

Overview of Accident Tolerant Fuel Activities

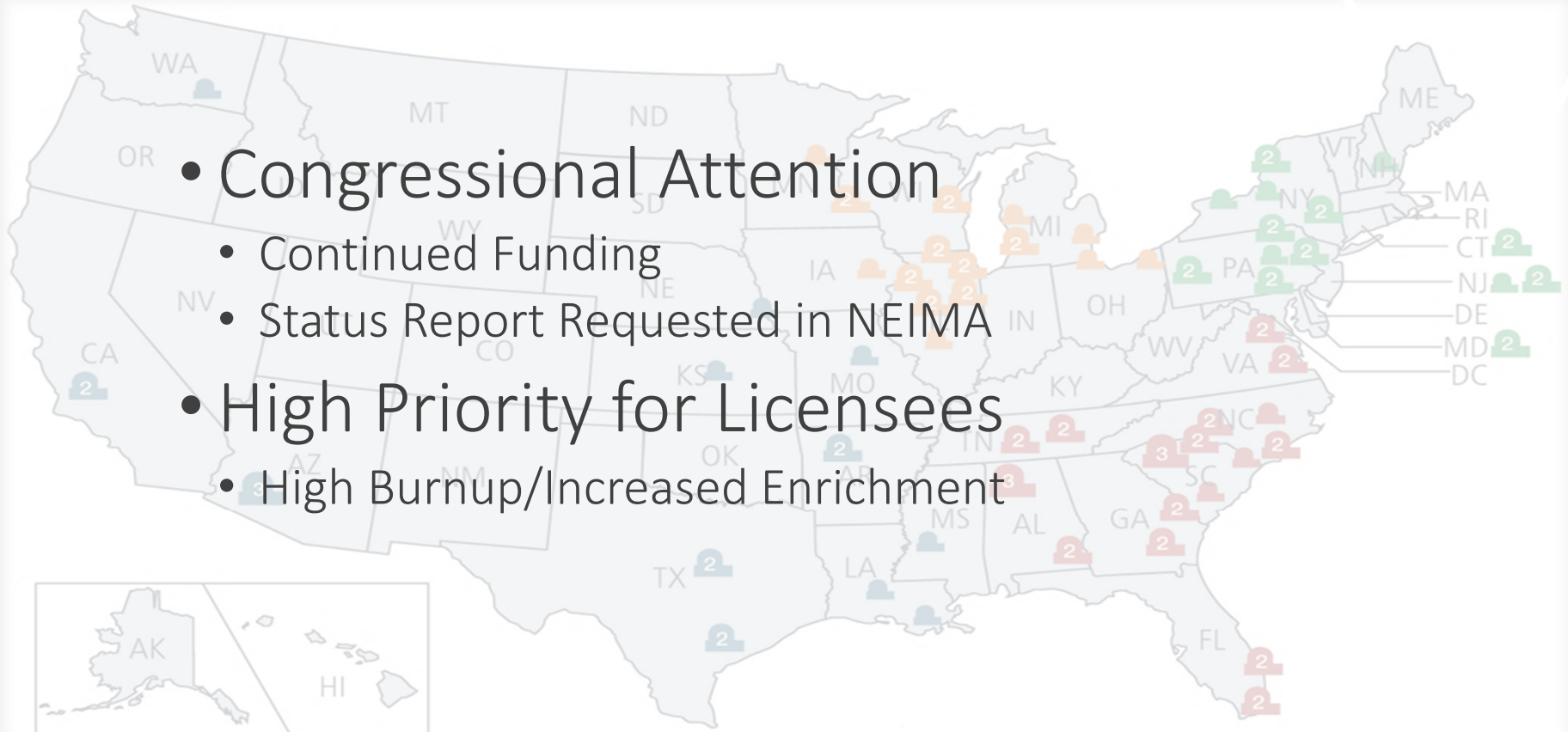
Commission Meeting
February 25, 2020



Opening Remarks

Daniel Dorman
Deputy Executive Director for Reactor
and Preparedness Programs

ATF Has National Strategic Importance

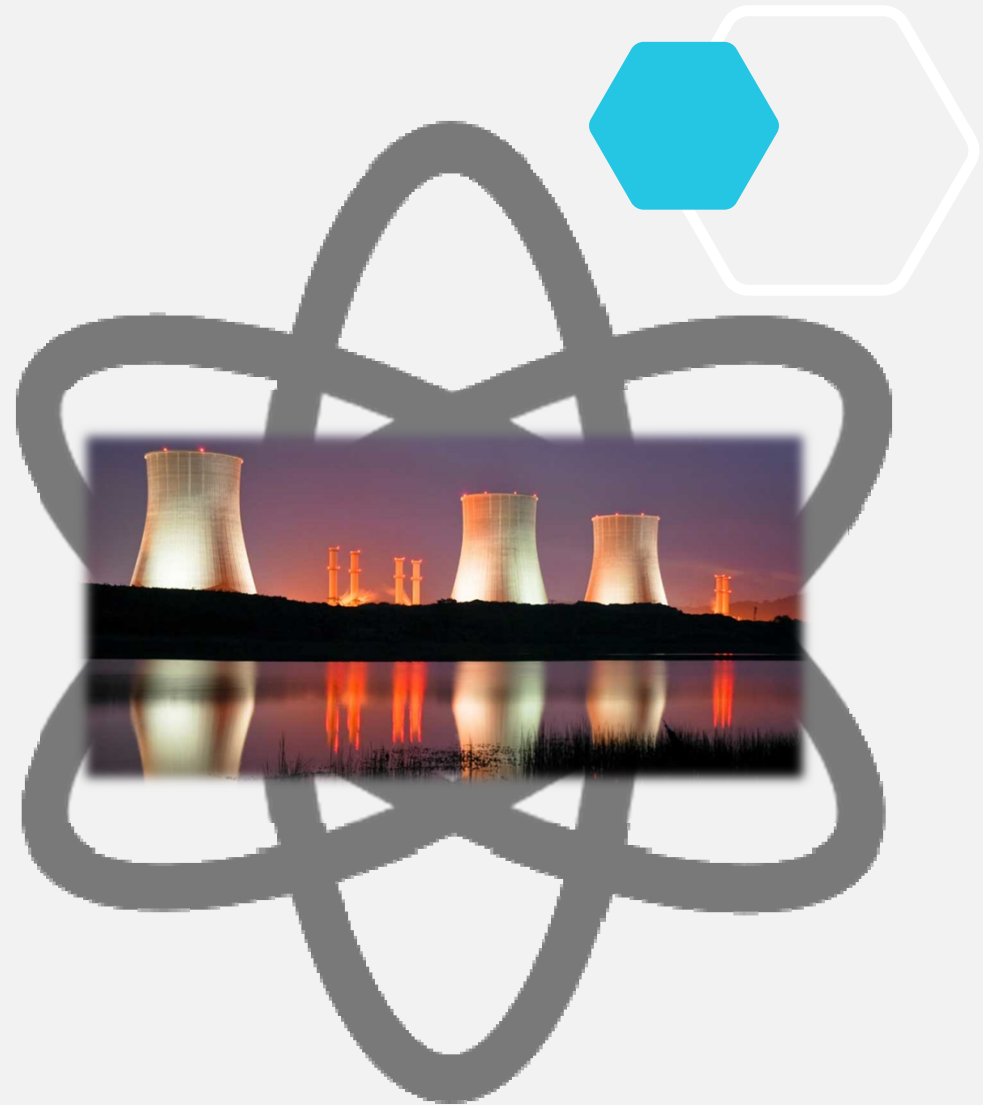


- Congressional Attention
 - Continued Funding
 - Status Report Requested in NEIMA
- High Priority for Licensees
 - High Burnup/Increased Enrichment

Following the ATF
Project Plan

