

TECHNICAL ASSESSMENT OF ALTERNATIVE CONFIGURATIONS  
OF TELE THERAPY-SOURCE SHIPPING/TRANSFER CASK INTERNALS

Ref: Certificate of Compliance No. 9215  
Docket No. 71-9215

November 17, 1993

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BACKGROUND

Prior Licensing Activities

Certificate of Compliance No. 9215 is the third generation of authorizations for shipping packages used by Neutron Products to ship teletherapy sources and to make source exchanges in the field with various makes and models of teletherapy machines.

- (1) Starting in 1972, Neutron Products used teletherapy-source shipping packages conforming to the U.S. Department of Transportation's 20WC-6 specification and Competent Authority Certificate USA/5800/B. These authorizations limit the activity per shipment to 100 thermal watts of decay heat, or about 6,300 curies of cobalt-60.
- (2) In 1977, Neutron Products applied for authorization to use its shipping packages with up to 9,500 curies of cobalt-60, or maximum internal decay heat of 150 thermal watts, per shipment. That authorization was granted by Certificate of Compliance No. 9102 [USA/9102/B( )].
- (3) In 1986, with the dual objectives of obtaining a B(U) certificate and increasing the authorized activity per shipment to 15,000 curies of cobalt-60, or maximum internal decay heat of 240 thermal watts, Neutron Products applied for a new Certificate of Compliance, that was issued as Certificate of Compliance No. 9215 [USA/9215/B(U)].

Regarding Certificate of Compliance No. 9215, both the initial application, dated August 5, 1986, and the consolidated application for renewal, dated October 29, 1992, remark that several alternative configurations of the cask internals, specifically the drum assemblies, are needed to match the range of teletherapy machines with which source transfers may be made. However, Neutron Products in its certification drawings showed only the one most frequently used design of the drum assembly. As Certificate of Compliance No. 9215 references the certification drawings, we wish to add to the drawings two alternative drum assembly designs.

Alternative Drum Assembly Designs

The two alternative designs of the drum assembly that we request be added to Certificate of Compliance No. 9215, are shown on Sheet 2 of Neutron Products Drawing N240122, Revision G, which is enclosed. The length and the outside diameter of the three drum assembly designs are all the same and all fit into the central cavity of the shipping/transfer cask of package USA/9215/B( ).

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(1) One of the alternative drum assembly designs (Item 4 on Sheet 2 of Drawing N240122, Rev. G) has three round holes of 2.810 inch I.D., whereas the currently authorized design (Item 5 on Sheet 1 of Drawing N240122) has three round holes of 2.560 inch I.D. This alternative drum assembly design is identical to the drum assembly design shown in the certification drawing (Neutron Products Drawing D240010, Rev.C) for Certificate of Compliance No. 9102.

(2) The second alternative drum assembly design (Item 2 on Sheet 2 of Drawing N240122, Rev. G) has two square holes of 3 inches by 3 inches. This drum assembly, which is used to ship and transfer sources to some models of Theratron and Siemens teletherapy units, meets the requirements of US DOT Specification 20WC-6 and Competent Authority Certificate USA/5800/B.

Source Holders/Drawers

Teletherapy sources are shipped in the through-holes of a drum assembly. A shipment utilizing a drum with three holes normally contains one or two sources, and a shipment utilizing a drum with two holes normally contains one source. Each source is loaded into a holder or drawer that positions the source near the axial midpoint of the drum assembly during shipment and that mates with the teletherapy machine at a hospital or clinic to effect the source transfer.

The holder or drawer is fabricated of one or more of the following materials: steel, depleted uranium, tungsten, lead or brass. After loading the source holder(s) or drawer(s), the remaining space in the drum assembly holes, including holes that do not contain sources, is filled with spacers and/or plugs of steel, tungsten, and/or lead of dimensions to restrict movement of the source in any direction to less than 0.25 inch.

Proposed Changes to the Certificate of Compliance

Neutron Products proposes that Certificate of Compliance No. 9215 be amended to reference Neutron Products, Inc. Drawing No. N240122, Rev. G., which replaces N240122, Rev. F. Revision G, a copy of which is enclosed, adds Sheet 2, which shows the two alternative drum assembly designs that have been described.

