North Anna ISFSI

High Burnup Dry Storage Research Project
TN-32 Storage Cask

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Agenda

- Background
- Fuel Selection Update & Baseline Data Activities
- License Amendment Approach (SNM-2507) & Considerations
  - Post Loading Considerations
- Gas Sampling
  - Licensing Considerations
  - Method
- Project Milestones
- Questions

North Anna ISFSI Research Project Background

- Storage of a TN-32 cask with high burnup fuel
  - North Anna ISFSI
  - Cask monitoring to provide valuable data for storage of high burnup fuel (>45,000 MWd/MtU)

North Anna ISFSI Research Project Background

- Data to be monitored
  - Fuel cladding temperature (indirect)
  - Cavity gas
    - Fission gases
    - Cavity pressure
    - Moisture
    - Hydrogen
    - Oxygen

North Anna ISFSI Research Project Projected Fuel Selection

- Eighteen Areva AMBW assemblies with M5™ cladding
- Twelve Westinghouse NAIF assemblies with Zirlo™ cladding
- One Westinghouse NAIF assembly with low-tin Zircaloy-4 cladding
- One Westinghouse LOPAR assembly with Zircaloy-4 cladding

North Anna ISFSI Research Project Fuel Selection

- Initial enrichment ranges from 3.59 w/o to 4.55 w/o
- Average assembly burnup ranges from 50.0 GWd/MtU to 58.1 GWd/MtU
- As of July 1, 2017
  - Payload heat load is just under 37 kW
  - Decay times range from 4.81 years to 27.85 years
  - Assembly decay heat values range from 725 Watts to 1511 Watts
    - Average assembly decay heat is 1155 Watts
- Peak cladding best estimate temperatures during drying expected to be approximately 340 °C

North Anna ISFSI Research Project Preliminary Loading Plan

	1 Zirlo 54.2 GWd/MtU 4.25%, 3cy, 11yr 1013 W	2 (TC Lance) M5 53.4 GWd/MtU 4.55%, 3cy, 8yr 1167 W	3 Zirlo 54.3 GWd/MtU 4.25%, 3cy, 11yr 1015 W	4 Zirlo 51.9 GWd/MtU 4.25%, 3cy, 13yr 909 W	
5 Zirlo 52.1 GWd/MtU 4.25%, 3cy, 13yr 914 W	6 (TC Lance) M5 52.0 GWd/MtU 4.55%, 3cy, 6yr 1276 W	7 M5 51.2 GWd/MtU 4.55%, 3cy, 5 yr 1503 W	8 M5 50.5 GWd/MtU 4.55%, 3cy, 5 yr 1477 W	9 M5 53.3 GWd/MtU 4.55%, 3cy, 8yr 1163 W	10 Zirlo 55.5 GWd/MtU 4.2%, 3cy, 17yr 906 W
11 Zirlo 54.6 GWd/MtU 4.2%, 3cy, 17yr 885 W	12 M5 51.0 GWd/MtU 4.55%, 3cy, 5 yr 1496 W	13 Zirc-4 58.1 GWd/MtU 3.59%, 4cy, 28yr 858 W	14 (TC Lance) M5 52.2 GWd/MtU 4.55%, 3cy, 6yr 1281 W	15 M5 50.6 GWd/MtU 4.55%, 3cy, 5 yr 1482 W	16 M5 51.8 GWd/MtU 4.55%, 3cy, 8 yr 1120 W
17 M5 53.3 GWd/MtU 4.55%, 3cy, 8yr 1165 W	18 M5 50.9 GWd/MtU 4.55%, 3cy, 5 yr 1492 W	19 (TC Lance) Zirlo 53.1 GWd/MtU 4.45%, 3cy, 10yr 1037 W	20 Low-Sn Zirc-4 50 GWd/MtU 4.0%, 2cy, 22yr 725 W	21 M5 51.0 GWd/MtU 4.55%, 3cy, 5 yr 1496 W	22 M5 51.9 GWd/MtU 4.55%, 3cy, 8 yr 1121 W
23 Zirlo 55.1 GWd/MtU 4.25%, 3cy, 11yr 1036 W	24 (TC Lance) Zirlo 52.9 GWd/MtU 4.45%, 3cy, 10yr 1031 W	25 M5 51.0 GWd/MtU 4.55%, 3cy, 5 yr 1495 W	26 M5 51.3 GWd/MtU 4.55%, 3cy, 5 yr 1511 W	27 M5 53.5 GWd/MtU 4.4%, 3cy, 8yrs 1178 W	28 (TC Lance) Zirlo 53.0 GWd/MtU 4.45%, 3cy, 10yr 1035 W
	29 M5 51.2 GWd/MtU 4.40%, 3cy, 8yr 1073 W	30 M5 53.0 GWd/MtU 4.55%, 3cy, 8yr 1155 W	31 (TC Lance) Zirlo 54.9 GWd/MtU 4.25%, 3cy, 11yr 1031 W	32 Zirlo 52.3 GWd/MtU 4.25%, 3cy, 13yr 918 W	

