GB/3358W/B(M)F (Rev.4)

**CERTIFICATE OF APPROVAL OF PACKAGE DESIGN
AND SHIPMENT 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 and shipment specified in Section 1 of this certificate, as submitted for approval by Magnox Limited (see Section 5)

as: Type B(M)F

by: road and rail in Great Britain.

Packaging identification: 1½-Modular Packaging for Dragon Fuel DN3358W.

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 2028 (see Section 5).

COMPETENT AUTHORITY IDENTIFICATION MARK: GB/3358W/B(M)F

Signature:  Date of Issue: 09/11/2023

Ian Barlow, 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 Application for Type B(M)F Approval for Modular Flask DN3358W, Ref: 96281/DE/TR/001, Issue B, 20 October 2020, 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** |
| 3358  | Assembly - 1½ Module Package Assembly (1)  | D/L EH11113 D/L EH11113  | 32 (new) 27D (original)  |
| 3358  | Outer - Outer Packaging (1)  | D/L EH10931/001b Sht. 1 Sht. 2 Sht. 1 Sht. 2  | Issue 29 (new) Issue 21 (new) Issue 25C (original) Issue 18C (original)  |
| 3360  | Inner – 1½-Module Shielded Flask (1)The 1½ Inner Packaging (Shielded Flask Assembly) is made up of the following individual components; Plug End Unit (DN3359), Door End Unit (DN3359), 1 Unit Body (DN3359), ½ Unit Body (DN3363), Shield Ring (DN3360).  | D/L EH11115 D/L EH11115  | Issue 29 (new) Issue 24D (original)  |
| 3909  | Inner Liner - Neutron Absorber (1)  | 0H11115/7  | Issue E and F  |
| Ancillary Equipment |
|  | Transport Frame  | D/S 0H98C14  | Issue G  |

* 1. The application is for the existing manufactured packaging components and for new manufactured components to maintain existing packages. There is no intention, at time of application, to manufacture new packages. To allow for new component manufacture all the drawings have been reviewed and updated to current standards. This means that there are two issues of the drawing lists quoted for each sub-assembly of the design, covering original and new manufacture.
	2. Package Description and Materials of Manufacture
		+ 1. The 1½-Modular Packaging DN3358W consists of an outer box comprised of a cork filled thermal barrier clad in steel sheet (outer packaging) and lead shielded flask (inner packaging). The W variation introduces a neutron absorbing liner. See Appendix 1 for package illustration.
	3. Package Dimension and Weights
		+ 1. Nominal dimensions:

Height 1.93 m

Width 2.34 m

Length 4.26 m

* + - 1. Maximum authorised gross weight: 23,180 kg
	1. Authorised Contents
		+ 1. The waste is irradiated Dragon fuel. This comprises uranium dioxide or carbide of up to 93.5% by weight pre-irradiation uranium-235 enrichment, normally compacted with graphite. Other fuel is in the form of loose spherical particles of UO2.
			2. The most significant radionuclides are Cs-137, Sr-90, Pu-239, Pu-240, Pu-241, Am-241 and U-233. Other radionuclides that may be present are of an insignificant quantity.
				1. Radioactive material in either elemental, oxide or carbide form.
				2. The limit equals the maximum total activity from two Dragon fuel containers, which is 6.2x1014 Bq.
				3. For fissile material refer to subsection below for further information.
	2. Restriction on Contents
		+ 1. All the Dragon fuel must have been removed from the reactor and stored for at least 45 years.
	3. Containment System
		+ 1. The Shielded Flask (Inner Packaging) Design No. 3360 is made up of; 1 body unit, ½ body unit, a plug end unit, a door unit, a shield ring and a neutron absorbing liner. The bodies, plug end and door containing the shield ring and liner are bolted together to form the assembled Flask. All the joints have double, leak-testable, O-ring seals with the exception of the cover for the door plug which has a flat, leak-testable, seal. This assembly provides the shielded containment system for the contents.
	4. 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:

A maximum quantity of radioactive material in a Package is:

1. up to 950 g U-235 in the form of compacts

or

(ii) up to 700 g U-235 in the form of particles

or

(iii) mixtures of compacts and particles, such that:

Mass of U-235 (g) as Compacts + Mass U-235 (g) as Particles ≤ 1

 950 700

or

(iv) up to 500 g U-235 in the form of compacts, with a pre-irradiation thorium content not greater than 4500 g

where mixing with (a) fissile material in the form of particles or (b) fissile material with a pre-irradiation U-235 enrichment of less than 20% by weight U-235/U is not permitted

or

(v) up to 950 g U-235 in the form of compacts, with a pre-irradiation U-235 enrichment of less than 20% by weight U-235/U and a maximum pre-irradiation U-238 content of 10000 g

 where mixing with (a) fissile material in the form of particles or (b) fissile material with a pre-irradiation U-235 enrichment of greater than or equal to 20% by weight U-235/U or (c) fissile material with a pre-irradiation thorium content greater than 2000 g is not permitted.

* + - 1. Conditions:
				1. Compliance with the fissile mass limits for the package shall be based on pre-irradiation U-235 content (and other nuclides where stated), with no account being taken of fuel burnup. The presence of other fissile and fissionable nuclides produced by fuel irradiation need not be included.
				2. The pre-irradiation U-235 enrichment shall be greater than or equal to 20% by weight U-235/U and not greater than 93.5% by weight U-235/U, except for approval (v) of paragraph 1.11.
				3. The pre-irradiation content of thorium in the package shall be no more than 2000 g, except for approval (iv) of paragraph 1.11.
				4. Where compacts are present, the C to U-235 weight ratio shall be at least 7.0.
				5. A borated centralising Vitrite liner as described in drawing OH11115/7 Issue E or F shall be used.
				6. The Vitrite liner density shall be at least 0.85 g/cm3.
				7. Moderating material with a hydrogen density greater than water shall not be present.
				8. Beryllium and substances enriched in deuterium shall not be carried.

