

CNSC/NRC Joint TRISO Fuel Assessment Project

Objective/Scope

CNSC and USNRC staff will work together to establish a common regulatory position on TRISO fuel qualification based on existing knowledge and to identify any potential analytical or testing gaps which would need to be addressed to enable TRISO use in advanced reactor licensing applications.

Context/Background

Recent documents were issued addressing the topic of fuel qualification in general and TRISO fuel qualification in particular:

- By letter dated August 11, 2020, NRC staff approved the use of Topical Report EPRI-AR-1(NP)-A, "Uranium Oxycarbide (UCO) Tristructural Isotropic (TRISO) Coated Particle Fuel Performance," (Reference 1). This topical report establishes a foundation for TRISO fuel performance, based on testing performed as part of the US Department of Energy (DOE) Advanced Gas Reactor (AGR) Fuel Development and Qualification Program.
- The Nuclear Energy Agency (NEA), Committee on Nuclear Regulatory Activities (CNRA), Working Group on the Safety of Advanced Reactors (WGSAR) developed the report, "Regulatory Perspectives on Nuclear Fuel Qualification for Advanced Reactors," which provides a set of goals that, if met, support a determination that a fuel is qualified for use. This report was approved by the Committee on Nuclear Regulatory Activities (CNRA) and contains input from regulatory authorities from Canada, US, France, Italy, UK, Germany, Russia, and the International Atomic Energy Agency. This NEA report has been incorporated into draft NRC fuel qualification guidance NUREG-2246, "Fuel Qualification for Advanced Reactors," (Reference 2). The set of goals, referred to as a framework, were identified by starting with a top level statement that, "qualified fuel means that reasonable assurance exists that the fuel, fabricated in accordance with its specification, will perform as described in the safety analysis." From this statement, goals were identified related to (1) requirements for specifying key manufacturing parameters, and (2) meeting safety criteria. These goals are further decomposed until a set of base goals, that can be directly satisfied by evidence, are identified. These base goals address several areas important to fuel qualification such as the identification of degradation mechanisms, steady-state and transient testing, evaluation models, and data quality.

In addition to the development of these documents, regulatory agencies have been engaged with advanced reactor vendors that are proposing the use of TRISO fuel in their reactor designs. A generic assessment of TRISO fuel would enable efficiencies in the licensing process by

providing reactor vendors and safety authorities with a referenceable report that documents the evidentiary basis for items related to fuel qualification and highlighting the areas where additional analyses and/or testing is needed to support licensing.

Relevance to Memorandum of Cooperation

This project is supportive of the USNRC/CNSC Memorandum of Cooperation (Reference 3), item 2, by (1) developing a shared advanced reactor and technical review approach that facilitate resolution of common technical questions associated with TRISO fuel, (2) collaborating on pre-application activity to ensure mutual preparedness to efficiently review advanced reactors that use TRISO fuel, and (3) collaborating on research to address novel considerations for ensuring the safety of advanced reactors.

Expected Outputs

The expected outcome of this project is the issuance of a report that will (1) provide the evidentiary basis to support regulatory findings for items associated with fuel qualification that are generically applicable to TRISO fuel based on currently available information, (2) identify areas of TRISO fuel qualification that are design dependent, and (3) highlight areas where additional information and/or testing is still needed to support regulatory approval.

Work Process

The CNSC and USNRC will form a working group to accomplish this project. The topic areas to cooperate on include the regulatory requirements and guidance associated with fuel qualification in Canada and the United States.

Milestones

This project will be accomplished in three phases that are highlighted below.

Task A, Project Planning (Complete)

- Timeline: Fourth Quarter 2021
- End Product: Initial project plan finalized with resources in place

Task B, Draft Fuel TRISO Fuel Assessment Report

- Timeline: Fourth Quarter 2021 to Fourth Quarter 2022
- End Products: Four interim draft reports. The final draft will be a comprehensive draft report addressing the goals within the fuel qualification framework from the NEA report, "Regulatory Perspectives on Nuclear Fuel Qualification for Advanced Reactors," and NUREG-2246.

Task C, Finalize Report

- Timeline: Fourth Quarter 2022 to Second Quarter 2023

- End Product: The final report will be a joint CNSC/NRC report providing a generic assessment of TRISO fuel.

Interaction with Stakeholders

Interaction with advanced reactor vendors, potential licensing applicants, and the general public will be conducted through the publicly held periodic stakeholder meetings (for more information, please go to <https://www.nrc.gov/reactors/new-reactors/advanced/stakeholder-engagement.html>). Additionally, the USNRC uses the GovDelivery subscription service to notify interested stakeholders of a number of topics, including Advanced Reactors. The NRC is using GovDelivery to notify stakeholders of upcoming periodic advanced reactor stakeholder meetings. If you are not already subscribed, please consider subscribing to the Advanced Reactors topic to ensure you get these notifications.

You can subscribe here: <https://service.govdelivery.com/accounts/USNRC/subscriber/new>

Points of Contact

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References

1. Transmittal of Published Topical Report, "Uranium Oxycarbide (UCO) Tristructural Isotropic (TRISO) Coated Particle Fuel Performance: Topical Report EPRI-1(NP)-A," November 2020 (ADAMS Accession No. ML20336A052).
2. NUREG-2246, "Fuel Qualification for Advanced Reactors: Draft Report for Comment," June 2021 (ADAMS Accession No. ML21168A063).
3. "Memorandum of Cooperation on Advanced Reactor and Small Modular Reactor Technologies between The United States Nuclear Regulatory Commission and The Canadian Nuclear Safety Commission," August 15, 2019 (ADAMS Accession No. ML19275D578).