

**From:** "CHARETTE, Marc-Andre" <Marc.CHARETTE@mdsinc.com>  
**To:** "Shawn Williams" <SAW8@nrc.gov>  
**Date:** 12/15/05 12:20AM  
**Subject:** RE: Any news on the Canadian NRC approving revised F-458....

Hi Shawn,

We are working with the CNSC and expect to have the certificate late this week or early next week. The CNSC pointed out a mistake with the Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages, IS/DS 1789 F458 which was revised to update Table 1 to correct the word "and" to "or" in the sentence "1 M NH<sub>4</sub>NO<sub>3</sub> or up to 0.4% NaOCl" in the fifth column for the Mo-99/Tc-99m row. Attached is the revised specification.

Sincerely  
Marc-Andre

-----Original Message-----

From: Shawn Williams [mailto:SAW8@nrc.gov]  
Sent: Tuesday, December 13, 2005 7:44 AM  
To: CHARETTE, Marc-Andre  
Cc: Fred.ferate@dot.gov; rick.boyle@RSPA.dot.gov  
Subject: Any news on the Canadian NRC approving revised F-458....

Hi Marc,

We are waiting for the Canadian NRC to approve the revised Canadian Certificate for the F-458 series and subsequently receive that from DOT. Any news on the status of that?

Shawn A. Williams  
Project Engineer  
U.S. Nuclear Regulatory Commission  
Spent Fuel Project Office, NMSS  
Work #: 301-415-3207  
Fax #: 301-415-8555  
Address:  
Mail Stop: O13D13  
Washington, DC 20555-0001

"There is a real magic in enthusiasm.  
It spells the difference between mediocrity and accomplishment."

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**CC:** <Fred.ferate@dot.gov>

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**Creation Date:** 12/14/05 3:54PM  
**From:** "CHARETTE, Marc-Andre" <Marc.CHARETTE@mdsinc.com>

**Created By:** Marc.CHARETTE@mdsinc.com

**Recipients**

nrc.gov

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SAW8 (Shawn Williams)

dot.gov

Fred.ferate CC

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## IS/DS 1789 F458 (7)

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Page 1 of 23

**Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages****Signatures**

Prepared by: signature on file Date: yy/mm/dd  
K. Glenn, Package Engineering

Reviewed by: signature on file Date: yy/mm/dd  
M.A. Charette, Regulatory Affairs

Reviewed by: signature on file Date: yy/mm/dd  
R. Kachaniwsky, Director  
Quality Assurance

Approved by: signature on file Date: yy/mm/dd  
B. Menna  
Technical Design Authority

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**NOTE:** A vertical line in the margin (tracking bar), denotes change. For complete rewrites, tracking bars are not used.

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## 1. SCOPE

This specification establishes the essential technical requirements for technical specifications, drawings, procedures and other documents that are used in the design, fabrication, maintenance, inspection and the preparation for shipment of the F-458 Family of Transport Packages.

Section 4, which pertains to manufacturing, shall not apply for the F-318 shielding vessels, as only the F-251 design is manufactured.

The requirements defined herein ensure compliance with the terms and conditions of the Safety Analysis Report [1], the package Design Approval Certificate for the F-458/F-245, F-458/F-247, F-458/F-251\*, F-458/F-318 and F-458/F-448 [2] and the Regulations [3, 4].

**\*NOTE:** The term "F-251" includes the model F-251 Mk II.

## 2. PACKAGE DESCRIPTION

### 2.1 Introduction

The F-458/F-245, F-458/F-247, F-458/F-251, F-458/F-318 and F-458/F-448 transport packagings have been designed to transport a variety of isotopes in solid or liquid form. The F-458/F-245 packaging is shown in MDS Nordion drawing F624501-002 [5]. The F-458/F-247 packaging is shown in MDS Nordion drawing F624701-002 [6]. The F-458/F-251 packaging is shown in MDS Nordion drawing F625101-002 [7]. The F-458/F-318 packaging is shown in MDS Nordion drawing F631801-002 [8]. The F-458/F-448 packaging is shown in MDS Nordion drawing F644801-002 [9]. Shielding is provided by the F-245, F-247, F-251 or F-318 shielding vessels, which are depleted uranium encased in stainless steel fabrications or the F-448 shielding vessel, which is lead encased in stainless steel fabrication. Containment is provided by either a welded stainless steel sealed sources, which may meet the requirements for Special Form radioactive material, or a model F-242, F-248, F-250, F-256 or F-320 leakproof insert. Fire and impact protection is provided by the F-458 overpack\*\* which is a double skinned stainless steel container with a bolted on closure lid. The space between skins of the stainless steel container is filled with closed cell polyurethane foam.

Only package configurations specified on the Design Approval Certificate [2] shall be shipped.

The nominal weights of the individual packages areas follows:

|             |          |
|-------------|----------|
| F-458/F-245 | 152.6 kg |
| F-458/F-247 | 124.5 kg |
| F-458/F-251 | 167.0 kg |
| F-458/F-318 | 164.0 kg |
| F-458/F-448 | 137.2 kg |

The above referenced drawings form an integral part of this specification.

**\*\*NOTE:** The F-458 is an integral part of the packaging and is therefore not considered an overpack according to IAEA regulation. The term in this particular case is used as a matter of convenience.

## 2.2 F-458 Overpack

The F-458 overpack provides impact and fire protection for the F-245, F-247, F-251, F-318 and/or F-448 shielding vessels and their contents during accident conditions of transport. They are illustrated in MDS Nordion drawings F625101-001 [5], F631801-001 [6], F625101-002 [7], F631801-002 [8] and F644801-002 [9]. The F-458 overpack consists of the following features:

- double skinned type 304L stainless steel container, 40 cm diameter by 49 cm high
- the container is equipped with two lifting apertures in the top chime
- a closure lid is bolted to the container body and may be fitted with a tamperproof seal
- one identification plate bearing the CNSC certification number and a trefoil is affixed to the side of the container
- one radiation warning plate is affixed to the side of the container
- the space between the double skins of the stainless steel container is filled with closed cell polyurethane foam
- the vent holes for the polyurethane foam, located on the bottom of the container and lid, are plugged with plastic pipe thread plugs, that are designed to melt in the hypothetical fire
- nominal weight of the empty F-458 container is 62 kg (136 lbs.).

## 2.3 F-245 Shielding Vessel

The F-245 is a depleted uranium-filled cylindrical vessel. It is illustrated in MDS Nordion drawing F624501-001 [5], and includes the following features:

- Type 304L stainless steel encased depleted uranium
- nominal depleted uranium thickness is 51 mm (2.0 in.)
- minimum thickness of the stainless steel shell of 2.54 mm (0.100 in.)
- nominal cavity size of 63 mm (2.47 in.) in diameter by 116 mm (4.56 in.) high
- shielding vessel plug retained with 4 screws, 3/8-16 UNC x 7 / 8 in. long SAE J429 Grade 5 (or equivalent)
- plug is sealed with a 1/8 in. thick Neoprene gasket
- auxiliary tungsten shielding insert may be used for additional shielding
- nominal weight of the F-245 shielding vessel is 87 kg (192 lbs.)

