Form NRC-618
(12-73)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE

For Radioactive Materials Packages

1.(a) Certificate Number	1.(b) Revision No.	1.(c) Package Identification No.	1.(d) Pages No.	1.(e) Total No. Pages
9178	0	USA/9178/A	1	3

2. PREAMBLE

2.(a) This certificate is issued to satisfy Sections 173.393a, 173.394, 173.395, and 173.396 of the Department of Transportation Hazardous Materials Regulations (49 CFR 170-189 and 14 CFR 103) and Sections 146-19-10a and 146-19-100 of the Department of Transportation Dangerous Cargoes Regulations (46 CFR 146-149), as amended.

2.(b) The packaging and contents described in item 5 below, meets the safety standards set forth in Subpart C of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."

2.(c) This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is issued on the basis of a safety analysis report of the package design or application—

3.(a) Prepared by (*Name and address*):

Nuclear Packaging, Inc.
815 South 28th Street
Tacoma, WA 98409

3.(b) Title and identification of report or application:

NUPAC application dated October 29, 1982, as supplemented.

3.(c) Docket No. 71-9178

4. CONDITIONS

This certificate is conditional upon the fulfilling of the requirements of Subpart D of 10 CFR 71, as applicable, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Fissile Class, Other Conditions, and References:

(a) Packaging

(1) Model No.: NUPAC 7/100

(2) Description

Steel encased lead shielded cask for low specific activity radioactive material. The cask is are right circular cylinder with a 75.5-inch ID by 40.75-inch IH cavity. The walls of the casks contain a lead thickness of 3.00 inches encased in 0.38-inch thick inner steel shell and 0.88-inch thick outer steel shell. The top cover and cask bottom are made up of two steel plates ranging in thickness from 2.0 to 3.5 inches. The primary cask lid is secured to the cylindrical cask body by eight, 1-1/4-inch rachet binders. An optional secondary lid is centered in the primary lid and is secured to the primary lid with eight, 3/4-inch studs and nuts. Each lid is provided with a Neoprene gasket seal. The cask may be provided with an optional 12 gauge stainless steel liner (seal welded along all edges), an optional lid vent line with pipe plug, and an optional 3/4-inch drain line and pipe plug. The cask is provided with four equally spaced lifting/tie down devices. The primary lid is provided with three lifting lugs and the optional secondary lid is provided with one lifting lug. The cask has a gross weight of 48,900 pounds.

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5. (a)(2) Description (continued)

(b) Drawing

The package is fabricated in accordance with Nuclear Packaging, Inc. Drawing No. X-20-204D, Sheets 1 and 2, Revision No. D.

(b) Contents

(1) Type and form of material

(i) Dewatered, solids, or solidified waste, meeting the requirements for low specific activity radioactive material as defined in 10 CFR §71.4(g), in secondary containers; or

(ii) Activated solid components meeting the requirements for low specific activity radioactive material as defined in 10 CFR §71.4(g), in secondary containers.

(2) Maximum quantity of material per package

Greater than Type A quantities of radioactive material which may contain fissile material provided the fissile material does not exceed the limits in 10 CFR §71.7. The decay heat load is limited to 17 watts.

6. Maximum gross weight of the contents, secondary containers, and shoring is limited to 13,000 pounds.

7. Except for close fitting contents, shoring shall be placed between secondary containers and the cask cavity to minimize movement during normal conditions of transport.

8. The lid and shield plug lifting lugs shall not be used for lifting the cask, and shall be covered in transit.

9. The cask shall be provided with either (or both) a drain line or a lid vent line as shown in the drawing in order to provide a method to leak test the package.

10. In addition to the requirements of Subpart D of 10 CFR Part 71:

    (i) Prior to each shipment, the packaging Neoprene lid seals must be inspected. The seals must be replaced with new seals if inspection shows any defects or every twelve (12) months, whichever occurs first. Cavity drain and vent lines shall be sealed with appropriate sealant applied to the pipe plug threads.

    (ii) The cask must meet the Acceptance Tests and Maintenance Program of Section 8.0 of the application. In addition, the cask shall be leak tested at least every twelve (12) months in accordance with Appendix 8.4 of the application.

11. The cask body and each cask lid shall be marked in accordance with 10 CFR §71.53(c).

12. The package authorized by this certificate shall be transported on a motor vehicle, railroad car, aircraft, inland watercraft, or hold or deck of a seagoing vessel assigned for the sole use of the licensee.

13. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR §71.12(b).

14. Expiration date: March 31, 1988.

REFERENCES

Nuclear Packaging, Inc. application dated October 29, 1982*.

Supplements dated: February 18 and March 24, 1983*.

*See Docket File No. 71-9159

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety, NMSS

Date: APR 18 1983

U.S. Nuclear Regulatory Commission
Transportation Certification Branch
Safety Evaluation Report
Model No. Series A Packages

SUMMARY

By application dated October 29, 1982, as supplemented, Nuclear Packaging, Inc. requested design approval of the Model No. Series A waste shipping packages for the shipment of low specific activity radioactive material.

Based on the statements and represent ,ons contained in the application, and the conditions listed below, we have concluded that the Model No. Series A packages meet the performance requirements of 10 CFR Part 71.

REFERENCES

1. Nuclear Packaging, Inc. application dated October 29, 1982.

2. Supplement dated February 18, 1983.

3. Supplement dated March 24, 1983.

DRAWING

The packages are fabricated in accordance with Nuclear Packaging, Inc. Drawing No. X-20-204D, Sheets 1 and 2, Revision No. D.

DESCRIPTION

Steel encased lead shielded casks for low specific activity radioactive material. The casks are right circular cylinders with a 61.0- to 77.25-inch ID by 40.75- to 80.25-inch IH cavity. The walls of the casks contain a lead thickness ranging from 1.25 to 3.56 inches encased in 0.38- to 0.50-inch thick inner steel shell and 0.88- to 1.13-inch thick outer steel shell. The top cover and cask bottom are made up of two steel plates ranging in thickness from 2.0 to 3.0 inches, The primary cask lid is secured to the cylindrical cask body by eight, 1-1/4-inch rachet binders. An optional secondary lid is centered in the primary lid and is secured to the primary lid with eight, 3/4-inch studs and nuts. Each lid is provided with a Neoprene gasket seal. The casks may be provided with an optional 12 gauge stainless steel liner (seal welded along all edges), an optional lid vent line with pipe plug, and an optional 3/4-inch drain line and pipe plug. The casks are provided with four equally spaced lifting/tie down devices. The primary lid is provided with three lifting lugs and the optional secondary lid is provided with one lifting lug. The casks gross weights range from 42,900 to 65,200 pounds.

CONTENTS

1. Type and form of material

   (i) Dewatered, solids, or solidified waste, meeting the requirements for low specific activity radioactive material as defined in 10 CFR §71.4(g), in secondary containers; or

   (ii) Activated solid components meeting the requirements for low specific activity radioactive material as defined in 10 CFR §71.4(g), in secondary containers.

2. Maximum quantity of material per package

   Greater than Type A quantities of radioactive material which may contain fissile material provided the fissile material does not exceed the limits in 10 CFR §71.7. The decay heat load ranges from 7 to 61 watts.

CONTAINMENT

The containment boundary consists of: a primary and optional secondary lid which are each sealed with Neoprene gaskets, the cask cavity, a drain line, and a sealed plug for pressurization. Containment is verified using a soap bubble leak test (Appendix 8.4, Rev. 2, Feb. 17, 1983). The leak test is called for prior to first use; annual gasket replacement is required unconditionally (Section 8). The approval has been conditioned to require an annual leak test. Inspection of the seals and seal regions is required before each shipment. These procedures are adequate and appropriate for these LSA casks.

STRUCTURAL

The applicant has performed various structural analyses to satisfactorily demonstrate the package has adequate structural integrity to meet the requirements of 10 CFR Part 71. The staff agrees with the applicant's conclusion that the packages have adequate structural integrity to meet the requirements of 10 CFR Part 71 subject to the conditions listed below.

A. General Standards for All Packaging

   Chemical and Galvanic Reaction

   There is no significant chemical, galvanic, or other reaction among the packaging components. All solidified resins are contained within a disposable liner to shield the contents from cask components. Resin liners used for any solidification process that may create a significant chemical, galvanic or other reaction, are lined with a protective coating.

Positive Closure

Inadvertent opening of the package is prevented by means of positive closure devices. The primary lid is secured by eight high strength ratchet binders and an optional secondary lid affixed with eight 3/4-inch diameter studs. The optional bottom drain is closed by a plug. In addition, each package is provided with suitable tamper indicating seal.

