



U.S. Department
of Transportation

Pipeline and
Hazardous Materials
Safety Administration

East Building, PHH-23
1200 New Jersey Ave, SE
Washington, D.C. 20590

**COMPETENT AUTHORITY CERTIFICATION FOR A
TYPE FISSILE
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0827/AF-96, REVISION 1**

**REVALIDATION OF GERMAN COMPETENT AUTHORITY
CERTIFICATE D/4377/AF-96**

The Competent Authority of the United States certifies that the radioactive material package design described in this certificate satisfies the regulatory requirements for a Type AF package as prescribed in the regulations of the International Atomic Energy Agency¹ and the United States of America² The package design is approved for use within the United States for import and export shipments made in accordance with applicable international and domestic transport regulations.

1. Package Identification - ANF-10.
2. Package Description and Authorized Radioactive Contents - as described in German Certificate of Competent Authority D/4377/AF-96, 1 (attached).
3. Criticality - The minimum criticality safety index is 7.2. The maximum number of packages per conveyance is determined in accordance with Table 11 of the IAEA regulations cited in this certificate.
4. General Conditions -
 - a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation. The user shall prepare the package for shipment in accordance with the documentation and applicable regulations.
 - b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Engineering and Research, (PHH-23), Pipeline and Hazardous

¹ "Regulations for the Safe Transport of Radioactive Material, 2012 Edition, No. SSR-6" published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

² Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

CERTIFICATE USA/0827/AF-96, REVISION 1

Materials Safety Administration, U.S. Department of
Transportation, Washington D.C. 20590-0001.

- c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.
 - d. Records of Management System activities required by Paragraph 306 of the IAEA regulations¹ shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors in the United States exporting shipments under this certificate shall satisfy the applicable requirements of Subpart H of 10 CFR 71.
5. Marking and Labeling - The package shall bear the marking USA/0827/AF-96 in addition to other required markings and labeling.
6. Expiration Date - This certificate expires on May 31, 2028. Previous editions which have not reached their expiration date may continue to be used.

This certificate is issued in accordance with paragraph(s) 816 of the IAEA Regulations and Section 173.472 and 173.473 of Title 49 of the Code of Federal Regulations, in response to the May 26, 2023 petition by Framatome Inc., Richland, WA, and in consideration of other information on file in this Office.

Certified By:



William Schoonover
Associate Administrator for Hazardous
Materials Safety

November 29, 2023
(DATE)

Revision 1 - Issued to revalidate German Certificate of Approval No. D/4377/AF-96, Rev. 1. German certificate was updated contents to include Framatome's BWR Type ATRIUM 11 fresh fuel.

Prüfung und Freigabe von Übersetzungen /
Examination and release of translations

Titel/Title:

Certificate of Approval

D/4377/AF-96 (Rev. 1)

**Übersetzung geprüft/
Translation verified:**

framatome

IMMKEN Helene
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H. Immken

Datum/Date

**Übersetzung freige-
geben/
Translation approved:**

**RAKEL
Wilfried**

Digital unterschrieben
von RAKEL Wilfried
Datum: 2023.05.26
07:59:21 +02'00'

W. Rakel

Datum/Date

Federal Office for the Safety of Nuclear Waste Management



Certificate of Approval

D/4377/AF-96 (Rev. 1)

for a transport package sample of Type A for fissionable radioactive materials

Based on the application of Advanced Nuclear Fuels GmbH, Lingen, dated 13 July 2021 (File Ref.: 864/21/BASE/HI), last amended 6 March 2023 (File Ref.: 950/23/BASE/HI), the container with manufacturer's designation "**Fuel assembly shipping container type ANF-10**" is approved as a type A transport package for fissionable radioactive materials according to the following regulations for transports by road, rail and sea:

Regulations for the Safe Transport of Radioactive Material, 2018 Edition, International Atomic Energy Agency (IAEA), No. SSR-6 (Rev. 1), Section 820,

Convention of 30 September 1957 concerning the International Carriage of Dangerous Goods by Road (ADR) (Federal Law Gazette 1969 II p. 1489), Annexes A and B as amended by the notice of 16 November 2021 (Federal Law Gazette 2021 II p. 1184), as last amended by the 29th ADR amendment ordinance dated 22 November 2022 (BGBl. 2022 II p. 601),

Convention concerning International Carriage by Rail (COTIF), Appendix C – Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) of 9 May 1980 (Federal Law Gazette 1985 II p. 296) as amended by the notice of 22 April 2022 (Federal Law Gazette 2022 II p. 279), last amended by the 23rd RID amendment ordinance dated 3 November 2022 (BGBl. 2022 II p. 555),