## 2.4 F-247 Shielding Vessel

The F-247 is a depleted uranium-filled cylindrical vessel. It is illustrated in MDS Nordion drawing F624701-001 [5], and includes the following features:

- Type 304L stainless steel encased depleted uranium
- nominal depleted uranium thickness is 46 mm (1.8 in.)
- minimum thickness of the stainless steel shell of 2.54 mm (0.100 in.)
- nominal cavity size of 52 mm (2.06 in.) in diameter by 96 mm (3.78 in.) high
- shielding vessel plug retained with 4 screws, 3/8-16 UNC x 7 / 8 in. long SAE J429 Grade 5 (or equivalent)
- plug is sealed with a 1/8 in. thick Neoprene gasket
- auxiliary tungsten shielding insert may be used for additional shielding
- nominal weight of the F-247 shielding vessel is 62 kg (137 lbs.)

## 2.5 F-251 Shielding Vessel

The F-251 is a depleted uranium-filled cylindrical vessel. It is illustrated in MDS Nordion drawing F625101-001 [5], and includes the following features:

- Type 304L stainless steel encased depleted uranium
- nominal weight of depleted uranium is 83 kg (183 lbs.)
- nominal depleted uranium thickness is 44 mm (1.75 in.)
- minimum thickness of the stainless steel shell of 2.5 mm (0.10 in.)
- nominal cavity size of 75 mm (3 in.) in diameter by 150 mm (5.9 in.) high
- shielding vessel plug retained with 4 screws, or 6 screws (model F-251 Mk II), 3/8-16 UNC x 1.0 in. long SAE J429 Grade 5 (or equivalent)
- plug is sealed with a 1/8 in. thick Neoprene gasket, or two neoprene O-rings (model F-251 Mk II)
- auxiliary tungsten shielding insert may be used for additional shielding
- nominal weight of the F-251 shielding vessel is 100 kg (220 lbs.)

## 2.6 F-318 Shielding Vessel

The F-318 is a depleted uranium-filled cylindrical vessel. It is illustrated in MDS Nordion drawing F631801-001 [6], and includes the following features:

- Type 304L stainless steel encased depleted uranium
- nominal weight of depleted uranium is 75 kg (165 lbs.)
- nominal depleted uranium thickness is 46 mm (1.8 in.)
- minimum thickness of the stainless steel shell of 2.5 mm (0.10 in.)
- nominal cavity size of 72 mm (2.85 in.) in diameter by 155 mm (6.12 in.) high
- shielding vessel plug retained with 6 screws, 3/8-16 UNC x 1.0 in. long SAE J429 Grade 5 (or equivalent)
- plug is sealed with a 1/8 in. thick Neoprene gasket
- auxiliary tungsten shielding insert may be used for additional shielding
- nominal weight of the F-318 shielding vessel is 95 kg (210 lbs.).

## 2.7 F-448 Shielding Vessel

The F-448 is a lead-filled cylindrical vessel. It is illustrated in MDS Nordion drawing F644801-002 and includes the following features:

- Type 304L stainless steel encased lead
- nominal lead thickness is 48 mm (1.88 in.)
- minimum thickness of the stainless steel shell of 2.54 mm (0.100 in.)
- nominal cavity size of 75 mm (3 in.) in diameter by 106 mm (4.2 in.) high
- shielding vessel plug retained with 6 screws, 3/8-16 UNC x 7 / 8 in. long SAE J429 Grade 5 (or equivalent)
- a leak test port is fitted between two O-rings
- auxiliary lead, steel or tungsten shielding insert may be used for additional shielding
- maximum weight of the F-448 shielding vessel including its contents is 79 kg (175 lbs.)

## 2.8 Containment System

Either a Special Form sealed source, or a C133 welded stainless steel sealed source, or an F-242, F-248, F-250, F-256 or F-320 leakproof insert provides containment. The leakproof inserts include the following features:

- cylindrical body, material stainless steel Type 304
- threaded cap, material stainless steel Type 416
- neoprene O-ring (or an equivalent O-ring material with an equal or better service temperature range)
- minimum internal volume of 103 ml for F-242, 390 ml for F-250 and F-320, 194 ml for F-248 and 252 ml for F-256
- minimum wall thickness of 0.25 cm (0.10 in.)
- the design shall be demonstrated to withstand a gauge pressure of 4.9MPa (711psi) at 138°C without leakage.

## 2.9 Shielding Inserts

The Iridium-192 sources shall be contained within the insert as follows:

The F-336 insert shall used with the F-245 shielding vessel and will include the following features:

- it shall fit directly into the F-245 shielding vessel cavities
- nominal tungsten thickness of 15 mm (0.6 in.)
- nominal weight of the F-336 insert is 4.65 Kg (10.25 lbs.).

The F-368 insert shall used with the F-251 and F-318 shielding vessels and will include the following features:

- it shall fit directly into the F-251 and F-318 shielding vessel cavities
- nominal tungsten thickness of 20 mm (0.8 in.)
- nominal weight of 9 Kg (20 lbs.).

The F-174, F-286, F-382 or F-389 inserts may be used with the F-448 shielding vessels and will include the following features:

- The F-174, F-286 and F-382 must fit directly into the F-448 shielding vessel cavity
- The F-389 must fit within the F-256 leakproof insert



## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## 2.10 Contents

The permissible activity and form of the radioisotopes shall be as listed in the tables below.

| <b>Table 1</b><br><b>Package Configurations and Authorized Radioactive Contents</b><br><b>F-458/F-245 and F-458/F-247</b> |                       |                       |                       |   |
|---|-----------------------|-----------------------|-----------------------|---|
| Isotope   | Package Configuration |                       |                       | Chemical and Physical Form  |
|   | F245 with F248 insert | F247 with F242 insert | F245 with F336 insert |   |
| I-131   | 7500 GBq (202 Ci)     | 3300 GBq (89 Ci)      | —                     | Solid or Aqueous NaOH solution or Aqueous NaOH with up to 0.2 M Na <sub>2</sub> SO <sub>4</sub>                   |
| Ir-192  |                       | 37 TBq (1000 Ci)      | —                     | Solid Pellets   |
| Ir-192  | —                     | —                     | 300 TBq (8100 Ci)     | Solid Pellets within a C133 sealed source   |
| Ir-192  | —                     | 110 TBq (2970 Ci)     |                       | Special Form Capsule  |
| Mo-99/Tc-99m  | 37 TBq (1000 Ci)      | 25 TBq (676 Ci)       | —                     | Solid or aqueous NaOH solution or aqueous NaOH with up to 1 M NH <sub>4</sub> NO <sub>3</sub> or up to 0.4% NaOCl |
| Co-60   |                       | —                     | 275 GBq (7.4 Ci)      | Solid   |

