71-9036

spec
SOURCE OF QUALITY

February 28, 2001

Mr. Steve O'Conner, Project Manager
Licensing Section, Mail Stop 013D13
Spent Fuel Project Office
U.S. Nuclear Regulatory Commission
One White Flint North
11155 Rockville Pike
Rockville, MD 20852

Subject: Docket 71-9036; Response to Request for Additional Information
Consolidated Application to Certificate of Compliance
SPEC Model C-1 Transportation Package
Package Identification Number USA/9036/B(U)

Dear Mr. O'Conner:

The purpose for this consolidated application is to provide the information identified in your request for additional information dated October 24, 2000. Chapters 1.0 - 8.0 dated July 3, 2000 have been revised in their entirety. Also, some drawings in Appendix 9.1 were revised and one drawing was added, and, the information referenced for the dates of January 23 and May 7, 1975 and February 16, 1984 was added as appendices 9.8, 9.9, and 9.10 respectively. All other appendices are unchanged from the Application for SPEC Model C-1 Transportation Package, Revision (0), dated July 3, 2000.

A description of the additional information appears below.

RAI Item No.

Item 1-1 The following SPEC engineering drawings have been revised to clearly identify the materials of construction, all safety related welds and dimensions, tolerances for all dimensions, and appropriate codes and standards used for the design, fabrication, and examination of components:

Drawing B311000: Added identification of the materials of construction for all panels and doors, weld specifications, examination standards, weight (from drawing B322000). Moved overall dimensions to drawing B311002.



NMSS/RGN1

Source Production & Equipment Co., Inc.
113 Teal Street St. Rose, LA 70087-9691 Phone 504/464-9471 FAX 504/467-7685 Website: www.spec150.com

Drawing B311001: Added sectional view to depict the radius of the U-tube.

Drawing B322000: Added depiction of the nameplate and trefoil and their locations on the overpack.

Drawing B311002: This drawing was added to describe the C-1 nameplate and trefoil, and their installation on a C-1 Shipping Container. Added overall dimensions from drawing B311000.

Item 1-2 Incorporated the information referenced for the dates of January 23 and May 7, 1975 and February 16, 1984

1. Original letter of application for the Model C-1 Shipping Container dated January 23, 1975.

2. Revised letter of application dated May 7, 1975.

3. Letter dated February 16, 1984 requesting that the certificate's material quantity specification be raised to an activity limit of 240 curies.

Specifically, the Hypothetical Accident Thermal Test results documented in the revised original letter of application dated May 7, 1975 were included in section 3.5.

Item 1-3. Revised Chapter 1 to reflect information and analyses that are related to the current package design, eliminating historical licensing and design details.

Item 2-1 Revised Chapters 2 and 3 to incorporate 1997 Model C-1 Transport Package drop and puncture test results which validate previous Type B Hypothetical Accident Condition Tests.

Item 7-1 In Chapter 7, removed procedures that are not related to the requirements of 10 CFR Part 71 with the exception of procedures related to 49 CFR 173.443 and 49 CFR 173.428 (required by NUREG-1609) and added information required by NUREG-1609.

Item 7-2 Revised Section 7.3 to describe the procedure for verifying that the package is empty prior to shipment as an empty package.

A vertical line marks the changes to Chapter 1.0 General Information, Chapter 2.0 Structural Evaluation, Chapter 3.0 Thermal Evaluation and 7.0 Operating Procedures. Chapter 4.0 Containment, 5.0 Shielding Evaluation, 6.0 Criticality Evaluation and 8.0 Acceptance Tests and Maintenance Program did not change. However, the pages were renumbered and made part of this application to make the changes easier to handle.

Please do not hesitate contact me if you need any further assistance or clarification.

Sincerely,

Kelley Richardt
Quality Assurance Manager

Enclosures: Three copies of the Consolidated Application for SPEC Model C-1 Transportation Package, dated July 3, 2000. Docket No.: 71-9036

/kdr

H:\RGLATORY\APPLICAT\SPECC-1\010228 (1)\010228.WPD

# CONSOLIDATED APPLICATION
# for
# NRC CERTIFICATE OF COMPLIANCE
# USA/9036/B(U)

## February 28, 2001
## Revision (1)

## Model SPEC C-1
## Type B(U) Radioactive Material Package

**SOURCE PRODUCTION AND EQUIPMENT CO., INC.**
**113 Teal Street St. Rose, Louisiana 70087**

# 1.0 GENERAL INFORMATION

## 1.1 Introduction and Purpose of Application for Amendment

### 1.1.1 Purpose of Application for Amendment

A) Per US Nuclear Regulatory Commission letter dated October 24, 2000, to consolidate previously submitted information.

B) To provide additional information to substantiate SPEC's request for "-85" designation for the USA/9036/B(U) package approval in order to resume production in accordance with 10 CFR 71.13(b)(1) and (d).

### 1.1.2 Introduction

The Model C-1 Transport Package consists of a depleted uranium shielded radiography SPEC C-1 Source Changer inside of a steel drum overpack. It's U.S. Nuclear Regulatory Commission Certificate of Compliance Approval No. is USA/9036/B(U). It has been approved for use since June 26, 1975. Currently there are approximately 200 Model C-1 Transport Packages in use.

#### 1.1.2.1 Inner Packaging (SPEC C-1 Source Changer)

The C-1 inner packaging is an industrial radiography source changer approved for use by the Louisiana Department of Environmental Quality. It is authorized to contain a maximum source activity of 240 Curies of $Iridium^{192}$ as sealed sources and is used as a packaging to transport sealed $Iridium^{192}$ sources to and from industrial radiography licensees and authorized distributors for exchange of sources.

#### 1.1.2.2 Outer Packaging (Overpack)

The C-1 outer packaging is a steel shipping drum which houses the inner packaging and a limited amount of associated radiography equipment during shipment. An overpack configuration with the source changer inside the outer packaging (overpack) is shown in this amendment application to have successfully passed the test conditions for both the normal conditions of transport and hypothetical accident conditions, with the exception of the Hypothetical Accident Conditions Thermal Test. The C-1 inner packaging has been tested and has successfully passed the hypothetical accident conditions, including the thermal test. Therefore, as specified in NUREG-1609, Section 3.5.3, comparative analysis is used to show that the Model C-1 Transport Package will pass the hypothetical accident thermal test as a "stand alone" package. Since the inner packaging (source changer) meets the requirement and since the overpack will not adversely affect the results of the source changer tests, the overpack configuration also meets the criteria for a Type B(U)-85 package. Therefore it was not necessary to perform the

thermal test analysis for the overpack and source changer configuration.

1.1.3 Packaging Description

1.1.3.1 Inner Packaging (Source Changer)

A) The source changer is constructed of commercial ASTM A-569 grade carbon steel, 1/8 inch (0.32 cm) nominal thick plates to form a rectangular box approximately 9-3/16 inches (23.3 cm) high, 7-1/2 inches (19.1 cm) wide and 7 inches (17.8 cm) deep which contains and supports a depleted uranium shield. The maximum weight of the source changer is 70 pounds (31.8 kg.). Fabrication and examination methods used in the construction and inspection of the source changer are described on Drawing B311000 in Appendix 9.1.

B) Shielding is provided by depleted uranium which is cast around a titanium or zircalloy U-tube with a septum in the middle forming two J-tubes. Approximately 2 inches of depleted uranium provides radiation shielding from the center of the shield which contains one or two sealed source Iridium$^{192}$ capsules. The J-tube and depleted uranium shield is designed to prevent direct streaming of radiation through the J-tube and to reduce scattered radiation to acceptable levels. The depleted uranium shield design is depicted on Drawing Number B311001, Appendix 9.1.

C) Tungsten or depleted uranium shielding pads are used as needed to supplement the shielding in locations where the depleted uranium shield contains minor porosity or internal voids created during casting of the shield. The use of additional shielding pads are determined by survey of the shield upon receipt. All shielding pads are located inside the depleted uranium shield compartment of the source changer (Inner Panel, Item 9 on Drawing B311000). The primary location where a shielding pad is installed is at the depleted uranium shield hot top adjacent to the rear panel (Items 21 & 28 on Drawing B311000). All source changers contain a hot top ring (Item 20, Drawing B311000) that is welded to the rear panel as a secondary means to position the hot top inside the packaging. (Note: The direct contact between the depleted uranium shield and the adjacent metal panels on all sides is the primary structural means to secure the depleted uranium shield within the source changer). When a shielding pad is installed at the hot top, the hot top ring is lengthened and the circular disk-shaped shielding pad is installed between the depleted uranium shield and the rear panel inside the hot top ring to prohibit movement of the pad inside the C-1. The maximum diameter of the hot top pad is 3 inches (7.6 cm). The maximum thickness of the pad is ½ inch (1.3 cm).

Shielding pads may also be installed at other locations inside the shield

compartment. In such instances the shield pad is made of tungsten only and is either attached directly to the inside surface of the compartment panel by welded brackets (clips) or attached directly to the shield using an epoxy compound. The maximum size and weight of a tungsten shielding pad used at locations other than at the hot top is limited by the void space inside the depleted uranium compartment (inner panel) and by the maximum allowable weight of the source changer at final assembly (70 pounds (31.8 kg) maximum). The foam fill material provides a redundant means of securing the pad in position. Shielding pads are not used in any location other than inside the shield compartment. In 25 years of use there are no known instances where a shielding pad has ever become loose. All source changers meet the accident condition radiation levels even if no additional shielding pads are used.

A metallic Positioning Shim may also be used at the hot top location to facilitate the manufacturing of the source changer (Item 29, Drawing B311000). The positioning shim is used only when necessary to orient the depleted uranium shield inside the inner panel as required during manufacturing and is not intended to provide additional radiation attenuation.

D) The principal system to prevent movement of the shield is provided by the basic design of the package. The shield is mounted in the source changer with all surfaces flushed against the housing panels to resist movement of the shield.

E) Outlet nipples are affixed to the outer end of the J-tubes for attachment of the source transfer tubes when making source exchanges.

F) A PVC handle is provided as a convenience on the source changer. The handle is not a structural part of the package and serves no function during transport of the package. No lifting or tiedown devices are provided since the source changer is placed inside a steel drum overpack during transport.

G) The source changer is not hermetically sealed and is opened to ambient pressure, therefore a pressure relief system is not applicable.

1.1.3.1.1 Inner Packaging Contents

A) The primary containment vessel to prevent the release of radioactive material is the sealed source capsule, which meets the requirements of special form radioactive material in 10 CFR 71.75. Therefore, no containment system is designed for the source changer. As an example Source Production &

Equipment Company, Inc. may ship special form radioactive material sources corresponding to IAEA Certificate of Competent Authority Number USA/0095/S.

B) A typical example of a sealed source assembly consist of Iridium$^{192}$ solid metallic wafers encapsulated in a stainless steel cylindrical capsule with a maximum activity of 240 Curies, measuring approximately 1 inch long by 1/4 inches diameter which is swaged onto a flexible cable approximately 7 - 8 inches long. Source assemblies ("pigtails") consist of the sealed source capsule, a stainless steel locking ball and connector swaged to a flexible cable for use in radiography operations. Several source assembly models are approved for use in the source changer.

C) The density of solid metallic iridium is approximately 22.5 grams per cubic centimeter. The weight of the Iridium$^{192}$ contents is negligible.

D) Iridium$^{192}$ is neither fissionable nor a neutron emitter, therefore moderator ratios and criticality configurations are not applicable.

E) The heat of decay for a maximum 240 Curies Iridium$^{192}$ is infinitesimal and the void space in the sealed source capsule is negligible, therefore pressure buildup is not a factor.

F) Structural closures of openings are not employed to contain the radioactive material within the package (capsule).

G) There are no valves, sampling ports, coolants or mechanisms for heat transfer or dissipation.

H) Each source assembly is contained in the source changer by a locking plunger which restricts rear movement of the source capsule and by the permanent septum in the U-tube which forms two J-tubes and which prohibits forward movement. The design is independent of the dimensions of the source assembly (pigtail) and locking ball. Each locking plunger is spring loaded to prevent inadvertent retraction of the locking plungers due to vibration, impact or temperature. As a redundant safety feature, the lock plungers must be engaged in order for the front door to close fully. Security of the source assemblies in the source changer is provided by closing both doors together. Lock hasps are attached to the source changer doors to facilitate additional security of the source assemblies by the use of a padlock when the doors are closed.

See Drawing B311000, Appendix 9.1

1.1.3.1.2 Operational Features

A. The source changer is a simple packaging and there are no operational considerations which are required for its use as a transport package.

B. Iridium$^{192}$ wafers are contained in a sealed source capsule which can not be operationally opened.

C. There are no valves, sampling ports, coolants or mechanisms for heat transfer or dissipation, connections, piping, seals or similar containment mechanisms.

1.1.3.2 Outer Packaging (Steel Drum Overpack)

The overpack is a nominal 12 gallon open head 20 or 22 gauge steel drum with snap ring or bolt ring closure, and is manufactured in accordance with the National Motor Freight Classification Item 260, 100-H or succeeding issues. The drum is partially filled with polyurethane foam to position the source changer in the center of the overpack. It has a maximum combined weight of 100 pounds (drum and its contents) and a maximum 22 pounds without its contents. See Drawing No. B322000, Appendix 9.1.

1.1.3.2.1 Outer Packaging Contents

The contents of the steel drum overpack is the source changer with sealed source assemblies as described above, related non-hazardous radiography equipment (ancillary equipment), and bracing as required to limit movement of the source exchanger during normal conditions of transport, as applicable (see Operating Procedures, Section 7.1.1.3).

1.1.3.2.2 Operational Features

A. The steel drum overpack is a simple packaging and there are no operational considerations.

B. Containment of the radioactive material within the inner package (source changer) is described above.

C. There are no valves, sampling ports, coolants or mechanisms for heat transfer or dissipation.

D. There are no valves, connections, piping, seals or similar containment mechanisms.

## 2.0 STRUCTURAL EVALUATION

*(Excerpts from June 19, 1990 Application)*

2.1 Structural Design

2.1.1 Discussion

A. The principal structural components of the Model C-1 Transport Package are a steel drum overpack and SPEC C-1 Source Changer consisting of (1) the depleted uranium shield which provides the necessary radiation shielding and protects the sealed source capsule; (2) the carbon steel shell which firmly encased the depleted uranium shield to prevent movement of the shield; and (3) secondarily the "hot top" retaining ring.

B. The stainless steel capsule provides the primary containment vessel preventing the release of radioactive material and meets the requirements of 10 CFR 71.75 for special form radioactive material.

C. The source assemblies, containing the sealed source capsule, are retained in the depleted uranium shield by spring loaded lock plungers which must be engaged before the front door of the SPEC C-1 source changer can be completely closed. The top and front doors to the SPEC C-1 source changer are secured together with a padlock or similar fastener through holes provided in adjacent surfaces of the door brackets when they are closed. The door brackets are designed to keep both doors in close contact regardless of the size or design of a padlock or other similar fastener the shipper chooses to use. This design feature prohibits partial opening of the front door which provides a redundant safety feature to keep the lock plungers in the secure position.

D. The steel drum overpack is designed to meet the conditions for normal conditions of transport. Since the inner SPEC C-1 package has previously been shown to meet the hypothetical accident conditions[1], it is only necessary to demonstrate that the SPEC C-1 steel drum overpack configuration meets the normal conditions for transport for this configuration to satisfy the criteria for a Type B(U) package. If the SPEC C-1 steel drum overpack configuration were subjected to the hypothetical accident condition test, then it would pass since the inner SPEC C-1 package has previously passed the test. The overpack can only provide additional structural protection for the SPEC C-1 package in the hypothetical accident condition tests by serving as an impact limiter and a partial thermal barrier.

E. To establish the significant margin of safety of the previously approved

[1] Application dated January 23, 1975 and supplements dated May 7, 1975 and February 16, 1984.

thermal metal joining technique a substandard SPEC C-1 was fabricated where each joint was fused intermittently along only 50% if its length and no fused length was longer than one inch. This substandard SPEC C-1 inner package and overpack configuration was subjected to the structural hypothetical accident condition thirty foot free drop and puncture tests.

2.1.2 Design Criteria

A. Primary consideration was given to protecting the depleted uranium shield by limiting its movement under typical working conditions, normal transportation and hypothetical accident conditions. The depleted uranium shield rests on the bottom panel, and the sides and interior panels are snug against the shield to prevent all vertical and side movement within the package. Use was also made of the casting "hot top" which is the cylindrical projection from the body of the casting and is the remains of the gate into which molten metal is poured to produce the casting. It is approximately 3 inches diameter by 3/16 inch high. A stainless steel ring is joined to the back panel of the SPEC C-1 housing and the "hot top" is fitted into the ring to resist lateral movement. The side, rear and bottom panels encasing the depleted uranium shield extend to form a larger container with hinged top and front doors that enclose and protect the spring loaded plungers which secure the source assemblies, and the outlet nipples to which transfer tubes are connected for exchange of source assemblies. Top and front door hinges are fused and bolted to the adjacent housing panels. See Drawing B311000, Appendix 9.1.

B. The direct contact of the shield with interior, bottom, back and side panels is the primary means to prevent movement of the shield within the package. By preventing movement of the depleted uranium shield within the housing, movement of the source assembly within the shield is also restrained such that the radiation levels after the hypothetical accident tests are within the established criteria.

C. The locking plunger were designed specifically to provide a high level of security in maintaining the sealed sources in the shielded position. Since the locking plungers prohibit rear movement of the sealed source capsule itself, and a permanent septum prevents forward movement, safety is maintained regardless of the physical condition or presence of the source pigtail. Although no source model which does not include a pigtail cable is currently authorized for use in the SPEC C-1, such a source design would remain fully shielded and secured through out normal and hypothetical accident conditions.

D. Because the sealed source capsule qualifies as special form radioactive material, it is known that the sealed source capsule is not damaged by the thirty foot drop test nor the 1475°F thermal test. Located in the center of the depleted uranium shield within the SPEC C-1 case, the sealed source capsule is adequately protected from any shear or crushing forces that could damage

the capsule.

E. An overpack whose principal component is a commercially available steel drum commonly used in transport provides an outer package that effectively transports the SPEC C-1 inner package along with a limited quantity of related radiography equipment, and adequately withstands substantial deformation from the normal condition of transport tests for drop, penetration and compression. This overpack has been in use successfully for 25 years. Foam is used to center the SPEC C-1 within the drum.

***(Excerpts from November 29, 1993 Supplement)***

2.2 Weights and Centers of Gravity

The SPEC C-1 steel drum overpack configuration weighs a maximum of 100 pounds and includes the SPEC C-1 inner container with a maximum gross weight of 70 pounds. The center of gravity is virtually the geometric center of the right circular cylinder defined by the drum.

