

North Anna ISFSI

TN-32 High Burnup Dry Storage Research Project

Tom Brookmire

May 13, 2015





Dominion

Agenda

- **Background**
- **Fuel Selection Update & Project Milestones**
- **HBU Cask Specifics & Confinement**
- **License Changes**
- **In Situ Gas Sampling**
- **ISFSI License Renewal**



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North Anna ISFSI Research Project Background

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





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North Anna ISFSI Research Project Finalized 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 55.5 GWd/MtU
- As of July 1, 2017
 - Payload heat load is just under 37 kW
 - Decay times range from 5.31 years to 30.2 years
 - Assembly decay heat values range from 696 Watts to 1511 Watts
 - Average assembly decay heat is 1155 Watts
- Peak cladding best estimate temperatures during drying expected to be approximately 340 °C



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North Anna ISFSI Research Project Design Loading Plan

	1	2 (TC Lance)	3	4	10
	Zirlio 54.2 GWD/MTHU 4.25%, 3cy, 11yr 1013 W	M5 53.4 GWD/MTHU 4.55%, 3cy, 8yr 1167 W	Zirlio 54.3 GWD/MTHU 4.25%, 3cy, 11yr 1015 W	Zirlio 51.9 GWD/MTHU 4.25%, 3cy, 13yr 909 W	Zirlio 55.5 GWD/MTHU 4.2%, 3cy, 17yr 906 W
5	6 (TC Lance)	7	8	9	16
Zirlio 52.1 GWD/MTHU 4.25%, 3cy, 13yr 914 W	M5 52.0 GWD/MTHU 4.55%, 3cy, 6yr 1276 W	M5 51.2 GWD/MTHU 4.55%, 3cy, 5 yr 1503 W	M5 50.5 GWD/MTHU 4.55%, 3cy, 5 yr 1477 W	M5 53.3 GWD/MTHU 4.55%, 3cy, 8yr 1163 W	M5 51.8 GWD/MTHU 4.55%, 3cy, 8 yr 1120 W
11	12	13	14 (TC Lance)	15	22
Zirlio 54.6 GWD/MTHU 4.2%, 3cy, 17yr 885 W	M5 51.0 GWD/MTHU 4.55%, 3cy, 5 yr 1496 W	Zirc-4 50.6 GWD/MTHU 3.59%, 3cy, 30yr 696 W	M5 52.2 GWD/MTHU 4.55%, 3cy, 6yr 1281 W	M5 50.6 GWD/MTHU 4.55%, 3cy, 5 yr 1482 W	M5 51.9 GWD/MTHU 4.55%, 3cy, 8 yr 1121 W
17	18	19 (TC Lance)	20	21	28 (TC Lance)
M5 53.3 GWD/MTHU 4.55%, 3cy, 8yr 1165 W	M5 50.9 GWD/MTHU 4.55%, 3cy, 5 yr 1492 W	Zirlio 53.1 GWD/MTHU 4.45%, 3cy, 10yr 1037 W	Low-Sn Zirc-4 50 GWD/MTHU 4.0%, 2cy, 22yr 725 W	M5 51.0 GWD/MTHU 4.55%, 3cy, 5 yr 1496 W	M5 53.0 GWD/MTHU 4.45%, 3cy, 10yr 1035 W
23	24 (TC Lance)	25	26	27	
Zirlio 55.1 GWD/MTHU 4.25%, 3cy, 11yr 1036 W	Zirlio 52.9 GWD/MTHU 4.45%, 3cy, 10yr 1031 W	M5 51.0 GWD/MTHU 4.55%, 3cy, 5 yr 1495 W	M5 51.3 GWD/MTHU 4.55%, 3cy, 5 yr 1511 W	M5 53.5 GWD/MTHU 4.4%, 3cy, 8yrs 1178 W	
	29	30	31 (TC Lance)	32	
	M5 51.2 GWD/MTHU 4.40%, 3cy, 8yr 1073 W	M5 53.0 GWD/MTHU 4.55%, 3cy, 8yr 1155 W	Zirlio 54.9 GWD/MTHU 4.25%, 3cy, 11yr 1031 W	Zirlio 52.3 GWD/MTHU 4.25%, 3cy, 13yr 918 W	