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In order to facilitate authorization to utilize the alternative drum assembly designs with package USA/9215/B( ), Neutron Products proposes that the maximum quantity of material per package would depend on the configuration of drum assembly used and would not exceed the currently authorized limits for packages USA/9102/B( ) and USA/5800/B. Proposed values are:

- For Drawing Item 5 (the currently authorized drum assembly design) the maximum authorized values would remain 15,000 curies of Co-60, or 240 thermal watts.
- For Drawing Item 4 (the drum assembly currently authorized by Certificate of Compliance No. 9102) the maximum authorized values would be 9,500 curies of Co-60, or 150 thermal watts.
- For Drawing Item 2 (a drum assembly design authorized by the U.S Department of Transportation's 20WC-6 specification and USA/5800/B) the maximum authorized values would be 6,300 curies of Co-60, or 100 thermal watts.

TECHNICAL ASSESSMENT OF ALTERNATIVE DRUM ASSEMBLY DESIGNS

Containment of the Sources During Transport

The primary containment of the cobalt-60 source is the source capsule, which meets the requirements for special-form radioactive material, and usually consists of two concentric stainless-steel capsules with welded closures. For containment the source capsule design has been proved for conditions more stringent than those required of the packaging.

The secondary containment of the source(s) is provided by the following components of the shipping/transfer cask: the spherical shell, the cylindrical shell of the cask cavity, the flanges at the ends of the cask cavity, and the two bolted-on cover plate assemblies. As long as this secondary containment remains intact, the source(s) in the cask are surrounded by solid metal and can not move any significant distance. Note that the drum assembly is not part of either the primary or the secondary containment of the source(s).

Structural Evaluation

The combined weights of the drum assembly, the source holders or drawers, and sleeves, spacers and shield plugs are essentially the same for the design currently approved by Certificate of Compliance No. 9215 and the two alternative drum designs. In all three cases the combined weights are lower than the combined weights assumed in Chapter 2, Structural Evaluation of the initial application and the consolidated application for renewal. This means

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that the stresses in the components of the secondary containment, during normal and hypothetical accident conditions of transport are within the values stated in the consolidated application. Therefore, use of either of the alternative drum assembly configurations would provide at least the same factors of safety as does use of the currently authorized drum assembly.

Thermal Evaluation

The alternative drum assembly designs are closely similar to the currently authorized drum assembly design, so that the heat transfer properties of the shipping package would not be significantly affected by use of either alternative drum assembly design. If the internal decay heat in the package is limited to lower values when the alternative drum assembly designs are used, the internal temperatures during normal and hypothetical accident conditions of transport will be lower than an alternative drum assembly is used. Therefore use of an alternative drum assembly would not reduce thermal margins of safety.

It is also noteworthy that in none of the three drum assembly/shipping cask combinations would melting of lead occur during normal or hypothetical accident conditions of transport.

Shielding Evaluation

The principal shielding is provided by the shipping/transfer cask. This shielding can be considered as comprising three parts: (1) the source holder or drawer and any sleeves or plugs in the holes of the drum assembly, (2) the drum assembly itself, and (3) the lead-filled steel shell assembly and cover plate assemblies.

The design guidelines for all of the teletherapy-source shipping packages are the same: that is, maximum dose rates of 100 mr/hr at the accessible surfaces of the package and 10 mr/hr at a distance of one meter from the surface of the package when the package is loaded with the maximum authorized quantities of material per package. As verified by numerous dose rate measurements, these limiting dose rates are met for the three drum assembly designs, when loaded up to the maximum authorized quantities of material per package.

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**DWG. NO. 240122, REV. G  
SHEET 1 OF 2**

**"SHIPPING/TRANSFER CASK  
MODEL S/TC MK II"**

**WITHIN THIS PACKAGE...OR,  
BY SEARCHING USING THE  
DRAWING NUMBER:**

**240122, REV. G**

**NOTE:** Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

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**DWG. NO. 240122, SHEET 2 OF 2  
"SHIPPING/TRANSFER CASK  
MODEL S/TC MK II"**

**WITHIN THIS PACKAGE...OR,  
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**240122**

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