2.3 Mechanical Properties of Materials

2.3.1 SPEC Model C-1 Source Changer

A. Materials used in the SPEC C-1 source changer are principally carbon steel, some stainless steel, depleted uranium, titanium or zircalloy, brass, foam fill and PVC.

B. All commercial grade materials are used in the construction of the SPEC C-1 and their mechanical properties are commonly established. There was no attempt nor necessity in the design of the SPEC C-1 to conduct theoretical engineering structural evaluations based on mechanical properties of materials, since it is a small light weight package whose simple design was based on extensive years of previous experience with similar packages and methods of construction, and which was proven by actual physical tests.

C. Carbon steel is used for the package panels and door brackets. The hot top ring and components of the lock housing are stainless steel. Brass is used in the outlet nipple. The radiation shield is a depleted uranium casting with a titanium or zircalloy tube through the shield. Stainless steel and PVC is used for the carrying handle, but it is not a structural part of the package. The identification plate is stainless steel to withstand the thermal test.

2.3.2 Steel Drum Overpack:

Commercially available 12 gallon, 20 or 22 steel gauge open head drum with snap ring or bolt ring closure and minimum 2 pounds per cubic foot polyurethane foam. A plywood disc, and carrying handles are employed. The mechanical properties of these

materials will meet general packaging requirements and normal conditions of transport since it is not the purpose of the overpack to provide impact protection, a thermal barrier, or shielding material. Neither is it necessary that they withstand the hypothetical accident conditions for thermal, drop or puncture tests, but by actual tests the steel drum overpack configuration do meet the hypothetical accident condition tests.

## 2.4 General Standards for All Packages

The SPEC C-1 source changer and the SPEC C-1 steel drum overpack meet the general standards for all packages in accordance with the provisions of 10 CFR Sections 71.43, 71.45 and 71.47.

### 2.4.1 Minimum Dimension

The smallest overall dimension of the SPEC C-1 source changer is nominally 7 inches. The smallest overall dimension of the steel drum is the nominal 14-1/2 inches diameter. Therefore the Model C-1 Transport Package meets the 4 inch minimum dimension requirement as specified in 10 CFR 71.43(a).

### 2.4.2 Tamper Seal

A lead wire tamper seal is affixed to the SPEC C-1 steel drum overpack configuration snap ring or bolt ring closure meeting the requirement of 10 CFR 71.43(b).

### 2.4.3 Positive Closure

The primary containment system preventing the release of radioactive materials is the special form sealed source capsule which can only be opened destructively. In addition the sealed source assemblies are retained in the depleted uranium shield by spring loaded lock plungers. The design of the locking plungers requires that they be engaged before the front door can be fully closed. The design of the door brackets prevents partial opening of the front door regardless of the size and design of any padlock or similar fastener devices used by the shipper. The front door provides a redundant mechanism to maintain the lock plungers in the secure position. The drum lid and closure ring hold the SPEC C-1 source changer inside the drum.

### 2.4.4 Chemical and Galvanic Reactions

The materials of construction are stable common metals which are known not to present chemical, galvanic or other reactions between the various metals. All the materials are inert to reaction with water, except for slow corrosion. As discussed below in Section 3.2 Thermal Properties of Materials an iron-uranium eutectic has been shown not to exist.

### 2.4.5 Package Operational Containment

No valves or other devices are present which would allow radioactive contents to escape from the primary containment of the sealed source capsule. The sealed capsule of the source assembly is retained in the shield by a spring loaded lock plunger and a permanent septum in the center of the U-tube, thereby forming two J-tubes.

2.4.6 Normal Conditions of Transport

As described below in Section 2.8, Normal Conditions of Transport, the Model C-1 Transport Package was subjected to the specified tests and demonstrated that there would be no loss or dispersal of radioactive contents, no significant increase in external radiation levels, and no reduction in the effectiveness of the packaging. In fact the test specified for normal conditions of transport did not cause any significant effect on the inner SPEC C-1 package.

2.4.7 Surface Temperature

The maximum activity of 240 Ci in the SPEC C-1 has negligible heat of decay and the surface temperature of the package will be that of the ambient temperature.

2.4.8 Venting

Venting considerations are not applicable. Any pressure increase resulting from the decay of the maximum 240 Ci Iridium-192 in the sealed source capsule will be negligible and will be adequately contained by the sealed source capsule.

2.4.9 Lifting Devices

Commercially available carrying handles are provided as a convenience on the SPEC C-1 steel drum overpack configuration. They are not considered a structural part of the Type B package, and failure of the carrying handles would not prevent the package from meeting the normal or hypothetical accident condition test requirements. A SPEC C-1 steel drum overpack configuration was suspended from a single point approximately in the center of one of the carrying handles and loaded with 300 pounds dead weight (100 pound maximum package weight times a minimum safety factor of three) for a minimum of thirty minutes, which is considerably longer than any anticipated duration that the package will be carried. The handle supported the weight without any deformation or damage in compliance with 10 CFR 71.45(a).

2.4.10 Tiedown Devices
None

2.4.11 External Radiation Standards

The Model C-1 Transport Package does not exceed 200 mR/hr at the surface of the drum overpack and 10 mR/hr at one meter from the surface of the drum overpack when the SPEC C-1 Source Changer contains 240 Ci of Iridium-192 meeting the

requirements of 10 CFR 71.47(a).

Instructions are provided in Section 7 Operating Procedures for preparing the package for shipment to meet the requirements for transport.

2.5 Standards for Type B Packaging

The SPEC C-1 steel drum overpack configuration meets the additional requirements for Type B packages in accordance with the provisions of 10 CFR 71.51.

2.5.1 Normal Condition of Transport Test Criteria

The results of tests described below in Section 2.8 for normal conditions of transport adequately demonstrate that there would be no loss or dispersal of radioactive contents, no increase in external radiation levels, and no reduction in the effectiveness of the SPEC C-1 steel drum overpack configuration.

***(Excerpts from November 29, 1993 Supplement)***

2.5.2 Hypothetical Accident Conditions Test Criteria

A. The results of the previously submitted tests[1] on the SPEC C-1 source changer for hypothetical accident conditions adequately demonstrate that there would be no possibility of 13.5 Ci Iridium-192 escaping from the package in one week nor would there be any radiation levels exceeding one rem per hour at one meter from the external surface of the package. The source assembly containing the radioactive material remained intact and was not released from the package.

B. The results of the structural hypothetical accident condition tests on the substandard SPEC C-1 inner package and overpack configuration adequately demonstrate that there would be no possibility of 13.5 Ci Iridium-192 escaping from the package in one week nor would there be any radiation levels exceeding one rem per hour at one meter from the external surface of the package. The source assemblies remained intact and were not released from the package.

2.5.3 Activity Release Limitations

Containment by filter or mechanical cooling systems are not applicable since there was no release of radioactive material. The source capsules remained intact after the tests for normal condition of transport and the hypothetical accident conditions.

2.6 Description of Test Packages

---

[1] Application dated January 23, 1975.

2.6.1 SPEC C-1 Source Changer for 1975 Tests

The SPEC C-1 source changer subjected to the hypothetical accident condition tests in 1975 was a typical and randomly selected package. It consisted of a C-1 only - there was no steel drum overpack.[2]

***(Excerpts from December 6, 1993 Supplement)***

2.6.2 Model C-1 Transport Package for Normal Conditions of Transport Tests.

A. The packaging that was subjected to the normal conditions of transport tests consisted of a C-1 inner package, an overpack and a changer tube. The total gross weight of the test package was 93 pounds.

B. The overpack was a 22 gauge steel drum overpack with a snap ring closure as specified in Drawing No. B322000, with the following exceptions. The handles and plywood disk were omitted to create a worst case test package from a structural perspective. The weight of the overpack was 19 pounds.

C. The C-1 inner package weighed 68-1/2 pounds. Approximately three (3) pounds of tungsten scrap material was loosely placed inside the C-1 source changer adjacent to the outlet nipples. This weight was added to exceed the weight of any typical C-1 source changer with a maximum weight of 70 pounds. A changer tube used to perform source exchanges was placed inside the C-1. The weight of the changer tube was approximately 1-1/2 pounds. The gross weight of the C-1 inner package used for the tests was approximately 73 pounds (including the tungsten scrap and changer tube).

2.6.3 Substandard SPEC C-1 with Steel Drum Overpack for Free Drop and Puncture Hypothetical Accident Tests.

A. At the request of the Nuclear Regulatory Commission a substandard SPEC C-1 with each joint intermittently fused along only 50% of its length and no fused length exceeding one inch, was subjected to the thirty foot free drop and puncture hypothetical accident condition tests to establish the high margin of safety of the thermal metal joining technique. The C-1 was placed inside of an overpack for these tests. This satisfactory test of the substandard SPEC C-1 package was to further confirm that all previously fabricated packages qualify as Type B(U) packages, since the substandard package is structurally very inferior to any previously fabricated SPEC C-1 package.

B. The package that was subjected to the hypothetical accident tests consisted of a C-1 inner package, and a steel drum overpack. The total gross weight of the test package was 87 pounds.

---

[2] Application dated January 23, 1975.

C. The substandard 50% fused joint SPEC C-1 test package had a gross weight of 68 pounds. It contained a shielding pad at the hot top. It did not include hinge bolts to attach the door hinges to the package rear and bottom panels (only TMJ welding was used to attach the door hinges), nor did it include foam fill (due to the 50% welding the foam would have leaked out of the test package during installation). No padlock or similar fastener was used on the C-1 test package, which represents a worst case configuration for the door closure mechanism.

D. The substandard C-1 test package was placed into a steel drum overpack as specified in Drawing No. B322000, which consisted of a 22 gauge steel drum with foam position material and snap ring closure.

E The overpack did not include the plywood bottom support disc nor handles in order to provide a weaker test package. The gross weight of the overpack was 19 pounds.

F. The discontinued design of this configuration (bolts through the hinges were not used and older version padlock hasp) was subjected to the selected structural hypothetical accident condition thirty foot free drop and puncture tests. See Photographs F-2 through F-6.

2.7 Description of Drop Targets

2.7.1 Requirements

The drop targets greatly exceed the requirements outlined in IAEA Safety Series No. 37 "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (1985 Edition) Third Edition, which recommends a steel plate as the upper surface of a concrete block. It specifies that the combined mass of the steel and concrete should be at least 10 times that of the specimen to be dropped; that the block should be set on firm soil; that the steel plate should be at least 4.0 cm thick and floated onto the concrete while it is still wet; and that the plate should have protruding steel structures on its lower surface to ensure tight contact with the concrete.

***(Excerpts from June 19, 1990 Application)***

2.7.2 Original Drop Target

The original drop target at Source Production & Equipment Company, Inc. was used for the normal condition tests. It was a 20' x 20' x 5" concrete slab foundation, 24,500 pounds, excluding grade beam and footings, which rests on twenty-eight pilings and soil. See Drawing 22689-4 "Drop Test Target Specifications" and Photograph Number A-1. A 4' x 4' x 1-3/4" steel plate, 1129 pounds, was bolted and grouted onto the concrete slab, centered atop a 12" x 18" grade beam, with a

10,125 psi grout to assure a firm tight contact with the concrete. The combined mass of the concrete and steel plate, 25,629 pounds, greatly exceeds ten times the mass of the 100 pound package, and the 1-3/4" (4.4 cm) thick steel plate meets the minimum 4 cm thickness specification for the steel plate. A 35 foot tripod was erected over the drop target. See Photograph Number A-2.

2.7.3 New Drop Target

The new drop target used for the hypothetical accident condition tests was not the same as that used for the normal condition tests, yet also greatly exceeds the requirements specified in IAEA Safety Series No. 37 "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material", Third Edition (1985 Edition).

The drop target consists of a solid carbon steel plate which measures 2'6" x 2'11" x 1-3-4" thick weighing 520 pounds. The thickness of the steel plate meets the minimum 4.0 cm IAEA requirement. The steel plate was wet floated onto the top surface of a flat horizontal concrete block which measures 4'6" x 4'6" x 4'6" thick weighing 13,668 pounds. See Photograph F-1A. The total weight of the drop target is 14,188 pounds which greatly exceeds ten times the mass of a 100 pound package. The concrete block is metal reinforced and is sunk to a depth of 4'2" into firm soil. See Drawing No. 50890-1, Appendix 9.1.

A 35 foot tall tripod was erected over the drop target and used to raise and release the test package from a minimum height of 30 feet (9.2 meters) above the top surface of the target. See Photograph F-1B. No damage nor separation of the steel plate from the concrete block occurred as a result of all drop and puncture tests.

2.8 Normal Conditions of Transport Tests for Model C-1 Transport Package

2.8.1 Heat

The overpack configuration was not tested at an ambient temperature of 100° F in still air and isolation, because the materials of construction of the steel drum overpack are stable at that temperature, and the inner SPEC C-1 has previously been shown to pass the more stringent 1475° F thermal test for the hypothetical accident conditions. Therefore it is concluded that a temperature of 100° F in still air and isolation would have no effect on the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.2 Cold

The overpack was not tested at -40° F since the materials of construction are stable at that temperature, and the inner SPEC C-1 was satisfactorily tested at -107°F as described above. The SPEC C-1 steel drum overpack was subjected to a temperature of -107° F for twenty four hours and satisfactorily passed the hypothetical accident

condition 30 foot free drop and puncture tests. It is concluded that a temperature of -40° F would had no effect on the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.3 Reduced External Pressure

This test was not performed because the overpack and the SPEC C-1 are open to the atmosphere and there are no materials in the package which would be affected by a pressure reduction to 3.5 psi absolute. The special form sealed source capsule will withstand reduced pressures much greater than the 3.5 psi absolute. A pressure reduction to 3.5 psi absolute would have no affect on the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.4 Increased External Pressure

The test was not performed because the overpack and SPEC C-1 are opened to the atmosphere and there are no materials in the package which would be affected by an increase of external pressure to 20 psi absolute. The special form sealed source capsule will withstand increased pressures much greater than the 20 psi absolute. An increase of external pressure to 20 psi absolute would have no affect on the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.5 Vibration

The effects of vibration on the overpack and SPEC C-1 configuration and their materials of construction incident to normal transportation are negligible. The SPEC C-1 steel drum overpack configuration has been transported over a period of 25 years in the U.S., Canada and overseas via all modes of common transportation on water, highway and air without displaying damage or other significant effects. Hinge damage is not due to vibration. Vibration incident to normal transportation has not reduced the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.6 Water Spray

A water spray test was not conducted. There are no materials of construction in the overpack which would be affected by a water spray and the SPEC C-1 would not be adversely affected by water.

2.8.7 Free Drop

The test package used for the penetration tests was used for the free drop tests. The package was dropped onto a flat, essentially unyielding, horizontal surface from a height of four feet. For each test the package was oriented to position the center of gravity directly over the point of impact. All points of impact for which maximum damage could occur were selected. Photograph D-1 depicts the drop target.

The first point of impact was the top of the package. See Photograph D-2. The top was dented flush with the top edge of the closure ring. No rupture occurred. See Photograph D-3.

The second point of impact was the latch of the closure ring. See Photograph D-4. The package was suspended and released from a single point along the edge of the bottom of the overpack exactly opposite the location of the closure latch. The edge dented inward 1/4 inch and the side of the overpack immediately below to point of impact dented inward ½ inch. The latch, closure ring and tamper seal remained fully intact. See Photographs D-5 and D-6.

The final point of impact was along the edge of the bottom of the overpack. The package was again released from a single opposite point at the edge of the top to maintain the center of gravity directly over the point of impact. See Photograph D-7. Damage consisted of a 3/4 inch deep dent along seven (7) inches of the edge of the bottom. No rupture occurred. See Photograph D-8.

At the conclusion of the three free drop tests the SPEC C-1 inner package was removed from the overpack and inspected for damage. Damage consisted of 3/8 inch dent to the top of the front door of the C-1 located at the door bracket, yet the tamper seal remained intact. See Photograph E-1. The hinges of the C-1 remained completely undamaged. See Photograph E-2. There was no effect on the operation or the shielding capability of the inner C-1 package.

The four foot free drop tests did not result in loss of radioactive contents from the SPEC C-1 steel drum overpack configuration, nor increase in radiation levels, nor reduce the effectiveness of the package.

2.8.8 Corner Drop

This test is not applicable since the overpack configuration is not constructed of wood or fiberboard.

2.8.9 Penetration

The test package used for the compression test was used as the penetration test package. A 1-1/4 inch diameter steel cylinder weighing 13 pounds was dropped vertically from a height of 40 inches on several points of the exposed surface which were determined to be most vulnerable to puncture. For each puncture test the long axis of the steel cylinder was perpendicular to the package surface. Preparations for the puncture tests are depicted in Photographs B-2 and B-3.

The first point of impact was the center of the package top. See Photograph C-1. Damage was limited to a 1/4 inch deep dent in the top. See Photograph C-2.

The second point of impact was the edge of the top on the closure latch. A snap type

closure latch was selected for the penetration test since it is more vulnerable to damage than the bolt ring closure. Damage consisted of superficial scratches to the closure ring and a 1/8 inch dent in the edge of the top. The latch remained fully secured. See Photograph C-3.

The third point of impact was the center of the side of the package. A 3/4 inch deep dent resulted without penetration. See Photograph C-4.

Three separate penetration tests were made on the fourth point of impact which was again on the latch of the closure ring. For this test the package was placed on its side to allow a different angle of impact onto the latch. Damage consisted of a 3/8 inch deep dent on the side of the package immediately below the closure ring and only superficial scratches to the latch and ring itself. The edge of the top was dented inward 1/8 inch. The latch and tamper seal remained fully intact. See Photograph C-5.

The final points of impact were to the center and edge of the bottom of the overpack while the package was placed upside down. A ½ inch deep dent resulted in the center and a 1/4 inch deep dent resulted at the edge. No puncture occurred. See Photograph C-6.

The penetration tests did not result in loss of radioactive contents from the package, nor increase the radiation levels, nor reduce the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.10 Compression

The test package was placed on a flat, horizontal surface and the top was uniformly loaded with 800 pounds of lead bricks, which greatly exceeds the required load of five times the gross weight of the package. The load was applied for a period of 24 hours. The compression test is shown in Photograph B-1. There were no observable effects of the compression test and there was no damage or deformation. The compression test did not result in loss of radioactive contents from the package, increased radiation levels nor reduce the effectiveness of the SPEC C-1 steel drum overpack configuration.

2.8.11 Test Summary

In compliance with 10 CFR Part 71.71, based upon the above tests and evaluations, it is determined that under normal conditions of transport:

A. There would be no loss or dispersal of radioactive contents.

B. There would be no significant increase in external radiation levels.

C. There would be no significant reduction in the effectiveness of the

packaging.

## 2.9 Hypothetical Accident Conditions

### 2.9.1 SPEC Model C-1 Source Changer

Hypothetical accident condition tests were performed on the SPEC C-1 source changer and presented in the application dated January 23, 1975. The following summarizes the information submitted in that application.