International Maritime Dangerous Goods Code (IMDG-Code), Amendment 41 22, published in the official German translation on 16 November 2022 (VkBl. 2022 p. 829),

Ordinance on the National and International Transport of Dangerous Goods by Road, Rail and Inland Waterways (Dangerous Goods Ordinance for Road, Rail and Inland Waterways - GGVSEB) in the version published on 26 March 2021 (BGBl. 2021 I p. 481), last amended by Article 28 of the Act of 2 March 2023 (BGBl. 2023 I No. 56)),

Ordinance governing the transport of dangerous goods by seagoing vessels (Dangerous Goods Ordinance, Maritime – GGVSee) as published on 21 October 2019 (BGBl. 2019 I p. 1475), last amended by Article 16 of the Law of 12 December 2019 (BGBl. 2019 I p. 2510),

In conjunction with the guidelines for the procedure for the construction type approval of transport packages for the transport of radioactive materials, of radioactive materials in a special configuration, of low dispersible radioactive materials and of exempted fissile materials (R003) as published on 17 September 2019 (VkBl. 2019 p. 618) and the BAM Dangerous Goods Regulation on quality assurance measures of package designs of transport packages requiring approval for the transport of radioactive materials (BAM-GGR 011 Rev. 1) dated 1 October 2018 (official information sheet of BAM, Volume 48, 3/2018 p. 109).

It is hereby confirmed that the Federal Office for the Safety of Nuclear Waste Management (BASE), is the authority authorised by the Federal Ministry of Transport and Digital Infrastructure pursuant to Section 7.9 of the IMDG Code.

Certificate holder: Advanced Nuclear Fuels GmbH
Am Seitenkanal 1
49811 Lingen, Germany

Documents:

1. Letter from Advanced Nuclear Fuels GmbH dated 13 July 2021 (File Ref.: 864/21/BASE/HI), 29 April 2022 (File Ref.: 908/22/BASE/HI), 21 December 2022 (File Ref.: 941/22/BASE/HI), 15 February 2023 (File Ref.: 946/23/BASE/HI), 21 February 2023 (File Ref.: 948/23/BASE/HI) and 6 March 2023 (File Ref.: 950/23/BASE/HI), with respective appendices
2. Safety analysis report of Advanced Nuclear Fuels GmbH No. ANFG-11.105 (06), Rev. 12, dated 1 March 2023
3. Test certificate by the Federal Institute for Material Research and Testing (BAM), Berlin, dated 31 January 2019 (File Ref.: 16018496) and BAM expert opinion dated 6 March 2023 (File Ref.: 3.3-22019708-GS)

With respect to the verification of criticality safety, we refer specifically to the reports ANFG-5.060 (086), Rev. 6 and ANF-1005393, Rev. 1, contained in the safety report.

Manufacturer's designation: Fuel assembly shipping container type ANF-10

Identification code of the package: D/4377/AF-96

Validity of approval: Up to and including 31st May 2028

Criticality Safety Index (CSI): 7.2

Permissible contents:

A maximum of two unirradiated fuel assemblies for boiling water reactors of the type ATRIUM™ 11 with, according to the definitions in ADR 2.2.7.1.3, unirradiated enriched uranium in accordance with the characterisation in Table 3 in Appendix 1. The fuel assemblies are each located in a fuel assembly channel and consist of fuel rods arranged in an 11 x 11 grid. A 3 x 3 fuel rod grid in the centre of the fuel element is replaced by a water channel. The fuel rods contain uranium oxide tablets and gadolinium oxide / uranium oxide tablets with an enrichment (mass content) of ²³⁵U of no more than 5%. The tablets are enclosed in zirconium alloy cladding tubes (e.g. Zry-2, Zry-2 liner, Zry-2-0.4 Fe liner or LTP-2) which are under an internal overpressure of max. 0.6 MPa at 25° C. The tablets are then placed in the zirconium alloy cladding tubes. The fuel assembly shall consist of full-length fuel rods with a maximum active length of 3900 mm and 20 partial-length fuel rods which shall be arranged as shown in the figure in Appendix 2. Furthermore, the conditions specified in Tables 1 and 2 in Appendix 1 shall be complied with. Fuel assemblies may contain gadolinium oxide fuel rods at any fuel rod positions, which can be equipped with Gd₂O₃-free end fittings of any length. All fuel assemblies may comprise zones comprising pellets of natural uranium dioxide or enriched uranium dioxide at both ends. The upper end zone of full-length fuel rods consisting of natural uranium dioxide or enriched uranium dioxide can be shorter. The fuel assembly channel has a square cross-section with a maximum internal width of 136 mm and is made of a zirconium alloy with a maximum wall thickness of 3.3 mm and a minimum wall thickness of 1.0 mm.

