3RC FORM 618 (8-2000) 10 CFR 71			U.S. NUCLEAR REGULATORY COMMISSION		
CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES					
1 a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9362	5	71-9362	USA/9362/AF-96	1 OF	3

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. 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

a. ISSUED TO *(Name and Address)*

Orano NCS GmbH
Margarete-von-Wrangell-Straße 7
D-63457 Hanau – GERMANY

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Safety Analysis Report of the DN30 Package
0023-BSH-2016-002-Rev. 3.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

(1) Model No.: DN30

(2) Description

The DN30 packaging consists of the protective structural packaging (PSP) and the 30B uranium hexafluoride (UF_6) cylinder as specified in ANSI N14.1.

The DN30 PSP is a right circular cylinder constructed of two austenitic stainless steel shells: (i) the bottom half with integrated feet, a valve protecting device, a plug protecting device, two rotation preventing devices, lower part of the closure system (consisting of six devices), and handling attachment points, and (ii) the top half with the upper part of the closure system and integrated handling attachment points for the top half .

For both the bottom and top halves of the PSP, the cavity between the inner and outer shells and the flange is filled with a polyisocyanurate rigid (PIR) foam with a layer of 10 mm thermal insulation between the inner shell and the foam. All the surfaces of the inner shell of both the top and bottom halves are covered with a layer of intumescent material.

The valve protecting device, enclosing the valve of the 30B cylinder, and connected to the bottom half of the DN30 PSP by two hinges, consists of a casing of stainless steel filled with PIR foam.

5.(a) Packaging (continued)

The two rotation protecting devices, welded at the sides of the inner flange of the bottom half of the PSP, are identical and consist of a pin, withdrawn into the flange during loading, and inserted, during transport, into the two holes in the skirt of the 30B cylinder.

The plug protecting device is welded to the inner shell of the bottom half of the PSP and allows the plug to move in the axial direction without making contact with any part of the PSP.

An elastomeric gasket, installed in the flange of the top half, prevents water inleakage during normal conditions of transport.

The PSP has a nominal length of 2,437 mm, a nominal external diameter of 1,216 mm, and a nominal height of 1,329 mm. The nominal gross weight of the package is 4,012 kg.

The 30B Cylinder, described in ANSI N14.1, is 2,070 mm long with a nominal diameter of 760 mm and a nominal wall thickness of 13 mm.

(3) Drawings

The Model No. DN30 packaging is fabricated in accordance with

Drawing No. 0023-ZFZ-1000-000, Rev. 3 – DN30 PSP
Drawing No. 0023-ZFZ-1000-100, Rev. 0 – Closure Device
Drawing No. 0023-ZFZ-1100-000, Rev. 5 – Bottom Half
Drawing No. 0023-ZFZ-1200-000, Rev. 3 – Top Half
Drawing No. 0023-ZFZ-1120-400, Rev. 0 – Rotation Preventing Device
Drawing No. 0023-ZFZ-1140-000, Rev. 4 – Valve Protecting Device
Part List No. 0023-STL-1000-000, Rev. 9

(b) Contents

(1) Type and form of material

Unirradiated commercial grade uranium, in the form of UF_6, with natural isotopic composition, and a U-235 mass percentage not to exceed 5 weight percent.

(2) Maximum quantity of material per package

2,277 kg UF_6 contained in an ANSI Standard N14.1 30B cylinder.
The maximum H/U atomic ratio for UF_6 is 0.088.

(c) Criticality Safety Index (CSI) 0.0

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

(a) The package shall be prepared for shipment and operated in accordance with the Operating Procedures of Chapter 1.7 of the application.

(b) Each packaging must meet the Acceptance Tests and Maintenance Program of Chapter 1.8 of the application.

(c) Packagings in which stainless steel components show pitting, corrosion, cracking, or pinholes are not authorized for transport.

7. The 30-inch diameter UF_6 cylinder valve and plug threads may be tinned with ASTM B32, alloy 50A or Sn50 solder material, or a mixture of alloy 50A or Sn50 with alloy 40A or Sn40A material, provided the mixture has a minimum tin content of 45 percent.

8. Transport by air is not authorized.

9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

10. Expiration date: June 30, 2029.

REFERENCES

Safety Analysis Report of the DN30 Package, 0023-BSH-2016-002- Rev.3.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Signed by Diaz-Sanabria, Yoira
on 06/11/24

Yoira Diaz-Sanabria, Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: June 11, 2024

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT
Docket No. 71-9362
Model No. DN30 Package
Certificate of Compliance No. 9362
Revision No. 5

SUMMARY

By letter dated April 3, 2024 (Agencywide Documents Access and Management System Accession No. ML24094A002), Orano NCS GmbH submitted an amendment request for the Model No. DN30 package.