| <b>Table 2</b><br><b>Package Configurations and Authorized Radioactive Contents</b><br><b>F-458/F-251 and F-458/F-318</b> |                                  |   |                                  |   |
|---|----------------------------------|---|----------------------------------|---|
| Isotope   | Package Configuration            |   |                                  | Chemical and Physical Form  |
|   | F-251, or F-318 with F248 insert | F-251, or F-318 with F320 insert or F251 with F250 insert | F-251, or F-318 with F368 insert |   |
| I-131   | 37 TBq (1000 Ci)                 | 37 TBq (1000 Ci)  | 37 TBq (1000 Ci)                 | Solid   |
| I-131   | 7.4 TBq (200 Ci)                 | 13 TBq (350 Ci)   | —                                | Aqueous NaOH solution or aqueous NaOH with up to 0.02 M Na <sub>2</sub> SO <sub>4</sub>                           |
| Ir-192  | —                                | —   | 300 TBq (8100 Ci)                | Special Form capsule  |
| Mo-99/Tc-99m  | 37 TBq (1000 Ci)                 | 55.5 TBq (1500 Ci)  | —                                | Solid or aqueous NaOH solution or aqueous NaOH with up to 1 M NH <sub>4</sub> NO <sub>3</sub> or up to 0.4% NaOCl |
| Sr-90/Y-90  | 6.4 TBq (173 Ci) each            | 11.1 TBq (300 Ci) each                                    | —                                | Liquid in up to 1 N HCl   |
| Y-90  | 6.4 TBq (173 Ci)                 | 11.1 TBq (300 Ci)   | —                                | Liquid in 0.04 N HCl  |
| Sr-90/Y-90  | 18.5 TBq (500 Ci) each           | 18.5 TBq (500 Ci) each                                    | —                                | Solid   |
| Y-90  | 18.5 TBq (500 Ci)                | 18.5 TBq (500 Ci)   | —                                | Solid   |

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

| Table 3<br>Authorized Radioactive Contents for Isotope Shipped in F-448/F-256 Leak Proof Inserts |                        |                        |   |
|--|------------------------|------------------------|---|
| Isotope  | Package Configuration  |                        | Chemical and Physical Form  |
|  | F448/F256              | F448/F256/F389         |   |
| I-125  | 7,400 GBq<br>(200 Ci)  | 7,400 GBq<br>(200 Ci)  | Solid<br>or Aqueous NaOH solution   |
| I-131  | 5,180 GBq<br>(140 Ci)  | 10,000 GBq<br>(270 Ci) | Solid or Aqueous NaOH solution<br>or aqueous NaOH with 0.02 M Na <sub>2</sub> SO <sub>4</sub>                     |
| Mo-99/Tc-99m   | 555 GBq<br>(15 Ci)     | 1,110 GBq<br>(30 Ci)   | Solid or aqueous NaOH solution<br>or aqueous NaOH with 1 M NH <sub>4</sub> NO <sub>3</sub> or up to<br>0.4% NaOCl |
| Y-90   | 16,000 GBq<br>(432 Ci) | —                      | Solid or Liquid in 0.04 N HCl   |
| Sr-90/Y-90   | 16,000 GBq<br>(432 Ci) | —                      | Solid or Liquid in up to 1 N HCl  |

| Table 4<br>Package Configuration and Authorized Radioactive Contents for Isotopes in Special Form Sources<br>F-458/F-448 |                        |                        |                        |                        |
|--|------------------------|------------------------|------------------------|------------------------|
| Isotope  | Package Configuration  |                        |                        |                        |
|  | F448                   | F448/F174              | F448/F286              | F448/F382              |
| Co-60  | 4.0 GBq<br>(0.1 Ci)    | 15.0 GBq<br>(0.4 Ci)   | 4.0 GBq<br>(0.11 Ci)   | 15.0 GBq<br>(0.4 Ci)   |
| Ir-192   | 2,405 GBq<br>(65 Ci)   | 9,250 GBq<br>(250 Ci)  | 4,800 GBq<br>(130 Ci)  | 33,300 GBq<br>(900 Ci) |
| Sb-124   | 7.4 GBq<br>(0.2 Ci)    | 11.1 GBq<br>(0.3 Ci)   | 7.4 GBq<br>(0.2 Ci)    | 44.4 GBq<br>(1.2 Ci)   |
| Y-90   | 18,000 GBq<br>(461 Ci) | 18,000 GBq<br>(461 Ci) | 18,000 GBq<br>(461 Ci) | 18,000 GBq<br>(461 Ci) |
| Sr-90/Y-90   | 18,000 GBq<br>(486 Ci) | 18,000 GBq<br>(486 Ci) | 18,000 GBq<br>(486 Ci) | 18,000 GBq<br>(486 Ci) |

### 3. QUALITY ASSURANCE

MDS Nordion has established, and maintains, a Quality Assurance Program. Within this program, the Radioactive Material Transport Package Quality Plan [10] and the Sealed Source Quality Plan [11] ensure that the specified requirements for the transport packaging for radioactive material (including sealed sources) comply with the regulations [3, 4].

These plans define the standard operating practices at MDS Nordion that prescribe the measures used to control the activities affecting radioactive material transport package quality. They define responsibilities and establish a documented system of management controls that provide confidence in the quality of all associated work activities, including design, manufacture, testing, documentation, use, maintenance and inspection.

### 3.1 Design Control

The design of the F-458/F-245, F-458/F-247, F-458/F-251, F-458/F-318 and F-458/F-448 packages is controlled in accordance with the Radioactive Material Transport Package and Sealed Source Quality Plans [10, 11].

### 3.2 Manufacturing Requirements

#### 3.2.1 F-458 container

Manufacture of the F-458 container will be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The F-458 container shall be inspected by the supplier for conformance with the current engineering drawings. The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

#### 3.2.2 F-245 Shielding Vessel

Manufacture of the F-245 shielding vessel shall be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

The following inspections shall be completed prior to first use:

1. Dimensional inspections for conformance with the engineering drawings.
2. Leak Test as per section 4.4.2 below.
3. Radiation survey as per section 4.4.3 below.

#### 3.2.3 F-247 Shielding Vessel

Manufacture of the F-247 shielding vessel shall be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

The following inspections shall be completed prior to first use:

1. Dimensional inspections for conformance with the engineering drawings.
2. Leak Test as per section 4.4.2 below.
3. Radiation survey as per section 4.4.3 below.

#### 3.2.4 F-251 or F-251 Mk II Shielding Vessel

Manufacture of the F-251 or F-251 Mk II shielding vessel shall be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

The following inspections shall be completed prior to first use:

1. Dimensional inspections for conformance with the engineering drawings.
2. Leak Test as per section 4.4.2 below.
3. Radiation survey as per section 4.4.3 below.