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North Anna ISFSI Research Project Milestone Schedule

- **6/15: Completion of sister rod retrieval**
- **7/31/15: Dominion submits LAR 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**



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**North Anna ISFSI
Research Project
TN-32 HBU Cask Specifics**

- **No significant changes to the cask body or basket are anticipated**
 - **TN-32B-81 (original nameplate) cask fabricated and certificate of conformance issued by Areva TN**
 - **Nameplate will be modified**
 - **Cask exterior will be recoated**
 - **No changes will be made to the pressure monitoring system, pressure switches, or alarm hookups**
 - **The pressure monitoring system will monitor additional thermocouple lance penetrations**



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North Anna ISFSI Research Project

TN-32 HBU Cask Specifics

- **Physical changes to the TN-32 HBU Cask include:**
 - **Seven thermocouple ports will be added to the lid**
 - Confinement maintained by dual metallic seals very similar to the port cover dual metallic seals described in the original TN-32 FSAR
 - Additional helium lines will be used to connect the thermocouple port seals to the Overpressure System (OP) for seal integrity monitoring
 - Top neutron shield elevated approximately one inch to provide space for thermocouple wiring and OP system tubing
 - **An additional hand-way will be added to the Protective Cover (environmental cover) to permit access to the vent port for subsequent gas sampling at the pad**
- **Upgraded lid closure bolt connections**



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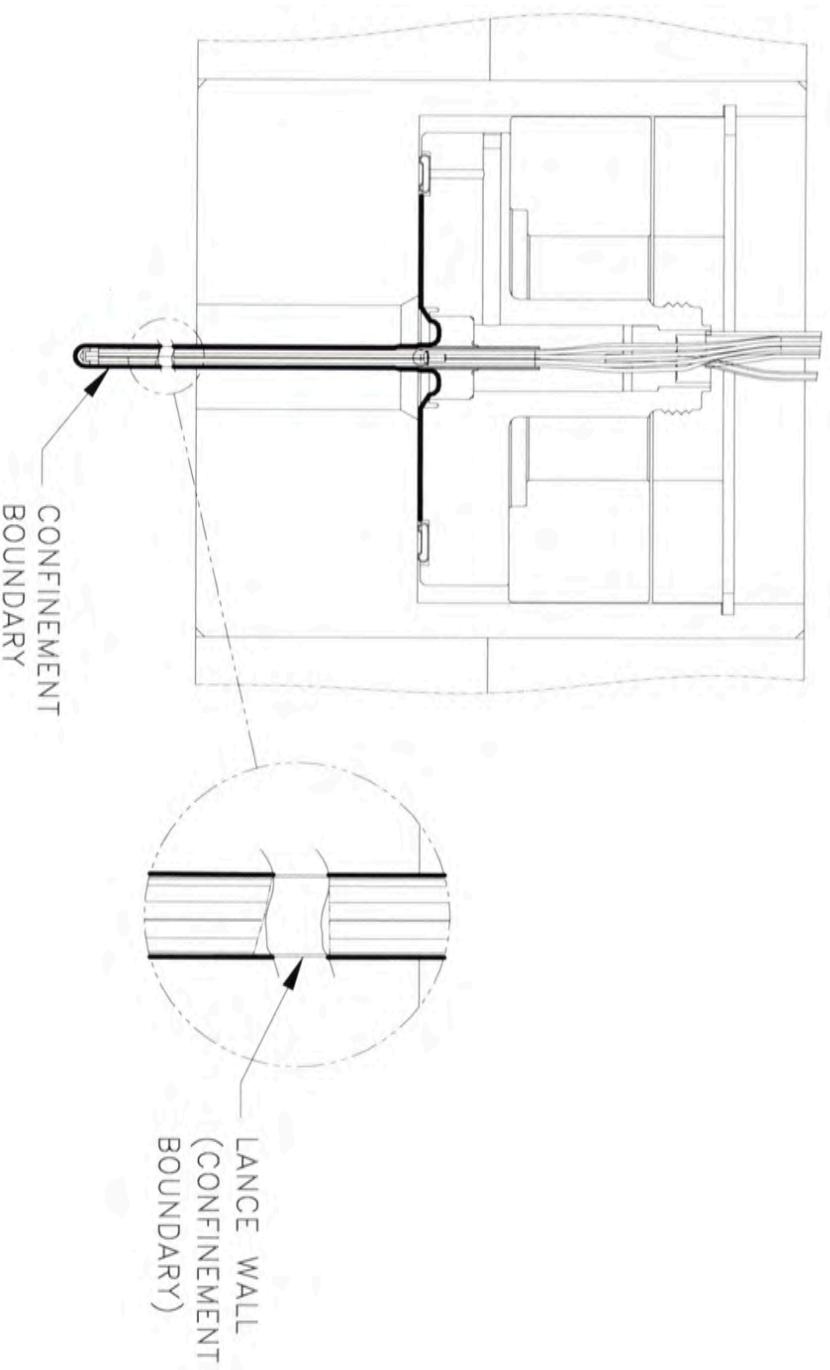
North Anna ISFSI Research Project TN-32 HBU Cask Specifics

