



U.S. Department
of Transportation
Pipeline and
Hazardous Materials
Safety Administration

**COMPETENT AUTHORITY CERTIFICATION
FOR A TYPE B(U)F FISSILE
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/9516/B(U)F-85, REVISION 6**

400 Seventh Street, S.W.
Washington, D.C. 20590

This certifies that the radioactive material package design described has been certified by the Competent Authority of the United States as meeting the regulatory requirements for a Type B(U)F packaging for fissile radioactive material as prescribed in the regulations of the International Atomic Energy Agency¹ and the United States of America².

1. Package Identification - Mound 1KW.
2. Package Description and Authorized Radioactive Contents - as described in U.S. Department of Energy Certificate of Compliance No. 9516, Revision 12 (attached).
3. Criticality - The minimum criticality safety index is 0. The maximum number of packages per conveyance is determined in accordance with Table X of the IAEA regulations cited in this certificate.
4. General Conditions -
 - a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation. The user shall prepare the package for shipment in accordance with the documentation and applicable regulations.
 - b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Technology, (PHH-23), Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, Washington D.C. 20590-0001.
 - c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

¹ "Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), No. TS-R-1 (ST-1, Revised)," published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

² Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

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- d. This certificate provides no relief from the limitations for transportation of plutonium by air in the United States as cited in the regulations of the U.S. Nuclear Regulatory Commission 10 CFR 71.88.
 - e. Records of Quality Assurance activities required by Paragraph 309 of the IAEA regulations¹ shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors and consignees in the United States exporting or importing shipments under this certificate shall satisfy the requirements of Subpart H of 10 CFR 71.
- 5. Special Condition - As described in Paragraph 5 (d) of U.S. Department of Energy Certificate of Compliance No. 9516, Revision 12.
 - 6. Marking and Labeling - The package shall bear the marking USA/9516/B(U)F-85 in addition to other required markings and labeling.
 - 7. Expiration Date - This certificate expires on February 28, 2011.

This certificate is issued in accordance with paragraph 817 of the IAEA Regulations and Section 173.471 and 173.472 of Title 49 of the Code of Federal Regulations, in response to the September 18, 2006 petition by Department of Energy, Washington, DC and in consideration of other information on file in this Office.

Certified By:



Robert A. McGuire
Associate Administrator for Hazardous Materials Safety

Oct 12 2006

(DATE)

Revision 6 - Issued to endorse DOE Certificate of Compliance
USA/9516/B(U)F-85(DOE), Revision 12.

U.S. DEPARTMENT OF ENERGY
CERTIFICATE OF COMPLIANCE
For Radioactive Materials Packages

1a. Certificate Number 9516	1b. Revision No. 12	1c. Package Identification No. USA/9516/B(U)F-85 (DOE)	1d. Page No. 1	1e. Total No. Pages. 10
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2. PREAMBLE

- 2a. This certificate is issued under the authority of 49CFR Part 173.7(d).
- 2b. The packaging and contents described in item 5 below meet the safety standards set forth in subpart E, "Package Approval Standards" and subpart F, "Package and Special Form Tests" Title 10, Code of Federal Regulations, Part 71.
- 2c. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is used on the basis of a safety analysis report of the package design or application --

(1) Prepared by (Name and address): U.S. Dept. of Energy Office of Space and Defense Power Systems, NE-50 1000 Independence Avenue SW Washington, DC 20585	(2) Title and Identification of report or application: MLM-MU-91-64-001, Rev. 7c Safety Analysis Report for Packaging (SARP) for the Mound 1KW Package, as supplemented	(3) Date: February 2006
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4. CONDITIONS

This certificate is conditional upon the fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR parts 100-199 and 10CFR Part 71, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Transport Index, Other Conditions, and References:

(a) Packaging

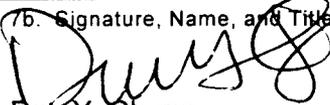
- (1) Model No.: Mound 1KW

The Mound 1KW package is designed for shipping heat source plutonium (primarily ²³⁸Pu) in various chemical forms and mechanical configurations. This Certificate approves its use for shipping 0.5 kW or less in two forms:

- (i) Powdered plutonium oxide, or
- (ii) Various configurations containing General Purpose Heat Source (GPHS) Fueled Clad Assemblies (FCAs) that have been pressed from powdered plutonium oxide within two years of being sealed in a Primary Containment Vessel (PCV) of the Mound 1KW package.

