EM and NNPP currently envision using several disposable canister designs to ship SNF and HLW to the repository.

Each of the SNF canister designs, identified in Section 2, is discussed in Section 10. The DOE-owned, commercial-origin fuel canisters are discussed in Section 12, and HLW canisters are discussed in Section 13.

Each subsection refers to appropriate interfaces listed in Table A-1 in Appendix A and figures in Appendix C for dimensions and constraints. Table A-1 and the figures in Appendix C contain details of the canister interfaces with the applicable waste packages, the canister-handling fixtures, the canister staging racks, and other facility interfaces, as applicable. A summary of these interfaces is provided in Table 3. Canister and Waste Package interfaces are also graphically displayed in Figure 1.

10.1 DISPOSABLE DOE STANDARDIZED SNF CANISTERS

10.1.1 General Standardized SNF Canister Information

Loaded DOE standardized canisters containing various DOE SNF waste forms must have the capability to stand upright on a flat, horizontal surface. Disposable DOE standardized SNF canisters, with their impact-absorbing skirts, are right-circular cylinders with the following nominal dimensions:

- 18 in. diameter by 10 ft long canister
- 18 in. diameter by 15 ft long canister
- 24 in. diameter by 10 ft long canister
- 24 in -diameter by 15 ft long canister.

The DOE 18 in. standardized SNF canisters may be placed in the center of a codisposal waste package (termed "center location canisters" or "CLCs"). The DOE 24 in. SNF standardized canisters may be placed outside the center of a codisposal waste package, where they are interchangeable with HLW canisters (termed "outside location canisters" or "OLCs"). When a 24 in. standardized SNF canister is placed in the outside location of a codisposal waste package, no 18 in. SNF canister would be placed in the center location. Each codisposal waste package is limited to zero or one 18 in. standardized SNF canister.

Table 3. Summary of Disposable Canister Interfaces with the Repository[1]

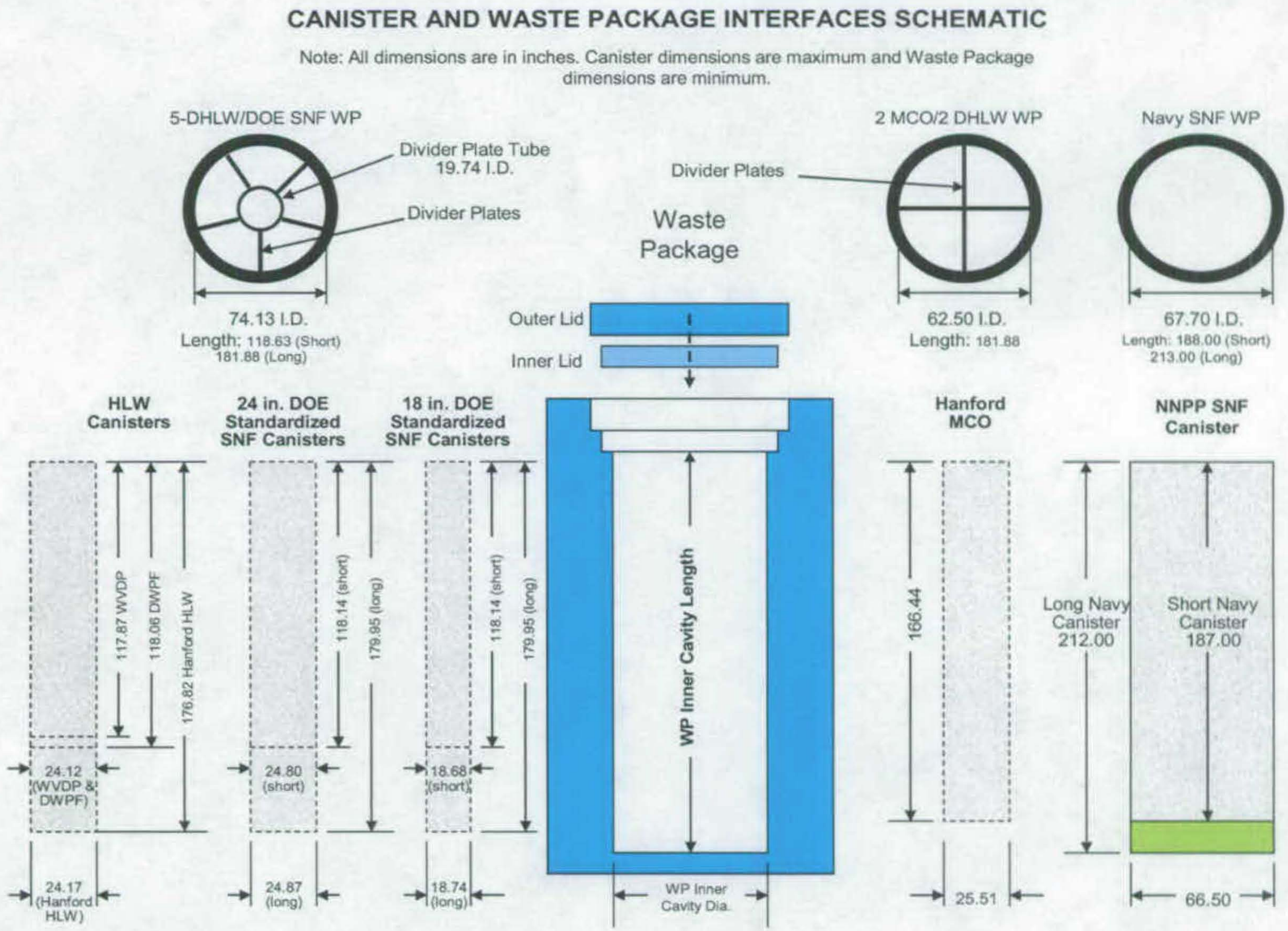
Disposable Canisters				Waste Packages						
Canister Type	Maximum Diameter, in.	Maximum Length, in.	Maximum Weight, lb	Waste Package Type	Inner Cavity I.D., in.	Divider Plate Tube I.D., in.	Inner Cavity Length, in.	Lifting Fixture	Staging Rack	Interface Identifier
18 in.-O.D. by 10 ft long DOE Standard SNF Canister	18.68	118.14	5,005	5-DHLW/DOE SNF-Short	74.13	19.74	118.63	CRCF 18 in. Grapple	CRCF 1 DOE Canister Staging Rack	I-4, I-5, I-6, I-13
18 in.-O.D. by 15 ft long DOE Standard SNF Canister	18.74	179.95	6,000	5-DHLW/DOE SNF-Long	74.13	19.74	181.88	CRCF 18 in. Grapple	CRCF 1 DOE Canister Staging Rack	I-4, I-5, I-7, I-13
2 -in.-O.D. by 10 ft long DOE Standard SNF Canister	24.80	118.14	8,996	5-DHLW/DOE SNF-Short	74.13	N/A	118.63	CRCF 24 in. Grapple	CRCF 1 DOE Canister Staging Rack	I-8, I-9, I-10, I-13
24 in.-O.D. by 15 ft long DOE Standard SNF Canister	24.87	179.95	10,000	5-DHLW/DOE SNF-Long	74.13	N/A	181.88	CRCF 24 in. Grapple	CRCF 1 DOE Canister Staging Rack	I-8, I-9, I-11, I-13
Hanford MCO Canister	25.51	166.44	20,220	2-MCO/2-DHLW	62.50	N/A	181.88	CRCF Hanford. MCO Grapple	CRCF 1 DOE Canister Staging Rack	I-12, I-13, I-14, I-15,
Naval SNF Short Canister	66.50	187.00	108,500	Naval Short	67.70	N/A	188.00	IHF Naval Lifting Adapter	N/A	I-16, I-17
Naval SNF Long Canister	66.50	212.00	108,500	Naval Long	67.70	N/A	213.00	IHF Naval Lifting Adapter	N/A	I-16, I-18
24 in.-O.D. by 10 ft-long DWPF HLW Canister	24.12	118.06	5,512	5-DHLW/DOE SNF-Short	74.13	N/A	118.63	CRCF/IHF DWPF/INL Grapple	CRCF 1 DOE Canister Staging Rack	I-19, I-20, I-23,

[1] Except for naval SNF canisters, all canister and waste package dimensions are at a temperature of 70°F ± 8°F. Naval canister dimensions include affects from a maximum internal gauge pressure of 20 pounds per square inch and a maximum external surface temperature of 350°F.

Table 3. Summary of Disposable Canister Interfaces with the Repository (Continued)

Disposable Canisters				Waste Packages						
Canister Type	Maximum Diameter, in.	Maximum Length, in.	Maximum Weight, lb	Waste Package Type	Inner Cavity I.D., in.	Divider Plate Tube I.D., in.	Inner Cavity Length, in.	Lifting Fixture	Staging Rack	Interface Identifier
24 in.-O.D. by 10 ft long WVDP HLW Canister	24.12	117.87	5512	5-DHLW/DOE SNF-Short	74.13	N/A	118.63	CRCF/IHF WVDP/ Hanford HLW Grapple	CRCF 1 DOE Canister Staging Rack	I-30, I-31, I-32, I-33
24 in.-O.D. by 15 ft long Hanford HLW Canister	24.1	176.82	9,260	5-DHLW/DOE SNF-Long 2-MCO/2-DHLW	74.13 62.50	N/A	181.88 181.88	CRCF/IHF WVDP/ Hanford HLW Grapple	CRCF 1 DOE Canister Staging Rack	I-21, I-22, I-24, I-25, I-26, I-27

NOTES: CRCF = Canister Receipt and Closure Facility; DHLW = defense high-level radioactive waste; I.D. = inside diameter; N/A =Not Applicable
O.D. = outside diameter



NOTES: I.D. = inside diameter; WP = waste package;

Figure 1. Schematic of Disposable Canisters and Waste Packages

Most of the SNF slated for standardized canisters will fit within either the 10-ft or 15-ft lengths of the 18-in.-diameter canisters (CRWMS M&O 1998c, Section 4.1.1.1, p. 6). The approved *Idaho Spent Fuel Project (ISF) ASME Code Design Specification for Spent Fuel Canister* (Foster Wheeler Environmental Corporation 2004) includes the 24-in.-diameter canister for those limited cases where the SNF will not fit within the 18-in.-diameter canister (e.g., the Shippingport light water breeder reactor fuel assemblies and the INL Materials and Fuels Complex electrometallurgical treatment waste forms). The INL is also considering the use of the 24-in.-diameter standardized SNF canister to dispose of their HLW, because this canister has been designed for relatively high drops.

Once the final INL HLW waste form has been determined, the use of this canister for HLW will be confirmed. Since the 24-in. standardized canister fits in the outer location of a waste package containing canistered SNF or HLW, the interface of using the 24-in. standardized canister for INL HLW is already being addressed in IICD-1.

10.1.2 Standardized SNF Canister[2] and Repository Interfaces

Figure C-3 and Table A-1, I-4 provides interfaces for the 18-in.-diameter standardized SNF canisters. The canister-lifting fixture interface is provided in Table A-1, I-5 for the 18-in.-diameter standardized canisters (both lengths having the same handling interface). Table A-1, I-6 and I-7 provide the dimensional interfaces for the 18-in.-diameter standardized SNF canisters and the waste package. Figure C-4 and Table A-1, I-8 provide interfaces for the 24-in.-diameter standardized SNF canisters. The canister-lifting fixture interface is provided in Table A-1, I-9 for the 24-in.-diameter standardized SNF canisters (both lengths having the same handling interface). Table A-1, I-10 and I-11 provide the dimensional interfaces for the 24-in.-diameter standardized SNF canisters and the waste package.

The DOE standardized SNF canisters must fit within various repository surface facility envelopes and handling equipment parameters as well as into the envelope in the appropriate waste package. The facility envelopes are primarily the small canister staging racks in the canister transfer system. The staging rack positions or cells are uniform and have the same dimensions. The length and diameter of the 24-in.-diameter standardized SNF canisters and the length of the 18-in.-diameter by 15-ft-long standardized SNF canister are bounded by other canisters; therefore, their interface with the staging rack is not shown. The largest-diameter canister interface with the staging rack is the MCO identified in Section 10.2 and Table A-1, I-13. The smallest SNF canister interface with the canister staging rack is with the 18-in.-diameter by 10-ft-long canister.

Weight restrictions for each of the DOE standardized canisters are identified on the corresponding figures and notes. The weights are based on the *Idaho Spent Fuel Project (ISF) ASME Code Design Specification for Spent Fuel Canister* (Foster Wheeler Environmental Corporation 2004). Although DOE provided handling details of the DOE standardized SNF canister (i.e., skirt and lifting ring dimensions), mechanical details for the handling fixture at the

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[2] Note: The final DOE standardized SNF canister will include some minor differences from the drawings shown in Figures C-3 and C-4, such as the possible addition of a second vent plug on the bottom of the canisters. This will not affect the physical or functional nterface characteristics contained in this document.

repository have not been provided for either the 18-in.-diameter or the 24 in. diameter SNF canisters. The lifting fixtures, however, are constrained to operate within the minimum diameter of the lifting ring of the canister.

In addition to waste packages, staging racks, and other handling equipment discussed above, canisters interface with aging casks (if necessary) and onsite transporters (if used to transfer canisters to the staging/storage area) for purposes of thermal management.

10.1.3 Thermal Design of Facilities and Equipment for DOE Standardized SNF Canisters

All systems designed to handle DOE standardized SNF canisters, during normal operations, shall ensure that canister wall temperatures do not exceed 315.5°C (600°F) in enclosed environments and 148.9°C (300°F) in open (air) environments (DOE 1999a, Section 3.2.10 (2.).

Compliance with the above requirements shall be shown to be achievable for any structure, system, or component that relies on the performance of the canister pressure vessel boundary. This includes activities from the loading of EM SNF into disposable canisters through final closure of the waste package.

10.2 HANFORD MULTICANISTER OVERPACK

10.2.1 General Hanford Multicanister Overpack Information

The Hanford MCO consists of a stainless-steel shell, a shield plug, and five or six fuel baskets for DOE SNF. *Multi-Canister Overpack Assembly (MCO)* (Gallagher 2005, Enclosure 2) provided MCO details. The MCO design includes a welded cover that would contribute to the canister's disposability. The MCO shall not be transported to the repository without the welded cover installed. Permanent labeling or markings must not exceed the maximum canister envelope dimensions (i.e., manufacturing tolerances). The MCO is a right-circular cylinder with the dimensions given on Figure C-5 and in Table A-1, I-12. The maximum weight of the MCO (20,220 lb.) is provided in Table A-1, I-14 and I-15.

10.2.2 Hanford Multicanister Overpack and Repository Interfaces

The MCO handling interface is a lifting ring on the cover. The canister cover is an integrally machined, axisymmetric lifting ring designed to support a 12-ton load when gripped with six equally spaced grippers. Each gripper must have a 50 mm (1.97 in.) tangential arc length and a 16.75-mm (0.66-in.) radial engagement length. The MCO canister cap details from the MCO mechanical closure canister cover (Gallagher 2005) that would interface with the repository lifting fixtures are provided in Figure C-5. In addition, the canister-handling fixture will operate within the nominal diameter of the canister cover. The MCO canister interfaces with the 2-MCO/2-DHLW waste package design are identified in Table A-1, I-15.

In addition to waste packages, staging racks, and other handling equipment discussed above, MCOs interface with aging casks (if necessary) and onsite transporters (if used to transfer canisters to the staging/storage area) for purposes of thermal management.

10.2.3 Thermal Design of Facilities and Equipment for Hanford Multicanister Overpacks

All systems designed to handle Hanford MCOs, during normal operations, shall ensure that canister wall temperatures do not exceed 132°C in either enclosed or open (air) environments.

Compliance with the above requirements shall be shown to be achievable for any structure, system, or component that relies on the performance of the canister pressure vessel boundary. This includes activities from the loading of EM SNF into disposable canisters through final closure of the waste package.

10.3 NAVAL NUCLEAR PROPULSION PROGRAM CANISTERS

10.3.1 General Naval Spent Fuel Canister Information

The NNPP plans to use two canisters, the short canister and the long canister, to ship their SNF to the repository for disposal by emplacement in Yucca Mountain (Guida 1997a and 1997b). Both naval SNF canisters will be disposable to prevent having to handle the naval SNF assemblies at the repository. These canisters will be disposed of in separate waste packages sized for each canister. Figure C-6 and Table A-1, I-17 and I-18 provide the interfaces of the short and long naval SNF canisters with the repository waste packages, including dimensions, tolerances, weights, center of gravity, fabrication materials, handling requirements, lifting fixtures, dose rates, and other restrictions that are available to date. The naval SNF canister handling interfaces with the repository lifting fixtures, which are shown on Figure C-6 (McKenzie 2007b) and Table A-1, I-16. Specific lifting-height limits for NNPP canisters (as well as for other waste forms) within casks, within waste packages, and when unconfined are specified in Appendix C of *Nuclear Safety Design Bases for License Application* (BSC 2005b). During handling at the repository, the naval SNF canister will not be stored or staged, but will be lifted from the transportation cask and placed directly into the corresponding waste package.

10.3.2 Naval Spent Fuel Canister and Repository Interfaces

10.3.2.1 Naval Spent Fuel Canister Criticality Control Performance

The surface facility and subsurface emplacement design and operational controls (such as nuclear isolation from other waste forms, moderator controls, and minimizing neutron reflection) shall ensure that the naval spent fuel canister criticality potential preclosure requirement identified in Section 10.A. of the *Naval Nuclear Propulsion Program Technical Baseline Document*, Revision 2, is met (NNPP 2006).

All areas that will handle bare naval SNF canisters or naval SNF canisters contained in an unsealed overpack (either waste package or transportation cask) will have sufficient moderator controls in place such that no event sequence with a mean probability of occurrence of at least 1 in 10,000 during the preclosure period will result in the accumulation of moderator within a breached naval SNF canister. (McKenzie 2007c)

Controls shall be incorporated so the only liquid neutron moderator materials present in any part of the IHF, where handling of naval SNF canisters either bare or contained in an unsealed overpack occurs, are water or other hydrogenous materials that are less effective moderators than water in the criticality calculations. As an alternative, the presence of hydrogenous materials that are effective moderators is only allowed when design features or administrative controls are implemented such that no event sequence with a mean probability of occurrence of at least 1 in 10,000 during the preclosure period will result in the accumulation of these hydrogenous materials in a breached naval SNF canister (McKenzie 2007c, Enclosure 1).

Controls shall be incorporated so the only liquid neutron moderator materials present in any part of the IHF, where handling of naval SNF canisters either bare or contained in an unsealed overpack occurs, are water or other hydrogenous materials that are less effective moderators than water in the criticality calculations. As an alternative, the presence of hydrogenous materials that are effective moderators is only allowed when design features or administrative controls are implemented such that no event sequence with a mean probability of occurrence of at least 1 in 10,000 during the preclosure period will result in the accumulation of these hydrogenous materials in a breached naval SNF canister. (McKenzie 2007c, Enclosure 1)

The surface facility and subsurface emplacement area design and operation will ensure that the only reflector materials that will be in close proximity to the naval SNF canister are (McKenzie 2007c, Enclosure 1):

1. Concrete or steel alloy material of any thickness.

2. Up to 5 inches of depleted uranium and 12 inches of polyethylene-based neutron shielding in close proximity to the naval SNF canister.

3. Five HLW canisters or one additional naval SNF canister, except in the emplacement drift, where a waste package will be placed on either end of the naval SNF canister.

4. Tuff in the emplacement drift.

The surface facility design will ensure that:

1. Any change that introduces lead into the IHF design (the design currently does not use lead), to include parts fabricated of lead or lead-glass, or requiring shield windows of any kind, shall be coordinated with the NNPP.

2. During normal operations, no more than two (2) naval spent fuel canisters will be present at a time in each IHF handling area.

3. The presence of more than two (2) SNF naval canisters in the same handling area has a probability of less than 1 in 10,000 during the preclosure period.

During underground emplacement, naval waste packages must be placed a minimum set back distance of two and one-half (2.5) meters (8.2 ft.) from mapped faults, which are determined to have a cumulative offset of at least 2 meters (6.6 ft.) (McKenzie 2007d) (SNL 2007, Section 6.11.2.2 and Appendix D, Section D.4).

10.3.2.2 Naval Spent Fuel Canister Thermal Performance

The surface facility design and operational controls (such as limiting combustion sources, natural or artificial cooling, and proximity to other heat sources) shall ensure that naval spent nuclear fuel time at temperature conditions are not exceeded as follows:

1. The IHF design and emplacement operational controls will be established to ensure that the analyzed naval SNF canister surface temperature will not exceed 400 °F from the time of detensioning the transportation cask closure until completion of emplacement of the naval waste package in the emplacement drift. The overall duration of these handling operations shall not exceed 30 days. (Harrington 2008)

2. OCRWM will implement design features and administrative controls sufficient for OCRWM to demonstrate that the mean frequency of breaching a naval SNF canister (Bettis Drawing 6253E73[3]) due to a fire is less than 1 in 10,000 over the preclosure period.

10.3.2.3 Naval Spent Fuel Canister Structural Performance

The surface facility design and operational controls (such as minimizing the probability and consequences of a drop and protection from external event sequences) shall ensure that any event sequence affecting the structural integrity of a naval spent fuel canister will meet the requirements of 10 CFR 63.111(b)(2).

The IHF design and operational controls will be sufficient for OCRWM to demonstrate that the mean frequency of breaching a naval SNF canister (Bettis Drawing 6253E73) is less than 1 in 10,000 for each preclosure initiating event over the preclosure period, including the following:

1. A flat bottom drop of the naval SNF canister into the open transportation cask or waste package from no more than 40 feet.
2. A drop of a canister lift adapter weighing no more than 5 tons onto the top surface of the naval SNF canister in an open transportation cask or waste package from no more than 10 feet.
3. A drop of a transportation cask containment cover or restraint onto the naval SNF canister inside an open transportation cask from no more than 40 feet.
4. A drop of a waste package inner vessel lid weighing no more than 2 tons onto the naval SNF canister inside an open waste package from no more than 40 feet.
5. A collision of a naval SNF canister against the inside surface of the canister transfer machine during horizontal transit of no more than 75 ft/min.

[3] McKenzie 2004

6. An IHF building collapse affecting the naval SNF canister or transportation cask.

7. Lightning strikes, tornadoes, missile impacts, high winds, and aircraft impacts affecting the naval SNF canister or transportation cask while in the IHF.

8. Any event sequence in the subsurface facility resulting in a waste package breach.

9. Any explosion, owing to any failure mode, which causes a breach of the naval SNF canister while in the IHF.

OCRWM will demonstrate that the following which are expected to occur at a frequency of less than 1 in 10,000 over the preclosure period (McKenzie 2007c, Enclosure 1):

1. An IHF building collapse affecting the naval SNF canister or transportation cask.

2. Lightning strikes, tornadoes, missile impacts, high winds, and aircraft impacts affecting the naval SNF canister or transportation cask while in the IHF.

3. Any event sequence in the Subsurface Facility resulting in a waste package breach.

4. Any explosion, owing to any failure mode, which causes a breach of the naval SNF canister while in the IHF.

10.3.2.4 Naval Spent Fuel Canister Surface Radiation

The gamma and neutron fluxes on the surface of the naval SNF canister to support OCRWM efforts to design the IHF are presented in Tables 4 and 5. These fluxes bound the surface radiation levels for naval SNF canisters that will be shipped to the repository (McKenzie 2007e).

The maximum on-contact total (gamma + neutron) radiation level at the top of the naval canister shall not exceed 100 mrem/hr, as stated in Figure C-6, Note 11.

