



DN30 Transportation Package Exemption Request for LEU+ Project

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Meeting Purpose

- Provide information on DN30 Transportation Package exemption request
- Pre-submittal consultation with NRC staff on approach

Agenda

- Overview of Exemption Request
- Safety Case for DN30 Transportation Package use for LEU+
 - Scope and approach
- Environmental Information for LEU+ transportation
 - Scope and approach

Exemption Request Overview

- UUSA intends to submit an Exemption Request to NRC proposing exemptions to certain regulatory requirements
- The Exemption Request will be to use the DN30 transportation package to domestically ship enriched U-235 up to 10 weight percent (wt%)
- UUSA will also request an amendment to the Materials License SNM-2010 to institutionalize the Exemption Request elements through new License Conditions
- No physical changes to the DN30 transportation package will be proposed
- Transportation Package safety reviews impacted will be:
 - Criticality safety assessment and analysis
 - External dose rate assessment and analysis

Exemption Request Overview

- Current proposed specific exemption elements will be:
 - 10 CFR 71.55(g)(4) identified exception limit of 5 wt% U-235
 - Certain Packaging specifications identified in Certificate of Compliance Number 9362 for DN30
 - (a)(2) Description
 - Conformance with certain ANSI N14.1 specifications for 30B cylinders
 - (b) Contents
 - Limit of U-235 maximum wt% of 5.0
 - (c) Criticality Safety Index (CSI)
 - CSI is limited to 0.0

Exemption Request Overview

- Current structure of Exemption Request
 - Submittal Letter
 - Description of Proposed Changes
 - Introduction (Purpose and Background)
 - Proposed Exemptions
 - Technical Basis of Proposed Exemptions
 - Safety Significance of Proposed Exemptions
 - Environmental Assessment Information
 - Mark-up Pages to License Basis Documents (if any)
 - Affidavit

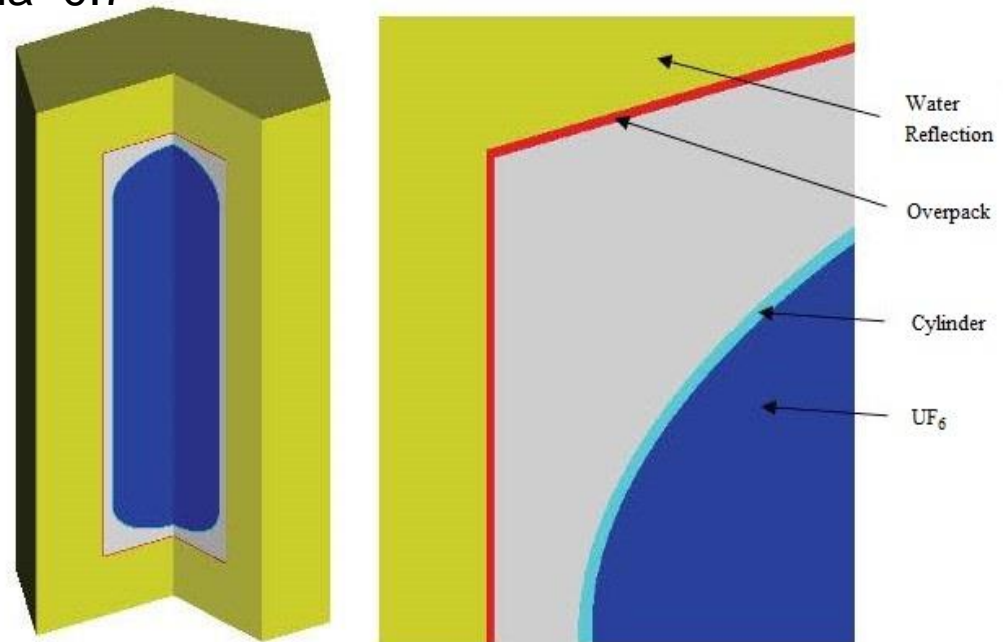
Exemption Request Overview

- After Proposed Exemption is approved
 - UUSA will submit a Special Permit application to US Department of Transportation in accordance 49 CFR 107.105 for relief from certain requirements

