71-9263

spec SOURCE OF QUALITY

June 6, 2000

Mr. Michael D. Waters, Project Engineer
Licensing Section, Mail Stop 06F18
Spent Fuel Project Office
U.S. Nuclear Regulatory Commission
One White Flint North
11155 Rockville Pike
Rockville, MD 20852

Subject: Docket 71-9263
Supplement No. 2 to Certificate of Compliance Consolidated Application
Model SPEC-150, Type B(U)-85 Transportation Package
Package Identification Number USA/9263/B(U)-85

Dear Mr. Waters:

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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

NMSS01 Public

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Please do not hesitate to contact me if any assistance or clarification is needed.

Sincerely,

Kenneth N. Carrington
Regulatory Affairs

/knc

Enclosures: 3 Copies of Supplement No. 2 to Certificate of Compliance Consolidated Application Model SPEC-150, Type B(U)-85 Transportation Package

CONSOLIDATED APPLICATION
for
NRC CERTIFICATE OF COMPLIANCE
USA/9263/B(U)

Supplement Number 2
June 6, 2000

Model SPEC-150
Type B(U) Radioactive Material Package

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

SOURCE OF QUALITY

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SUPPLEMENT NO. 2

JUNE 6, 2000

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of
NRC CERTIFICATE OF COMPLIANCE NO. 9263

REMOVE	INSERT
Application Pages 1 through 4 April 22, 1999	Supplement No. 2 Pages 1 through 4 June 6, 2000
Application Page 6 April 22, 1999	Supplement No. 2 Page 6 June 6, 2000
Application Pages 8 through 13 April 22, 1999	Supplement No. 2 Pages 8 through 13 June 6, 2000
Application Page 15 April 22, 1999	Supplement No. 2 Page 15 June 6, 2000
Application Page 18 April 22, 1999	Supplement No. 2 Page 18 June 6, 2000
Application Page 21 April 22, 1999	Supplement No. 2 Page 21 June 6, 2000
Application Pages 27 through 29 April 22, 1999	Supplement No. 2 Pages 27 through 29 June 6, 2000
Application Pages 33 through 34 April 22, 1999	Supplement No. 2 Pages 33 through 34 June 6, 2000

Application Page 36 April 22, 1999	Supplement No. 2 Page 36 June 6, 2000
Application Pages 39 through 40 April 22, 1999	Supplement No. 2 Pages 39 through 40 June 6, 2000
Application Page 42 April 22, 1999	Supplement No. 2 Page 42 June 6, 2000
Application Pages 44 through 45 April 22, 1999	Supplement No. 2 Pages 44 through 45 June 6, 2000
Supplement No. 1 Page 46 May 6, 1999	Supplement No. 2 Page 46 June 6, 2000
Application Pages 48 through 49 April 22, 1999	Supplement No. 2 Pages 48 through 49 June 6, 2000
Appendix 9.1, Drawings None	Appendix 9.1, Drawings 15B625, Rev. (0) 19B005, Rev. (0) 19B006, Rev. (0) 19B007, Rev. (0) 190909, Rev. (0)
Appendix 9.3, Documents IAEA Certificate of Competent Authority USA/0095/S, Revision 6	Appendix 9.3, Documents IAEA Certificate of Competent Authority USA/0095/S, Revision 7

CONSOLIDATED APPLICATION
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USA/9263/B(U)

Supplement Number 2
June 6, 2000

Model SPEC-150
Type B(U) Radioactive Material Package

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

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Introduction

The Source Production & Equipment Company, Inc. model SPEC-150 is an industrial radiography exposure device approved for use by the Louisiana Radiation Protection Division, and it is authorized to contain a maximum source activity of 150 Ci of Iridium-192 as a sealed source. The 150 curie maximum activity is based on the measured output procedures given in ANSI N432-1980. It is used as a package to transport the sealed Iridium-192 source by licensed industrial radiographers as private carriers to perform nondestructive testing, and it is transported by common carriers and for export and import.

1.2 IAEA Safety Series No. 6

It is requested that the Certificate of Compliance reflect that it is based on IAEA Safety Series No. 6, 1985 Edition (As Amended 1990).

1.3 Model SPEC-150 Packaging

1.3.1 Gross weight: Maximum 53 pounds.

1.3.2 Description

A. The device consists of a depleted uranium shield inside a welded titanium housing measuring approximately 14.1 cm (5-9/16 inches) high, 13.6 cm (5-3/8 inches) wide, and 36.8 cm (14-1/2 inches) long. See Drawing 15B000, Isometric View and 15B002A, Full Sectional View. The depleted uranium shield includes a curved S-Tube that the source travels through when used as a radiography device. See Drawing 15B008, Depleted Uranium Shield. Depleted uranium is cast around a titanium or zircalloy S-Tube to provide a minimum of 1.8 inches of radiation shielding from the center of the shield which contains a sealed source Iridium-192 capsule. The DU shield is coated with a primer paint by the manufacturer of the casting. The source assembly is secured in the S-tube during transportation. Multiple securing and locking mechanisms are installed at the lock end of the device and a safety plug is installed in the outlet nipple at the other end. The device weighs a maximum of 24.1 kg (53 pounds). The DU shield weighs a maximum of 37-1/4 pounds.

B. The S-Tube and depleted uranium shield is designed to prevent direct streaming of radiation through the S-Tube even with the lock cap and safety plug removed. Radiation levels are not uniform among depleted uranium castings. Occasionally shielding pads of tungsten not exceeding one pound are used to further reduce low level radiation where marginal radiation levels have been found to exist at the surface or one meter from the surface of the package in order to meet the radiation level requirements of 10 CFR 71.47. The optional shielding pad is not used to qualify a device to meet the allowable radiation levels following the Type B package Hypothetical Accident Conditions tests. The shielding pad is a solid, round, tungsten disk with a maximum 3/4 thickness, and one pound weight. It is attached directly to the coated surface of the depleted uranium shield with an epoxy potting compound. It is further secured in place by a polyurethane foam material with a density of two - three pounds per cubic foot that fills the interior cavity of the package and completely surrounds the DU shield. The pad is used at any accessible location on the surface of the DU shield. However, it cannot be used at any location that would require the modification of any component of the package to install. Historically, the most common location for the pad is on the hot top of the DU shield (left side of the package).

C. Iridium-192 is neither fissionable nor a neutron emitter, therefore no materials are used as neutron absorbers or moderators.

D. The depleted uranium shield is secured in the model SPEC-150 package by two titanium cups which are filled with Devcon F epoxy potting compound. The cups are welded to the outlet end plate and the inner bulkhead plate. See Drawing 15B002A, Item Nos. 7 and 8. Lateral movement of the shield toward the outlet end is limited by the outlet end plate, Drawing 15B002A, Item No. 1. Lateral movement toward the lock end is limited by the metal Positioning Shim on the inner bulkhead plate shown on Drawing 15B002A. The inner bulkhead is in direct contact with the ASM/Lock Module which is bolted to the lock end plate. Therefore, movement of the shield toward the lock end in an accident is resisted by the combined structural support provided by the inner bulkhead and the lock end plate. The strong construction of the ASM/Lock Module prevents crushing in an accident. See Drawing 15B002A, Item Nos. 14 and 15. The titanium cups limit movement of the shield in the other directions. An automatic securing mechanism (ASM)/lock module secures and also locks the source assembly ("pigtail") with the sealed source capsule inside the S-tube of the model SPEC-150 radiography exposure device to meet the requirements of 10 CFR 34.23(a) and equivalent agreement state regulations.