The plastic mass inside the inner protective boxes is not subject to any weight restrictions. All plastics up to a density of 1.04 g/cm³ with a maximum hydrogen mass fraction of 11.8% and a maximum carbon mass fraction of 73.0%, all plastics up to a density of 1.42 g/cm³ with a maximum hydrogen mass fraction of 7.3% and a maximum carbon mass fraction of 62.6% and polyethylene with a maximum density of 0.951 g/cm³ may be used. Polyethylene and other plastics must not be present in the active fuel assembly zone.

Type of packaging:

The design of the fuel assembly shipping container type ANF-10 fulfils the requirements for a package of type A for fissile radioactive material with regard to the mechanical and thermal properties according to the above mentioned test certificate and the above mentioned expert opinion of BAM and with regard to criticality safety and radiation shielding according to the examination by BASE (IAEA Regulations for the Safe Transport of Radioactive Material, 2012 Edition §§ 635 and 673).

In the criticality safety analysis, the penetration of water into all cavities/hollow spaces of the transport package was considered.

Description of the packaging:

The transport package sample consists of the following components: container bottom, container cover, head cover with two guide tubes and top-end adapters, two inner protective boxes with bottom-end adapters and the enclosure of the inner protective boxes with polyethylene and foam material. The container walls, the central divider in the container bottom, the container cover and the head cover, all of which form part of the outer protective enclosure, consist of multiple layers of aluminium honeycombs covered with aluminium sheeting and enclosed on all sides by austenitic steel plates. The inner protective boxes are made of boronised, austenitic sheet steel with a mass fraction of at least 0.8% boron in natural isotopic composition and have a wall thickness of at least 3 mm.

A schematic diagram of the package (drawing no. ANF-5-121-3075-03, Rev. 1) is attached as Appendix 3.

The containment system is formed by the fuel rod cladding tubes which are welded gas-tight.

The confinement system is formed by the container bottom, container cover, the head cover with the guide tubes and top-end adapters, the inner protective boxes with the bottom-end adapters and the fuel assemblies with the fuel channels.

The external dimensions are: Length approx. 4725 mm, width approx. 668 mm, height approx.

362 mm. Mass: packing (tare) max. 910 kg, package (gross) max. 1550 kg.

The packages identified by the relevant revisions of the Index of Drawings in Appendix 4 currently comply with this approval (see also supplementary condition no. 7).

Supplementary conditions and notes:

1. All quality assurance measures relating to planning, monitoring inspections and operation must be performed in accordance with the BAM dangerous goods regulation "Quality Assurance Measures of Packagings for Competent Authority Approved Package Designs of Transport Packages for the Transport of Radioactive Material" (BAM-GGR 011, Rev. 1).
2. The remanufacture of packing materials is only permissible in accordance with Index of Drawings 5-3 21-3100-04 with the highest revision index in Appendix 4, including the changes in accordance with supplementary condition no. 7.
3. This approval applies only in conjunction with the certificate of acceptance issued for the relevant series-production sample; this certificate shall be sent to the BAM (Federal Institute for Material Research and Testing) and BASE (Federal Office for Radiation Protection) unasked. Any deviations tolerated by the BAM in accordance with BAM-GGR 011, Rev. 1, and any changes as per Supplementary Condition no. 7 shall be documented in this certificate of acceptance. In the case of series-production samples already manufactured, the deviations tolerated by the BAM and the changes as per supplementary condition no. 7 shall be documented for the series-production sample in the inspection log book.
4. It must be ensured that each user of the packaging registers with the BASE before first-time use and confirms that he has received and complies with the inspection log book, which mainly contains the Certificate of Approval, the instructions for handling and maintenance and the instructions for in-service inspections. These are in particular:
 - Container instruction "Handling and maintenance of ANF10 BWR fuel assembly shipping containers" ANFG-11.101 (11), Rev. 8,
 - Container instruction "Recurring tests of ANF-10 fuel assembly shipping containers" ANFG-11.101 (12), Rev. 5.

Within the framework of this Approval, the use of documents with a higher revision index is only permissible after prior release by the BAM and with authorisation of the BASE.

