GB/5125/B(U)F (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 GNS Gesellschaft für Nuklear-Service mbH (see Section 5)

as: Type B(U)F

by: road, rail and sea.

Packaging identification: CASTOR® HAW28M

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 09 February 2028 (see Section 5).

COMPETENT AUTHORITY IDENTIFICATION MARK: GB/5125/B(U)F

Signature:  Date of Issue: 03 August 2023

Geoff Frackelton, 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 2020 Edition incorporating Amendment 40-20

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 (Dangerous Goods and Marine Pollutants) Regulations 1997 (SI 1997 No. 2367); Merchant Shipping Notice MSN 1906 (M) The carriage of dangerous goods and marine pollutants: Amendments to international standards

***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 the following application documentation for the Type B(U)F package transport and storage cask CASTOR® HAW28M:
			+ GNB B 061/2007 Rev. 15 dated 13 January 2023
			+ GNB B 055/2003 Rev. 18 dated 28 November 2022
			+ GNB B 230/2006 Rev. 17 dated 15 December 2022

and modifications to the package design approved by the authorities named on page 1 of this certificate under the established modifications procedure.

* 1. Design Drawings
		+ 1. The design is specified in the following drawings.

|  |  |  |  |
| --- | --- | --- | --- |
| **Design No.** | **Title** | **Drawing / Parts List** | **Issue** |
| CASTOR® HAW28M | Parts list: Trans. and storage cask | GNB500.111-001/1 | Rev. 14 |
| CASTOR® HAW28M | Drawing: Transport configuration part 1/2 CASTOR® HAW28M | GNB500.111-001 | Rev. f |
| CASTOR® HAW28M | Drawing: Transport configuration part 2/2 CASTOR® HAW28M | GNB500.111-001/2 | Rev. d |
| CASTOR® HAW28M | Parts list: Trans. and storage cask | GNB500.111-001/1 | Rev. 16 |
| CASTOR® HAW28M | Drawing: Transport configuration part 1/2 CASTOR® HAW28M  | GNB500.111-001 | Rev. i |
| CASTOR® HAW28M | Drawing: Transport configuration part 2/2 CASTOR® HAW28M  | GNB500.111-001/2 | Rev. e |

* 1. Package Description and Materials of Manufacture
		+ 1. The transport and storage cask CASTOR® HAW28M consists of a thick-walled cylindrical cask body with radial cooling fins and a bottom, tightly closed by a primary lid, with the closure lid contained therein, and the corresponding associated threaded connection and metal seal. The cask body is made of spheroidal graphite cast iron, and the lids are made of stainless steel. Neutron shielding is ensured by two rows of polyethylene rods in the wall of the cask body, polyethylene plates in the lid and bottom areas as well as six encapsulated graphite columns in the interior of the cask. A fuel basket made of copper plate, accommodating 28 canisters with vitrified residues (4 levels of 7 canisters with vitrified residues per level) is placed in the interior of the cask. The cask is fitted with lid, bottom and lateral impact limiters that are part of the package.
	2. Package Dimension and Weights
		+ 1. Nominal dimensions: Diameter 2750 mm, Height (with impact limiters) 7016 mm.
			2. Maximum authorised gross weight: 116500 kg (loaded, with impact limiters).
	3. Authorised Contents
		+ 1. The **transport package** must meet the following conditions:
				1. The maximum thermal power is 45 kW.
				2. The maximum total activity is 1270 PBq.
				3. The package must be loaded with 28 canisters.
				4. The maximum mass of Sellafield Ltd. canisters with vitrified residues is 14200 kg.
				5. Fissile Limits are as stipulated in Section 1.10 - 1.18
				6. The maximum thermal power per horizontal layer of Sellafield Ltd. canisters within the package is 11.8 kW.
			2. Each **canister** containing vitrified residue must meet the following conditions:
				1. The maximum thermal power is 2.0 kW.
				2. The maximum mass is 530 kg
				3. The maximum Uranium (total) content is 2000 g
				4. The maximum Plutonium (total) content is 100 g
				5. The maximum Am-241 content is 1500 g
				6. The maximum Cm-244 content is 40 g
				7. The maximum Cs-137 activity content is 6.5 PBq
				8. The maximum Sr-90 activity content is 4.22 PBq
				9. The length of a canister when cold is 1338 mm ± 2 mm
				10. The diameter of a canister when cold is 430 mm ± 2 mm
				11. The activities or masses for the dose rate-relevant nuclides (reference nuclides) must be limited per cask in such a way that the following conditions are fulfilled:

$$S\_{j}= \max\_{x=A1…D7}\left(S\_{j}^{x}\right)\leq 1 for j=1,3…7$$

$$S\_{j}^{x}=∑\frac{A\_{i}^{x}}{A\_{Gij}} for i=1…7$$

where:

* Sj is the sum criterion S for j=1, 3 to 7
* x is the position number of the canister (A1 to D7) according to Appendix 1
* i is the reference nuclide 1 to 7 according to the following table
* Aix is the actual inventory of nuclide i in the canister at position no. x
* AGij is the reference inventory j of reference nuclide i according to the following table

|  |  |  |  |
| --- | --- | --- | --- |
| **No. i**  | **Reference Nuclide**  | **Unit**  | **Reference nuclide**  |
| **AGi1** | **AGi3** | **AGi4** | **AGi5** | **AGi6** | **AGi7** |
| 1 | Ru-106  | PBq/canister  | 11.10 | 18.00 | 20.60 | 10.20 | 8.33 | 7.85 |
| 2 | Cs-134  | PBq/canister  | 4.26 | 7.00 | 6.45 | 4.66 | 4.26 | 3.53 |
| 3 | Cs-137  | PBq/canister  | 42.60 | 82.30 | 46.40 | 67.30 | 64.30 | 52.40 |
| 4 | Ce-144  | PBq/canister  | 4.12 | 4.44 | 10.20 | 2.44 | 2.15 | 2.08 |
| 5 | Eu-154  | PBq/canister  | 1.09 | 1.29 | 1.63 | 0.87 | 0.78 | 0.68 |
| 6 | Am-241  | g/canister  | 7396 | 22680 | 8347 | 6103 | 6341 | 7647 |
| 7 | Cm-244  | g/canister  | 130 | 415 | 140 | 110 | 112 | 138 |

* + - * 1. Fissile Limits as stipulated in Section 1.11 - 1.19
				2. Unless otherwise determined in this Certificate of Approval, the parameters and conditions of the “Vitrified Residues Specification, March 1990, BNFL” apply.
	1. Restriction on Contents
		+ 1. The radioactive content is restricted to highly active canisters containing vitrified residue from reprocessing operations at Sellafield Ltd.
	2. Containment System
		+ 1. The package containment system comprises the cask body, the screwed primary lid with its metal O-ring gasket and the screwed closure lid with its metal O-ring gasket.
	3. Fissile Material Restrictions
		+ 1. The maximum total fissile material inventory (U-233, U-235, Pu-239 and Pu-241) is 200 g per canister.
			2. The maximum combined mass of U-233 and U-235 is 100 g.
			3. The minimum weight per cent of B2O3 in glass is 21.0%.
			4. The minimum mass of glass is 202.5 kg/canister.
			5. The package confinement system comprises the cask body with lids (including threaded connections and gaskets), the stainless-steel canisters and the glass with the fissile material inventory contained therein.
			6. Criticality Safety Index (CSI) = 0
			7. The criticality safety documentation comprises GNB B 070/2011 Rev. 1 ‘Kritikalitätssicherheitsnachweis für das Typ B(U)F-Versandstück Transport- und Lagerbehälter CASTOR® HAW28M mit CSD-B- bzw. Sellafield-Glaskokillen’ dated 16 September 2021.
			8. 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.
			9. Any fissile materials not specified in paragraph 1.10 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.
			10. The ambient temperature range for which the package design has been approved is -40ºC to +38ºC.
1. use of package
	1. Information Provided in Safety Report on Use of Packaging
		* 1. The packaging shall be used, handled and maintained in accordance with GNB B 036/2003 Rev. 15, ‘Benutzungs- und Wartungsanleitung des Typ B(U)F-Versandstücks Transport- und Lagerbehälter CASTOR® HAW28M zur Erfüllung der verkehrsrechtlichen Anforderungen‘ dated 24 November 2022.
	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. Supplementary Operational Controls
		* 1. Carriage is only permitted under Exclusive Use.
	4. 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 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 GNB B 061/2007 Rev. 15 dated 13 January 2023 referred to in Section 1 above, and comprise the following:
* Quality Management Plan QMP-001 Rev. 9 dated 20 August 2021
	+ - 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 CASTOR® HAW28M package design has been approved by the German Competent Authority as D/4325/B(U)F-96 (Rev. 4).
	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:

GNS - Gesellschaft für Nuklear-Service mbH

Frohnhauser Straße 67

45127 Essen

Germany

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| --- | --- | --- | --- |
| **Issue / Revision Number** | **Date of Issue** | **Date of Expiry** | **Reason for Revision** |
| D/4325/B(U)F-96 Issue 1 | 02 Dec 2015 | 20 Dec 2018 | First validation certified in UK as D/4325/B(U)F-96 |
| GB/5125/B(U)F-96 (Rev 0)  | 05 Feb 2020 | 13 Jul 2023 | Second UK validation as GB/5000 series partial validation for Sellafield Ltd. content only. To run concurrently with the German certificate D/4325/B(U)F-96 (Rev. 3) |
| GB/5125/B(U)F (Rev.1) | 03 August 2023 | 09 February 2028 | Partial validation of CASTOR® HAW28M for Sellafield Ltd content. To run concurrently with the German certificate D/4325/B(U)F-96 (Rev. 4). |

Appendix 1 – Overview drawing for transport and storage cask CASTOR® HAW28M