- **Confinement boundary**
 - **Maintained from original TN-32 design, with the following additions:**
 - **Thermocouple sleeve inserts, head, and lance**
 - **Thermocouple is based on the design used in PWR reactors**
 - **Dual seal configuration with same Tech Spec monitoring equipment - connected at the ISFSI pad**



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North Anna ISFSI Research Project TC Lance Confinement Boundary





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North Anna ISFSI Research Project TN-32 HBU Cask Specifics

- **Additional components included in the design**
 - **Thermocouple/fuel assembly interface guides**
 - **Neutron absorber rods for future transport considerations**
 - **Similar to absorber assemblies used during operation**



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**North Anna ISFSI
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TN-32 HBU Cask Specifics**

- **TN-32B HBU cask fabricated to CoC 72-1021 requirements**
 - **Not initially licensed for high burnup fuel**
- **Seek to amend North Anna's site specific ISFSI license SNM-2507 for TN-32 storage casks to add the HBU Cask**



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North Anna ISFSI Research Project License Changes

- **Requested changes to the license will include:**
 - **Allowable fuel parameters**
 - Initial Enrichment
 - 4.60 wt. % (Areva Advanced Mark BW)
 - 3.64 wt. % (Westinghouse Standard)
 - 4.50 wt. % (Westinghouse Vantage 5H)
 - Average Burnup
 - ≤ 60 GWD/MTU
 - Minimum Cooling Time
 - 5 years
 - Decay Heat
 - ≤ 36.96 kW
 - Fuel Assembly Designs
 - Areva Advanced Mark BW
 - Westinghouse Standard
 - Westinghouse Vantage 5H



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North Anna ISFSI Research Project License Changes

- **Requested changes to the license will include:**
 - **Allowable fuel parameters**
 - Fuel Assembly Inserts
Unirradiated Poison Rod Assemblies (six total)
 - Fuel Assembly Weight, Including PRAs
≤ 1551 pounds
 - Fuel Assembly Initial Uranium Content
≤ 469.0 kgU/assembly



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North Anna ISFSI Research Project License Changes

- **Requested changes to the license will include:**
 - **Changes to LCOs**
 - A surveillance will be added to LCO 3.1.2 for SSSC seal integrity to allow for cavity testing during Loading Operations (extended period of time before final closure - “thermal soak period”)
 - Frequency period for LCO 3.1.3 moved to Table 3-1 to allow for cavity testing during Loading Operations
 - No change to the limits in Table 3-1 for existing TN-32 design
 - Surface dose rates for the top of the cask will increase, but no change to the side surface dose rate is necessary



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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**



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North Anna ISFSI Research Project In Situ Cavity Gas Sampling

- **Method**
 - Install scaffold building over cask, remove vent port cover, fill gas sample bottles, analyze contents
 - 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 approximately 3 years after first sample
 - Once prior to transport
- **Basis**
 - Aligns with station resource requirements and ALARA principles
 - Supports industry license renewal timing needs



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North Anna ISFSI Research Project

In Situ Cavity Gas Sampling - Licensing

- **SNM-2507 license does not describe in situ cavity gas sampling**
- **In situ cavity gas sampling will be addressed in a separate licensing action following LAR submittal**



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North Anna ISFSI Research Project

Questions?