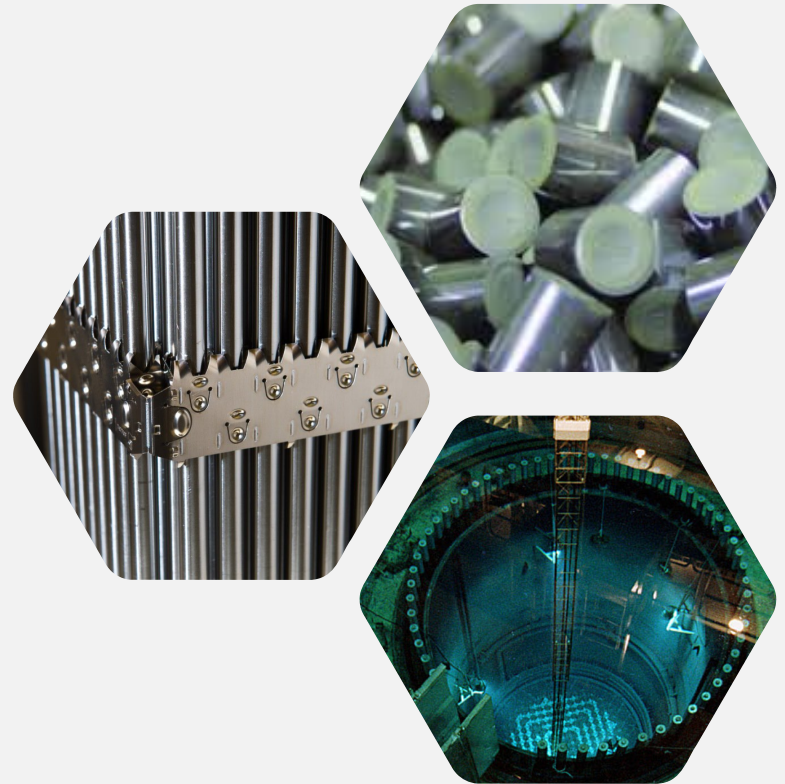
Prepared to License
Near-term ATF Concepts

Being a Modern, Agile, and Risk-
Informed Regulator



Meeting Agenda

- Overview of ATF Activities
 - Andrea Veil
- Readiness for Licensing Near-term ATF Concepts
 - Michael Orenak
- Front-end and Back-end Burnup/Enrichment Considerations
 - Marilyn Diaz
- Technical Bases for Review of Chromium-coated Cladding and In-reactor Burnup Extension
 - Josh Whitman
- Preparation of Confirmatory Analysis Tools for ATF Concepts
 - James Corson