Table 4. Gamma Fluxes (γ/cm²-s) on the Surface of the Naval Spent Nuclear Fuel Canister

Energy Group	Characteristic Energy (MeV)	Upper Energy (MeV)	Top, Above Bolt Hole	Top, 18 inches from Centerline	Top, Above Outer Seal Plate	Side	Bottom
1	3.60	3.85	$0.00000 \times 10^{+00}$	$0.00000 \times 10^{+00}$	$0.00000 \times 10^{+00}$	$2.10671 \times 10^{+01}$	$0.00000 \times 10^{+00}$
2	3.15	3.35	$0.00000 \times 10^{+00}$	$0.00000 \times 10^{+00}$	$0.00000 \times 10^{+00}$	$1.29411 \times 10^{+03}$	$0.00000 \times 10^{+00}$
3	2.80	2.95	$1.23009 \times 10^{+00}$	2.91294×10^{-02}	$1.23002 \times 10^{+00}$	$8.67060 \times 10^{+03}$	$2.23548 \times 10^{+02}$
4	2.50	2.65	$5.01767 \times 10^{+00}$	1.08170×10^{-01}	$5.23176 \times 10^{+00}$	$4.09057 \times 10^{+04}$	$1.01383 \times 10^{+03}$
5	2.19	2.35	$1.93284 \times 10^{+02}$	$3.20751 \times 10^{+00}$	$2.19586 \times 10^{+02}$	$2.32557 \times 10^{+06}$	$5.19896 \times 10^{+04}$
6	1.90	2.03	$1.30894 \times 10^{+02}$	$2.77436 \times 10^{+00}$	$1.49026 \times 10^{+02}$	$5.03901 \times 10^{+05}$	$2.09788 \times 10^{+04}$
7	1.67	1.77	$2.30833 \times 10^{+02}$	$3.65293 \times 10^{+00}$	$3.05049 \times 10^{+02}$	$4.31484 \times 10^{+06}$	$8.18985 \times 10^{+04}$
8	1.50	1.57	$1.76444 \times 10^{+02}$	$3.00276 \times 10^{+00}$	$2.45489 \times 10^{+02}$	$9.44611 \times 10^{+05}$	$5.53192 \times 10^{+04}$
9	1.37	1.43	$5.63392 \times 10^{+02}$	$1.76880 \times 10^{+00}$	$9.43432 \times 10^{+02}$	$4.22969 \times 10^{+07}$	$4.69540 \times 10^{+05}$
10	1.25	1.31	$7.74400 \times 10^{+02}$	6.86345×10^{-01}	$1.38833 \times 10^{+03}$	$4.49626 \times 10^{+07}$	$6.15540 \times 10^{+05}$
11	1.13	1.19	$9.21513 \times 10^{+02}$	$8.81196 \times 10^{+00}$	$1.81460 \times 10^{+03}$	$4.21077 \times 10^{+07}$	$6.54166 \times 10^{+05}$
12	1.01	1.07	$1.10796 \times 10^{+03}$	$2.00862 \times 10^{+01}$	$2.44191 \times 10^{+03}$	$5.65506 \times 10^{+07}$	$8.50114 \times 10^{+05}$
13	0.90	0.95	$1.03648 \times 10^{+03}$	$2.50676 \times 10^{+01}$	$2.51034 \times 10^{+03}$	$4.30085 \times 10^{+07}$	$7.86103 \times 10^{+05}$
14	0.80	0.85	$1.48094 \times 10^{+03}$	$2.27685 \times 10^{+01}$	$4.38780 \times 10^{+03}$	$5.94656 \times 10^{+08}$	$3.27078 \times 10^{+06}$
15	0.72	0.75	$1.04144 \times 10^{+03}$	$2.82791 \times 10^{+01}$	$3.43060 \times 10^{+03}$	$1.76096 \times 10^{+08}$	$1.80849 \times 10^{+06}$
16	0.66	0.69	$1.42240 \times 10^{+03}$	$1.03256 \times 10^{+02}$	$6.11474 \times 10^{+03}$	$1.54369 \times 10^{+09}$	$7.99660 \times 10^{+06}$
17	0.60	0.63	$1.79275 \times 10^{+03}$	$1.20323 \times 10^{+02}$	$8.46431 \times 10^{+03}$	$1.06995 \times 10^{+09}$	$7.52393 \times 10^{+06}$
18	0.51	0.57	$4.01027 \times 10^{+03}$	$1.60454 \times 10^{+02}$	$2.42157 \times 10^{+04}$	$1.98436 \times 10^{+09}$	$1.88491 \times 10^{+07}$
19	0.40	0.45	$3.53234 \times 10^{+03}$	$2.95556 \times 10^{+01}$	$2.51817 \times 10^{+04}$	$1.93166 \times 10^{+09}$	$2.08670 \times 10^{+07}$
20	0.30	0.35	$4.26574 \times 10^{+03}$	$1.00446 \times 10^{+03}$	$2.91605 \times 10^{+04}$	$2.14891 \times 10^{+09}$	$2.40771 \times 10^{+07}$
21	0.23	0.25	$9.22921 \times 10^{+03}$	$1.01881 \times 10^{+04}$	$2.26012 \times 10^{+04}$	$8.77862 \times 10^{+08}$	$9.94564 \times 10^{+06}$
22	0.195	0.21	$1.50509 \times 10^{+04}$	$1.75463 \times 10^{+04}$	$2.91706 \times 10^{+04}$	$6.03189 \times 10^{+08}$	$7.00907 \times 10^{+06}$
23	0.165	0.18	$1.57444 \times 10^{+04}$	$1.91316 \times 10^{+04}$	$3.23303 \times 10^{+04}$	$5.26271 \times 10^{+08}$	$6.10038 \times 10^{+06}$
24	0.135	0.15	$1.53245 \times 10^{+04}$	$1.92260 \times 10^{+04}$	$3.19147 \times 10^{+04}$	$4.02718 \times 10^{+08}$	$4.53269 \times 10^{+06}$
25	0.0645	0.12	$1.10382 \times 10^{+04}$	$1.42917 \times 10^{+04}$	$2.33927 \times 10^{+04}$	$1.89471 \times 10^{+08}$	$2.13930 \times 10^{+06}$
26	0.070	0.09	$3.20822 \times 10^{+03}$	$4.23850 \times 10^{+03}$	$6.79654 \times 10^{+03}$	$1.93253 \times 10^{+07}$	$2.27928 \times 10^{+05}$
27	0.0255	0.05	$4.48379 \times 10^{+01}$	$5.72164 \times 10^{+01}$	$8.64569 \times 10^{+01}$	$3.56756 \times 10^{+04}$	$4.19000 \times 10^{+02}$

McKenzie 2007e, Enclosure 1

Table 5. Neutron Fluxes (η/cm²-s) on the Surface of the Naval Spent Nuclear Fuel Canister

Energy Group	Characteristic Energy (MeV)	Upper Energy (MeV)	Top, Above Bolt Hole	Top, 18 inches from Centerline	Top, Above Outer Seal Plate	Side	Bottom
1	17.005	21.17	3.73236×10^{-04}	6.01221×10^{-05}	2.63067×10^{-04}	9.96081×10^{-02}	4.07590×10^{-03}
2	11.42	12.84	1.86724×10^{-03}	2.88735×10^{-04}	1.37762×10^{-03}	6.15202×10^{-01}	2.27708×10^{-02}
3	8.895	10.00	6.39639×10^{-03}	9.61807×10^{-04}	4.95271×10^{-03}	$2.57845 \times 10^{+00}$	8.78546×10^{-02}
4	6.93	7.79	1.31634×10^{-02}	1.84827×10^{-03}	1.09682×10^{-02}	$7.37125 \times 10^{+00}$	2.16450×10^{-01}
5	5.395	6.07	2.46971×10^{-02}	3.38753×10^{-03}	2.15505×10^{-02}	$1.63487 \times 10^{+01}$	4.53232×10^{-01}
6	3.79	4.72	1.18636×10^{-01}	1.75040×10^{-02}	1.00961×10^{-01}	$7.13470 \times 10^{+01}$	$2.17008 \times 10^{+00}$
7	2.30	2.86	5.55548×10^{-01}	9.94957×10^{-02}	4.11980×10^{-01}	$1.69369 \times 10^{+02}$	$8.02862 \times 10^{+00}$
8	1.280425	1.74	$9.95623 \times 10^{+00}$	$2.78278 \times 10^{+00}$	$5.27016 \times 10^{+00}$	$5.53382 \times 10^{+02}$	$7.06042 \times 10^{+01}$
9	0.604295	0.82085	$7.76878 \times 10^{+01}$	$2.91417 \times 10^{+01}$	$2.94797 \times 10^{+01}$	$7.75806 \times 10^{+02}$	$2.50759 \times 10^{+02}$
10	0.28545	0.38774	$1.56185 \times 10^{+02}$	$6.70569 \times 10^{+01}$	$5.25802 \times 10^{+01}$	$6.36049 \times 10^{+02}$	$3.42023 \times 10^{+02}$
11	0.12527	0.18316	$1.35045 \times 10^{+02}$	$5.58659 \times 10^{+01}$	$4.11694 \times 10^{+01}$	$4.15179 \times 10^{+02}$	$2.43135 \times 10^{+02}$
12	3.6455×10^{-02}	6.738×10^{-02}	$1.11818 \times 10^{+02}$	$3.82445 \times 10^{+01}$	$2.95758 \times 10^{+01}$	$2.81074 \times 10^{+02}$	$1.47316 \times 10^{+02}$
13	2.7763×10^{-03}	5.530×10^{-03}	$4.40430 \times 10^{+01}$	$1.13795 \times 10^{+01}$	$7.51885 \times 10^{+00}$	$5.75864 \times 10^{+01}$	$3.30614 \times 10^{+01}$
14	1.1613×10^{-05}	2.260×10^{-05}	$4.27056 \times 10^{+00}$	$1.09599 \times 10^{+00}$	7.46972×10^{-01}	$2.58825 \times 10^{+00}$	$2.61694 \times 10^{+00}$
15	3.125×10^{-07}	6.250×10^{-07}	2.71912×10^{-02}	6.32879×10^{-03}	4.39899×10^{-03}	5.05851×10^{-02}	1.49411×10^{-02}

McKenzie 2007e, Enclosure 2

11. RESERVED

12. DOE-OWNED, COMMERCIAL-ORIGIN FUELS TO REPOSITORY SURFACE FACILITY AND WASTE PACKAGE INTERFACES

The DOE-EM holds title to some commercial-origin SNF that is traceable back to commercial electric utilities. This SNF (approximately 256 MTHM) includes SNF that is under the standard contract (such as Big Rock Point and Fort Saint Vrain) as well as SNF that is not under the standard contract (such as TMI-2). All of the DOE SNF is within the scope of IICD-1. The SNF identified in the following sections does not constitute EM's entire waste stream, but is representative of only that portion currently identified for possible shipment as bare or uncanistered SNF. Additional waste form details and interfaces will be included as disposal options are identified to OCRWM.

12.1 GENERAL DOE-OWNED, COMMERCIAL-ORIGIN FUEL INFORMATION

The DOE owns BWR SNF designed by General Electric that was irradiated in the Philadelphia Electric Company's Peach Bottom Nuclear Station that is representative of the larger BWR SNF assembly sizes owned by DOE (with the exception of Big Rock Point). These units use the General Electric BWR/4 assembly class with an assembly length of 176.2 in. and a width of 5.44 in. for a fuel bundle with a 0.080-in. channel attached but excluding channel fastener clips or spacer buttons (DOE 1992, pp. 2A-20 to 2A-25).

The DOE owns PWR SNF designed by Westinghouse that was irradiated in Carolina Power & Light Company's H.B. Robinson Nuclear Station that is representative of the larger PWR SNF assembly types owned by DOE. These units use the Westinghouse 15 × 15 assembly class with an assembly length of 159.8 in. and a width of 8.44 in. (DOE 1992, pp. 2A-28 to 2A-29).

The DOE has title to additional SNF, such as 85 BWR assemblies that were irradiated in Consumers Power Company's Big Rock Point Nuclear Power Station, 40 PWR assemblies that were irradiated in Rochester Gas and Electric Company's Robert E. Ginna nuclear plant, and 33 PWR assemblies that were irradiated in Virginia Electric Power Company's Surry Nuclear Station (Denney 1998, Attachment 1). The DOE also has title to up to 97 PWR assemblies that were irradiated in Core 2 of the Shippingport reactor (DOE 1992, Section 2.6.4). The method of shipping these other DOE fuels to the repository will be as bare commercial SNF in casks or in DOE SNF standardized canisters.

12.2 DOE-OWNED, COMMERCIAL-ORIGIN FUELS AND REPOSITORY INTERFACES

DOE SNF of commercial origin having handling features interchangeable with either BWR or PWR fuel assemblies and known to have no defects might be shipped to the repository as bare fuel within a transportation cask for placement in a TAD canister at the repository. The DOE SNF of commercial origin might also be shipped to the repository within a disposable DOE standardized SNF canister. The disposable DOE standardized canister and MCO interfaces with the repository have already been addressed (see Figures C-3, C-4, and C-5, and Table A-1, I-4 through I-15).

If the DOE SNF of commercial origin is shipped as bare fuel, the transportation cask would be sent to the Wet Handling Facility, where the SNF is removed from the cask and placed into a repository-provided transportation, aging, and disposal (TAD) canister.

Table A-1, I-28, and I-29 are included as placeholders for interface information between DOE-owned SNF of commercial origin and the TAD canister. I-28 will provide the interfaces between General Electric BWR/4 assemblies owned by DOE and the TAD canister. The BWR fuel assembly interfaces will encompass all assembly sizes except for Big Rock Point fuel assemblies, which the repository will load into PWR TAD canisters discussed in the next paragraph.

Table A-1, I-29 will provide the interfaces between Westinghouse PWR assemblies (e.g., 17×17) owned by DOE and the TAD canister. The PWR fuel assembly interfaces will be shown for all DOE PWR assembly sizes.

Specific interfaces for other DOE SNF assembly types have not been specified at this time.

13. HLW CANISTERS

This section identifies the interfaces between the disposable HLW canisters and the repository surface facilities and systems. All vitrified HLW shall be placed in a sealed disposable canister designed specifically for vitrified HLW. The standard vitrified HLW form shall be sealed inside an austenitic stainless-steel canister with a concentric neck and lifting flange. Some of the DWPF canisters could contain plutonium incorporated into glass in cans arranged within a vitrified HLW canister. The vitrified plutonium waste form canisters are dimensionally identical to the DWPF HLW canisters. The final composition of the plutonium waste form has not been determined.

Disposable HLW canisters are expected to come in two varieties. One variety is a short 10-ft by 24-in. canister represented by the canisters developed for DWPF at the SRS. The second variety is a long 15-ft by 24-in. canister being developed for the River Protection Project Waste Treatment Plant at the Hanford Site.

All systems designed to handle HLW canisters, during normal operations, shall ensure that the maximum temperature of the vitrified glass does not exceed 400°C. Compliance with this requirement shall be shown to be achievable for any structure, system, or component that relies on the performance of the vitrified glass HLW. This includes activities from the storage of HLW canisters at the EM site through emplacement in the repository subsurface facilities.

13.1 DEFENSE WASTE PROCESSING FACILITY HLW CANISTER

Figure C-7 and Table A-1, I-19 and I-20 provide dimensional interfaces for the DWPF HLW canister as defined in *DWPF Canister, Procurement, Control, Drop Test, and Closure (U)* (Culbertson et al. 2004) and handling interfaces with the repository canister transfer system's lifting equipment. Table A-1, I-23 provides dimensional interfaces for the DWPF HLW canister and the DOE canister staging rack. Table A-1, I-25 provides dimensional interfaces for the DWPF HLW canister and the 5-DHLW/DOE short waste package. The canister alphanumeric identifiers are shown in Figure C-7.

13.2 HANFORD HLW CANISTER

Figure C-8 and Table A-1, I-22 provide the Hanford HLW canister and the handling interfaces with the repository canister transfer system's lifting equipment. Table A-1, I-24 provides the dimensional interfaces for the Hanford HLW canister and the DOE canister staging rack. Table A-1, I-26 provides the dimensional interfaces for the Hanford HLW canister and the repository 5-DHLW/DOE long waste package. Table A-1, I-27 provides the dimensional interfaces for the Hanford HLW canister and the repository 2-MCO/2-DHLW waste package. The canister alphanumeric identifiers are shown in Figure C-8.

13.3 IDAHO NATIONAL LABORATORY HLW CANISTER

The HLW canisters being considered for the INL have not been specified, but are conceptually thought to be similar to the DWPF HLW canisters (DOE 1992). However, since the final INL HLW waste form has not yet been determined, the INL is also considering the use of other canisters for their HLW, which could be the Hanford 15-ft by 24-in.-diameter HLW canisters, the 10- or 15-ft by 18-in. DOE SNF standardized canisters, the 10- or 15-ft by 24-in. DOE SNF standardized canisters, and the large naval SNF canisters. Approximately sixty, 24-in. DOE SNF standardized canisters at the INL are expected to contain HLW resulting from the electrometallurgical treatment of sodium-bonded SNF. Since all of these canisters are already addressed in IICD-1, the interfaces with the repository are already established. If DOE standardized canisters are used, their canister alphanumeric identifiers will be an IDH0000 series.

13.4 WEST VALLEY DEMONSTRATION PROJECT HLW CANISTER

The HLW from the WVDP is contained in canisters similar in gross external dimensions to the DWPF HLW canisters. The fill neck and flange are wider and the canisters are loaded to higher metric tons of heavy metal equivalent than the standard HLW glass form being poured into the DWPF HLW canisters. The walls of the WVDP canisters are also thinner than those of the DWPF. Repository facilities are being designed to accommodate the WVDP canisters. The WVDP canister details, including handling interfaces, are included in IICD-1 on Figure C-9 and Table A-1, I-30 through I-33 (WVNS 1998). The canister alphanumeric identifiers are shown on Figure C-9.

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APPENDIX A

TABLE OF CONTROLLED INTERFACE PARAMETERS BETWEEN NNPP AND OCRWM AND EM AND OCRWM

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-1	Naval Railroad Transportation System and Transporter for NNPP SNF Interfaces with Repository Gates, Doors, Structures, and Onsite Prime Mover	C-1	Refer to Figure C-1	Refer to Figure C-1	Refer to Updated Notes on Figure C-1	McKenzie 2007b
I-2	Caliente Interchange to REMY Interfaces	None	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder
I-3	NNPP Transportation Cask Interfaces	C-2	Refer to Figure C-2	N/A	Refer to Updated Notes on Figure C-2	McKenzie 2007a
I-4	18 in. O.D. DOE Standardized SNF Canister	C-3, Sheets 1 – 5	Refer to Figure C-3 Maximum Diameter (cylindricity) for 10 ft Long DOE Standardized SNF Canister = 18.68 in. (see Figure C-3, Sheet 5, Note 2) Maximum Diameter (cylindricity) for 15 ft long DOE standardized SNF Canister = 18.74 in. (see Figure C-3, Sheet 5, Note 2)	N/A	Refer to Notes on Figure C-3	Foster Wheeler Environmental Corporation 2004
I-5	18 in. Diameter Codisposed SNF Canister Interface with the Repository Lifting Fixture	None	Refer to Figure C-3 Minimum Grapple Clearance from Bottom of Lifting Ring to Top of Vent Socket = 3.92 in. Minimum Lifting Ring I.D. = 15.10 in.	Canister Receipt and Closure Facility 18 in. SNF Canister Grapple Mechanical Equipment Envelope 060-MJ0-HTC0-00301-000-00A Canister Grapple Minimum Retraction Dimension = 14.99 in.	1. Maximum loaded mass (weight) of the 18 in. canisters and content of 6,000 lb (Foster Wheeler Environmental Corporation 2004) is the Minimum Design Load of the Repository Lifting Fixture for this Canister Size. 2. Codisposed SNF Canister Provided by DOE-EM. Canister Lifting Fixture and Space Envelope for Canisters Provided by the Repository. 3. The Combined Canister and Lifting Fixture Shall be Compatible with the Repository's Canister Transfer System Remote Handling Equipment (cranes, hooks, and fixtures) and Must be Operable within the Canister-Diameter Dimensional Envelope. 4. The Canister and Lifting Fixture Designs Shall have the Structural Integrity to be Lifted Vertically. 5. DOE SNF Canister Shall have a Permanently Attached Lifting Fixture. The Ring is the Permanently Attached Lifting Fixture.	BSC 2007a. Canister Receipt and Closure Facility 18 in.SNF Canister Grapple Mechanical Equipment Envelope. 060-MJ0-HTC0-00301-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. Foster Wheeler Environmental Corporation 2004, Section 4.1

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-6	18 in. Diameter by 10 ft Long Codisposed SNF Canister Interfaces with the 5 DHLW/DOE Short Waste Package	None	Refer to Figure C-3	5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration: 000-MW0-DS00-00101-000-00D 000-MW0-DS00-00102-000-00C 000-MW0-DS00-00103-000-00C 5 DHLW/DOE SNF Short And Long Divider Plate Tube: 000-MW0-DS00-00601-000-00B <u>Interface Parameters from WP Drawings:</u> WP Inner Vessel Cavity Length = 118.63 in. WP Inner Vessel ID = 74.13 in. WP Divider Plate Tube Inner Diameter = 19.74 in. WP Divider Plate Tube Outside Diameter = 22.24 in.	1. Maximum Loaded Mass (weight) of the 18 in 10 ft Long Canister and Contents of 5,005 lb (Foster Wheeler Environmental Corporation 2004) is the Minimum Canister Design Load for Repository Equipment. 2. The Center-Location Canister Guide Tube will be Beveled Toward the Center of the Canister Envelope to Aid in the Insertion of the Canister into the Disposal Container. 3. Canister is Identified for Loading into the 5 DHLW/DOE Short Waste Package. 4. Codisposed SNF Canister Provided by DOE EM. Waste Package. Lifting Fixture and Space Envelope for Canisters Provided by the Repository. 5. DOE SNF Canister may be Placed in the Center of a Codisposal Waste Package (termed "center location canister" or "CLC").	BSC 2007b. Design & Engineering, 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00101-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007c. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007d. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007e. 5 DHLW/DOE SNF Short and Long Divider Plate Tube. 000-MW0-DS00-00601-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. Foster Wheeler Environmental Corporation 2004, Section 4.1
I-7	18 in. Diameter by 15 ft Long Codisposed SNF Canister Interfaces with the 5 DHLW/DOE Long Waste Package	None	Refer to Figure C-3	5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration: 000-MW0-DS00-00201-000-00D 000-MW0-DS00-00202-000-00C 000-MW0-DS00-00203-000-00C 5 DHLW/DOE SNF Short And Long Divider Plate Tube: 000-MW0-DS00-00601-000-00B <u>Interface Parameters from WP Drawings:</u> WP Inner Vessel Cavity Length = 181.88 in. WP Inner Vessel ID = 74.13 in. WP Divider Plate Tube Inner Diameter = 19.74 in. WP Divider Plate Tube Outside Diameter = 22.24 in.	1. Maximum Loaded Mass (weight) of the 18 in Diameter 15 ft Long Canister and Contents of 6,000 lb (Foster Wheeler Environmental Corporation 2004) is the Minimum Design Load for the Repository Waste Package Position. 2. The Center-Location Canister Guide Tube will be Beveled Toward the Center of the Canister Envelope to Aid in the Insertion of the Canister into the Disposal Container. 3. Canister is Identified for Loading into the 5 DHLW/doe Long Waste Package. 4. Codisposed SNF Canister Provided by DOE-EM. Waste Package Lifting Fixture and Space Envelope for Canisters Provided by the Repository. 5. DOE SNF Canister May be Placed in the Center of a Codisposal Waste Package (termed "center location canister" or "CLC").	BSC 2007f. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00201-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007g. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00202-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007h. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00203-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007e. 5 DHLW/DOE SNF Short and Long Divider Plate Tube. 000-MW0-DS00-00601-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. Foster Wheeler Environmental Corporation 2004, Section 4.1
I-8	24 Inch O.D. DOE Standardized SNF Canister	C-4, Sheets 1 – 4	Refer to Figure C-4 Maximum Diameter (cylindricity) for 10 ft Long DOE Standardized SNF Canister = 24.80 in.(see Figure C-4, Sheet 4, Note 2) Maximum Diameter (cylindricity) for 15 ft Long DOE Standardized SNF Canister = 24.87 in. (see Figure C-4, Sheet 4, Note 2)	N/A	Refer to Notes on Figure C-4	Foster Wheeler Environmental Corporation 2004, Section 4.1

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-9	24 in. Diameter Codisposed SNF Canister Interface with the Repository Lifting Fixture	None	Refer to Figures C-4 Minimum Grapple Clearance from Bottom of Lifting Ring to Top of Vent Socket = 4.16 in. Minimum Lifting Ring I.D. = 20.85 in.	CRCF 24 in. DOE SNF Canister and WP Inner Lid Grapple Mechanical Equipment Envelope. 060-MJ0-HTC0-00401-000 REV 00B.] Canister Grapple Minimum Retraction Dimension = 20.63 in.	1. Maximum Loaded Mass (weight) of the 24 in. Canisters and Content of 10,000 lb (4535 kg) (DOE 1999) is the Minimum Design Load of the Repository Lifting Fixture for this Canister Size. 2. Codisposed SNF Canister Provided by DOE-EM. Canister Lifting Fixture and Space Envelope for Canisters Provided by the Repository. 3. The Combined Canister and Lifting Fixture Shall be Compatible with the Repository's Canister Transfer System Remote Handling Equipment (cranes, hooks, and fixtures) and Must Be Operable within the Canister-Diameter Dimensional Envelope.	BSC 2008a. CRCF 24 in.DOE SNF Canister and WP Inner Lid Grapple Mechanical Equipment Envelope. 060-MJ0-HTC0-00401-000 REV 00B. Las Vegas, Nevada: Bechtel SAIC Company.
I-10	24 in. Diameter by 10 ft Long Standardized Canister Interfaces with the 5 DHLW/DOE SNF - Short Codisposal Waste Package	None	Refer to Figure C-4	5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration: 000-MW0-DS00-00101-000-00D 000-MW0-DS00-00102-000-00C 000-MW0-DS00-00103-000-00C 5 DHLW/DOE SNF Short And Long Divider Plate Tube 000-MW0-DS00-00601-000-00B <u>Interface Parameters from WP Drawings:</u> Inner vessel cavity length = 118.63 in. Inner vessel ID = 74.13 in. Divider plate tube OD = 22.24 in.	N/A - Placeholder	BSC 2007b. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00101-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007c. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007d. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007e. 5 DHLW/DOE SNF Short and Long Divider Plate Tube. 000-MW0-DS00-00601-000-00B. Las Vegas, Nevada: Bechtel SAIC Company.
I-11	24 in .Diameter by 15 ft Long Standardized Canister Interfaces with the 5 DHLW/DOE SNF - Long Codisposal Waste Package	None	Refer to Figure C-4	5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration: 000-MW0-DS00-00201-000-00D 000-MW0-DS00-00202-000-00C 000-MW0-DS00-00203-000-00C 5 DHLW/DOE SNF Short And Long Divider Plate Tube 000-MW0-DS00-00601-000-00B <u>Interface Parameters from WP Drawings:</u> Inner Vessel Cavity Length = 181.88 in. Inner Vessel ID = 74.13 in. Divider Plate Tube OD = 22.24 in.	N/A - Placeholder	BSC 2007f. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00201-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007g. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00202-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007h. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00203-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007e. 5 DHLW/DOE SNF Short and Long Divider Plate Tube. 000-MW0-DS00-00601-000-00B. Las Vegas, Nevada: Bechtel SAIC Company.
I-12	Hanford MCO SNF Canister	C-5, Sheets 1 – 3	Refer to Figure C-5 Maximum MCO Diameter = 25.51 in. (see Figure C-5, Sheet 3, Note 5)	N/A	Refer to Notes on Figure C-5	Gallagher, R.G. 2005. "Spent Nuclear Fuel and High-Level Waste Canister Information to Update the Integrated Interface Control Document." Letter from R.G. Gallagher (Fluor Hanford) to K. A. Klein (DOE Richland Operations Office), January 27, 2005, FH-0500288A R1, with Attachments. ACC: ENG.20060329.0013; ENG.20060329.0014. Drawing H-2-828041 Drawing H-2-828042