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Baseline Fuel Data (Sister Assemblies)

- Six planned donor assemblies providing approximately 22 fuel rods for evaluation
- The six planned donor assemblies have a complement of 20 assemblies planned for storage that are designated as sister assemblies
- Three of the 20 sister assemblies planned for loading will also be donor assemblies
  - That is, the only sisters available for three of the sister assemblies are also planned for loading

North Anna ISFSI Research Project Upcoming Site Work

- Sister Rod Work
  - Shipping basket arrives on-site
    - December 2014
  - Areva sister rod extraction
    - January 2015
  - Westinghouse sister rod extraction
    - June 2015
  - Sister rod cask shipment
    - 1Q16

North Anna ISFSI Research Project Licensing Approach

- TN-32 cask fabricated to CoC 72-1021 requirements
  - TN-32B-81 cask fabricated and certificate of conformance issued by Areva TN
  - Not initially licensed for high burnup fuel
- Proposed license amendment to SNM-2507
  - North Anna's site specific ISFSI license for TN-32 storage casks

Dominion

North Anna ISFSI Research Project Design Basis

- A Design and Licensing Basis Document (DLBD) will be submitted with the License Amendment Request (LAR) (proprietary submittal)
- The DLBD will provide the analytical bases and conclusions for departures from the existing approved analyses in the TN-32 FSAR
  - For example:
    - Criticality safety analysis, higher enrichment
    - Thermal safety analysis, higher heat loading
    - Shielding analysis, higher source term

North Anna ISFSI Research Project Design Basis

- Other materials included in the design
  - Thermocouple (TC) lances
  - Thermocouple/fuel assembly interface guides
  - Neutron absorber rods for future transport
    - Similar to absorber assemblies used during operation

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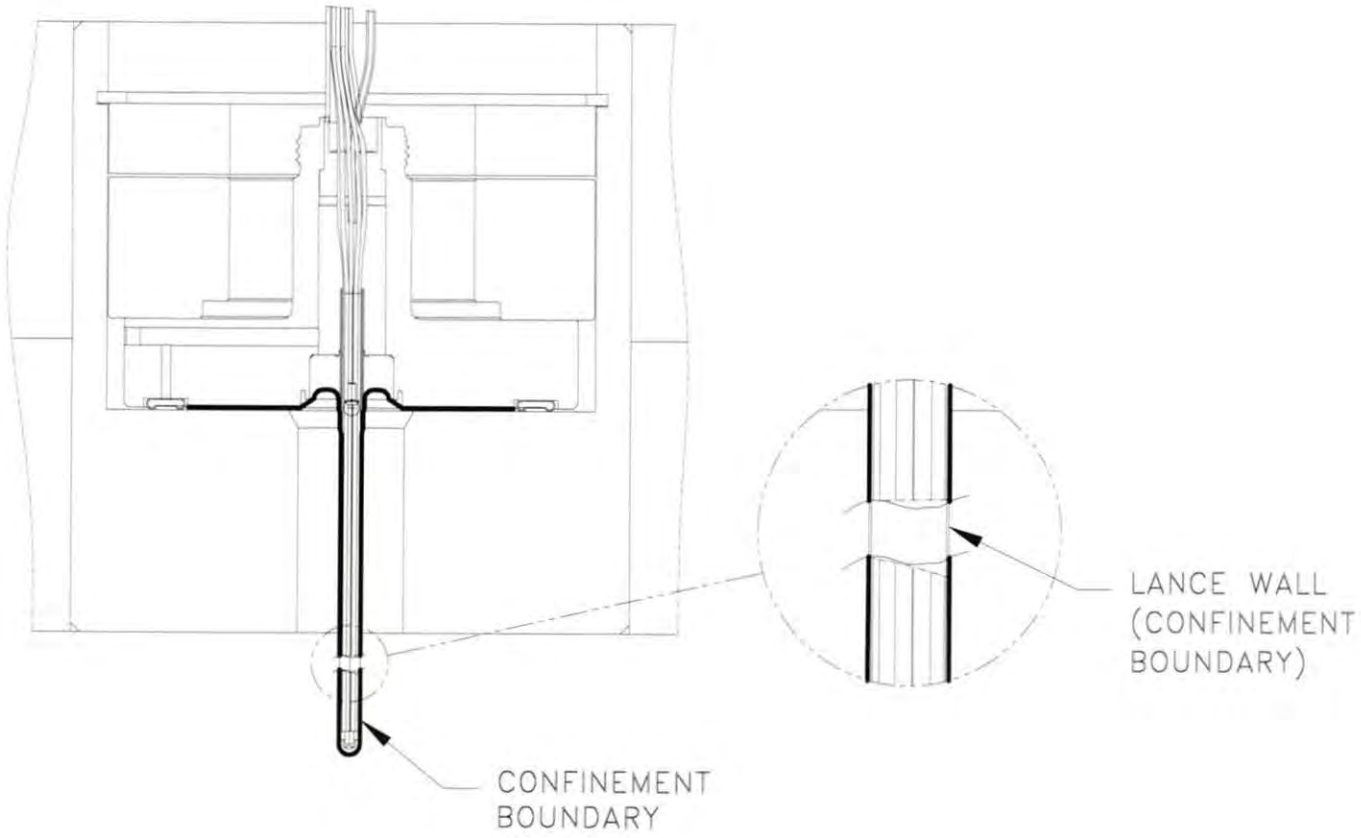
Research Project
TC Lance Conceptual Confinement



