

U.S. Nuclear Regulatory Commission  
Transportation Certification Branch  
Safety Evaluation Report  
Model No. 864 Packaging  
Docket No. 71-9166

SUMMARY

By application dated July 15, 1982, as supplemented, Technical Operations, Inc. requested design approval of the Model No. 864 source changer. Shielding of the 360 curies of Iridium-192 is provided by a minimum of 1.8" thickness of depleted uranium. Containment is provided by the source capsule meeting the requirements of special form.

Based on the statements and representations contained in the application, and the conditions listed below, we have concluded that the Model No. 864 package (source changer) meets the performance requirements of 10 CFR Part 71.

REFERENCES

Technical Operations, Inc. application dated July 15, 1982.

Supplement dated December 28, 1982.

DRAWINGS

The packaging is constructed in accordance with the following Technical Operations, Inc. Drawing Nos.: 86490, Sheets 1 through 6, Rev. 1; and 86491, Sheet 1, Rev. 1.

PACKAGING DESCRIPTION

The Model No. 864 shipping container is designed for use as a source changer, storage container, and Type B shipping container for radiographic sources in special form. The Model No. 864 source changer is 6.0 inches in diameter and 9.56 inches high. The package incorporates two handles which protrude from the side of the package (8.31 inches at its widest point). Three radioactive source assemblies are housed in brass source tubes. The source tubes are surrounded by uranium metal shielding (43 lbs). The uranium shield assembly is encased in a carbon steel housing with void space filled with a castable rigid polyurethane foam. A deck plate above the shield contains three source latching assemblies and a shipping cover protecting the latching assemblies during shipment. The gross weight of the container is 67 pounds.

## CONTENTS

### (1) Type and form of material

Iridium-192 as sealed sources which meet the requirements of special form as defined in 10 CFR §71.4(o).

### (2) Maximum quantity of material per package

360 curies.

## CONTAINMENT

The Iridium-192 is encapsulated in either 304 or 304L stainless steel which meets the requirements of special form as defined in 10 CFR §71.4(o).

## STRUCTURAL

### A. General Standards for all Packaging

#### Chemical and Galvanic Reaction

The Model No. 864 has been designed and constructed of such materials that there will be no significant chemical, galvanic, or other reaction between packaging components or between packaging components and the package contents.

#### Positive Closure

The source assemblies in the Model No. 864 cannot be exposed without opening a latch bar. Access to this latch bar requires removal of the cover. The cover is seal weld and provided with tamper proof seal.

#### Lifting Devices

The two handles attached to the package surfaces of the Model No. 864 are shown by analysis to be capable of lifting three times the maximum package weight as prescribed in 10 CFR §71.31(c)(1) and §71.31(c)(4). However, the applicant did not provide any analysis for the lid lifting device. Based on a calculation by the staff, the lid lifting device was found to meet the requirements of 10 CFR §71.31(c)(2).

### Tie-Down Devices

Calculations by the NRC staff indicate that the handles of the Model No. 864 are capable of meeting the tie-down criteria given in 10 CFR §71.31(d)(1). If under extreme load the tie-down device fails, the staff judges that the effectiveness of the Model No. 864 will not be significantly reduced because of the general arrangement of the package. It should be noted that the overall tie-down system for the Model No. 864 is stable in only one direction.

## B. Structural Standards for Type B and Large Quantity Packaging

### Load Resistance

The Model No. 864 is shown by analysis to be capable of withstanding statically five times of its fully loaded weight uniformly distributed along its length without generating stress in any material of the packaging in excess of its yield strength.

### External Pressure

The Model No. 864 is open to the atmosphere. Therefore, there will be no differential pressure acting on it. In addition, the source capsules of the Model No. 864 are shown by analysis to be capable of withstanding an external pressure of 25 psig.

## C. Normal Conditions of Transport

### Heat

The applicant has shown by evaluation that the Model No. 864 can withstand the normal heat conditions of transport.

### Cold

The metals used in the manufacture of the Model No. 864 can all withstand a temperature of -40°C. The lower operating limit of polyurethane foam is 100°F (73°C). Thus, the package can withstand the normal transport cold condition.