Changes were made to the design of the packaging to remove the housing from the valve protecting device because the housing was at risk of coming in contact with the valve depending on the drop test orientation. The applicant provided updated admissible temperatures of the 30B cylinder and of the contents for hypothetical accident conditions (HAC) of transport. The applicant provided detailed calculations for these admissible temperatures and updated the Safety Analysis Report (SAR) accordingly due to the removal of the housing.

By letter dated May 15, 2024, Orano NCS also requested timely renewal of the certificate USA/9362/AF-96 (ML24142A001) and provided the final version of the SAR -0023-BSH-2016-002, Rev. 3, as well as a revised thermal analysis (ML24137A158, non-public), revised versions of the DN30 handling instructions “Use and Handling of the DN30 Package” appendix 1.7.1: 0023-HA-2015-001-Rev. 12, Test Instruction “ Contamination and Dose Rate Measurements of the DN30 package with commercial grade UF_6 contents” appendix 1.7.2: 0023-PA-2024-001-Rev 0 and Test Instruction “Periodical Inspections of the DN30 PSP” appendix 1.8.1: 0023-PA-2015-015-Rev. 6.

The certificate was revised to reflect the modified design, updated licensing drawings and operating procedures, the reference to the 2023 American National Standards Institute (ANSI) N14.1 and 2020 International Organizations for Standardization (ISO) 7195 editions of the standards, including the use of previous editions of the standards at the time of fabrication and/or inspection of the 30B cylinders. The certificate also reflects the new expiration date of June 30, 2029.

Based on the statements and representations in the application, and the conditions listed in the CoC, the U.S. Nuclear Regulatory Commission staff (the staff) concludes that the package meets the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

1.0 GENERAL INFORMATION

The Model No. DN30 packaging is fabricated in accordance with the following drawings:

Drawing No. 0023-ZFZ-1000-000, Rev. 3 – DN30 PSP
Drawing No. 0023-ZFZ-1000-100, Rev. 0 – Closure Device
Drawing No. 0023-ZFZ-1100-000, Rev. 5 – Bottom Half
Drawing No. 0023-ZFZ-1200-000, Rev. 3 – Top Half
Drawing No. 0023-ZFZ-1120-400, Rev. 0 – Rotation Preventing Device
Drawing No. 0023-ZFZ-1140-000, Rev. 4 – Valve Protecting Device
Part List No. 0023-STL-1000-000, Rev. 9

2.0 STRUCTURAL SAFETY EVALUATION

The applicant, Orano NCS GmbH, submitted an application for a design change of the DN30 package.

The proposed design change is to remove the housing of the valve protecting device from the design of the DN30 package to improve its structural safety.

The applicant submitted a revised safety analysis report (SAR) to the U.S. Nuclear Regulatory Commission (NRC) for review and evaluation. The objective of the structural safety evaluation in this safety evaluation report section 2.0 is to verify that the structural performance of the package meets the regulatory requirements of 10 CFR Part 71.

2.1 Background Information for the DN30 Structural Design

The DN30 is a Type AF package and consists of the DN30 protective structural packaging (PSP) that houses the 30B cylinder (containment boundary), which is designed to carry uranium hexafluoride (UF_6).

The PSP has a clam shell design that utilizes a mortise-and-tenon closure system located on the exterior portion of the PSP. The PSP portion of the package has a stainless-steel support structure which is used to tie down the package to a conveyance via bolts during transportation. The PSP portion of the package has both an outer and inner shell which is separated by an impact absorbing foam and fire-retardant material.

At the inside of the PSP, there is a valve protecting device (VPD) attached by hinges to the PSP. The VPD is shaped like a “U” and surrounds the valve of the 30B cylinder during transport. The main function of the VPD is to prevent contact of the valve with any part of the PSP or any other part of the 30B cylinder under normal conditions of transport (NCT) and HAC.

In addition, the VPD has a design feature of a housing that can be inserted into the VPD. The housing is shaped like a “box” and is made of 0.04 inch (1 mm) thick stainless-steel sheet. It is designed to provide support for placing the intumescent material and improve the thermal conditions in the VPD during the thermal tests.