5. Each series-production sample shall be subjected to in-service inspections in due time. For series-production samples that are to be used solely outside the Federal Republic of Germany, the in-service inspections can be performed and certificated by testing personnel authorised by the responsible authorities in the relevant country. The certificates for the recurring tests shall be forwarded to BAM without request from the organisation.
6. Each series-production sample must be provided permanently with the identification mark detailed above and with the date (month/year) of the next in-service inspection.
7. Changes relating to the Index of Drawings and the drawings listed therein, upon which the approval is based, require the consent of the BASE for the Revision Certificate or an extended type list (in accordance with Appendix 4) after their release by the BAM. Thus they become part of the present approval.
8. This approval does not relieve the sender from the obligation to comply with all statutory regulations of any country through which or in which the transport package is conveyed.

Costs:

1. On the basis of Section 12 (1) and (2) of the Act on the Transport of Dangerous Goods (Gefahrgutbeförderungsgesetz - GGBefG) of 6 August 1975, as last amended by Article 26 of the Act of 2 March 2023 (BGBl. 2023 I No. 56), in conjunction with Section 1 (2) of the Ordinance on Costs for Measures in the Transport of Dangerous Goods (GGKostV) of 11 March 2019 (BGBl. 2019 I p. 308), as last amended by Article 4 of the Ordinance of 11 March 2019 (BGBl. 2019 I p. 308) 2 of the Cost Ordinance for Measures in the Transport of Dangerous Goods (Dangerous Goods Cost Ordinance - GGKostV) of 11 March 2019 (BGBl. 2019 I p. 308), which was last amended by Article 4 of the Ordinance of 26 March 2021 (BGBl. 2021 I p. 475), costs - fees and expenses - shall be charged for this notice. Fees arise from Section 2 in connection with Appendix 2 of the GGKostV.
2. Pursuant to section 12 (1) of the GGBefG in conjunction with section 13 (1) no. 1 of the Administrative Costs Act of 23 June 1970 (BGBl. 1970 I p. 821), in the version of 5 December 2012 (BGBl. 2012 I p. 2415) applicable until 14 August 2013, the costs shall be borne by Advanced Nuclear Fuels GmbH.
3. The costs shall be determined by a separate decision.

Information about available legal remedies:

Objections may be lodged to the Federal Office for the Safety of Nuclear Waste Management in Berlin within one month of notification of this decision.

Salzgitter, dated 25. May 2023

By order

Dr. Holländer

Appendices

Appendix: Revision list

Appendix 1: Inventory
parameters

Appendix 2: Arrangement of full-length and partial-length fuel rods in ATRIUM™ 11 fuel assembly

Appendix 3: Data sheet FA shipping container Type ANF-10,
Drawing number ANF-5-121-3075-03, Rev. 1

Appendix 4: Type list

- Appendix to Certificate of Approval D/4377/AF-96 (Rev.

Rev. No.	Date of issue	Validity	Reason for revision
0	2019-03-21	2024-03-21	First registration
1	25.05.2023	31.05.2028	Addition of permissible modes of transport, adjustments due to changes in legal provisions (citations of regulations, costs), consideration of new or revised documents, removal of previously permissible content and addition of new content, updating of ancillary provisions

Table 1: Geometry data of the fuel assemblies

Type of fuel assembly		ATRIUM™ 11
Number of fuel rods	in total	112
Number of full-length fuel rods		92
Number of partial-length fuel rods (short)		12
Number of partial-length fuel rods (long)		8
Active length of full-length fuel rods	maximum	3900 mm
Active length L_1 of partial-length fuel rods (long)	maximum	3000 mm
Active length L_2 of partial-length fuel rods (short)	maximum	2000 mm
Ratio of active lengths of partial-length fuel rods		$L_1 \geq L_2 + 500$ mm
Distance between fuel rod centres		variable 11.41 mm – 12.75 mm
Diameter of uranium oxide pellets	maximum	8.20 mm
Cladding tube outside diameter	minimum	9.30 mm