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM (Continued)

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-13	SNF Standardized Canister and MCO Interfaces with the CRCF 1 DOE Canister Staging Rack	None	Refer to Figures C-3, C-4, and C-5	CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope: 060-MJ0-HTC0-00501-000-00B Interface Parameter from Staging Rack Drawing: Circular Opening Diameter = 2 ft – 3 in. +½ in. / -0 in. A Removable Pedestal is Used (except for the MCO) to Ensure Top of Canister is at the Required Elevation.	1. The MCO and the Smallest DOE SNF Canister Bounds the Other Canisters. 2. The Length of the MCO at 166.29 ± 0.145 in. (4223.8 ± 3.683 mm) is Exceeded by the Longest Standardized Canister at 179.88 + 0.04/ -0.06 in. (4569 +1/ -1.5 mm). These Lengths are Not Critical Interfaces. As the Rack is Open Topped. 3. Maximum Canister Weight Supported by the Rack is 20,220 lb (9,171.6 kg) for the MCO (based on 270 Mark IV Fixed Assemblies).	BSC 2008b. CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope. 060-MJ0-HTC0-00501-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. Gallagher, R.G. 2005. "Spent Nuclear Fuel and High-Level Waste Canister Information to Update the Integrated Interface Control Document." Letter from R.G. Gallagher (Fluor Hanford) to K.A. Klein (DOE Richland Operations Office), January 27, 2005, FH-0500288A R1, with Attachments. ACC: ENG.20060329.0013; ENG.20060329.0014.
I-14	Hanford MCO Handling Interface with the Repository Lifting Fixture	None	Refer to Figure C-5	Canister Receipt and Closure Facility Hanford MCO Canister Grapple Mechanical Equipment Envelope: 060-MJ0-HTC0-00201-000-00A	1. MCO is Provided by DOE-EM. Canister Lifting Fixture is Provided by OCRWM. 2. Maximum Loaded Weight of the MCO of 20,220 lb (9,171.6 kg) is the Minimum Design Load for the Repository Lifting Fixture.	BSC 2007k. Canister Receipt and Closure Facility Hanford MCO Canister Grapple Mechanical Equipment Envelope. 060-MJ0-HTC0-00201-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. Gallagher, R.G. 2005. "Spent Nuclear Fuel and High-Level Waste Canister Information to Update the Integrated Interface Control Document." Letter from R.G. Gallagher (Fluor Hanford) to K.A. Klein (DOE Richland Operations Office), January 27, 2005, FH-0500288A R1, with Attachments. ACC: ENG.20060329.0013; ENG.20060329.0014.
I-15	Hanford MCO Interfaces with the 2 MCO/2 DHLW Waste Package	None	Refer to Figure C-5	2 MCO/2-DHLW Waste Package Configuration: 000-MW0-DS00-00301-000-00C 000-MW0-DS00-00302-000-00C 000-MW0-DS00-00303-000-00C Interface Parameters from WP Drawings: Inner Vessel Cavity Length = 181.88 in. Inner Vessel ID = 62.50 in.	1. Maximum Loaded Mass (weight) of the MCO and Contents of 20,220 lb. (9,171.6 kg) is the Maximum Design Load for Each Repository Waste Package Position. 2. MCO Provided by DOE-EM. Waste Package, Provided by the Repository. 3. The Waste Package Fabricator will be Responsible for the Provision of the Impact Absorber.	BSC 2007j. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00301-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007k. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00302-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007l. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00303-000-00C. Las Vegas, Nevada: Bechtel SAIC Company
I-16	Naval SNF Canister Interfaces with the Repository	C-6	Refer to Figure C-6	Initial Handling Facility Naval Canister Lifting Adapter Mechanical Equipment Envelope: 51A-MJ0-HTC0-00201-000-00A CRCF, RF, WHF and IHF CTM Canister Grapple Mechanical Equipment Envelope: 000-MJ0-HTC0-00301-000	Refer to Updated Notes on Figure C-6	McKenzie 2007b BSC 2007m. IHF Naval Canister Lifting Adaptor Mechanical Equipment Envelope. 51A-MJ0-HTC0-00201-000-00A. Las Vegas, Nevada: Bechtel SAIC Company
I-17	Short Naval SNF Canister Interfaces with the Naval Short Waste Package	None	Refer to Figure C-6	Naval Short Waste Package Configuration: 000-MW0-DNF0-00201-000-00C 000-MW0-DNF0-00202-000-00C 000-MW0-DNF0-00203-000-00C Interface Parameters from WP Drawings: Inner Vessel Cavity Length = 188.00 in. Inner Vessel ID = 67.70 in.	1. Waste Packages are Provided by OCRWM and the Canisters are Provided by NNPP. 2. The Canister Shall be Capable of Lifting without Forcing, When Inner Vessel lowered Vertically into the Waste Package with the Dimensions Shown. 3. See Figure C-6 for General Notes and Details of Naval SNF Canister Interfaces.	BSC 2007n. Naval Short Waste Package Configuration. 000-MW0-DNF0-00201-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007o. Naval Short Waste Package Configuration. 000-MW0-DNF0-00202-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007p. Naval Short Waste Package Configuration. 000-MW0-DNF0-00203-000-00C. Las Vegas, Nevada: Bechtel SAIC Company

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM (Continued)

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-18	Long Naval SNF Canister Interfaces with the Naval Long Waste Package	None	Refer to Figure C-6	Naval Long Waste Package Configuration: 000-MW0-DNF0-00101-000-00C 000-MW0-DNF0-00102-000-00C 000-MW0-DNF0-00103-000-00C Interface Parameters from WP Drawings: Inner Vessel Cavity Length = 213.00 in. Inner Vessel ID 67.70 in.	1. Waste Packages are Provided by OCRWM and the Canisters are Provided by NNPP. 2. The Canister Shall be Capable of Lifting Without Forcing, When Lowered Vertically into the Waste Package with the Dimensions Shown. 3. See Figure C-6 for General Notes and Details of Naval SNF Canister Interfaces.	BSC 2007q. Naval Long Waste Package Configuration. 000-MW0-DNF0-00101-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007r. Naval Long Waste Package Configuration. 000-MW0-DNF0-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007s. Naval Long Waste Package Configuration. 000-MW0-DNF0-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company.
I-19	DWPF HLW Canister	C-7 Sheets 1 – 4	Refer to Figure C-7	N/A	Refer to Notes on Figure C-7	Culbertson, B.H., Ray, J.W., Marra, S.L., Harbour, J.R., and Plodinec, M.J. 2004. DWPF Canister Procurement, Control, Drop Test, and Closure (U). WSRC-IM-91-116-8, Rev. 2. Aiken, South Carolina: Westinghouse Savannah River Company. ACC: MOL.20060419.0272.
I-20	DWPF HLW Canister Handling Interfaces with the Repository Canister Transfer System Lifting Equipment	None	Refer to Figure C-7	CRCF and IHF DWPF/INL Canister Grapple Mechanical Equipment Envelope: 000-MJ0-HTC0-00601-000-00A	Refer to Notes on Figure C-7	BSC 2007t. CRCF and IHF DWPF/INL Canister Grapple Mechanical Equipment Envelope. 000-MJ0-HTC0-00601-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.
I-21	Hanford HLW Canister 3/8 Wall	C-8 Sheets 1 – 2	Refer to Figure C-8 Maximum Canister Length with Primary Lid Welded in Place = 176.82 in. (see also Figure C-8, Sheet 2, Note 6) Maximum Canister Diameter = 24.17 in. (see Figure C-8, Sheet 2, Note 7)	N/A	Refer to Notes on Figure C-8	Eschenberg, J.R. 2008. Transmittal of Hanford High-Level Waste (HLW) Canister Drawings and Dimensions. Memorandum from John R. Eschenberg, Project Manager, Waste Treatment and Immobilization Plant Project to Frank Marcinowski, Deputy Assistant Secretary for Regulatory Compliance, EM-10, HQ. January 09, 2008. WTP: AAK 08-WTP-008. ACC: HQO.20080204.0009.
I-22	Hanford HLW Canister Handling Interfaces with the CRCF and IHF WVDP/Hanford HLW Canister Grapple	None	Refer to Figure C-8	CRCF and IHF WVDP/Hanford HLW Canister Grapple Mechanical Equipment Envelope: 000-MJ0-HTC0-00401-000-00A	1. Loaded Hanford HLW Canisters Shall Have a Weight Not to Exceed 9,260 lb. (4200 kg.) (DOE 2007d, Section 4.8.4).	BSC 2007u. CRCF and IHF WVDP/Hanford HLW Canister Grapple Mechanical Equipment Envelope. 000-MJ0-HTC0-00401-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.
I-23	DWPF HLW Canister Interfaces with the CRCF 1 DOE Canister Staging Rack	None	Refer to Figure C-7	CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope: 060-MJ0-HTC0-00501-000-00B Interface Parameter from Staging Rack Drawing: Circular Opening Diameter = 2 ft – 3 in. +½ in. / -0 in. A Removable Pedestal is Used (except for the MCO) to Ensure Top of Canister is at the Required Elevation.	1. DWPF HLW Canister Dimensions are Provided on Figure C-7. 2. A Removable Pedestal is Used (except for the MCO) to Ensure Top of Canister is at the Required Elevation.	BSC 2008b. CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope. 060-MJ0-HTC0-00501-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. Culbertson, B.H., Ray, J.W., Marra, S.L., Harbour, J.R., and Plodinec, M.J. 2004. DWPF Canister Procurement, Control, Drop Test, and Closure (U). WSRC-IM-91-116-8, Rev. 2. Aiken, South Carolina: Westinghouse Savannah River Company. ACC: MOL.20060419.0272.

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM (Continued)

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-24	Hanford HLW Canister Interfaces with the CRCF 1 DOE Canister Staging Rack	None	Refer to Figure C-8	CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope 060-MJ0-HTC0-00501-000-00B <u>Interface Parameter from Staging Rack Drawing:</u> Circular Opening Diameter = 2 ft – 3 in. +½ in./ -0 in. A Removable Pedestal is Used (except for the MCO) to Ensure Top of Canister is at the Required Elevation.	Refer to Notes on Figure C-8.	BSC 2008b. CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope. 060-MJ0-HTC0-00501-000-00B. Las Vegas, Nevada: Bechtel SAIC Company.
I-25	DWPF HLW Canister Interfaces with the Repository 5 DHLW/DOE Short Waste Package	None	Refer to Figure C-7	5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration: 000-MW0-DS00-00101-000-00D 000-MW0-DS00-00102-000-00C 000-MW0-DS00-00103-000-00C <u>Interface Parameters from WP Drawings:</u> Inner Vessel Cavity Length = 118.63 in. Inner Vessel ID = 74.13 in. Divider Plate Tube OD = 22.24 in.	1. Canister Parameters are Shown on Figure C-7. 2. DWPF HLW Canister Provided by DOE-EM. Waste Package Provided by the Repository. 3. Canister May be Placed in Any of the Outer Positions.	BSC 2007b. 5 DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00101-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007c. 5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007d. 5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. Culbertson, B.H., Ray, J.W., Marra, S.L., Harbour, J.R., and Plodinec, M.J. 2004. DWPF Canister Procurement, Control, Drop Test, and Closure (U). WSRC-IM-91-116-8, Rev. 2. Aiken, South Carolina: Westinghouse Savannah River Company. ACC: MOL.20060419.0272.
I-26	Hanford HLW Canister Interfaces with the Repository 5 DHLW/DOE Long Waste Package	None	Refer to Figure C-8	5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration: 000-MW0-DS00-00201-000-00D 000-MW0-DS00-00202-000-00C 000-MW0-DS00-00203-000-00C <u>Interface Parameters from WP Drawings:</u> Inner Vessel Cavity Length = 181.88 in. Inner Vessel ID = 74.13 in. Divider plate tube OD = 22.24 in.	1. Canister Parameters are Shown on Figure C-8. 2. Maximum Loaded Mass (weight) of the Support Tube Hanford HLW Canister and Contents of 9,260 lb. (4,200 kg.) is the Minimum Design Load for Each Repository Waste Package's HLW Positions. 3. Hanford HLW Canister Provided by DOE-EM. Waste Package. Lifting Fixture and Space Envelope for Canister Provided by the Repository. 4. Canister May be Placed in Any of the Outer Positions. 5. The Hanford HLW Canister Design Includes a Secondary Lid (repair cap) to be Used in the Unlikely Event of a Primary Lid Closure Weld Defect. If Used, this Secondary Lid Would Increase the Overall Canister Length by 0.38 in.	BSC 2007f. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00201-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007g. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00202-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007h. 5 DHLW/DOE SNF - Long Codisposal Waste Package Configuration. 000-MW0-DS00-00203-000-00C. Las Vegas, Nevada: Bechtel SAIC Company.

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM (Continued)

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-27	Hanford HLW Canister Interfaces with the 2-MCO/2-DHLW Waste Package	None	Refer to Figure C-8	2-MCO/2-DHLW Waste Package Configuration: 000-MW0-DS00-00301-000-00C 000-MW0-DS00-00302-000-00C 000-MW0-DS00-00303-000-00C <u>Interface Parameters from WP Drawings:</u> Inner Vessel Cavity Length = 181.88 in. Inner Vessel ID = 62.50 in.	1. Canister Parameters are Shown DOE SNF on Figure C-8. 2. Maximum Loaded Mass (weight) of the Hanford HLW Canister and Contents of 9,260 lb. (4,200 kg.) is the Minimum Design Load for Each Repository Waste Package's HLW Position. 3. Hanford HLW Canister Provided by DOE-EM. Waste Package. Lifting Fixture. And Space Envelope for Canister Provided by the Repository. 4. Canister may be placed in either of the HLW canister inner vessel positions. HLW canister may not be placed in MCO positions with the impact absorbers. 5. The MCO Head Diameter is 25.31 in. The Overall MCO Diameter is 25.51 in. Due to the Buildup of the Closure Weld. 6. The waste package fabricator will be responsible for the provision of the impact absorber. 7. The Hanford HLW Canister Design Includes a Secondary Lid (repair cap) to be Used in the Unlikely Event of a Primary Lid Closure Weld Defect. If Used, this Secondary Lid Would Increase the Overall Canister Length by 0.38 in.	BSC 2007j. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00301-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007k. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00302-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007l. 2 MCO/2-DHLW Waste Package Configuration. 000-MW0-DS00-00303-000-00C. Las Vegas, Nevada: Bechtel SAIC Company.
I-28	Commercial-Origin DOE BWR SNF Assembly Interfaces with the TAD Canister.	None	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder
I-29	Commercial-Origin DOE PWR SNF Assembly Interfaces with the TAD Caniste.r	None	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder	N/A-Placeholder
I-30	WVDP HLW Production Canister.	C-9 Sheets 1 – 4	Refer to Figure C-9 Overall Canister Length with Primary Lid Welded in Place = 117.81 + 0.06/-0.13 in. (see also Figure C-9, Sheet 4, Note 2.)	N/A	Refer to Notes on Figure C-9	High Level Waste Production Canister Assembly & Details Drawing Number 900D-5743 Sheet 1 of 2 High Level Waste Production Canister Details Drawing Number 900D-5743 Sheet 2 of 2 High Level Waste Production Canister Lids Details Drawing Number 900D-5744 Sheet 1 of 1 WVNS (West Valley Nuclear Services Company) 1998. Waste Form Qualification Report (WQR), West Valley Demonstration Project. WVDP-186. West Valley, New York: West Valley Nuclear Services Company. TIC: 242094.
I-31	WVDP HLW Canister Handling Interfaces with the CRCF and IHF WVDP/Hanford HLW Canister Grapple	None	Refer to Figure C-9	CRCF and IHF WVDP/Hanford HLW Canister Grapple Mechanical Equipment Envelope: 000-MJ0-HTC0-00401-000-00A	Refer to Notes on Figure C-9	BSC 2007u. CRCF and IHF WVDP/Hanford HLW Canister Grapple Mechanical Equipment Envelope. 000-MJ0-HTC0-00401-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. WVNS (West Valley Nuclear Services Company) 1998. Waste Form Qualification Report (WQR), West Valley Demonstration Project. WVDP-186. West Valley, New York: West Valley Nuclear Services Company. TIC: 242094.

Table A-1. Controlled Interface Parameters Between NNPP and OCRWM and EM and OCRWM (Continued)

Interface Identifier	Interface Description	Rev 4 Figure	Cask/Canister Interface Parameters	Repository Interface Parameters	Notes Including Retained Notes from Discarded Figures	Sources/Reference
I-32	WVDP HLW Canister Interfaces with the CRCF 1 DOE Canister Staging Rack.	None	Refer to Figure C-9	CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope: 060-MJ0-HTC0-00501-000-00B Interface Parameter from Staging Rack Drawing: Circular Opening Diameter = 2 ft – 3 in. +½ in. / -0 in. A Removable Pedestal is Used (except for the MCO) to Ensure Top of Canister is at the Required elevation.	WVDP HLW Canister Dimensions are Provided on the Figure C-9.	BSC 2008b. CRCF 1 DOE Canister Staging Rack Mechanical Equipment Envelope. 060-MJ0-HTC0-00501-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. WVNS (West Valley Nuclear Services Company) 1998. Waste Form Qualification Report (WQR), West Valley Demonstration Project. WVDP-186. West Valley, New York: West Valley Nuclear Services Company. TIC: 242094. DOE 2007d. Waste Acceptance System Requirements Document. DOE/RW-0351, Revision 4. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.
I-33	WVDP HLW Canister Interfaces with the Repository 5 DHLW/DOE Short Waste Package.	None	Refer to Figure C-9	5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration: 000-MW0-DS00-00101-000-00D 000-MW0-DS00-00102-000-00C 000-MW0-DS00-00103-000-00C Interface Parameters from WP Drawings: Inner Vessel Cavity Length = 118.63 in. Inner Vessel ID = 74.13 in. Divider plate tube OD = 22.24 in.	Refer to Notes on Figure C-9	BSC 2007b. 5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00101-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007c. 5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007d. 5-DHLW/DOE SNF - Short Codisposal Waste Package Configuration. 000-MW0-DS00-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. BSC 2007e. 5-DHLW/DOE SNF Short and Long Divider Plate Tube. 000-MW0-DS00-00601-000-00B. Las Vegas, Nevada: Bechtel SAIC Company.

APPENDIX B

INTERFACE FIGURES FOR INTERFACES AT DOE-EM PRODUCER SITES

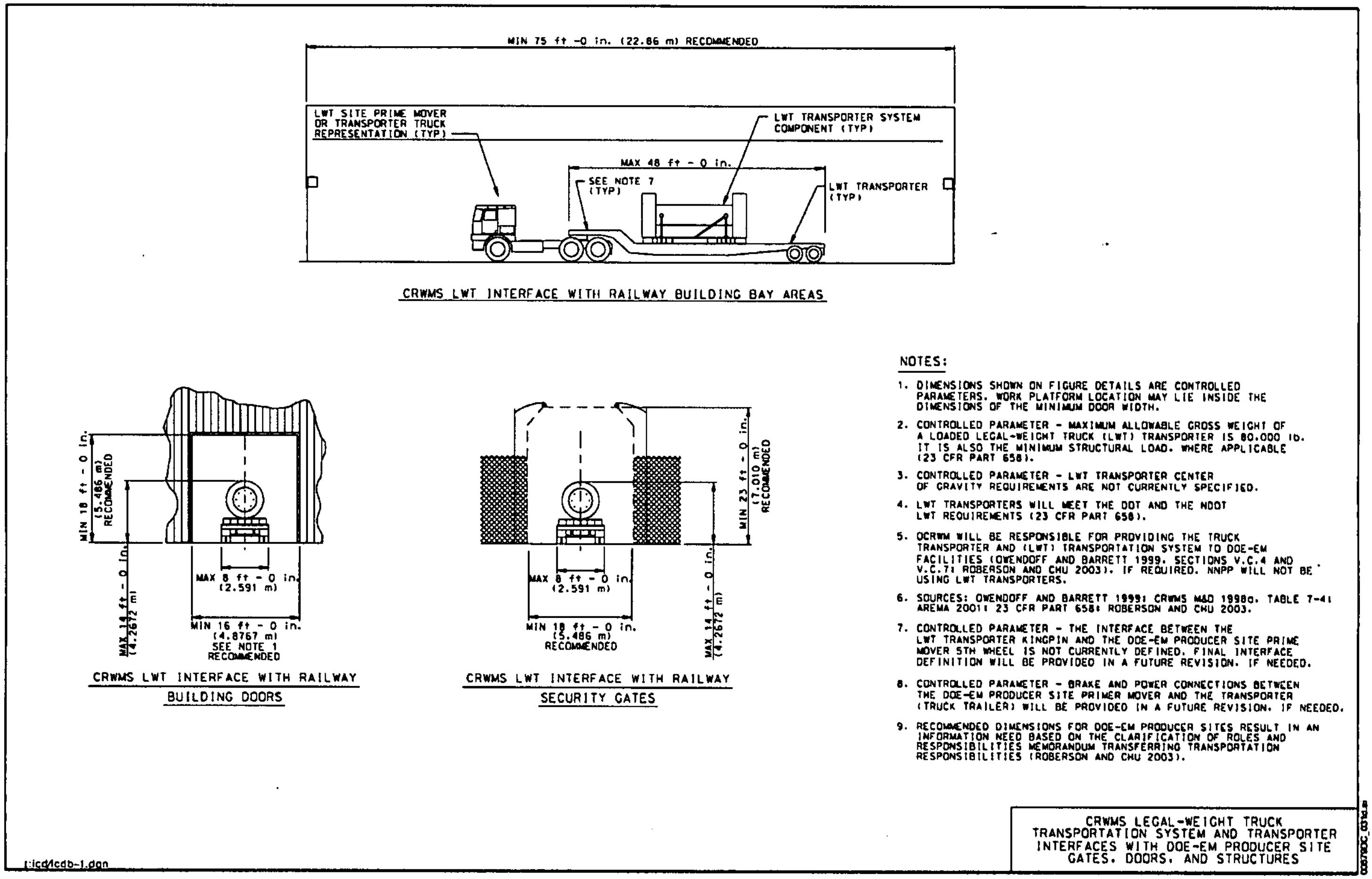


Figure B-1. CRWMS Legal-Weight Truck Transportation System and Transporter Interfaces with DOE-EM Producer Site Gates, Doors, and Structures

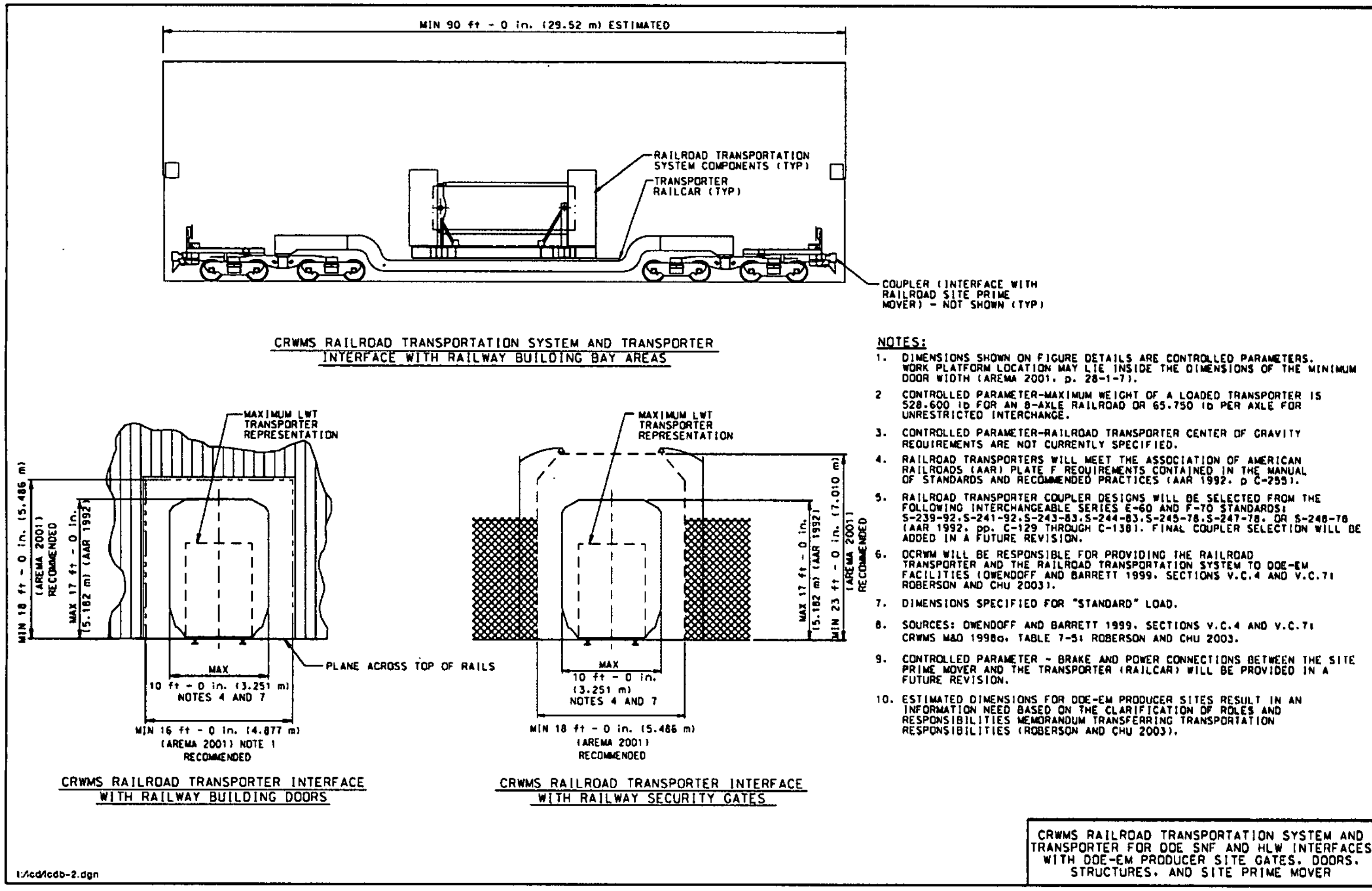


Figure B-2. CRWMS Railroad Transportation System and Transporter for DOE SNF and HLW Interfaces with DOE-EM Producer Site Gates, Doors, Structures, and Site Prime Mover