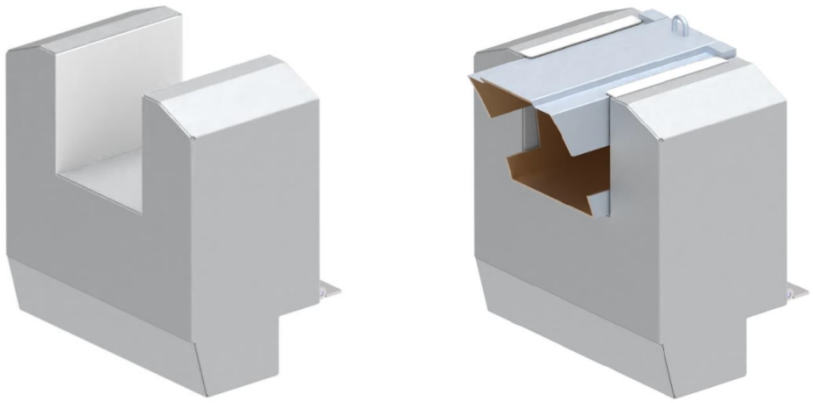
The VPD with and without the housing is shown in Figure 2.1.

2.2 Proposed Design Change - Removal of the Housing of the Valve Protecting Device

The applicant stated that the VPD did not use the housing during the structural drop tests presented in the SAR, Rev. 1, which were previously reviewed and accepted by the NRC staff. However, during the second (September 2016) and third (November 2017) experimental thermal tests after the drop tests, the housing was placed into the VPD. The housing was covered on the inside with intumescent material with the intent of improving thermal safety conditions to prevent hot gases from reaching the valve during the thermal tests.

However, the applicant found that the microporous insulation layer added to the PSP design during the third and final experimental thermal test was efficient regarding the thermal protection of the 30B cylinder and, as a result, the housing of the VPD was not needed to improve thermal safety conditions.

Therefore, the applicant decided to remove the housing of the VPD from the PSP and proposed the design change of removing the housing in this application.



(a) **(b)**

Figure 2.1. (a) Valve Protecting Device (VPD) without Housing, and (b) VPD with Housing

2.3 Structural Evaluation for Removal of the Housing of the Valve Protecting Device

The applicant stated in appendix 2.2.1.3, “Structural Analysis of the DN30 Package under NCT and HAC,” of the SAR that the housing of the VPD was not used during the previous structural drop tests. The housing of the VPD was only used during the second and third experimental thermal tests. Therefore, there are no changes in the results of the structural drop tests by the removal of the housing of the VPD.

Additionally, the applicant stated that there are no changes in the results of the previous structural analyses using the ANSYS and LS-DYNA finite element (FE) computer programs. The applicant indicated that, since the previous structural analyses presented in the SAR, Rev. 1, which were reviewed and accepted by the NRC staff, did not take into account the housing of the VPD in the FE model, there are no additional structural analyses required. Therefore, the

applicant concluded that the structural analyses presented in appendix 2.2.1.3 of the SAR, Rev. 2, is still completely applicable to the DN30 package without the housing of the VPD.

The NRC staff reviewed the licensing drawings with tolerances and dimensions, component descriptions, and arrangement of the components relative to each other. Additionally, the NRC staff reviewed the results of the model tests and structural FE analyses. Based on these reviews, the NRC staff confirmed that the applicant's statements are accurate and agreed with its conclusion that the removal of the housing from the VPD does not affect the structural performance of the DN30 package under NCT and HAC.

Therefore, the NRC staff determined that the applicant's proposed design change of the removal of the housing from the VPD is acceptable and concludes that the DN30 package without the housing of the VPD will perform its intended structural functions under NCT and HAC.

2.4 Conclusion for Safety Evaluation

The NRC staff reviewed and evaluated the applicant's statements and representations in the application. Based on the review and evaluations, the NRC staff concludes that the DN30 transportation package is adequately analyzed and evaluated to demonstrate that its structural capability and integrity meet the regulatory requirements of 10 CFR Part 71.

3.0 THERMAL EVALUATION

The objective of this review is to verify that the thermal performance of the changes to the package design has been adequately evaluated for the thermal tests specified under NCT and HAC, and that the package design meets the thermal performance requirements of 10 CFR Part 71.

3.1 Changes in the DN30 Thermal Design

The thermal design changes in this amendment that the staff reviewed included:

- the change in the HAC temperature limit to 183 degrees Celsius (°C), also referred to as the admissible component temperature, for the containment system (30B cylinder, valve, and plug),

- the additional justification for the contents (air, UF_6, or mixture of both) HAC temperature limit (admissible temperature) of 131°C, and

- the removal of the housing of the DN30 PSP valve protective device because the housing was at risk of coming in contact with the valve depending on the drop test orientation.