North Anna ISFSI

SNM-2507 License Renewal

Rich Ridder

May 13, 2015



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North Anna ISFSI License Renewal Plan

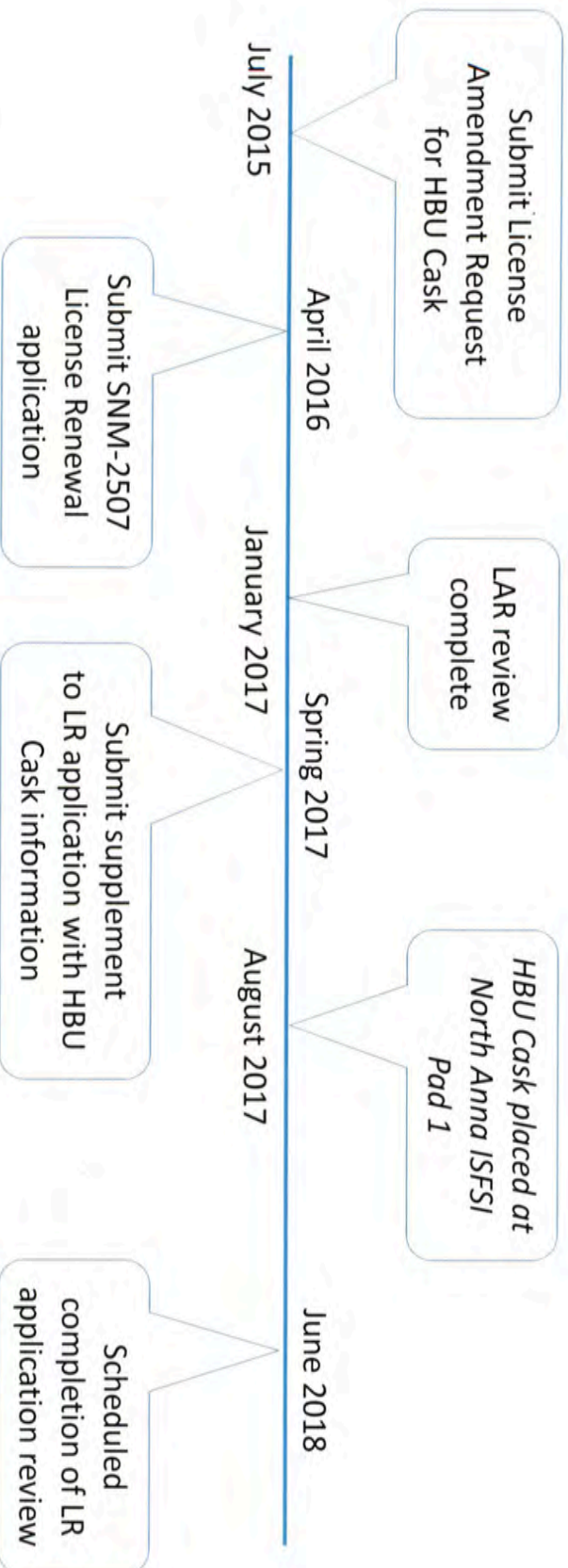
- **Site-Specific License SNM-2507 expires June 2018**
- **License Renewal (LR) application scheduled for submittal April 2016**
 - **Includes the TN-32 casks presently on Pad 1**
 - **NUREG-1927 Rev. 0, use expanded guidance (draft) from Rev. 1**
 - **Aging Management guidance from NEI 14-03**
 - **TLAAs**
- **40 year renewal period**
- **2016 LR application will not contain information about the HBU Cask**



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North Anna ISFSI License Renewal Application and LAR Timing

HBU Cask Activities



License Renewal Activities



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North Anna ISFSI License Renewal Plan - Summary

- **License Amendment Request for the HBU Cask to be submitted July 2015, prior to the ISFSI License Renewal application in 2016**
 - **Needed to support HBU Cask loading schedule**
 - **Submittal letter for the License Amendment Request will explain the plan for the License Renewal application**
- **Inclusion of HBU Cask information in a Supplement to the LR application once LAR review is completed**
- **HBU Cask is planned to be loaded and placed at the ISFSI during the License Renewal application review period**



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North Anna ISFSI License Renewal

Questions?