A. Free Drop

"The container was dropped from a height of 30 feet onto a steel plate on a concrete slab. The point of impact was a bottom corner of the device. No damage effecting the operation of the container, the inner shield, or the position of the source was experienced."[3]

B. Puncture

"The container was dropped from a height of 40 inches onto a vertical cylindrical mild steel bar mounted on a steel plate. The bar was 6 inches in diameter and 10 inches in length. No damage was experienced."[4]

C. Thermal

"The whole package was placed in a heat treating furnace and kept at a temperature of 1475 degrees Fahrenheit for 30 minutes. The heat had no effect on the proper functioning of the package, the shield, or the position of the source."[5]

D. Water Immersion

"The package was submerged under three feet of water for eight hours. This time test had no effect on the package."[6]

The above test was performed in 1975 although the water immersion test would not have been required since no fissionable materials are involved in the package, and since there are no materials of construction which would be damaged by water and water pressure equivalent to a 50 foot depth for a period of eight hours.

---

[3] Application dated January 23, 1975.
[4] Application dated January 23, 1975.
[5] Application dated January 23, 1975.
[6] Application dated January 23, 1975.

E. Summary of Structural Damage

The package was subjected to the hypothetical accident conditions for a Type B package including the 30 foot drop test, the puncture or percussion test and the heating test. (See 3.5.1 for Thermal Test results.)

The test resulted in no significant damage to the package whatsoever. "The 30 foot drop test dented a bottom corner of the package but had no effect on the shield, locking mechanisms, or position of the shield. The hinges affixed to the vertical outer door were slightly mashed but remained intact. Actually, the door could still be opened and closed, but somewhat stiffly. The hinges on the top of the horizontal door were not affected. Source connectors and locking mechanisms were absolutely unaffected."[7]

2.9.2 Model C-1 Transport Package

The inner SPEC C-1 package has been shown to successfully pass the hypothetical accident condition tests.[8] Therefore, if any overpack and SPEC C-1 configuration were subjected to the hypothetical accident condition tests the configuration would successfully pass the tests, because:

A. If the overpack were completely destroyed or ineffective the inner SPEC C-1 has been previously shown to pass the specified test.

B. The presence of the overpack could in no way adversely affect the ability of the inner SPEC C-1 to pass the test; conversely the overpack could only enhance the ability of the overpack and SPEC C-1 configuration to pass the hypothetical accident condition tests by serving as an impact limiter, partial thermal barrier and by reducing radiation levels due to the increased distance to the external surface.

2.9.3 Substandard SPEC C-1 with Steel Drum Overpack Configuration

A. Free Drops

The same substandard test package was dropped six times onto the drop target described in Section 2.7.3 of this application. Six points of impact were selected which were expected to result in the maximum damage to the package.

---

[7] Application dated January 23, 1975; letter dated May 7, 1975.

[8] Application dated January 23, 1975.

Prior to the first drop the test package was frozen in dry ice for a period of 24 hours. See Photograph F-7. The test package was dropped within 90 seconds after removal from cold storage, and was returned to cold storage immediately after each of the first four free drops. For each free drop the center of gravity of the test package was positioned directly over the point of impact. The distance from the bottom of the test package to the top of the drop target was a minimum of 30 feet for each free drop test.

1) First Drop: Top surface (lid)

The point of impact was the top surface (lid) of the overpack. See Photograph G-1. The center of the lid dented outward approximately 1/4". An impression of the outline of the upper edges of the four sides of the SPEC C-1 were impressed upon the inside surface of the lid, (see photograph G-2) and the surface of the drop target. See Photograph G-3. The door bracket of the SPEC C-1 dented the center of the lid outward approximately 1/8". No rupture of the package occurred. The snap ring closure remained intact. See Photograph G-4.

2) Second Drop: Edge of top (lid) at closure clamp

The point of impact was the edge of the top surface (lid) of the overpack on the snap ring closure clamp. The top edge of the overpack at the location of the snap ring closure clamp dented inward approximately 3/4". The upper edge of the sides of the SPEC C-1 again made an impression on the inside surface of the lid, and split the lid approximately 1" wide (at the widest spot) and 6" long at the location where the left top edge of the SPEC C-1 impacted. See Photograph H-1. The SPEC C-1 dented the lid outward an additional ½". The snap ring closure remained intact. See Photograph H-2.

3) Third Drop: Side of overpack at closure clamp

The point of impact was the side of the overpack adjacent to the snap ring closure clamp. See Photograph I-1 and I-2. The side of the drum at the area of impact dented inward approximately 3/4" (at the deepest) x 7" wide x the entire 20" height of the drum. See Photograph I-3. Two ruptures, each approximately 1" long, occurred along the side of the drum 6" below the lid at the locations where the top rear corners of the SPEC C-1 impacted. The snap ring closure remained intact.

4) Fourth Drop: Side of overpack along drum seam

The point of impact was the side of the overpack alone the seam of the drum. See Photograph J-1. The seam is 90 degrees around the circumference of the drum from the area of impact of the 3rd free drop. The side of the drum at the area of impact dented inward 3/4" deep similar to the 3rd free drop. See Photograph J-2. A single vertical rupture approximately 2" long x 3/16" wide occurred at a location 6" below the lid of the drum where the top right rear corner of the SPEC C-1 impacted. The snap ring closure remained intact, but as a combined result of the 3rd and 4th free drops, the lid separated upward from the closure ring approximately 2-1/2" (at the highest point) for approximately 35% around the circumference of the lid. See Photograph J-3. Small portions of polyurethane fill were crushed and crumbled. The SPEC C-1 remained intact within the overpack.

5) Fifth Drop: Bottom surface

The point of impact was the bottom surface of the overpack. The bottom of the drum dented outward approximately ½". No rupture occurred. No additional damage occurred to the closure ring, tamper seal or top edge of the drum, yet the lid completely separated from the drum upon final impact of the test package with the ground. See Photograph K-1.

With the lid missing the damage to the interior of the overpack and to the SPEC C-1 were able to be visually inspected. Portions of the polyurethane fill were crushed and chunks broken away, yet the majority of the foam remained intact. See Photograph K-2. The top door of the SPEC C-1 was dented inward approximately 1" as a result of the 1st and 2nd free drops. Both hinges of the top door of the SPEC C-1 were separated from the rear panel. Both pigtails remained completely secured and intact within the SPEC C-1.

6) Sixth Drop: Edge of bottom below closure clamp

The point of impact was the edge of the bottom surface of the overpack directly below the snap ring closure clamp. See Photograph L-1. The bottom edge at the point of impact dented inward approximately 1-1/8". See Photograph L-2. No rupture occurred. The SPEC C-1 remained intact within the overpack, although primarily as a result of being jammed in the foam at the bottom half of the overpack. See Photograph L-3. The SPEC C-1 did not fall out of the overpack even when it was suspended upside down.

7) Results

After six free drop tests to the same substandard SPEC C-1 steel drum overpack configuration test package there was no loss of radioactive content. Radiation levels after six successive thirty foot drop tests and three puncture tests did change slightly because of the closer proximity of the inner SPEC C-1 source changer to the outer surface of the drum, but the radiation levels remained well below the test criteria for the hypothetical accident conditions. The maximum radiation level measure after the six free drop and three puncture test was 4.2 mrem per hour at one meter from the surface of the package extrapolated to an activity of 240 Ci Iridium-192. This is well below the criteria of 1000 mrem/hr at one meter established for the hypothetical accident condition tests.

***(Excerpts from September 24, 1990 Supplement)***

8) Orientation of C-1 Inner Package During Third and Fourth 30 Foot Drop Tests.

During the third and fourth 30 foot drop tests of the C-1 steel drum overpack configuration the C-1 inner package was positioned at the bottom of the rectangular shaped cavity which is molded into the form material of the overpack. During the third drop test the front panel of the C-1 was oriented parallel to the target surface, and the side of the C-1 was parallel to the target surface during the fourth drop test. No reorientation of the C-1 inside the overpack, nor repair or repackaging of any sort between any of the six drop tests was conducted. This was done in order to create a worst case test protocal of cumulative damage to the package.

***(Excerpts from June 19, 1990 Application)***

B. Puncture

The same SPEC C-1 Steel Drum Overpack configuration test package that was used for each of the six free drop tests described in 2.9.3A of this application was used for each of three puncture tests. Three points of impact were selected which were expected to result in the maximum damage to the package.

The puncture test target consisted of a solid, vertical, cylindrical carbon steel bar mounted on the center of the drop target described in Section 2.7.3 of this application. The bar measured 6" in diameter and 8" in height with the upper edge rounded to a 1/8" radius. For each puncture test the center of gravity of the test package was positioned directly over the point of impact. The distance

from the bottom of the test package to the top of the steel bar measured 40 inches for each test. See Photograph M-1.

1) First Puncture Test: Top surface of SPEC C-1 inside overpack

The point of impact was the center of the top door of the SPEC C-1 inner package. See Photograph M-2. This point of impact was possible due to the loss of the lid of the overpack as a result of the fifth free drop test. There was no apparent additional damage to the inner substandard SPEC C-1. Top door was displaced slightly as a result of the hinge separation which occurred from the free drop test. See Photograph M-3. No damage to the overpack occurred.

2) Second Puncture Test: Center of bottom of overpack

The point of impact was the middle of the bottom of the overpack. See Photographs N-1 and N-2. The center of the overpack drum dented inward approximately ½". See Photograph N-3. No ruptures occurred. No additional damage occurred to the inner substandard SPEC C-1 package which remained intact within the overpack, with the exception that the previously separated top door fell out of the overpack. See Photograph N-4.

3) Third Puncture Test: Side of overpack

The point of impact was the side of the overpack adjacent to the center of the SPEC C-1 inner package. See Photographs O-1 and O-2. This was the same location which was the point of impact of the third free drop test. The side dented inward approximately ½". See Photograph O-3. No rupture occurred. No additional damage occurred to the inner substandard SPEC C-1 test package. The cumulative damage to the polyurethane foam resulting from of all free drop and puncture tests was an approximate 20% loss of material due to being crushed and crumbled. See Photograph O-4.

4) Results

The front door of the inner substandard SPEC C-1 was dented downward approximately ½" at the location where the door bracket is connected to the top of the door. See Photograph P-1. All three fused joints used to connect the door bracket to the top of the front door remained undamaged with the exception of the flaking of paint. Both hinges connecting the front door to

the bottom of the SPEC C-1 were slightly bent and the left hinge was torn inward approximately 3/16" from both sides. See Photograph P-2. Both hinges remained fully operational.

The top door of the SPEC C-1 was dented downward approximately 7/8" at the location where the door bracket is connected to the top of the door. All three fused joints used to connect the door bracket to the top door remained undamaged. Both hinges used to connect the top door to the rear panel were separated. The separation resulted from a combination of joint failure and parent metal failure of the hinge.

The side panels of the SPEC C-1 were dented downward from the tops edges approximately 1" at the location adjacent to the rear panel. See Photographs P-3 and P-4. The carrying handle was slightly bent but remained fully functional and intact. See Photograph P-5. The outlet nipples were undamaged and fully functional although the top edges were slightly scratched when the pigtail cables were crushed against them by the separated top door. Both pigtails cables were bent at the connector end where they protruded from the outlet nipples, but the source capsules remained secured in their proper position. The interior panel was completely undamaged. See Photograph P-5. The bottom of the SPEC C-1 source changer and the depleted uranium shield were completely undamaged. All fused joints, with the exception of the top door hinge joints, were completely undamaged. The left lock plunger was jammed in the locked position, but continued to hold the pigtail and source capsule firmly in place. The right lock plunger was slightly jammed, but continued to hold the pigtail and source capsule firmly in place and remained fully operational. Both lock plunger housings were completely undamaged. See Photographs P-5 and P-6.

2.9.4 Additional Type B Hypothetical Accident Conditions Tests - 1997

In response to an NRC Confirmatory Action Letter, issued June 24, 1997, the SPEC Model C-1 package was subjected to additional Type B Hypothetical Accident Conditions tests. The purpose of the tests were to validate previous testing, particularly in regards to the Drop and Puncture Test as specified in 10 CFR 71.73. The tests were performed on June 26, 1997 and were witnessed by various members of the US Nuclear Regulatory Commission and the State of Louisiana. The tests and results are summarized below.

2.9.4.1 Nine (9) Meter (30 ft.) Drop Test

In accordance with 10 CFR 71.73, the package was dropped from a distance of 9 meters (30 feet). The point of impact was directly on the top of the drum overpack.

2.9.4.1.1 Outer Packaging (Steel Drum Overpack) Damage

The top edge crushed inward approximately 1 inch at the location of the bolt closure for the lid. The bolt ring and lid separated from the drum. The foam lining in the drum was full intact which shows that the C-1 inner package remained flush with the drum lid throughout the free drop. The foam walls to the drum cavity were not damaged and the foam did not provide any impact reduction for the C-1 inner packaging.

2.9.4.1.2 Inner Packaging (C-1 source changer) Damage

Front Door: The upper left corner of the door dented downward 3/8 inch. The upper right corner dented downward 1/8 inch. The upper center dented downward 3/4 inch. The hinges remained intact and undamaged. Weld joint to padlock hash is fully intact and undamaged

Top Lid: Pushed downward 5/8 inch. Hinges bent but intact. All 8 hinge bolts remained intact. Left hinge was torn half way across its length.

Left Side: Upper 2-1/2 inches were buckled outward a maximum amount of 3/8 inch in center of buckle.

Right Side: Top edge is bent outward 1 inch along the entire length.

Back: Back of top lid bent outward 1/2 inch.

Bottom: No damage.

Interior: No damage. Source remained fully installed, secured and undamaged. Left and right side lock plungers are fully functional and operate freely.

Padlock: The padlock is not part of the design of the C-1 inner packaging. It is a commercial lock manufactured by the Master Lock Co. It is used to secure the two doors of the source changer together. The door lock is an NRC requirement for radiography source changers such as the C-1. After the 30' drop test, the padlock was open, yet remained installed in the

door hasps. The key was inadvertently left in the padlock for the drop test. We consider the lock opening to be a unique event promoted by the presence of the key. The padlock is a Master model MA7KA which has been used successfully by SPEC for over 20 years with the C-1 without an incident in which the lock has inadvertently opened for any reason. On June 27, 1997 the Research and Development office of Master Lock Co. reported that leaving the key in the lock increases the probability for the interior lock ball to move and release the shackle in the event of an impact on the right side. This issue is addressed by maintaining the current shipping preparation procedure of removing the key before transport.

In summary, structural damage was limited to the top edges of the side panels and the top lid being crushed in. The lock plungers and all structural features and all weld joints remained completely intact. There was no displacement of the DU shield within the shield enclosure. Both sources remained undamaged and securely locked in the fully shielded position. The C-1 functioned properly as a radiography source changer. The 30 foot drop test did not cause significant structural damage to the C- 1 inner package.

2.9.4.2 Puncture Test.

2.9.4.2.1 Selection of Orientation.

The lid to the steel drum overpack separated from the drum in the 9 meter drop test yet the C- 1 remained within the drum. Nevertheless, to create a worst case orientation for the puncture test, the C-1 source changer was removed from the drum. In addition, although the open padlock remained installed and continued to secure the two doors together after the 9 meter drop, the padlock was removed from the door hasp. The C-1 doors were then opened to evaluate the orientation for the puncture test. This is a most severe step to select the most damaging orientation. It should be noted that when the doors are closed the front door serves as a redundant means to prevent the lock plungers from retracting far enough to release a source.

The open doors allow direct access to the spring loaded lock plungers that secure the radioactive source assemblies. The two spring loaded lock plungers directly secure the source capsules within the C-1 and they are the most vulnerable to damage from impact when the doors are open; therefore the lock plungers were selected for impact. Considering the location of the center of gravity of the package, the package orientation expected to

cause maximum damage would be upside down, with the bottom of the C- 1 horizontal. This point of impact had never been selected for any of the previous puncture tests. To prepare for the puncture test on C- 1 s/n 283 an unplanned additional test was performed on the same point of impact and orientation on another C- 1 production package. That test was performed on C- 1 s/n 88 and is described below.

2.9.4.2.1.1 Unplanned Additional Test Orientation and Results. Another production model C- 1 inner package, s/n 88, was used to conduct a puncture test on the lock plungers. This test was done to assure proper test preparations to perform the puncture test on C- 1 s/n 283 that was in the process of being tested in accordance with the Test Plan. Additional test preparations were needed because this orientation had never been selected before for any of the puncture tests that were previously conducted on C- 1 packages. The opening of the padlock during the 9 meter drop test is unprecedented and was unexpected. Therefore, the decision to open the package doors and select the lock plungers as the point of impact was equally unanticipated and no preparations had been made in advance for that possibility.

The unplanned additional test is not considered a valid "certification" test because the package was not first subjected to the 9 meter free drop test. This information is provided to supplement the information in this test report

The weight of C-1 s/n 88 was 67 pounds. A 5-3/4 pound lead block was attached to the top surface (bottom panel) of the test package to increase the weight to a total of 72-3/4 pounds to simulate a worse case weight for the Puncture Test. (The heaviest C-1 allowed by the Certificate of Compliance is 70 pounds.) Dummy sources were installed in the C-1 for the test.

Orientation: The top lid and the front door of the C-1 inner package were wired open exposing the inside of the package, including the inner panel, plunger knobs and bosses, male outlet nipples and source assembly connectors. The package was then oriented upside down and positioned such that the point of impact would be directly on the two plunger knobs. It was

necessary to artificially wire the front door open when the package is oriented upside down otherwise the door would have been the point of impact instead of the lock plungers. There is no other means to attack the plungers.

Damage: The top edge of the left side (blue) plunger knob was dented approximately 1/4 inch long. The left plunger knob appears to have been impacted first. The top edge of the right side (red) plunger knob has a superficial mark. Both plungers were difficult to operate but continued to operate properly manually. The dummy sources remained secured within the depleted uranium shield. The hinges to the top door were bent and the door could not close after the test.

2.9.4.2.2 Puncture Test Configuration

The top lid and the front door of the package (C-1 stand alone; no overpack drum) were wired open exposing the inside of the package, including the inner panel, lock plunger knobs, male outlet nipples and source assembly connectors. As designed, the sealed sources were secured within the depleted uranium shield by the spring loaded plunger pins. The package was then oriented upside down and positioned such that the point of impact would be directly on the two plunger knobs. The distance between the side panels of the C- 1 is approximately 7 inches and provides very little clearance to allow the 6 inch diameter puncture pin to strike the lock plungers. The C-1 inner package s/n 283 was dropped from a height of 40 inches from the top of the puncture pin to the bottom of the package. The distance from the pin to the point of impact is approximately 45 inches. The actual point of impact was the top edge of the two source lock plungers as planned.