North Anna ISFSI Research Project Licensing Considerations

- Other LAR features
  - Possible evaluations of non-conforming conditions as a result of fabrication
    - Previously evaluated via 72.48 for the CoC
  - Separate Technical Specifications
    - Will address modifications associated with the high burnup cask
    - These will be in addition to current Tech Specs for existing TN-32 casks on the pad

North Anna ISFSI Research Project
Licensing Considerations – Post Loading

- Thermal soak period
  - Not currently in SNM-2507
  - Thermal equilibrium expected within three weeks after helium backfill
  - Cask will remain in cask prep bay with cask cavity pressure monitoring in place
  - Data logger will record thermal performance data for entire thermal soak period
- Final leak testing performed after thermal soak period

North Anna ISFSI Research Project
Licensing Considerations – Post Transfer to Pad

- Tech Spec monitoring equipment (OP system pressure switches) will be installed at pad
  - Identical to existing North Anna TN-32 casks
  - OP system will "see" the TC lances
  - Identical periodic test frequency for Tech Spec monitoring equipment as existing North Anna TN-32 casks

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Cavity Gas Sampling – Licensing

- **In situ cavity gas sampling**
  - **May need exemption from confinement regulation 72.128(a)(3)**
  - **Will establish controls and radiological monitoring**
- **In situ cavity gas sampling is not currently described in SNM-2507**
  - **Will re-establish confinement boundary seal, but cannot meet the same acceptance criterion as initially performed.**
  - **Seal integrity will rely upon pressure monitoring system Tech Specs**

North Anna ISFSI Research Project Cavity Gas Sampling – Method

- Method
  - Remove vent port cover, fill gas samples, analyze at site lab
  - Vent port cover will be reseated using same seal design as the original (i.e., bolts, lubricant, torque technique, and o-ring will be same design)
- Planned frequency
  - Once before 2020 (target 1 year after loading)
  - Once ~ 3 years after first sample
  - Once prior to transport
- Basis
  - Aligns with station resource requirements
  - Associated dose aligned with ALARA principle
  - Supports license renewal timing needs

North Anna ISFSI Research Project Milestone Schedule

- 1/31/15: Areva TN completes DLBD
- 7/31/15: Dominion submits LAR & Exemption Request to NRC
- 1Q16: Sister rods shipped to laboratory
- 1/31/17: Target for NRC review completion
- 6/30/17: Dry run and functional tests complete
- 7/31/17: Cask loading complete – begin thermal soak period
- 8/21/17: Cask emplaced at ISFSI pad

Questions

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