E. An outlet nipple, which is a commercially available male quick disconnect mechanical coupling, is screwed into the outlet panel which is affixed to the outlet end plate on the model SPEC-150. The outlet nipple provides a means of connecting a source tube when the model SPEC-150 is used as a radiography exposure device and serves no structural purpose. During shipment a source safety plug, a female quick disconnect coupling with a stainless steel cable and a stainless steel cap, is installed in the outlet nipple as a redundant mechanism to prevent the forward movement of the source assembly through the S-Tube toward the outlet end. See Drawing 15B002A, Item No. 12.

F. An aluminum handle attached with stainless steel rods are provided as a convenience to carry the model SPEC-150 in the field when it is being used as an industrial radiography device. The original design of the SPEC-150 exposure device has four convenient mounting holes located at the bottom of each housing protective flange at the corners of the device which provide a sturdy means to attach security harnesses, pipeline trolleys, suspension lifts and permanent installation mounts. The currently approved design has a additional four holes located at the top corners of the housing's protective flange which can also be utilized for attaching a lifting or securing apparatus. The carrying handle and mounting holes are not structural parts of the package and serve no function during transport of the package, although the carrying handle and the eight holes have been tested and easily withstands more than ten times the weight of the package. The model SPEC-150 may also be lifted and secured from movement during transport without structural provisions for any lifting or tie down devices.

G. A titanium lock cap at one end protrudes approximately 7/8 inches beyond the flange of model SPEC-150. See Drawing 15B002A, Item No. 13. It protects the source assembly connector from damage, which would only affect its operation as an industrial radiography exposure device, and it is not a structural part of the model SPEC-150 shipping package. On the other end the outlet nipple and source safety plug do not protrude beyond the flange of the model SPEC-150, and is not subject to damage during normal transport.

H. The model SPEC-150 is not hermetically sealed and is opened to ambient pressure, therefore a pressure relief system is not applicable.

I. 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 pursuant to IAEA Certificate of Competent Authority Number USA/0095/S. Approximate dimensions of the stainless steel capsule is one inch long by 1/4 inches diameter. Source assemblies ("pigtails") consist of the sealed source capsule swaged onto a flexible cable to which is swaged a locking ball and a drive cable connector. See Drawing 15B002A, Source Assembly.

J. Containment of the source assembly in the model SPEC-150 package is achieved by (1) the source assembly lock, which is located in the automatic securing mechanism/lock module assembly, prevents movement in both directions and is the primary mechanism to contain the source assembly in the model SPEC-150; (2) the diameter of the locking ball which can not pass through the smaller diameter orifice of the automatic securing mechanism module, (containment in this direction is maintained even when all locks are unlocked and the release plunger is depressed); (3) the automatic securing mechanism which engages the locking ball and provides a redundant mechanism to prevent forward movement through the S-Tube; (4) the lock cap which provides a redundant safety feature preventing the source assembly from coming out the lock end of the model SPEC-150; and (5) the safety plug which redundantly prevents the source assembly from passing through the outlet end. See Drawing 15B625, ASM/Lock Module Housing.

The source assembly lock is a solid, stainless steel, irregular shaped part with a curved slot that fits over the source assembly between the connector and locking ball. It prohibits movement of the source assembly in both directions. The source assembly lock is opened and closed by rotating the operating lever counterclockwise on the control assembly. The control assembly is a 25 foot long (minimum) mechanical piece of equipment that must be attached to the SPEC-150 to operate the source assembly lock (to perform radiography). The controls must be removed from the device to prepare the package for transport (to install the lock cap). The source assembly lock must be locked in order for the controls to be removed from the device. It is not possible to inadvertently leave the source assembly unlocked when preparing the package for transport.

The source assembly lock is held in the closed position by two spring loaded plungers located inside the lock module. It is also held in the closed position by the device lock. The device lock is a solid, stainless steel, fan-blade shaped part that is operated by the device key.

The key must be inserted into the lock end plate with sufficient force to depress a large stainless spring, then rotated clockwise to unlock the source assembly lock. This action does not open the source assembly lock. The device lock must be locked in order for the key to be removed from the device, and the key must be removed in order to remove the controls. Like the source assembly lock, it is not possible to inadvertently leave the device unlocked when preparing the package for transport. See Drawings 19B005, 19B006, 19B007 and 190909 which depicts the SPEC-150 Lock Module and the Device and Source Lock Operation.

Failure of the locking system in an accident is virtually impossible unless the entire structure of the package is destroyed. For failure to occur the lock system must be subjected to (1) a compressive force applied to the spring-loaded device lock toward the outlet end simultaneously combined with, (2) a clockwise rotational force applied to the device lock, sequentially followed by (3) a counterclockwise rotational force applied to the spring-loaded source assembly lock, combined with (4) a temporary perpendicular, compressive force to depress the source release plunger, and then (5) a compressive force

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

1.3.4 Contents of Packaging

A. The model SPEC-150 has been approved by the Louisiana Radiation Protection Division (agreement state radiation control agency) as a radiography exposure device with a maximum activity of 150 Ci of Iridium-192 as a sealed source.

B. The sealed source capsule meets the requirements of special form radioactive material pursuant to 10 CFR 71.75 as demonstrated by IAEA Certificate of Competent Authority Number USA/0095/S.

C. Iridium-192 solid metallic wafers are encapsulated in a stainless steel cylindrical capsule measuring approximately 3/4 inches by 1/4 inches diameter which is swaged onto a flexible cable approximately 7-7/8 inches long forming a source assembly.

D. The density of solid metallic iridium is approximately 22.5 grams per cubic centimeter. The weight of the Iridium-192 contents is negligible.

E. Iridium 192 is not fissile material, therefore moderator ratios and criticality configurations are not applicable.

F. The heat of decay for a maximum 150 Ci Iridium-192 is infinitesimal and the void space in the sealed source capsule is negligible, therefore pressure buildup is not a factor.

2. STRUCTURAL EVALUATION

A structural evaluation of the model SPEC-150 was performed in conjunction with the application as an industrial radiography device in accordance with 10 CFR 34.20 and American National Standards Institute N432-1980. All of the information from the radiography device application that is relevant to a Type-B package is included in this application. Additional test and structural evaluation information has been added to this application. The NRC Office of Nuclear Materials Safety and Safeguards reviewed the model SPEC-150 industrial radiography device application and the Louisiana Radiation Protection Division reviewed and approved it.

All thermal metal joining (TMJ) of structural joints are performed in accordance with SPEC Titanium GTAW TMJ Procedure P51-1, QAM 9.6 of the quality assurance program, U. S. Nuclear Regulatory Commission Certificate of Compliance No. 0102.

directions. The cups are filled with an epoxy potting compound to protect against ingress of moisture. By preventing movement of the depleted uranium shield within the housing the radiation levels after the hypothetical accident tests are within the established criteria. The principal area of concern is the nine meter drop test. The lock end of the shield is additionally secured against upward movement by direct contact with the top of the device housing. The outlet end of the shield is additionally secured against downward movement in an accident by direct contact with the bottom of the device housing.