2.9.4.2.3 Damage Assessment.

Left Plunger: The plunger on the left side (blue color) withdrew a maximum of 0.150 inch and is solidly jammed. It could not be inserted nor retracted manually. The source remained completely and fully secured within the depleted uranium shield. The source could not be manually removed from the package. The left plunger received the majority of the impact force. It has a more defined mark (dent) on it when compared to the plunger knob on the right side. The dent in the left plunger knob is approximately 3/16" long.

Right Plunger: The plunger on the right side (red color) operated smoothly. The source remained secured within the depleted uranium shield. The impact mark on the right plunger knob is only a superficial indication.

Top Lid: The weld joints and bolts used to attach the hinges remained fully intact and undamaged yet both door hinges ripped apart and the top lid separated from the package. This damage was caused after the initial impact and after the package fell off the puncture pin and struck the drop target pad.

Puncture Test Damage Summary.
There was no puncture to the package. There was no damage to any weld joint of the structural enclosure to the DU shield and the lock plunger housings. The damage to the left side lock plunger was insufficient to significantly reduce the securing integrity of the mechanism. The damage to the top lid was insignificant.

2.9.4.3 Summary of Structural Evaluation.

The Model C-1 Transport Package is adequately designed to meet the hypothetical accident test requirements. This is substantiated by the fact that the C-1 inner package alone passes the accident condition free drop and puncture tests. Since the C-1 inner package is required to be transported within the steel drum overpack, and since the steel drum overpack can only increase the structural integrity of the inner package, the Model C-1 transport package is more than adequately designed to meet the accident condition structural requirements for a Type B(U) package.

## 2.10 Special Form

Source assemblies transported in the SPEC C-1 steel drum overpack configuration may be from manufacturers other than Source Production & Equipment Company, Inc. In these cases it is the shippers responsibility pursuant to 49 CFR 173.476(a) and the Certificate of Compliance for this package to verify that the source assemblies are special form radioactive material. Source assemblies manufactured by Source Production & Equipment Company, Inc. meet the requirements for special form radioactive material as described below.

Iridium-192 wafers are encapsulated in a stainless capsule which meets the requirements of special form radioactive material pursuant to 49 CFR 173.403, 10 CFR 71.75 and Paras 142, 502-504 IAEA Safety Series No. 6 "Regulations for the Safety Transport of Radioactive Material" 1985 Edition. The individual iridium wafers could qualify as special form radioactive material, if it were not for the minimum dimension requirement; but the stainless steel capsule represents the primary containment vessel. The IAEA Certificate of Competent Authority No. USA/0095/S describes representative special form source assemblies which may be shipped in the SPEC C-1 steel drum overpack configuration. See Appendices Section 9.3 Documents.

### 2.10.1 Description

A stainless steel sealed source capsule approximately 1 inch long by 1/4 inches diameter represents a typical capsule on source assembly shipped in the SPEC C-1 source changer. Such a sealed source capsule has one or more dimensions greater than or equal to 5 mm and meets the minimum dimension requirement for special form radioactive material. Source assemblies ("pigtails") consist of the sealed source capsule swaged onto a flexible cable to which is swaged a stainless steel locking ball and a connector.

### 2.10.2 Free Drop

Since the stainless steel capsule is very light and ruggedly constructed it is apparent that effects of its impact onto a flat, horizontal, essentially surface would be negligible.

### 2.10.3 Percussion

The design and yield strength will permit the stainless steel capsule to withstand impacts much greater than that which would be incurred from the specified three pound steel billet falling from a height of one meter onto the capsule while it rests on a lead sheet, maximum 25 mm thick, which is supported on a flat, smooth, essentially unyielding surface.

2.10.4 Bending

This test is not applicable since the sealed source capsule is less than 10 cm long.

2.10.5 Heating

The stainless steel capsule and the iridium wafers will withstand sustain temperatures greater than 1475° F for ten minutes without adverse effects.

2.10.6 Summary

The primary containment vessel in the SPEC C-1 steel drum overpack configuration is a special form sealed source capsule, such as that described in IAEA Certificate of Competent Authority No. USA/0095/S.

## 3.0 THERMAL EVALUATION

*(Excerpts from June 19, 1990 Application)*
Due to the materials of construction of the SPEC C-1 which are known to have stable thermal properties and which will not be affected by the prescribed 1475° F heat test it was not necessary to incorporate any special thermal engineering features in the package for it to comply with the normal conditions of transport and the hypothetical accident conditions. The SPEC C-1 demonstrated its ability to pass the hypothetical accident thermal test in 1975.[1]

As discussed previously, any overpack and inner SPEC C-1 configuration will successfully meet the prescribed 1475° F heat test since the inner SPEC C-1 package has previously been shown to meet the thermal test. Even if an overpack were completely destroyed in the heat test the inner SPEC C-1 would still pass the test and the presence of the overpack would enhance its ability to pass the test by providing additional thermal shielding.

### 3.1 Discussion

The heat of decay from the maximum activity 240 Ci Iridium-192 source is negligible. There are no fluids in the SPEC C-1 package, it is not hermetically sealed, it is vented to the atmosphere, and there can be no pressure build up in the package. The effects of the free drop and puncture tests do not affect the thermal characteristics of the package since the individual materials of construction are not affected by a temperature of 1475° F. PVC, plywood and foam are the only materials of construction which are affected by the 1475° F test temperature, but PVC is only used in the carrying handle grip which is not a structural part of the package. Brass has the next lowest melting point which is not lower than 1550° F. Brass is used in the outlet nipple. A temperature of -40° F would have no effect on the critical materials of construction since there are no moving operational parts of the package which require lubricants or other substances which are affected by reduced temperatures.

### 3.2 Summary of Thermal Properties of Materials

References: ASM International, Guide to Materials Engineering Data and Information, 1986.
Private Communication - Nuclear Metals, Incorporated.

[1] Application dated January 23, 1975.

The materials of construction are as follows:

| Material | Melting Temperature |
|---|---|
| Brass | 1550 degrees F |
| Depleted Uranium | 2070 degrees F |
| Stainless Steel | 2550 degrees F |
| Titanium 3-2.5 | 3000 degrees F |
| Zircalloy 2 | 3270 degrees F |

From the above table it is readily apparent that a 1,475° F temperature would have no effect on the device.

There have been reports indicating a possibility of a iron-uranium eutectic formation at 1,340° F. Such eutectic formation has been associated with metallurgically clean surfaces and vacuum heat treatment. The depleted uranium casting used in the construction of the SPEC C-1 is not cleaned to obtain a metallurgically clean surface and the steel plates are not chemically clean. No iron-eutectic formation has ever been observed or reported in the fabrication of radiography devices, and the supplier of the depleted uranium castings, Starmet, Inc., knows of no occurrences.

3.3 Technical Specification of Components

This section is not applicable. The only operating component in the SPEC C-1 package are the lock plungers, and there are no temperature or pressure limitations.

3.4 Thermal Evaluation for Normal Conditions of Transport

The SPEC C-1 steel drum overpack configuration is manufactured from materials which are not affected by temperatures in the range of -40° C to 70° C. A SPEC C-1 source changer test package was previously subjected to a temperature of 1475° F in conjunction with the hypothetical accident thermal test and there were no observable detrimental effects.[2] A SPEC 2-T exposure device is constructed from identical materials and similarly to a SPEC C-1 source changer and it has been previously shown that it did not incur any reduction in the effectiveness of the package when it was subjected to a temperature of -107° F for 20 hours.

The SPEC C-1 steel drum overpack configuration was subjected to 107°F for twenty-four hours prior to the hypothetical accident condition free drop and puncture tests with no observable effects. From the above it is conservatively concluded that within a temperature range between -40° C and 70° C the SPEC C-1 package will not release it contents, will not present increased radiation levels, and will not incur any reduction in the effectiveness of the package.

---

[2] Application dated January 23, 1975.

## 3.5 Hypothetical Accident Thermal Evaluation

### 3.5.1 SPEC C-1 Source Changer

***(Excerpts from May 7, 1975 Application)***

The SPEC C-1 Source Changer was subjected to the hypothetical accident conditions for a Type B package including the 30 ft. drop test, the puncture test and the thermal test. In 1975 at the time of the test, the "whole package" was the C-1 source changer only without a steel drum overpack. "The whole package was placed in a heat treating furnace and kept at a temperature of 1475 degrees Fahrenheit for 30 minutes. The heat had no effect on the proper functioning of the package, the shield, or the position of the source in the container."[3] The C-1 contained a nominal 100 Curie Iridium-192 source during the tests. A survey utilizing a G-M tube type survey instrument indicated there was absolutely no change in radiation levels or shielding efficiency. The test resulted in no significant damage to the package whatsoever. The thermal test, of course, burned off all the external vinyl labels and completely blackened the unit but in no way did it disturb any components.

The radiation profile for the container following the hypothetical accident conditions tests was identical to the profile prior to the test and for normal conditions for transport. With 115 Curies of Iridium-192, the profile was as follows:

| Location | Surface (mR/hr) | At 3 feet (mR/hr) |
|---|---|---|
| Top | 80 | Less than 1 |
| Front | 45 | Less than 1 |
| Back | 90 | 1 |
| Bottom | 85 | Less than 1 |
| Right Side | 30 | Less than 1 |
| Left Side | 86 | 1 |

Note: Source was located in left side source tube.

### 3.5.2 Model C-1 Transport Package

The substandard SPEC C-1 source changer was constructed from the same materials which were used in the 1975 thermal evaluation. The reported damage to the SPEC C-1 source changer from the free drop and puncture hypothetical accident condition tests would in no way adversely affect the structure, containment and shielding results of the hypothetical accident thermal evaluation. Neither would the presence of the steel drum overpack adversely affect the thermal results. The damage to the substandard SPEC C-1 resulting from the hypothetical accident condition test in the SPEC C-1 steel drum overpack configuration did not significantly exceed the damage which resulted from the 1975 hypothetical accident conditions test. In addition, the

[3] Application dated January 23, 1975.

hypothetical accident conditions test performed in 1997 produced results very similar to those which resulted from the 1975 tests, in that there was no significant structural damage to the C-1 source changer as a result of the 30 foot drop and puncture test. In every series of tests there was no loss of shielding or loss of functionality. The current package configuration requires the use of an overpack. Since the SPEC C-1 inner package has been previously tested and has successfully passed the hypothetical accident thermal test, it is concluded that a Model C-1 transport package meets the hypothetical accident thermal test requirements of 10 CFR 71.73..

3.5.3 Summary

Based on: 1) the thermal properties of the materials used in all test packages, 2) similar methods of construction and design , and 3) the results of the thermal testing in the January 23, 1975 C-1 application that the C-1 passed the test with no damage, it is concluded that the SPEC Model C-1 Transport Package meets the thermal test requirements of 10 CFR 71.73.

## 4.0 CONTAINMENT

*(Excerpts from June 19, 1990 Application)*

4.1 Containment Boundary

4.1.1 Containment Vessel

The sealed source capsule containing metallic Iridium-192 wafers described in Section 2.10 represents the primary containment boundary and vessel. This capsule meets the requirements of 10 CFR 71.75 and 49 CFR 173.469 for special form radioactive material.

4.1.2 Containment Penetrations

Due to the size of the sealed source capsule and the location of the capsule within the SPEC C-1 there will be no penetrations of the primary containment vessel.

4.1.3 Seals and Welds

The sealed source capsule is fused in a thermal metal joining procedure to meet the requirements of special form radioactive material and there are no mechanical or chemical seals pertaining to the primary containment capsule.

4.1.4 Closure

The special form, sealed source capsule may only be opened destructively and there are no mechanical closure provisions.

4.2 Requirements for Normal Conditions of Transport

4.2.1 Release of Radioactive Material

Based on the results of the evaluations for normal conditions of transport performed in Section 2.8 above there was no release of radioactive material from the primary containment vessel.

4.2.2 Pressurization of Containment Vessel

There is negligible gas volume contained within the minute void of the sealed source capsule, therefore any pressurization due to temperature or reduced pressure at flight altitudes would not effect the integrity of the sealed source capsule.

4.2.3 Coolant Contamination

No coolants are used in the package.

4.2.4 Coolant Loss

No coolants are used in the package.

4.3 Containment Requirement for the Hypothetical Accident Conditions

4.3.1 Fission Gas Products

No fissionable radioactive material is used in the SPEC C-1 package.

4.3.2 Releases of Contents

Based on the results of the Type B performance tests performed in 1975 and described in Section 2.9 the special form, sealed source capsule was not affected in any manner.[1] Also the sealed source capsule was not affected by the free drop and puncture tests performed on the substandard SPEC C-1 inner package and steel drum overpack configuration. Therefore, there can be no release of radioactive material from the primary containment vessel due to the conditions specified in the hypothetical accident conditions.

[1] Application dated January 23, 1975.

## 5.0 SHIELDING EVALUATION

*(Excerpts from June 19, 1990 Application)*

5.1 SPEC Model C-1 Source Changer

Adequate shielding design for SPEC C-1 was previously established by actual measurements of resulting radiation levels after the numerous tests performed for the hypothetical accident conditions on the test package in 1975[1].

5.2 Radiation Level Measurements

All radiation level measurements made for this application have been made in accordance with the standard specified in Section A-433, IAEA Safety Series No. 37 "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material", Third Edition (1985 Edition).

5.3 Model C-1 Transport Package

5.3.1 Package Shielding

Radiation levels were measured at the surface of the drum in three horizontal planes at ten degree intervals around the drum corresponding to the position of the two bungs on the drum and the horizontal center plane. Thirteen surface readings were taken on the top of the drum at positions corresponding to the projected four corners of the Model C-1; the four mid-points between the four corners of the Model C-1; the center of the top; and four readings at the outer edge of the drum at 0°, 90°, 180° and 270°. Seventeen surface readings were taken on the bottom of the drum corresponding to the above thirteen position on the top of the drum plus four additional readings half way between the center of the top and the projected mid-points between the four corners of the Model C-1. Thirteen readings were taken at one meter from the top surface and seventeen readings were taken at one meter from the bottom surface at positions one meter distance from the above described points for the surface readings. Results presented in the following table were extrapolated to 240 Ci Iridium-192, and they demonstrate that radiation levels from the SPEC C-1 steel drum overpack configuration do not exceed 200 mrem/hr at the surface of the package.

---

[1] Application dated January 23, 1975.

| SURFACE | mrem/hr | | |
|---|---|---|---|
| 240 Ci | Points | Average | Maximum |
| Sides | 108 | 40.9 | 99.5 |
| Top | 13 | 10.1 | 14.0 |
| Bottom | 17 | 71.9 | 97.5 |
| Total | 138 | 41.9 | 99.5 |

Radiation levels were measured at one meter from the surface of the drum in three horizontal planes at forty-five degree intervals around the drum corresponding to the position of the two bungs on the drum and the horizontal center plane. Thirteen readings were taken at one meter from the top surface and seventeen readings were taken at one meter from the bottom surface at positions one meter distance from the above described points for the surface readings. Results presented in the following table were extrapolated to 240 Ci Iridium-192, and they demonstrate that radiation levels from the SPEC C-1 steel drum overpack configuration do not exceed 10 mrem/hr at one meter from the surface of the package.

| ONE METER | mrem/hr | | |
|---|---|---|---|
| 240 Ci | Points | Average | Maximum |
| Sides | 24 | 1.8 | 2.6 |
| Top | 13 | 0.5 | 0.7 |
| Bottom | 17 | 3.9 | 4.7 |
| Total | 54 | 2.1 | 4.7 |

5.3.2 Normal Conditions of Transport

Radiation levels were measured after the normal conditions of transport tests, four foot drop, penetration, and compression. Readings were extrapolated to 240 Ci Iridium-192 for comparison to determine if there were any significant changes compared to the radiation levels prior to the tests. No changes in radiation level were measured.

5.3.3 Hypothetical Accident Conditions

A. As discussed previously any overpack and inner SPEC C-1 configuration will successfully meet the prescribed maximum hypothetical accident conditions since the inner SPEC C-1 package has been shown to meet the tests. Even if the overpack were completely destroyed in the hypothetical accident condition

tests the inner SPEC C-1 would still pass the tests and the presence of the overpack would enhance its ability to pass the tests.

B. The substandard SPEC C-1 steel drum test package was subjected to the previously described six 30 foot free drops and three puncture tests. Resulting maximum radiation levels at one meter from the surface of the package for the top, bottom, and each of four quadrants around the sides of the drum were measured, and the results extrapolated to 240 Ci Iridium-192 are presented below:

| SUBSTANDARD SPEC C-1 in STEEL DRUM OVERPACK<br>Maximum Radiation Levels (mrem/hr)<br>One Meter from Surface<br>240 Ci Iridium-192 | |
|---|---|
| Package Surface | Six Drop Tests and Three Puncture Tests |
| Top | 1.5 |
| Bottom | 1.3 |
| 1st Quadrant | 4.2 |
| 2nd Quadrant | 1.3 |
| 3rd Quadrant | 1.8 |
| 4th Quadrant | 3.5 |
| Maximum | 4.2 |

5.3.4 Shielding Evaluation

The typical radiation levels from a SPEC C-1 steel drum overpack configuration are within the radiation level limits for a package in common carrier transportation.

The above results and evaluations conservatively showed that there was no significant increase in radiation levels for the normal condition of transport tests for the SPEC C-1 steel drum overpack configuration. Since the inner SPEC C-1 package meets the hypothetical accident conditions then the commercial overpack SPEC C-1 configuration satisfies the conditions for a Type B(U) package.

## 6.0 CRITICALITY EVALUATION

***(Excerpts from June 19, 1990 Application)***

This section is not applicable since the SPEC C-1 does not contain and is not designed to transport fissile material.

## 7.0 OPERATING PROCEDURES

The source assembly is initially loaded into the SPEC C-1 source changer at the SPEC facilities under the provisions of Louisiana Radioactive Material License LA-2966-L01 in accordance with the procedures and radiation protection standards established under that license and 10 CFR 71.87(f). Only licensed users of the SPEC C-1 source changer may be authorized to exchange source assemblies in accordance with specific provisions of their agreement state or NRC radioactive material license.

### 7.1 Procedures for Preparing and Loading the Package

The SPEC C-1 shall be loaded and prepared for shipment in accordance with written operating procedures. The user will ensure that the use of the package complies with the conditions of approval in the Certificate of Compliance, including authorized contents.

