Byron Shipment Update

LINE Commission meeting, October 26th 2023 College of Southern Idaho, Twin Falls, Idaho

Fabi Cappia, Ph.D.Characterization and Advanced PIE division





- What is "the" Byron shipment?
- R&D plans and significance for the industry and nuclear community
 - Integrated Recycling Test (IRT) for Joint Fuel Cycle Studies (JFCS)
 - Accident Tolerant Fuels (ATF)
 - Burnup extension (HBu)
- Transportation Logistics

Advanced Fuel Campaign (AFC)

"The" Byron shipment



NAC-LWT cask held with the crane in HFEF high bay during qualification efforts 25 total rods

Leading program/company	# Rods	Activities
JFCS	12	 Limited PIE to support program objectives Demonstration of integrated recycling test
AFC	4	 Comprehensive PIE pre and post testing LOCA testing in TREAT and SATS HERA testing in TREAT
ATF	5	 Comprehensive PIE to support WEC-led licensing efforts HERA testing in TREAT (segments)
Westinghouse (Strategic Partnership)	4	Comprehensive PIE scope to support licensing efforts of their product



Additional synergies with other programs possible to maximize PIE data harvesting (e.g., used fuel program, NSUF etc)

Shipping container where rods are loaded within the NAC-LWT cavity

"The" Byron shipment quantities in perspective



17x17 PWR fuel assembly

Typical core loading strategy for a 4-loop WEC PWR Capps et al., NED 379

IDAHO NATIONAL LABORATORY

JFCS and the IRT scope (1/2)

- The Joint Fuel Cycle Studies (JFCS) program is a cooperative research effort between the U.S. DOE and the Republic of Korea (ROK)
- A key component of the collaboration is an evaluation of the recycling of used Light Water Reactor (LWR) oxide fuels via electrochemical technologies and a fast reactor. Unutilized resources in the spent LWR fuel are casted into fuels for fast reactors
- The Integrated Recycling Tests (IRT) were planned at INL as part of the JFCS

Integrated Recycling Tests (IRT) at INL

- Kg-scale integrated testing activity
- Test bed for demonstration of safeguards and security technologies



Byron shipment

- LWR rods identified as ideal base material
- Receipt of used LWR could be synergized with other programs goals

JFCS and the IRT scope (2/2)

- Key outcomes of IRT:
 - Improvement of process knowledge of electrochemical technologies
 - Evaluation of associated safeguards and security methods and technologies



CAD model of the equipment installed in the hot cells to accomplish the IRT goals

Advanced Fuel Campaign (AFC): ATF and HBu (1/2)



- The mission of the Fuel Cycle Research and Development (FCRD) program of the U.S. DOE Nuclear Energy is to conduct research and development to help develop sustainable fuel cycles, i.e., cycles that:
 - o improve uranium resource utilization
 - o maximize energy generation
 - o minimize waste generation
 - o improve safety
 - limit proliferation risk
- The Advanced Fuel Campaign (AFC) focuses on LWR fuels and advanced fuels for fast reactors (mainly metallic)

Advanced Fuel Campaign (AFC): ATF and HBu (2/2)

Key outcomes of ATF/HBu:

- Qualification of state-of-the-art LWR fuel technology, meeting industry's goal to deploy by mid 2020s
- Extension of fuel cycles (18 to 24 months for BWR and 18 months and beyond for PWR) saving \$M from reduced outages and used fuel costs

ATF/HBu

- Address industry testing needs and priorities
- Provide expertise and independent testing to address data gaps (e.g., LOCA)



Byron shipment

- LWR rods identified as ideal base material to fill the gap
- Critical data in the most prototypical conditions for base irradiation and safety testing

LWR industry priorities and importance of the Byron shipment

- Tier 1 Industry Priorities
 - Establish a transportation network for irradiated materials between commercial plants and national labs

INL TREAT

- Develop and maintain facilities and capabilities to support industry needs (e.g. LWR Test Bed)
- Develop and Execute LOCA Test Plan for FFRD resolution
- Establish BWR/PWR Ramp testing capability



ORNL Severe Accident Test Station



Advanced Fuels Campaign

DR. JENNIFER UHLE Vice President, Generation and Suppliers	NÉI
1201 F Street, NW, Suite 1100 Washington, DC 20004 P. 2027, 293, 514 ju@nei.org	NUCLEAR ENERGY INSTITUTE
September 13, 2022	
Andrew Griffith Deputy Assistant Secretary for Nuclear Fuel Cycle and Supply Chain U.S. Department of Energy 1000 Independence Ave., S.W. Washington, DC 20585	
Subject: Industry's Research and Development Priorities for Accident Tolerant Fuels	3
Dear Mr. Griffith:	
The Nuclear Energy Institute (NEI) ¹ appreciates the U.S. Department of Energy's (DI and coordination with the U.S. nuclear industry in support of accelerating the research licensing, and deployment of Accident Tolerant Fuels (ATF) including increased enrich higher burnup. Currently, the U.S. industry is engaged in a variety of licensing activitie Nuclear Regulatory Commission for ATF, Low Enriched Uranium with greater than 5° (LEU+), and High-Burnup fuels. Research and development (R&D) activities are part to facilitating the industry's ATF deployment goals by the mid-2020s. Given that there testing resources, and time it is vital that R&D activities are focused on those that acc industry's time-sensitive objectives.	DE) engagement h, development, chments and es with the U.S. % enrichments icularly important e is limited funding, celerate the
Attachment 1 to this letter provides the industry's prioritization of the DOE R&D activi activities are key to meet the industry's strategic goals, however, these activities sho critical funding needed by the ATF fuel vendors to design, fabricate, transport, and c irradiate Lead Test Assemblies (LTAs) for follow-on testing at DOE national laboration fuel vendors and utilities coordinate LTA irradiation schedules and licensing activities	ties. These uld not impact the ommercially ry facilities. ATF around the rigid

fuel vendors and utilities coordinate LTA irradiation schedules and licensing activities around the rigid commercial power reactor outage schedules. Unpredictable funding allocations impact the ability of the fuel vendors to meet the strict LTA deployment schedules which could lead to multi-year delays based on outage schedules and possible cancellation of commercial LTA irradiations altogether. DOE's focus on R&D activities identified in Tier I of the attachment remains important to industry's efforts to develop, license, and deploy ATF with increased enrichment and higher burmuy. As the industry progresses

NUCLEAR. CLEAN AIR ENERGY

¹ The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory appect of generic operational and technical issues. NEI's members include entries its energe to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

Overall medium-term schedule of the LOCA and HERA safety testing



LOC-C safety testing executed in September 2023





Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.

WWW.INL.GOV