### Pressure

The Model No. 864 is open to the atmosphere, therefore, there will be no pressure differential acting upon it. The source capsules can withstand a pressure reduction of 1/2 atmosphere.

Vibration

The vibration loading is judged not to have significant effects on the package safety.

Water Spray

Water spray will have no effect on the package.

Free Drop

The Model No. 864 can safely withstand the free drop requirement in Appendix A of 10 CFR Part 71 as demonstrated by meeting the more stringent requirements specified in Appendix B of 10 CFR Part 71 for the hypothetical accident conditions.

Corner Drop

Not applicable for this design case.

Penetration

Three penetration tests were performed on the Model No. 864; twice on the outside of the shell, and once on the cover plate of the container. As a result of these tests, the Model No. 864 suffered only minor superficial dents to the exterior of the package. There was no loss of structural or shielding effectiveness.

Compression

The Model No. 864 is shown by analysis to be capable of withstanding a load of five times the package weight without generating stress in any material of the packaging in excess of its yield strength.

D. Hypothetical Accident Conditions

Free Drop

The applicant's evaluation of the Model No. 864 to meet the 30-foot drop test of 10 CFR Part 71 is based on the results of two actual tests. The Model No. 864 was struck on a different corner each time, first the bottom and then the top, causing minor deformation of the outer shell. There was no loss of structural integrity. Subsequent radiation profile reading also indicated that there was no loss of shielding integrity.

#### Puncture

The Model No. 864 was twice submitted to a free fall of 40 inches onto a steel bar 6 inches in diameter and eight inches high; once on each end. These two tests resulted in no reduction of shielding effectiveness or loss of radioactive material.

#### Thermal

The staff agrees with the Applicant's conclusion that the Model No. 864 design satisfactorily meets the requirements for the hypothetical accident thermal condition of 10 CFR Part 71.

#### Immersion

Not applicable; fissile packages only.

#### THERMAL

For normal conditions, it is stated that there is no damage to the package for the maximum 73°C (163°F) package temperature. For the fire accident, it is stated that no package damage will result for the package at 800°F (1472°F). It is noted that the polyurethane foam will decompose and vent through vent holes provided.

#### SHIELDING

The applicant has demonstrated by measurements and analysis the adequacy of the depleted uranium shield for the Model No. 864 under normal and accident damage conditions for the maximum Iridium-192 loading of 360 curies. The DOT normal condition of transport was shown to be satisfied by actual gamma profile measurements (342 Ci Iridium-192 extrapolated to the 360 Ci maximum Iridium-192 loading) which gave dose rates less than the 200 mr/hr surface dose rate limit. The applicant has shown by radiation profile that the depleted uranium shields remain intact with no significant change in the shielding effectiveness when subjected to the accident damage conditions and, therefore, the subject containers satisfy the Part 71 accident radiation limit of less than 1000 mr/hr, three feet from the surface of the container.

The above results demonstrate satisfaction of 10 CFR §71.36 which has a permissible limit of 1000 mr/hr at 3 feet from the external surface of the package under accident conditions.

CRITICALITY

Not applicable, no fissile material.

OPERATING, ACCEPTANCE, AND MAINTENANCE

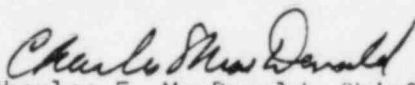
General operating, acceptance, and maintenance procedures and controls are given in Sections 7 and 8 of the application. In addition to the requirements of 10 CFR §§71.53, 71.54, and 71.55, Sections 7 and 8 provide adequate information for development of procedures to prepare the package for transport.

CONDITIONS

1. The source attached to the source assembly must be secured in the shielded position of the packaging by the source latching assembly with the latch bars in the engaged position. The safety pins shall be operational and the shipping cover shall be in place and secured.
2. The two (2) 1/4 inch diameter vent holes in the sides of the package shall be covered with tape or rubber (plastic) plugs to preclude the entry of rain water into the packaging.
3. The name plates must be fabricated of materials capable of resisting the fire test of 10 CFR Part 71 and maintaining their legibility.

CONCLUSION

Based on our review, the statements and representations contained in the application and the conditions listed above, we find that the Model No. 864 package meets the requirements of 10 CFR Part 71.

  
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Date: FEB 10 1983



