

# NRC Reviews of HALEU Fuels

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# Agenda

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- Review process
- Enriched feed material
- Items to note during the NRC review

# Key Messages

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- Early engagement on design and certification strategy
- Performance-based regulations sufficient to certify transportation packages for new fuel designs
- NRC co-regulates transportation with the U.S. Department of Transportation

# NRC's Fuel Transportation Responsibilities

- Co-regulated by NRC and USDOT
  - Memorandum of Understanding lays out the agencies' responsibilities
  - DOT regulates carriers, modes of transport (rail, road, air, etc.)
  - NRC establishes design standards for fuel transportation packages
- Any entity licensed to possess commercial fuel is granted a general license to transport licensed material in an NRC-approved package
- Fuel is transported in packages evaluated against hypothetical accident conditions, including:
  - free-drop onto hard surface, and puncture impact
  - fire and water immersion



# Transportation Tests

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- Normal conditions of transport (10 CFR 71.71)
  - Hot and cold temperatures
  - Reduced and increased external pressure
  - Vibration
  - Water spray
  - Free drop (1 to 4 feet)
  - Corner drop
  - Compression test
  - Penetration test
- Hypothetical accident conditions (10 CFR 71.73)
  - 30-foot drop test
  - 40-inch puncture test
  - 30-minute fire at 1,475 degrees Fahrenheit
  - Immersion test

# Transportation Package Approval Criteria

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- Package performance criteria
  - Criticality safety
    - Single package
    - Array of packages
  - Shielding
    - Dose rates in 10 CFR 71.47, “External Radiation Standards for All Packages”
  - Containment—Type B packages only
    - Leakage rate testing for Type B packages (10 CFR 71.51, “Additional Requirements for Type B Packages”)

# Transport of Enriched Feed Material

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- Uranium Hexafluoride ( $UF_6$ )
  - 5B cylinder
  - 30B cylinder
  - New 30-inch cylinder
  
- Uranium Dioxide ( $UO_2$ )/Uranium Metal
  - Pellet and powder packages for low-enriched (non-HALEU) material
  - Low-enriched liquid uranyl nitrate

## Building the safety case

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- Crediting structural integrity for criticality safety
  - Fuel/fuel assembly structure
- Compensation for lack of critical benchmarks
  - Increased margin for  $k_{\text{eff}}$  above 5%.
  - Sensitivity/uncertainty analysis tools
  - New critical experiments
- REMINDER: Early engagement on design and certification strategy



# Transportation Additional Information

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- For additional information or if you have any questions contact Bernie White
  - [Bernard.White@nrc.gov](mailto:Bernard.White@nrc.gov)
  - (301) 415-6577
- For reference, see 2019 NRC RIC Presentation:
  - Dry Cask Storage and Transportation Considerations for New Fuel Designs
  - At ADAMS Accession Number: ML20111A297