#### 7.1.1 Package Registration

Before first use of the package, in accordance with 10 CFR 71.12(c)(3), the shipper, including users who transport the SPEC C-1 steel drum overpack configuration as a private carrier, must register as a user of the package by writing to:

> Director, Office of Nuclear Material Safety and Safeguards,
> U.S. Nuclear Regulatory Commission
> Washington, D.C. 20555-0001

#### 7.1.2 General Packaging Inspection

A. C-1 Source Changer

Visually, ascertain that there are no cracks, pinholes, uncontrolled voids or other defects that could significantly reduce the effectiveness of the C-1 source changer. Visually inspect the SPEC C-1 source changer to determine if it is in unimpaired condition for shipment. The SPEC C-1 source changer should be inspected to determine that it is not damaged, and that the hinges, outlet nipples and lock plungers and doors are functional.

Verify that the C-1 source changer packaging is conspicuously and durably marked with its model number and serial number.

B. Steel Overpack Drum

Visually, ascertain that there are no cracks, pinholes, uncontrolled voids or other defects that could significantly reduce the effectiveness of the steel drum overpack. Inspect the steel drum, foam, and the bolt or snap ring top closures to determine if it is in unimpaired condition for shipment. Superficial dents

and scratches on the steel drum overpack are permissible.

7.1.3 Loading of Contents

Open the empty side of the C-1 by pulling up spring-loaded plunger knob and rotating it slightly. Connect the exchanger tube to outlet nipple of empty side of the C-1 and to the exposure device. Crank the source into the C-1 until a stop is met. Rotate the C-1 plunger knob until the plunger snaps into the closed position. Disconnect the exchanger tube and source assembly. Verify that the lock plungers are fully depressed, that the source assemblies are properly secured, and that the doors to the SPEC C-1 source changer are fully closed and secured together by a padlock or similar fastener. Remove the key from the lock.

The SPEC C-1 source changer must fit securely in the foam cavity. When additional ancillary equipment (up to eight pounds maximum) is shipped inside the steel drum overpack with the C-1 source changer, it should be positioned between the top of the C-1 source changer and the drum lid as to limit movement of the C-1 in the event that the drum is inadvertently turned upside down during normal conditions of transport. When no additional ancillary equipment is shipped inside the steel drum overpack with the C-1 source changer, the C-1 should be braced in place to limit its movement in the event that the drum is inadvertently turned upside down during shipment. A generic spacer with sufficient strength and length placed between the C-1 source changer and the drum lid is adequate to meet this requirement. Ensure that the drum top fits snugly and is secured with a bolt or snap closure ring. Ensure that a lead wire or other shipping tamper seal is affixed to the closure ring in accordance with 10 CFR 71.43(b).

7.1.4 External Radiation Levels

Measure the maximum surface radiation level and the maximum radiation level at one meter from the surface of the package. As required by 10 CFR 71.47, the maximum surface radiation level must not exceed 200 mrem/hr and the maximum radiation level at one meter from the surface on the package (Transport Index) must not exceed 10 mrem/hr.

7.1.5 Outer Package Surface Contamination

In accordance with 10 CFR 71.87, non-fixed (removable) contamination on the external surfaces of the outer package being shipped on a non-exclusive use basis must not exceed $10^{-5}$ $\mu$Ci/cm$^2$ (220 dpm/cm$^2$) averaged over 300 cm$^2$ of any part of the surface. The outer surface contamination may be determined by measuring the activity on wipes taken from representative locations and the above criteria is assumed to be met if the activity on any sample averaged over the surface area wiped does not exceed $10^{-5}$ $\mu$Ci/cm$^2$ (22 dpm/cm$^2$). If the contamination on the surface of the outer package exceeds the above amount or if the source is known to be leaking or contaminated DO NOT SHIP, but contact Source Production & Equipment

Company, Inc. for assistance.

7.1.6 Transportation Requirements

The C-1 Source Changer and Steel Overpack Drum must be properly marked, labeled and described on a shipping paper in accordance with U.S. Department of Transportation regulations. Shipping papers will be retained for three years.

7.2 Procedures for Receipt and Unloading the Package

7.2.1 Receipt of Package From Carrier

The SPEC C-1 steel drum overpack configuration may be handled during transport and unloaded as an ordinary package by hand. No special equipment or procedures are required.

If the measured maximum radiation levels at the surface of the outside package and at one meter from the surface of the outside package exceed either of the following limits:

| Location | Maximum mrem/hr |
|---|---|
| Surface of Outside Package | 200 |
| One Meter from Surface of Outside Package | 10 |

then the consignee must immediately notify the final delivering carrier, and either the agreement state radiation control agency, if applicable, or the NRC Operations Center (301-816-5100). It is also recommended that the shipper be notified.

7.2.2 Removal of Contents

The consignee must establish written procedures for receiving and safely opening the SPEC C-1 steel drum overpack. The procedures should provide for inspection, monitoring, notification and records.

Connect the control assembly to the empty exposure device. Connect the connector to the drive cable and the exchanger tube between the outlet nipple of the loaded side of the C-1 and the exposure device. Open the lock plunger by pulling up and rotating slightly. Crank the source backward from the C-1 into the exposure device.

7.3 Procedures for Shipping an Empty SPEC C-1

7.3.1 Preparation of an Empty Package for Transport

Verify that the C-1 does not contain a radioactive source. Visually inspect the exchanger to verify that no source assembly connector is protruding from either outlet nipple. This will indicate that there is no source assembly installed.

Verify that the lock plungers are fully depressed and that the doors to the SPEC C-1 source changer are fully closed and secured together by a padlock or similar fastener. Place the SPEC C-1 source changer in a strong tight outside container, such as the 12 gallon steel drum overpack in which it was received.

7.3.2 External Radiation Levels

Verify that the maximum radiation level on the surface of the outside package does not exceed 0.5 mrem/hr.

7.3.3 Check Outer Package Surface Contamination

In accordance with 10 CFR 71.87, non-fixed (removable) contamination on the external surfaces of the outer package being shipped on a non-exclusive use basis must not exceed $10^{-5}$ $\mu$Ci/cm$^2$ (220 dpm/cm$^2$) averaged over 300 cm$^2$ of any part of the surface. The outer surface contamination may be determined by measuring the activity on wipes taken from representative locations and the above criteria is assumed to be met if the activity on any sample averaged over the surface area wiped does not exceed $10^{-5}$ $\mu$Ci/cm$^2$ (22 dpm/cm$^2$). If the contamination on the surface of the outer package exceeds the above amount or if the source is known to be leaking or contaminated, DO NOT SHIP, but contact Source Production & Equipment Company, Inc. for assistance.

7.4 Records and Documentation

In accordance with 10 CFR 71.12(c)(1) and (c)(2), the shipper, including users who transport the SPEC C-1 steel drum overpack configuration as a private carrier, are required to have a current copy of the NRC Certificate of Compliance No. 9036, drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken before shipment. Users of the C-1 steel drum overpack configuration are required to comply with all provisions in the approval certificate.

In accordance with 10 CFR 71.91, the following records must be maintained for at least three years after each shipment:

1) Identification of packaging by the model and serial number: Model SPEC C-1, Serial Number _____
2) Verification that the package was in satisfactory condition when shipped
3) Activity of Iridium-192 in each shipment
4) Date of each shipment, note that this includes transport by a user of the SPEC C-1 steel drum overpack configuration as a private carrier
5) Name and address of the transferee
6) Address to which shipment was made
7) Records that the package was properly prepared for shipment and an indication that the package had not been in the presence of any radioactive material contamination or the results of surface contamination measurements.

A shipping checklist is suitable to meet these requirements.

As required by 10 CFR 71.95, licensed users of the C-1 package shall report to the Director, Office of Nuclear Material Safety and Safeguards within 30 days, 1) any instance in which there is significant reduction in the effectiveness of the packaging during use, 2) any instance in which the conditions of approval in the Certificate of Compliance USA/9036/B(U)-85 were not observed in making a shipment, 3) details of any defects with safety significance with the means employed to repair the defects and prevent their reoccurrence.

## 8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

*(Excerpts from June 19, 1990 Application)*

8.1 Acceptance Tests (Prior to First Use)

Source Production and Equipment Company, Inc. manufacturers the SPEC C-1 steel drum overpack configuration and is the principal user of the package. The acceptance test prior to first use of the package by Source Production & Equipment Company, Inc. is the final inspection of the package under the Quality Assurance Program. Source Production & Equipment Company, Inc. is the sole domestic owner of the SPEC C-1 steel drum overpack configuration and maintains all the packages under their control.

Source Production & Equipment Company, Inc. performs acceptance tests on all SPEC C-1 steel drum overpack configurations regardless if the package is for their use or sold to a foreign radioactive material supplier for their use and maintenance.

Licensees returning sources to Source Production & Equipment Company, Inc. or to other radioactive material suppliers using the SPEC C-1 steel drum overpack configuration are only required to verify that the package is in satisfactory condition for shipment as described above in Section 7.1 Procedures for Preparing and Loading the Package.

8.1.1 Visual Inspection

Source Production & Equipment Company, Inc. performs a general visual inspection of the package in accordance with a quality assurance checklist.

8.1.2 Structural and Pressure Tests

Structural acceptance tests on the SPEC C-1 are not indicated because of the rugged design and durable materials of construction any structural failure would be apparent. Pressure tests are not indicated because there is no possibility of a pressure build up which would affect the structure of the containment or the integrity of the package.

8.1.3 Leak Tests

The primary containment of radioactive material in the SPEC C-1 is the sealed source capsule which meets the special form radioactive material requirements. The capsule has been shown to pass the special form test criteria, which demonstrates that the capsule will not leak radioactive material in excess of the normal accident condition and hypothetical accident condition criteria. A leak test is perform by Source Production & Equipment Company, Inc. prior to shipment of any source in a SPEC C-1. The leak test is capable of detecting at least 0.001 microcurie of activity.

8.1.4 Component Tests

Component acceptance tests on the SPEC C-1 are not indicated.

8.1.5 Tests for Shielding Integrity

Radiation surveys are performed on depleted uranium shields upon receipt from the supplier and radiation levels are measured after fabrication of the SPEC C-1.

Prior to each shipment of the SPEC C-1 steel drum overpack configuration a survey is performed to determine that the maximum radiation level at the surface of the package does not exceed 200 mrem/hr and the maximum radiation level at one meter from the surface of the package does not exceed 10 mrem/hr.

8.1.6 Thermal Acceptance Tests

Thermal acceptance tests for the SPEC C-1 steel drum overpack configuration is not indicated since heat of decay for the maximum permissible activity Iridium-192 source (240 Ci) is negligible.

8.2 Maintenance Program

8.2.1 Structural and Pressure Tests

Periodic structural acceptance tests on the SPEC C-1 source changer (inner package) or the SPEC C-1 steel drum overpack configuration are not indicated because of the rugged design and durable materials of construction any structural failure would be apparent. Periodic pressure tests are not indicated because there is no possibility of a pressure build up which would affect the structure of the containment or the integrity of the package.

8.2.2 Leak Tests

A leak test for removable contamination of sealed sources is performed at the time of manufacture. Thereafter, a leak test of the sealed source is required to be performed at least every six months pursuant to 10 CFR 34.27 or equivalent agreement state regulations on the sealed sources shipped in the SPEC C-1 steel drum overpack configuration. A leak test should also be performed whenever there is indication of damage to a sealed source capsule which has been shipped in the SPEC C-1 steel drum overpack configuration. The leak test sample should be taken by inserting at least a six inch cotton tipped swab into each outlet nipple. If the tests indicate 0.005 microcurie or more of removable contamination the sealed source must be removed from use, action taken to prevent the spread of contamination, and a report filed with the applicable radiation control agency within five days. It is also recommended that Source Production & Equipment Company, Inc. be notified.

This procedure assures that the package will not leak radioactive materials in excess of the normal transport and hypothetical accident condition criteria.

8.2.3 Subsystems Maintenance

The SPEC C-1 has no subsystems.

8.2.4 Valves, Rupture Discs, and Gaskets on Containment Vessel

Not applicable since the primary containment vessel is a small sealed source capsule.

8.2.5 Shielding

The frequent surveys performed prior to each shipment are sufficient to establish the continuing integrity of the shield.

8.2.6 Thermal

Periodic thermal tests on the SPEC C-1 source changer (inner package) is not indicated since heat of decay for the maximum permissible activity Iridium-192 source (240 Ci) is negligible. There are no components which be thermally degraded by typical use and transport.

8.2.7 Miscellaneous

The inspection of the SPEC C-1 steel drum overpack configuration prior to each shipment is more than sufficient to assure the continuing integrity of the package.

## 9.0 APPENDICES

| APPENDIX | DESCRIPTION |
|---|---|
| 9.1 | Drawings |
| 9.2 | Photographs |
| 9.3 | Documents |
| 9.4 | Thermal Metal Joining Specification |
| 9.5 | Liquid Pentetrant Inspection Specification |
| 9.6 | Visual Inspection Procedures |
| 9.7 | Additional 1997 Puncture Tests |
| 9.8 | Original letter of application for the Model C-1 Shipping Container dated January 23, 1975 |
| 9.9 | Revised letter of application dated May 7, 1975 |
| 9.10 | Letter dated February 16, 1984 |

## APPENDIX 9.1
## DRAWINGS

| DRAWING | TITLE |
|---|---|
| B322000 Revision 1 | SPEC C-1 Steel Drum Overpack |
| B311000 Revision 1 | SPEC C-1 Source Changer |
| B311001 Revision 1 | SPEC C-1 Depleted Uranium Shield |
| B311002 Revision 0 | SPEC C-1 Shipping Container Global Dimensions |
| 22689-4 Revision 0 | Original Drop Test Target |
| 50890-1 Revision 1 | New Drop Test Target |

CONTROLLED COPY NO

| REVISIONS | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | APPROVED |
| (1) | INCORPORATED ECR# 001103-2. | 11/8/00 2/26/01 3/19/01 | S. BYRD |

NOTES:

1. HANDLES (5) TO BE LOCATED ABOVE TOP DRUM RIB ON SIDES ADJACENT TO DRUM SEAM. ATTACH USING 3/16" RIVETS.
2. BOLT RING CLOSURE SHOWN.
3. NAME PLATE (7) TO BE CENTERED BETWEEN DRUM RIBS, OPPOSITE DRUM SEAM. ATTACH USING 1/8" RIVETS.
4. TREFOIL (8) TO BE CENTERED ABOVE TOP DRUM RIB, OPPOSITE DRUM SEAM. ATTACH USING 1/8" RIVETS.
5. REMOVED.
6. STEEL DRUM OVERPACK MAXIMUM WEIGHT: 22 LBS.
7. PACKAGING (C-1, OVERPACK, ASSOCIATED HARDWARE AND BRACING) MAXIMUM GROSS WEIGHT: 100 LBS.
8. REMOVED.
9. NAME PLATE MARKING "TYPE B(U) PACKAGE UN2916" REFLECTS NEW SHIPPING NAME PROPOSED BY USDOT ON 10/23/00. OLD SHIPPING NAME "SPECIAL FORM, NOS UN2974" TO BE USED UNTIL NEW SHIPPING NAME BECOMES EFFECTIVE.

| QTY REQD | UM | MANUF | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | ITEM NO. |
|---|---|---|---|---|---|
| 8 | EA | OPT | POP RIVET 1/8 | 300 SERIES SS | 9 |
| 1 | EA | OPT | TREFOIL | 300 SERIES SS | 8 |
| 1 | EA | OPT | NAME PLATE | 300 SERIES SS | 7 |
| 8 | EA | OPT | POP RIVET 3/16 | ALUMINUM | 6 |
| 2 | EA | OPT | HANDLE | ZINC PLATED STEEL | 5 |
| 1 | EA | OPT | TAMPER SEAL | LEAD/STEEL WIRE | 4 |
| 1 | EA | OPT | SUPPORT DISC 13-5/8 DIA x 1/2 | PLYWOOD | 3 |
| AR | LBS | OPT | POLYURETHANE FOAM | 2 LBS/CU FT MIN | 2 |
| 1 | EA | OPT | 12 GAL DRUM, LID AND CLOSURE NATIONAL MOTOR FREIGHT CLASSIFICATION ITEM 260, 100-H OR SUCCEEDING ISSUES | 20/22 GA STEEL | 1 |
| 322000 | | | | | |

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

NOMINAL

DO NOT SCALE DRAWING

TREATMENT NONE

FINISH NONE

| APPROVALS | | DATE |
|---|---|---|
| DRAWN | SRB | 6/28/00 |
| CHECKED | PW | 6/30/00 |
| APPROVED | RDD | 7/6/00 |
| QA CLASS | N | |

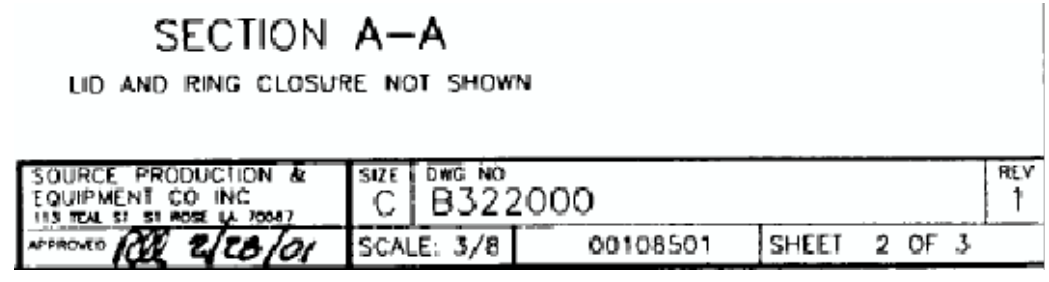
SOURCE PRODUCTION & EQUIPMENT CO., INC.
113 TEAL ST, ST ROSE, LA 70087

