

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

¹ a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9388	1	71-9388	USA/9388/AF-96	1 OF	5

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

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| a. ISSUED TO (<i>Name and Address</i>)
Orano NCS GmbH
Margarete-von-Wrangell-Straße 7
D-63457 Hanau – GERMANY | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
Safety Analysis Report for the DN30-X Package
0045-BSH-2020-001-Rev.5, dated July 10, 2025. |
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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-X
- (2) Description

The DN30-X packaging consists of the DN30 protective structural packaging (PSP) and the 30B-X uranium hexafluoride (UF₆) cylinder.

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.

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5.(a) Packaging (continued)

The valve protecting device, enclosing the valve of the 30B-X 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.

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-X 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 in leakage 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-X Cylinder contains an interior criticality control system (CCS) that consists of criticality control rods (CCRs), filled with neutron poison material in the form of boron carbide (B_4C), and lattice holders to keep each CCR in place. Longitudinal stiffeners between the lattice holders help to keep the lattice holders separated from each other. The length of the CCRs is fitted to the elliptical heads of the 30B-X cylinder. The two CCRs that end in front of the valve are shortened by 40 mm to facilitate filling and emptying of the cylinder.

The 30B-10 cylinder (with a maximum enrichment of 10 wt.% ^{235}U) includes 33 CCRs while the 30B-20 cylinder (with a maximum enrichment of 20 wt.% ^{235}U) includes 43 CCRs. Apart from the B_4C filling, the CCS is made of carbon steel for low-temperature service, like the pressure envelope of the cylinder.

Both cylinders have a nominal length of 2,070 mm, a nominal diameter of 762 mm, a nominal wall thickness of 13 mm, and an identical nominal gross weight of 2,912 kg: the 30B-10 has a nominal tare weight of 1,452 kg and the 30B-20 has a nominal tare weight of 1,641 kg.

(3) Drawings

The DN30 PSP is fabricated in accordance with:

Drawing No. 0023-ZFZ-1000-000, Rev. 3 – DN30 PSP

Drawing No. 0023-ZFZ-1000-003, Rev. 0 – Additional Package Nameplate

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

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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 – Part List DN30 PSP

The 30B-10 Cylinder is fabricated in accordance with:

Drawing No. 0045-ZFZ-1000-000, Rev. 4 – 30B-10 Cylinder

Drawing No. 0045-ZFZ-1100-000, Rev. 3 – 30B Cylinder Modified

Drawing No. 0045-ZFZ-1200-000, Rev. 4 – CCS

Parts List No. 0045-STL-1000-000, Rev. 7 – 30B-10 Cylinder – Parts List

5(a)(3) Drawings (Continued)

The 30B-20 Cylinder is fabricated in accordance with:

Drawing No. 0045-ZFZ-2000-000, Rev. 3 – 30B-20 Cylinder

Drawing No. 0045-ZFZ-1100-000, Rev. 3 – 30B Cylinder Modified

Drawing No. 0045-ZFZ-2200-000, Rev. 3 – CCS

Parts List No. 0045-STL-2000-000, Rev. 4 – 30B-20 Cylinder – Parts List

(b) Contents

(1) Type and form of material

HALEU 10 and HALEU 20 shall be enriched from commercial natural UF₆ and comply with the isotopic limits below. The isotopic composition shall not exceed a Type A quantity.

Isotopic limits of UF₆ HALEU 10 and HALEU 20
Maximal concentration in wt.-% in uranium

Nuclide	HALEU 10	HALEU 20
²³² U	3x10 ⁻⁸	7x10 ⁻⁸
²³⁴ U	1.2x10 ⁻¹	2.6x10 ⁻¹
²³⁵ U	10	20
²³⁶ U	5x10 ⁻²	10 ⁻¹
²³⁸ U	balance	balance
⁹⁹ Tc	10 ⁻⁶	10 ⁻⁶

(2) Maximum quantity of material per package

Package	Enrichment limit wt% ²³⁵ U	Mass UF ₆ (kg)	Fissile material (kg)	Maximum heel quantity (kg)
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DN30-10	10	1460	98	11.3
DN30-20	20	1271	170	11.3

The maximum H/U atomic ratio for UF₆ is 0.088.

- (3) The UF₆ concentration shall not be less than 99.5g UF₆ per 100 g of sample to limit hydrogen content. The total hydrocarbon, chlorocarbon, and partially substituted halohydrocarbon content shall not exceed 0.01 mole % of UF₆. Total absolute vapor pressure of content shall not exceed UF₆ industry standard values to prevent overpressure when heating.
- (4) Decay heat shall not exceed 3 W.
- (c) Criticality Safety Index (CSI): 0.0
6. The 30B-X cylinder must be fabricated in accordance with Section VIII, Division I, of the ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code and be ASME Code stamped.
7. 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.
8. The 30-inch diameter UF₆ 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.
9. Transport by air is not authorized.
10. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
11. Expiration date: August 31, 2030.