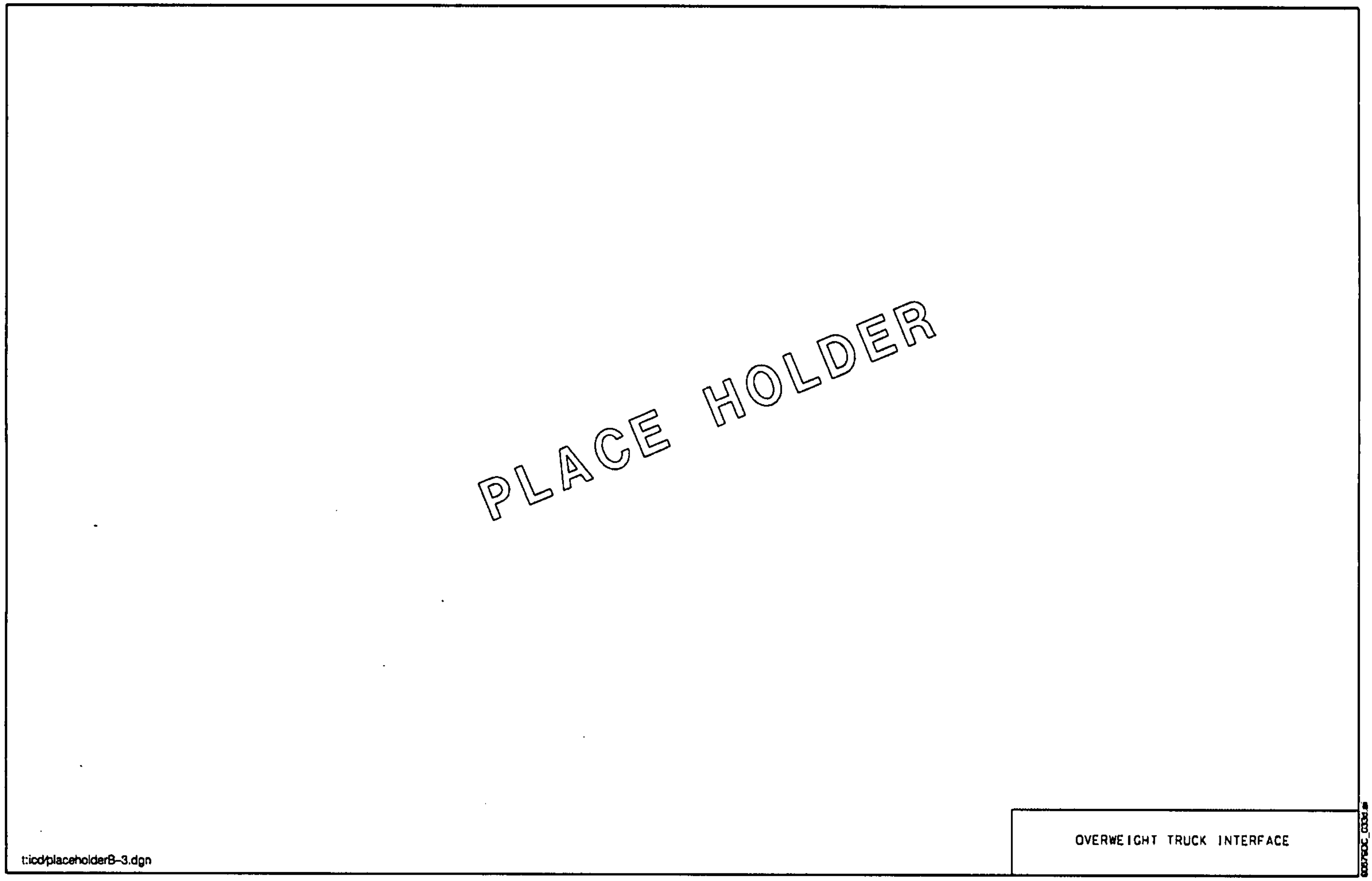


Figure B-3. Overweight Truck Interface

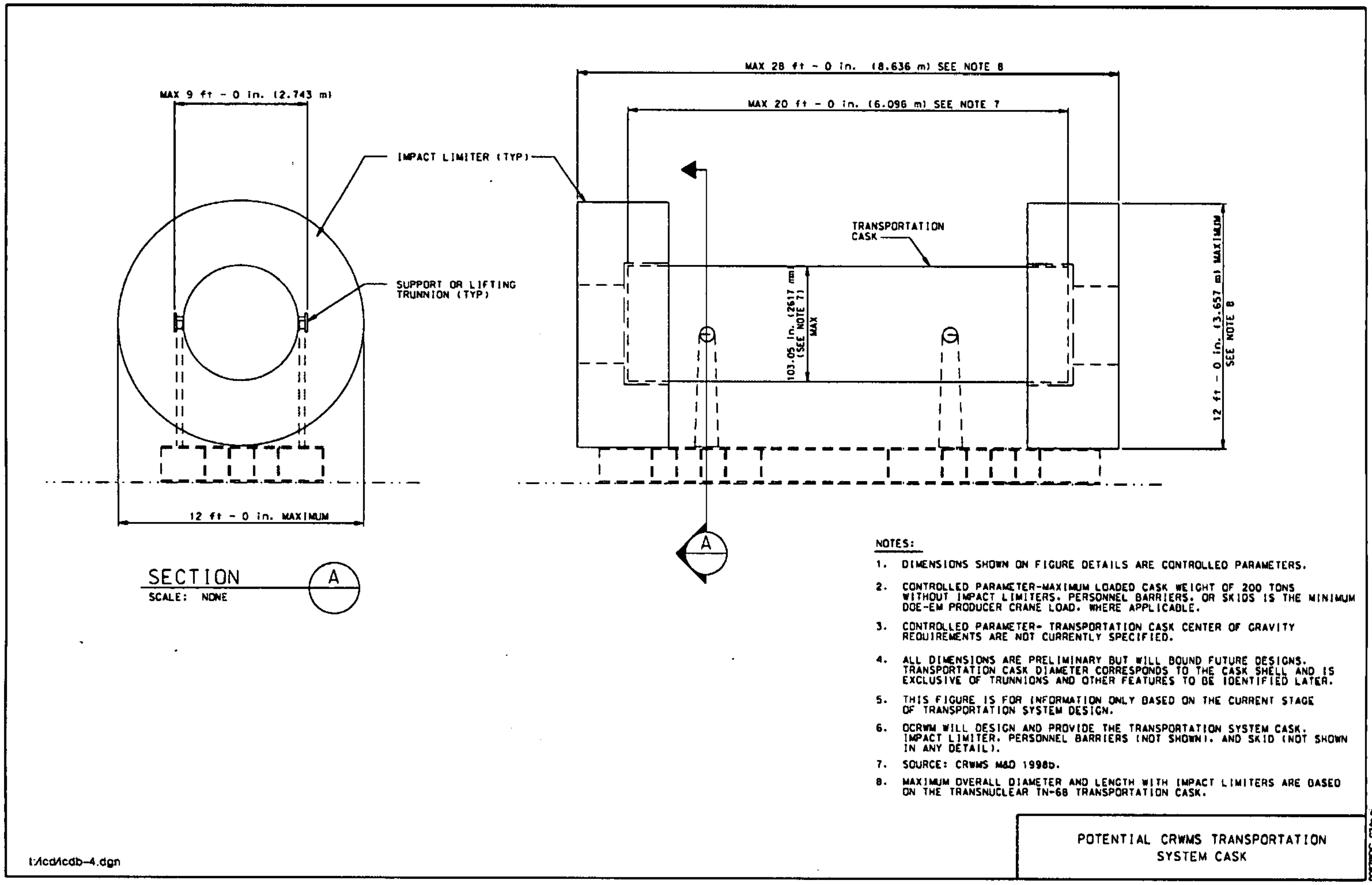


Figure B-4. Potential CRWMS Transportation System Cask

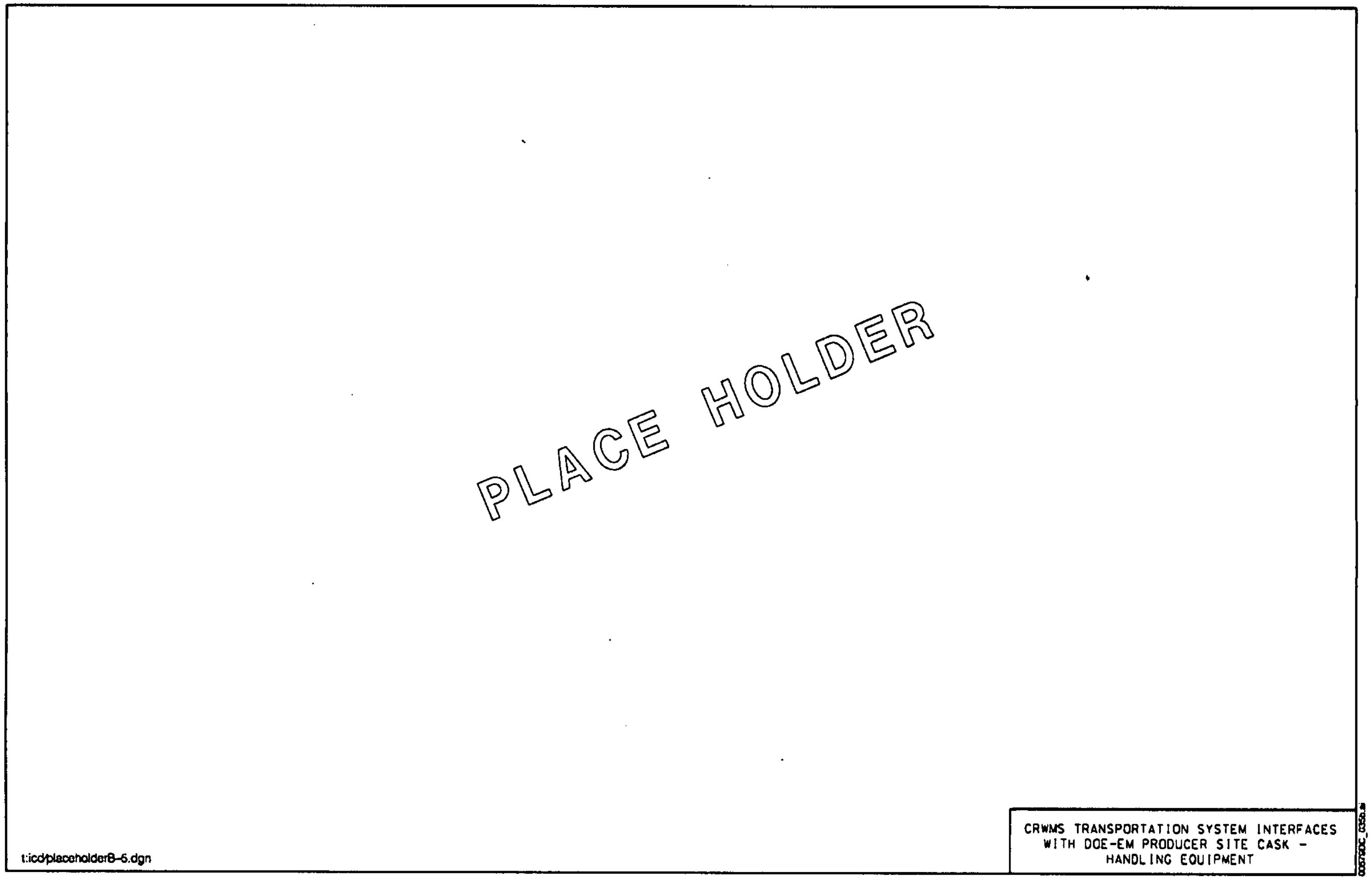


Figure B-5. CRWMS Transportation System Interfaces with DOE-EM Producer Site Cask-Handling Equipment

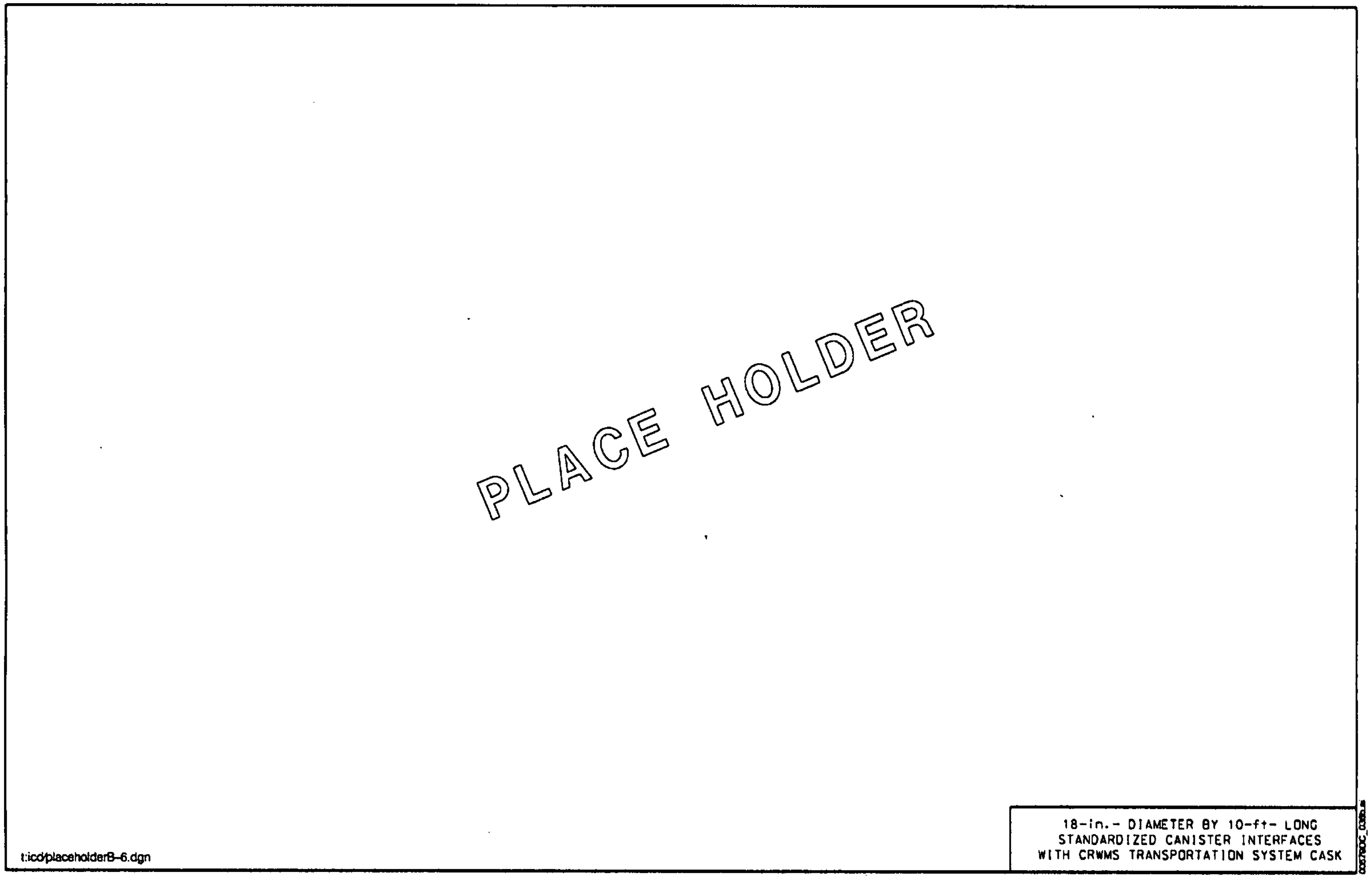


Figure B-6. 18-in.-Diameter by 10-ft-Long Standardized Canister Interfaces with CRWMS Transportation System Cask

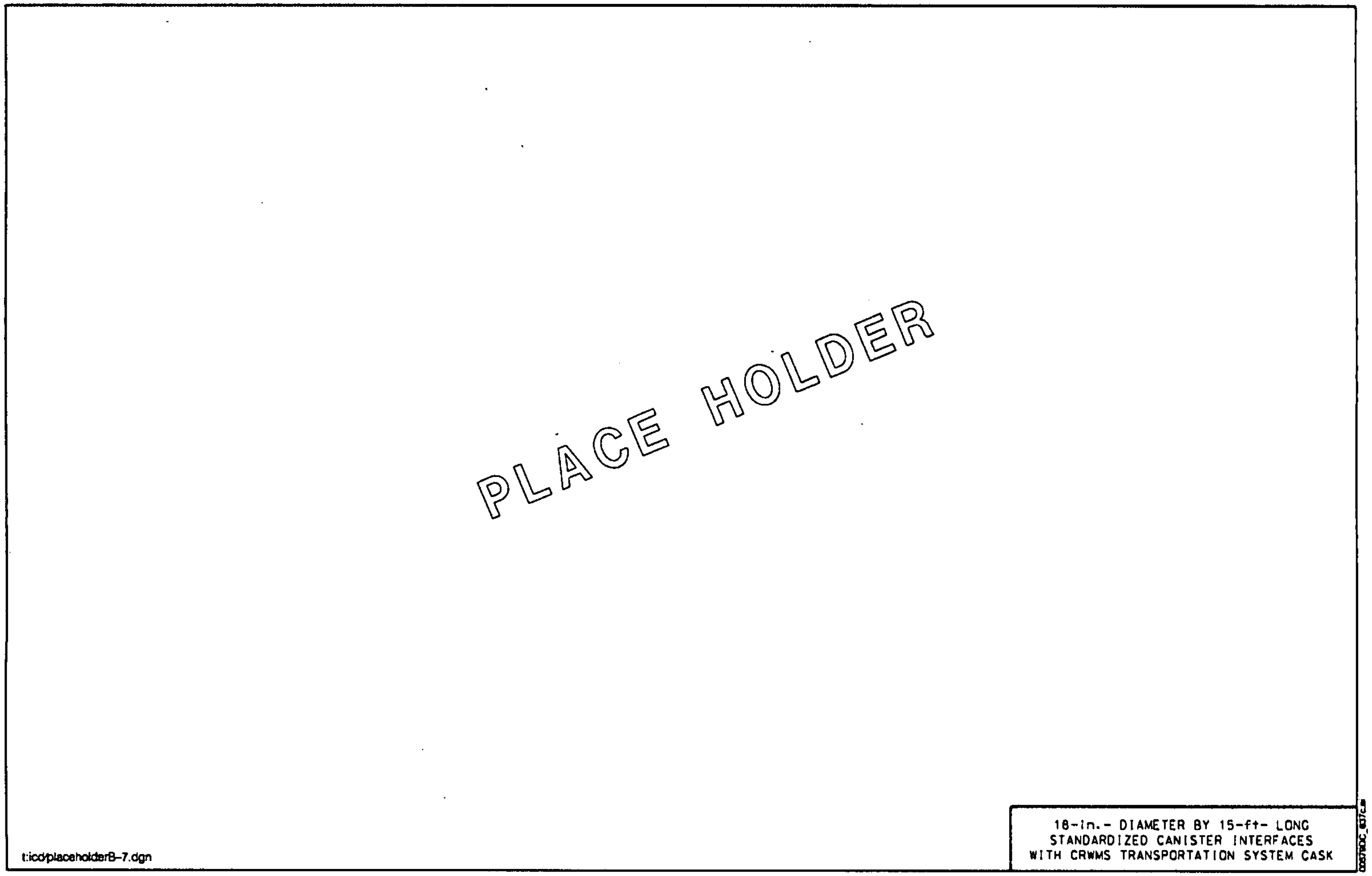


Figure B-7. 18-in.-Diameter by 15-ft-Long Standardized Canister Interfaces with CRWMS Transportation System Cask

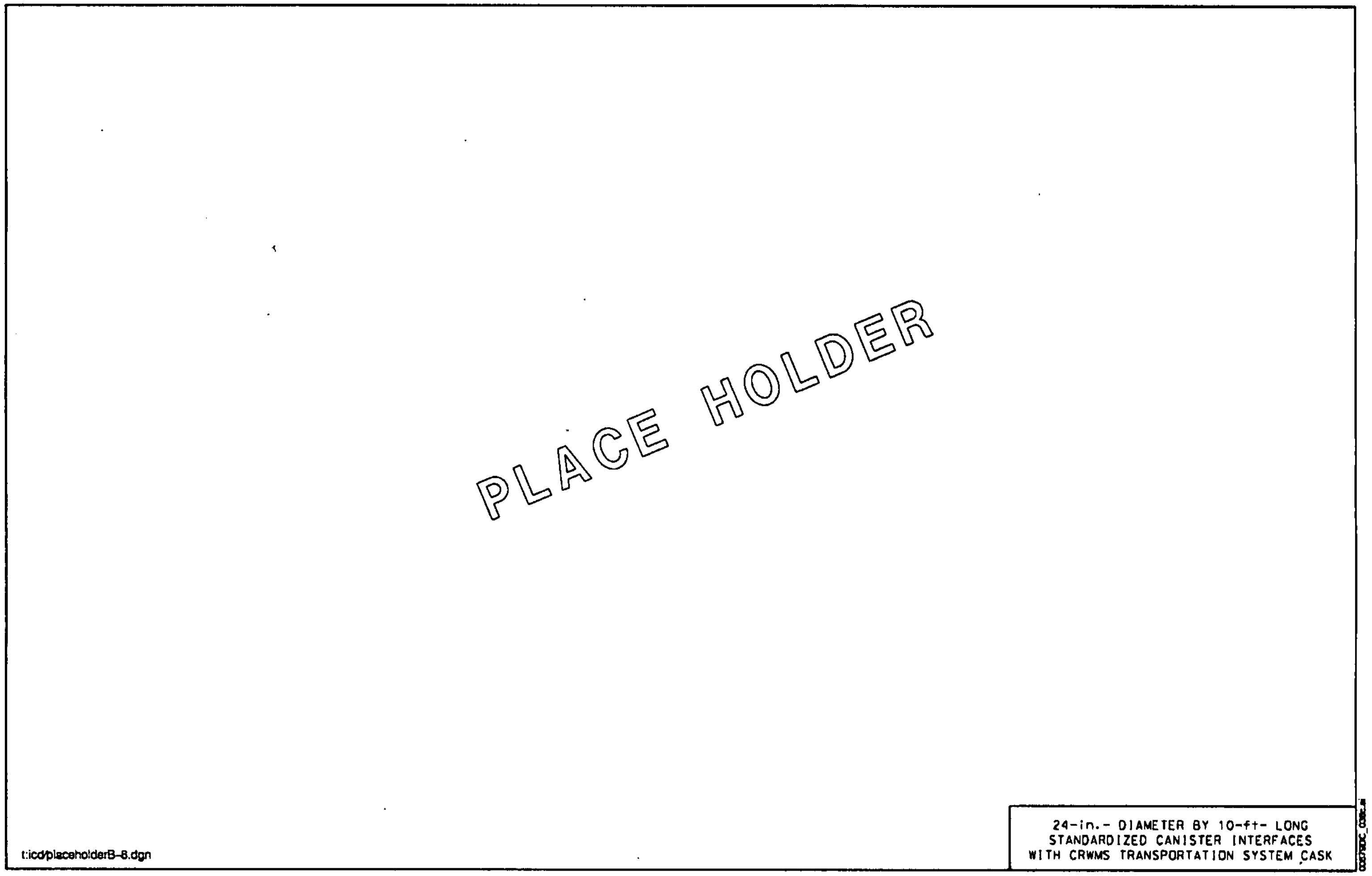


Figure B-8. 24-in.-Diameter by 10-ft-Long Standardized Canister Interfaces with CRWMS Transportation System Cask