C. 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 1475^0 F thermal test. Located in the center of the depleted uranium shield within the model SPEC-150 case the sealed source capsule is adequately protected from any shear or crushing forces that could damage the capsule.

2.2 Weights and Centers of Gravity

The model SPEC-150 weighs a maximum of 53 pounds. The center of gravity is approximately the geometric center of the rectangular parallelpiped defined by the outlet end plate, the lock end plate and the outer dimensions of the case.

2.3 Mechanical Properties of Materials

2.3.1 Materials List

Structural materials used in the model SPEC-150 are principally titanium, stainless steel, depleted uranium. Epoxy potting compound, aluminum, bronze, rubber and foam are used in non-critical structural components.

2.3.2 All commercial grade materials are used in the construction of the model SPEC-150 and their mechanical properties are commonly established.

2.3.3 Titanium sheet and plate, ASTM B265-90 commercial grade 2, is used for the package shell, end plates, inner bulkhead, and the ASM/lock module. Titanium tubing, ASTM B337 commercial grade 2, is used for the lock cap and support cups. Inside the automatic securing mechanism Series 300 and 440C stainless steel is used.

Bronze is used for some bushings. The radiation shield is a depleted uranium casting with a titanium or zircalloy tube through the shield. The depleted uranium shield has a maximum weight of 37 1/4 pounds. Optional tungsten shielding pads are used as needed. Aluminum is used for the carrying handle, but it is not a structural part of the package.

Information plates are stainless steel to withstand the thermal test.

2.4 General Standards for All Packages

The model SPEC-150 meets 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 package is nominally 5-3/8 inches plus or minus 1/8 inch, and therefore never smaller than 4 inches.

2.4.2 Tamper Seal

The sealed radioactive source may only be released from the package by unlocking the camera with a key pursuant to the requirements of 10 CFR 34.23. The camera can be unlocked only after sequential application of a mating mechanism and by two mutually independent operational mechanical procedures. Camera keys are not normally shipped in the same container as a model SPEC-150, but when a camera key is shipped in the same container with a model SPEC-150 it will be in a sealed envelope. When a model SPEC-150 is shipped in an overpack the overpack will employ a wire seal or tape that is destroyed upon removal for a security seal. The lock cap is designed for the installation of a wire tamper seal or a tape seal that is also destroyed upon removal meeting the requirements 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 assembly is retained in the depleted uranium shield by a key multiple securing mechanism, a redundant safety plug and a redundant lock cap. The camera can be unlocked only after sequential application of a mating mechanism and by two mutually independent operational mechanical procedures.

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. A titanium-uranium or tungsten-uranium eutectic has not be shown to exist even at elevated temperatures (i.e. the titanium S-tube has been subjected to 1475^0 F). The depleted uranium shield is protected from corrosion by foam and epoxy moisture barriers.

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 source assembly is retained in the shield primarily by a key operated source assembly lock, additional securing mechanisms, a redundant safety plug, a restricting orifice through which the source assembly can not back out of the lock end, and a lock cap provide redundant positioning of the source assembly in the depleted uranium shield.

2.4.6 Normal Conditions of Transport

As described below in Section 2.8, Normal Conditions of Transport, the model SPEC-150 was subjected to the specified tests which demonstrated 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 model SPEC-150 package.

2.4.7 Surface Temperature

The maximum activity of 150 Ci in the model SPEC-150 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 150 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

A carrying handle is provided for use as a radiographic exposure device, and is not considered a structural part of the Type B package. A model SPEC-150 was suspended from a single point at the end of the carrying handle and loaded with approximately 500 pounds dead weight (53 pound package weight times a safety factor of at least ten) for a minimum of ten minutes. The handle supported the weight without any deformation or damage exceeding the minimum safety factor of three times the package weight in compliance with 10 CFR 71.45(a).

2.4.10 Tiedown Devices

Although the model SPEC-150 has eight tiedown holes located at the corners of the package their primary purpose is securing the camera during its use as an exposure device in the field and not for securing it during transport. The mounting holes are 3/8 inch diameter and are located approximately ½ inch from the end of each side panel and approximately 3/4 inch above the bottom and ½ inch below the top of the package. The mounting holes can withstand forces greatly in excess of ten times the mass of the package in compliance with 10 CFR 71.45(b)(1).

2.4.11 External Radiation Standards

External radiation levels for the model SPEC-150 package are shown to meet the requirements of 10 CFR 71.47. The model SPEC-150 containing no more than 150 Ci Iridium-192 also does not exceed the U.S. Department of Transportation requirements specified in 49 CFR 173.441(a) of 200 mrem/hr at the surface of the package and 10 mrem/hr at one meter from the surface of the package. 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 model SPEC-150 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 model SPEC-150 packaging.

2.5.2 Hypothetical Accident Conditions Test Criteria

The results of tests described below in Section 2.9 for hypothetical accident conditions adequately demonstrate that there would be no possibility of 27 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. In fact the source capsule containing the radioactive material remained intact and was 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 capsule remained intact after the tests for normal condition of transport and the hypothetical accident conditions.

2.6 Description of Test Packages

Model SPEC-150 prototype test packages, which were constructed in standard production fashion pursuant to applicable quality assurance procedures specified in NRC Certificate of Compliance No. 0102, were used for normal conditions of transport tests and hypothetical accident condition tests. For each of the hypothetical accident conditions tests a loaded prototype Iridium-192 source assembly, which was constructed in standard production fashion pursuant to applicable quality assurance programs, was contained within the test package to effectively measure the change in radiation levels after the tests.

2.6.1 Prototype No. 2 & 4

SPEC-150 prototypes No. 2 and 4 were used as test packages. The design of Prototype No. 2 is different from Prototype No. 4, and both meet Type-B requirements. As a result of the damage to No. 2 caused by the 30-foot drop tests the design of the SPEC-150 was revised. The revisions were incorporated into Prototype No. 4 and tested. The structural changes consist of the following items. (1) The design of the welded joint that attaches the control attachment boss to the lock end plate, Drawing 15B002A, Item No. 9. The design was revised to increase the size and strength of the joint. (2) The design of the welded joints that attach the outlet end plate and the outlet end plate support cup to the bottom plate was revised to increase the size and strength of the joints, Drawing 15B002A, Item Nos. 1 and 7. With the exception of the above design changes, both test packages represent the basic design, and No. 4 completely represents the final design.

2.6.2 Design Changes of Production Packages

The only structural design change from Prototype No. 4 that will be incorporated into the final design of production packages is a reduction in height of the outlet end plate support cup by 5/16 inch to 2-13/32 inches. This will not reduce the strength of the cup nor the outlet end plate. With the exception of the optional use of a tungsten shielding pad described in Section 1.3.2(B), there are no other design features, details, sizes, dimensions, weights, weld materials, methods of fabrication of the test specimens that are different from production packages. The weight of Prototype No. 2 is 52 pounds. The weight of Prototype No. 4 is 52 pounds without the extra weight installed and is 53 pounds with the tungsten rod extra weight installed in the carrying handle (used for the 30-foot drop and puncture tests). The tungsten rod weighs 13 ounces.