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REFERENCES

Safety Analysis Report for the DN30-X Package, 0045-BSH-2020-001 Rev. 5, dated July 2025.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Haimanot

Yilma, Haimanot signing on behalf
of Diaz-Sanabria, Yaira
on 08/27/25

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

Date: August 27, 2025



SAFETY EVALUATION REPORT
Docket No. 71-9388
Model No. DN30-X Package
Certificate of Compliance No. 9388
Revision No. 1

SUMMARY

By letter dated March 25, 2025 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML25119A147), Orano NCS GmbH (Orano or the applicant) submitted an application for approval of the Safety Analysis Report (SAR), revision no. 4, for the Model No. DN30-X package, incorporating changes to Certificate of Compliance (CoC) No. 9388 to remove the housing of the valve protecting device (VPD) from the design of the DN30 protective structural packaging (PSP), in addition to design changes to the 30B-X cylinder resulting from manufacturing of and tests with 30B-10 prototypes. Orano also requested renewal of the certificate USA/9388/AF-96. The U.S. Nuclear Regulatory Commission (NRC) staff performed an acceptance review of the application, and on June 6, 2025, the application was accepted for a detailed review (ML25168A217).

On June 23, 2025, a teleconference call was held between the NRC staff and Orano representatives to discuss the status of the revisions of Orano's Quality Assurance Program Description (QAPD) (ML25188A252). On July 10, 2025, Orano NCS GmbH submitted revision no. 5 of the SAR (ML25191A119) removing the QAPD as an appendix.

The Model No. DN30-X package was evaluated against the regulatory standards in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71, including the general standards for all packages and the performance standards specific to fissile material packages under normal conditions of transport (NCT) and hypothetical accident conditions (HAC). This review also considered whether the package is consistent with the acceptance criteria of NUREG-2216, "Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material."

The certificate was revised to reflect the modified design, updated licensing drawings and operating procedures. The certificate also reflects the new expiration date of August 31, 2030.

Based on the statements and representations in the application, and the conditions listed in the CoC, the staff concludes that the package meets the requirements of 10 CFR Part 71.

EVALUATION

1.0 GENERAL INFORMATION

The Model No. DN30-X package consists of the DN30 PSP, approved under Docket No. 71-9362 for the Model No. DN30 package, and the 30B-X cylinder. The "X" in DN30-X and 30B-X is either replaced by "10" or by "20" to refer to a specific design for a maximum enrichment of 10 or 20 percent by weight (wt.%) uranium-235 (²³⁵U), respectively.

The applicant proposed a design change to the DN30 PSP for removing the housing of the VPD attached to the PSP, in addition to design changes to the 30B-X cylinder resulting from manufacturing of and tests with 30B-10 prototypes. Material changes proposed are discussed in more detail in chapter 7 of this safety evaluation report (SER).

The DN30 PSP is fabricated in accordance with:

Drawing No. 0023-ZFZ-1000-000, Rev. 3 – DN30 PSP
Drawing No. 0023-ZFZ-1000-003, Rev. 0 – Additional Package Nameplate
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 – Part List DN30 PSP

The 30B-10 Cylinder is fabricated in accordance with:

Drawing No. 0045-ZFZ-1000-000, Rev. 4 – 30B-10 Cylinder
Drawing No. 0045-ZFZ-1100-000, Rev. 3 – 30B Cylinder Modified
Drawing No. 0045-ZFZ-1200-000, Rev. 4 – CCS
Parts List No. 0045-STL-1000-000, Rev. 7 – 30B-10 Cylinder – Parts List

The 30B-20 Cylinder is fabricated in accordance with:

Drawing No. 0045-ZFZ-2000-000, Rev. 3 – 30B-20 Cylinder
Drawing No. 0045-ZFZ-1100-000, Rev. 3 – 30B Cylinder Modified
Drawing No. 0045-ZFZ-2200-000, Rev. 3 – CCS
Parts List No. 0045-STL-2000-000, Rev. 4 – 30B-20 Cylinder – Parts List

The applicant stated in section 1.6.2.4 of the SAR that the 30B-X cylinder is designed, fabricated, inspected, tested and marked with regard to the requirements for standard 30B cylinders in American National Standards Institute (ANSI) N14.1. The applicant is working on a formal inclusion of the 30B-X cylinder in ANSI N14.1.

The applicant demonstrated that an infinite array of DN30-X packages, containing either a 30B-10 or 30B-20 UF₆ cylinder, will remain subcritical under NCT and HAC. The corresponding Criticality Safety Index of the package is 0.

The staff concludes that the information presented in this section of the application provides an adequate basis for the evaluation of the Model No. DN30-X package against 10 CFR Part 71 requirements for each technical discipline.

2.0 STRUCTURAL EVALUATION

The applicant submitted an application to renew the CoC USA/9388/AF-96 for the DN30-X package. The applicant submitted the application with a revised SAR, rev. 4 for the DN30-X with the proposed changes in the application (Reference 1). The staff reviewed the proposed changes and found two design changes that are most relevant to the structural performance of the package and required structural evaluations. Those proposed design changes are:

- Design change of the 30B-X cylinder, and
- Design change of the DN30 PSP.