6a. Date of Issuance: SEP 08 2006	6b. Expiration Date: February 28, 2011
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FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address (of DOE Issuing Office) U.S. Department of Energy Office of Environmental Management, EM-60 1000 Independence Avenue SW Washington, DC 20585	7b. Signature, Name, and Title (of DOE Approving Official)  Dae Y. Chung Headquarters Certifying Official Safety Management and Operations Office of Environmental Management
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(2) Description

The Mound 1KW package (Figure 1) consists of a pallet with the cylindrical cask bolted upright in its center. The pallet is of stainless steel and is welded to 8 by 4 inch carbon steel rectangular tubes. The rectangular tubes provide for handling by forklifts.

The cask is surrounded by a mesh barrier supported by steel bars that keeps personnel about 25 cm (10 in) from the cask except at the bottom where the mesh keeps personnel about 14 cm (5.5 in) away. The mesh barrier is 78.1 cm (30.75 in) square by 86.4 cm (34.0 in) tall. The mesh barrier is welded to the pallet and, along with the pallet, defines the accessible surface of the package.

Tiedown brackets are provided on the steel bars that support the mesh personnel barrier. The tiedown brackets are designed so they cannot be used for overhead lifting.

Access to the cask is through the top panel and one side panel of the mesh barrier; these removable panels are held in place by screws.

The cask is of 304L stainless steel 24.1 cm (9.5 in) outside diameter by 49.5 cm (19.5 in) tall outside and 3.81 cm (1.5 in) thick.

The cask is closed by a bolted flange lid which is designed to confine the large components inside the cask but not to provide containment for radioactive particles.