STEEL DRUM OVERPACK- C-1, SPEC

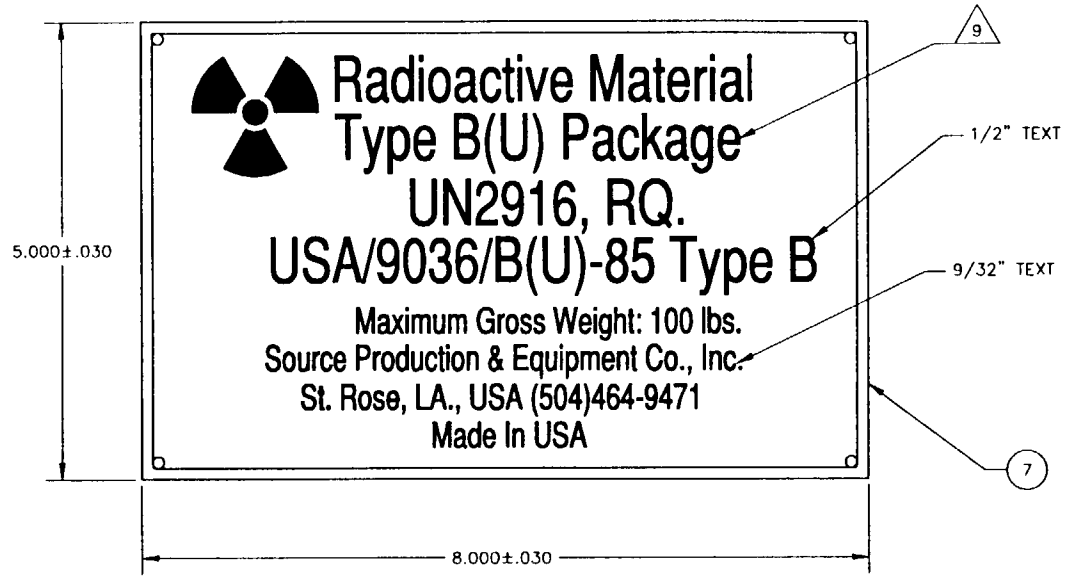
SIZE C | DWG NO. B322000 | REV 1

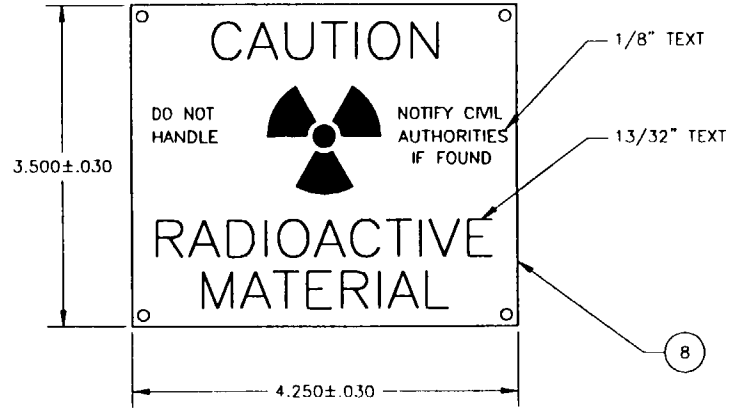
SCALE: 3/8 | 00108501 | SHEET 1 OF 3

FIGURE WITHHELD UNDER 10 CFR 2.390



| CONTROLLED COPY No | | | |
|---|---|---|---|
| REVISIONS | | | |
| REV | DESCRIPTION | DATE | APPROVED |




| SOURCE PRODUCTION & EQUIPMENT CO INC. 113 TEAL ST ST ROSE LA 70087 | SIZE | DWG NO | REV |
|---|---|---|---|
| | C | B322000 | 1 |
| APPROVED RW 2/28/01 | SCALE: 3/8 | 00108501 | SHEET 3 OF 3 |

CONTROLLED COPY NO

| REVISIONS | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | APPROVED |
| (1) | INCORPORATED ECR# 001103-4. | 11/8/00<br>2/26/01<br>2/28/01 | S. BYRD |

NOTES:

1. NAME PLATE (25) NOT SHOWN. ATTACH USING 3/16 RIVETS (26).
2. RADIOACTIVE MATERIAL DECAL (27) NOT SHOWN.
3. SPRING LOADED LOCK PLUNGER (18) SHOWN IN THE SECURED POSITION, PREVENTING REMOVAL OF THE SOURCE ASSEMBLY. DURING SOURCE EXCHANGE, THE KNOB (17) IS PULLED OUT AND ROTATED 90°, LOCKING IT IN THE UNSECURED POSITION. THE CONTAINER CANNOT BE PREPARED FOR SHIPMENT IN THIS CONDITION, SINCE THE FRONT DOOR CANNOT BE CLOSED WITH EITHER KNOB IN THE UNSECURED POSITION.
4. USE DU SHIELDING PAD (21), TUNGSTEN SHIELDING PAD (28), OR POSITIONING SHIM (29), ONLY IF REQUIRED.
5. GAS TUNGSTEN ARC WELD (GTAW) IN ACCORDANCE WITH SPEC's "THERMAL METAL JOINING" INSTRUCTION.
6. SHIELDED METAL ARC WELD (SMAW) IN ACCORDANCE WITH SPEC's "THERMAL METAL JOINING" INSTRUCTION.
7. THESE WELDS ARE INSPECTED IN ACCORDANCE WITH ASTM E-165 OR AN EQUIVALENT INDUSTRY STANDARD. THE ACCEPT/REJECT CRITERIA ARE IN ACCORDANCE WITH ASME SECTION VIII, DIVISION 1, OR EQUIVALENT INDUSTRY STANDARD.
8. THESE WELDS ARE VISUALLY INSPECTED IN ACCORDANCE WITH ASME SECTION V, ARTICLE 9, OR AN EQUIVALENT INDUSTRY STANDARD. THE ACCEPT/REJECT CRITERIA ARE IN ACCORDANCE WITH SPEC's "VISUAL WELD INSPECTION" INSTRUCTION.
9. C-1 SOURCE EXCHANGER (SHIPPING CONTAINER) MAXIMUM WEIGHT: 70 LBS.

STATEMENTS OF FABRICATION:

1. ALL THERMAL METAL JOINING IS CONTINUOUS ALONG THE ENTIRE LENGTH OF EACH JOINT.
2. ALL THERMAL METAL JOINING FABRICATION, PERSONNEL QUALIFICATION, AND JOINT INSPECTION PROCEDURES CONFORM WITH SOURCE PRODUCTION & EQUIPMENT CO., INC. "THERMAL METAL JOINING SPECIFICATIONS".

| QTY REQD | UM | MANUF | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | ITEM NO. |
|---|---|---|---|---|---|
| 311000 | | | | | |
| AR | IN | OPT | POSITIONING SHIM | 300 SERIES SS | 29 |
| AR | IN | OPT | SHIELDING PAD | TUNGSTEN | 28 |
| 4 | EA | OPT | RADIOACTIVE MATERIAL DECAL | VINYL | 27 |
| 4 | EA | OPT | RIVET 3/16 | 300 SERIES SS | 26 |
| 1 | EA | OPT | NAME PLATE | 300 SERIES SS | 25 |
| 16 | EA | OPT | NUT 1/4-28 UNF | 300 SERIES SS | 24 |
| 8 | EA | OPT | HINGE BOLT 1/4-28 UNF x 3/8 FLAT HD | 300 SERIES SS | 23 |
| 8 | EA | OPT | HINGE BOLT 1/4-28 UNF x 3/8 TRUSS HD | 300 SERIES SS | 22 |
| AR | IN | OPT | SHIELDING PAD | DEPLETED URANIUM | 21 |
| 1 | EA | OPT | HOT TOP RING | 300 SERIES SS | 20 |
| 2 | EA | OPT | LOCK PLUNGER SPRING | 300 SERIES SS | 19 |
| 2 | EA | OPT | LOCK PLUNGER ROD | 300 SERIES SS | 18 |
| 2 | EA | OPT | LOCK PLUNGER KNOB | 300 SERIES SS | 17 |
| 2 | EA | OPT | LOCK PLUNGER HOUSING TOP | 300 SERIES SS | 16 |
| 2 | EA | OPT | LOCK PLUNGER HOUSING BASE | 300 SERIES SS | 15 |
| 4 | EA | OPT | HINGE 1/16 x 1 x 1-1/2 | 300 SERIES SS | 14 |
| 2 | EA | OPT | HANDLE NUT 5/16-18 UNC HEX | 300 SERIES SS | 13 |
| 1 | EA | OPT | HANDLE ASSEMBLY | PVC/300 SERIES SS | 12 |
| 1 | EA | OPT | TOP DOOR | CARBON STEEL-ASTM A-569 1/8 NOMINAL PLATE | 11 |
| 1 | EA | OPT | BACK PANEL | CARBON STEEL-ASTM A-569 1/8 NOMINAL PLATE | 10 |
| 1 | EA | OPT | INNER PANEL | CARBON STEEL-ASTM A-569 1/8 NOMINAL PLATE | 9 |
| 1 | EA | OPT | SIDE & BOTTOM PANEL | CARBON STEEL-ASTM A-569 1/8 NOMINAL PLATE | 8 |
| 1 | EA | OPT | TOP DOOR BRACKET | CARBON STEEL-ASTM A-569 | 7 |
| 1 | EA | OPT | FRONT DOOR BRACKET | CARBON STEEL-ASTM A-569 | 6 |
| 1 | EA | OPT | FRONT DOOR | CARBON STEEL-ASTM A-569 1/8 NOMINAL PLATE | 5 |
| AR | LBS | OPT | FOAM-2 LBS/CU FT MIN | POLYURETHANE | 4 |
| 2 | EA | OPT | OUTLET NIPPLE BOSS | 300 SERIES SS | 3 |
| 2 | EA | OPT | OUTLET NIPPLE | BRASS | 2 |
| 1 | EA | OPT | SHIELD | DEPLETED URANIUM | 1 |

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE AS NOTED

DO NOT SCALE DRAWING

TREATMENT NONE

FINISH NONE

| APPROVALS | | DATE |
|---|---|---|
| DRAWN | SRB | 6/29/00 |
| CHECKED | PW | 6/30/00 |
| APPROVED | RDD | 7/6/00 |
| QA CLASS | N | |

SOURCE PRODUCTION & EQUIPMENT CO., INC.
113 TEAL ST, ST ROSE, LA 70087

SHIPPING CONTAINER-
MODEL C-1,
SPEC

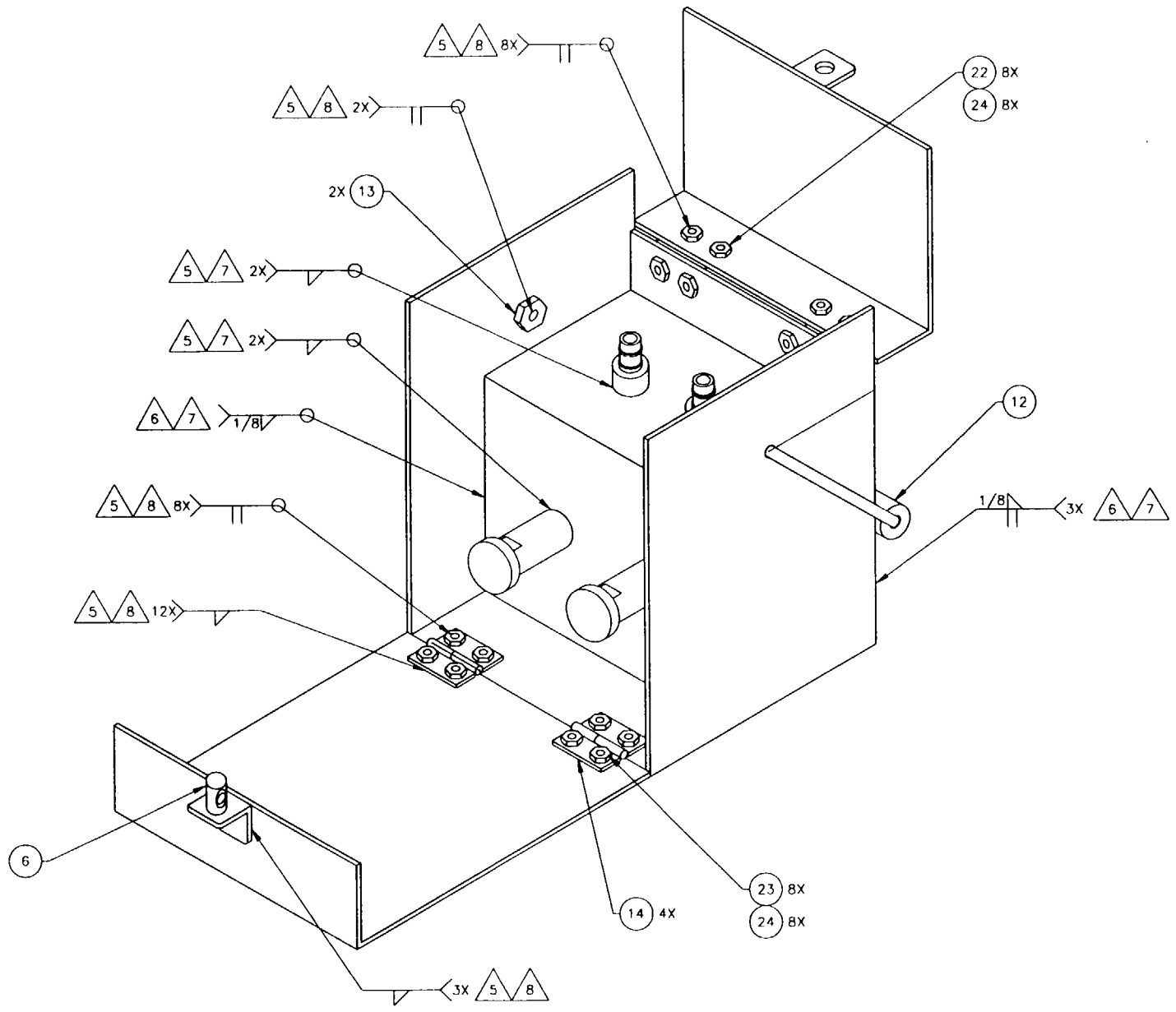
SIZE C | DWG NO. B311000 | REV 1

SCALE: 1/2 | 00108301 | SHEET 1 OF 5

CONTROLLED COPY NO

REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|

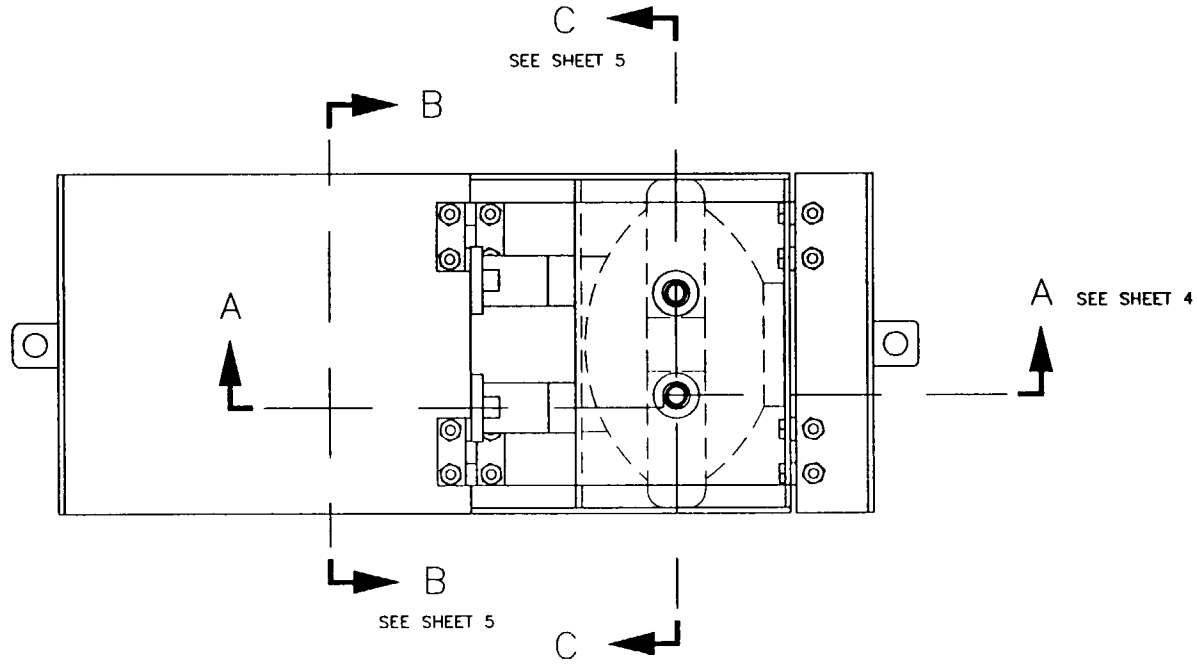



| | | | |
|---|---|---|---|
| SOURCE PRODUCTION & EQUIPMENT CO INC. 113 TEAL ST. ST ROSE LA 70087 | SIZE C | DWG NO B311000 | REV 1 |
| APPROVED 2/28/01 | SCALE: 1/2 | 00108301 | SHEET 2 OF 5 |

CONTROLLED COPY NO

REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|




TOP VIEW

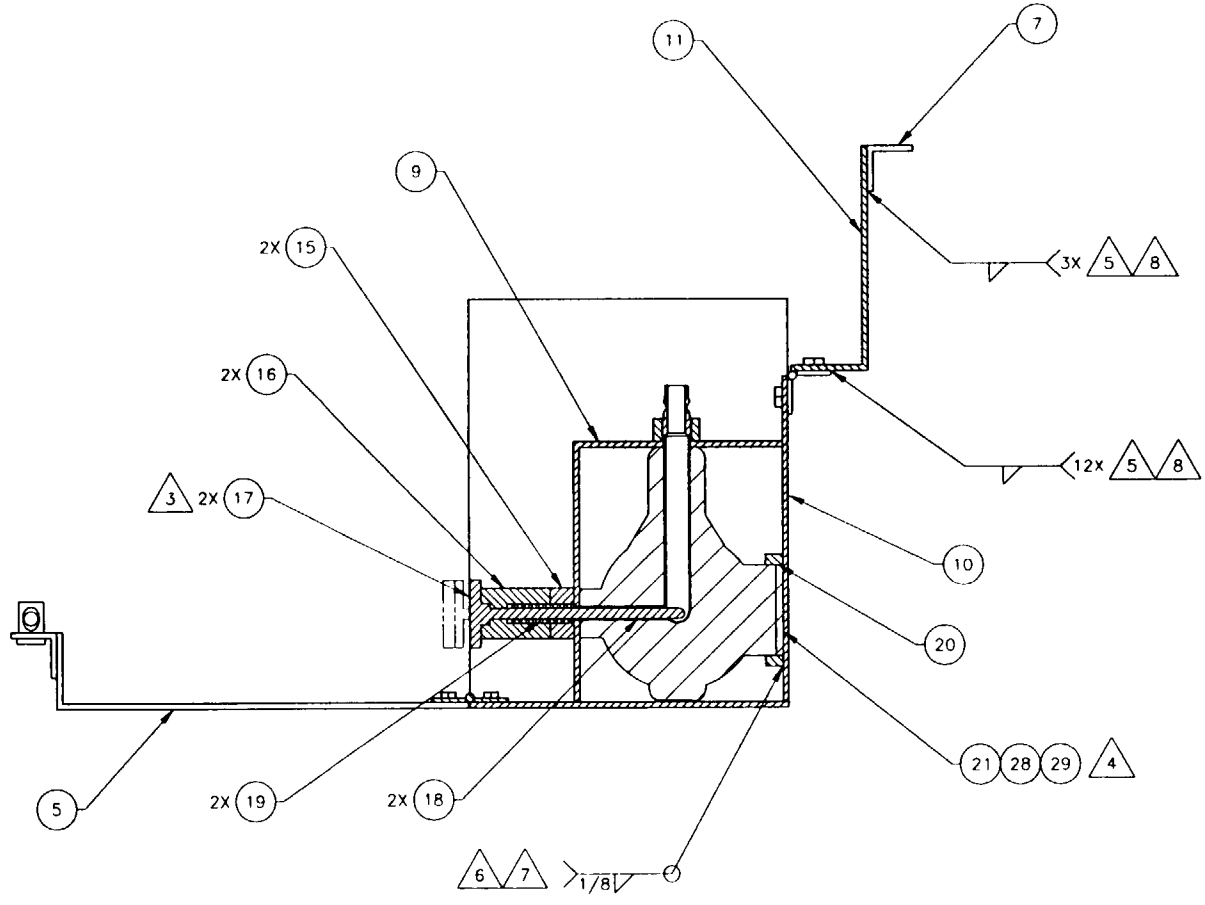
HANDLE NOT SHOWN

| | | | |
|---|---|---|---|
| SOURCE PRODUCTION & EQUIPMENT CO INC<br>113 TEAL ST. ST ROSE LA 70087 | SIZE C | DWG NO B311000 | REV 1 |
| APPROVED 2/28/01 | SCALE: 1/2 | 00108301 | SHEET 3 OF 5 |