This SER section evaluates the structural assessments performed by the applicant for the DN30-X package with the proposed changes to verify that the structural performance of the DN30-X package meets the regulatory requirements of 10 CFR Part 71.

2.1 Description of Structural Design

The DN30-X is a Type AF package and consists of the DN30 PSP that contains the 30B-X cylinder designed to carry uranium hexafluoride grade high-assay low-enriched uranium (HALEU). The DN30 PSP has a clamshell design that utilizes a mortise-and-tenon closure system on the exterior 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 DN30 PSP portion of the package has both outer and inner shells which are separated by an impact-absorbing and fire-retardant foam material. Several lifting lugs are attached to the PSP to facilitate handling.

The 30B-X cylinder vessel has ellipsoidal heads with valve and plug hardware that are attached to the heads and protected by skirts. The cylinder contains an integral criticality control system (CCS), consisting of an array of criticality control rods (CCRs) filled with the neutron poison material (B_4C). The position and orientation of the CCS are maintained by restraints welded at the inside junctions of the 30B-X cylindrical section and heads.

The applicant provided a detailed description of the DN30-X packaging and components including the arrangement of components in section 1.4, "Specification of the Packaging," of the SAR, rev. 4. The applicant also provided the weight of the package with and without its contents, as well as the overall physical dimensions of the package. The 30B-X cylinder and DN30 PSP package dimensions are presented in tables 1-13 and 1-14 of the SAR, rev. 4, respectively.

2.2 Evaluation of the Design Change of the 30B-X Cylinder

The applicant identified an operational issue related to the 30B-X cylinder design associated with retention of wash solution behind the CCS restraint after washing the cylinder, where the CCS restraint is connected to the 30B-X cylinder through continuous fillet welds. To resolve the issue, the applicant proposed a design change to the 30B-X cylinder to split the continuous CCS restraint into three segments, creating gaps that allow drainage of all the wash solution from the cylinder.

The applicant performed a structural analysis to demonstrate the structural design adequacy of the proposed arrangement of the CCS restraint segments. The new arrangement is designed to

be practically identical to the design of the current continuous CCS restraint under HAC. The applicant selected the flat drop onto the valve side with the proposed design of the CCS restraint for the structural analysis. The LS-DYNA finite element (FE) computer code was used for the analysis. Figure 8.1 in section 8.4, "Division of the Criticality Control System Restraints into Three Segments," of appendix 2.2 (Reference 2) shows the FE mesh used for the analysis of the CCS restraint.

The applicant provided the results of the analysis in subsection 8.4.4.1, "Criticality Control System of the 30B-X Cylinder," of appendix 2.2 of the SAR. The applicant provided a comparison between the results of the current continuous non-segmented design of the CCS restraint and the new proposed segmented design of the CCS restraint in figure 8-3 of appendix 2.2. Figure 8-3 presents the distribution of the plastic deformations at the lattice holders for both designs. The NRC staff reviewed figure 8-3 and found that the distribution of the plastic deformations at the lattice holders shown in the figure has hardly changed with the new design of the CCS restraint. The difference is only about 0.4 percent (%) in the maximal plastic strain, indicating that the impact of the design change is negligible.

The applicant also provided a comparison between the results of both current and proposed designs for the CCRs in figure 8-4 of appendix 2.2. Figure 8-4 presents the plastic deformations at the CCRs for both designs. The NRC staff reviewed figure 8-4 and found that the difference is only about 0.2% in the maximal plastic strain showing that the impact of the design change is negligible.

Additionally, the applicant calculated the relative displacements between the CCRs and the entire CCS with respect to the 30B-X cylinder shell under HAC. Figures 8.5 and 8.6 of appendix 2.2 provide comparisons between the current and proposed designs for the relative CCR displacements, while figure 8.7 of appendix 2.2 provides a comparison for the relative displacement of the CCS with respect to the 30B-X cylinder shell. The NRC staff reviewed the results of the comparisons and found that the relative displacements are smaller than the design criteria defined in section 2.1, "Acceptance Criteria and Design Assumptions for the Structural Design," of appendix 2.2, which was previously reviewed and accepted by the NRC staff.

In addition, the applicant proposed adding a backing-ring to the CCRs. The applicant stated that each CCR in the 30B-X cylinder is a single tube closed by a lid on each end. One of these two lids is connected to the tube by a welded joint before the CCR is filled with the neutron poison material (B_4C). The other lid is welded to the tube after the CCR is completely filled with B_4C material. As a result, a backing-ring is incorporated in the design of the CCR lids to avoid impurities from B_4C material in the welded joint. The applicant stated that the addition of this backing-ring has no adverse impact on the structural analysis of the DN30-X package because the weight of the backing-ring is minimal. The NRC staff reviewed the information of the backing-ring provided in appendix 1.4.1A, "Drawings 30B-X Cylinder," and confirmed that the weight of the backing ring is very small compared with the total weight of the CCR including its contents. The NRC staff finds that the addition of this backing-ring does not negatively impact the structural analysis of the DN30-X package.