3.2 Change in the Containment System HAC Temperature Limit

The applicant described in section 2.1.2.2 of the SAR that the temperature of the 30B cylinder, including the valve, plug, and shell, should not exceed 183°C during the HAC thermal test. The applicant provided justification for this change in section 2.1.4.2.6.2 of the SAR such that the design reduces the maximum temperature of the valve and the plug to be below the solidus

temperature of the thread tinning (183°C) and the HAC temperature limit (also 183°C) for the 30B cylinder and its components.

The applicant further described in section 2.2.2.1.4 of the SAR that this temperature limit is based on the thermal properties of the materials as further described in section 3.5.1 of appendix 2.2.2.3 (Thermal Analysis), rev 4. The staff reviewed the descriptions in the aforementioned sections of the SAR and appendix 2.2.2.3, rev 4 and finds this justification for the maximum allowable temperature of the 30B cylinder, valve, and plug to be acceptable.

3.3 Additional Justification for the Contents HAC Temperature Limit

The applicant described in section 2.1.2.2 of the SAR that the temperature of the 30B cylinder contents should not exceed 131°C during the HAC thermal test. The applicant further descried in section 2.2.2.1.4 of the SAR that this value is calculated considering a possible pressure build-up of melted UF_6 contents and provided additional detailed calculations in section 9.7 of appendix 2.2.2.3, rev 4.

The applicant also addressed in section 2.2.2.3.5.2 of the SAR the pressure build-up within the 30B cylinder that is based on the conservatively calculated HAC content temperature of 126°C, which is below the 131°C admissible temperature limit. The applicant described that this calculated temperature is conservative because only the outer edge of the contents reaches that temperature, and the average temperature of the contents is much lower.

The applicant also described that for a completely filled 30B cylinder (when the maximum pressure build-up would be expected), the maximum temperature is slightly lower (120°C), so the actual pressure build-up would be lower. The calculations for the maximum pressure and safety margin based on the required wall thickness for the 30B cylinder and dished heads are further described in section 9.7 of appendix 2.2.2.3, rev 4.

The staff reviewed the descriptions in the aforementioned sections of the SAR and also verified the calculations in section 9.7 of appendix 2.2.2.3, rev 4 and finds the justification provided for the maximum allowable temperature of the 30B cylinder air / UF_6 contents during HAC to be acceptable.

3.4 Removal of the Housing of the DN30 PSP Cylinder Valve Protective Device

The applicant described in section 2.1.4.2.8.1 of the SAR that the DN30 PSP cylinder valve protective device housing (a box-shape made of 1-mm thick stainless steel covered internally with intumescent material) that was used in the mechanical tests and thermal tests was removed from the design because it provides no significant thermal safety benefit.

The applicant further described that while the housing was designed to keep hot gases from reaching the valve, the microporous insulation layer that has been part of the DN30 PSP design for the third (and successful) experimental thermal test provides sufficient thermal protection, and therefore the housing was no longer necessary.

The applicant summarized in section 2.1.4.2.8.3.2 of the SAR the technical basis for the removal of the housing for the valve protective device and provided additional description in section 11 of appendix 2.2.2.3, rev 4. The applicant summarized that based on the “Benchmark 1” fire test conducted in November 2017 (which was also the last of the three

experimental fire tests) that included the housing and intumescent material, the maximum temperature of the valve, which was covered by the housing in the experimental thermal test, and the maximum temperature of nearby sensors that were not covered by the housing did not have a significant temperature difference (3°C).

The applicant noted that the heat transfer is dominated by conduction through the 30B cylinder mantle during the post-fire cool down phase (not through conduction through the housing or thermal radiation across the air gap), which is the phase that the maximum temperature of the valve is reached; this indicates that the housing is not necessary to reduce the valve temperature. The applicant also noted that intumescent material within the housing had not increased in volume, which also indicates that the housing is not necessary to reduce the valve temperature.

Also, the applicant provided in section 11.2.3 of appendix 2.2.2.3, rev 4, an evaluation description for applying the maximum HAC plug temperature (144°C) during the Benchmark 1 fire test to the valve, with reasons for why that was conservative, and showed that there was still margin (39°C) to the containment system HAC temperature limit (183°C).

The applicant further summarized in section 2.1.4.2.8.3.2 of the SAR, while also providing additional description in section 11 of appendix 2.2.2.3, rev 4, that the housing was not necessary based on the thermal test through confirmatory calculations that show that there was not a significant increase in valve temperature (2°C) when conservative thermal modeling assumptions were used. The conservative thermal modeling assumptions, further described in section 11.3 of appendix 2.2.2.3, rev 4, included modeling the heat transfer mechanisms of the DN30 and 30B cylinder valve side to meet or exceed that of the plug side. With the conservative modeling assumptions, the applicant showed that radiation was the dominant heat transfer mechanism resulting in a small temperature increase, and an additional sensitivity study on the conduction of the air gap, also showed that the temperature increase of the valve was minimal.