Lifting Devices

1. Four lifting lugs are shown by analysis to be capable of lifting three times the maximum package weight without exceeding material yield stress in any material of the packaging.

2. It is also shown by analysis that the primary and secondary lid lifting devices are capable of supporting three times the weight of lid and any attachments without generating stress in any material of the lid in excess of its yield strength.

3. The staff agrees with the applicant's conclusion that failure of lifting devices under excessive loads would not result in any release of radioactive materials.

Tie-down Devices

Applicant has shown by computer analysis that the tie-down devices which are structural parts of the packages are adequately designed to meet the regulatory requirements of 10 CFR §73.31.

B. Structural Standards for Type B and Large Quantity Packaging

Load Resistance

The packages are shown by analysis to be capable of withstanding statically five times of their fully loaded weight uniformly distributed along their length without generating stress in any material of the packagings in excess of their yield strength.

External Pressure

The applicant has shown by analysis that the packaging designs meet the regulatory requirement with a large safety margin.

C. Normal Conditions of Transport

Heat

The maximum package equilibrium temperature has been estimated to be 192°F. The effects of this temperature increase from the room temperature on material properties are insignificant and are not expected to cause any stresses to exceed their yield stress limits.

Cold

The stresses caused by thermal contraction under the cold (-40°F) environment are judged not to reduce packaging effectiveness substantially as follows:

1. By selecting a steel that is made to a "fine grain practice."

2. By using a steel whose maximum NDT Temperature is 10°F.

Pressure

The applicant has shown by analysis that the cask containment vessels can withstand a differential pressure of 0.5 atmospheric pressure with large safety margins.

Vibration

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

Water Spray

Water spray will have no effect on the packages.

Free Drop

For the bottom end one foot drop, the lead slump was estimated at 0.05 to 0.07 inches based on the method delineated in the Cask Designer's Guide, ORNL-NSIC-68, February 1970. However, the stepped design of the cask ends provides adequate protection for this small lead settlement to have no significant effects on shielding.

The effects of a one foot side drop on the cask shielding capabilities is evaluated using the methods outlined in the Cask Designer's Guide. The reduction of package shielding is shown to be small and insignificant.

The one-foot corner drop has been analyzed by computer based on energy balance methods. The applicant has shown by analysis that the lid rachet binders have sufficient strength to withstand a top end corner drop impact loading with the package, e.g., directly above the point of impact. Because of the stepped design of the lid, the top of the cask wall is expected to remain cylindrical and sealed.

Corner Drop

Not applicable for this design case.

Penetration

The staff agrees with the applicant's judgement that this regulatory loading has insignificant adverse effects on the package design.

Compression

Not applicable to the present design case.

D. Hypothetical Accident Conditions

Not applicable for greater than Type A quantities of LSA materials shipped by exclusive use vehicle.

THERMAL

The package has been evaluated for the normal conditions thermal environments of 10 CFR Part 71, Appendix A. It is exempt from the hypothetical accident conditions of 10 CFR Part 71, Appendix B in accordance with provisions of 10 CFR §71.36(a) for LSA material.

The cask was analyzed for normal conditions of -40°F with no solar heat and 130°F with solar heat; internal heats of 0 and 400 watts were assumed. For -40°F ambient, no solar heat, and no internal heat, a uniform -40°F cask temperature must result. For 130°F ambient and solar heat surface temperatures of 176°F and 190°F were found, corresponding to internal heat loads of 0 and 400 watts. The maximum gradient through the cask wall for the 400 watt heat load was found to be 0.3°F.

To determine the maximum possible temperature difference across the waste product, the equation for steady state heat transfer from an infinite length cylinder with internal heat generation was used. Instead of using the assumed 400 watt heat load, more realistic heat loads were used, based on shielding limits. The maximum activity was estimated for each cask; its heat generation rate was found, and then doubled to provide conservative upper bounds on the temperature differences for waste products of concrete and asphalt. (Conductivity, k, for concrete and asphalt were reported as: 0.8 and 0.1 BTU/ft-hr-°F, respectively.) The cask designated as Model No. NUPAC 6/100H with an asphalt waste product had a temperature difference of 32°F, which was the highest temperature difference; the same cask had a 4°F difference with a concrete waste product.