Based on the review of the structural analysis and its results for the proposed design change of the 30B-X cylinder, the NRC staff concludes that the proposed design is acceptable, and the DN30-X package meets the requirements of 10 CFR 71.73.

2.3 Evaluation for the Design Change of the DN30 Protective Structural Packaging

The applicant proposed a design change to the DN30 PSP for removing the housing of the VPD attached to the PSP. The VPD is U-shaped and surrounds the valve of the 30B-X 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-X cylinder under NCT and HAC. The housing is box-shaped and is made of 0.04 inch (1 millimeter [mm]) thick stainless-steel sheet. It is designed to provide support for placing the intumescent material and to improve the thermal conditions in the VPD during the thermal tests.

The applicant stated that the housing of the VPD was only used during the prototype thermal tests with the DN30 PSP. The inner surfaces of the VPD were covered with intumescent material, having the intended safety function to prevent hot gases from reaching the valve of the standard 30B cylinder. The microporous insulation layer added to the DN30 PSP design for the thermal test was so efficient regarding the thermal protection of the 30B-X cylinder that the housing of the VPD provides no significant safety benefit. The explanation for this is laid out in detail in SAR appendix 2.3, "Thermal Analysis of the DN30-X Package."

The applicant stated that the housing was not used during the prototype structural model tests; therefore, its removal does not impact the results in the previous SARs. Additionally, the applicant further stated that there are no changes in the results of the previous structural analyses using the ANSYS and LS-DYNA programs presented in references 2, 3, and 4, which were reviewed and accepted by the NRC staff, because the results of the previous structural analyses did not take into account the housing of the VPD in the FE models. As a result, the applicant stated that there are no additional structural analyses required for the removal of the housing of the VPD and concluded that the structural analyses and their results are still applicable.

The NRC staff reviewed the applicant's statements regarding the removal of the housing of the VPD from the DN30 PSP and confirmed that the removal of the housing of the VPD does not affect the structural performance of the DN30-X package under NCT and HAC. Therefore, the NRC staff determines that the applicant's proposed design change of the removal of the housing of the VPD is acceptable and concludes that the DN30-X package without the housing of the VPD will perform its intended structural functions under NCT and HAC, and the DN30-X package meets the requirements of 10 CFR 71.

2.4 Evaluation Findings

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 design changes of the DN30-X transportation package are adequately described, analyzed, and evaluated to demonstrate that its structural capability and integrity meet the regulatory requirements of 10 CFR Part 71.

2.5 References

1. Orano NCS GmbH, Safety Analysis Report for the DN30-X Package, 0045-BSH-2020-001, Rev. 4, 2025.

2. Orano NCS GmbH, Structural Analysis of the DN30-X Package, 0045-BSH-2020-001-Appendix-2.2, Rev. 1, 2025.
3. Orano NCS GmbH, Structural Analysis of the DN30-X Package, 0045-BSH-2020-001-Appendix-2.2, Rev. 0, 2022.
4. Orano NCS GmbH, Calculation Report, Structural Analysis of Drop Tests for the DN30 Package under NCT and ACT, 0023-BBR-2022-004 Rev. 1.

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 to the Package Design

The staff reviewed the changes to the package design described in section 2.1.2.2 of the SAR that included the following:

- 30B-X cylinder division of CCS restraints into segments,
- 30B-X cylinder lids of CCRs,
- 30B-X cylinder substitute material for criticality control rod pipes and lids, and
- DN30 PSP removal of the housing of the VPD.

3.2 Three 30B-X Cylinder Changes

The staff reviewed section 2.1.2.2.1.1 of the SAR that described that the division of CCS restraints into segments was necessary for operations. Section 2.1.2.2.1.1.2 of the SAR further described that the CCS restraints were not explicitly modeled in the thermal analysis and therefore the division of the CCS restraints into segments would have no impact on thermal safety.

The staff reviewed section 2.1.2.2.1.2 of the SAR that described the addition of a backing ring to criticality control rod lids. Section 2.1.2.2.1.2.2 of the SAR described that the additional backing ring would slightly increase the mass of each criticality control rod, but not noticeably on the aggregate and would have no impact on thermal safety.

The staff reviewed sections 2.1.2.2.1.3 and 2.1.2.2.1.4 of the SAR that described the substitution of material for the criticality control rod pipes and criticality control rod lids. Sections 2.1.2.2.1.3.2 and 2.1.2.2.1.4.2 of the SAR described that both grades of material are carbon steel and for thermal analysis purposes they can be assumed to be the same.

Based on the staff's review, the staff finds that these three changes to the 30B-X cylinder have no impact on the thermal design of the 30B-X cylinder.

3.3 Removal of the DN30 PSP Cylinder Valve Protective Device Housing

The applicant described in section 2.1.2.2.2.1 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 2.1.2.2.2.1.2 of the SAR the technical basis for the removal of the housing for the valve protective device and provided additional description in section 7 of appendix 2.3, rev 1. The applicant described 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 degrees Celsius [$^{\circ}\text{C}$]).