- UUSA current transportation practices include six cylinders per shipment
- Exemption request impacting safety base case includes:
 - Increase of enrichment to 10 wt% U-235 enrichment
 - Increase of Criticality Safety Index (CSI)
- Preliminary UUSA studies aim to determine the lowest CSI based on the following variables:
 - Limit the UF_6 content in the 30B cylinder to 2277 kg or less
 - Apply a more realistic representation of the hydrogenated uranium residue (HUR) sphere
 - Reduction of recommended administrative margin (0.05) for establishing an Upper Safety Limit (USL) for transportation activities/analysis

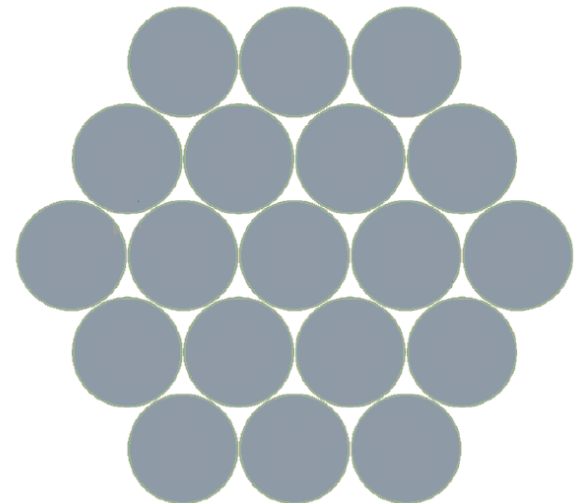
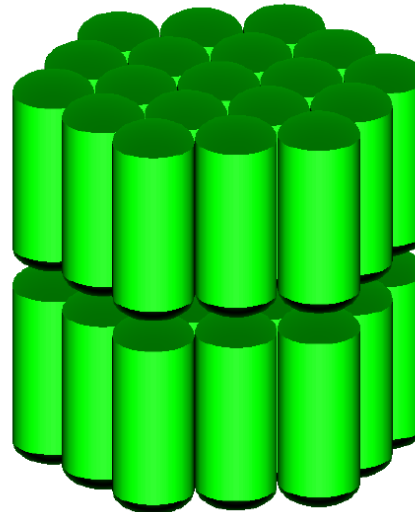
- ORNL report “Analysis of the 30B UF₆ Container for Use with Increased Enrichment” (ORNL/TM-2021/2043) was relied for developing bounding conditions for the analysis of the safety base case
- External radiation dose from cylinder will be calculated at higher enrichment for 10 CFR 71.47 compliance

- Single package [10 CFR 71.55(b), (d), and (e)]
 - 30B cylinder modeled with overpack and without overpack
 - Both models include full water reflector
 - These models do not consider hydrogenated uranium residue (HUR) (consistent with DN30 Safety Analysis Report)
 - UF_6 content limited to maximum allowed loading of 2277 kg
 - UUSA MCNP6 $k_{\text{calc}} + 2\sigma \sim 0.7$
 - ❖ Consistent with ORNL/TM-2021/2043 analysis, 30B cylinder without overpack is most reactive



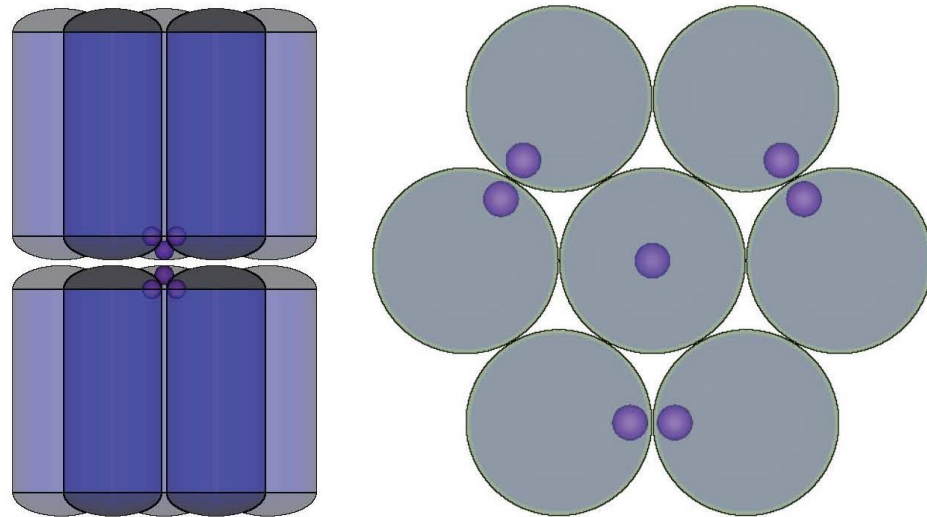
Note: Figure adapted from ORNL/TM-2021/2043