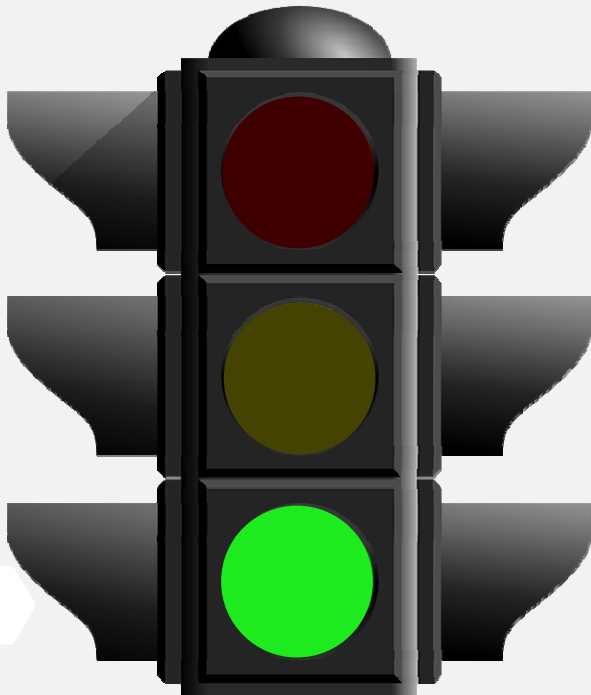




Overview of ATF Activities

Andrea Veil
Deputy Director for Engineering
Office of Nuclear Reactor Regulation

Ready to Engage in the Licensing Process

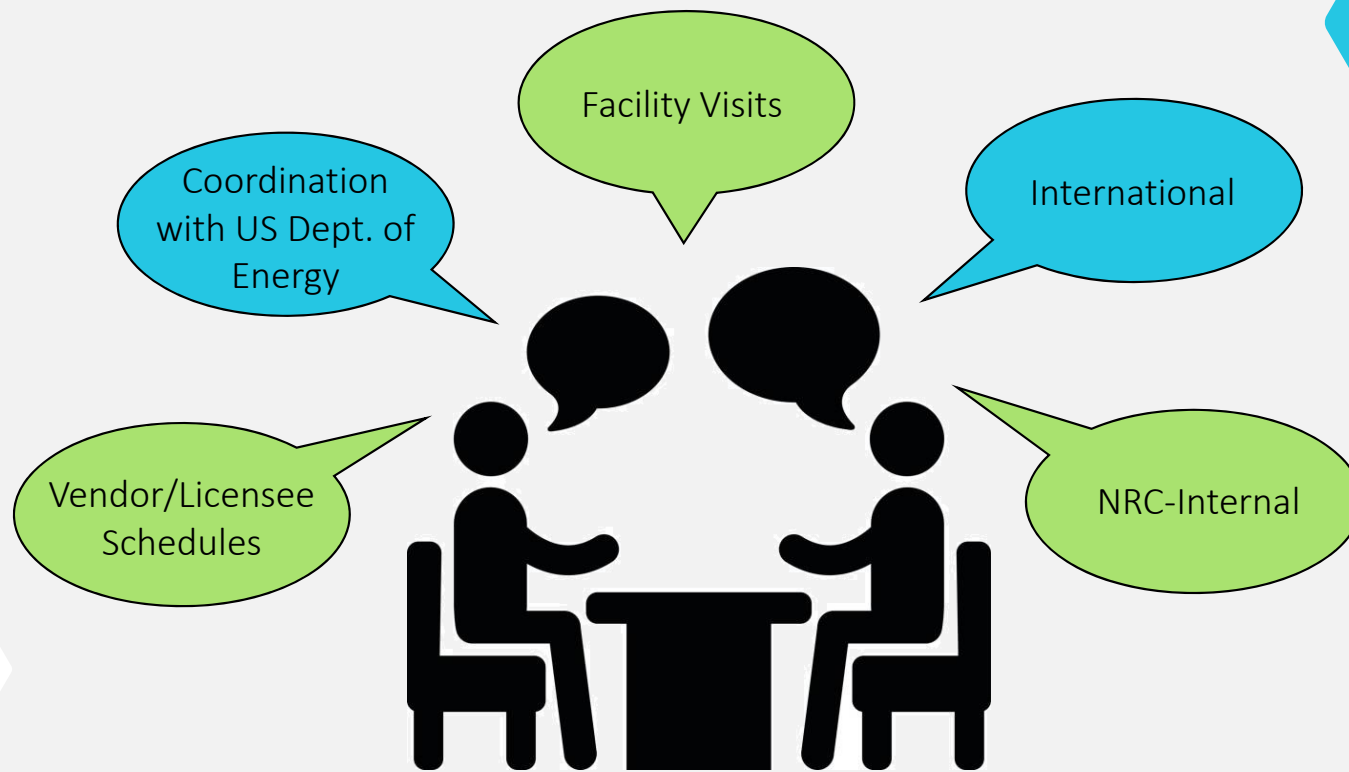


Early and Frequent
Communication