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 7.2.3 of appendix 2.3, revision 1, 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 described in section 7 of appendix 2.3, revision 1, 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 7.3 of appendix 2.3, revision 1, 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 section 7.3 of appendix 2.3, revision 1, 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 VPD, Drawing No. 0023-ZFZ-1140-000, Revision 4, that is part of appendix 1.4.1B as described in the list of applicable documents for the DN30-X (ML25119A150, non-public) and appendix 1.4.1 for the DN30 (ML24137A159), 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.

In addition, the changes related to the removal of the DN30 PSP cylinder valve protective device housing were also reviewed in detail in connection with the renewal of CoC USA/9362/AF-96 (Rev. 5) for the DN30 package, ADAMS Accession No. ML24159A019.

3.4 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.

4.0 CONTAINMENT EVALUATION

The objective of the amendment review was to verify that the containment-related changes to the Model No. DN30-X package (designated as Type AF) transporting a 30B-X cylinder (i.e., 30B-10 or 30B-20 cylinder) with UF₆ content would meet regulations under NCT and HAC. Regulations applicable to the containment review include 10 CFR 71.31, 71.33, 71.35, 71.43, and 71.51.

4.1 Changes to the Package Design

According to the SAR list of revisions as well as section 2.4 and appendix 2.4, rev. 1 ("Containment Analysis of the DN30-X Package," document 0045-BSH-2020-001-Appendix 2.4-Rev1) of the application, there were no significant containment-related changes of the content or the containment boundary (i.e., 30B-X cylinder consisting of the shell, plug and threaded connection, valve body, stem, and threaded connection, per section 1.4.3 of the application) to the amendment. Table 1-15 and section 1.9.7 of the application indicated that the 30B-X cylinder containment boundary is characterized as a Category A safety element (i.e., important-to-safety component). Section 1.6.2.4 of the application stated that "[t]he 30B-X cylinder is designed, fabricated, inspected, tested, and marked to the requirements for standard 30B cylinders in ANSI N14.1."

SAR section 1.3 stated that the content is commercial natural UF₆ enriched to 10 wt% U₂₃₅ (30B-10 cylinder) or 20 wt% U₂₃₅ (30B-20 cylinder); SAR section 3.1.2 stated that neither reprocessed nor derived enriched UF₆ shall be used. SAR table 1-8 indicated that the content, whether a filled cylinder or holding residual heeled material, has less than an A₂ of activity.

Section 2.2 and section 2.1.2.2.2.1 of the application indicated that there was no dispersal, no rupture of the 30B-X cylinder, and no part of the 30B-X cylinder came in contact with the DN30 PSP overpack that confines the 30B-X cylinder during NCT and HAC tests. In addition, section 2.3 of the application indicated that temperatures and pressures were within allowable values during NCT and fire HAC. Therefore, the Type A content would remain within the 30B-X cylinder

during NCT and HAC. In addition, there were no containment-related changes associated with 30B-X cylinder operations. For example, SAR section 1.2.10 and section 1.7.2.1 of the application stated that a filled 30B-X cylinder continues to undergo a leakage rate test with a standardized helium leakage rate acceptance criterion of no more than 0.0001 pascal cubic meters per second ($\text{Pa}\cdot\text{m}^3/\text{sec}$), which is less than allowable leakage rates calculated for each cylinder type presented in table 2-18 of the application.

4.2 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the amendment has not changed the previously reviewed DN30-X containment design; therefore, the package has been adequately described and evaluated and that the package design meets the containment requirements of 10 CFR Part 71.

5.0 SHIELDING EVALUATION

The staff reviewed the application to verify that the design of the Orano NCS DN30-X package meets the external radiation requirements in 10 CFR Part 71. This review also considered whether the package is consistent with the acceptance criteria in section 5 (Shielding Evaluation) of NUREG-2216, "Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material."

5.1 Changes to the Package Design

The applicant has requested to include 30B-X cylinders containing uranium hexafluoride (UF_6) enriched to a maximum of 20 wt.% U-235 as authorized contents for the DN30-X package. The proposed UF_6 content types, HALEU 10 and HALEU 20, will be transported in 30B-10 and 30B-20 cylinders, respectively. The DN30-X packaging is largely identical to that of the DN30 (Docket No. 71-9362) that NRC staff previously approved. The changes that may be of concern to external dose rates and radiation safety are:

1. Changes to handling instructions and contamination and dose rate measurements.
2. Increased radioactivity due to the higher enrichment of the proposed contents.

Regarding proposed change no. 1, the staff reviewed the handling instructions in 0045-HA-2021-001-Rev 2, compared them to a previously approved version, 0023-HA-2015-001-Rev 6, and found no changes that would affect shielding or radiation safety. The staff also reviewed the contamination and dose rate measurement procedures in 0045-PA-2021-002-Rev 1, compared them to a previously approved version, 0023-PA-2015-017-Rev 2, and found no changes that would affect shielding or radiation safety.