In addition, the applicant removed some of the inner shell intumescent material from the valve side of the thermal model. The applicant summarized in both section 2.1.4.2.8.3.2 of the SAR and in section 11.3 of appendix 2.2.2.3, rev 4, that the valve temperature (124°C) is significantly below the HAC temperature limit (183°C), there is no risk of exceeding the HAC temperature limit of the contents (131°C).

The staff reviewed the valve protecting device, Drawing No. 0023-ZFZ-1140-000 rev. 4, to verify that the box-shaped housing was removed. The staff finds that because the housing was designed to keep hot gases from reaching the valve, and there are no hot gases during routine conditions of transport and NCT, it is acceptable to remove the housing for NCT. The staff also finds, based on its review of the applicant's evaluations described in this section of the SER, that it is acceptable to remove the housing for HAC.

3.5 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the thermal design changes have been adequately described and evaluated, and that the thermal performance of the package meets the thermal requirements of 10 CFR Part 71.

7.0 OPERATING PROCEDURES

The applicant has edited the operating procedures, namely the instruction 0023-PA-2024-001 which now deals exclusively with commercial grade UF_6 and is the document that referenced in the SAR for the Model No. DN30. The “Use and Handling” instruction has been revised to include this new test instruction. Modifications were also made due to the removal of housing in the packaging design and the tightening torque of bolts used for tie-down was adjusted to cover the option that DN30 packages are mounted laterally on flat racks.

Modifications were made in the test instructions in accordance with the as low as is reasonably achievable principle, namely a reduced number of measurement points at the package itself (to be in accordance with proven procedures from another 30B cylinder overpack design), and a methodology for a direct application of measurements at the package for the dose rates at the transport vehicle.

Modifications were also made for the periodical Inspections of the DN30 PSP and DIN 1593 is the standard for soap bubble testing.

Apart from the 2023 updated ANSI standard, the changes mainly concern valve installation and specification. None of the changes was related to dimensions, requirements, or materials for the 30B cylinder, and accordingly none of them impacted the DN30 SAR.

8.0 FABRICATION AND MAINTENANCE

Clarifications were done in several sections of the application to allow for the deletion of the previous Condition No. 6 of the previous CoC regarding ANSI N14.1 2012 edition.

The SAR refers to the 2023 edition of ANSI N14.1 and the 2020 edition of ISO 7195. In particular, the reference to “any previous editions of these standards” was removed in SAR section 1.4.1.1 (Packaging Specification) since this section only covers general compliance; the 30B cylinders permissible for the transport in DN30 PSPs are in full compliance with ANSI N14.1 2023 edition and ISO 7195 2020 edition in section 1.4.2.1 (Packaging description) of the SAR. Regarding manufacturing, the 30B cylinders transported in DN30 PSPs can be manufactured according to earlier versions of these standards in effect at the time of fabrication.

In addition, the 30B cylinder as the containment system is manufactured and tested before its first use to comply with ANSI N14.1 and ISO 7195 (or earlier versions in effect at the time of fabrication) in section 1.6.2 of the SAR.

Likewise, the 5-year inspection of the 30B cylinder shall be performed in accordance with ANSI N14.1 2023 edition or ISO 7195 2020 edition (or earlier versions in effect at the time of inspection) in section 1.8.2 of the SAR.

Also, the fabrication of 30B cylinders is specified in ANSI N14.1 2023 edition and ISO 7195 2020 edition while older 30B cylinders must have been manufactured in compliance with earlier versions of these standards in effect at the time of fabrication, per section 1.9.2.1 of the SAR

CONDITIONS

Item No. 1.b, “Revision Number,” was updated to Revision No. 5.

Item No. 3(b) was modified to include the latest revision of the application, Revision No. 3

Condition No. 5(a)(3) was revised to include the latest revisions of the licensing drawings.

Condition No. 6 was deleted. The references to ANSI N14.1 (2023 edition) and ISO 7195 (2020 edition) are in the application and references to ANSI N14.1 and ISO 7195 were removed from Condition No. 6.

Condition No. 10 (previously No. 11) extends the validity of the certificate to June 30, 2029.

The references section of the certificate was updated to include the SAR, Revision No. 3

CONCLUSION

Based on the statements and representations contained in the application, and the conditions listed above, the staff concludes that the design has been adequately described and evaluated, and the Model No. DN30 package meet the requirements of 10 CFR Part 71.

Issued with CoC No. 9362, Revision No. 5.