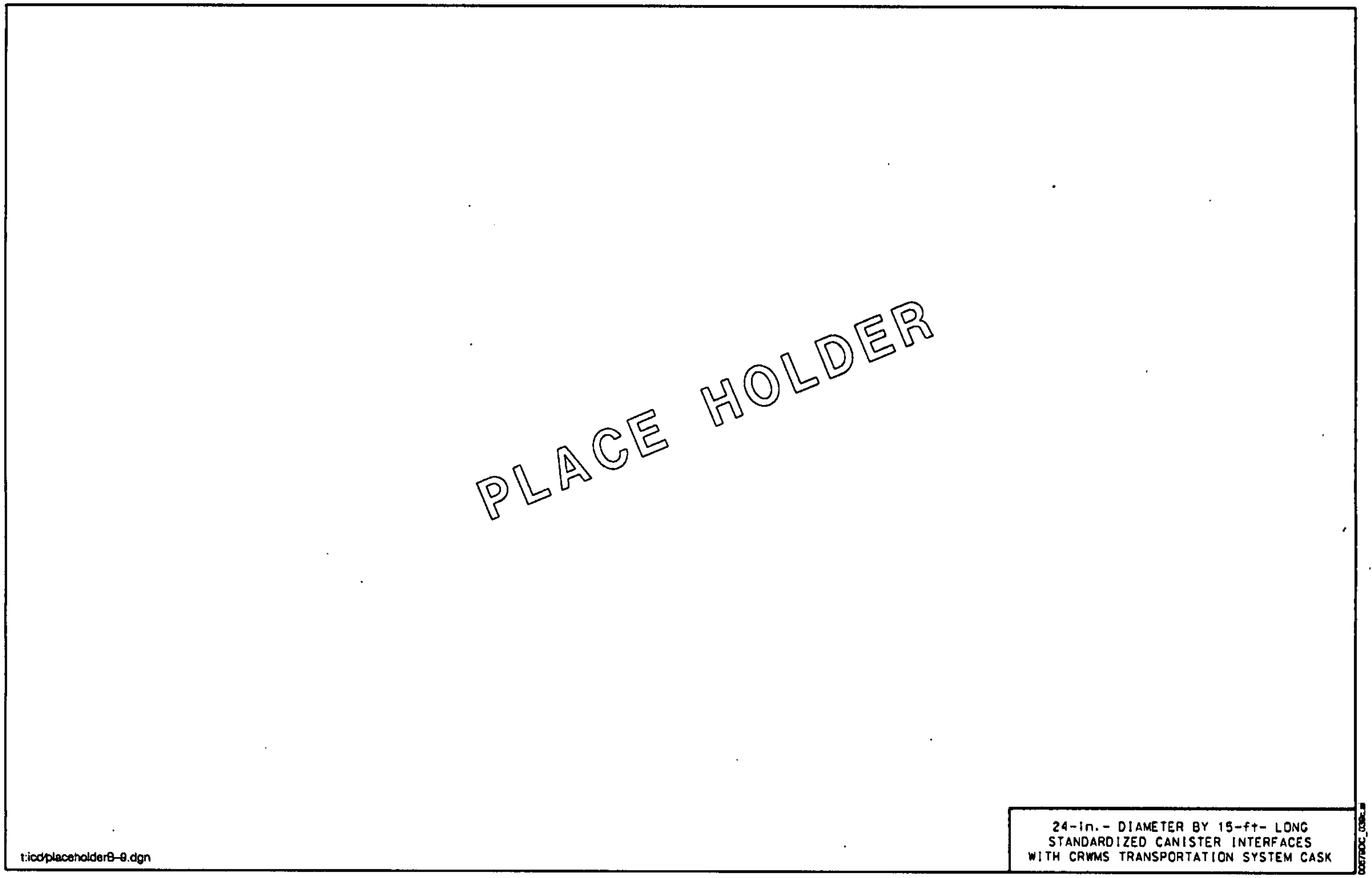


Figure B-9. 24-in.-Diameter by 15-ft-Long Standardized Canister Interfaces with CRWMS Transportation System Cask

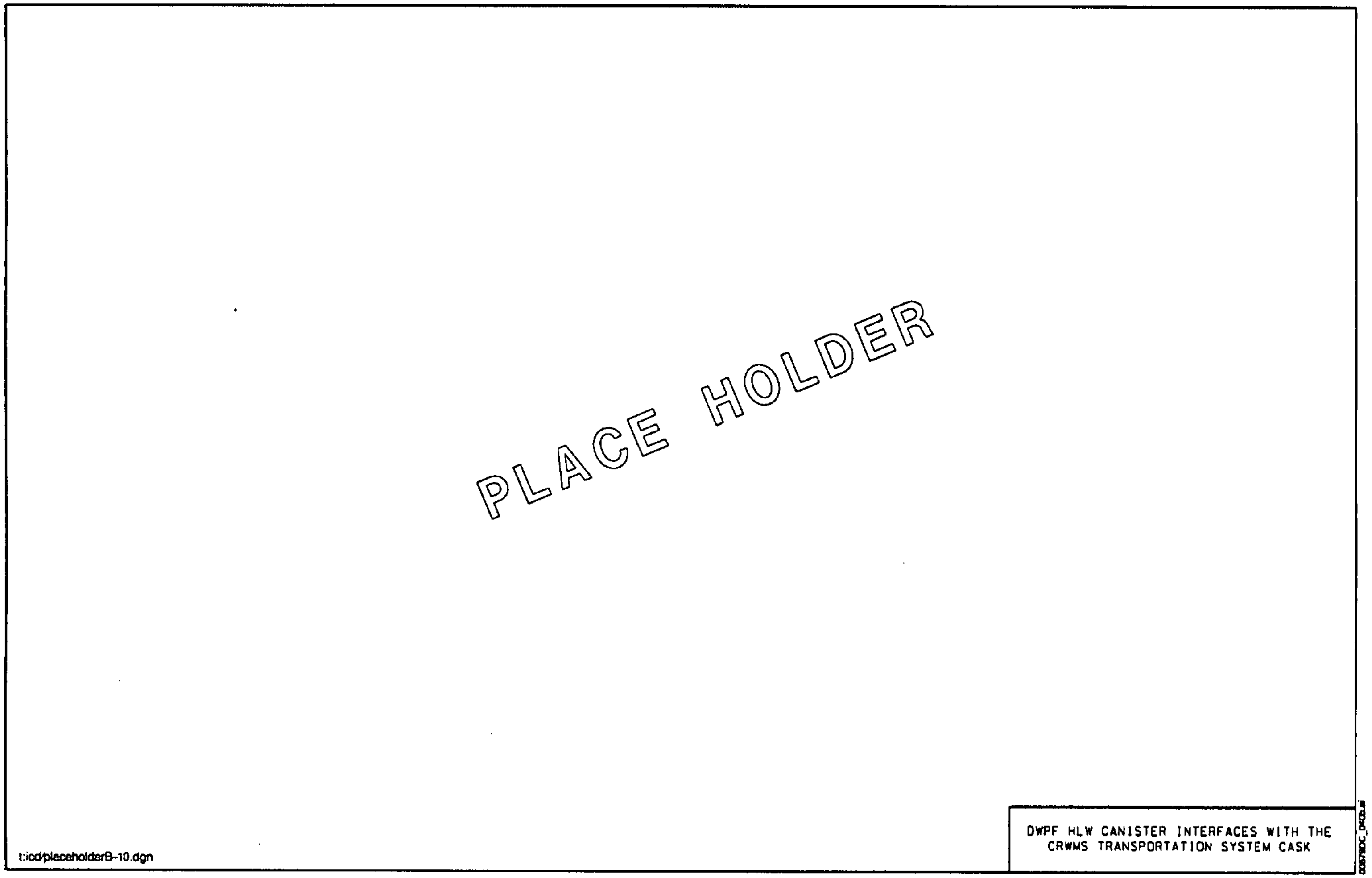


Figure B-10. DWPF HLW Canister Interfaces with the CRWMS Transportation System Cask

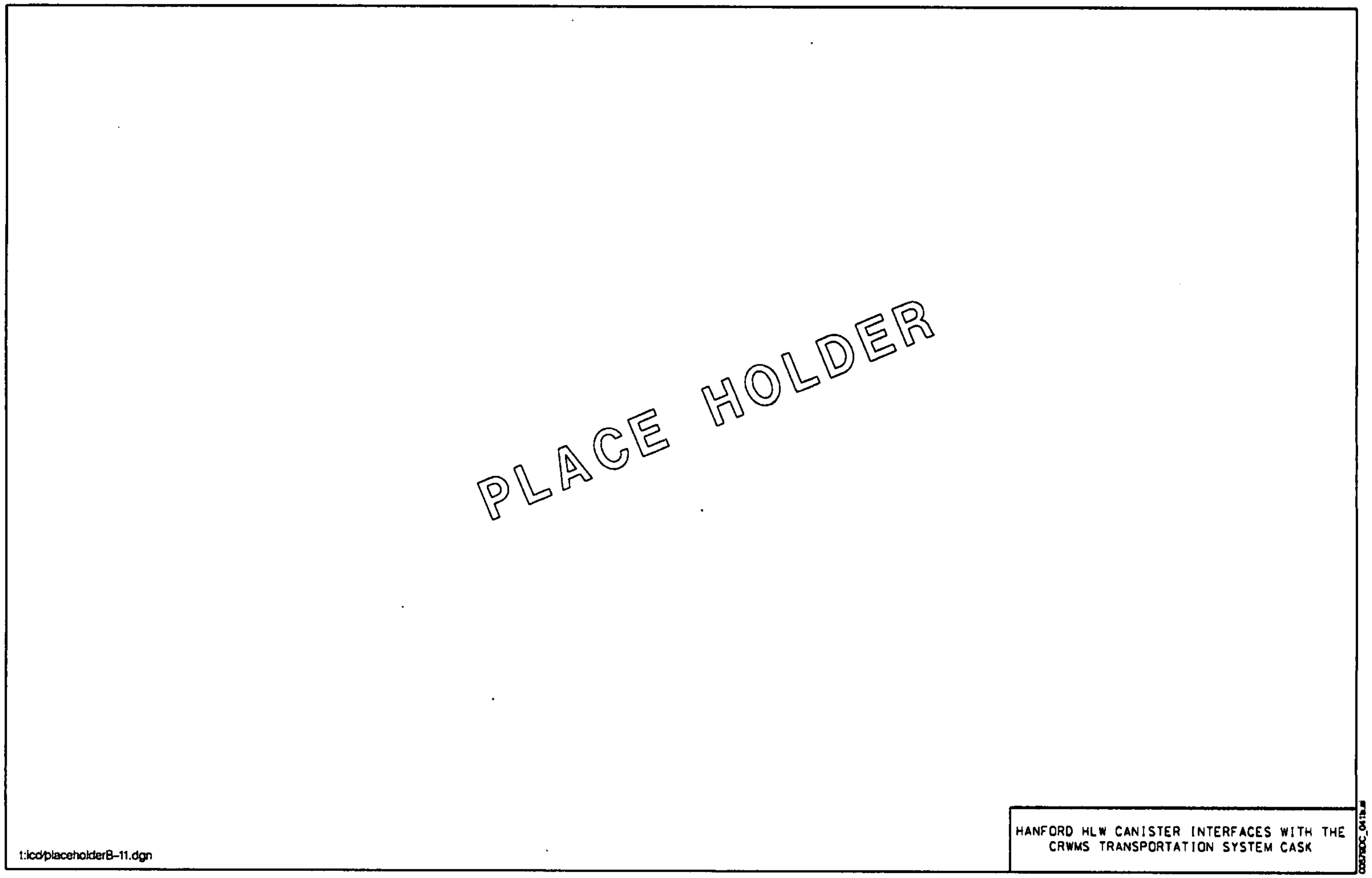


Figure B-11. Hanford HLW Canister Interfaces with the CRWMS Transportation System Cask

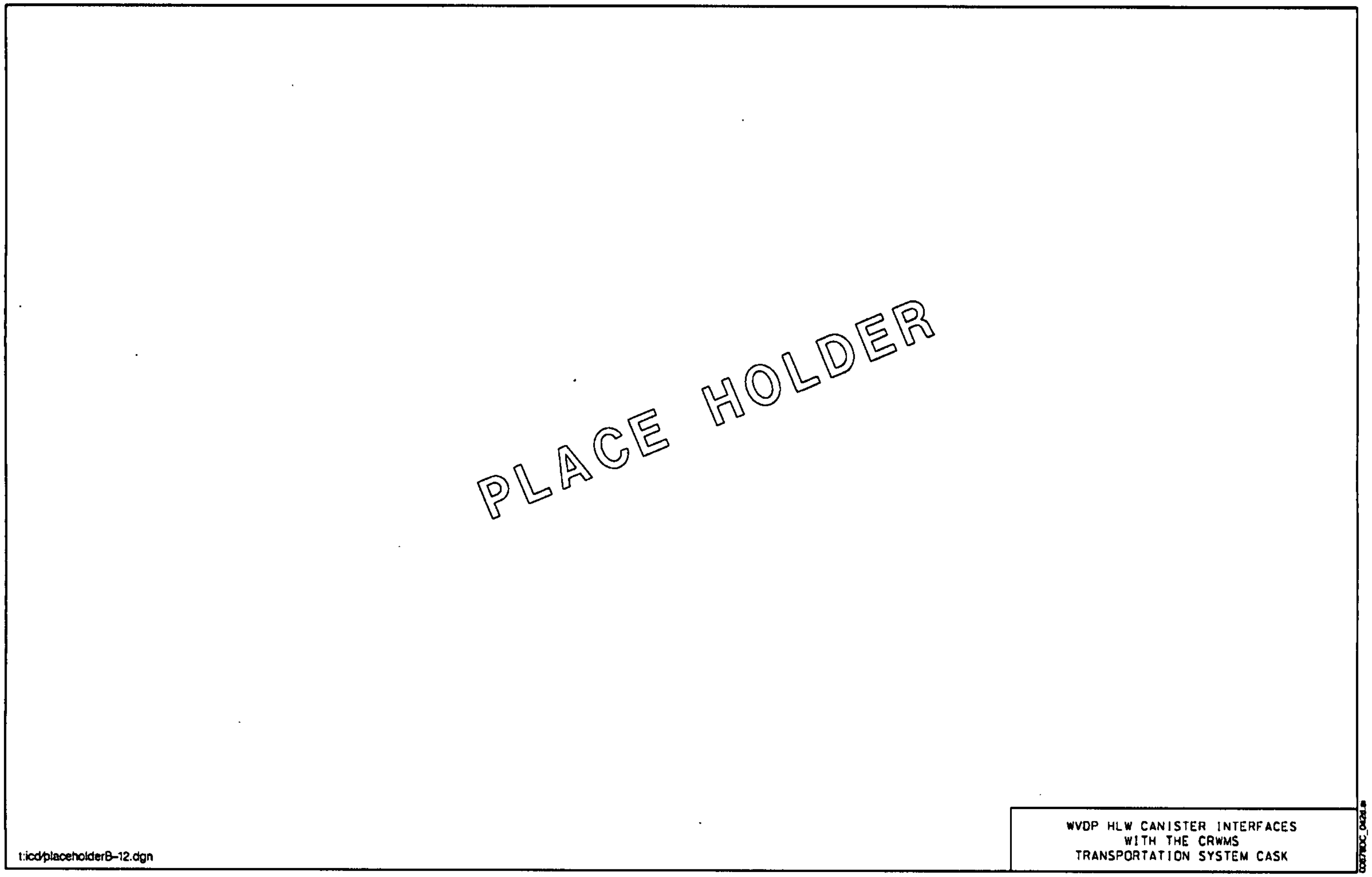


Figure B-12. WVDP HLW Canister Interfaces with the CRWMS Transportation System Cask

PLACE HOLDER

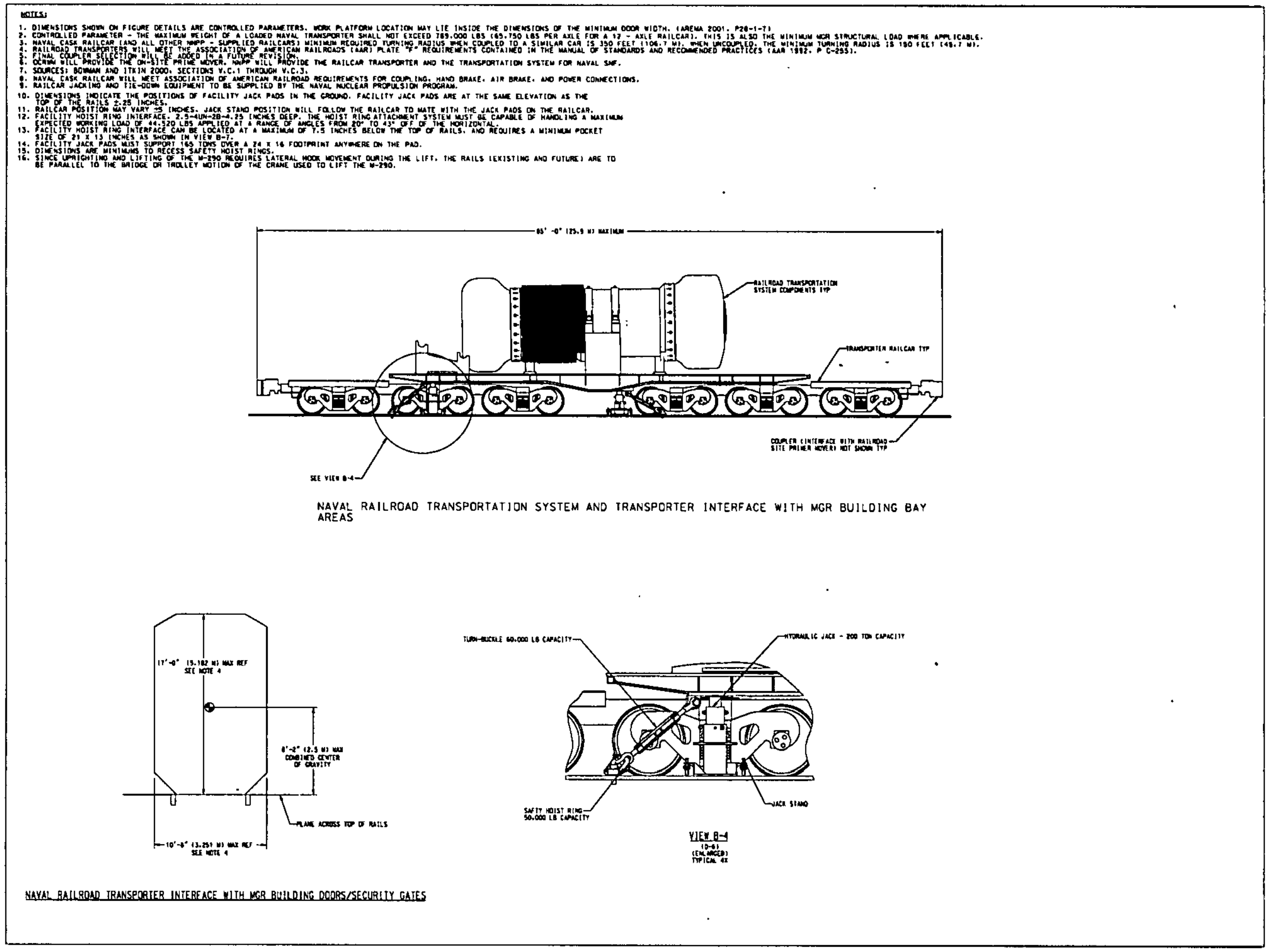
HANFORD MULTICANISTER OVERPACK
INTERFACES WITH THE CRWMS
TRANSPORTATION SYSTEM CASK

l:icd/placeholderB-13.dgn

Figure B-13. Hanford Multicanister Overpack Interfaces with the CRWMS Transportation System Cask

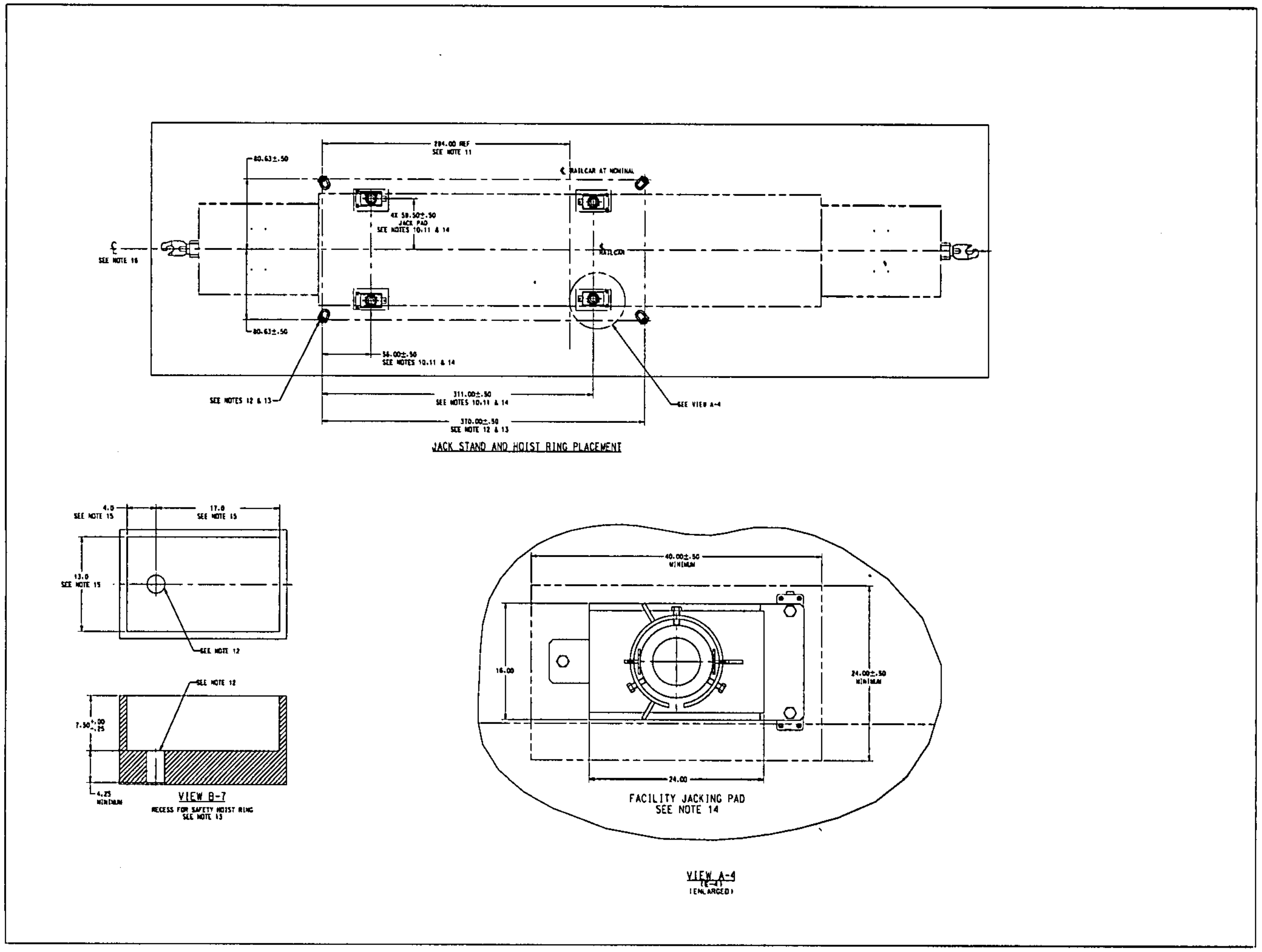
APPENDIX C

INTERFACE FIGURES FOR INTERFACES AT THE REPOSITORY



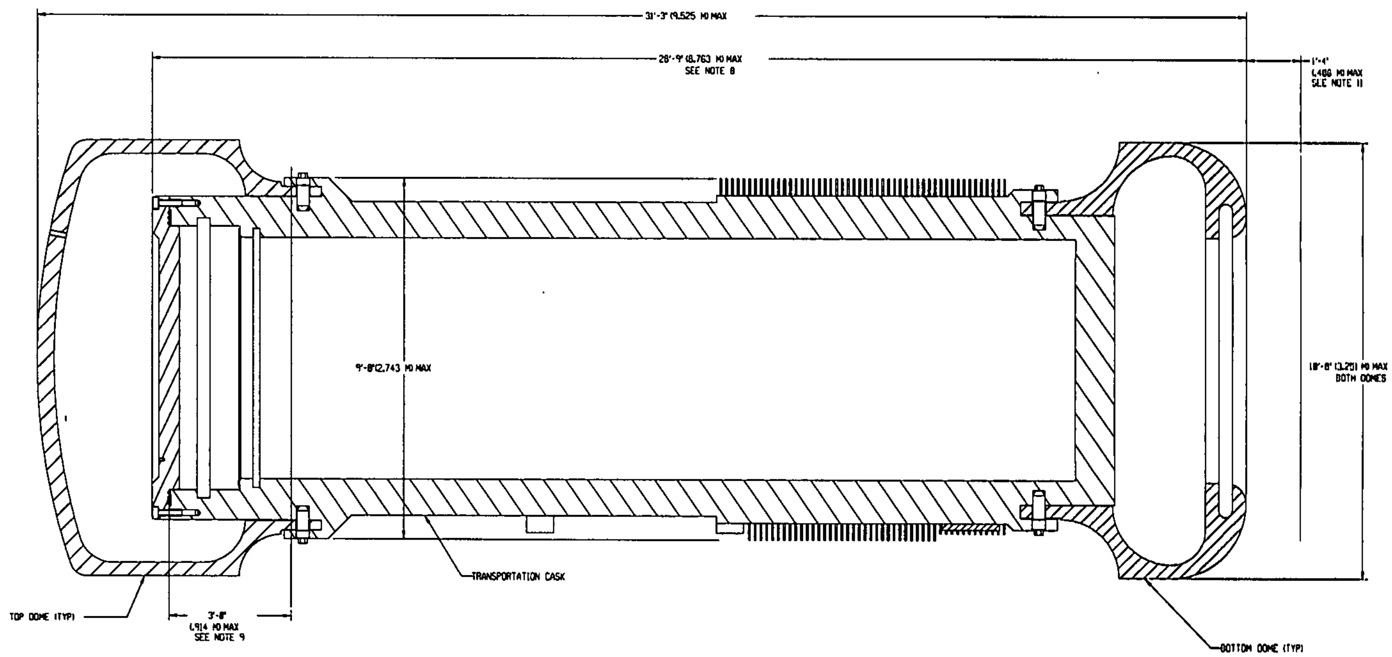
Source: McKenzie 2007b.

Figure C-1. Naval Railroad Transportation System and Transporter for NNPP SNF Interfaces with Repository Gates, Doors, Structures, and Onsite Prime Mover Sheet 1 (Sheet 1 of 2)



Source: McKenzie 2007b.