### 3.2.5 F-448 Shielding Vessel

Manufacture of the F-448 shielding vessel shall be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

The following inspections shall be completed prior to first use:

1. Dimensional inspections for conformance with the engineering drawings.
2. Leak Test as per section 4.4.2 below.
3. Radiation survey as per section 4.4.3 below.

### 3.2.6 F-318 Shielding Vessel

The design of the F-251 shielding vessel prevails and no new F-318 shielding vessels will be manufactured.

### 3.2.7 Leakproof Inserts

Manufacture of leakproof inserts will be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The supplier's quality program must be certified to ISO 9002 or an approved equivalent.

The following inspections shall be completed prior to first use:

1. Dimensional inspection for conformance with the engineering drawings.
2. Hydrostatic pressure test per section 4.4.1 below.
3. Leak testing per section 4.4.2 below.

### 3.2.8 Shielding Inserts

Manufacture of the shielding inserts will be completed in accordance with the technical specification and the controlled engineering drawings specified in the drawing and document list (refer to Appendix A). The shielding inserts shall be inspected by the supplier for conformance with the engineering drawings.

The following inspections shall be completed prior to first use:

1. Dimensional inspections for conformance with the engineering drawings.
2. Radiation survey per section 4.4.3 below.

### 3.2.9 Sealed Sources

Manufacture of sealed sources will be completed in accordance with a technical specification and controlled engineering drawings. The supplier's quality program must be certified to ISO 9002 or an approved equivalent. Sealed source welding shall be in accordance with section 4.3.2.2 below.

The following inspections shall be completed prior to first use:

1. Dimensional inspection of components for conformance with the engineering drawings. This inspection will be completed prior to welding
2. Periodic examination of test welds for conformance with an 80% minimum penetration requirement.
3. Leakage testing by hot-liquid bubble test per ISO 9978 paragraph 6.2.2 or a test of equivalent or better sensitivity.
4. Dry wipe contamination testing per ISO 9978 paragraph 5.3.2 or a test of equivalent or better sensitivity.

### 3.3 Controls in Use

The package shall be inspected and prepared for shipment as described in Sections 5 and 6 below.

## 4. MANUFACTURING

### 4.1 Quality Levels

The F-458/F-245, F-458/F-247, F-458/F-251 and F-458/F-448 package components shall be manufactured according to the Quality Assurance requirements defined in Section 3 above.

### 4.2 Storage and Handling

Storage and handling of all materials and sub-assemblies shall be carried out in a manner that ensures their positive identification during manufacture and assembly. Components shall be stored in a dry, clean area. All components shall be protected and covered to prevent damage, corrosion, and the ingress of foreign materials. Materials and assemblies shall be packaged in such a manner that they will not be damaged during transit.

Handling of stainless steel components and assemblies is considered a Special Process and shall be in accordance with section 4.3.3 below.

### 4.3 Special Processes

#### 4.3.1 Processing and Cleaning

After fabrication and assembly, all dirt, salt, oil, grease, chemical deposits or other surface contaminants shall be removed.

Cleaning of stainless steel components shall be in accordance with ASTM A380. All stainless steel parts shall be cleaned such that when submitted to the ASTM A380 Water Wetting and Drying Test, surfaces will show no evidence of rust stains or corrosion.

#### 4.3.2 Welding

##### 4.3.2.1 Shielding Vessel and F-458 Container Welding

Welding shall be in accordance with ASME Boiler and Pressure Vessel Code Section IX, or CSA Standard W59, or other approved equivalent standards. Welders shall be qualified to the applicable standard.

Welded surfaces shall be smooth and shall merge smoothly into the parent metal. All scale, oxide, weld spatter, oil, chips, and other foreign material shall be completely removed.

Completed welds shall be inspected in accordance with ASTM E165 "Standard Methods for Liquid Penetrant Inspection". The acceptance criteria shall be as follows:

- No more than five (5) linear indications
- Maximum size of a linear indication shall be 2 mm (0.08 in) long
- Adjacent linear indications shall be 25 mm (1.0 in) apart
- The sum of the diameters of visible porosities shall not exceed 20 mm (0.8 in) in any 300 mm (12 in.) length of weld

The inspector shall be certified to CGSB Standard 48-GP-9 or equivalent.

#### 4.3.2.2 Sealed Source Welding

Sealed sources shall be designed, manufactured and tested in accordance with the Sealed Source Quality Plan [11].

Welding shall be in accordance with formal procedures. Only trained personnel shall perform welding.

Welded surfaces shall be smooth and shall merge smoothly into the parent metal. All scale, oxide, weld spatter, oil, chips, and other foreign material shall be completely removed. Weld penetration shall be 80% minimum.

Sealed sources shall be leakage tested according to ISO 9978.

#### 4.3.3 Handling Stainless Steel Components

Stainless steel parts shall be processed and handled in such a way as to minimize contamination by iron, grit, lead, halogens, and sulfur. Only clean stainless steel brushes and iron-free grinding wheels shall be used on stainless steel surfaces.

### 4.4 Manufacturing Testing

#### 4.4.1 Pressure Test

The leakproof insert body shall be subjected to a hydrostatic pressure test at a minimum gauge pressure of 1,070 kPa (155 psi) for at least 5 minutes at room temperature (20°C). As a result of the test the insert shall not deform permanently, leak, or crack.

#### 4.4.2 Leak Testing

Each F-248, F-250, F-256 and F-320 leakproof insert shall be leak tested using a method sensitive to  $10^{-8}$  std cc/s according to a procedure prepared in accordance with ISO 12807. The leak test shall be performed after the pressure test.

The leak rate shall be less than  $10^{-7}$  std cc/s.

The stainless steel shell surrounding the depleted uranium in the F-245, F-247 and F-251 shielding vessels shall be leak tested using a test sensitive to  $10^{-8}$  std cc/s. The leak rate shall be less than  $10^{-7}$  std cc/s.

In addition, the F-245, F-247 and F-251 cavities shall be leak tested using a test sensitive to  $10^{-4}$  std cc/s. The leakage rate from assembled units shall be less than  $1 \times 10^{-3}$  std.cc/s.

#### 4.4.3 Radiation Survey

The shielding vessel shall be subjected to a radiation survey using I-131, Ir-192 or Mo-99. The activity of isotope used for the test shall be sufficient to produce radiation fields of at least 500  $\mu$ Sv/h (50 mR/h) on the surface of the shielding vessel.

An additional radiation survey shall be completed with the shielding vessel installed in the F-458 overpack. Maximum radiation levels on contact shall be determined for the side, top, and bottom of the package. Similarly, maximum Tl readings shall be recorded.

