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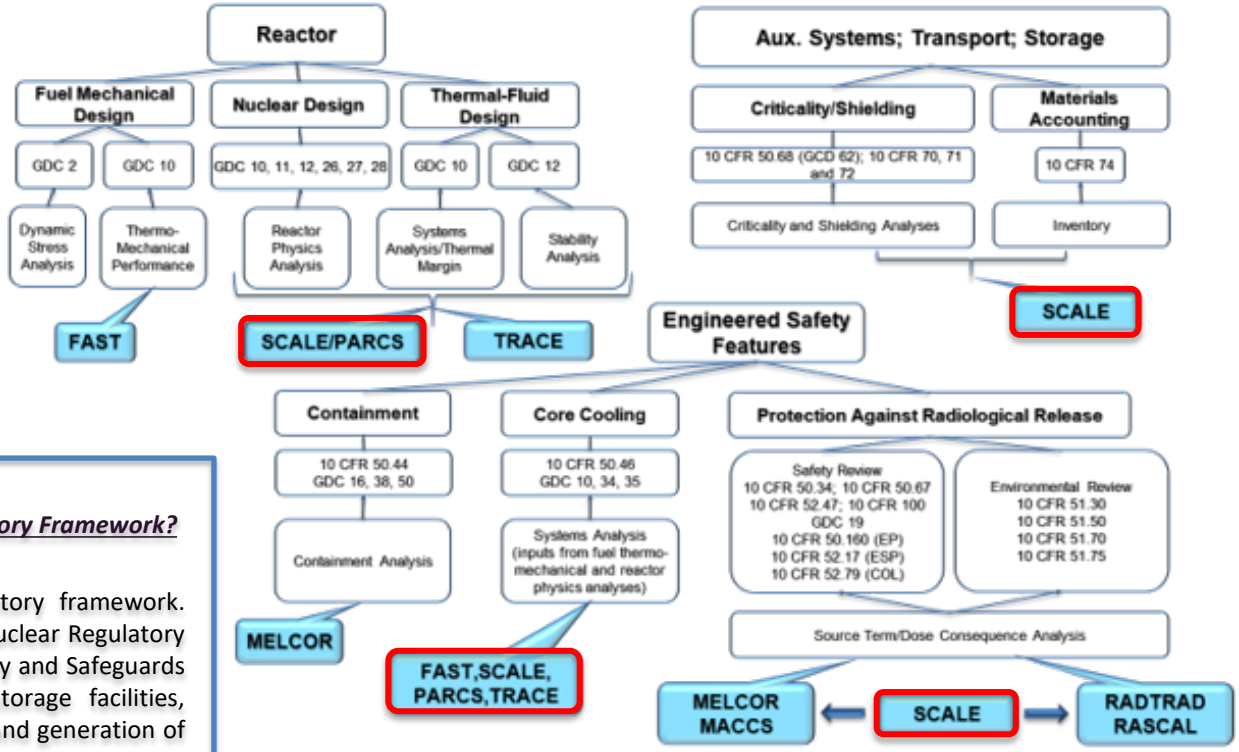
Nuclear Data at the US NRC

Lucas Kyriazidis
Office of Nuclear Regulatory Research

October 2022
Nuclear Data Uncertainty Quantification Working Meeting

Nuclear Data in the Regulatory Framework



Where does Nuclear Data Fit under the NRC's Regulatory Framework?

Nuclear data is used throughout the NRC's regulatory framework. Licensing activities and decision-making in Office of Nuclear Regulatory Regulation (NRR) and Office of Nuclear Materials Safety and Safeguards (NMSS) includes review of consolidated interim storage facilities, burnup credit, analyses of spent fuel pool criticality, and generation of reactor physics and decay heat parameters for design basis accident analysis. All of these rely on quality nuclear data (e.g., ENDF/B) utilized through its neutronics computer code package SCALE.

LWR Activities at the NRC

Near-term ATF

- Higher burnup (>75 GWd/MTU) & Increased Enrichment (< 10 wt. % U-235)
- Chromium-doped fuels
- Iron-based claddings (FeCrAl)
- Cr-coated Zirconium Cladding Systems

Mid- & Long-term ATF

- *Metallic Fuels (< 20 wt. % U-235)*
- *Silicon Carbide*
- *Uranium Silicide*
- *Uranium Nitride*

Does the NRC envision any nuclear data needs for LWRs, including ATF?

Large uncertainties in nuclear data, such as cross-sections, fission yields, and decay data, can propagate into increased uncertainties in key quantities of interests (i.e., k-eff for criticality safety analyses to fuel, moderator, and void reactivity coefficients for reactor physics applications). Thus, the NRC would find it important that nuclear datasets, including uncertainties are complete for the application areas mentioned.