Regarding proposed change no. 2, the staff reviewed the dose rate calculations and material limits in the application (0045-BSH-2020-001 Rev 4). The applicant calculated external dose rates using the same modeling assumptions with updated versions of the same software (SCALE/ORIGEN-ARP) using the same multi-group cross-section library that NRC staff found acceptable for the DN30 package. The residual material from the decay products (i.e., the heels) that remain in emptied cylinders are responsible for much of the external dose since the self-shielding effects of a full cylinder are no longer present. With higher enrichment, shorter lived isotopes make up a greater proportion of the contents and the quantity of heels will be greater. ANSI-N14.1, "Uranium Hexafluoride - Packagings for Transport," defines the maximum quantity of heels material permissible for the 30B cylinder. This is the same maximum heels

quantity given in Section 1.3.1.1 of the DN30 application (0023-BSH-2016-001 Rev 0). The maximum permissible quantity of the proposed heel quantities shown in table 1-4 of the DN30-X application remains nearly identical to the previously approved DN30 package. The applicant assumed that all decay products remain completely in the heels (i.e., no credit for the cylinder cleaning process), and the applicant also assumed that residual heels displace zero volume during subsequent filling cycles. This will conservatively maximize the quantity of accumulated heels. Even with these conservative assumptions, the applicant's calculations show the expected quantity of heels will remain below the maximum value defined in ANSI-N14.1 and the maximum values in table 1-4 of the application. The applicant presented the expected radioactivity as fractions of A_2 values in table 1-8 of the application, and the staff noted that the largest sum of all nuclides remains less than $0.6 A_2$. Based on the considerations described in this paragraph, the staff finds reasonable assurance that the radioactive contents will remain below A_2 quantities to meet the limit for a Type AF package.

For the reasons described above, the staff finds reasonable assurance that the DN30-X package will meet the dose rate criteria of 10 CFR 71.

5.2 Evaluation Findings

Based on its review of the statements and representations provided in the application, the staff has reasonable assurance that the shielding evaluation is consistent with the appropriate codes and standards for shielding analyses and NRC guidance. Therefore, the staff finds that the package design and contents satisfy the dose rate limits in 10 CFR Part 71.

6.0 CRITICALITY EVALUATION

The staff reviewed the application to use the Orano NCS DN30-X package to transport UF_6 enriched up to 20 wt.% as a Type AF package and verified that the package criticality safety design has been described and evaluated under NCT and HAC as required in 10 CFR Part 71. This review also considered whether the package is consistent with the acceptance criteria in section 6 (Criticality Evaluation) of NUREG-2216, "Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material."

6.1 Changes to the Package Design

The applicant requested to modify the CoC for the Model No. DN30-X package to change several packaging features. The changes consist of:

- Division of the CCS restraint into segments,
- Allowing a substitute material for CCR pipes and lids,
- Removal of the valve protection housing from the PSP, and
- Addition of a weld backing ring to the design of the CCR lid.

The applicant evaluated each of these changes in section 2.1.2.2 of the SAR for their effect on the criticality safety analysis of the package. The division of the CCS restraint into segments does not affect the criticality safety of the package, as discussed in section 2.1.2.2.1.1 of the SAR. The applicant conservatively neglected the presence of that package feature. The restraint is made of the same steel as the cylinder and would serve to displace UF_6 inside the cylinder and absorb neutrons, both of which would reduce system k-effective (k_{eff}). Therefore, it

remains conservative to neglect the CCS restraint, and that segmenting the restraint will have no effect on criticality safety.

The applicant demonstrated in sections 2.1.2.2.1.3 and 2.1.2.2.1.4 of the SAR that substituting a different steel material than originally approved for the CCR pipes and lids will not affect criticality safety of the package. The applicant used the standard material definition for carbon steel in the SCALE computer code standard composition library. This material is representative of all the steel material options that the applicant requested for the CCR pipes and lids, in that it is carbon steel with relatively low neutron absorption. Therefore, allowing substitute steel materials for the CCR pipes and lids will have no effect on criticality safety.

The applicant demonstrated in section 2.1.2.2.2.1 of the SAR that removing the valve protection housing from the PSP will not affect criticality safety of the package. The applicant did not consider the valve protection housing of the PSP in its original criticality safety analysis, so removing this feature has no effect on package criticality safety.

The applicant evaluated the effect of adding a weld backing ring to each CCR lid closure on the criticality safety of the DN30-X package, as described in section 2.1.2.2.1.2 of the SAR. This change required a recalculation of system k_{eff} , since the weld backing ring in the CCR displaces B_4C neutron absorber and could potentially make the system more reactive. The applicant performed additional criticality analyses evaluating the effect of the modified CCR closure in section 10.5 of appendix 2.6 of the SAR. These additional criticality analyses result in slight increases in k_{eff} in most cases, as shown in table 38 of appendix 2.6 of the SAR. However, the maximum k_{eff} when considering the CCR weld backing ring, for a homogeneous uranyl fluoride (UO_2F_2) and water mixture in a single package in isolation, remains well below the applicant's calculated upper subcritical limit.

