

North Anna ISFSI

High Burnup Dry Storage Research Project TN-32 Storage Cask

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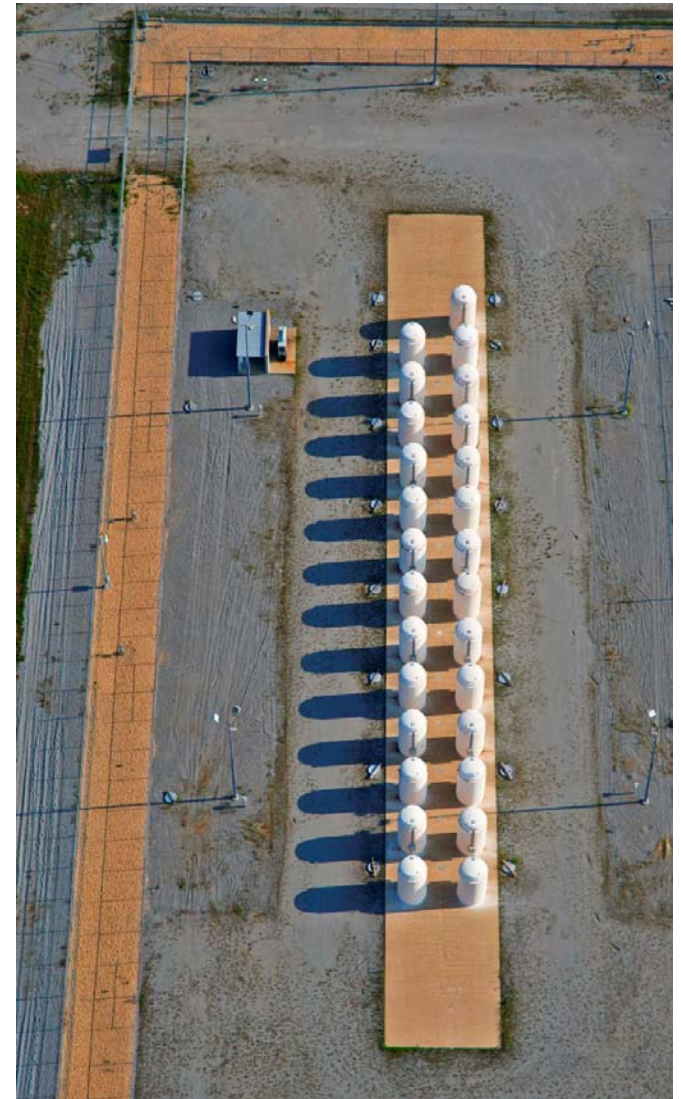
Agenda

- 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	



North Anna ISFSI Research Project 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**



North Anna ISFSI Research Project Design Basis

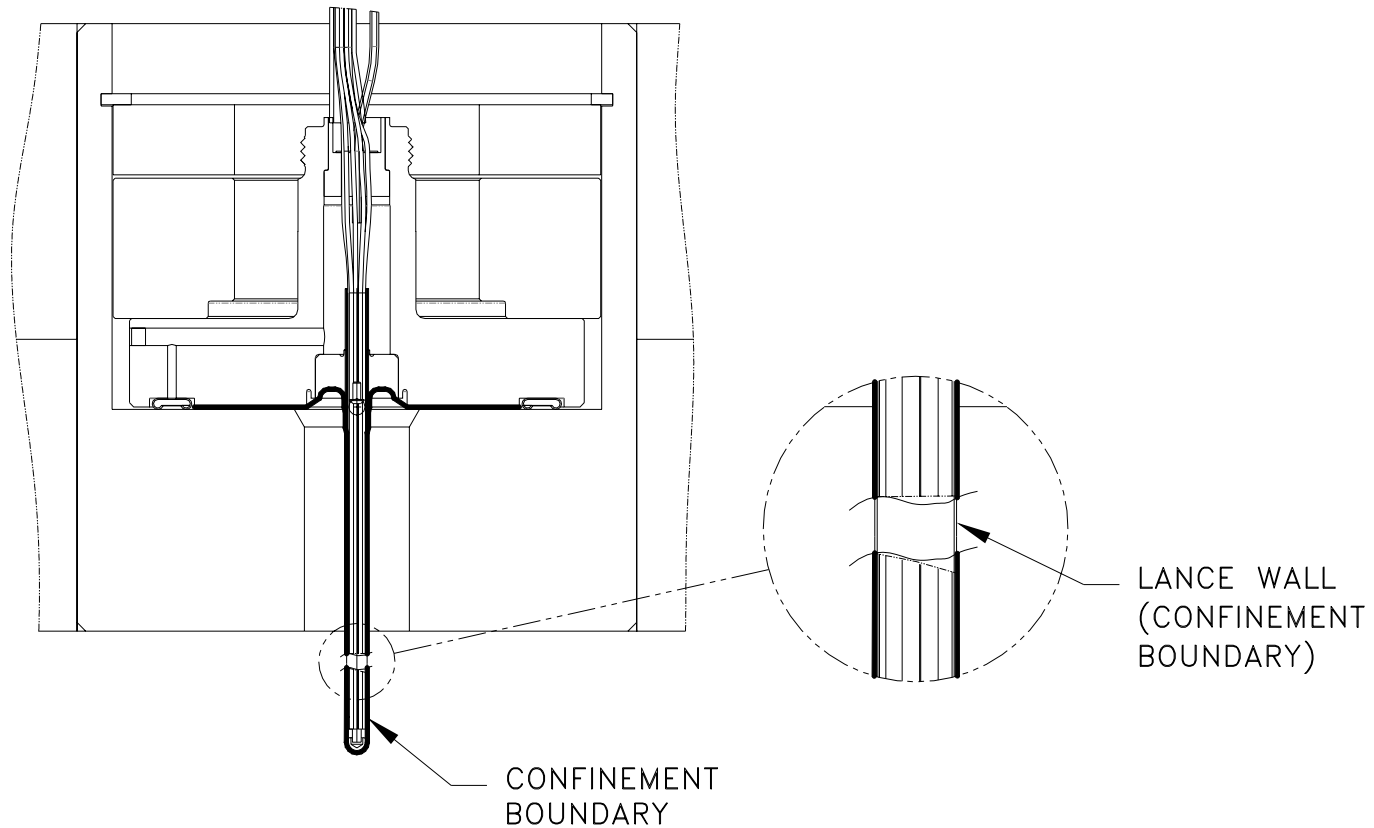
- **A Design and Licensing Basis Document (DLBD) will be submitted with the License Amendment Request (LAR) (proprietary submittal)**
- **The DLBD will provide the analytical bases and conclusions for departures from the existing approved analyses in the TN-32 FSAR**
 - **For example:**
 - **Criticality 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**

North Anna ISFSI 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**



North Anna ISFSI Research Project 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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