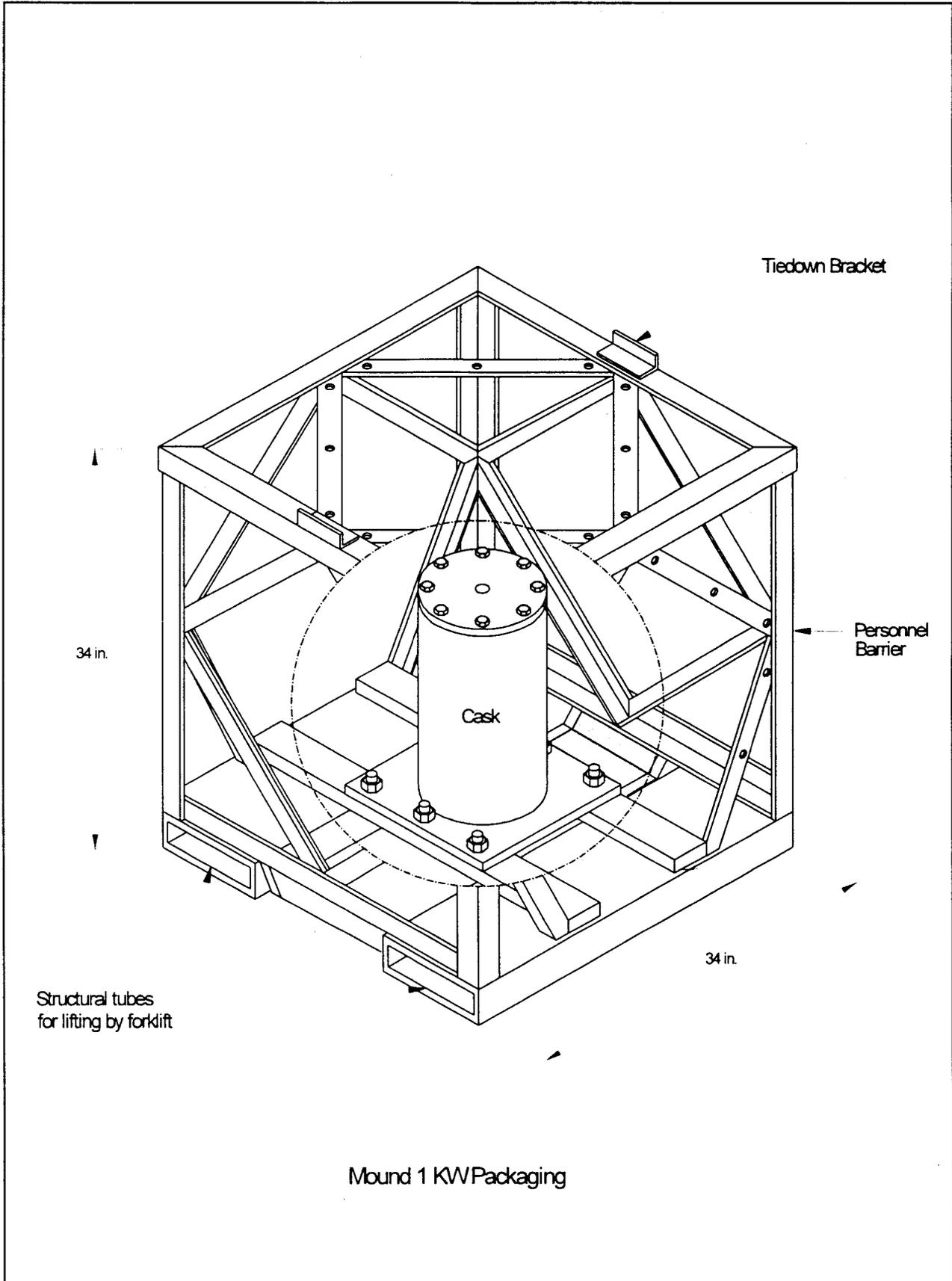


Figure 1

Containment is provided by vessels nested inside the cask (Figure 2). The first vessel inside the cask is the Secondary Containment Vessel (SCV) and inside the SCV are two Primary Containment Vessels (PCV) with a Graphite Filler Block (GFB) between them.

The SCV and PCVs are completely welded, one-trip vessels. The SCV and PCVs comply with Section III, Subsection NB of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PVC). Both the SCV and the PCV are of 304L stainless steel.

The SCV is a cylinder 16.2 cm (6.38 in) outside diameter, 41.3 cm (16.25 in) outside length, and 0.30 cm (0.120 in) thick.

There are two sizes of PCV. Both PCVs have the same outside diameter, 14.6 cm (5.75 in), and wall thickness, 0.30 cm (0.120 in). The PCV for carrying Product Cans (PCs) has an outside length of 14.6 cm (5.75 in); the PCV for carrying GPHS Modules has an outside length of 12.4 cm (5.00 in). The two sizes of PCV are separated by GFBs of different lengths. The GFB separating PCVs for carrying PCs is 8.6 cm (3.38 in) high by 14.3 cm (5.62 in) diameter. The GFB separating PCVs carrying GPHS Modules is 12.4 cm (4.88 in) high by 14.3 cm (5.62 in) diameter.