Reviewing Regulatory
Framework and Processes

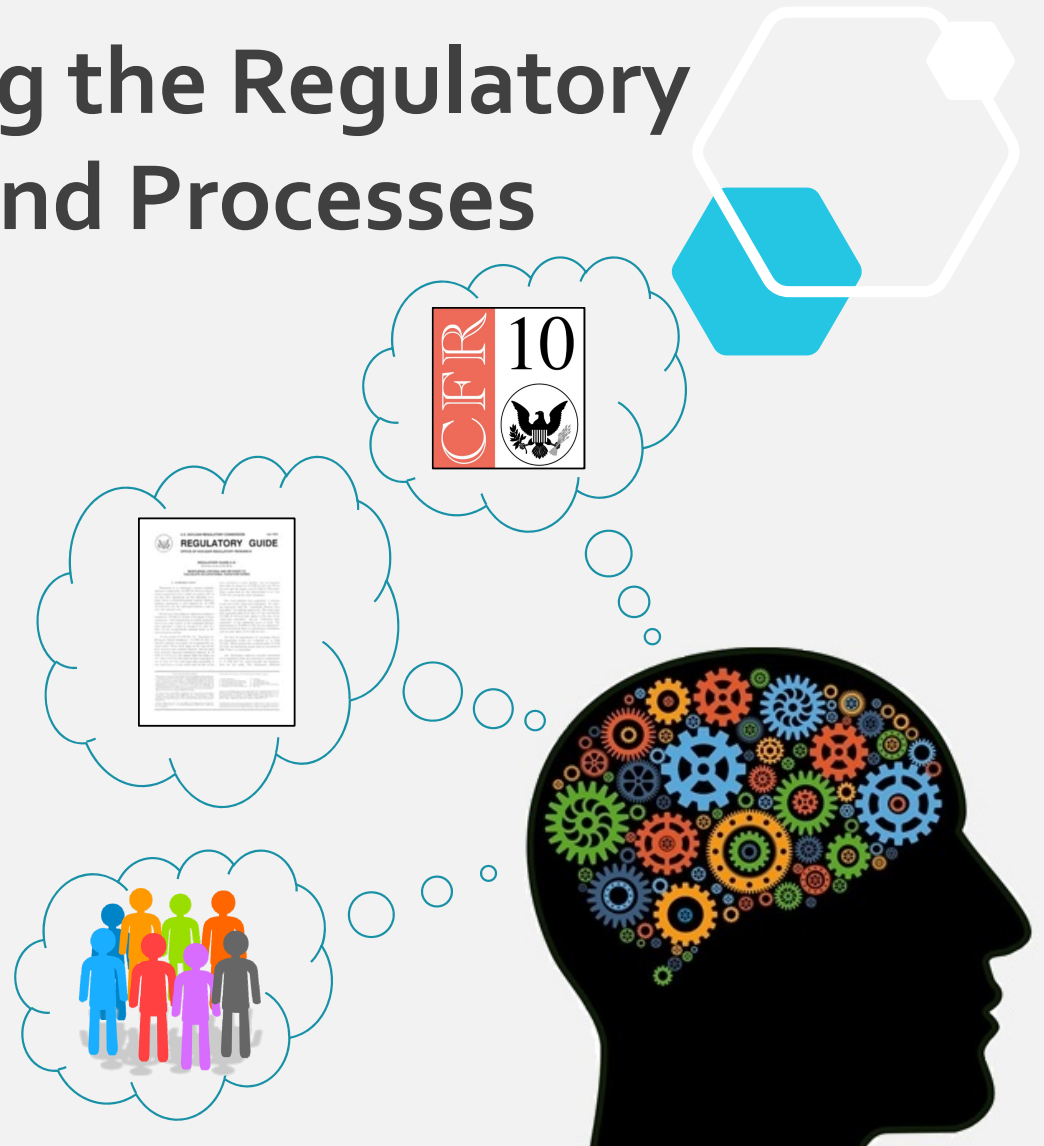
Following Technical Issues

Early and Frequent Communication Is Key

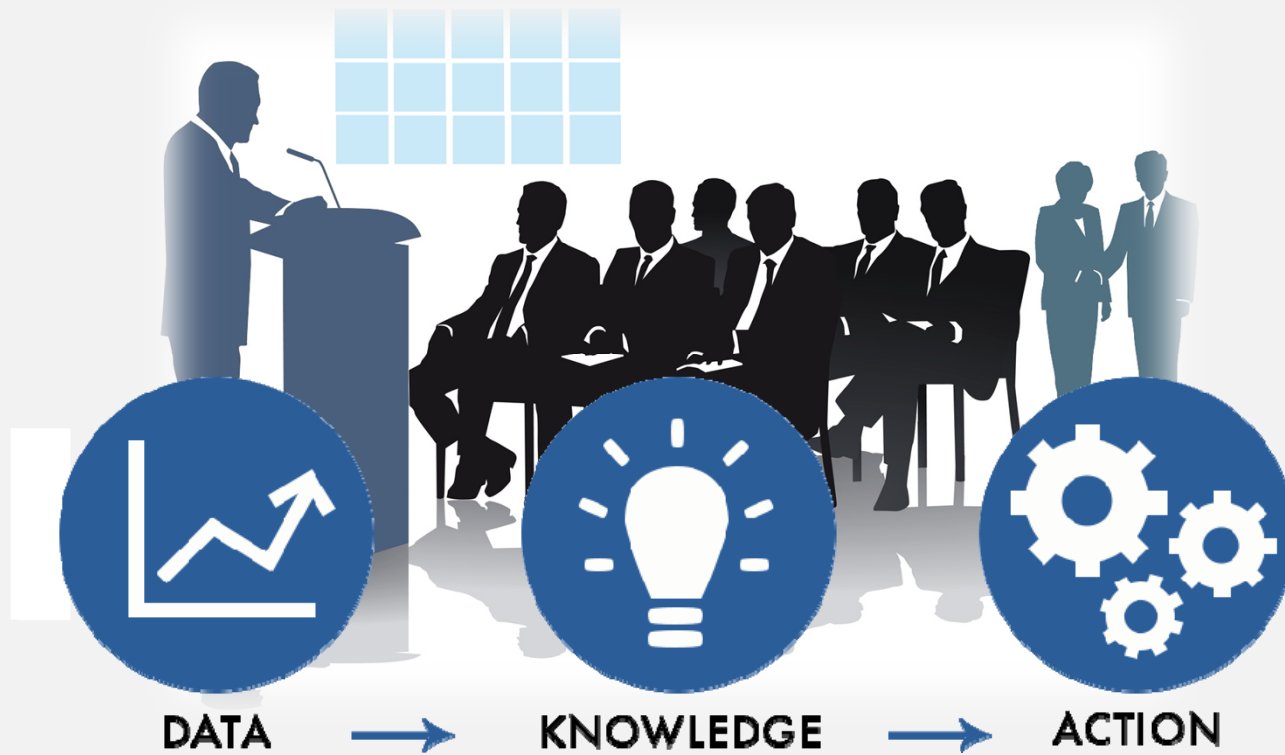


We Are Reviewing the Regulatory Framework and Processes

- Assessing need for rulemaking and new/updated guidance documents