The applicant has shown, and the staff agrees, that the Model No. DN30-X, with the package design changes described in section 2.1.2.2 of the SAR, will remain subcritical under NCT and HAC in single package and array configurations per the requirements of 10 CFR 71.55 and 10 CFR 71.59.

6.2 Evaluation Findings

The staff reviewed the applicant's requested changes to the CoC, initial assumptions, model configurations, analyses, and results. The staff finds that the applicant has identified the most reactive configurations of the Model No. DN30-X package with the requested contents, and that the criticality results are conservative. Therefore, the staff finds with reasonable assurance that the package, with the requested contents, will meet the criticality safety requirements of 10 CFR Part 71.

7.0 MATERIALS EVALUATION

The staff reviewed revision 4 to the DN30-X SAR, to verify that the material performance of the DN30-X package to ensure it meets the requirements of 10 CFR Part 71. Only the sections of the materials evaluation that changed from the previous SAR will be discussed below.

7.1 Materials of Construction

The applicant submitted a revision to the SAR, to incorporate design changes from fabrication and testing of prototype cylinders.

As described in SAR section 2.1.2.2.1.1, the applicant proposed splitting the CCS restraints into three segments, vice continuous rings, to improve washing of the 30B-X cylinders. No material changes are proposed to these restraints.

As described in SAR sections 2.1.2.2.1.2 and 2.1.2.2.1.4, the applicant proposed that the lids of the controls rods of the CCS be fabricated from American Society for Testing and Materials (ASTM) A350 LF2 Class 1 steel, in addition to the previously approved ASTM A516 steel, grades 65 or 70, to facilitate a design change that provides a flange for joint inspection between the control lid and pipe. Additionally, the applicant proposed adding a backing ring to the top lid of control rods to avoid introducing impurities from the B₄C entering the weld during welding. The backing ring is fabricated from the same ASTM A333 steel as the control rod pipes.

As described in SAR section 2.1.2.2.1.3 and the licensed drawings, the applicant proposed that the control rod pipes of the CCS be fabricated from ASTM A333 grade 8 steel, in addition to the previously approved ASTM A333 grade 9 steel, due to material availability.

The staff reviewed the addition of ASTM A350 LF2 Class 1 and ASTM A333 grade 8 material specifications and confirmed that the use of these specifications, as described in the SAR, adequately ensures that the steel used to fabricate the control rod lids and control rod pipes has the properties and performance characteristics needed to perform their required safety functions over the full range of service temperatures. Therefore, the staff finds that the applicant's description of the materials of construction to be acceptable.

7.2 Drawings

The applicant modified the drawings in appendix 1.4.1A and B of the SAR to incorporate the design changes described in section 7.1 above. The drawings parts list that provides the materials of construction and codes/standards were likewise modified. The staff reviewed the drawing changes using the guidance in NUREG/CR-5502, "Engineering Drawings for 10 CFR Part 71 Package Approvals," and confirmed that the drawings provide an adequate description of the materials, fabrication, and examination requirements, and, therefore, the staff finds them to be acceptable.

7.3 Codes and Standards

The applicant did not propose any changes to the codes and standards of the DN30-X package. The staff reviewed the proposed materials changes, described in section 7.1 above, and verified that the applicant used materials that conform to ASTM international standards. Therefore, the staff determines that the previous finding on the materials codes and standards continue to be acceptable.

7.4 Material Properties

The applicant did not make any changes to the mechanical properties and thermal properties used in the structural analyses and thermal analysis, except for foam aging related mechanical

properties and intumescent material thermal expansion properties. The staff reviewed the results of the manufacturer testing provided in PROMASEAL-PL (Reference 1) and PIR FOAM (Reference 2) and found the additional material properties to be acceptable.

As described in SAR section 2.1.2.2.1.4.1, the applicant states that ASTM A350 rolled bar is an acceptable substitution for ASTM A516 plate because the A350 has an equivalent or higher breaking strength and elongation at fracture, with a minor decrease in yield strength. For this reason, the applicant did reperform the structural analysis for this material substitution. The staff reviewed the mechanical properties for ASTM A350 and ASTM A516 from American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section II Part D and ASTM and determined that the applicant's statements about the similarities of the mechanical properties of the two materials to be factual and acceptable. The staff also confirmed that the application includes suitable requirements for performing Charpy V-Notch impact testing of ASTM A350 steel to ensure adequate resistance to brittle fracture at the lowest service temperature.

As described in SAR section 2.1.2.2.1.4.2, the applicant states that ASTM A350 rolled bar and ASTM A516 plate are similar carbon steels and their thermal properties can be assumed to be identical. For this reason, the applicant did not reperform the thermal analysis for this material substitution. The staff reviewed the thermal properties for ASTM A350 and ASTM A516 from ASME B&PV Code Section II Part D and other technical literature and determined that thermal properties (density, thermal conductivity, and specific heat) of the two materials are the same.

