GB/5131/AF (Rev.1)

**CERTIFICATE OF APPROVAL OF PACKAGE DESIGN**   
**FOR THE CARRIAGE OF RADIOACTIVE MATERIAL**

This is to certify that for the purposes of the Regulations of the International Atomic Energy Agency

* The Competent Authority of Great Britain in respect of inland surface transport, being the Office for Nuclear Regulation;
* The Competent Authority of the United Kingdom of Great Britain and Northern Ireland in respect of sea transport, being the Secretary of State for Transport;
* The Competent Authority of the United Kingdom of Great Britain and Northern Ireland in respect of air transport, being the Civil Aviation Authority; and
* The Competent Authority of Northern Ireland in respect of road transport, being the Department of Agriculture, Environment and Rural Affairs - Northern Ireland

approve the package design specified in Section 1 of this certificate, as submitted for approval by TN Americas LLC (see Section 5).

as: Type AF

by: Road, sea and air.

Packaging identification: Versa-Pac VP-55

Packages manufactured to this design meet the requirements of the regulations and codes on pages 3 and 4, relevant to the mode of transport, subject to the following general condition and to the conditions in the succeeding pages of this certificate.

In the event of any alteration in the composition of the package, the package design, the management system(s) associated with the package or in any of the facts stated in the application for approval, this certificate will cease to have effect unless the Competent Authority is notified of the alteration and the Competent Authority confirms the certificate notwithstanding the alteration.

Expiry Date: This certificate cancels all previous revisions and is valid until the end of October 2027 (see Section 5).

COMPETENT AUTHORITY IDENTIFICATION MARK: GB/5131/AF

Signature: Date of Issue: 28 August 2024

Head of Transport Competent Authority

Office for Nuclear Regulation

Redgrave Court, Merton Road

Bootle, Merseyside

L20 7HS

on behalf of the Office for Nuclear Regulation; the Secretary of State for Transport; the Civil Aviation Authority; and the Department of Agriculture, Environment and Rural Affairs - Northern Ireland.

***This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be transported.***

**REGULATIONS GOVERNING THE TRANSPORT OF RADIOACTIVE MATERIALS**

**INTERNATIONAL**

International Atomic Energy Agency (IAEA)

SSR-6 Regulations for the Safe Transport of Radioactive Material 2018 Edition

United Nations Economic Commission for Europe (UNECE)

Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) 2023 Edition

Intergovernmental Organisation for International Carriage by Rail (OTIF)

Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) 2023 Edition

International Maritime Organization (IMO)

International Maritime Dangerous Goods (IMDG) Code 2022 Edition incorporating Amendment 41-22

International Civil Aviation Organization (ICAO)

Technical Instructions for the Safe Transport of Dangerous Goods by Air 2023-2024 Edition

**UNITED KINGDOM**

***ROAD***

GREAT BRITAIN ONLY:

The Energy Act 2013 (2013 c. 32); The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (SI 2009 No. 1348); The Energy Act 2013 (Office for Nuclear Regulation) (Consequential Amendments, Transitional Provisions and Savings) Order 2014 (SI 2014 No. 469)

NORTHERN IRELAND ONLY:

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (Northern Ireland) 2010 (SR 2010 No. 160)

***RAIL***

GREAT BRITAIN ONLY:

The Energy Act 2013 (2013 c. 32); The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (SI 2009 No. 1348); The Energy Act 2013 (Office for Nuclear Regulation) (Consequential Amendments, Transitional Provisions and Savings) Order 2014 (SI 2014 No. 469)

***SEA***

British registered ships and all other ships whilst in United Kingdom territorial waters:

The Merchant Shipping Act 1995 (1995 c. 21); The Merchant Shipping (Carriage of Dangerous Goods and Harmful Substances) (Amendment) Regulations 2024 (SI 2024 No. 636)

***AIR***

The Air Navigation Order 2016 (SI 2016 No. 765); The Air Navigation (Dangerous Goods) Regulations 2002 (SI 2002 No. 2786)

1. DESIGN SPECIFICATION
   1. Package Design
      * 1. The package design specification shall be in accordance with Versa-Pac Transportation Package Safety Analysis Report, Revision 13, December 2021 and modifications to the package design approved by the authorities named on page 1 of this certificate under the established modifications procedure.
   2. Design Drawings
      * 1. The design is specified in the following drawings.

|  |  |  |  |
| --- | --- | --- | --- |
| **Design No.** | **Title (number of components)** | **Drawing / Drawing List** | **Issue** |
| Versa-Pac VP-55 | 55 Gallon Versa-Pac Shipping Container – 52 components | VP-55-LD | 6 |
| Versa-Pac VP-55 | 5 Inch Pipe Container | VP-55-2R | 1 |