When extrapolated to the activity limit specified in the Design Approval Certificate, the radiation fields shall be no greater than 2 mSv/h (200 mR/h) on the surface and 100  $\mu$ Sv/h (10 mR/h) at 1 m from the surface of the package.

#### 4.5 Documentation

For all package components manufactured to a quality program, manufacturing records shall include the following:

- Inspection and Test Plan
- Inspection records
- List of drawings and specifications used in the manufacture
- List of approved Special Process Procedures
- List of serial numbers of the units manufactured
- Certification of materials used in the manufacture in the form of Certified Material Test Reports (CMTR's), Mill Certificates, or alternatively Certificates of Compliance
- Certified NDE reports, leak test reports, personnel qualifications and radiation survey reports
- Records of any approved deviations, repair or rework.

### 5. REQUIREMENTS FOR MAINTENANCE AND INSPECTION PROCEDURES

#### 5.1 General

1. The F-458/F-245, F-458/F-247, F-458/F-251, F-458/F-318 and the F-458/F-448 packaging shall be subjected to a Routine Inspection prior to each shipment and a Detailed Inspection once a year, or more frequently if a Routine Inspection identifies a defect. The requirements for the Routine Inspection and the Detailed Inspection procedure are specified in sections 5.2 and 5.3 below.
2. Formal procedures shall be prepared for the inspection and maintenance of the transport packaging components. The results of the inspections shall be documented and the inspection history of packaging components shall be recorded.
3. Only trained personnel shall perform packaging inspections.
4. Package components shall be quarantined until they have passed inspection.
5. Repairs to damaged packaging components shall be in accordance with the standards for manufacturing identified in section 4 above. Repairs shall be documented and reinspected.
6. All inspections are to be performed on empty packagings.

#### 5.2 Requirements for Routine Inspection Procedure

##### 5.2.1 F-458 Overpack

1. The external surface of the cylinder shall be checked for contamination, and decontaminated if necessary.
2. The outer surface of the cylinder shall be inspected for damage such as rust, severe dents and perforation.
3. The condition of the lifting perforations shall be inspected.
4. All permanent labels (e.g. MDS Nordion Identification and Radiation Caution Plate, This Side Up Label, etc.) shall be examined for legibility and proper attachment to the drum.
5. The lid and bolts shall be removed and inspected. If they are not significantly damaged, these components may be reused.
6. The F-245, F-247, F-251, F-251 Mk II, F-318 or the F-448 shielding vessel shall be removed from the overpack and checked for contamination. It shall be decontaminated if necessary. If the outside surface of the shielding vessel is contaminated, the interior of the F-458 overpack shall be checked for contamination.

**5.2.2 F-245, F-247, F-251, F-251 Mk II, F-318 or the F-448 Shielding Vessel**

1. The shielding vessel shall be inspected for significant damage, such as cracks, dents or other such deformation.
2. The top plug shall be removed and checked for contamination. It shall be decontaminated if necessary.
3. The screws securing the plug shall be inspected to verify that they are clean and in good condition. The threads shall be inspected and there shall be no cracks or gouges in the screws. Damaged screws shall be replaced as necessary.
4. The leakproof insert shall be removed and checked externally for contamination. It shall be decontaminated if necessary and inspected in accordance with section 5.2.3 below.
5. The shielding vessel cavity shall be checked for contamination and decontaminated if necessary.
6. The neoprene gasket shall be inspected and replaced if necessary. (all models except F-448 and F-251 Mk II)
7. The two neoprene O-rings shall be removed and replaced with the new ones (models F-448 and F-251 Mk II only)
8. The O-rings grooves shall be inspected for damage and cleaned prior installation of new O-rings (models F-448 and F-251 Mk II only)
9. The condition of the internal threads shall be inspected. They shall be clean and the screws shall turn freely in the screw holes.
10. The top face of the shielding vessel shall be inspected for gouges, corrosion, or any damage that may affect the gasket seal.
11. The sealing face of the top plug shall be inspected for gouges, corrosion, or any damage that may affect the gasket seal.

**5.2.3 F-242, F-248, F-250, F-256 or F-320 Leakproof Inserts**

1. The leakproof insert shall be decontaminated inside and out.
2. *The lifting handle on the insert shall be in working order and shall lie flat when it is in the down position.*
3. The leakproof insert shall be checked for dents, deformation, or other damage.
4. The lid and the body shall have matching serial numbers.
5. The lid shall thread freely onto the body without an O-ring. The sealing surfaces shall be smooth and free of defects.
6. A new O-ring shall be placed in the cavity of the insert for installation prior to the next product loading.
7. If routine inspection identifies a defect, the leakproof insert shall be quarantined.

**5.2.4 F-368 Shielding Insert**

1. The shielding insert shall be decontaminated inside and out.
2. The shielding insert shall be checked for dents, deformation, or other damage.
3. If routine inspection identifies a defect, the shielding insert shall be quarantined.



### 5.3 Requirements for Detailed Inspection Procedure

In addition to Routine Inspection, the following inspection shall be performed.

#### 5.3.1 F-458 Overpack

1. The external surface of the container shall be examined for rust, severe dents, perforation, or other damage. If significant damage is observed, the container shall be repaired or replaced. The new container shall have the same serial number as the original.
2. The shielding vessel shall be removed from the overpack. The F-458 cavity shall be checked for cracks or other damage. If significant damage is observed the container shall be repaired or replaced.

#### 5.3.2 F-245, F-247, F-251, F-251 Mk II, F-318 and the F-448 Shielding Vessel

1. The top plug shall be removed from the shielding vessel. The sealing faces of the body and plug shall be free of gouges, deformation or any other damage that may affect the integrity of the seal.
2. The gasket or O-ring shall be inspected and replaced if necessary.
3. The plug screws shall be examined for cleanliness, damaged threads, cracks, or other such damage. The screws shall be replaced if necessary.
4. The condition of the internal threads in the shielding vessel shall be checked. The threads shall be clean and the screws shall turn freely.
5. The condition of the cavity walls shall be checked for cracks, holes, or other damage.
6. Check the internal and external surfaces of the shielding vessel for alpha contamination.

#### 5.3.3 F-242, F-248, F-250, F-256 or F320 Leakproof Insert

1. A hydrostatic pressure test shall be performed on the leakproof insert body at a minimum gauge pressure of 1,070 kPa (155 psi) for at least 5 minutes at room temperature (22°C). There shall be no permanent deformation, leaking, or cracking.
2. A Vacuum Liquid Bubble Test shall be performed on the leakproof insert. There shall be no visible sign of leakage. Alternative leakage tests in accordance with ISO 12807 may be used provided that they have equal or better sensitivity. The leak test shall be performed after the pressure test.