Figure C-1. Naval Railroad Transportation System and Transporter for NNPP SNF Interfaces with Repository Gates, Doors, Structures, and Onsite Prime Mover Sheet 2 (Sheet 2 of 2)

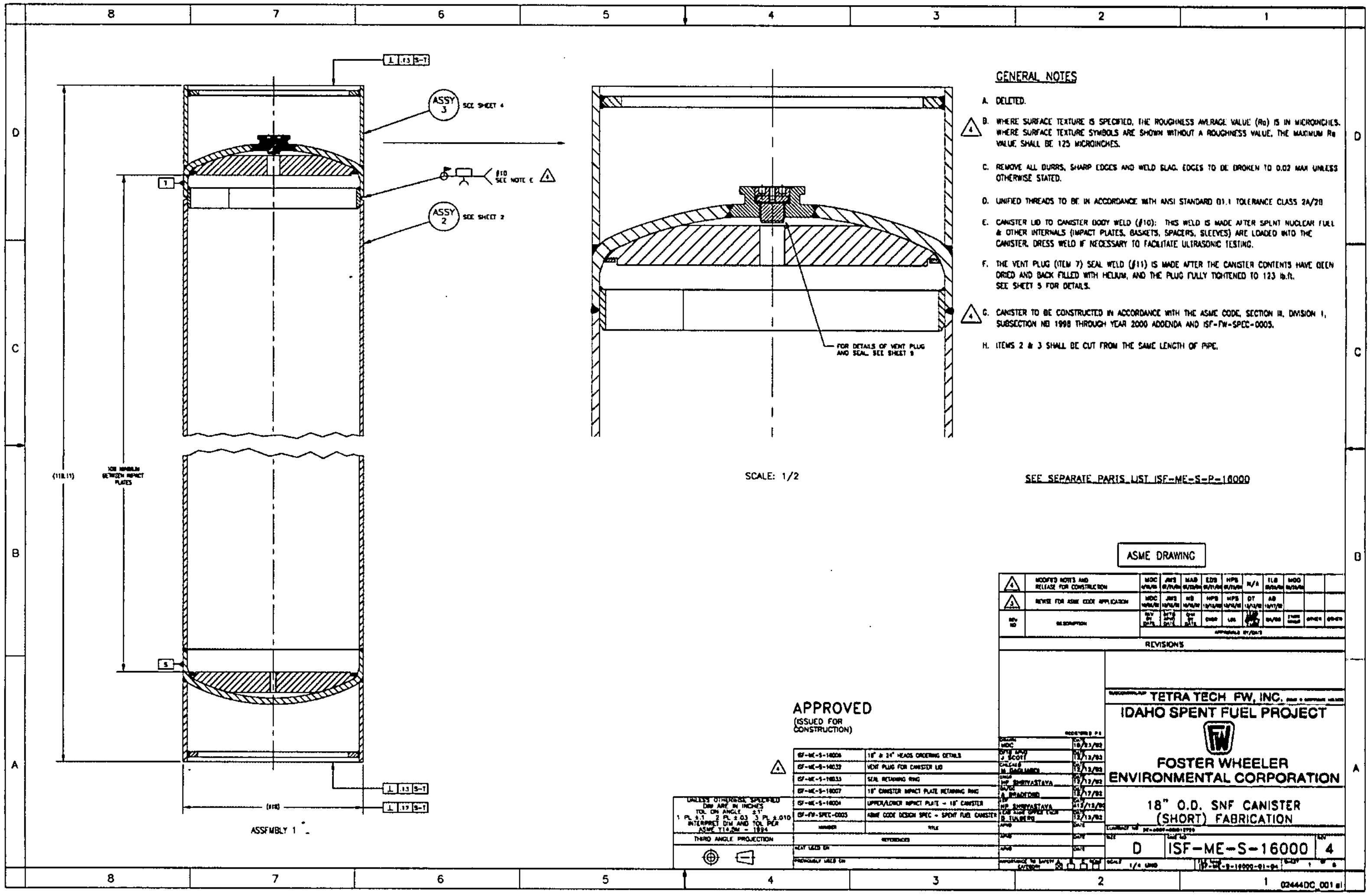


NOTES:

1. DIMENSIONS SHOWN ON FIGURE DETAILS ARE CONTROLLED PARAMETERS.
2. CONTROLLED PARAMETER - MAXIMUM LOADED CASK AND LIFTING DEVICES WEIGHT OF 295 SHORT TONS (WITHOUT PERSONNEL BARRIERS NOT SHOWN) IS THE MINIMUM MGR CRANE LOAD WHERE APPLICABLE. COMPONENT WEIGHTS TO BE LIFTED INCLUDE 30 SHORT TONS RESERVED FOR THE CASK RIGGING AND 265 SHORT TONS RESERVED FOR THE CASK.
3. CONTROLLED PARAMETER - NAVAL TRANSPORTATION CASK CENTER OF GRAVITY REQUIREMENTS ARE CURRENTLY NOT SPECIFIED.
4. ALL DIMENSIONS ARE PRELIMINARY BUT WILL BOUND FUTURE DESIGNS.
5. THIS FIGURE IS FOR INFORMATION ONLY AND IS BASED ON THE CURRENT STAGE OF TRANSPORTATION SYSTEM DESIGN.
6. NNPP WILL DESIGN AND PROVIDE THE TRANSPORTATION SYSTEM CASK AND PERSONNEL BARRIERS (NOT SHOWN) IN ACCORDANCE WITH BOWMAN AND ITKIN, 2000 SECTION V.C.1. THERE WILL BE NO SKID IN THE TRANSPORTATION CASK SYSTEM.
7. THE MAXIMUM LIFT WEIGHT FOR AN INDIVIDUAL IMPACT LIMITER AND ASSOCIATED RIGGING IS CURRENTLY NOT SPECIFIED.
8. ONLY TOP DOME IS REMOVED TO SUPPORT UNLOADING.
9. THIS DIMENSION REPRESENTS THE MAXIMUM DISTANCE FROM THE TOP OF THE NAVAL TRANSPORTATION CASK BODY (WITHOUT COVER) TO THE TOP OF EITHER NNPP SPENT FUEL CANISTER (LONG OR SHORT).
10. THE STACK-UP FOR UPRIGHTING AND LIFTING THE M-290 FROM THE RAILCAR, FROM THE TOP OF THE TRAIN RAILS TO THE LIFT FIXTURE ATTACHMENT POINT, IS NO GREATER THAN 45 FEET. ALLOW 1 ADDITIONAL FOOT TO LIFT THE M-290 CLEAR OF THE RAILCAR.
11. THE 1'-4" DIMENSION IS THE MAXIMUM DISTANCE FROM THE BOTTOM OF THE LOWER DOME TO THE SEATING SURFACE OF THE M-290.

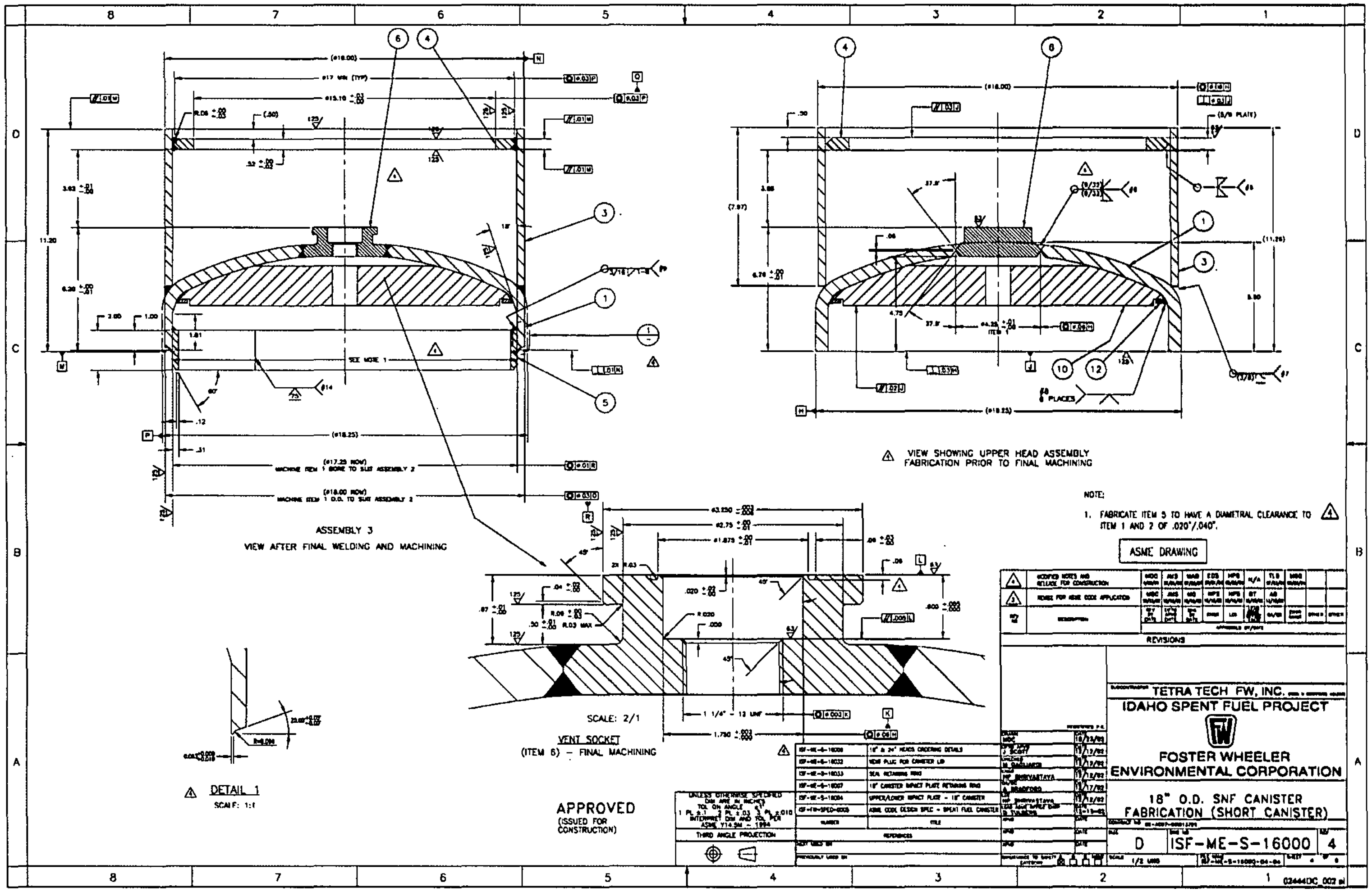
Source: McKenzie 2007a.

Figure C-2. NNPP Transportation Cask Interfaces



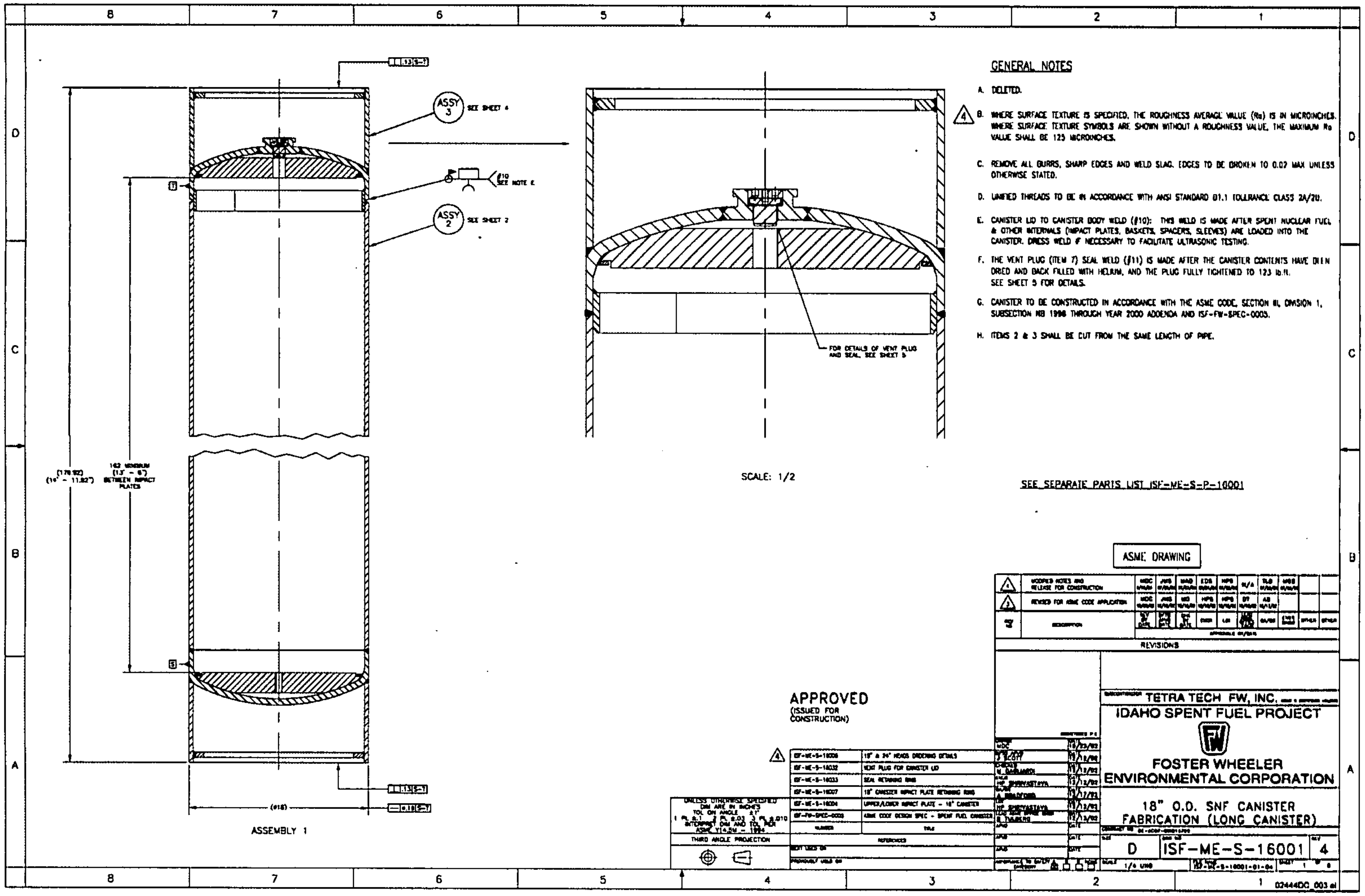
Source: Foster Wheeler Environmental Corporation 2004.

Figure C-3. 18-in.-O.D. DOE Standardized SNF Canister Sheet 1: Short (10-ft.) Canister (Sheet 1 of 5)



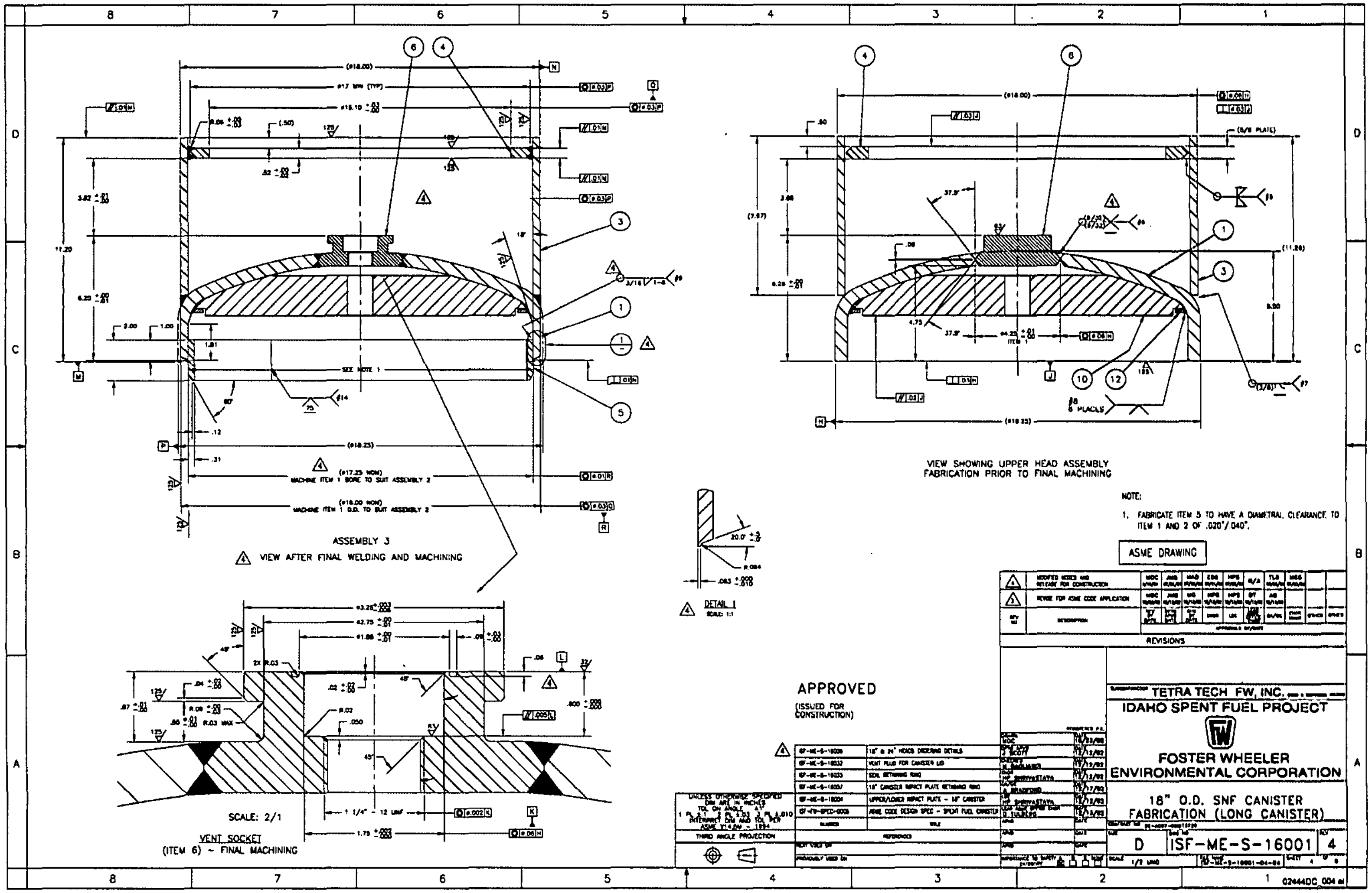
Source: Foster Wheeler Environmental Corporation 2004.

Figure C-3. 18-in.-O.D. DOE Standardized SNF Canister Sheet 2: Short (10-ft.) Canister (Sheet 2 of 5)



Source: Foster Wheeler Environmental Corporation 2004.

Figure C-3. 18-in.-O.D. DOE Standardized SNF Canister Sheet 3: Long (15-ft.) Canister (Sheet 3 of 5)



Source: Foster Wheeler Environmental Corporation 2004.

Figure C-3. 18-in.-O.D. DOE Standardized SNF Canister Sheet 4: Long (15-ft.) Canister (Sheet 4 of 5)

Notes for Figure C-3

1(a). Maximum loaded mass (weight) of the 18-in. 10-ft. long canister and contents of 5005 lb (Foster Wheeler Environmental Corporation 2004, Section 4.1) is the minimum canister design load for repository equipment.

1(b). Maximum loaded mass (weight) of the 18-in. 15-ft. long canister and contents of 6000 lb (Foster Wheeler Environmental Corporation 2004, Section 4.1) is the minimum canister design load for repository equipment.

2. Maximum canister cylindricity (including margins, such as for manufacturing tolerances, etc.) equals the sum of the nominal diameter and the following (Foster Wheeler Environmental Corporation 2004, Section 4.1):
   (a) Canister diametrical tolerance is ± 0.093 in. (±2.4 mm) per ASME SA-530.
   (b) Canister ovality shall not exceed 1.5% of the specified nominal diameter or 0.27 in. (6.855 mm) per ASME SA-530.
   (c) Canister straightness shall not exceed 0.125 in. (3.2 mm) for every 10 ft (3.0 m) of pipe length per ASME SA-530.
   (d) Final canister weld crown may add an additional 0.1875 in. (4.76 mm) to the diameter.

3. Canister center of gravity shall be within 24.00 in. (609.6 mm) of the canister centroid and less than 5 in. (127 mm) from the axial centerline (DOE 1999a, Section 3.2.4).

4. Codisposed SNF canister provided by DOE-EM.

5. Thermal characteristics at the time of shipment to the CRWMS have not been determined. Although additional analysis is required, it may be estimated (assuming a coefficient of expansion for 316L stainless steel of 10×10^{-6} in/in ^{0}F) that the 18-in. diameter x 10 ft. long canister will expand at 300^{0}F by 0.36 in. in length and 0.05 in. diameter; the 18 in. diameter x 15 ft. long canister will expand at 300^{0}F by 0.54 in. in length and 0.05 in. in diameter. (Foster Wheeler Environmental Corporation 2004, Section 4.4).

6. Loaded canisters shall be roughly right-circular cylinders capable of standing upright on a flat horizontal surface and remain with the dimensions specified.

7. Canisters with parameters outside the stated ranges are considered "nonstandard" and will be evaluated by DOE-RW for acceptance on a case-by-case basis.

8. The canister shall have a permanently attached lifting fixture that allows remote attachment of the lifting fixture. The ring is the permanently attached lifting fixture.

9. Canisters and lifting fixtures shall have the structural integrity to be lifted vertically.

10. Canisters shall be dried, backfilled with an inert gas (helium), seal welded, and leak tested.

11. SNF canisters shall have a unique alphanumeric identifier that is located prominently on the top external lid, is visible (via remotely operated cameras) from the top, and is integral to and chemically compatible with the canister. The identifier can be expected to remain legible through multiyear storage at temperatures in excess of 150°C and after handling associated with loading into and removal from transportation casks. The identifier shall not impair the integrity of or exceed dimensional limits of the canister.

12. Identifier numbering convention: consisting of a two-digit site identifier, then a dash, followed by a four-digit sequential number (e.g., HF-0001). Site identifiers shall be Hanford: HF, Idaho National Laboratory: ID, Savannah River: SR. The data packages will indicate the types of fuel that have been placed in the standardized canister.

13. Labels shall be a unique alphanumeric identifier approximately 1 in. (25.4 mm) high embossed or stamped on the top (outer) surface of the canister rings (DOE 1999a, Section 3.2.15).

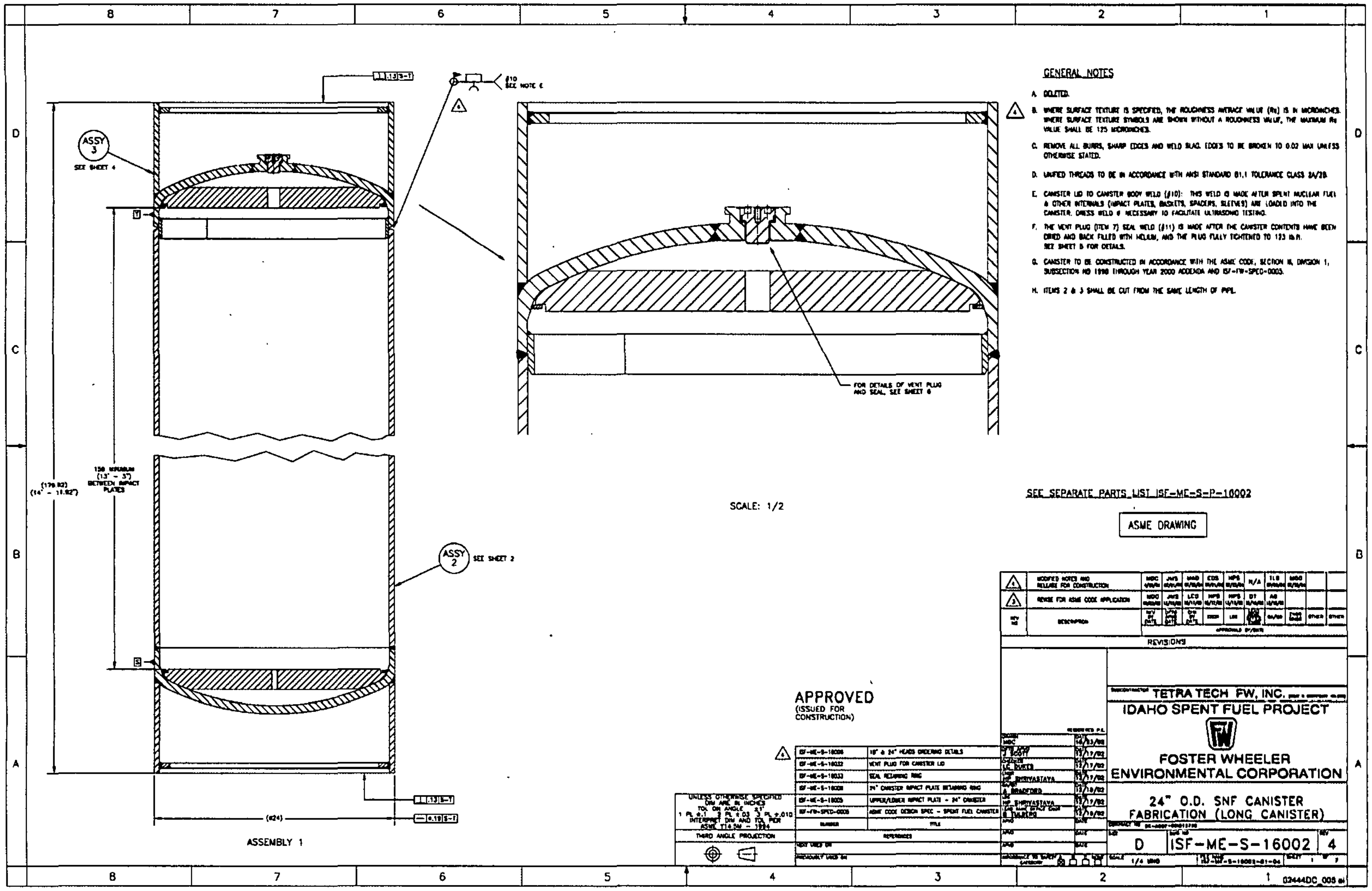
14. For canisters where markings are no longer legible, administrative controls shall be implemented prior to cask loading such that the canister remains compliant with the item control provisions of 10 CFR 73.51 at the time of delivery to the CRWMS.

15. SNF disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment to the CRWMS.

Figure C-3. 18-in.-O.D. DOE Standardized SNF Canister Sheet 5: Notes (Sheet 5 of 5).