* 1. Package Description and Materials of Manufacture
     + 1. The Versa-Pac VP-55 is a 55 gallon drum type package. The exterior skin of the packaging is a UN1A2/Y425/S minimum, carbon steel material. It uses a bolted closure ring, ASTM A429 bolts and nuts, a silicone gasket, a drum cover reinforced by a 10-gauge thick plate with four bolts. It is strengthened with vertical stiffeners, two inner liners insulated by a ceramic fibre blanket and a ¼” carbon steel reinforcing plate on the bottom. The package interior is completely insulated with layers of a ceramic fibre blanket around the containment cavity with rigid polyurethane foam disks on the top and bottom of the cavity. A ½” thick fiberglass ring is used as a thermal break at the payload cavity flange. The cavity blind flange is secured to the flange with twelve bolts. See Appendix 1 for package illustration.
  2. Package Dimension and Weights
     + 1. Nominal dimensions: 58.9 cm Outside Diameter (OD) x 88.3 cm height
       2. Maximum authorised gross weight: 340 kg
       3. Maximum payload weight: 158.8 kg
  3. Authorised Contents
     + 1. The authorised contents are the following types and forms of radioactive material:

1. Solid, homogeneous (powder or crystalline), or non-homogeneous, uranium materials with no free-standing liquids. Materials shall be stable and in a non-pyrophoric form. Materials may include natural thorium in any form. Materials may include neutron absorbers (e.g. boron, hafnium, erbium and gadolinia). Contents are limited to:
2. Uranium oxides (UxOy)
3. Uranyl nitrate crystals in the form of uranyl nitrate hexahydrate, trihydrate or dihydrate
4. Other uranium compounds, e.g. uranyl fluorides and uranyl carbonates. Uranium compounds may also contain carbon or be mixed with carbon or graphite, including uranium carbides. Uranium hydrites are not permitted.
5. Uranium metal or uranium alloys.
6. Natural thorium in any form.
7. TRISO fuel and compacts composed of uranium kernels encased within layers of carbon and SiC to form TRISO particles, The uranium may be in the form of uranium oxides, carbides and/or nitrides. Uranium kernels and TRISO particles are of unrestricted size, density and uranium content per kernel/particle. Uranium kernels and TRISO particles may be loose or mixed in a graphite matrix and pressed into compacts of various fuel forms (e.g. annular cylinders, planks, right circular cylinders and spheres). Pressed TRISO fuel compacts may include a graphite fuel-free zone at the periphery of the component.
   * + 1. The contents may be pre-packaged in polyethylene, polytetrafluoroethylene and aluminium. Carbon steel, aluminium trihydrate, sodium borate (borax, fused), perlite, paper labels, plastic tape, plastic bags, plastic bottles and dessicant such as “Quik-Solid” are permitted as packing materials. The quantity of hydrogenous packing materials is unlimited unless otherwise restricted by the fissile material approval. Packing materials shall have a hydrogen density not greater than 0.141 g/cm3.

**Restriction on Contents**

* + - 1. The radioactive contents shall have an auto-ignition temperature and melting point greater than 315.6ºC.
      2. The contents are limited to normal form material. The radionuclide inventory of the loaded contents, including U-234 and U-236, shall be less than the calculated mixture A2 value.
      3. The total heat output from the contents shall not exceed 11.4 W.
  1. Containment System
     + 1. The containment boundary of the package is defined as the payload vessel with its associated welds, payload vessel high temperature heat resistant fiberglass sleeve gasket, payload vessel blind flange, and reinforcing ring.
  2. Fissile Material Restrictions
     + 1. Unless the contents of the package and/or consignment meet the provision of paragraphs 417, 674 or 675 of IAEA SSR-6, the packages shall comply with the following fissile material approval.
     1. Fissile Material Approval
        1. Fissile material containing U-235 limited according to uranium enrichment, mode of transport, package configuration, mass of hydrogenous packing material and Criticality Safety Index (CSI) as presented below.

1. Versa-Pac VP-55

|  |  |  |
| --- | --- | --- |
| **U-235 Enrichment** | **U-235 Mass Limit (g), CSI = 1.0** | |
| **Ground/Vessel** | **Air** |
| ≤100 wt.% | 360 | 360 |
| ≤20 wt.% | 445 | 445 |
| ≤10 wt.% | 505 | 505 |
| ≤5 wt.% | 610 | 610 |
| ≤1.25 wt.% | 1,650 | - |

or

1. Versa-Pac VP-55 with Limited Hydrogenous Packing Material

|  |  |  |
| --- | --- | --- |
| **U-235 Enrichment** | **U-235 Mass Limit (g)** | |
| **CSI = 0.7** | **CSI = 1.0** |
| ≤100 wt.% | 515 | - |
| ≤20 wt.% | 605 | 635 |
| ≤10 wt.% | 685 | - |
| ≤5 wt.% | 800 | - |

or

1. Versa-Pac VP-55 with Single 5-inch Pipe

|  |  |  |  |
| --- | --- | --- | --- |
| **U-235 Enrichment** | **U-235 Mass Limit (g)** | | **CSI** |
| **Ground/Vessel** | **Air** |
| ≤100 wt.% | 695 | 395 | 1.0 |
| ≤20 wt.% | 1,215 | 495 | 1.0 |
| ≤10 wt.% | Unlimited | 590 | 0.7 |
| ≤5 wt.% | Unlimited | 790 | 0.7 |

or

1. Versa-Pac VP-55 with 5-inch Pipe(s) and Limited Hydrogenous Packing Material

|  |  |  |  |
| --- | --- | --- | --- |
| **U-235 Enrichment** | **Number of**  **Pipes** | **U-235 Mass Limit (g)** | **CSI** |
| ≤20 wt.% | 1 | Unlimited | CSI = 1.0 for all compounds & uranium metal |
| ≤10 wt.% | 2 | Unlimited | CSI = 1.0 for uranium oxides  CSI = 1.4 for all other compounds & uranium metal |