2.6.3 Other Prototypes

Four prototype SPEC-150s have been fabricated. Prototypes No. 2 and 4 were used to perform tests to evaluate the package pursuant to 10 CFR Part 71 as a Type-B package. Prototype No. 1 was used to perform the portions of the ANSI N432-1980 tests pursuant to 10 CFR Part 34 as a radiography device. Prototype No. 3 has not been used for tests. Both #1 and #3 will continue to be used for additional tests that are not required pursuant to 10 CFR Parts 34 and 71 or other regulatory requirement.

2.7 Drop Target Description

The drop target greatly exceeds the requirements outlined in IAEA Safety Series No. 37 "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (1985 Edition as amended 1990), 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 it lower surface to ensure tight contact with the concrete.

The drop target at SPEC greatly exceeds the requirements specified in IAEA Safety Series No. 37 "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material," (1985 Edition as amended 1990). 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. 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. A 40 foot tall structure 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. No damage nor separation of the steel plate from the concrete block occurred as a result of all tests.

2.8 Normal Conditions of Transport

2.8.1 Heat

The test at an ambient temperature of 70° C (158° F) in still air and isolation, was not performed because the materials and methods of construction would not be adversely affected in such a manner that there would be a loss or dispersal of the radioactive contents or a loss of shielding integrity that would result in more than a 20% increase in the radiation level at any external surface of the package.

2.8.2 Cold

The test at an ambient temperature of -40° C (-40° F) in still air and isolation, was not performed because the materials and methods of construction would not be adversely affected in such a manner that there would be a loss or dispersal of the radioactive contents or a loss of shielding integrity that would result in more than a 20% increase in the radiation level at any external surface of the package.

2.8.3 Reduced External Pressure

This test was not performed because the model SPEC-150 is 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 model SPEC-150 package.

2.8.4 Increased External Pressure

The test was not performed because the model SPEC-150 is 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 model SPEC-150 package.

2.8.10 Compression

A model SPEC-150 prototype package was subjected to a compressive load of 266 lbs for a period of 24 hours. The test package was placed on a flat, horizontal surface. Cement blocks were loaded onto the top surface providing a total compressive force of 266 lbs. There were no observable effects of the compression test. The compression test did not result in loss of radioactive contents from the package, increased radiation levels, nor reduce the effectiveness of the model SPEC-150 package.

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 Free Drops

A model SPEC-150 prototype package, Prototype No. 2, was subjected to four successive free drops and a second model SPEC-150 prototype package, Prototype No. 4, was subjected to four successive free drops from a distance of 9 meters (30 feet) onto the previously described drop target. Although not required under the test criteria, the multiple successive drops were made and the damage was cumulative to more than adequately demonstrate the durability of the package and to obviate any questions concerning selection of the most vulnerable points of impact and drop orientation.

A. Prototype No. 2

1. Selection of Points of Impact

Sketches of the drop test impact orientations are located in Appendix 9. It is impossible to determine the most vulnerable point of impact by engineering evaluation alone. This fact was confirmed by the Engineering Department at Louisiana State University. Their opinion is that an engineering evaluation can easily identify the most likely points. However, there is no nationally recognized method to conclusively determine the most vulnerable point, particularly considering the resulting radiation levels. Therefore, the points of impact for Prototype No. 2 were based on an analysis of the design of the SPEC-150 and extensive past experience with testing numerous similar devices.

as a result of the dislocation of the depleted uranium shield away from the ASM/lock module. The source capsule was no longer in the fully shielded position within the S-tube. The radiation level at one meter from the lock end was 5.57 mSv (557 millirem) per hour extrapolated to 150 curies. After four successive drop tests the SPEC-150 prototype No. 2 test device continued to meet the shielding requirements specified in 10 CFR 71.51(a)(2).

6. Summary of Damage - Prototype No. 2

The significant structural damage consisted of (1) the splitting of the welded seam at the top of the lock end plate in the 2nd drop, (2) the splitting of the welded seam at the bottom of the outlet end plate and the shifting of the depleted uranium shield in the 3rd drop, and (3) the splitting of the welded seams along both sides of the outlet end plate and the additional outward distortion of the outlet end plate and shifting of the depleted uranium shield in the 4th drop. Additional significant damage consisted of the separation of the control attachment boss and lock cap in the first drop. The source assembly lock remained intact. With the exception of the loss of the lock cap, all other redundant source assembly securing mechanisms also remained intact.

7. Summary of Drop Tests - Prototype No. 2

The cumulative damage resulted in an increase in radiation level at the lock end of the SPEC-150 to 5.57 mSv (557 millirem) per hour at one meter extrapolated to 150 curies of Ir-192 which remains far below the maximum allowable limit of 10 mSv (1000 millirem) per hour at one meter from the surface. There was no loss of radioactive content.

Following all accidental drop tests the radiation levels were less than 1000 millirem per hour at one meter in all directions. The tests were video recorded and are available for review upon request.

The voluntary procedure to subject the test device to cumulative damage from four successive 9 meter drop tests more than adequately demonstrates that the SPEC-150 design greatly exceeds established standards for a Type B package.

B. Prototype No. 4

The following information describes the accidental drop tests using SPEC-150 Prototype No. 4. Prototype No. 2 successfully passed the accidental drop tests. Nevertheless, minor design revisions were made to Prototype No. 4 based on the damage evaluation of prototype No. 2. The control attachment boss was redesigned to prevent the lock cap

The radiation levels were less than 0.5 millirem per hour at 1 meter in all directions. This extrapolates to 3.3 millirem per hour at 150 curies.

3. 2nd 9 Meter Drop Test - Prototype No. 4

Based on a discussion with NRC and Louisiana Department of Radiation Protection personnel witnessing the tests performed on Prototype No. 4 a decision was made to conduct an additional 9 meter drop test after the puncture test. The point of impact was directly on the top of the exposure device based on the observation that this was the only surface of either prototype that had not been selected as a point of impact. The carrying handle was taped to the top left side of the exposure device to limit the device deflection as much as possible upon impact. See photographs 515A, 515B, 515I and 515J. See photograph 515C for drop height verification.

The top of the release plunger was the initial point of impact. See photograph 515D. There was a 1/4" deep imprint of the handle in the top of the device housing closest towards the outlet end. Also, the impact caused an imprint of the knurled carrying handle grip into the top of the device housing. See photographs 515E, 515F and 515M. The ASM Lid Plate was bent upward 1/4" between the release plunger and carrying handle. See photographs 515F and 515L. The ASM Lid Plate was dented inward at the location where the plunger was impacted. See photograph 515G. The lock end plate was bent outward 1/8" at the Control Attachment Boss. See photographs 515G, 515H and 515K. At the conclusion of the 2nd 9 meter drop test the device was surveyed by a member of the Louisiana Division of Radiation Protection staff. See photograph 515N. A complete radiation survey was performed by SPEC personnel. The radiation levels at the surface of the device, extrapolated to 150 curies, after the 2nd 9 meter accidental drop test were:

Top	163 mR/hr
Bottom	147 mR/hr
Left Side	163 mR/hr
Right Side	229 mR/hr
Outlet End	114 mR/hr
Lock End	212 mR/hr

Radiation level readings at one meter were less than 3.3 mrem/hr from all six surfaces.

was limited to deformation and tearing of the flanges at both ends of the package and slight denting to the surface of the housing. The lock system was damaged only to the extent that the device lock could not be opened. In summary; the structural integrity, shield, and all features designed to maintain the radioactive source in the shielded position under hypothetical accident conditions remained intact and performed fully as intended.