## 6. REQUIREMENTS FOR PREPARATION FOR SHIPMENT PROCEDURE

### 6.1 General

1. The F-458/F-245, F-458/F-247, F-458/F-251, F-458/F-318 and F-458/F-448 packages shall be prepared for shipment according to the requirements specified in sections 6.2 through 6.5 below.
2. Formal procedures shall be prepared for preparing the package for shipment.
3. Only trained personnel shall prepare the package for shipment. The training shall be documented.
4. All package components shall be subjected to a routine inspection prior to shipment. On an annual basis, the package components shall be subjected to a detailed inspection.
5. The package shall contain only isotopes in quantities and form specified on the Design Approval Certificate.
6. Only package configurations with sources, leakproof inserts, and shielding inserts listed on the Design Approval Certificate shall be used.
7. Either a sealed source or a leakproof insert shall provide containment of the radioisotope.
8. The package shall be lifted using two opposing lifting handles on the package.

## 6.2 Packaging the Product

1. If the product is to be contained in a leakproof insert, the O-ring shall be lightly greased and installed on the cap of the leakproof insert.
2. The product shall be dispensed into its bottle or source and sealed. The radioactive contents shall not exceed the authorized limit specified on the Design Approval Certificate. Receptacles with isotopes in liquid form shall not be filled beyond 80% of their volume capacity.
3. If the product is in a bottle, it shall be placed into the leakproof insert and the cap of the LPI shall be installed. The cap shall be seated and there shall be no visible gap between the body and the lid.
4. If the product is in a sealed source, the F-368 tungsten shielding insert shall be installed in the shielding vessel.
5. Inside the hot cell, the product shall be placed into the shielding vessel body and it shall be properly seated. If applicable, the lifting handle on the leakproof insert shall be in the down position.
6. The shielding vessel top plug shall be installed.
7. All external surfaces of the shielding vessel shall be decontaminated. The level of non-fixed radioactive contamination shall be determined by wiping an area of 300 cm<sup>2</sup> of the external surface by hand with a dry filter paper, or a wad of dry cotton wool, or any other material of this nature. The maximum permissible level of contamination is 3.7 Bq/cm<sup>2</sup> (10<sup>-4</sup> μCi/cm<sup>2</sup>).
8. The top plug screws shall be installed and torqued evenly to 14-20 N·m (10-15 ft lb.).
9. The shielding vessel shall be placed inside the F-458 overpack.
10. The container cover shall be installed in place and fastened down with six hex. head cap screws.
11. The screws shall be torqued to 14 -20 N·m (10-15 ft lb.).
12. A tamper-evident seal shall be installed.
13. When 150TBq (4050 Ci) or more of Iridium-192 is to be transported the supplemental heat shield F145801-003 is to be installed.

When the shipment exceeds 115TBq (3100 Ci), the following instruction shall be added in the Shipper's Declaration for Dangerous Goods document, under the Additional Handling Information:

"To allow for adequate air circulation for the safe dissipation of heat, do not cover with other materials."

## 6.3 Contamination Check and Radiation Survey

1. The exterior surfaces of the overpack shall be tested for removable contamination. The level of non-fixed radioactive contamination shall be determined by wiping an area of 300 cm<sup>2</sup> of the external surface by hand with a dry filter paper, or a wad of dry cotton wool, or any other material of this nature. The maximum permissible level of contamination is 3.7 Bq/cm<sup>2</sup> (10<sup>-4</sup> μCi/cm<sup>2</sup>).
2. A radiation survey shall be performed on the assembled package. Radiation levels shall not exceed 2 mSv/h (200 mrem/h) on the external surface of the package or 0.1 mSv/h (10 mrem/h) at any point one meter from the surface of the package.

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**Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages**

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**6.4 Labeling**

1. Two appropriate category labels shall be affixed to opposite sides of the drum. The required information regarding the contents shall be completed (e.g. radionuclide, activity, transport index, etc.).
2. One appropriate UN number label shall be affixed next to each of the category labels, on opposite sides of the drum, for a total of two UN number labels per package.
3. The "ship to" label and the appropriate shipping documents shall be affixed to the drum.
4. The Shipper's Declaration, the Emergency Response Form, and the Waybill, shall be completed.
5. The Design Approval Certificate shall be included with the shipping documents.

**6.5 Shipping Empty Packages**

1. When the package is shipped empty, it shall be prepared for shipment in accordance with a formal procedure that complies with the pertinent requirements of the regulations [3, 4].

**7. APPLICABLE STANDARDS**

The current editions of the following standard and codes shall apply unless a specific edition of the standard or code is referenced. In addition to the IAEA regulations, the F-458 family transport packages comply with the relevant transport regulations for dangerous goods and the regulations of the cognizant transport organizations.

1. ASTM A380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems.
2. ASTM E165, Standard Methods for Liquid Penetrant Inspection.
3. ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
4. CAN/CGSB Standard 48.9712, Qualification and Certification of Nondestructive Testing Personnel.
5. CSA Standard W59, Welded Steel Construction (Metal Arc Welding).
6. ISO 9978, Radiation Protection – Sealed Radioactive Sources – Leakage Test Methods, 1992.
7. ISO 12807, Safe Transport of Radioactive Materials – Leakage Testing on Packages, 1996.

**8. REFERENCED DOCUMENTATION**

1. MDS Nordion Report No. IS/TR 1791 F458, "Engineering Assessment of the Ability of the F-458/F-251 and the F-458/F-318, F-458/F-448, F-458/F-245 and F-458/F-247 to Meet the Requirements of IAEA TS-R-1, 1996 Edition (Revised).
2. Radioactive Material Type B(U) Package Design Approval Certificate No. TBD
3. Packaging and Transport of Nuclear Substances Regulations, Nuclear Safety and Control Act, SOR/DORS/2000-208, 31 May, 2000.
4. Regulations for the Safe Transportation of Radioactive Materials, 1996 Edition (Revised), IAEA Regulations No. TS-R-1 (ST-1, Revised).
5. MDS Nordion drawing F624501-002, "F-458/F-245 Transport Package Information Drawing".
6. MDS Nordion drawing F624701-002, "F-458/F-247 Transport Package Information Drawing".
7. MDS Nordion drawing F625101-002, "F-458/F-251 Transport Package Information Drawing".
8. MDS Nordion drawing F631801-002, "F-458/F-318 Transport Package Information Drawing".
9. MDS Nordion drawing F644801-002, "F-458/F-448 Transport Package Information Drawing".
10. MDS Nordion Specification No. IN/QA 0224 Z000, "Radioactive Material Transport Package Quality Plan".
11. MDS Nordion Specification No. IN/QA 0562 A000, "Sealed Source Quality Plan".