CONTROLLED COPY No

REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|




SECTION A–A

SEE SHEET 3

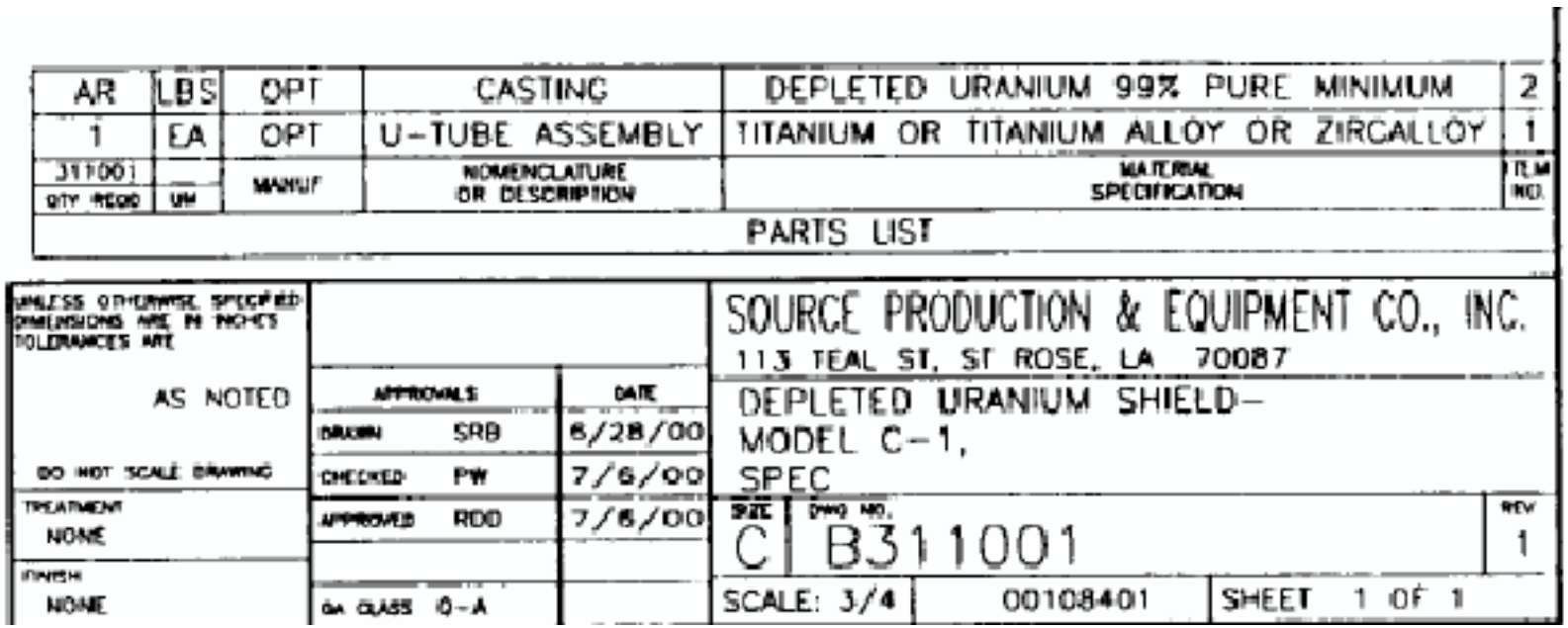
HANDLE NOT SHOWN

| | | | |
|---|---|---|---|
| SOURCE PRODUCTION & EQUIPMENT CO INC. 113 TEAL ST. ST ROSE LA 70087 | SIZE C | DWG NO B311000 | REV 1 |
| APPROVED [illegible] 2/28/01 | SCALE: 1/2 | 00108301 | SHEET 4 OF 5 |

FIGURE WITHHELD UNDER 10 CFR 2.390

| | | | |
|---|---|---|---|
| SOURCE PRODUCTION & EQUIPMENT CO INC<br>813 TEAL ST. ST ROSE LA 70087 | SIZE C | DWG NO B311000 | REV 1 |
| APPROVED RLL 2/28/01 | SCALE: 1/2 | 00108301 | SHEET 5 OF 5 |

FIGURE WITHHELD UNDER 10 CFR 2.390



| AR | LBS | OPT | CASTING | DEPLETED URANIUM 99% PURE MINIMUM | 2 |
|---|---|---|---|---|---|
| 1 | EA | OPT | U-TUBE ASSEMBLY | TITANIUM OR TITANIUM ALLOY OR ZIRCALLOY | 1 |
| 311001 | — | MANUF | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | ITEM NO. |
| QTY REQD | UM | | | | |

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

AS NOTED

DO NOT SCALE DRAWING

TREATMENT NONE

FINISH NONE

| APPROVALS | | DATE |
|---|---|---|
| DRAWN | SRB | 6/28/00 |
| CHECKED | PW | 7/6/00 |
| APPROVED | RDD | 7/6/00 |
| | | |
| QA CLASS | Q-A | |

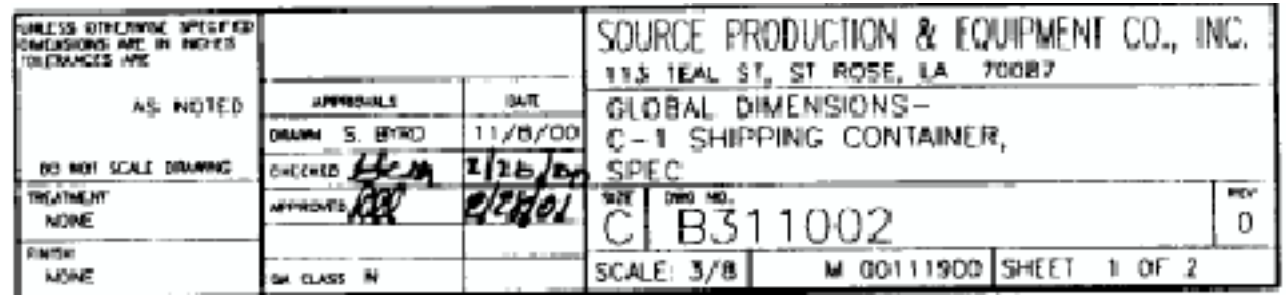
SOURCE PRODUCTION & EQUIPMENT CO., INC.
113 TEAL ST, ST ROSE, LA 70087

DEPLETED URANIUM SHIELD-
MODEL C-1,
SPEC

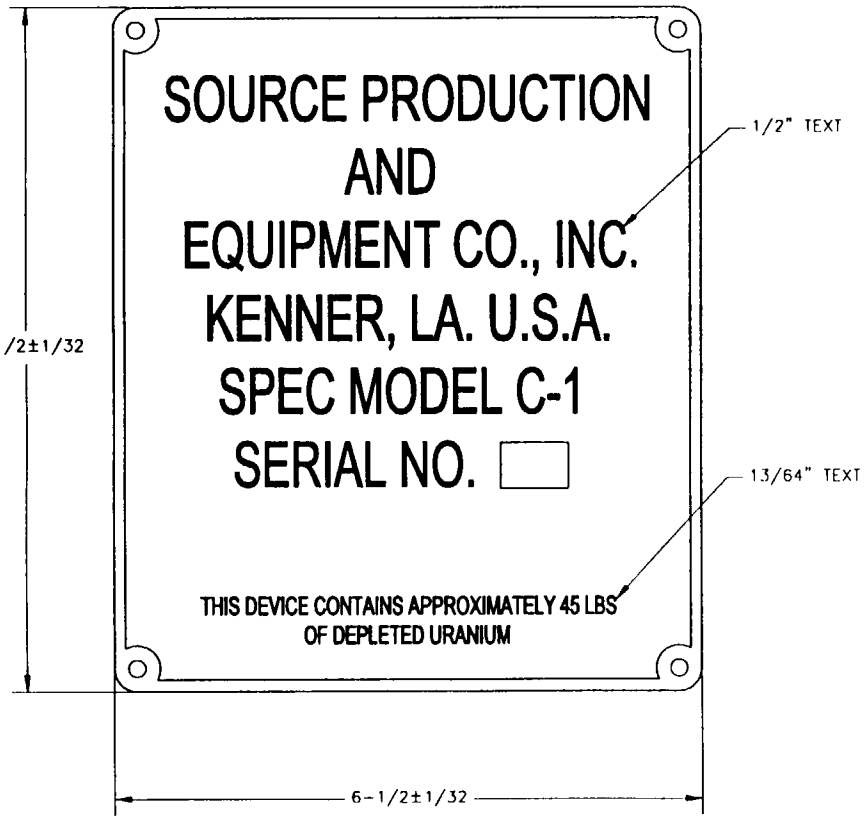
| SIZE | DWG NO. | REV |
|---|---|---|
| C | B311001 | 1 |

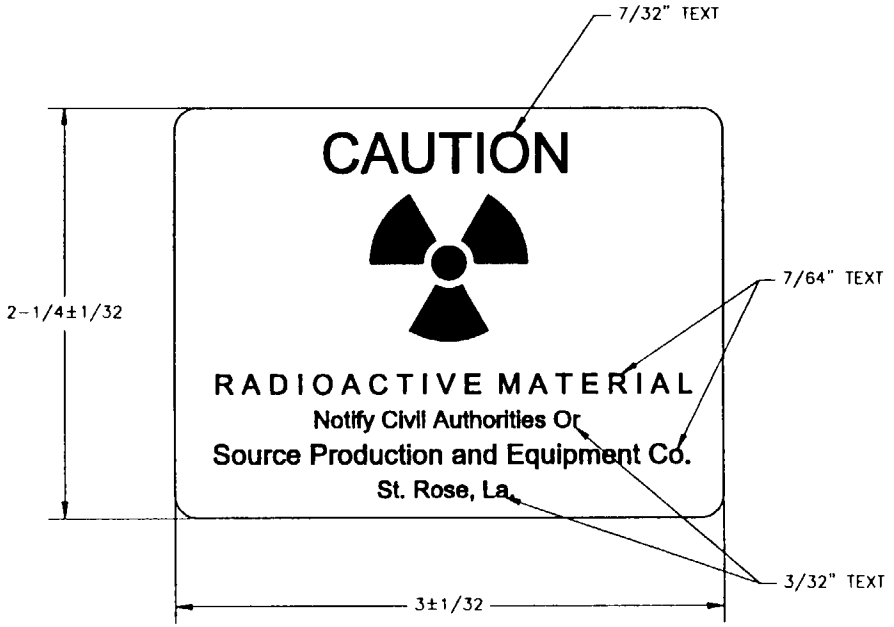
SCALE: 3/4 | 00108401 | SHEET 1 OF 1

FIGURE WITHHELD UNDER 10 CFR 2.390



| CONTROLLED COPY NO | | | |
|---|---|---|---|
| REVISIONS | | | |
| REV | DESCRIPTION | DATE | APPROVED |




SCALE: 2/1

| SOURCE PRODUCTION & EQUIPMENT CO INC<br>113 TEAL ST. ST ROSE LA 70087 | SIZE C | DWG NO B311002 | REV 0 |
|---|---|---|---|
| APPROVED 2/28/01 | SCALE: 1/1 | M 00111900 | SHEET 2 OF 2 |

## APPENDIX 9.2
## PHOTOGRAPHS

| PHOTO | DESCRIPTION |
|---|---|
| A-1 | Original Drop Target |
| A-2 | Original Drop Target |
| B-1 | Compression Test |
| B-2 | SPEC C-1 Steel Drum Overpack Configuration |
| B-3 | Normal Condition Test Preparation |
| C-1 | Penetration Test Set-Up |
| C-2 | First Penetration Test Damage |
| C-3 | Second Penetration Test Damage |
| C-4 | Third Penetration Test Damage |
| C-5 | Fourth through Sixth Penetration Test Damage |
| C-6 | Seventh through Eighth Penetration Test Damage |
| D-1 | Free Drop Set-Up |
| D-2 | First Free Drop |
| D-3 | First Free Drop Damage |
| D-4 | Second Free Drop |
| D-5 | Second Free Drop Damage |
| D-6 | Second Free Drop Damage |
| D-7 | Third Free Drop |
| D-8 | Third Free Drop Damage |
| E-1 | SPEC C-1 Drum Package Damage |
| E-2 | SPEC C-1 Drum Package Damage |
| F-1A | New Drop Target |
| F-1B | New Drop Test Platform |
| F-2 | C-1 Test Package - Front View |
| F-3 | C-1 Test Package - Front View, Open |

| | |
|---|---|
| F-4 | C-1 Test Package - Rear View, w/Condensation |
| F-5 | C-1 Test Package - Bottom & Front View |
| F-6 | C-1 Test Package - Side & Rear View, Open |
| F-7 | C-1 and Steel Drum Overpack Test Package, Dry Ice Storage |
| G-1 | First Free Drop |
| G-2 | First Free Drop Damage, Overpack Lid |
| G-3 | First Free Drop, Drop Target Impact |
| G-4 | First Free Drop Damage, Snap Ring Closure |
| H-1 | Second Free Drop Damage, Overpack Lid |
| H-2 | Second Free Drop Damage, Snap Ring Closure |
| I-1 | Third Free Drop, At Impact |
| I-2 | Third Free Drop, Instant After Impact |
| I-3 | Third Free Drop Damage, Overpack Side |
| J-1 | Fourth Free Drop, At Impact |
| J-2 | Fourth Free Drop Damage, Overpack Seam |
| J-3 | Fourth Free Drop Damage, Overpack Lid |
| K-1 | Fifth Free Drop, Instant After Impact |
| K-2 | Fifth Free Drop Damage, Overpack Interior and C-1 |
| L-1 | Sixth Free Drop, Instant After Impact |
| L-2 | Sixth Free Drop Damage, Overpack Bottom Edge |
| L-3 | Sixth Free Drop Damage, Overpack Interior & C-1 |
| M-1 | Puncture Test Preparation |
| M-2 | First Puncture Test, Package Orientation |
| M-3 | First Puncture Test Damage, Overpack Interior & C-1 |
| N-1 | Second Puncture Test, Preparation |
| N-2 | Second Puncture Test, Instant After Impact |
| N-3 | Second Puncture Test Damage, Overpack Bottom |
| N-4 | Second Puncture Test Damage, Overpack Interior & C-1 |

| | |
|---|---|
| O-1 | Third Puncture Test, Preparation |
| O-2 | Third Puncture Test, Instant After Impact |
| O-3 | Third Puncture Test Damage, Overpack Side |
| O-4 | Third Puncture Test Damage, Overpack Interior |
| P-1 | Total Accident Condition Tests Damage, C-1 |
| P-2 | Total Accident Condition Tests Damage, C-1 Interior |
| P-3 | Total Accident Condition Tests Damage, C-1 Interior |
| P-4 | Total Accident Condition Tests Damage, C-1 |
| P-5 | Total Accident Condition Tests Damage, C-1 Interior |
| P-6 | Total Accident Condition Tests Damage, C-1 Interior |

## APPENDIX 9.3
## DOCUMENTS

| DOCUMENTS |
| --- |
| NRC Certificate of Compliance 9036, Revision 8 |
| IAEA Certificate of Competent Authority, USA/0095/S, Revision 7 |
| 9036 Approval Record, Revision 7 (describes previous shield variation approval) |

# APPENDIX 9.4
# THERMAL METAL JOINING SPECIFICATION

SPEC Work Instruction Number PR21, Revision (1)

# APPENDIX 9.5
# LIQUID PENETRANT INSPECTION PROCEDURE

SPEC Work Instruction Number QA28, Revision (1)

# APPENDIX 9.6
# VISUAL INSPECTION PROCEDURES

SPEC Work Instruction Number QA27, Revision (2)

# APPENDIX 9.7
# 1997 ADDITIONAL PUNCTURE TEST REPORT

## APPENDIX 9.8
## ORIGINAL LETTER OF APPLICATION FOR THE MODEL C-1 SHIPPING CONTAINER DATED JANUARY 23, 1975

# SOURCE PRODUCTION & EQUIPMENT CO., INC.

625 OXLEY ST.
KENNER, LA. 70062

TELEPHONE 504-721-1428


January 23, 1975

Atomic Energy Commission
Director, Division of Materials Licensing
Transportation Branch
Washington, D.C. 20545

Dear Sir:

We respectfully submit this application for a license for a Type B shipping container for radioactive materials in accordance with CFR Title 10 part 71.

PACKAGE DESCRIPTION

Packaging:

Gross Weight: 45 lbs.

Model Number: SPEC Model C-1

Materials of Construction: The inner receptacle consists of a depleted uranium shield equipped with a zircoloy tube to house up two "pigtail type" special form sources. The shield weight is approximately 35 pounds. The inner shield is secured within the outer container via two (2) welded steel straps in addition to its being tightly sandwiched between the six sides of the steel housing.

The outer container is a welded 1/8" thick mild steel shell. The configuration is that of a rectangular box 9" high, 7½" wide and 7" deep. All fittings and locking components are protected and are enclosed within the outer container. The enclosed sketch further describes the construction of the container.

Heat dissipation and the use of coolants are not applicable.

Contents of Package: The container is to be used for the shipment of not more than two sealed sources of iridium 192 whose combined activity will not exceed 200 Curies. The isotope is in solid form and is encapsulated in a stainless steel capsule. These capsules meet special form requirements. Weight and decay heat are insignificant. A copy of the special form certification is enclosed.

0394

PACKAGE EVALUATION

General Standards for all packaging:

a) Materials and construction insure that there is no reaction among the packaging components.

b) The package is equipped with a closure which accommodates both a lock and a seal. It cannot be opened without proper key or combination.

c) Lifting device consists of a handle fabricated from ¼" steel bar stock capable of supporting in excess of three times the weight of the unit. Failure of the handle would in no way effect the shielding qualities.

d) Tie-down devices are not applicable.

e) All structural standards for Type B packaging are met. Specifically, load resistance is in excess of five times its fully loaded weight. Further the package is adequate to withstand an external pressure of 25 pounds per square inch.