As described in SAR section 2.1.2.2.1.3.1, the applicant states that ASTM A333 grade 8 is an acceptable substitution for ASTM A333 grade 9 because grade 8 has higher yield and tensile strength, with a minor decrease in elongation at fracture. Further, the applicant states that the lower elongation at fracture still meets the minimum value used in the structural analysis. The staff reviewed the mechanical properties for ASTM A333 grade 8 and ASTM A333 grade 9 from ASME B&PV Code Section II Part D and ASTM and determined that the applicant's statements about the similarities of the mechanical properties of the two materials to be factual and acceptable. The staff also confirmed that the application includes suitable requirements for performing Charpy V-Notch impact testing of ASTM A333 grade 8 steel to ensure adequate resistance to brittle fracture at the lowest service temperature.

As described in SAR section 2.1.2.2.1.3.2, the applicant states that ASTM A333 grade 8 and ASTM A333 grade 9 are similar carbon steels and their thermal properties can be assumed to be identical. For this reason, the applicant did not reperform the thermal analysis for this material substitution. The staff reviewed the thermal properties for ASTM A333 grade 8 and ASTM A333 grade 9 from ASME B&PV Code Section II Part D and other technical literature and determined that thermal properties (density, thermal conductivity, and specific heat) of the two materials are the same.

Per the above discussion, the staff finds the mechanical and thermal material properties used in the applicant's structural and thermal analysis to be acceptable.

7.5 Corrosion Resistance and Content Reactions

The staff reviewed the SAR revision 4 changes and verified that they do not introduce any adverse corrosive or other reactions that were not previously considered in the staff's prior review of the DN30-X package. The materials of construction and the service environments are

bounded by those that were previously evaluated to support issuance of the CoC. Therefore, the staff finds the applicant's evaluation of corrosion resistance and potential adverse reactions to be acceptable.

7.6 Evaluation Findings

The staff concludes that revision 4 to the DN30-X SAR adequately considers material properties and material quality controls such that the design is in compliance with 10 CFR Part 71. This finding is reached on the basis of a review that considered the regulation, itself, appropriate regulatory guides, applicable codes and standards, and accepted engineering practices.

7.7 References

1. [PROMASEAL-PL] Promaseal-PL of Company PROMAT, Material Report, 0023-BSH-2016-001-Appendix-1.4.3, Rev. 3, Orano NCS, Hanau, February 2025
2. [PIR FOAM] "PIR Foam of company DUNA-Corradini", Material Report, 0023-BSH-2016-001-Appendix-1.4.2, Rev. 3, Orano NCS GmbH, Hanau, February 2025

8.0 OPERATING PROCEDURES EVALUATION

The purpose of this evaluation is to verify that the applicant has established operating procedures that ensure compliance with the applicable requirements of 10 CFR Part 71. These procedures must adequately control packaging operations such as loading, unloading, preparation for transport, and other handling activities, in a manner that supports the safe use of the package.

The applicant proposed revisions to the operating procedures as it relates specifically to SAR section 1.7, "Operations," and appendix 1.7.1, "Handling instruction." These changes were both editorial in nature, impacting page formatting, and functional, including the addition and removal of specific handling steps, as applicable to the change involving the removal of the housing of the VPD from the DN30 PSP. These changes were made to align the procedures with current practices and to ensure consistency with the revised package design and licensing basis.

8.1 Evaluation Findings

The NRC staff has reviewed the description of the operating procedures and finds that the package will be prepared, loaded, transported, received, and unloaded in a manner consistent with its design and evaluation for approval.

Based on review of the statements and representations in the application, the NRC staff finds that the operating procedures have been adequately described and meet the requirements of 10 CFR Part 71.

9.0 ACCEPTANCE TESTS AND MAINTENANCE

No actual changes were made to the applicant's acceptance tests and maintenance. No acceptance tests and maintenance safety evaluation is necessary.

10.0 QUALITY ASSURANCE EVALUATION

The purpose of this evaluation is to determine whether the applicant's QAPD satisfies the requirements of 10 CFR Part 71, Subpart H, "Quality Assurance." These requirements apply to activities that affect the safety functions of packaging used for the transportation of radioactive material, including design, procurement, fabrication, assembly, inspection, testing, operation, maintenance and repair.

As part of this application, the applicant included a reference to their previously approved QAPD, 0023-QAP-2017-001, in SAR section 1.9, "Management System." The staff verified that the previously approved QAPD remains applicable to the applicant's transportation package activities.

Based on the reference to the NRC-approved QAPD, the staff finds that the applicant's quality assurance program meets the requirements of 10 CFR Part 71, Subpart H, and is acceptable for use in support of this amendment.

CONDITIONS

Item No. 1.b, "Revision Number," was updated to Revision No. 1.

Item No. 3(b) was revised to include the latest revision of the SAR, Revision No. 5.

Condition No. 5(a)(2) was revised to remove mention of the protective housing.

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

Condition No. 11 extends the validity of the certificate to August 31, 2030.

The References section of the certificate was updated to include the SAR, Revision No. 5.

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-X package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9388, Revision No. 1.