- Ensuring staff resources



Staff Is Following Technical Issues



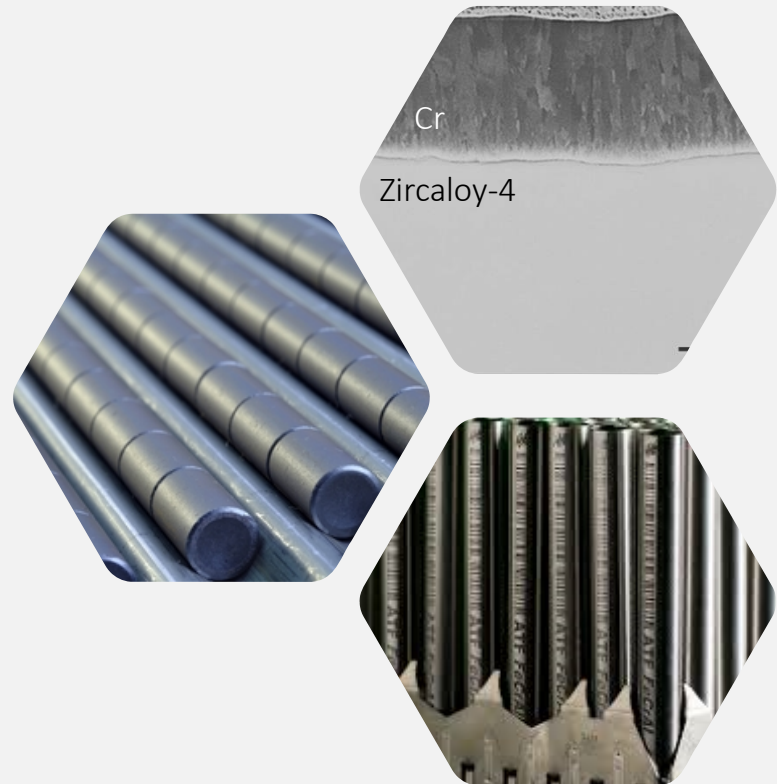


Readiness for Licensing Near-Term ATF Concepts

Michael Orenak, ATF Project Manager
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