- Array of 5N undamaged packages [10 CFR 71.59(a)(1)]
 - 30B cylinders were modeled with optimum water layer (film) thickness
 - 5N (5 x 6=30) is modeled as a 2 x 15 array
 - UUSA MCNP6 $k_{\text{calc}} + 2\sigma \sim 0.92$
- Larger array size evaluated to lower CSI
 - Increased array modeled as a 2 x 19 array
 - UUSA MCNP6 $k_{\text{calc}} + 2\sigma \sim 0.95$



Note: Figure adapted from ORNL/TM-2021/2043

- Array of 2N damaged packages [10 CFR 71.59(a)(2)]
 - 30B cylinders were modeled with optimum water layer (film) thickness
 - 2N (2 x 7=14) is modeled as a 2 x 7 array
 - UF_6 content limited to maximum allowed loading of 2277 kg and 11.4 kg HUR
 - HUR is represented as $\text{UO}_2\text{F}_2 \cdot 2\text{H}_2\text{O} \cdot 2\text{HF}$ (H/U=6) modeled as a single sphere with the HF mixed homogeneously throughout the UF_6
 - UUSA MCNP6 $k_{\text{calc}} + 2\sigma \sim 0.90$



Note: Figure adapted from ORNL/TM-2021/2043

- HUR Modelling
 - No HF spherical shell layers considered
 - ❖ Reference: Rezgui, S. and Hilbert, F., Paper No. 130, PATRAM2013
 - Bounding H/U ratio of 6 used for HUR
 - ❖ Reference: Milin, M., et al, Paper No. 2029, PATRAM2016
- UF₆ Fill Limit
 - Maximum mass of UF₆ considered is 2277 kg (with corresponding UF₆ density)
 - UUSA has considered smaller fill amounts of UF₆ below the maximum allowed fill limit of 2277 kg
 - Reduced UF₆ mass for safety base case analysis allows for a lower CSI

- Administrative Margin for USL
 - UUSA has an established USL of 0.958 (MCNP6) for site analysis
 - USL accounts for administrative margin of 0.03
 - 10 CFR 71 has an acceptance criteria of $k_{\text{eff}} < 0.95$
 - NRC recommends administrative margin of 0.05 (NUREG/CR-5661)
 - UUSA will use a USL=0.948 for the transportation analysis, i.e., apply administrative margin of 0.04

Environmental Report (ER) Approach

- Following guidance of NUREG-1748, the ER will address the following:
 - Proposed action of transporting LEU+ in 30B cylinders in DN30 transportation package from UUSA Eunice facility to three US destinations
 - Purpose and need for the proposed action
 - Alternatives discussion - including no action
 - Describe operational controls during loading and transport operations
 - Describe applicable regulatory requirements (NRC and DOT)
 - Describe the affected environment

ER Approach (cont.)

- Discuss environmental impacts for proposed action on environmental resources; including public and occupational health and accident scenarios during transportation.
- Environmental resources not impacted by the proposed action will be clearly identified.
- Environmental impacts will be evaluated for significant/not significant impact.
- Appropriate references and supporting documentation will be provided
- Transportation impacts for the proposed action will be assessed utilizing NRC-RADTRAN v1.0 model.