* + - 1. Conditions:
         1. Hydrogenous packing materials shall have a hydrogen density not greater than 0.141 g/cm3.
         2. The mass of hydrogenous packing materials (excluding the bumper pad and insulation plug) shall not exceed 454 g per package under fissile material approval (ii) of paragraph 1.14.
         3. The mass of hydrogenous packing materials shall not exceed 567 g per 5-inch pipe under fissile material approval (iv) of paragraph 1.14.
         4. Uranium compounds containing hydrogen (e.g. hydrates and hydrides) are not permitted under fissile material approvals (ii) and (iv) of paragraph 1.14.
         5. The fissile contents shall be loaded into the 5-inch pipe(s) under fissile material approvals (iii) and (iv) of paragraph 1.14.
      2. The confinement system is the fissile material approved in paragraph 1.14 and either (a) the inner container with associated welds, containment gasket, inner container blind flanges and reinforcing ring, or (b) the 5-inch pipe(s) if used.
      3. The Criticality Safety Index (CSI) is dependent upon the uranium enrichment, mode of transport, hydrogen packing material and form of the contents. The CSI values are stated for fissile material approvals (i) to (iv) in paragraph 1.14.
      4. The criticality safety documentation comprises Section 6 Criticality Evaluation of the document referred to in paragraph 1.1 of this certificate.
      5. This package design has been shown to be sub-critical following water ingress as required by paragraphs 680 and 681 of IAEA SSR-6. Special features to exclude water are not therefore required.
      6. Ambient temperature range for package design:
         1. -40ºC to +38ºC
      7. Air transport restrictions:
         1. The package may be transported by air subject to the limits in fissile material approvals (i) and (iii) of paragraph 1.14.
      8. Any fissile materials not specified in paragraph 1.14 are permitted to be present in only trace quantities, that is to say up to either a total of 1 g per package, or a concentration of 0.1 % by mass of the total fissile nuclides present.

1. use of package
   1. Information Provided in Safety Report on Use of Packaging
      * 1. The packaging shall be used and handled in accordance with section 7 of the document referred to in paragraph 1.1 of this certificate.
        2. The packaging shall be maintained in accordance with section 8 of the document referred to in paragraph 1.1 of this certificate.
   2. Actions Prior to Shipment
      * 1. Administrative controls shall ensure that the contents are in accordance with Section 1 of this certificate, and that the consignor and consignee hold a copy of the certificate and instructions on the use of the packaging.
   3. Emergency Arrangements
      * 1. Before shipment takes place, adequate emergency arrangements must be made, copies of which shall be supplied to the GB Competent Authority on demand.
        2. Within Great Britain, if the consignor’s own, or other approved emergency plans, cannot be initiated for any reason, then the police shall be informed immediately.
2. management systems
   * + 1. The management system(s) assessed as adequate in relation to this design by the authorities named on page 1 of this certificate, at the date of issue, are as specified in the Versa-Pac Transportation Package Safety Analysis Report, Revision 13, December 2021, referred to in Section 1 above, and comprise the following:

* TN Americas, Quality Assurance Program Description Manual, Revision 17, 25 February 2022.
  + - 1. No alteration may be made to any management system confirmed as adequate in relation to this design, unless:
         1. the authorities named on page 1 of this certificate have confirmed the amended management system is adequate prior to implementation or use; or
         2. the alteration falls within the agreed change control procedures set out in the management system(s).
      2. Other management systems for design, testing, manufacture, documentation, use, maintenance, inspection, transport and in-transit storage operations may be used providing they comply with international, national or other standards for management systems agreed as acceptable by the authorities named on page 1 of this certificate.

1. ADMINISTRATIVE INFORMATION
   1. Related Approvals
      * 1. The U.S. Department of Transport have certified this package design under USA/9342/AF-96 (Rev.7).
   2. Packaging Serial Numbers
      * 1. For the purpose of compliance with ADR / RID, the owner of the packaging shall be responsible for informing ONR of the serial number of each packaging manufactured to this design.
2. CERTIFICATE STATUS
   1. Design approval issued to:

TN Americas LLC

7160 Riverwood Drive

Suite 200

Columbia, MD 21046

USA

|  |  |  |  |
| --- | --- | --- | --- |
| **Issue / Revision Number** | **Date of Issue** | **Date of Expiry** | **Reason for Revision** |
| 0 | 08 November 2022 | 31 May 2024 | First GB validation of USA/9342/AF-96  (Rev.5) |
| 1 | 28 August 2024 | 31 October 2027 | GB package design approval of USA/9342/AF-96, Revision 7 |

Appendix 1 – package illustration