2.10 Special Form

Iridium-192 wafers are encapsulated in a capsule which meets the requirements of special form radioactive material pursuant to 49 CFR 173.403(z), 10 CFR 71.75 and Paras 142, 502-504 IAEA Safety Series No. 6 "Regulations for the Safety Transport of Radioactive Material" (1985 Edition as amended 1990). The individual iridium wafers could qualify as special form radioactive material, if it were not for the minimum dimension requirement; but the capsule represents the primary containment vessel. The capsule meets the requirements of special form radioactive material as demonstrated by IAEA Certificate of Competent Authority No. USA/0095/S. See Appendices Section 9.3, Documents.

2.10.1 Description

The sealed source capsule in the model SPEC-150 package is approximately 3/4 inches long by 1/4 inches diameter. The sealed source capsule meets the minimum dimension requirement of 5 mm for special form radioactive material in compliance with IAEA Safety Series No. 6, para 502. Source assemblies ("pigtails") consist of the sealed source capsule swaged onto a flexible cable to which is swaged a locking ball and a connector.

2.10.2 Free Drop

Since the 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 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 capsule and the iridium wafers will withstand sustain temperatures greater than 1475^0 F for ten minutes without adverse effects.

2.10.6 Summary

As a result of previously performed evaluations resulting in the issuance of IAEA Certificate of Competent Authority No. USA/0095/S and on the basis of the above summary assessment the primary containment vessel in the model SPEC-150 package, the sealed source capsule, meets or exceeds the requirements for special form radioactive material as specified in 10 CFR 71.75.

3. THERMAL EVALUATION

Due to the materials of construction of the model SPEC-150 which are known to have stable thermal properties and which will not be affected by the prescribed 1475^0 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.

3.1 Discussion

The heat of decay from the maximum activity 150 Ci Iridium-192 source is negligible. There are no fluids in the model SPEC-150 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 percussion tests do not affect the thermal characteristics of the package since the individual materials of construction are not affected by a temperature of 1475^0 F. Aluminum, buna rubber, foam and epoxy potting compound are the only materials which will be affected by the 1475^0 F test temperature, but they are not critical to the safety of the packaging. Bronze had the next lowest melting point which is not lower than 1300^0 F. The bronze bushing melting would only prevent unlocking the device. The hypothetical accident temperature of 1475^0 F could only affect the temper of the springs in the automatic securing mechanism, but it would remain in the locked position. A temperature of -40^0 F would have no effect on the critical materials of construction since there are no moving operational parts of the package.

3.2 Summary of Thermal Properties of Materials

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

The materials of construction are as follows:

Structural Materials	Melting Temperature
Depleted Uranium	2070° F
Stainless Steel; 304, 316, 440C	2550° F
Titanium Grade 2	3000° F
Tungsten (alloy)	3000° F
Zircalloy 2	3270° F

Non-Structural Materials Assumed to melt or volatilized below 1475° F:

Aluminum
Bronze, Imperial
Epoxy
Polyurethane Foam
Rubber 70 Buna
Enamel Paint

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 in the model SPEC-150 is coated with enamel paint at the factory. Titanium, tungsten, foam and an epoxy potting compound would come in contact with the enamel paint on the shield exterior, but would not come in direct contact with the deplete uranium. A titanium-uranium or tungsten-uranium eutectic has not be shown to exist. Depleted uranium castings have employed titanium S-tubes for years without any indication of a titanium-uranium eutectic

3.3 Technical Specification of Components

This section is not applicable. The only operating component in the model SPEC-150 package is the source assembly lock which is a one piece component made of stainless steel which is not affected by a 1475° F temperature. The model SPEC-150 is locked when the package is prepared for transport. There are no operating components during transport.

3.4 Thermal Evaluation for Normal Conditions of Transport

The radiation level shielding and containment of the source assembly within the model SPEC-150 is totally dependent on materials which are not adversely affected by temperatures in the range of -40° C (-40° F) to 70° C (158° F). Therefore, the model SPEC-150 package will not release it contents, will not present increased radiation that the source capsule in the in fully shielded position in accordance with 10 CFR 34.20(a) and American National Standards Institute N 432-1980 Section 5.1.2.4 which states "It shall not be possible to operate the lock unless the source assembly is in the fully shielded position." The automatic securing mechanism, device lock, lock cap and safety plug provide redundant safety systems for securing the source assembly in the shield in the proper position. The curvature of the S-Tube and the elongated shape of the depleted uranium shield prevent primary radiation and provides secondary shielding.

Measurements were taken on the surface of Prototype No. 4 before the normal conditions of transport and hypothetical accident condition tests. Radiation readings were taken at points on an approximate one-inch by one-inch grid located on each of the six sides of the package. This provided 75 points on the top, 90 points each on the bottom and two sides, and 40 points each on the end plates for a total of 425 measurement points. A correction factor was applied for the diameter of the detector probe. Measurements were taken with a 137 Ci Iridium-192 source and the results extrapolated to 150 Ci Iridium-192.

Surface 150 Ci Iridium-192

Package Surface	Number of Points	Maximum mrem/hr	Minimum mrem/hr	Average mrem/hr
Top	75	110	13	53
Bottom	90	116	8	56
Left Side	90	92	18	64
Right Side	90	144	21	50
Lock End	40	79	18	34
Outlet End	40	47	13	25
Combined	425	144	8	51

The highest unadjusted and unextrapolated surface radiation readings and their locations on Prototype No. 4 are shown on the radiation profile sketch of the survey dated 8/26/94. The survey was made before both 30-foot drops and a puncture test conducted on 8/26/94. See Appendix 9.

Measurements were taken of the maximum radiation level at one meter from each of the six surfaces of Prototype No. 4 using a 137 Ci Iridium-192 source and the results were extrapolated to 150 Ci Iridium-192.

One Meter from Surface	150 Ci Iridium-192
Package Surface	Maximum mrem/hr
Top	1.1
Bottom	1.1
Left Side	0.9
Right Side	1.1
Lock End	1.6
Outlet End	0.9
Combined	1.6

5.2 Normal Conditions of Transport

Radiation surveys were performed after each of the normal conditions of transport tests which were performed; free drop, penetration and compression. Radiation levels were measured at a sufficient number of locations to determine if there were any significant changes compared to the radiation levels prior to the tests. No changes in radiation levels were measured after each of the penetration and compression tests. The five 4 foot free drop tests were performed on Prototype No. 4 after the combined hypothetical accident condition tests. The maximum surface radiation levels on each of the six surfaces were measured after each drop. The results were extrapolated to 150 Ci Iridium are tabulated below:

Surface	Maximum mrem/hr		150 Ci Iridium-192			
	Before	1st	2nd	3rd	4th	5th
Top	144	135	144	131	140	126
Bottom	108	113	108	117	117	122
Right Side	153	149	158	153	153	117
Left Side	126	131	122	122	113	131
Outlet End	72	72	63	63	72	68
Lock End	99	95	108	104	104	113

The maximum change in surface radiation levels above was 14% which is less than the 20% increase in surface radiation criteria specified in IAEA Safety Series No. 6 Regulations for the Safe Transport of Radioactive Material 1985 Edition (As Amended 1990). The highest unadjusted and unextrapolated surface radiation readings and their locations are shown on the radiation profile sketch of the survey dated 12/17/94. See Appendix 9. The activity of the Ir-192 source was eight curies. The highest radiation level was located at the right side of the package and measured 7.0 mR/hr at the surface. Readings at one meter were not made because the surface readings alone verify that the package meets the radiation level requirements at one meter and because the readings at one meter would be too low to be statistically relevant.