STANDARDS FOR HYPOTHETICAL ACCIDENT CONDITIONS:

The package is designed and constructed such that when subjected to the hypothetical accident conditions specified in Appendix B of Part 71, it met the following conditions:

1. No reduction in shielding whatsoever.

2. No radioactive material was released from the package.

The following hypothetical accident conditions were applied sequentially:

1. Free Drop - The container was dropped from a height of 30 feet onto a steel plate on a concrete slab. The point of impact was a bottom corner of the device. No damage effecting the operation of the container, the inner shield, or the position of the source was experienced.

2. Puncture - The container was dropped from a height of 40 inches onto a vertical cylindrical mild steel bar mounted on a steel plate. The bar was 6 inches in diameter and 10 inches in length. No damage was experienced.

3. Thermal - The whole package was placed in a heat treating furnace and kept at a temperature of 1475 degrees farenheit for 30 minutes. The heat had no effect on the proper functioning of the package, the shield, or the position of the source in the container.

4. Water Immersion - The package was submerged under three feet of water for eight hours. This time test had no effect on the package.

OPERATING PROCEDURES

Establishment and Maintenance of Procedures:

1. Procedures - A complete operating procedure for the proper operation of the unit has been approved by the Louisiana Board of Nuclear Energy. This procedure will be distributed to all users and will usually become a part of the user's license.

2. Periodic Inspection - Since each unit will normally be returned to SPEC following each trip, inspection procedures will be executed every time the package arrives at SPEC. This will include an inspection of closures, proper function of the source changed, and source shielding integrity.

We have enclosed supporting information including "before" and "after" photographs of our test unit.

The primary mode of transportation is air freight while secondary modes will include motor carrier and sea transport.

We require the use of these containers just as soon as possible, thus your expediting the approval of the package will be greatly appreciated. If we can provide further information that might assist you in the evaluation of the container, please call us.

Kindest personal regards,

SOURCE PRODUCTION & EQUIPMENT CO., INC.

Richard F. Dicharry
President

RFD.mg

Enclosure

# SOURCE PRODUCTION & EQUIPMENT CO., INC.

625 OXLEY ST.

KENNER, LA. 70062

TELEPHONE 504-721-1428


Atomic Energy Commission
Div. of Materials Licensing
Transportation Branch
Washington, D.C. 20545

## SPECIAL FORM CERTIFICATION

All Source capsules fabricated by Source Production & Equipment Co., Inc. are manufactured in accordance with ANSI classification C32515 as described in N5.10-1968 and thereby meets special form requirements.

RICHARD F. DICHARRY
PRESIDENT

## APPENDIX 9.9
## REVISED LETTER OF APPLICATION DATED MAY 7, 1975

# SOURCE PRODUCTION & EQUIPMENT CO., INC.

625 OXLEY ST.
KENNER, LA. 70062

TELEPHONE 504-721-1428


71-9036


MAY 7, 1975

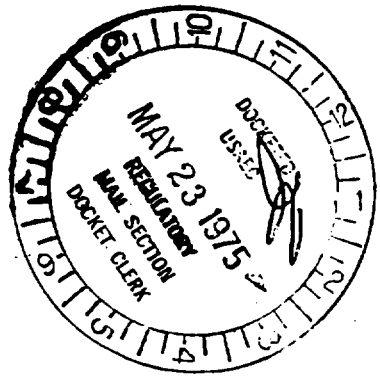
COVER PAGE

ENCLOSED HEREWITH:

7 Copies of the following

1. Original letter of application dated Jan. 23, 1975
2. Revised letter of application dated May 7, 1975
3. Special Form Certification revised
4. SPEC C-1 Source Change Procedure
5. SPEC C-1 Source Change Procedure Shipping Instructions
6. Supporting drawings:

   SPEC Model C-1
   Casting movement prevention
   Lock Plunger Assembly
   Plate Assembly
   Cover Assembly
   Depleted Uranium Casting
   Zircoloy Tube




1019

SOURCE PRODUCTION & EQUIPMENT CO., INC.
625 OXLEY ST.
KENNER, LA. 70062

TELEPHONE 504-721-1428

May 7, 1975

U. S. Nuclear Regulatory Commission
Mr. Charles MacDonald, Chief
Transportation Branch
Division of Materials Licensing
Washington, D. C. 20555

REF: Docket No. 71-9036

Dear Mr. MacDonald:

We are in receipt of your letter of March 18 and wish to thank you for your prompt attention to our application for approval of our shipping container. The success of our business depends on the use of our container so your immediate consideration is so essential.

Per your request, we are enclosing seven copies of our original application, seven copies of this addendum to the original application, seven copies of a revised special form certification for our sealed sources, seven copies of drawings which we believe clearly describe all of the components as requested in your letter of March 18, 1975, and seven copies of the source change and shipping procedures.

The following is a discussion and enumeration of each point in the enclosure to your letter:

1. (a) The enclosed drawings verify the source positioning and locking features. You will note that positioning is accomplished through the use of the septum; i.e., the source is pushed all the way in and simply can go no further once it reaches the bottom of the blind tube. At that point, it is clearly located in the shielded or safe position. You will further note that the lock plungers are positioned to depress immediately behind the capsule. Thus, in the locked position, the source cannot move backward because of the lock plunger and cannot move forward because it has already reached the bottom of the tube.

   (b) The welded steel clips which anchor the shield inside the steel "box" are depicted in the drawing. These clips are more than adequate to prevent the shield from moving,

even in the 30' drop test. You will note, also, that the shield is in contact with the 6 sides of the enclosure. Therefore, the box itself aids in maintaining the position of the shield and renders movement virtually impossible.

(c) Materials are 1/8" carbon steel sheet with all joints welded. Lock plungers are stainless steel. Outside hasp for the padlock is also 1/8" welded steel construction. The shielding is depleted uranium and all tubes are zircalloy.

2. (a) As previously discussed, the source capsule is positioned between the septum or bottom of the tube and the lock plunger. The steel plunger is spring loaded to apply pressure toward the locked or down position at all times. Although not illustrated in the drawing, the outer door of the container cannot be closed unless both plungers are depressed or in the locked position. This renders the shipment of the container with "unlocked" plungers impossible. In addition to these two locking functions, snap on caps are positioned and snapped on to the inlet nipples. These caps afford protection to the exposed or connector ends of the source. They would also prevent the sources from moving out of their shielded position in the tubes if no other lock functions were activated.

Finally, the outer doors are locked closed with a padlock and a seal is affixed.

In summary, there are four locking functions:

1. The lock plunger which securely holds the source in the shielded position.

2. The vertical outer door which cannot be closed unless the plungers are in the locked position.

3. The snap on caps which attach to the top of the tubes making it impossible for any source cable to back out.

4. The outer doors which are locked with a padlock and a tamper seal.

2. (b) A complete set of operating instructions and a summary of shipping instructions and copies of the procedure are enclosed with this addendum.

   (c) Because the depleted uranium shield is completely enclosed in a welded steel enclosure, the formation of uranium-iron eutectics or oxidation poses no problem or hazard.

3. Because the sources are locked by the positioning of a plunger behind the source capsule, almost any length source pigtail in common usage today can be placed in this container. This locking system is unlike other containers now in use that lock on the connector end. Clearly the capsule is locked in the shielded position irrespective of the pigtail length. The only limitation is the outer dimension of the container shield. The unit will be used with the pigtails in common use ranging from about 6½" to 8½" in length. Any diameter cable can be accomodated up to 3/16".

4. All sources to be shipped in the SPEC Model C-1 will contain Iridium-192 solid wafers and consist of stainless steel capsules sealed by heliarc welding and tested in accordance with special form requirements as outlined in 10CFR Part 71. Copies of Special Form Certification are enclosed.

5. The package was subjected to the hypothetical accident conditions for a Type B package including the 30 foot drop test, the puncture or percussion test and the heating test. The C-1 contained a nominal 100 Curie Iridium-192 source during the tests. A survey utilizing a G-M tube type survey instrument indicated there was absolutely no change in radiation levels or shielding efficency.

   The test resulted in no significant damage to the package whatsoever. The heating test, of course, burned off all the external vinyl labels and completely blackened the unit but in no way did it disturb any components. The 30 foot drop test dented a bottom corner of the package but had no effect on the shield, locking mechanisms, or position of the shield. The hinges affixed to the vertical outer door were slightly mashed but remained intact. Actually, the door could still be opened and closed, but somewhat stiffly. The hinges on the top of the horizontal door were not affected.

Source connectors and locking mechanisms were absolutely unaffected.

6. The radiation profile for the container following the hypothetical accident conditions tests was identical to the profile prior to the test and for normal conditions for transport. With 115 Curies Iridium-192, the profile was as follows:

| | SURFACE (mR/hr) | AT 3 FEET (mR/hr) |
|---|---|---|
| Top | 80 | Less than 1 |
| Front | 45 | Less than 1 |
| Back | 90 | 1 |
| Bottom | 85 | Less Than 1 |
| Right Side | 30 | Less than 1 |
| Left Side | 86 | 1 |

*Source was located in left side source tube.

We believe that the preceding discussion thoroughly explains all points enumerated in the enclosure to your letter. We trust this information will be adequate and will enable your office to promptly review our application. It is of the utmost importance that we are able to ship our source throughout the United States as well as internationally.

Thank you for your consideration.

Kindest personal regards,

SOURCE PRODUCTION & EQUIPMENT CO., INC.

R. F. Dicharry
President

RFD/mg

Enclosures

# SOURCE PRODUCTION & EQUIPMENT CO., INC.

625 OXLEY ST.

KENNER, LA. 70062

TELEPHONE 504-721-1428


5/7/75

Atomic Energy Commission
Division of Materials Licensing
Transportation Branch
Washington, D. C. 20545

## SPECIAL FORM CERTIFICATION

All source capsules fabricated by Source Production and Equipment Co., Inc. are manufactured in accordance with ANSI classification C32515 so described in N5.10-1968 and in accordance with special form requirements as defined in Appendix D of 10CFR Part 71.

Richard F. Dicharry
President

## SUMMARY OF SHIPPING INSTRUCTIONS - MODEL C-1

It is imperative that all Department of Transportation requirements be met. To assist you in properly preparing the container for shipment, we have enclosed a packet of return shipping labels and a tamper seal. We hope the following check list will be helpful.

1. Survey Container - Do not ship if container reads greater than 200 mr/hr on the surface.

2. Determine the transport index by surveying 3 feet away from all accessible surfaces of the container including the bottom. (When shipping a depleted source, the index will usually be less than 1). The transport index is the highest reading obtained, rounded off to the nearest 1/10 mr.

3. Write this transport index in the square on the radioactive III label. Also indicate the isotope (IR-192) and the number of curies.

4. Attach two radioactive III labels to the shipping package, one on each side.

5. Make sure the container is locked and affixed a tamper seal.

6. Attach the address tag (consignee) to the tamper seal or in a conspicious location on the container.

7. Attach a complete "shippers certification" to the freight bill. Iridium-192 falls in Group III, is in Special Form and is Type B if more than 20 curies, (type A if less than 20 curies).

SOURCE PRODUCTION & EQUIPMENT CO., INC.
625 OXLEY ST.
KENNER, LA. 70062

TELEPHONE 504-721-1428

January 23, 1975

Atomic Energy Commission
Director, Division of Materials Licensing
Transportation Branch
Washington, D. C. 20545

Dear Sir:

We respectfully submit this application for a license for a Type B Shipping Container for radioactive materials in accordance with CFR Title 10 part 71.

PACKAGE DESCRIPTION

Packaging:

Gross Weight: 45 lbs.

Model Number: SPEC Model C-1

Materials of Construction: The inner receptacle consists of a depleted uranium shield equipped with a zircoloy tube to house up two "pigtail type" special form sources. The shield weight is approximately 35 pounds. The inner shield is secured within the outer container via two (2) welded steel straps in addition to its being tightly sandwiched between the six sides of the steel housing.

The outer container is a welded 1/8" thick mild steel shell. The configuration is that of a rectangular box 9" high, 7½" wide and 7" deep. All fittings and locking components are protected and are enclosed within the outer container. The enclosed sketch further describes the construction of the container.

Heat dissipation and the use of coolants are not applicable.

Contents of Package: The container is to be used for the shipment of not more than two sealed sources of Iridium-192 whose combined activity will not exceed 200 Curies. The isotope is in solid form and is encapsulated in a stainless steel capsule. These capsules meet special form requirements. Weight and decay heat are insignificant. A copy of the special form certification is enclosed.

PACKAGE EVALUATION

General Standards for all packaging:

a) Materials and construction insure that there is no reaction among the packaging components.

b) The package is equipped witha closure which accommodates both a lock and a seal. It cannot be opened without proper key or combination.

c) Lifting device consists of a handle fabricated from ¼" steel bar stock capable of supporting in excess of three times the weight of the unit. Failure of the handle would in no way effect the shielding qualities.

d) Tie-down devices are not applicable.

e) All structural standards for Type B packaging are met. Specifically, load resistance is in excess of five times its fully loaded weight. Further the package is adequate to withstand an external pressure of 25 pounds per square inch.

STANDARDS FOR HYPOTHETICAL ACCIDENT CONDITIONS:

The package is designed and constructed such that when subjected to the hypothetical accident conditions specified in Appendix B of Part 71, it met the following conditions:

1. No reduction in shielding whatsoever.

2. No radioactive material was released from the package.

The following hypothetical accident conditions were applied sequentially:

1. Free Drop - The container was dropped from a height of 30 feet onto a steel plate on a concrete slab. The point of impact was a bottom corner of the device. No damage effecting the operation of the container, the inner shield, or the position of the source was experienced.

2. Puncture - The container was dropped from a height of 40 inches onto a vertical cylindrical mild steel bar mounted on a steel plate. The bar was 6 inches in diameter and 10 inches in length. No damage was experienced.

3. Thermal - The whole package was placed in a heat threating furnace and kept at a temperature of 1475 degrees farenheit for 30 minutes. The heat had no effect on a proper functioning of the package, the shield, or the position of the source in the container.

4. Water Immersion - The package was submerged under three feet of water for eight hours. This time test had no effect on the package.

OPERATING PROCEDURES

Establishment and Maintenance of Procedures:

1. Procedures - A complete operating procedure for the proper operation of the unit has been approved by the Louisiana Board of Nuclear Energy. This procedure will be distributed to all users and will usually become a part of the user's license.

2. Periodic Inspection - Since each unit will normally be returned to SPEC following each trip, inspection procedures will be executed every time the package arrives at SPEC. This will include an inspection of closures, proper function of the souce changed, and source shielding integrity.

We have enclosed supporting information including "before" and "after" photographs of our test unit.

The primary mode of transportation is air freight while secondary modes will include motor carrier and sea transportation.

We require the use of these containers just as soon as possible, thus your expediting the approval of the package will be greatly appreciated. If we can provide further information that might assist you in the evaluation of the container, please call us.

Kindest personal regards,

SOURCE PRODUCTION & EQUIPMENT CO., INC.

Richard F. Dicharry
President

RFD/mg

Enclosures

# SOURCE PRODUCTION & EQUIPMENT CO., INC.

625 OXLEY ST.

KENNER, LA. 70062

TELEPHONE 504-721-1428


Atomic Energy Commission
Div. of Materials Licensing
Transportation Branch
Washington, D.C. 20545

## SPECIAL FORM CERTIFICATION

All Source capsules fabricated by Source Production & Equipment Co., Inc. are manufactured in accordance with ANSI classification C32515 as described in N5.10-1968 and thereby meets special form requirements.

RICHARD F. DICHARRY
PRESIDENT

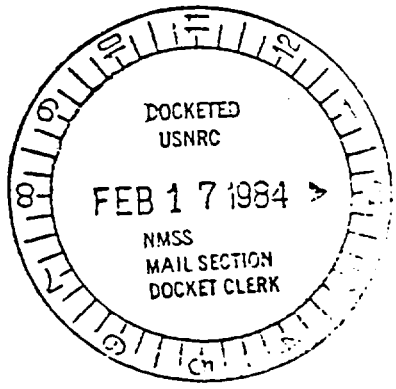
# APPENDIX 9.10
# LETTER DATED FEBRUARY 16, 1984

71-9036

PDR

Return to 396 SS

H-11-84




'84 FEB 16 P3:06

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Mr. Charles E. Mc Donald
Transportation Certification Branch
Division of Fuel Cycle and Material Safety

Ref: Certificate of Compliance No. 9036, Revision No. 3
Docket 71-9036

Dear Mr. McDonald:

The subject certificate specifies a material quantity per package of two sources with a combined activity not to exceed 200 curies. We request that this be changed to read "one or two sources" or simpler still that the activity shall not exceed the specified limit. This change is requested since it sometimes happens that we need to ship one (1) 200 curie source instead of two (2) 100 curie sources.

Most by-product material radiography licenses allow an IR-192 source strength tolerance of 20%. Consequently, we further request that the activity limit be raised to 240 curies in order to accomodate the 20% overload. The C-1 container is designed to shield this quantity of radioactivity and all shipments will comply with 49CFR 173.393 i.

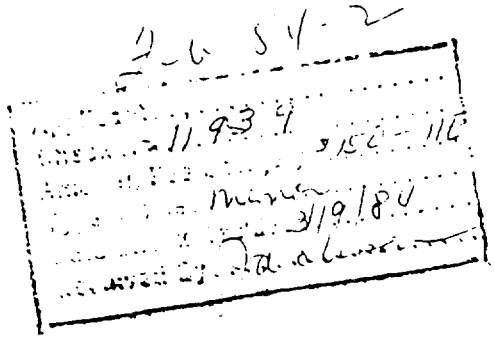
If additional information is required, please advise.

Yours very truly,

Richard F. Dicharry (de)

Richard F. Dicharry
President

RD/de



"TRANSPORTATION APPROVALS"

Docket No. 71-9036

William O. Miller
License Fee Management Branch
Office of Administration

MATERIALS TRANSPORTATION APPROVAL CLASSIFICATION

Applicant: Source Production & Equipment Co, Inc.
Approval No: _____ Fee Category 11E
Application Dated: undated (received 2/16/84) Received: _____
Applicant's Classification: _____

The above application for amendment has been reviewed by the NMSS Transportation Branch, in accordance with Section 170.31, and is classified as follows:

1. Amendments to Approvals in Fee Categories 11A through 11E

   (a) ____ Major

   (b) X Minor

   (c) ____ Administrative

2. Justification for reclassification: Requires shielding review.

3. The application was filed (a) ____ pursuant to written NRC request and the amendment is being issued for the convenience of the Commission, or (b) ____ Other (State reason): _____

Signature: [illegible]
Transportation Bra
Date: 2/17