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

**Appendix A**  
**Drawing and Document List for the F-458 Family of Transport Packages**

| Document        | Component   | Description  |
|-----------------|-------------|--|
| IS/DS 1789 F458 | All         | Design, manufacturing and Operating Specification for the F-458 Family of Transport Packages |
| F624501-002     | F-458/F-245 | Specification Drawing for the F-458/F-245 Transport Package                                  |
| F624701-002     | F-458/F-247 | Specification Drawing for the F-458/F-247 Transport Package                                  |
| IS/IM 1767 F458 | All         | Inspection and Maintenance Procedure for the F-458 Family of Transport Packaging             |
| IS/PP 1693 F458 | All         | Preparation for Shipment Procedure for the F-458 Family of Transport Packaging               |
| IS/TS 1680 F458 | F-458       | Technical Specification for the F-458 Overpack   |
| IS/TS 1686 F458 | F-458       | Technical Specification for Rigid Polyurethane Foam  |
| IS/OP 1685 F458 | F-458       | Procedure for the Foam Filling of the F-458 Overpack   |
| F145801-001     | F-458       | F-458 Cylinder, Shipping Assembly  |
| F545801-001     |             | F-458 Cylinder Specification   |
| F545801-002     |             | Name and Radiation Caution Plate   |
| F545801-003     |             | Gasket   |
| F545801-004     |             | Locating Pin   |
| F145801-002     |             | Bottom Spacer Disk   |
| IS/TS 0058 F245 | F-245       | Technical Specification for the F-245 Shielding Vessel                                       |
| F124501-001     | F-245       | F-245 Shipping Container Assembly (4 oz)   |
| F124501-003     |             | Container Cavity Welding   |
| F124501-005     |             | Container Top Plate  |
| F124501-019     |             | Plug Bottom Plate  |
| F124501-020     |             | Outer Tube   |
| F124501-021     |             | Uranium Top Plug   |
| F124501-022     |             | Top Plate Plug   |
| F124501-023     |             | Handle   |
| F124501-010     |             | Uranium Casting  |
| F124501-033     |             | Uranium Casting Assembly   |
| F124501-034     |             | Bottom Plate   |
| F124501-035     |             | Outer Casing   |
| F124501-036     |             | Gasket   |
| A15676          |             | Radioactivity Caution Plate  |

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## (Cont.) Drawing and Document List for the F-458 Family of Transport Packages

| Document        | Component    | Description  |
|-----------------|--------------|--|
| IS/TS 0059 F247 | F-247        | Technical Specification for the F-247 Shielding Vessel                   |
| F124701-001     | F-247        | F-247 Shipping Container Assembly  |
| F124701-003     |              | Container Top Plug Welding And Machining                                 |
| F124701-019     |              | Plug Top Plate   |
| F124701-020     |              | Outer Tube   |
| F124701-021     |              | Top Plug   |
| F124701-022     |              | Plug Bottom Plate  |
| F124701-023     |              | Handle   |
| F124701-004     |              | Container Cavity Welding And Machining                                   |
| F124701-005     |              | Uranium Outer Casting Assembly   |
| F124701-017     |              | Bottom Plate   |
| F124701-018     |              | Uranium Outer Tube   |
| F124701-006     |              | Gasket   |
| F124701-016     |              | Uranium Casting  |
| A15676          |              | Radioactivity Caution Plate  |
| IN/TS 0100 F000 | F-248, F-242 | Technical Specification for Leakproof Inserts                            |
| IS/IM 0015 F000 | F-248, F-242 | Inspection and Maintenance Procedure for Leakproof Inserts               |
| F124501-004     | F-248        | F-248 Leakproof Insert, 4 oz   |
| F124501-029     |              | Outer Body   |
| F124501-030     |              | Top Cap  |
| F124501-031     |              | Bottle Flask Handle  |
| F124701-026     | F-242        | F-242 Leakproof Insert   |
| F124701-009     |              | Top Cap  |
| F124701-010     |              | Handle   |
| F124701-028     |              | Outer Body   |
| IS/TS 1273 F000 | F-336        | Technical Specification for Shielding Inserts used in Transport Packages |
| F133601-001     | F-336        | F-336 Tungsten Insert Assembly, Ir-192                                   |
| F133601-002     |              | Bottom Cap   |
| F133601-003     |              | Spacer   |
| F133601-004     |              | Body   |
| F133601-005     |              | Top Cap  |
| F133601-006     |              | Washer Assembly  |
| F133601-007     |              | Washer   |

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## (Cont.) Drawing and Document List for the F-458 Family of Transport Packages

| Document        | Component   | Description  |
|-----------------|-------------|--|
| IS/DS 1789 F458 | All         | Design, manufacturing and Operating Specification for the F-458 Family of Transport Packages |
| F625101-002     | F-458/F-251 | F-458/F-251 Transport Package Information Drawing  |
| F631801-002     | F-458/F-318 | F-458/F-318 Transport Package Information Drawing  |
| IS/IM 1767 F458 | All         | Inspection and Maintenance Procedure for the F-458 Family of Transport Packaging             |
| IS/PP 1693 F458 | All         | Preparation for Shipment Procedure for the F-458 Family of Transport Packaging               |
| IS/TS 1680 F458 | F-458       | Technical Specification for the F-458 Overpack   |
| IS/TS 1686 F458 | F-458       | Technical Specification for Rigid Polyurethane Foam  |
| IS/OP 1685 F458 | F-458       | Procedure for the Foam Filling of the F-458 Overpack   |
| F145801-001     | F-458       | F-458 Cylinder, Shipping Assembly  |
| F545801-001     |             | F-458 Cylinder Specification   |
| F545801-002     |             | Name and Radiation Caution Plate   |
| F545801-003     |             | Gasket   |
| F545801-004     |             | Locating Pin   |
|                 |             |  |
|                 |             |  |
| IS/TS 0049 F251 | F-251       | Technical Specification for the F-251 Shielding Vessel                                       |
| F125101-001     | F-251       | F-251 Shipping Container Assembly (8 oz)   |
| F125101-002     |             | Outer Casing Assembly  |
| F125101-008     |             | Bottom Plate   |
| F125101-009     |             | Outer Casing   |
| F125101-005     |             | Plug Welding And Machining Assembly  |
| F125101-010     |             | Plug Bottom Plate  |
| F125101-011     |             | Outer Tube   |
| F125101-012     |             | Uranium Top Plug   |
| F125101-013     |             | Plug Top Plate   |
| F125101-014     |             | Handle   |
| F125101-006     |             | Uranium Casting  |
| F125101-007     |             | Gasket   |
| F125101-024     |             | Adapter For 4 oz Bottle  |
| F125101-030     |             | Cavity   |
| A15676          |             | Radioactivity Caution Plate  |
|                 |             |  |
| F125101-032     | F-251 Mk II | F-251 MK II Shipping Container Assembly (8 oz)   |
| F125101-035     |             | Plug Welding And Machining Assembly  |
| F125101-010     |             | Plug Bottom Plate  |
| F125101-041     |             | Outer Tube   |
| F125101-012     |             | Uranium Top Plug   |
| F125101-037     |             | Plug Top Plate   |
| F125101-014     |             | Handle   |
| F144802-009     |             | Boss (Plug)  |
| F125101-039     |             | Container Bottom Assembly  |