Non-LWR Activities at the NRC

Technology & Reactor Type	*Key Design Characteristics*	

High-Temperature Gas-Cooled Reactors	***Fast Spectrum Systems*****
	• *Fuel Forms*
	  • *Uranium Carbide Fuel*
	  • *Silicon Carbide Claddings*
	• *Helium-cooled*
		Thermal Spectrum Systems**
		• *Graphite Moderated,*
		• *Helium-cooled,*
		• *TRISO particle (<20 wt.% U-235)*

Fluoride salt-cooled Reactors	***Thermal Spectrum Systems**** • *Graphite Moderated,* • *Molten fluoride salt cooled,* • *FLiBe* • *TRISO particle (UCO kernel) (<20 wt.% U-235)*	

Molten Salt Reactors	***Fast Spectrum Systems***
	• *Uranium-chloride salt fueled*
		Thermal Spectrum Systems*
		• Molten fluoride salt, fueled with UF_4
		  • *LiF, BeF_2, UF_4*
		  • *< 20 wt.% U-235*
		• Graphite moderated

Sodium Fast Reactors	***Fast Spectrum Systems*** • *High Assay LEU metallic fuels* • *Sodium coolant*	

* Applications submitted

** Pre-application activities (e.g., topical reports, white papers, etc.)

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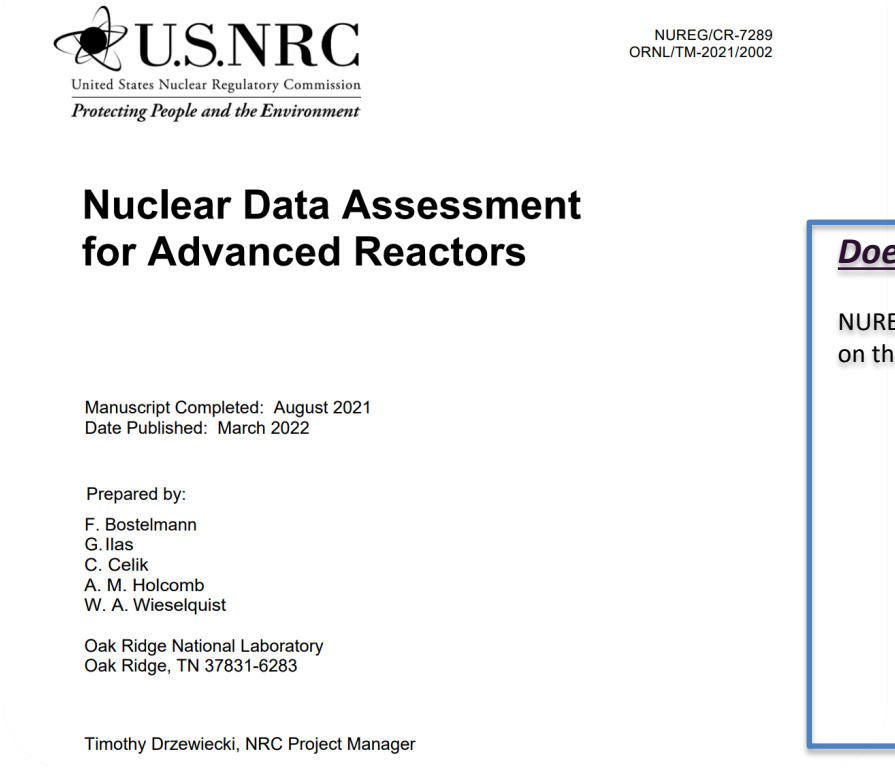
Non-LWR Nuclear Data Needs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NUREG/CR-7289
ORNL/TM-2021/2002

Nuclear Data Assessment for Advanced Reactors

Manuscript Completed: August 2021
Date Published: March 2022

Prepared by:

F. Bostelmann
G. Ilas
C. Celik
A. M. Holcomb
W. A. Wieselquist

Oak Ridge National Laboratory
Oak Ridge, TN 37831-6283

Timothy Drzewiecki, NRC Project Manager

- *NUREG/CR-7289*
  - *Assessment on key nuclear data relevant to reactor safety analysis in selected non-LWR technologies*

Does the NRC envision any nuclear data needs for non-LWRs?

NUREG/CR-7289 identified many key isotopes for the various types of non-LWR designs on the horizon. This assessment also identified missing nuclear data. Examples include:

- Many non-LWR designs are **graphite-rich**. Thus, complete nuclear data sets for graphite would be important. One key missing nuclear data identified was missing graphite thermal scattering uncertainty data.
- Nuclear data related to the salts (e.g., FLiBe) under consideration. Some salts make use of Lithium-7. Large uncertainty in Li-7(n,γ) has found to be a dominating contributor to impacting reactivity effects.
- Understanding the differences between nuclear data libraries which impact reactivity (ENDF/B VII.1 to VIII.0) (e.g., Cl-35)

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