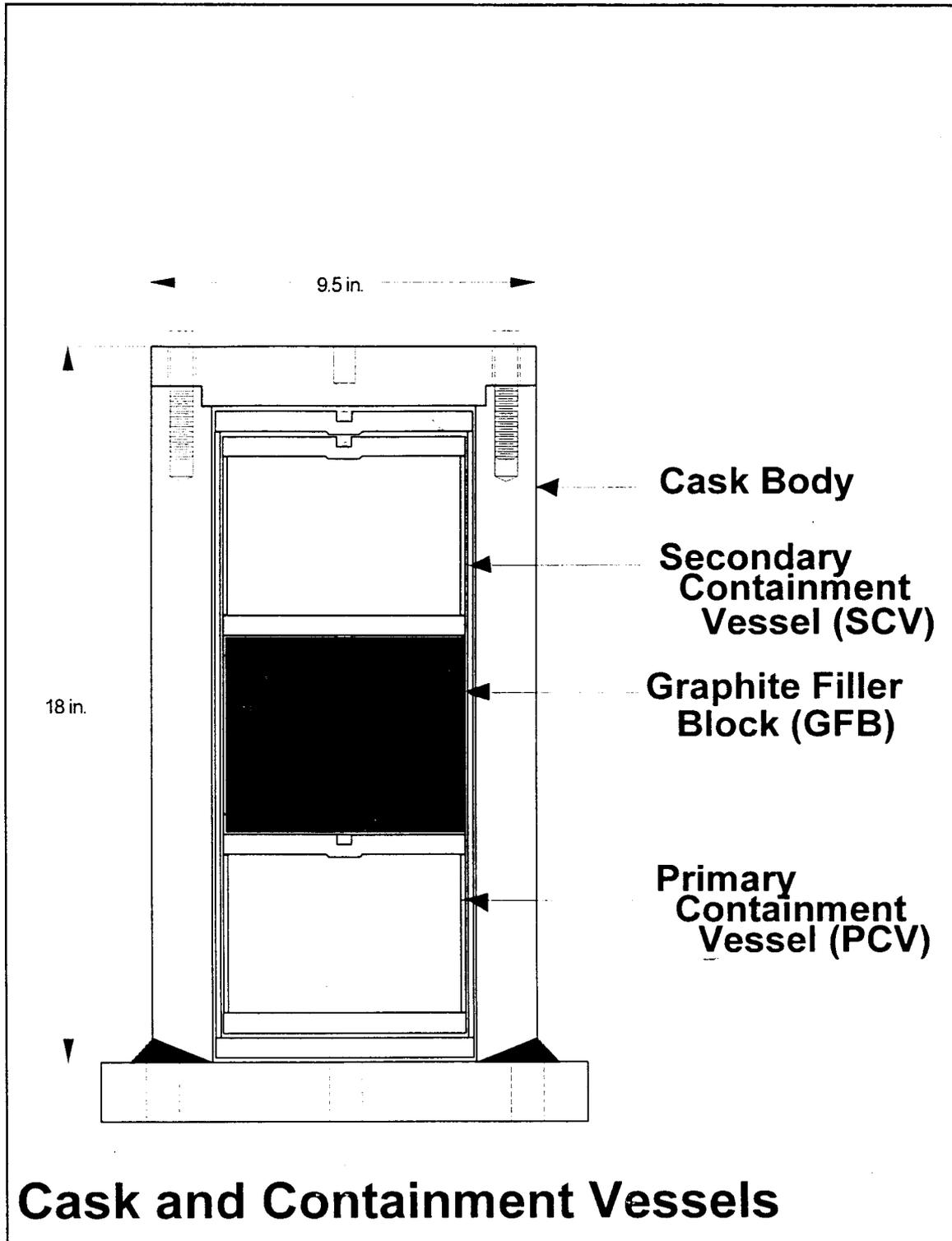


Figure 2

Inside the PCV is either the GPHS Module positioned by a Graphite Support Block (GSB) or one to four PCs also positioned by a GSB.

The PCs are of 304 or 304L stainless steel and have a welded or a threaded closure. One to four PCs are placed in four symmetrically spaced holes parallel to the axis of the GSB block that fills all but the top 1.3 cm (0.5 in) of each PCV. In the case of the GPHS Module, the gap between the GSB and the inside top of the PCV is 0.76 cm (0.3 in). These gaps allow the closure weld of the PCV to be inspected by radiography.

Each PC can contains plutonium oxide powder, one or two FCAs with graphite caps and spacers, or two FCAs in a Graphite Impact Shell (GIS).

Two sizes of PCs are authorized by this Certificate. The Savannah River Site PC (SRS-PC) is 5.1 cm (2.00 in) diameter by 10.8 cm (4.25 in) tall. The Russian PC (Russian-PC) is 3.8 cm (1.5 in) diameter by 11.4 cm (4.5 in) tall. The holes in the GSB are sized to fit the SRS-PC and the Russian-PC closely.