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## (Cont.) Drawing and Document List for the F-458 Family of Transport Packages

| Document        | Component                  | Description  |
|-----------------|----------------------------|--|
| F125101-006     |                            | Uranium Casting  |
| F125101-033     |                            | Cavity   |
| F125101-034     |                            | Uranium Outer Casing Assembly  |
| F125101-008     |                            | Bottom Plate   |
| F125101-036     |                            | Outer Casing   |
| F125101-040     |                            | Pin  |
|                 |                            |  |
| F131801-001     | F-318                      | F-318 Transport Packaging  |
| F131801-002     |                            | Gasket   |
| F131801-005     |                            | Body, F-318 Transport Packaging  |
| F131801-006     |                            | Plug, Lid, F-318 Transport Packaging                                     |
| F131801-007     |                            | Body, F-318 Transport Packaging  |
| A15676          |                            | Radioactivity Caution Plate  |
|                 |                            |  |
| IN/TS 0100 F000 | F-248, F-250, F-320        | Technical Specification for Leakproof Inserts                            |
| IS/IM 0015 F000 | F-248, F-250, F-320        | Inspection and Maintenance Procedure for Leakproof Inserts               |
|                 |                            |  |
| F124501-004     | F-248                      | F-248 Leakproof Insert, 4 oz   |
| F124501-029     |                            | Outer Body   |
| F124501-030     |                            | Top Cap  |
| F124501-031     |                            | Bottle Flask Handle  |
|                 |                            |  |
| F125101-025     | F-250                      | F-250 Leakproof Insert, 8 oz   |
| F125101-022     |                            | Top Cap  |
| F125101-023     |                            | Handle   |
| F125101-026     |                            | Outer Tube   |
| F125101-027     |                            | Bottom Plate   |
|                 |                            |  |
| F132001-001     | F-320                      | F-320 Leakproof Insert, 8 oz   |
| F132001-002     |                            | Top Cap  |
| F132001-003     |                            | Body   |
| F132001-004     |                            | Handle   |
|                 |                            |  |
| IS/TS 1273 F000 | F-368                      | Technical Specification for Shielding Inserts used in Transport Packages |
| F136801-001     | F-368                      | F-368 Tungsten Insert Assembly   |
| F136801-002     |                            | Body, F-368 Tungsten Insert Assembly                                     |
| F136801-003     |                            | Cap, F-368 Tungsten Insert Assembly                                      |
| F136801-006     |                            | Washer Assembly  |
|                 |                            |  |
| F145801-003     | F458/F251 and<br>F458/F318 | Heat Shield  |

## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## (Cont.) Drawing and Document List for the F-458 Family of Transport Packages

| Document        | Component | Description  |
|-----------------|-----------|--|
| IS/DS 1789 F458 | All       | Design, manufacturing and Operating Specification for the F-458 Family of Transport Packages |
| F644801-002     | All       | F-458/F-448 Transport Package Information Drawing  |
| IS/PP 1693 F458 | All       | Preparation for Shipment Procedure for the F-458 Family of Transport Packaging               |
| IS/IM 1767 F458 | All       | Inspection and Maintenance Procedure for the F-458 Family of Transport Packagings            |
| IS/TS 1680 F458 | F-458     | Technical Specification for the F-458 Overpack   |
| IS/TS 1686 F458 | F-458     | Technical Specification for Rigid Polyurethane Foam  |
| IS/OP 1685 F458 | F-458     | Procedure for the Foam Filling of the F-458 Overpack   |
| F145801-001     | F-458     | F-458 Cylinder, Shipping Assembly  |
| F545801-001     |           | F-458 Cylinder Specification   |
| F545801-002     |           | Name and Radiation Caution Plate   |
| F545801-003     |           | Gasket   |
| F545801-004     |           | Locating Pin   |
| F145801-002     |           | Bottom Spacer Disk   |
| IS/TS 1457 F448 | F-448     | Technical Specification for the F-448 Shielding Vessel Assembly                              |
| F144802-001     | F-448     | F-448 Shipping Container Assembly  |
| F144802-002     |           | Plug Machining Assembly  |
| F144802-003     |           | Plug Welding Assembly  |
| F144802-006     |           | Bottom Plate (Plug)  |
| F144802-008     |           | Top Plate (Plug)   |
| F144802-009     |           | Boss (Plug)  |
| F144802-010     |           | Handle (Plug)  |
| F144802-004     |           | Container Body Machining Assembly  |
| F144802-005     |           | Container Body Welding Assembly  |
| F144802-011     |           | Cylinder Body  |
| F144802-012     |           | Bottom Plate (Body)  |
| F144802-013     |           | Cavity   |
| IN/TS 0100 F000 | F-256     | Technical Specification for Leakproof Inserts  |
| IS/IM 0015 F000 | F-256     | Inspection and Maintenance Procedure for Leakproof Inserts                                   |
| F125601-001     | F-256     | F-256 Insert Assembly  |
| F125601-003     |           | Body   |
| F125601-004     |           | Top Cap  |
| F125101-023     |           | Bottle Flask -- Handle   |



## Design, Manufacturing and Operating Specification for the F-458 Family of Transport Packages

## (Cont.) Drawing and Document List for the F-458 Family of Transport Packages

| Document        | Component                  | Description  |
|-----------------|----------------------------|--|
| IS/TS 1273 F000 | F-382, F-389, F-174, F-286 | Technical Specification for Shielding Inserts Used in Transport Packages |
| F138901-001     | F-389                      | F-389 Tungsten Insert  |
| F138201-001     | F-382                      | F-382 Insert Assembly  |
| F138201-002     |                            | F-382 Top Insert   |
| F138201-003     |                            | F-382 Bottom Insert  |
| F138201-004     |                            | F-382 Handle   |
| F128601-001     | F-286                      | F-286 Source Holder for C-182 Capsules                                   |
| CP36-B-671      | F-174                      | Insert Assembly for SC-18 F-174  |
| CP36-B-682      |                            | Top Insert Machining   |
| CP36-B-672      |                            | Top Insert Welding Assembly  |
| CP36-B-680      |                            | Plate  |
| CP36-B-677      |                            | Inner Tube   |
| CP36-B-675      |                            | Outer Tube   |
| CP36-B-679      |                            | Inner Plate  |
| CP36-B-681      |                            | Plate  |
| CP36-B-683      |                            | Bottom Insert Machining  |
| CP36-B-673      |                            | Bottom Insert Welding  |
| CP36-B-680      |                            | Plate  |
| CP36-B-678      |                            | Inner Tube   |
| CP36-B-679      |                            | Inner Plate  |
| CP36-B-676      |                            | Outer Tube   |
| CP36-B-674      |                            | Bottom Plate   |