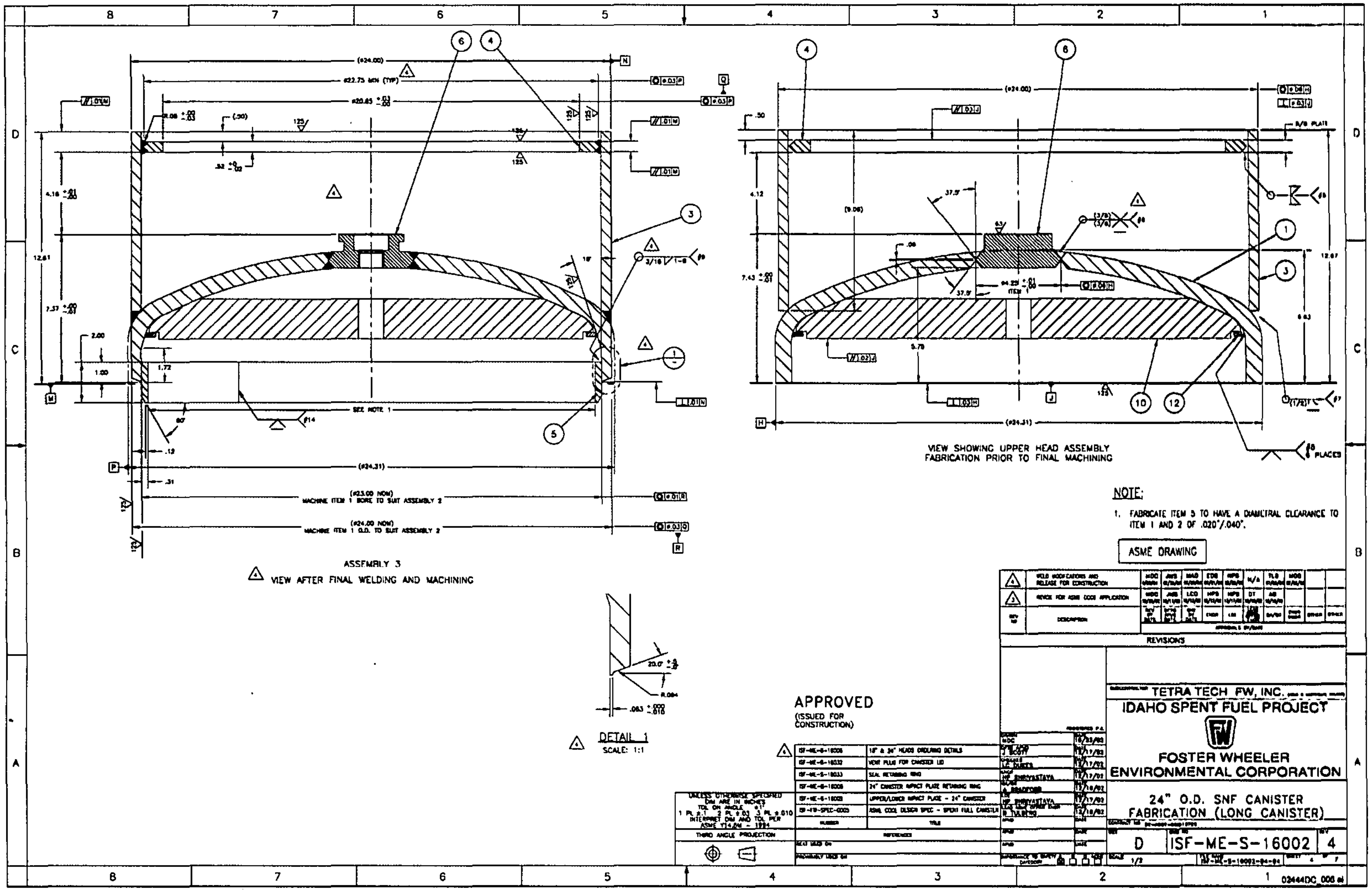
PLACE HOLDER

Figure C-4. 24-in.-O.D. DOE Standardized SNF Canister Sheet 1: Short (10-ft.) Canister (Sheet 1 of 4)



Source: Foster Wheeler Environmental Corporation 2004.

Figure C-4. 24-In.-O.D. DOE Standardized SNF Canister Sheet 2: Long (15-ft.) Canister (Sheet 2 of 4)



Source: Foster Wheeler Environmental Corporation 2004.

Figure C-4. 24-in.-O.D. DOE Standardized SNF Canister Sheet 3: Long (15-ft.) Canister (Sheet 3 of 4)

Notes for Figure C-4

1(a). Maximum loaded mass (weight) of the 24-in diameter 10-ft long canister and contents of 8996 lb (4080 kg) (DOE 1999a, Section 3.2.4) is the minimum canister design load for repository equipment.

1(b). Maximum loaded mass (weight) of the 24-in diameter 15-ft long canister and contents of 10,000 lb (Foster Wheeler Environmental Corporation 2004, Section 4.1) is the minimum canister design load for repository equipment.

2. Maximum canister cylindricity (including margins, such as for manufacturing tolerances, etc.) equals the sum of the nominal diameter and the following (Foster Wheeler Environmental Corporation 2004, Section 4.1):
   (a) Canister diametrical tolerance is ± 0.125 in. (±3.2 mm) per ASME SA-530.
   (b) Canister ovality shall not exceed 1.5% of the specified nominal diameter or 0.36 in. (9.15 mm) per ASME SA--530.
   (c) Canister straightness shall not exceed 0.125 in. (3.2 mm) for every 10 ft (3.0 m) of pipe length per ASME material specification SA-530.
   (d) Final canister weld crown may add an additional 0.1875 in. (4.76 mm) to the diameter.

3. Canister center of gravity shall be within 24.00 in. (609.6 mm) of the canister centroid and less than 8 in. (203.2 mm) from the axial centerline (DOE 1999a, Section 3.2.4).

4. Codisposed SNF canister provided by DOE-EM.

5. Thermal characteristics at the time of shipment to the CRWMS have not been determined. Although additional analysis is required, it may be estimated (assuming a coefficient of expansion for 316L stainless steel of $10x10^{-6}$ in/in ^{0}F) that the 24-in. diameter x 10-ft. long canister will expand at 300°F by 0.36-in. in length and 0.07-in. in diameter; the 24 in. diameter x 15 ft. long canister will expand at 300^{0}F by 0.54-in. in length and 0.07-in. in diameter (Foster Wheeler Environmental Corporation 2004, Section 4.4).

6. Loaded canisters shall be roughly right-circular cylinders capable of standing upright on a flat horizontal surface and remain with the dimensions specified.

7. Canisters with parameters outside the stated ranges are considered "nonstandard" and will be evaluated by DOE-RW for acceptance on a case-by-case basis.

8. The canister shall have a permanently attached lifting fixture that allows remote attachment of the lifting fixture. The ring is the permanently attached lifting fixture.

9. Canisters and lifting fixtures shall have the structural integrity to be lifted vertically.

10. Canisters shall be dried, backfilled with an inert gas (helium), seal welded, and leak tested.

11. SNF canisters shall have a unique alphanumeric identifier that is located prominently on the top external lid, is visible (via remotely operated cameras) from the top, and is integral to and chemically compatible with the canister. The identifier can be expected to remain legible through multiyear storage at temperatures in excess of 150°C and after handling associated with loading into and removal from transportation casks. The identifier shall not impair the integrity of or exceed dimensional limits of the canister.

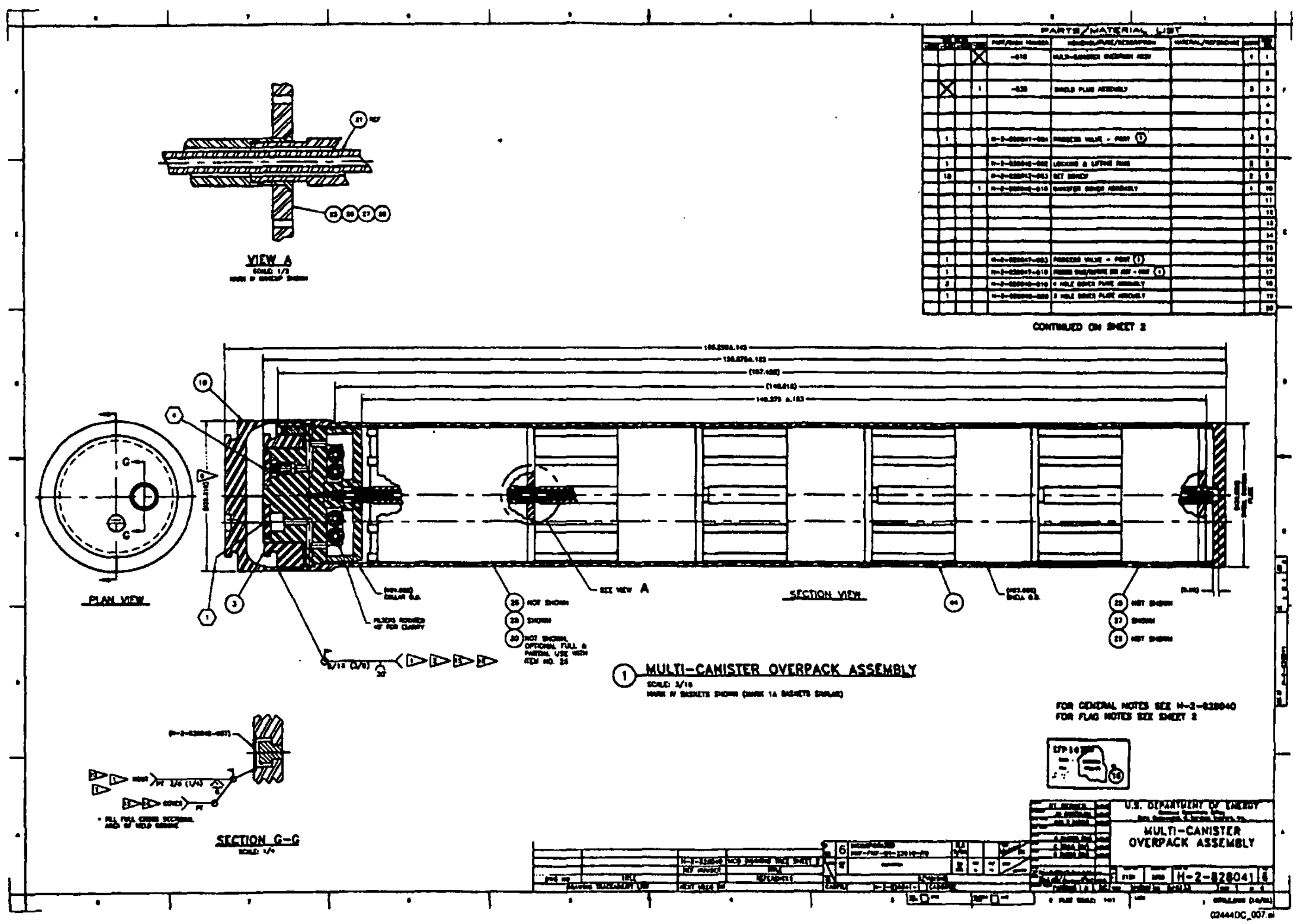
12. Identifier numbering convention: consisting of a two-digit site identifier, then a dash, followed by a four-digit sequential number (e.g., HF-0001). Site identifiers shall be Hanford: HF, Idaho National Laboratory: ID, Savannah River: SR. The data packages will indicate the types of fuel that have been placed in the standardized canister.

13. Labels shall be alphanumeric identifier approximately 1 in. (25.4 mm) high embossed or stamped on the top (outer) surface of the canister rings (DOE 1999a, Section 3.2.15).

14. For canisters where markings are no longer legible, administrative controls shall be implemented prior to cask loading such that the canister remains compliant with the item control provisions of 10 CFR 73.51 at the time of delivery to the CRWMS.

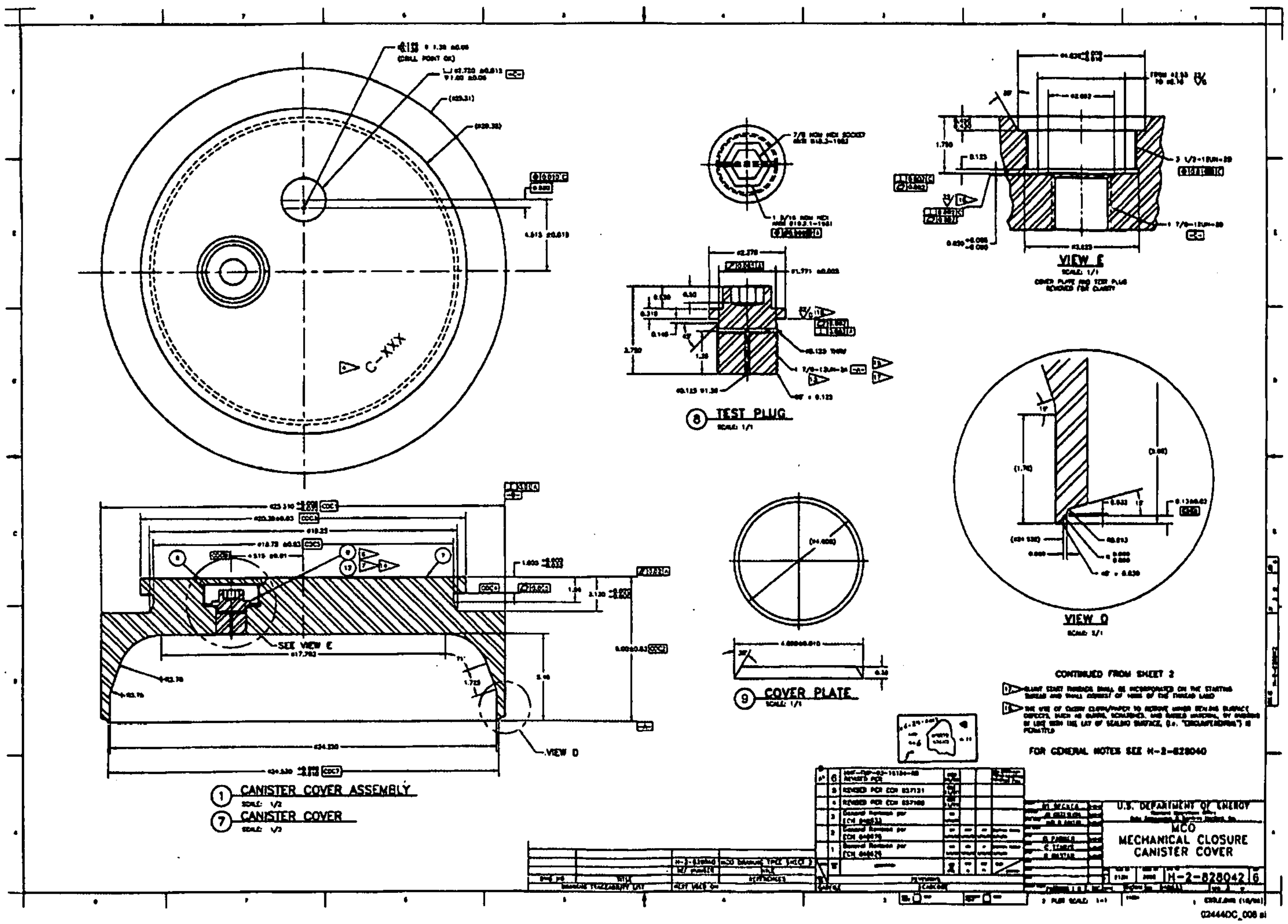
15. SNF disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment to the CRWMS.

Figure C-4. 24-In.-O.D. DOE Standardized SNF Canister Sheet 4: Notes (Sheet 4 of 4)



Source: Gallagher 2005

Figure C-5. Hanford MCO SNF Canister Sheet 1: Assembly (Sheet 1 of 3)



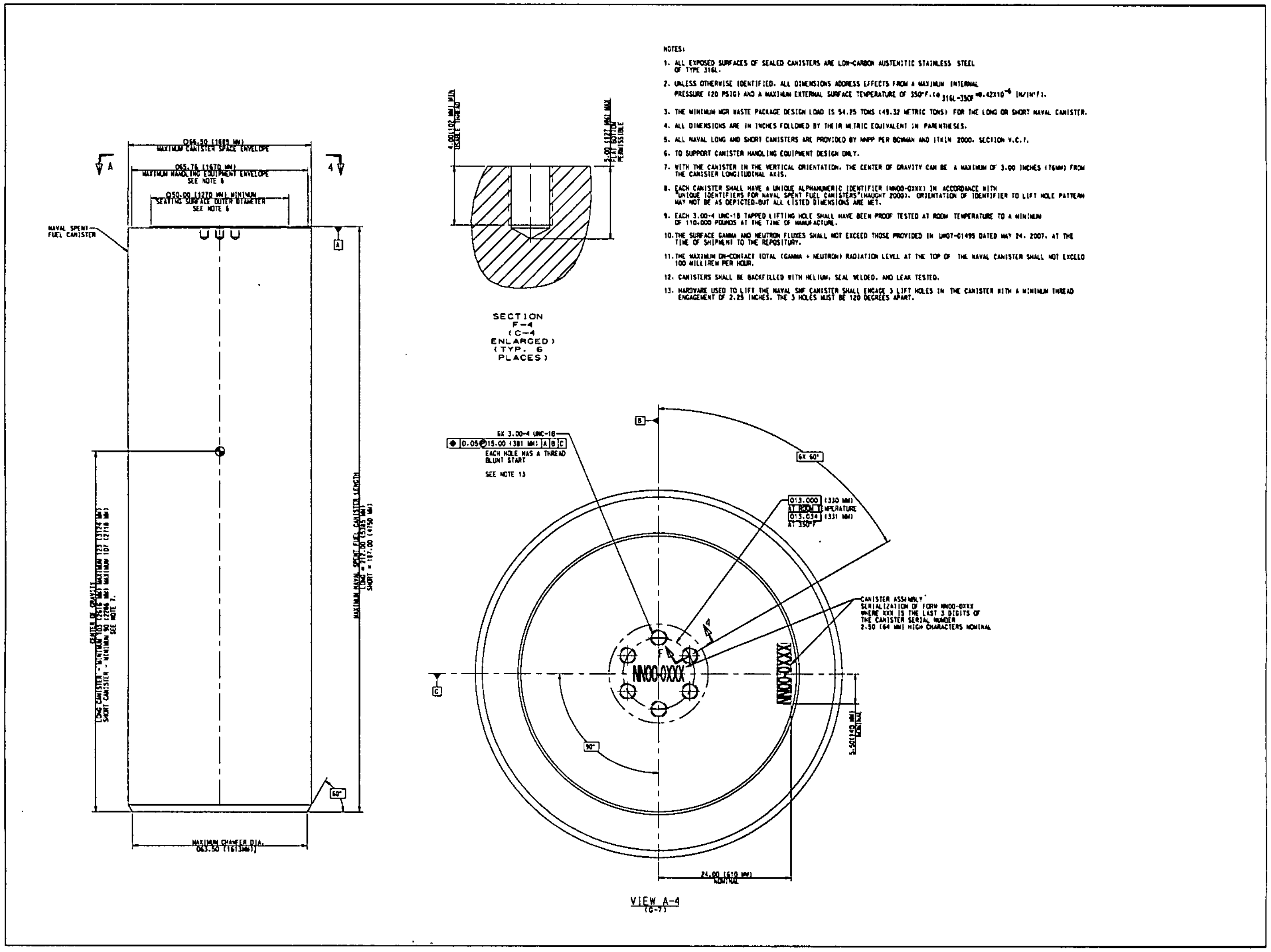
Source: Gallagher 2005.

Figure C-5. Hanford MCO SNF Canister Sheet 2: Closure Cover (Sheet 2 of 3)

Notes for Figure C-5

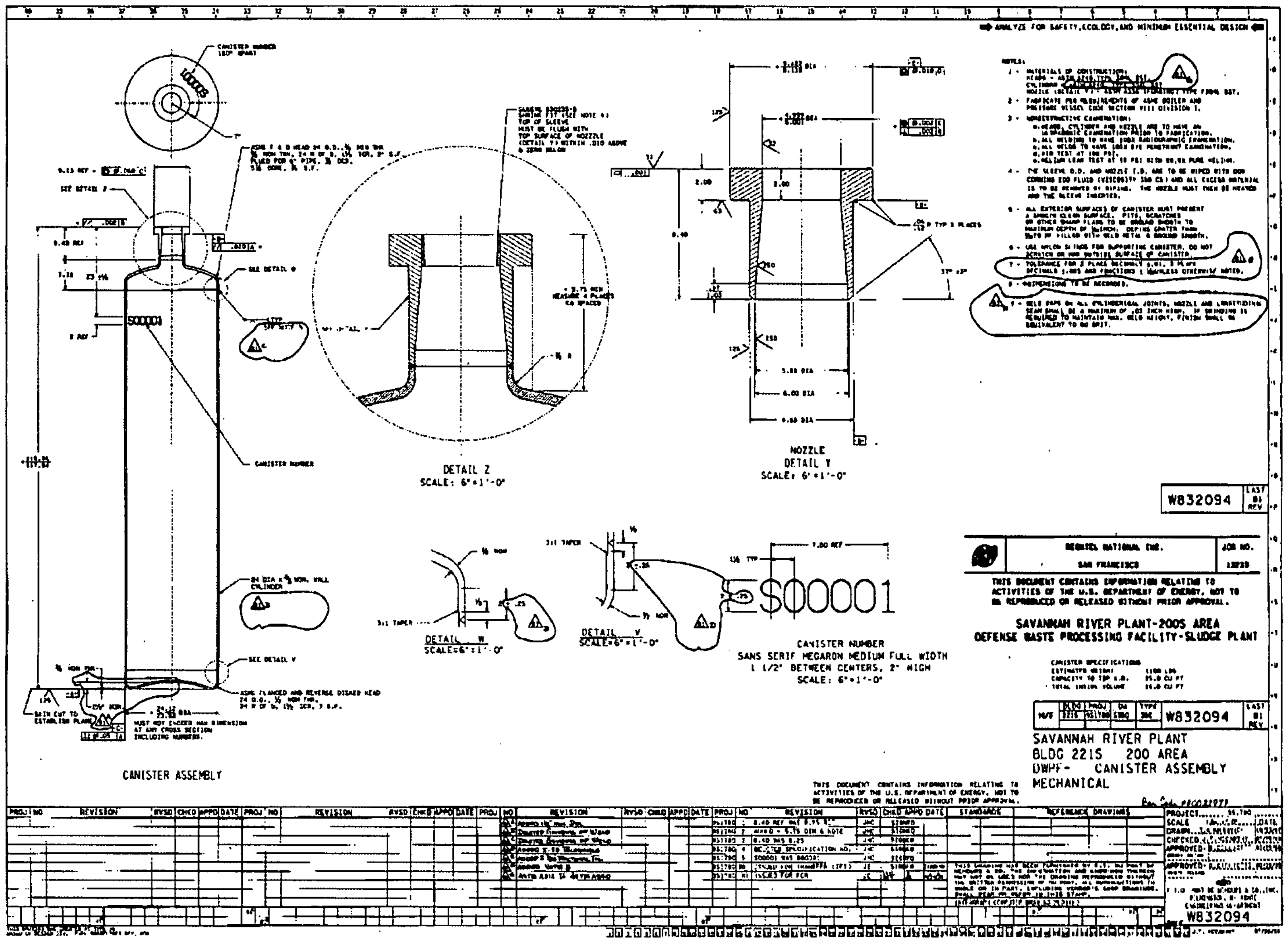
1. Canisters shall have a permanently attached lifting fixture that allows for remote attachment. The fixture must be operable within the canister diameter dimensional envelope. The top flange is the permanently attached lifting fixture.
2. Canisters and lifting fixtures shall have the structural integrity to be lifted vertically.
3. Shield plug and canister cover shall be impression stamped blunt-nosed continuous dies. Components shall be impression stamped using blunt-nosed continuous dies or blunt-nosed interrupted dot die stamps. Alternate methods, such as direct engraving or vibra etching, may be submitted for buyer approval. The canister shell shall be marked with the ASME "N" stamp information as required for nameplates, as specified in ASME NCA-8200 (ASME 1998).
4. SNF disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment to the CRWMS.
5. The MCO head diameter is 25.31 in. The overall MCO diameter is 25.51 in. due to the buildup of the closure weld.
6. Design length of the MCO is 166.29 ± 0.145 in. In actual practice, the overall length could be slightly shorter due to weld shrinkage. No as-built length measurements were taken.
7. MCO identifier numbering convention: H-001 through H-xxx for U-metal fuels (both n reactor and SPR fuels): HF20-0001 through HF20-xxxx for the U-oxide fuels (Shippingport PWR Core 2 blanket fuel). The top of the welded cover cap assembly of an MCO is identified by C-xxx for U-metal fuels, and C2-xxx for the U-oxide fuels. The cover cap number is not the MCO canister number but is being provided as information. Data packages for the MCOs provide relevant information that defines each MCO payload with a unique MCO serial number and unique cover cap assembly serial number.
8. Maximum canister weight supported by the rack is 20,220 lb. (9,171.6 kg) for the MCO (based on 270 Mark IV fixed assemblies).
9. Canister thermal characteristics at the time of shipment to the CRWMS have not been determined.
10. MCO center of gravity shall be below the centroid and along the axial centerline. The center of gravity is not currently specified.