There are also two varieties of SRS-PC; one with a welded closure and one with a threaded closure. The two varieties of SRS-PCs have different inside lengths and are not interchangeable except that powder may be shipped in either SRS-PC.

The SRS-PC and Russian-PC provide for handling at the shipping and receiving sites; the PC is not claimed for containment in transportation.

When a PC is used to carry plutonium oxide powder, the powder is not loose in the PC. Nested inside the SRS-PC is a powder can which contains the loose plutonium oxide powder. The SRS powder can is closed with a threaded lid with a copper gasket. Nested inside the Russian-PC is a metal capsule; nested inside the metal capsule is a metal ampule which contains the loose plutonium oxide powder. The Russian metal capsule is closed with a welded lid; the Russian ampule has a screwed lid with a thin gasket of stainless steel. The powder can, the metal capsule, and the ampule also provide for handling plutonium oxide powder at the shipping and receiving facilities; they are not claimed for containment in transportation.

The Mound 1KW package as presented for shipping weighs 408 kg (900 lbs).

(3) Drawings

The cask, pallet, and personnel barrier are defined by PAI Corporation drawings as follows:

MD-9516,	Sheet 1,	Rev.4
"	Sheet 2,	Rev.3
"	Sheet 3,	Rev.5
"	Sheet 4,	Rev.6
"	Sheet 5,	Rev.5
"	Sheet 6,	Rev.5
"	Sheet 7,	Rev.6
"	Sheet 8,	Rev.6
"	Sheet 9,	Rev.7
"	Sheet 10,	Rev.6
"	Sheet 11,	Rev.6
"	Sheet 12,	Rev.7
"	Sheet 13,	Rev.3
"	Sheet 14a,	Rev.2
"	Sheet 14b,	Rev.1

The two sizes of PCVs, the two sizes of GFBs, and the SCV are defined by Mound drawings as follows:

AYD901015,	Sheet 1/3,	Issue G (5.00 inch high PCV)
"	Sheet 2/3,	Issue G (" " " ")
"	Sheet 3/3,	Issue F (" " " ")
AYD901017,	Sheet 1/3,	Issue H (5.75 inch high PCV)
"	Sheet 2/3,	Issue H (" " " ")
"	Sheet 3/3,	Issue F (" " " ")
AYD901018,	Sheet 1/1,	Issue B (Items 1 and 2 only)
AYD901019,	Sheet 1/2,	Issue G
"	Sheet 2/2,	Issue G

The GSB for carrying the GPHS Module within a PCV is defined by Mound drawing:

AYD901020,	Sheet 1/1,	Issue A
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The GSB that positions the SRS-PCs within a PCV is defined by Mound drawing:

AYD901021,	Sheet 1/1,	Issue A
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The GSB that positions the Russian-PCs within a PCV is defined by Mound drawing:

AYD920631,	Sheet 1/1,	Issue A
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The SRS-PC with the threaded closure is defined by Mound drawing:

AYD901022,	Sheet 1/3,	Issue D (Part 7)
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The SRS-PC with the welded closure is defined by Mound drawings:

AYD820774,	Sheet 1/2,	Issue E (Weldment only)
"	Sheet 2/2,	Issue C

The graphite caps and spacers that position one or two FCAs inside the SRS-PC with welded closure are defined by Mound drawings:

AYD820774,	Sheet 1/2,	Issue E
"	Sheet 2/2,	Issue C

A thin graphite spacer may be required to position the GIS inside the SRS-PC with threaded closure. The graphite spacer is defined by Mound drawing:

AYD820774,	Sheet 2/2,	Issue C (Welded closure)
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The powder can that nests inside the SRS-PC is defined by Mound drawings:

AYD901022,	Sheet 2/3,	Issue C
"	Sheet 3/3,	Issue B

The Russian-PC and GSB are defined by Mound drawings:

AYD920592,	Sheet 1/2,	Issue B
"	Sheet 2/2,	Issue B
AYD920631,	Sheet 1/1,	Issue A

The Russian capsule and Russian ampule are described in Figure 1.18 of the SARP.