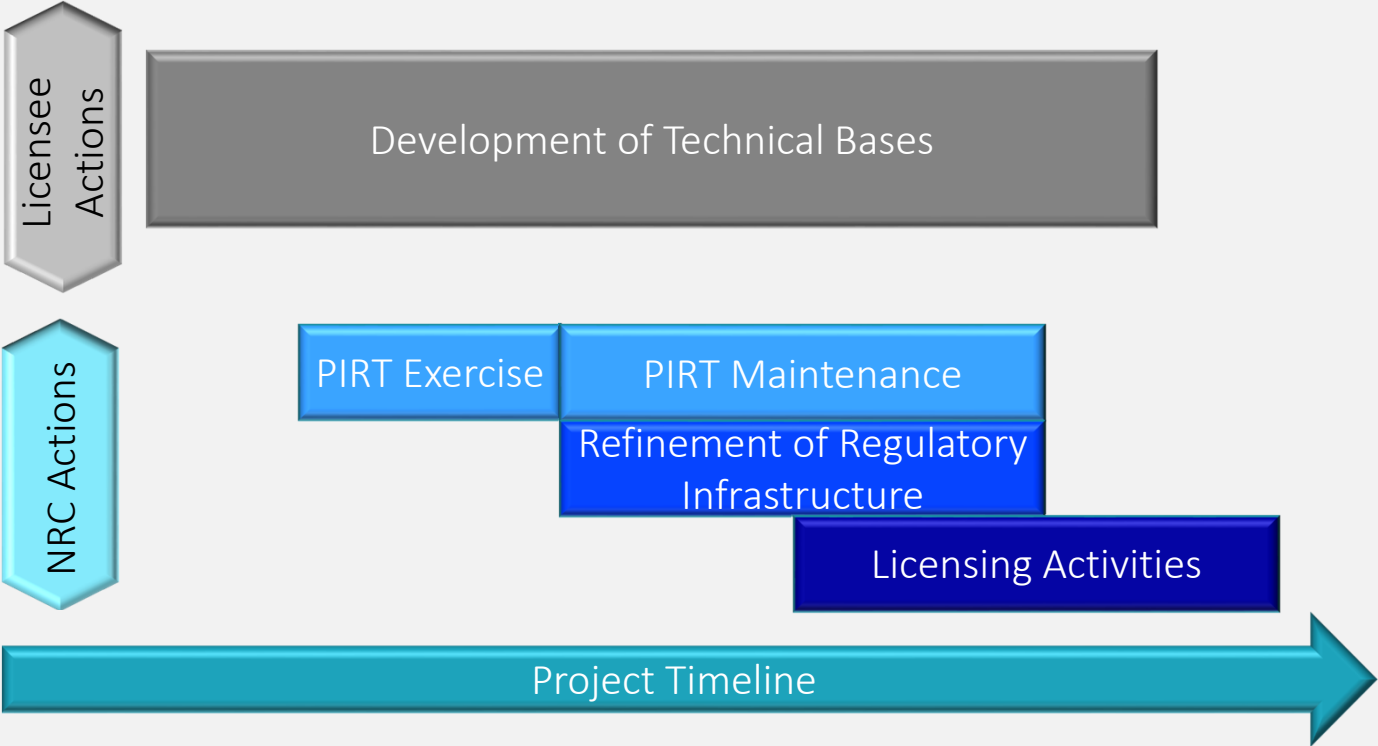
Status of Near-Term ATF Technologies

- Chromium-coated Cladding
 - Topical report coming in 2020
- Doped Pellets
 - Approved for BWR applications
 - Vendors exploring PWR applications
- FeCrAl Cladding
 - Lead Test Assemblies have been inserted
 - No submittal dates are currently known

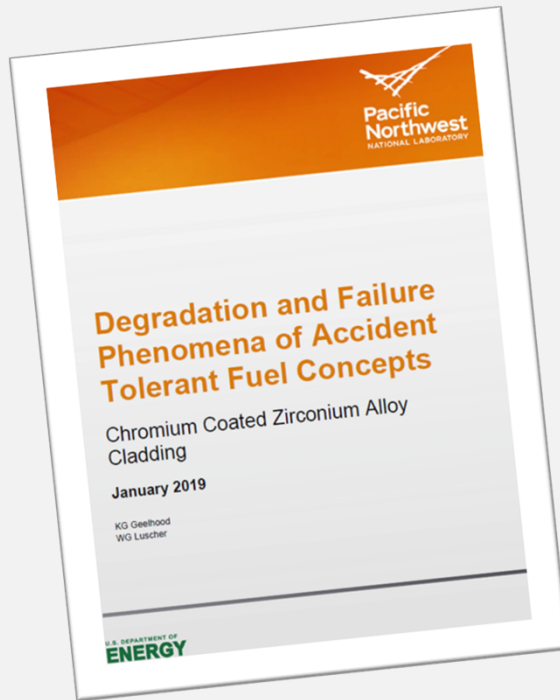


The ATF Project Plan Is Being Followed

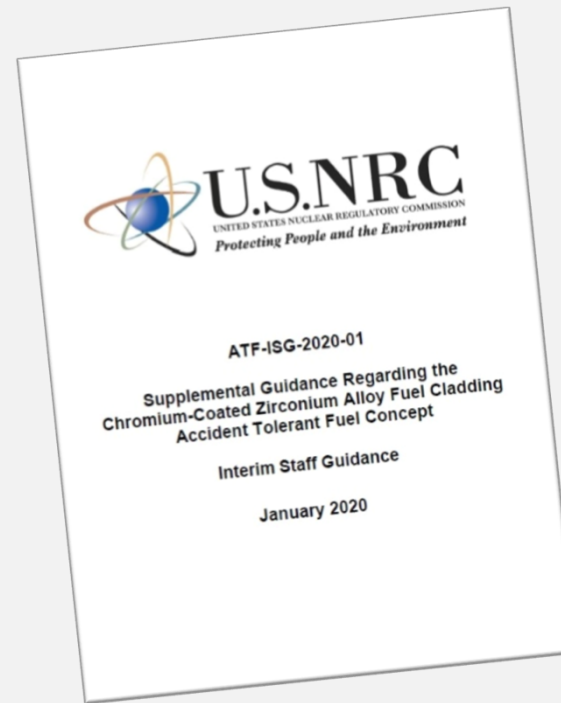
Regulatory and Licensee Actions are Happening in Parallel



The ATF Project Plan Is Being Followed



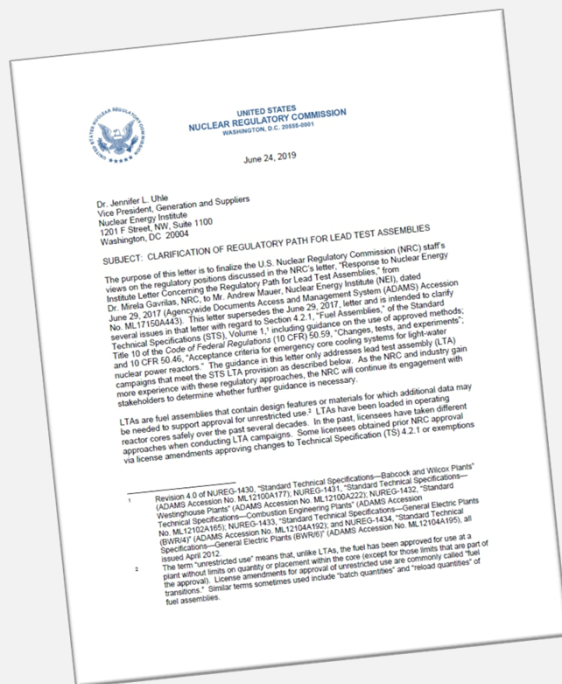
Use of a PIRT in Regulatory Infrastructure Development