The highest unadjusted and unextrapolated surface radiation readings and their locations on Prototype No. 4 are shown on the radiation profile sketch of the survey dated 8/30/94. See Appendix 9. The activity of the Ir-192 source was 22 curies. The highest radiation level was located at the right side of the package and measured 28 mR/hr at the surface. Adjusted and extrapolated to 150 curies the reading is 229 mR/hr which is far below the allowable limit of 1,000 mR/hr at one meter.

Prototype No. 4 was subjected to five four-foot drop tests December 17, 1994. A survey was made after all five tests. The highest unadjusted and unextrapolated surface radiation readings and their locations are shown on the radiation profile sketch of the survey dated 12/17/94. See Appendix 9. The activity of the Ir-192 source was eight curies. The highest radiation level was located at the right side of the package and measured 7 mR/hr at the surface. Adjusted and extrapolated to 150 curies the reading is 158 mR/hr which is far below the allowable limit of 1,000 mR/hr at one meter. The readings are assumed to be less accurate than the previous readings made on August 30, 1994 because the activity of the Ir-192 source is only eight curies.

Prototype No. 4 was subjected to a third 30-foot drop test, followed by a one meter puncture test, and a fourth 30 foot drop test on February 25, 1995. The highest unadjusted and unextrapolated surface radiation readings and their locations on Prototype No. 4 are shown on the radiation profile sketch of the survey dated 2/25/95. A survey was made after all three tests. See Appendix 9. The activity of the Ir-192 source was four curies. The highest radiation level was located at the top of the package and measured 4.2 mR/hr at the surface. Adjusted and extrapolated to 150 curies the reading is 171 mR/hr which is far below the allowable limit of 1,000 mR/hr at one meter. The readings are assumed to be less accurate than the previous readings made on August 30, 1994 and December 17, 1994 because the activity of the Ir-192 source is only four curies. Readings at one meter were not made because the surface readings alone verify that the package meets the radiation level requirements at one meter and because the readings at one meter would be too low to be statistically relevant.

5.4 Source Specification

The source assembly used in the normal condition of transport and hypothetical accident conditions radiation level measurements was a model SPEC G-60 with an original activity of 137 Ci. The source was corrected for decay to each day that the tests were performed and the presented results extrapolated to an activity of 150 Ci.

5.5 Model Specification

Physical radiation measurements were performed on prototype packages and radiation surveys were performed on the prototype test packages after the tests for normal conditions of transport and hypothetical accident conditions. Theoretical calculations or scale models were not used.

7. OPERATING PROCEDURES

7.1 Procedures for Preparing and Loading the Package

Training of personnel who prepare, offer and transport hazardous material shipments, including the model SPEC-150, for transport is required pursuant to 49 CFR 172.700, and Section 10 of the Louisiana Radiation Regulations.

The source assembly is loaded into the model SPEC-150 at the SPEC facilities under the provisions of Louisiana Radioactive Material License LA-2966-L01 in accordance with procedures and radiation protection standards established under that license and in compliance with 10 CFR 71.87(f) and 10 CFR 20.1906.

The following instructions provided meet the requirements of 10 CFR 71.85, 71.87, 71.89 and 71.91.

7.1.1 General Package Inspection

Visually inspect the model SPEC-150 to determine if it is in unimpaired condition for shipment. The model SPEC-150 should be inspected to determine that it is not damaged, that the lock operates properly, that the source assembly (pigtail) is securely locked in the package, and that the safety plug and lock cap are securely positioned. Verify that the package identification plate is present and legible, which identifies the package as a model SPEC-150 and displays the Certificate of Compliance identification number.

7.1.2 Packaging

Verify that the package is proper for the contents to be shipped.

Verify that the source assembly is properly secured and locked in the model SPEC-150. The source safety plug and the lock cap must be firmly attached.

Measure the maximum surface radiation level and the maximum radiation level at one meter from the surface of the package. The maximum surface radiation level must not exceed 200 mrem/hr. The maximum radiation level at one meter from the surface of the package must not exceed 10 mrem/hr.

If the lock key is to be shipped in the same container with the camera, then seal the lock key in an envelope which will be destroyed when opened.

7.1.3 Outer Package Surface Contamination

Packages may not be shipped on a non-exclusive use basis with outer surface contamination levels exceeding the values below, and it is the shipper's responsibility to ensure that the following conditions are met.

Regulations require that the non-fixed (removable) contamination on the external surfaces of the outer package being shipped on a non-exclusive use basis not exceed 10^{-5} uCi/cm² (0.0001 uCi/cm²) averaged over 300 cm² of any part of the surface, as required in 10 CFR Part 71.87(i). This 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} uCi/cm² (0.4 Bq/cm² or 22 dpm/cm²). If the contamination on the surface of the outer package exceeds the above amount it will not be shipped.

7.1.4 Transportation Requirements

The model SPEC-150 package will be properly marked, labeled and described on a shipping paper in accordance with U.S. Department of Transportation regulations. Placards will be offered to carriers transporting a Radioactive Yellow III labeled package. Shipping papers will be retained for one year in accordance with U.S. Department of Transportation regulation Section 5110 of the Federal Hazardous Materials Transportation Law, published October 1994.

7.1.5 Type B Quantity Consignee Notification

Prior to each shipment of a model SPEC-150 containing more than 27 Ci Iridium-192 the shipper shall notify the consignee of the dates of shipment and expected arrival.

7.2 Procedures for Receipt and Unloading the Package

7.2.1 Unloading

The consignee must establish written procedures for receiving the model SPEC-150 package in accordance with applicable NRC and agreement state regulations. Such procedures should provide for inspection, monitoring, notification and records. The model SPEC-150 package becomes an industrial radiography exposure after receipt by the licensed industrial radiographer user. The source assembly is temporarily removed and then returned to the exposure device frequently throughout its use in accordance with the licensed user's procedures and in accordance with applicable NRC or agreement state regulations.

7.2.2 Receiving the model SPEC-150

A. Delivery, Pick Up and Acceptance from Carrier

Regulations require that the consignee must make arrangements to receive the model SPEC-150 when it is offered for delivery by the carrier; or must make arrangements to receive notification from the

D. Records

Records of the receiving survey should be maintain for a period of three years which include at least: date and time package received or picked up; date and time monitored; identification of package by serial number; identification of source by serial number, isotope and activity (includes date of measurement); identification of individual performing survey; identification of survey meter by serial number; maximum radiation levels at surface of outside package and at one meter from surface of outside package; and corrective action and notification to carrier and regulatory agency, if applicable.

7.3 Preparation of an Empty Package for Transport

Test to verify that the SPEC-150 does not contain a radioactive source (authorized source, unauthorized source, modified source, or a source capsule that has been removed from the source assembly) by the following method. This test should be performed by authorized and monitored personnel who have been trained in radiation safety and equipped with a properly operating survey instrument.