1.13 The confinement system is the Inner Packaging (Shielded Flask), neutron poisoning is provided by a boron / polythene Vitrite liner, as detailed in the drawings identified in paragraph 1.2 above.

1.14 Criticality Safety Index (CSI) = 50.

1.15 The criticality safety documentation comprises (i) Transport Criticality Assessment of the DN3358W Modular Flask W Variation Containing Dragon Fuel, CE/NGD/NSE/202163/R001, Issue 7, January 2018 and (ii) Analysis of the Effects of Burnup on the Reactivity of Dragon Fuel in the Modular Flask W Variation, NSE-202163-R002 Issue 3, Revision 2, May 2023.

1.16 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.

1.17 Ambient temperature range for package design:

1. -20°C to +38°C.

1.18 Air transport restrictions:

1. This package shall not be transported by air.

1.19 The fissile material approvals specified in paragraph 1.11 relate to the Dragon fuel prior to irradiation. There are no limits on the presence of other fissile nuclides post-irradiation (such as U-233 and Pu), subject to the conditions specified in paragraph 1.12 (b) and (c) and the general description of Dragon fuel in paragraphs 1.6 and 1.7.

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 the Operating and Handling Instructions 96281/DE/TS/003, Issue G, 20 July 2023.
			2. The packaging shall be maintained in accordance with the annual and interim inspection and maintenance schedules for the packaging as specified in:
				1. Turn Round Maintenance Schedule for Modular Flask Packaging 96281/DE/TS/004, Issue G, 11 August 2023.
				2. Annual Maintenance Schedule for Modular Flask Inner Packaging 96281/DE/TS/005, Issue E, 26 August 2020.
				3. Annual Maintenance Schedule for Modular Flask Outer Packaging 96281/DE/TS/006, Issue E, 26 August 2020.
				4. Annual Maintenance Schedule for Modular Flask Transport Frame 96281/DE/TS/009, Issue D, 26 August 2020.
	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.
			2. Detailed instructions on package preparation including content limits, filling, closure, inspection, and leak tests are specified in Turn Round Maintenance Schedule, (see 2.2 above) and the Operating and Handling Instructions, (see 2.1 above).
	3. Supplementary Operational Controls
		* 1. The Shielded Flask must remain at a temperature not less than 5°C for a period of at least 4 hours prior to closure/leak testing and shall not be sealed if the ambient temperature is less than 5°C. The contents may be loaded during this 4-hour period.
	4. Range of Ambient Conditions for Package Design
		* 1. To compensate for the package design not meeting the requirements of IAEA SSR-6 paragraph 666, the use of the package is restricted to -20°C to +38°C.
	5. 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.
	6. Nonconformity with IAEA SSR-6 Paragraphs 639, 655–657 and 660–666
		* 1. The requirements of paragraphs 639 and 666 are not met; see paragraph 2.6 above.
	7. Requirements of IAEA SSR-6 Paragraph 634
		* 1. Not applicable.
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 Application for Type B(M)F Approval for Modular Flask DN3358W, Ref: 96281/DE/TR/001, Issue B, 20 October 2020 referred to in Section 1 above, and comprise the following:
* Magnox Company Organisational Manual M-001, Issue 12, 2 September 2019.
* Magnox Harwell and Winfrith Manual MAN0001, Issue 15, 14 December 2020.
* Magnox Standard Procedure Dangerous Goods (including Radioactive Materials) Transport S-142, Issue 8, 28 July 2021.
* Magnox Standard Procedure, Licensing / Approval of Radioactive Material Transport Packages S-075, Issue 3, 29 June 2020.
* Magnox Standard Procedure, Radioactive Materials Transport Emergency Arrangements S-463, Issue 5, 13 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

Related Approvals

* + - 1. Not applicable.
	1. Shipment Approval
		+ 1. Shipment approval is required for this package because it does not meet the requirements of para. 639 and 666 of IAEA SSR-6.
			2. Shipment approval for carriage into or through the United Kingdom is authorised by this certificate.
	2. Packaging Serial Numbers
		+ 1. This design approval applies only to packaging serial numbers specified in Serial No Identification of Components for Modular Flask, DN3358W 96281/DE/TR/002, Issue B, 26 August 2020, and subsequent formal notifications to the Competent Authority.
			2. 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.
	3. Additional Technical Data / Information
		+ 1. Not applicable.
1. CERTIFICATE STATUS
	1. Design approval issued to:

Magnox Limited

Winfrith Newburgh

Dorchester

Dorset

DT2 8WG

UK

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| --- | --- | --- | --- |
| **Issue / Revision Number** | **Date of Issue** | **Date of Expiry** | **Reason for Revision** |
| 0  | 30 September 2016  | End of September 2021  | First approval of this design variant to -96 Regulations  |
| 1  | 14 August 2018  | End of September 2021  | Modification design variant approval in accordance with paragraph 1.1 above  |
| 2  | 26 January 2022  | End of September 2026  | Re-approval for this package  |
| 3  | 26 January 2022  | End of September 2026  | Minor typographic errors in Rev. 2  |
| 4  | 09 November 2023  | End of October 2028  | Approval of Modification 008 (Extension to Allowable Contents)  |

Appendix 1 – package illustration