ISG Issuance Before Applications are Received



The Staff Is Being Flexible and Responsive to Stakeholder Needs



Clarification of Regulatory Positions for Lead Test Assemblies

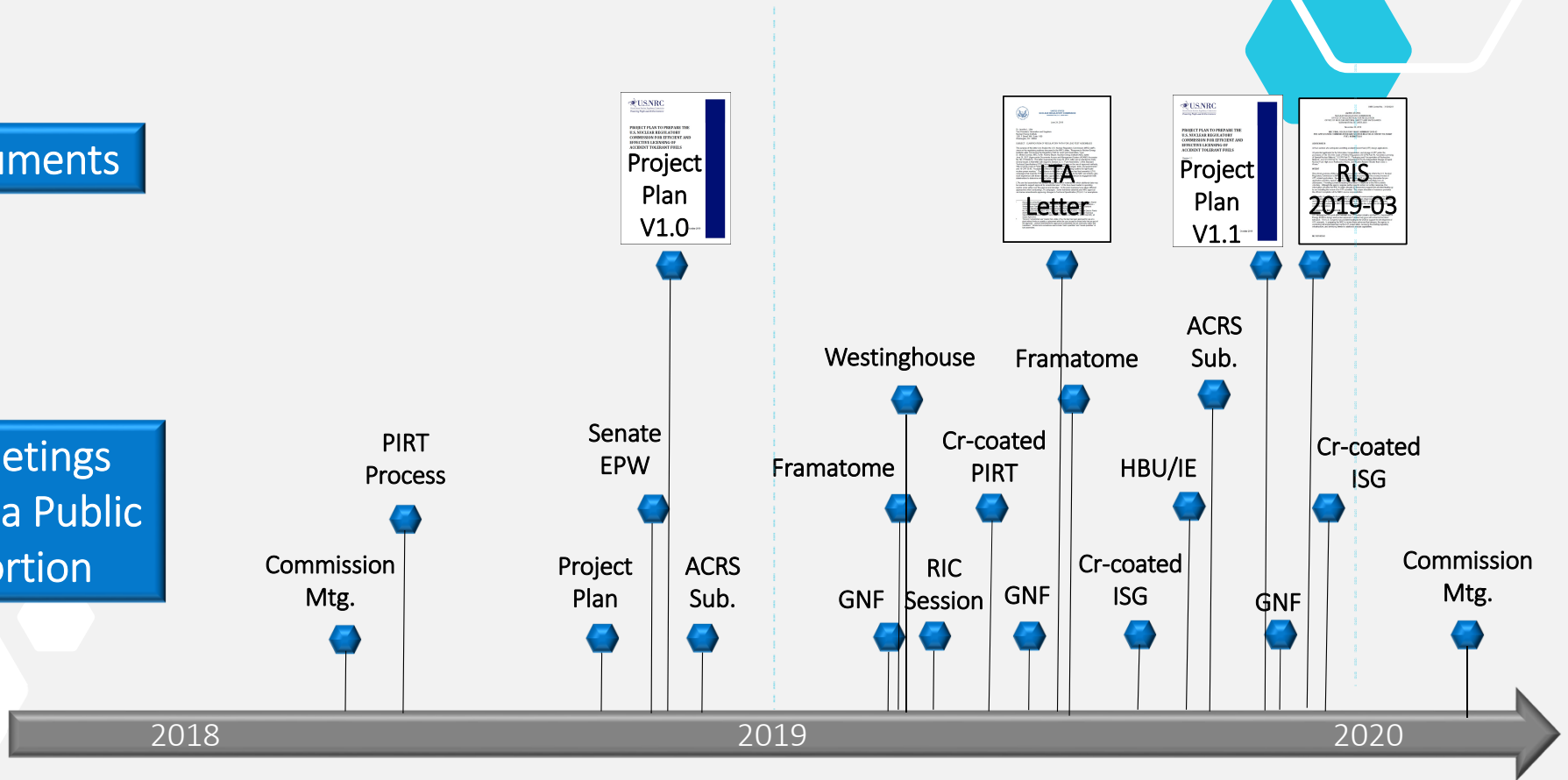


High Burnup and Increased Enrichment Appendix 15