First; remove the safety plug and survey the open outlet nipple. The depleted uranium shield is radioactive and will emit radiation even when no sealed source is installed in the package, but the highest radiation level should not exceed approximately 2 mR/hr. Second; remove the lock cap and visually inspect the device to verify that no source assembly connector is protruding. Third; attach the control assembly to the device and crank the drive cable forward two complete revolutions while monitoring the survey instrument for radiation hazards. An exposed source must be treated as an emergency. Fourth; crank the drive cable back, disconnect and remove the control assembly from the device, and install the safety plug and lock cap. As an option, before cranking the drive cable back, a dummy connector or a dummy source assembly may be attached to the drive cable and retracted into the device. If a dummy connector is used it will pull out of the device with the drive cable when the controls are removed. If a dummy source assembly is used it will remain in the device and must be disconnected from the control drive cable to remove the controls. Inspect the connector of the dummy source assembly to verify that it has no serial number.

The empty packaging contains a maximum of 37 1/4 pounds of depleted uranium and may be shipped as either labeled radioactive material package or as an excepted package, article manufactured from depleted uranium as required by applicable U.S. Department of Transportation regulations.

8. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8.1 Acceptance Tests (Prior to First Use)

The acceptance tests prior to first use is a combination of the in progress and final the package.

8.1.3 Leak Tests

Leak tests are performed in accordance with approved procedures pursuant to the Source Production & Equipment Company, Inc. Louisiana Radioactive Material License LA-2966-L01 on the source assembly after fabrication of the source capsule, and a source assembly will be rejected if there is removable contamination in excess of 0.002 microcuries. Prior to shipment the outer surfaces of the package are monitored for removable contamination and a package will not be shipped if it exhibits more than 220 dpm/cm^2 removable contamination averaged over 300 square centimeters.

8.1.4 Component Tests

As part of the final manufacturing inspection the operation of the source assembly lock, device lock and automatic securing mechanism are tested for proper operation. The lock cap and source safety plug are tested for proper closure.

Prior to shipment with a source assembly the package is inspected to assure that the source assembly, lock cap and source safety plug are properly secured.

8.1.5 Tests for Shielding Integrity

A radiation profile is performed on the camera as part of the final inspection. Although 10 CFR 71.47 allows maximum radiation levels of 200 mR/hr at the package's surface and 10 mR/hr at one meter from the package's surface, the model SPEC-150 will not exceed 200 mrem/hr at the surface of the camera and 2 mrem/hr at one meter from the surface of the camera when the activity is extrapolated to 150 Ci of Iridium-192 in compliance with 10 CFR 34.20(a) which references American National Standards Institute N432-1980. Prior to shipment of the camera with a source assembly the package is surveyed to assure compliance with transportation requirements.

8.1.6 Thermal Acceptance Tests

Thermal acceptance tests for the model SPEC-150 are not indicated since heat of decay for the maximum permissible activity Iridium-192 source (150 Ci) is negligible.

8.2 Maintenance Program

8.2.1 Structural and Pressure Tests

Periodic structural acceptance tests on the model SPEC-150 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.

Quarterly inspection of the package by licensed radiography users as required by 10 CFR 34.31 is sufficient. The quarterly inspection requirements that are relevant to assure that the SPEC-150 operates properly as a Type-B package consist of a visual inspection and operational tests of the lock cap, device lock, source assembly lock, safety plug and outlet nipple. There are no quarterly maintenance requirements such as disassembly, cleaning, replacement of components, or lubrication. The inspection and maintenance procedures are described in the SPEC-150 Users Manual and should be included in the licensed radiography users' Operating Procedures required by 10 CFR Part 34.45.

8.2.2 Leak Tests

Leak test for removable contamination are required to be performed at least every six months on the sealed source pursuant to 10 CFR 34.27 or equivalent agreement state regulations. A leak test should also be performed whenever there is indication of damage to the sealed source capsule. 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.

8.2.3 Subsystems Maintenance

The model SPEC-150 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 daily and quarterly inspection program performed by the licensee pursuant to 10 CFR 34.31 and 10 CFR 34.49 or equivalent agreement state regulations, are sufficient to establish the continuing integrity of the shield.

8.2.6 Thermal

Periodic thermal tests on the model SPEC-150 is not indicated since heat of decay for the maximum permissible activity Iridium-192 source (150 Ci) is negligible. There are no components which be thermally degraded by typical use and transport.

8.2.7 Miscellaneous

The daily and quarterly inspection and maintenance program required of all licensed users of the model SPEC-150 is more than sufficient to assure the continuing integrity of the package.

9. Appendices

9.1 Drawings

DRAWING		TITLE
15B000	Rev (5)	Isometric View
15B002A	Rev (4)	Full Sectional View
15B008	Rev (3)	Depleted Uranium Shield
15B001-3	Rev (1)	Materials List
15B625	Rev (0)	ASM/Lock Module Housing
19B005	Rev (0)	LM-200 Lock Module
19B006	Rev (0)	LM-200 Lock Operation
19B007	Rev (0)	LM-200 Lock Operation
190909	Rev (0)	Source Lock Operation

9.2 Photographs

PHOTO	DESCRIPTION - Prototype No. 2
53A	First 9 meter drop - Set up
53B	First 9 meter drop - Set up
53G	First 9 meter drop - Set up
53C	First 9 meter drop - Lock cap separation
53D	First 9 meter drop - Source connector undamaged
53E	First 9 meter drop - Source connector undamaged
53F	First 9 meter drop - Superficial damage
53H	First 9 meter drop - Superficial damage
53I	First 9 meter drop - Imprint on target
54A	Second 9 meter drop - Drop orientation
54B	Second 9 meter drop - Drop orientation
54C	Second 9 meter drop - ASM lid screw shear
54D	Second 9 meter drop - ASM lid screw shear
54E	Second 9 meter drop - Source connector
54F	Second 9 meter drop - Remained locked
55A	Third 9 meter drop - Orientation
55B	Third 9 meter drop - Orientation

515L	Second 9 meter drop - ASM lid plate bent upward
515G	Second 9 meter drop - ASM lid plate dented inward
515H	Second 9 meter drop - Lock plate bent outward
515K	Second 9 meter drop - Lock plate bent outward
515N	Second 9 meter drop - Survey by LRPD staff member

PHOTO	DESCRIPTION - Prototype No. 4
F01	First 4 foot drop - Set up and orientation
F02	First 4 foot drop - Landed on bottom and rolled
F03	First 4 foot drop - Survey
F04	First 4 foot drop - Survey
F05	Second 4 foot drop - Set up and orientation
F06	Second 4 foot drop - Landed on side flange
F07	Second 4 foot drop - Survey
F08	Second 4 foot drop - Survey
F09	Third 4 foot drop - Set up and orientation
F10	Third 4 foot drop - Landed on lock end corner
F11	Third 4 foot drop - Survey
F12	Third 4 foot drop - Survey
F13	Fourth 4 foot drop - Set up and orientation
F14	Fourth 4 foot drop - Landed on outlet end corner
F15	Fourth 4 foot drop - Survey
F16	Fourth 4 foot drop - Survey
F17	Fifth 4 foot drop - Set up and orientation
F18	Fifth 4 foot drop - Landed flat on lock cap
F19	Fifth 4 foot drop - Survey
F20	Fifth 4 foot drop - Survey