Figure C-5. Hanford MCO SNF Canister
Sheet 3: Notes (Sheet 3 of 3)



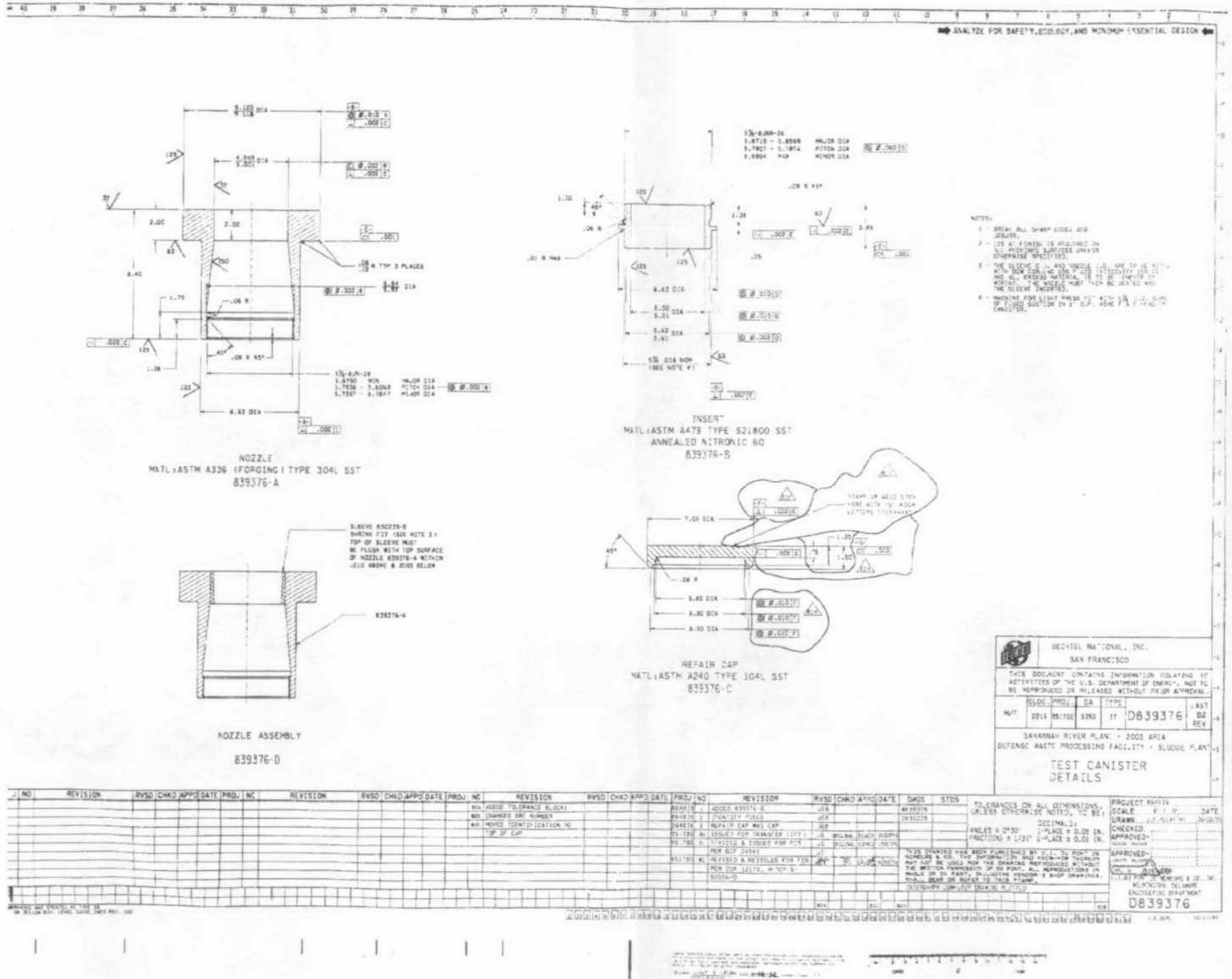
Source: McKenzie 2007b.

Figure C-6. Naval SNF Canister Interfaces with the Repository



Source: Marcinowski 2008, Culbertson 2004.

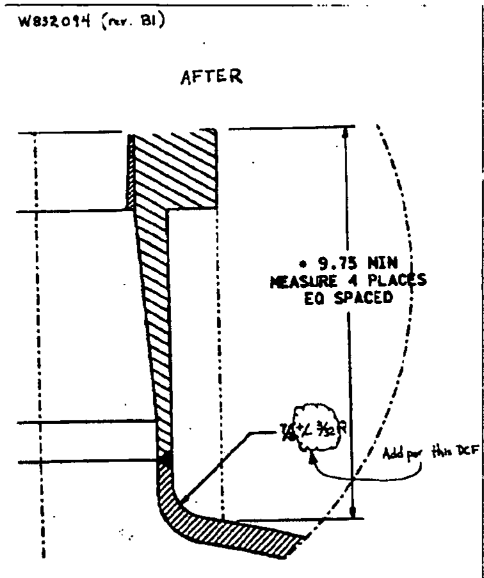
Figure C-7. DWPF HLW Canister Sheet 1: Assembly (Sheet 1 of 4)

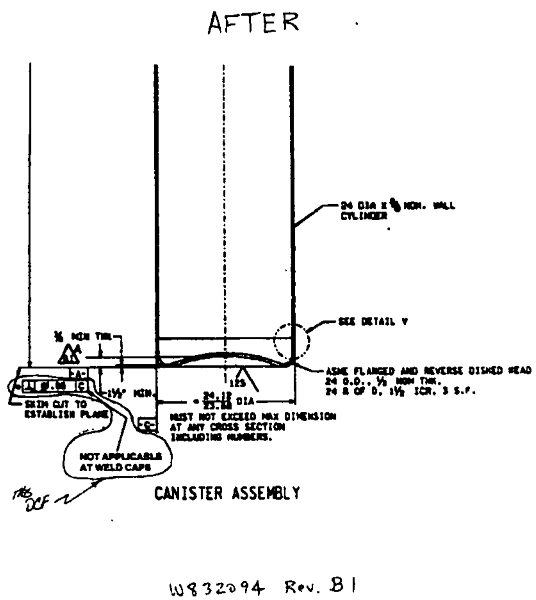


This illegibility item does not affect the content of this document. [signature] 8/28/08

Source: Marcinowski 2008, Culbertson 2004

Figure C-7. DWPF HLW Canister Sheet 2: Details (Sheet 2 of 4)





AFTER

NOTES:

THIS DCF

3 - NONDESTRUCTIVE EXAMINATION:

b. ALL WELDING TO HAVE 100% RADIOGRAPHIC EXAMINATION.
d. AIR TEST AT 188 PSI.
e. HELIUM LEAK TEST AT 15 PSI WITH 99.9% PURE HELIUM.

5 - ALL EXTERIOR SURFACES OF CANISTER MUST PRESENT A SMOOTH CLEAN SURFACE. PITS, SCRATCHES OR OTHER SHARP FLAWS TO BE GROUND SMOOTH TO MAXIMUM DEPTH OF 1/16 INCH. DEPTHS GREATER THAN 1/16 MAY BE FILLED WITH WELD METAL & GROUND SMOOTH.

THIS DCF

9 - WELD CAPS ON ALL CYLINDRICAL JOINTS, AND LONGITUDINAL SEAM SHALL BE A MAXIMUM OF .03 INCH HIGH. IF GRINDING IS REQUIRED TO MAINTAIN MAX. WELD HEIGHT, FINISH SHALL BE EQUIVALENT TO 80 GRIT.

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Source: Marcinowski 2008, Culbertson 2004

Figure C-7. DWPF HLW Canister Sheet 3: Design Changes (Sheet 3 of 4)

Notes for Figure C-7

1. DWPF HLW canisters shall have a unique alphanumeric identifier that is visible via remotely operated cameras from overhead with canister-handling fixtures attached, will remain legible after storage at temperatures in excess of 150°C and after handling activities, does not impair canister integrity, is chemically compatible with the canister, and maintains the dimensional limits of the canister (Culbertson 2004).

2. Canister alphanumeric identifiers shall be 2 in. (5.1 cm) tall, 1.5 in. (3.8 cm) between centers, and use a san serif style megaron medium typeface. Numbering convention consists of a six-character alphanumeric string, with the first character being the letter "S" and the following five characters being numbers (Culbertson 2004, Section 3.2).

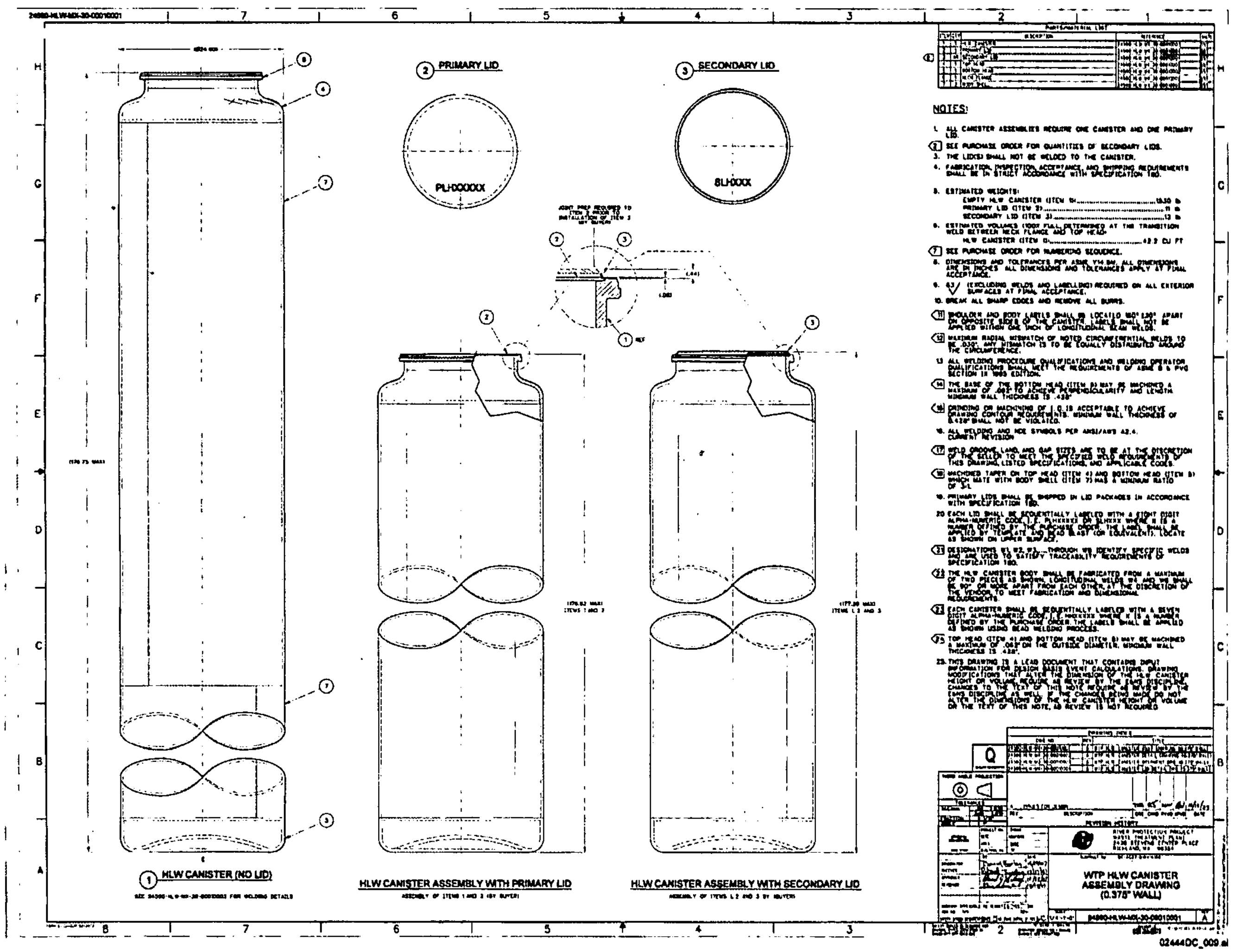
3. The loaded DWPF HLW canisters, including the lifting flange and canister neck, shall have the capability to stand upright without support on a flat horizontal surface.

4. Loaded DWPF HLW canisters shall have a weight not to exceed 5,512 lb. (2500 kg.) (DOE 1996 (WAPS), Section 3.11.1).

5. HLW disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment (DOE 1996 (WAPS), Section 3.9).

6. The DWPF HLW canister design includes a repair cap to be used in the unlikely event of a weld plug defect. If used, the repair cap would increase the overall canister length by 1.51 in.

Figure C-7. DWPF HLW Canister Sheet 4: Notes (Sheet 4 of 4)



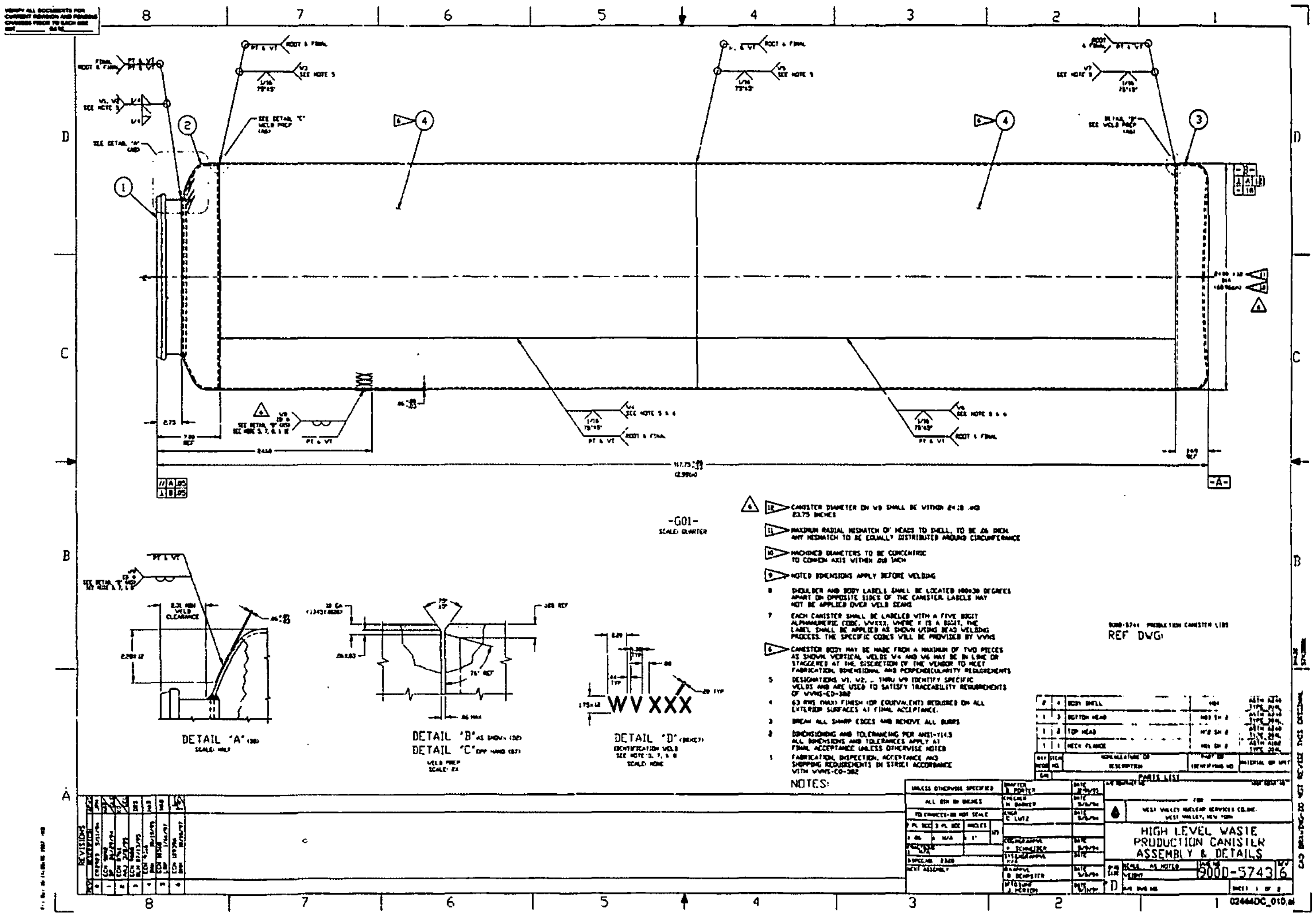
Source: Eschenberg, 2008

Figure C-8. Hanford HLW Canister 3/8 Wall
Sheet 1: Canister Body (Sheet 1 of 2)

Notes for Figure C-8

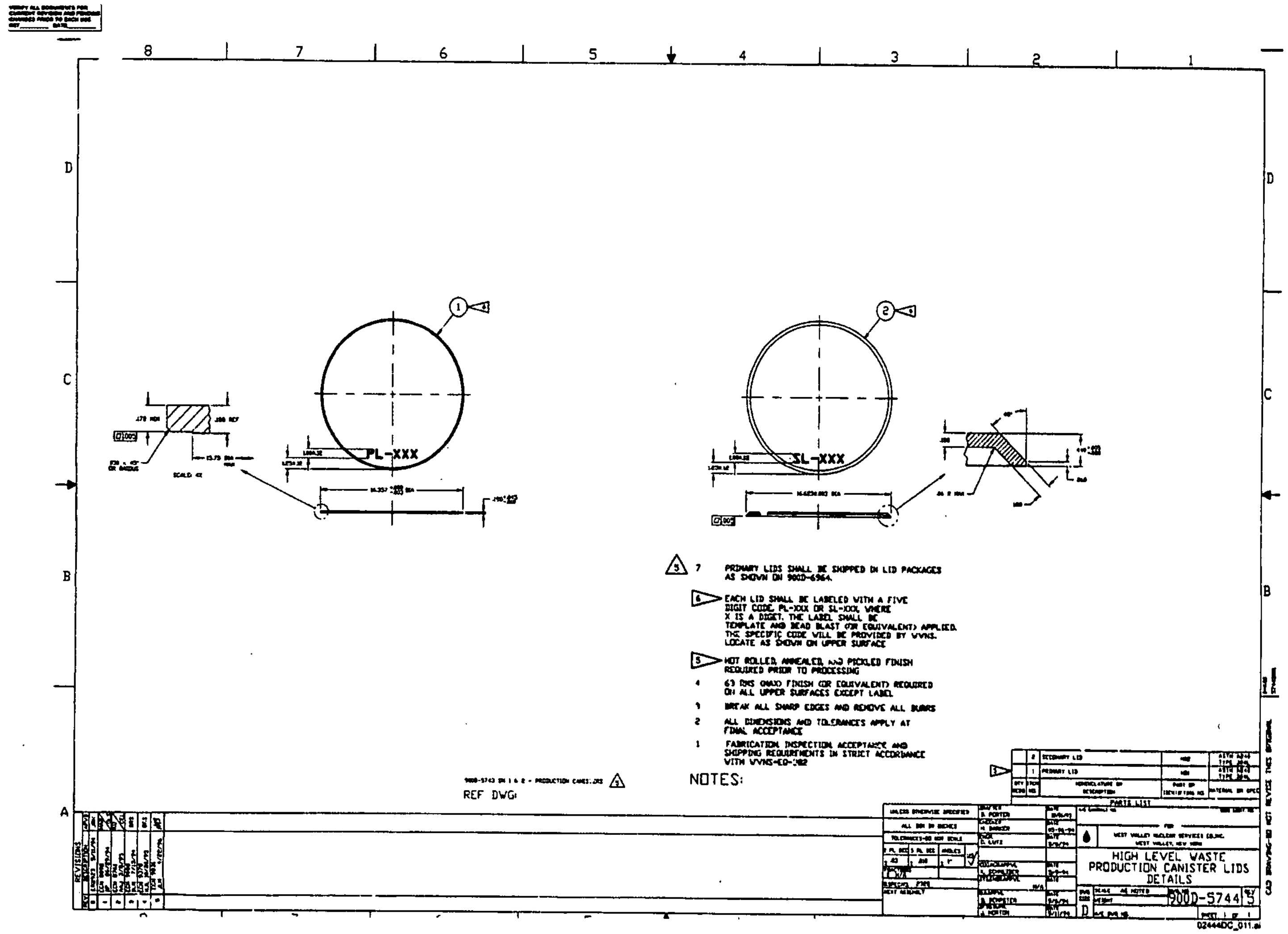
1. Dimensions shown on the figure are for the unfilled canister.
2. HLW canisters shall have a unique alphanumeric identifier that is visible via remotely operated cameras from overhead with canister-handling fixtures attached, will remain legible after storage at temperatures in excess of 150°C and after handling activities, does not impair canister integrity, is chemically compatible with the canister, and maintains the dimensional limits of the canister (DOE 1996 (WAPS), Section 2.3.2).
3. The loaded Hanford HLW canisters, including the lifting flange and canister neck, shall have the capability to stand upright without support on a flat horizontal surface.
4. Loaded Hanford HLW canisters shall have a weight not to exceed 9,260 lb. (4200 kg.) (DOE 2007d, Section 4.8.4).
5. HLW disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment.
6. The Hanford HLW canister design includes a secondary lid (repair cap) to be used in the unlikely event of a primary lid closure weld defect. If used, this secondary lid would increase the overall canister length by 0.38 in.
7. Maximum canister diameter = 24.17 in., calculated from the sum of the following:
   (a) Canister diameter = 24.00 in.
   (b) Tolerance (decimal .00) = ± 0.030 in.
   (c) Cylindricity = 0.125 in. (Bechtel Drawing 24590-HLW-MX-30-00010003 Rev A)
   (d) Tolerance (decimal .000) = ± 0.010 in.

Figure C-8. Hanford HLW Canister 3/8 Wall
Sheet 2: Notes (Sheet 2 of 2)



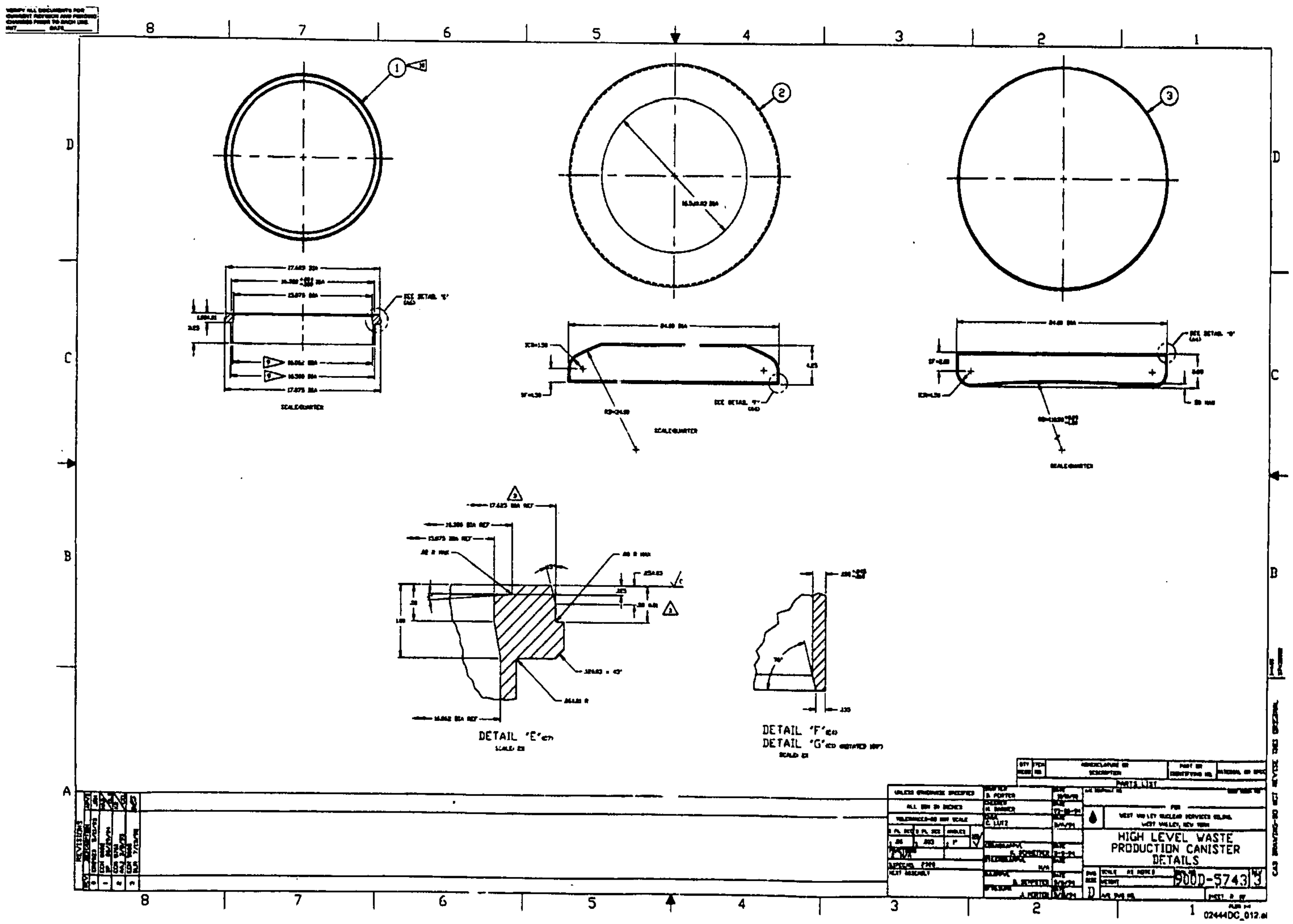
Source: WVNS 1998.

Figure C-9. WVDP HLW Production Canister Sheet 1: Canister Body (Sheet 1 of 4)



Source: WVNS 1998.

Figure C-9. WVDP HLW Production Canister Sheet 2: Lid (Sheet 2 of 4)



Source: WVNS 1998.

Figure C-9. WVDP HLW Production Canister
Sheet 3: Details (Sheet 3 of 4)

Notes for Figure C-9

1. HLW disposable canisters shall not exceed a maximum surface gamma dose rate of 100,000-rem per hour and a maximum neutron dose rate of 10-rem per hour at the time of shipment..
2. Secondary lid or repair cap was not used.
3. At the time of delivery, the HLW canister shall stand upright without support on a flat horizontal surface and fit without forcing into a right--circular cylindrical cavity 64-cm diameter and 3.01-m length (DOE 2007d).
4. Loaded DWPF HLW canisters shall have a weight not to exceed 5,512 lb (2500 kg.) (Cadoff 1995, Section 3.11.1).

Figure C-9. WVDP HLW Production Canister
Sheet 4: Notes (Sheet 4 of 4)