(b) Contents

The composition of the plutonium shipped in the Mound 1KW package whether as powder or FCAs shall fall within the following radioactive isotopic compositions:

Isotope	Weight %
^{236}Pu	$\leq 2 \times 10^{-4}$
^{238}Pu	79.5 to 90.0
^{239}Pu & ^{241}Pu	20.0 to 8.4
Pu (all other)	≤ 4.0
^{241}Am	≤ 0.1
^{237}Np	≤ 1.0
U (all isotopes)	≤ 3.0
Th (all isotopes)	≤ 0.5

The total radioactive content of the Mound 1KW package shall not exceed 590 TBq (15,930 Curies). The Mound 1KW package shall not carry more than 1110 grams of ^{233}U , ^{235}U , ^{238}Pu , ^{239}Pu , and ^{241}Pu isotopes combined. These isotopes are defined as "fissile material" in paragraph 129 of IAEA Safety Series 6, 1985 Revised Edition (As Amended 1990).

The available shipment times for Fueled Clads with one, two, three and four product cans per PCV are provided in Figures 3.11a, 3.11b, 3.11c, and 3.11d of the SARP. The maximum internal pressures for the PCVs under NCT thermal conditions are provided in Table 3.17 of the SARP.

The Mound 1KW package shall contain no more than the following amounts of the ^{238}Pu isotope, expressed in Watts, whether as powder or FCAs:

^{238}Pu LIMIT IN WATTS

Component	GPHS Module	GIS in SRS-PC with Threaded Closure	FCA in SRS-PC with Welded Closure	Powder in SRS-PC	Powder in Russian-PC
SCV	500	500	500	464	500
PCV	255	255*	255*	232	255
PC	NA	130	130	58	70

* When only two PCs are to be loaded into a single PCV, they shall be loaded in diametrically opposite holes in the GSB.

If the total neutron generation rate in an SCV exceeds 15.87×10^6 neutrons/sec (the average rate of all the radioactive material in an SCV exceeds 18,000 neutrons/sec/gm ^{238}Pu), the SCV content shall be

reduced to the amount shown in Figure 3. Also the PCV limit and the PC limit shall be multiplied by the ratio of the reduced SCV content in watts obtained from Figure 3 divided by 500 watts.