The applicant concluded that the resulting waste product centerline temperatures would not significantly effect the cask or payload (i.e., waste product and radioactive content). The actual maximum centerline temperature was not reported by the applicant; however, using the data reported with some additional independent calculations, resulted in a maximum centerline temperature of 212°F for the 6/100H with asphalt and 61 watts. The applicant's conclusion of adequacy is supported by the independent calculational results; however, if higher heat loads are considered, the waste product should be specified more precisely and criteria for maximum centerline temperatures should be set.

The maximum pressure was calculated assuming gas expansion (cavity air) and vaporization of water. The vapor pressure calculation was based on the maximum cavity wall temperature (191°F); this assumption is correct, since the cavity provides the condensing surface. The gas was assumed to expand from 70°F at closure to 191°F; since the bulk air will be slightly higher, this assumption is not correct, but the resulting error is not significant. The reported pressure differential of 12.45 psig for the cask is, therefore, accepted.

SHIELDING

Since gamma measurements are required to be made prior to each shipment and there is no significant shielding loss under normal conditions, the requirement of 49 CFR §173.393(j) will be met.

CRITICALITY

Not applicable, no fissile material.

OPERATING, ACCEPTANCE, AND MAINTENANCE

The application (Section 7) describes general operating procedures for use of the cask. Acceptance tests, including a gamma scan of the shielding and closure leak tests are described in the application (Section 8.1). The application (Section 8.2) also describes a maintenance program to be used for casks in service.

CONDITIONS

1. Maximum gross weight of the contents, secondary containers, and shoring is limited to 12,000 to 20,000 pounds.

2. Except for close fitting contents, shoring shall be placed between secondary containers and the cask cavity to minimize movement during normal conditions of transport.

3. The lid and shield plug lifting lugs shall not be used for lifting the cask, and shall be covered in transit.

4. The cask shall be provided with either (or both) a drain line or a lid vent line as shown in the drawing in order to provide a method to leak test the package.

5. In addition to the requirements of Subpart D of 10 CFR Part 71:

   (i) Prior to each shipment, the packaging Neoprene lid seals must be inspected. The seals must be replaced with new seals if inspection shows any defects or every twelve (12) months, whichever occurs first. Cavity drain and vent lines shall be sealed with appropriate sealant applied to the pipe plug threads.

   (ii) Each cask must meet the Acceptance Tests and Maintenance Program of Section 8.0 of the application. In addition, the cask shall be leak tested at least every twelve (12) months in accordance with Appendix 8.4 of the application.

6. The cask body and each cask lid shall be marked in accordance with 10 CFR §71.53(c).

7. The package authorized by this certificate shall be transported on a motor vehicle, railroad car, aircraft, inland watercraft, or hold or deck of a seagoing vessel assigned for the sole use of the licensee.

CONCLUSION

Based on our review, the statements and representations contained in the application and the conditions listed above, we find that the Model No. Series A packages meet the requirements of 10 CFR Part 71.

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety, NMSS

Date: MAR 28 1983

NUPAC Series A Casks

Model Number	Gross Weight, pounds	Content Weight, pounds	Heat Load, watts	Cask OD, inches	Cask OH, inches	Cavity ID, inches	Cavity IH, inches	Lead Thickness, inches	Inner/Outer Shell, Thickness inches	Top/Bottom Thickness, inches
NUPAC 14/210L	51,600	20,000	9	82.25	88.06	77.25	80.25	1.25	0.38/0.88	4.0/4.0
NUPAC 14/210H	58,400	20,000	9	83.5	88.06	77.25	80.25	1.88	0.38/0.88	4.0/4.0
NUPAC 14/190L	49,200	20,000	7	80.5	81.19	75.5	73.38	1.25	0.38/0.88	4.0/4.0
NUPAC 14/190M	53,500	20,000	7	81.5	81.19	75.5	73.38	1.75	0.38/0.88	4.0/4.0
NUPAC 14/190H	65,200	20,000	25	83.25	83.19	75.5	73.38	2.63	0.38/0.88	5.0/5.0
NUPAC 10/140	56,500	15,000	24	74.77	82.81	66.0	73.0	2.75	0.50/1.13	5.0/5.0
NUPAC 7/100	48,900	13,000	17	84.0	51.56	75.5	40.75	3.00	0.38/0.88	5.5/5.5
NUPAC 6/100L	42,900	12,000	9	69.11	70.81	61.0	62.0	2.43	0.50/1.13	4.5/4.5
NUPAC 6/100H	53,900	12,000	61	71.37	73.81	61.0	62.0	3.56	0.50/1.13	6.0/6.0

MAR 28 1983