PHOTO	DESCRIPTION - Prototype No. 4
G01	Before 3rd 30-foot drop - Right side, highest surface radiation spot
G02	Before 3rd 30-foot drop - Top, highest surface radiation spot
G03	Before 3rd 30-foot drop - Left side, highest surface radiation spot
G04	Before 3rd 30-foot drop - Outlet end, highest surface radiation spot
G05	Before 3rd 30-foot drop - Lock end, highest surface radiation spot
G06	Before 3rd 30-foot drop - Lock end, source assembly connector
G07	Before 3rd 30-foot drop - Lock end, source assembly connector
G08	Before 3rd 30-foot drop - Lock end, source assembly connector
G09	Before 3rd 30-foot drop - Orientation, lock cap
G10	Before 3rd 30-foot drop - Orientation, lock cap
G11	Before 3rd 30-foot drop - Orientation, lock cap
G12	Before 3rd 30-foot drop - Suspended over target
H01	After 3rd 30-foot drop - Lock end
H02	After 3rd 30-foot drop - Lock cap
H03	After 3rd 30-foot drop - Lock end and target imprint

H04	After 3rd 30-foot drop - Lock end, bottom plate
I01	Before 2nd Puncture Test - Set up
I02	Before 2nd Puncture Test - Orientation, lock cap
I03	After 2nd Puncture Test - Lock cap
I04	After 2nd Puncture Test - Lock cap
J02	Before 4th 30-foot drop - Orientation, lock cap
J03	Before 4th 30-foot drop - Orientation, lock cap
J04	Before 4th 30-foot drop - Orientation, lock cap
J01	Before 4th 30-foot drop - Orientation, lock cap
K01	After 4th 30-foot drop - Right side and target imprint
K02	After 4th 30-foot drop - Lock cap and right flange
K03	After 4th 30-foot drop - Lock cap and right flange
K04	After 4th 30-foot drop - Lock cap
K05	After 4th 30-foot drop - Source assembly lock engaged
K06	After 4th 30-foot drop - Source assembly connector
K07	After 4th 30-foot drop - Lock end
K08	After 4th 30-foot drop - Lock end

9.3 Documents:

IAEA Certificate of Competent Authority USA/0095/S, Revision 7

9.4 Sketches of Drop Test Impact Orientations

9.5 Sketches of Highest Surface Radiation Survey Data

9.6 1997 Puncture Tests

FIGURE WITHHELD UNDER 10 CFR 2.390

TOLERANCES (EXCEPT AS NOTED)	REVISIONS			
	#	DATE	DWG BY	APP'D BY
DECIMAL +/- N/A	1			
	2			
FRACTIONAL +/- N/A	3			
ANGULAR	4			
+/- N/A	5			

SOURCE PRODUCTION & EQUIPMENT CO.,INC 113 TEAL ST., ST.ROSE, LA. 70087		
SPEC-150 EXPOSURE DEVICE ASM/LOCK MODULE HOUSING		
DRAWN BY S. BYRD	SCALE 3/4" = 1"	MATERIAL NOTED
CHK'D BY	DATE 3-4-95	DRAWING NO. 15B625
Q.A. CLASS. Q-B	APPR'D BY [signature]	REV.(0)

FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS N/A DO NOT SCALE DRAWING	APPROVALS	DATE	SOURCE PRODUCTION & EQUIPMENT CO, INC 113 TEAL ST, ST ROSE, LA 70087
	DRAWN SRB	4-17-00	LOCK MODULE- MODEL LM-200, SPEC
TREATMENT NONE	CHECKED	4.17.00	SIZE B DWG NO. 19B005 REV 0
FINISH NONE	APPROVED	4/17/00	
	QA CLASS N		SCALE: 1/1 M 00106000 SHEET 1 OF 1

FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

N/A

DO NOT SCALE DRAWING

TREATMENT NONE

FINISH NONE

APPROVALS	DATE
DRAWN SRB	4-17-00
CHECKED	
APPROVED	
QA CLASS	

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

DEVICE LOCK OPERATION (LOCKED)-
MODEL LM-200,
SPEC

SIZE	DWG NO.	REV
C	19B006	0

SCALE: 2/1 | M 00106100 | SHEET 1 OF 1

FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

N/A

TREATMENT NONE

FINISH NONE

DRAWN SRB 4-17-00

CHECKED

APPROVED

QA CLASS N

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

DEVICE LOCK OPERATION (UNLOCKED)-
MODEL LM-200,
SPEC

SIZE C | DWG NO. 19B007 | REV 0

SCALE: 2/1 | M 00106200 | SHEET 1 OF 1

FIGURE WITHHELD UNDER 10 CFR 2.390

TOLERANCES ARE N/A	APPROVALS	DATE	SOURCE PRODUCTION & EQUIPMENT CO., INC. 113 TEAL ST, ST ROSE, LA 70087
	DRAWN RAM	7/12/99	SOURCE LOCK OPERATION, SPEC-300 USER'S MANUAL
TREATMENT NONE	CHECKED		SIZE C DWG NO. 190909 REV 0
FINISH NONE	APPROVED		SCALE: NTS 00084900 SHEET 1 OF 1

U.S. Department of Transportation
Research and Special Programs Administration

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

IAEA CERTIFICATE OF COMPETENT AUTHORITY
SPECIAL FORM RADIOACTIVE MATERIALS
CERTIFICATE NUMBER USA/0095/S, REVISION 7

This certifies that the sources described have been demonstrated to meet the regulatory requirements for special form radioactive material as prescribed in the regulations of the International Atomic Energy Agency[1] and the United States of America[2] for the transport of radioactive materials.

1. Source Identification - Source Production and Equipment Co. Series B, G, R and T Model Sources.

2. Source Description - The sources are encapsulations constructed of Type 316 stainless steel with welded closures which measure 5.84 mm (0.23") in diameter and 20.32 mm (0.8") long. Construction must be in accordance with the attached Source Production and Equipment Co. Drawing No. 101 dated 8/14/85.

3. Radioactive Contents - These sources consist of not more than 4.1 TBq (110 Ci) of Cobalt 60 or 8.9 TBq (240 Ci) of Iridium 192 as metal pellets.

4. Quality Assurance - Records of Quality Assurance activities required by Paragraph 209 of the IAEA regulations[1] shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors and consignees in the United States exporting or importing shipments under this certificate shall satisfy the requirements of Subpart H of 10 CFR 71.

5. Expiration Date - This certificate expires September 30, 2000.

This certificate is issued in accordance with paragraph 703 of the IAEA Regulations and Section 173.476 of Title 49 of the Code of Federal Regulations, in response to the petition and information dated July 31, 1995 submitted by Source Production and Equipment Company, St. Rose, LA, and in consideration of other information on file in this Office.

Certified by:

James K. O'Steen, Director
Office of Hazardous Materials
Technology

NOV - 3 1995
(DATE)

Revision 7 - Issued to incorporate the 1985 Edition of the IAEA regulations, and to extend the expiration date.

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1 "Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1985 Edition, as amended 1990", published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

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