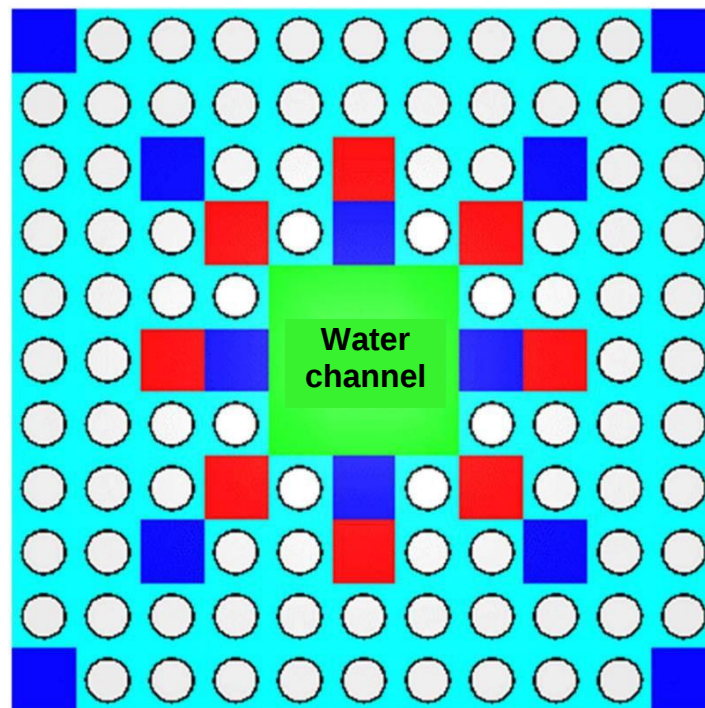
Table 2: Fuel data and overall mass of the fuel assemblies

Type of fuel assembly		ATRIUM™ 11
Enrichment (mass content) of ^{235}U in uranium	maximum	5.00%
Pellet density	maximum	10.96 g/cm ³
Overall mass per fuel assembly incl. structure material	maximum	320 kg
Uranium mass per fuel assembly	maximum	236 kg
^{235}U mass per fuel assembly	maximum	11.8 kg

Table 3: Characterisation of the permissible fuel, which is unirradiated according to the terminology in ADR 2.2.7.1.3

Nuclide	Mass fraction of uranium nuclides maximum	Activity per gram of uranium maximum	Mass of the uranium nuclides per transport package maximum
	in %	in Bq	in g
U-232	1.00×10^{-8}	8.27×10^1	4.72×10^{-5}
U-234	5.50×10^{-2}	1.27×10^5	2.60×10^2
U-235	5.00	4.00×10^3	2.36×10^4
U-236	2.50×10^{-2}	5.98×10^2	1.18×10^2
U-238¹⁾	≥ 94.92	$\geq 1.18 \times 10^4$	$\geq 4.48 \times 10^5$
Fission nuclide Ce-144		9.07×10^3	
Fission nuclide Tc-99		6.36×10^0	
Transuranic elements		1.00×10^2	

¹⁾ The maximum fraction depends on the actual composition of the uranium and can be up to 100%.



Legend

-  Full-length fuel rod
-  Partial-length fuel rod (short)
-  Partial-length fuel rod (long)

Arrangement of full-length and partial-length fuel rods in ATRIUM™ 11 fuel assembly

Type list
for ANF-10 fuel assembly shipping container

Type ANF-10 shipping containers, which shall be or have been manufactured in accordance with the following Index of Drawings, conform to the model type specified in this Certificate of Approval (see also supplementary conditions 2, 3 and 7).

Index of Drawings - Revision	Release by BAM
5-3 21-3100-04, Rev. 29	Test certificate of BAM (File Ref.: 16018496) dated 31.01.2019
5-3 21-3100-04, Rev. 33	Letter of BAM (File Ref.: 3.3/190013172019/Ku/11) dated 20.12.2019
5-3 21-3100-04, Rev. 39	Expert opinion of BAM (File Ref.: 3.3-22019708-GS) dated 06.03.2023

Salzgitter, dated 25. May 2023

By order

Dr. Holländer



U.S. Department of
Transportation

**Pipeline and
Hazardous Materials
Safety Administration**

East Building, PHH-23
1200 New Jersey Ave, SE
Washington, D.C. 20590

CERTIFICATE NUMBER: USA/0827/AF-96

ORIGINAL REGISTRANT(S) :

RSB Logistic, Inc.
219 Cardinal Crescent
Saskatoon, Saskatoon, S7L 7K8
CANADA

TN Americas LLC
Orano TN
7160 Riverwood Drive
Suite 200
Columbia, MD, 21046
USA

Framatome Inc.
2101 Horn Rapids Road
Richland, WA, 99354
USA

RSB International
RSB INTERNATIONAL Freight Forwarding Inc.
1000 Rue De La Gauchetière O
Suite 900
Montréal, Quebec, QC H3B 5H4
Canada