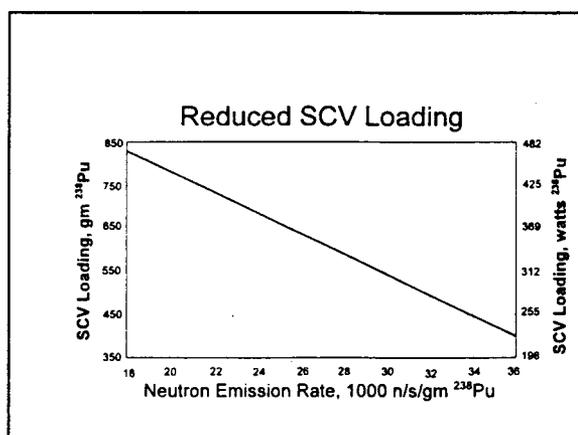


Figure 3

- (c) Minimum Criticality Safety Index: 0
- (d) Conditions
- (1) Transport shall be by exclusive use.
 - (2) Transportation of PCVs containing ²³⁸Pu must be completed within 365 days of the time the PCV is welded shut.
 - (3) Except for shipments made under the auspices of the Office of Secure Transportation, under the conditions provided in Chapter 7 of the SARP, or except as provided in Condition 5.(d)(5), the Mound 1KW package may not be shipped in an enclosed space that impedes natural convection heat transfer with the atmosphere.
 - (4) The Mound 1KW package may not be covered with a tarpaulin or other material that impedes natural convection heat transfer with the atmosphere.
 - (5) Cargo containers 8x8x20 feet in size, made of metal (except for the flooring) single wall construction, uninsulated, and with at least 3.8 cm (1.5 in) thick flooring, may transport up to three Mound 1KW packages containing no more than 500 watts of plutonium oxide powder each. In land transport, all surfaces of the cargo container except its bottom must be fully exposed to the ambient air. In sea transport, the cargo container must be in the top layer of the on-deck stacks with at least 60 cm (2 ft) clearance on both long sides from other cargo containers and ship structure.
 - (6) The Mound 1KW package may not be used to transport plutonium by air.
 - (7) In accordance with 49 CFR 173.441(b)(4), the land transport crew shall wear radiation dosimetry devices and operate under provisions of a regulated radiation protection program. In sea transport the external surface of the cargo container must be 2.4 meters (8 feet) or more from normally occupied positions.
 - (8) In addition to the requirements of Subparts G and H of 10 CFR Part 71, each package must be fabricated, acceptance tested, operated, and maintained in accordance with the Operating Procedures requirements of Chapter 7, Acceptance Tests and Maintenance Program

requirements of Chapter 8, and packaging-specific Quality Assurance requirements of Chapter 9 of the SARP.

- (9) If any SCV or PCV welded at a participant site fails the periodic overpressure test specified in Chapter 8 of the SARP, the DOE Headquarters Certifying Official shall be notified immediately. SCVs and PCVs welded by that site since its last successful periodic overpressure test must be removed from transportation service.
- (10) All SCV and PCV closure welds must be examined by radiography in accordance with the ASME B&PVC, Section III, Subsection NB, paragraphs NB-5220 and NB-5320. The acceptance criteria for elongated indications, other than cracks or zones of incomplete fusion or penetration, which are not allowed, shall be 1.0 mm (0.040 in) or less. For use of the double-wall exposure technique, at least six x-ray exposures taken at 60° increments are required. In lieu of the requirement in NB-5220 for either a liquid penetrant or magnetic particle inspection, each PCV and SCV shall be visually inspected per ASME B&PVC, Section V, Article 9 and shall be helium leak tested per section 8.1.3 of the SARP. This Condition applies to weld qualification vessels and to periodic overpressure test vessels as well as all production vessels. The number of x-ray exposures may be reduced by demonstrating to the satisfaction of the DOE Headquarters Certifying Official that all cracks, all incomplete fusion zones, and all unacceptable elongated indications are detectable with the proposed number of x-ray views.

For all other SCV and PCV welds, a single-wall exposure technique may be used for radiography whenever practical with at least four x-ray exposures at 90° increments. When it is not practical to use the single-wall technique, four x-ray exposures at 90° increments using the double wall technique may be used in conjunction with visual examination of the outside weld beads and heat affected zones per the requirements of the B&PVC Section V, Article 9. Acceptance criteria shall be the same as for the closure welds.

- (11) If the welding apparatus is diverted to uses other than fabricating Mound 1KW packages or welding operations are halted for more than 90 days, welding procedure qualification records shall be reviewed and a qualified welder using this procedure shall weld one PCV or one SCV whichever is appropriate for the welding apparatus being requalified. These trial welds shall be examined per Condition 5.d(10) of this Certificate. If they are not acceptable per Condition 5.d(10) of this Certificate, then the welding procedure specification shall be requalified per the requirements of the ASME B&PVC, Section IX and the overpressure tests shall be redone.
- (12) Shipments made under the auspices of the Office of Secure Transportation will be made in accordance with the requirements specified in the latest revision to the DOE Restraint Manual, Type B and ARG Packages, Rev. 0, March 2006.

List of Acronyms:

ASME	American Society of Mechanical Engineers
B&PVC	Boiler and Pressure Vessel Code
DOE	Department of Energy
FCA	Fueled Clad Assembly
GFB	Graphite Filler Block
GIS	Graphite Impact Shell
GPHS	General Purpose Heat Source
GSB	Graphite Support Block
PC	Product Can
PCV	Primary Containment Vessel
SCV	Secondary Containment Vessel