



**Global Nuclear Fuel**

A Joint Venture of GE, Toshiba, & Hitachi



FUEL COMPANY

**TVEL**

# TVS-K Lead Test Assembly Program Status Update

December 7, 2017



**Exelon** Generation®

# Agenda

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- Introductions and Opening Remarks
- Meeting Purpose
- Project Overview
- Design and Fabrication of LTAs
- LTA Analysis
- LTA Licensing
- Summary
- NRC Questions/Feedback

## ***Meeting Purpose***

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- Provide an update to NRC on the status of work planned and in progress to load TVS-K LTAs into the Braidwood Station Unit 1 reactor in response to the NRC's request at the March 6, 2017 meeting
  - Summarize the LTA design features and overall project
  - Report on Operating Experience with the design
  - Discuss engineering and manufacturing of the LTAs, including Quality Assurance
  - Outline Exelon's proposed licensing approach for the LTAs
- Obtain NRC feedback on the program and identify specific NRC Staff issues

# Agenda

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- Introductions and Opening Remarks
- Meeting Purpose
- ***Project Overview***
  - *Background and Objective*
  - *Description of TVS-K Fuel Design*
  - *Overall Project*
  - *Ringhals Operational Experience*
- Design and Fabrication of LTAs
- LTA Analysis
- LTA Licensing
- Summary
- NRC Questions/Feedback

## ***Project Overview***

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- Exelon plans to load up to eight TVEL TVS-K LTAs in the Braidwood Station Unit 1 reactor core for operation in Cycles 22, 23, and 24; Unit 1 Cycle 22 starts in Fall 2019
- The purpose of this evaluation program is to allow Exelon to gain an understanding of the behavior of mixed fuel cores prior to a possible transition from Westinghouse fuel to the TVS-K fuel design
  - TVEL fuel is currently used in non-US pressurized water reactors; however, the TVS-K LTA fuel design has not been reviewed by the NRC and the cladding alloy is not explicitly listed in 10 CFR 50.46 or 10 CFR 50 Appendix K as an approved material type
- LTA program is a joint initiative among Exelon, GNF and TVEL
- Exelon has briefed NRC on the program previously:
  - August 8, 2016 to introduce NRC to Exelon's plans to load TVS-K LTAs
  - March 6, 2017 to discuss the licensing approach to utilize the LTAs

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- Introductions and Opening Remarks
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- Project Overview
- Design and Fabrication of LTAs
- LTA Analysis
- ***LTA Licensing***
  - *Approach*
  - *Schedule*
- Summary
- NRC Questions/Feedback

## ***Licensing Approach***

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- In October 2017, the NRC provided verbal guidance to Exelon regarding the regulatory path forward for Accident Tolerant Fuel LTAs
  - This guidance will be utilized for the subject TVS-K LTAs
  - The regulatory approach for addressing LTAs presented by the NRC during the 2017 Regulatory Information Conference (RIC), “Accident Tolerant Fuel Lead Test Assemblies” is appropriate. Key conclusions include:
    - Plant Technical Specifications allow for the irradiation of a limited number of LTAs in non-limiting locations (i.e. T.S. 4.2.1 for Braidwood Station)
    - LTA evaluations may be based on engineering judgement and unapproved codes and methods
    - An exemption to 10 CFR 50.46 is not required
- In the October 2017 verbal guidance, the NRC further clarified that a Licensing Amendment for use of ATF LTAs is not required, provided that LTAs are allowed by plant Technical Specifications and an associated 10 CFR 50.59 evaluation supports LTA insertion

## Licensing Approach – Additional Detail

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- Technical Specification 4.2.1 states:  
*“Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. **A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions**”*
  - In the 2017 RIC presentation, the NRC indicated that:
    - *“The determination of a limited number of new design features may be based on engineering judgment and unapproved codes and methods”*
    - *“The determination of nonlimiting core region may be based on engineering judgment and unapproved codes and methods”*
- As noted in the 2017 RIC presentation, applicability of 10 CFR 50.46 is limited to UO<sub>2</sub> pellets within cylindrical Zircaloy or ZIRLO cladding; therefore, an exemption to 10 CFR 50.46 is not required for LTAs irradiated under the provisions of Technical Specifications



## ***Licensing Approach – Additional Detail***

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- Evaluation of the TVS-K LTAs will be documented in a 10 CFR 50.59 Evaluation; anticipated conclusion is that a LAR will not be needed
- During the October 2017 NRC verbal guidance call, the NRC provided additional insight regarding 50.59 Evaluation question 7 (regarding fission product barrier design basis limits); and question 8 (regarding methods of evaluation)
  - Question 7 “may” be answered “No” based on guidance in NEI 96-07, Section 4.1 which states:  
*“To reduce duplication of effort, 10 CFR 50.59 (c)(4) specifically excludes from the scope of 10 CFR 50.59 changes to the facility or procedures changes that are controlled by other more specific requirements and criteria established by regulation.”*
    - Technical Specification 4.2.1 provides these more specific criteria
  - Question 8 “may” be answered “No” since evaluations are being done to confirm that placing a limited number of LTAs in non-limiting locations does not invalidate the existing “approved” core reload analysis methodologies
- The NRC noted (and Exelon concurs) that a 50.59 Evaluation is the Licensee’s responsibility

## ***Project Schedule/Milestones***

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- Jul 2016 Commercial agreements in place for TVS-K LTA core reload analysis
- Aug 2016 NRC pre-submittal presentation
- Mar 2017 50.46 Exemption Request Pre-submittal Meeting held with NRC; preliminary feedback indicated no exemption request needed
- Dec 2017 NRC status meeting
- Jul 2018 LTA 50.59 Evaluation drafted
- Sep 2018 Core design with LTAs complete for Braidwood Station Cycle 22
- Oct 2018 Begin manufacturing TVEL LTAs
  - 9 months lead time prior to ship date
- Jul 2019 Core reload analysis complete
  - Exelon will notify the NRC and confirm analysis results are acceptable prior to loading LTAs
  - LTA 50.59 Evaluation completed
- Jul 2019 Ship 8 TVS-K LTAs to Braidwood Station
- Oct 2019 Load 8 TVS-K LTAs in Braidwood Station Unit 1 core

## Summary

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- Extensive work is in progress to support loading up to 8 TVS-K LTAs into the Braidwood Station Unit 1 reactor prior to Cycle 22
  - Operating experience from the Ringhals 3 TVS-K LTA program is being factored into Exelon's program
- LTA *evaluations* will be documented in a 10 CFR 50.59 Evaluation based on guidance provided by the NRC to Exelon in October 2017
  - No 10 CFR 50.46 exemption request or License Amendment Request will be needed
- NRC is welcome to review the evaluations supporting the LTAs, including the 50.59 Evaluation
- Future updates will be provided to the NRC as appropriate

# ***NRC Questions/Feedback***

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