

A photograph of the interior of a nuclear reactor. A bright, glowing fuel assembly is visible in the center, surrounded by complex piping and structural elements. A red indicator light is visible in the upper right corner. The overall scene is dimly lit, with the primary light source being the fuel assembly.

NRC Regulatory Research

Enabling Regulatory Readiness

Kim Webber

Director, Division of Systems Analysis

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International Experimental Research

Studsvik Cladding Integrity Project –IV

OECD/NEA Program

Generating data and insights on HBU fuels during LOCA, storage and transportation

2019-2024

Framework for Irradiation Experiments

OECD/NEA Program

Various joint experiment programs for aggregating data on cladding creep behavior and transient behavior, including for ATF

2021-2024

SPARE

Studsvik Joint Project

Saves high-value irradiated fuel materials from final waste disposal for potential new research through transports

2020-2025

2021-2023

Halden Reactor Project

OECD/NEA Program

Opportunities for new insights on key fuel performance topics from old data

2021-2024

QUENCH-ATF

OECD/NEA Program

Experiments for ATF cladding materials in the QUENCH facility at Karlsruhe Institute of Technology (KIT) – Near term chromium-coated cladding under design basis accident (DBA) and beyond DBA

FFRD Research

Research Information Letter (RIL 2021-013)

- Provides NRC technical reviewers with timely interpretations of over 10 years of research on a complex technical issue important to high burnup fuel safety **ML21313A145**

Source Term (RG 1.183, Rev 1)

- “Applicability of Source Term for Accident Tolerant Fuel, High Burn Up and Extended Enrichment,” dated May 13, 2020 **ML20126G376**
- “Letter Report on Evaluation of the Impact of Fuel Fragmentation, Relocation, and Dispersal for the Radiological Design Basis Accidents in Regulatory Guide 1.183” **ML21197A067**

Full-Core LOCA Analysis

- Method to estimate mass loss from FFRD during large break loss of coolant accident (LBLOCA) using NRC tools (Polaris/PARCS – TRACE – FAST)

Fuel Enrichment and Neutronics Research

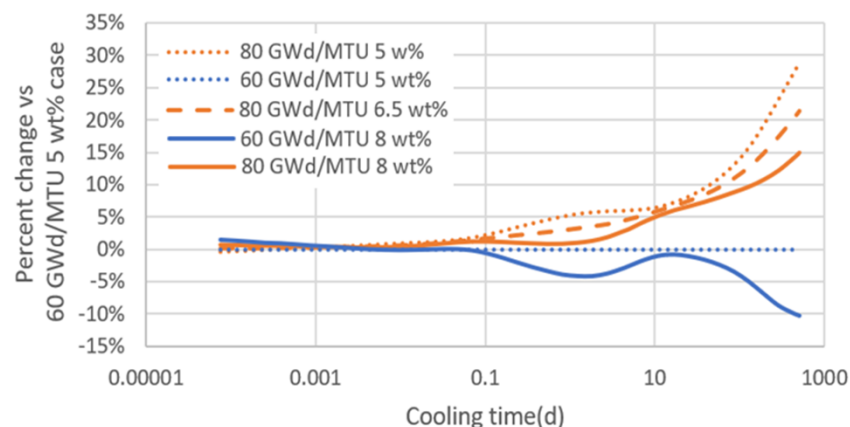
Assessments on Fresh Fuel Criticality

- ATF & Enrichment Impacts to Existing Transportation Packages (ML21040A518)
- ATF & Enrichment Impacts to Fresh Fuel Staging (FY22 Spring)

Assessments on In-Reactor & Spent Nuclear Fuel

- ATF, Enrichment, and HBU Impacts to Decay Heat and Radiation Source Term (FY22 Spring)
- ATF, Enrichment, and HBU Impacts on Lattice Physics and Fuel Isotopics for BWRs & PWRs (ML21088A336/354/254)

Decay heat after discharge for prototypical Westinghouse 17x17 spent fuel assembly



ML21040A518

ORNL/TM-2020/1725

Assessment of Existing Transportation Packages for Use with HALEU

ML21088A254

ORNL/TM-2021/1961

Extended-Enrichment Accident-Tolerant LWR Fuel Isotopic and Lattice Parameter Trends

ML21088A354

ORNL/TM-2020/1835

Isotopic and Fuel Lattice Parameter Trends in Extended Enrichment and Higher Burnup LWR Fuel

Volume II: BWR Fuel

ML21088A336

ORNL/TM-2020/1833

Isotopic and Fuel Lattice Parameter Trends in Extended Enrichment and Higher Burnup LWR Fuel

Vol. I: PWR Fuel



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OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Severe Accident and Source Term Research



NUREG/CR-7282
EPR/CR-21-203

**Review of Accident
Tolerant Fuel Concepts
with Implications to Severe
Accident Progression and
Radiological Releases**

NUREG/CR-7282

ML21113A277



NUREG/CR-7283
EPR/CR-21-204

**Phenomena Identification
Ranking Tables for
Accident Tolerant Fuel
Designs Applicable to
Severe Accident Conditions**

NUREG/CR-7283

ML21210A321

Office of Nuclear Regulatory Research

Cr-Doped UO_2 Fuel

- Not very different from conventional fuels
- Considerable amount of Cr already exists in conventional core
- Some thermophysical properties are slightly less well known
- Limited information regarding fission product speciation and chemistry

Cr-Coated Zr-Clad UO_2 Fuel

- Not very different from conventional fuels
- Considerable amount of Cr already exists in conventional core
- Some thermophysical properties are slightly less well known
- Initial oxidation expected to be lower

HBU/HALEU

- Thermophysical properties of fuel & cladding
- Fission product chemistry & gap inventories
- Effect of fragmentation on core degradation
- No significant differences between HBU/HALEU and HBU

U.S. NRC

United States Nuclear Regulatory Commission
Protecting People and the Environment

We make SAFE use of nuclear technology POSSIBLE.

RES Planned Work and Priorities

Source Term Calculations
for ATF Cr-Coated Cladding
using MELCOR
(Sept. 2022)

Demonstrate capability to
perform full-core LOCA
simulation to quantify fuel
dispersal (FY22/FY23)

Develop in-house
familiarity with DOE codes
(e.g., BISON, Serpent,
Griffin)

Deploy SCALE 6.3 with
updates to support
ATF/HALEU/HBU analyses

Assess FAST against Halden
and SCIP LOCA and
transient FGR tests