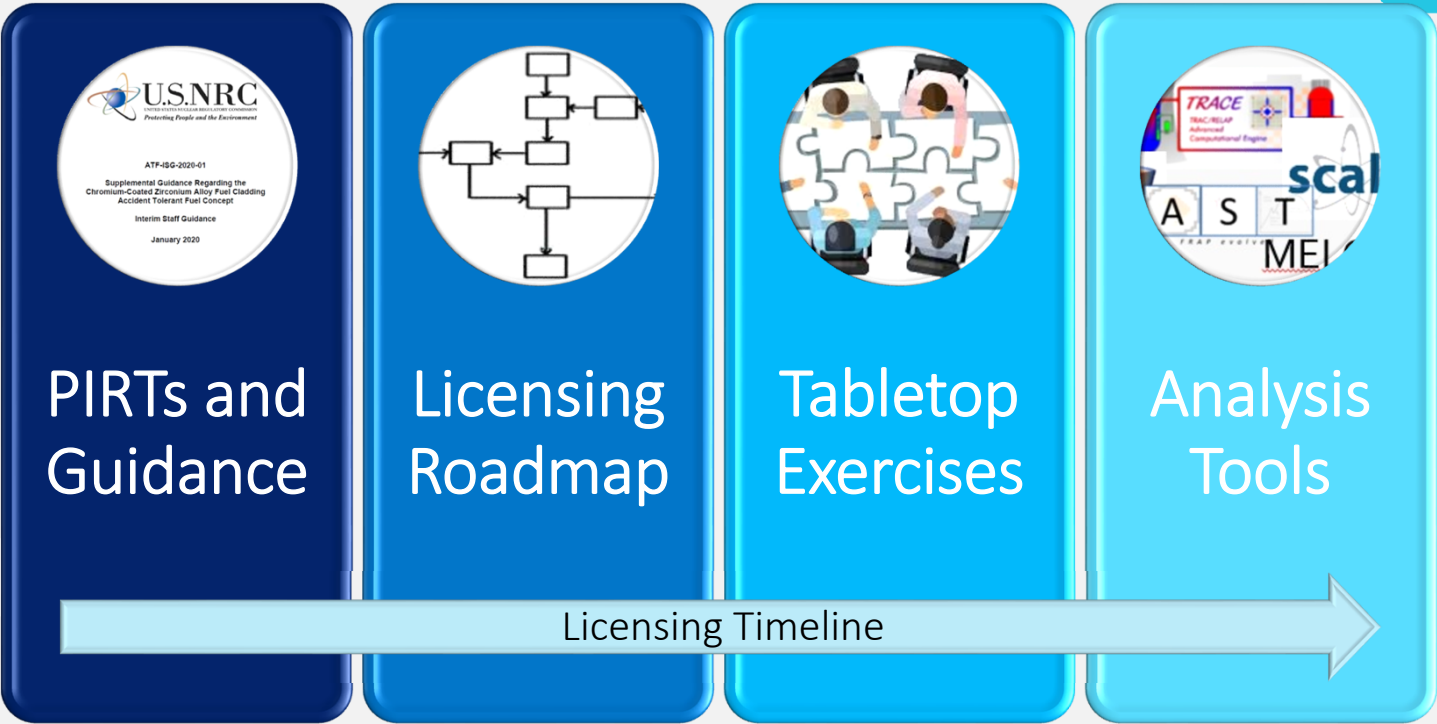
Early and Frequent Communication Is Key to Success of the Project Plan

Documents

Meetings with a Public Portion



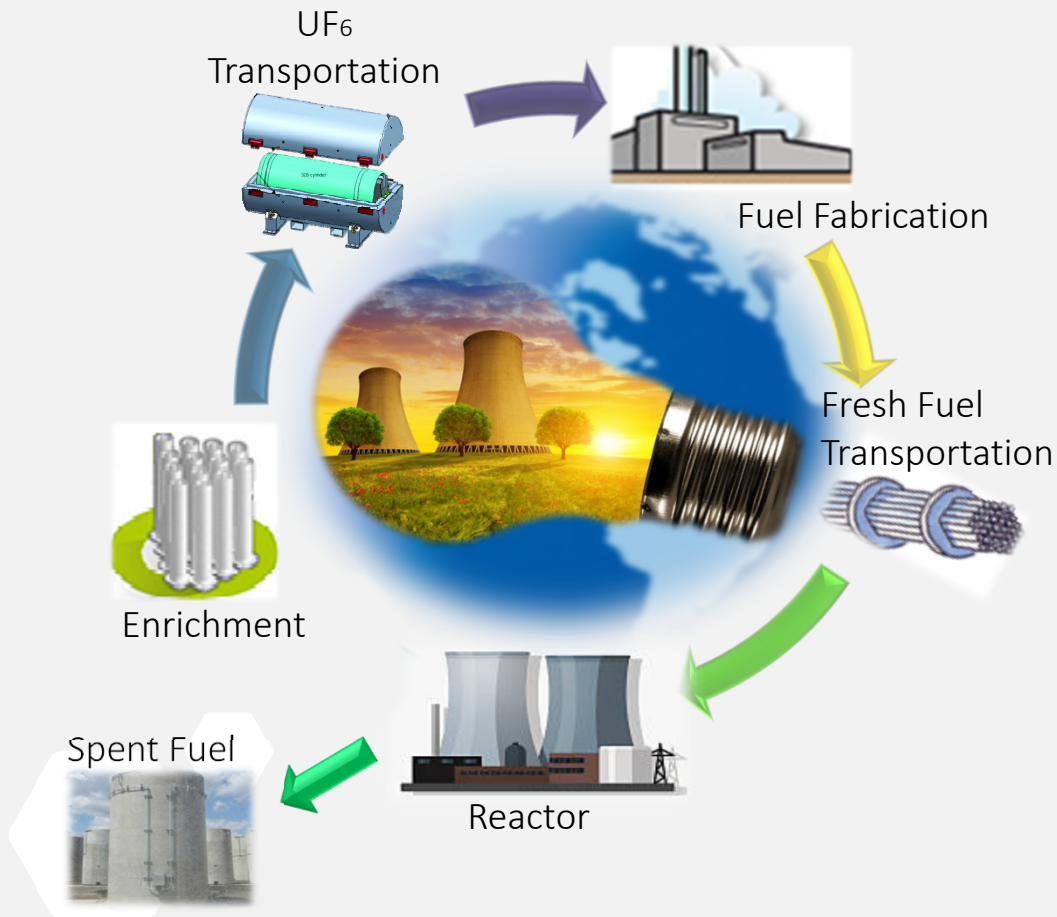
The Staff Is Ready for Known Forthcoming Applications



Front-end and Back-end Burnup/Enrichment

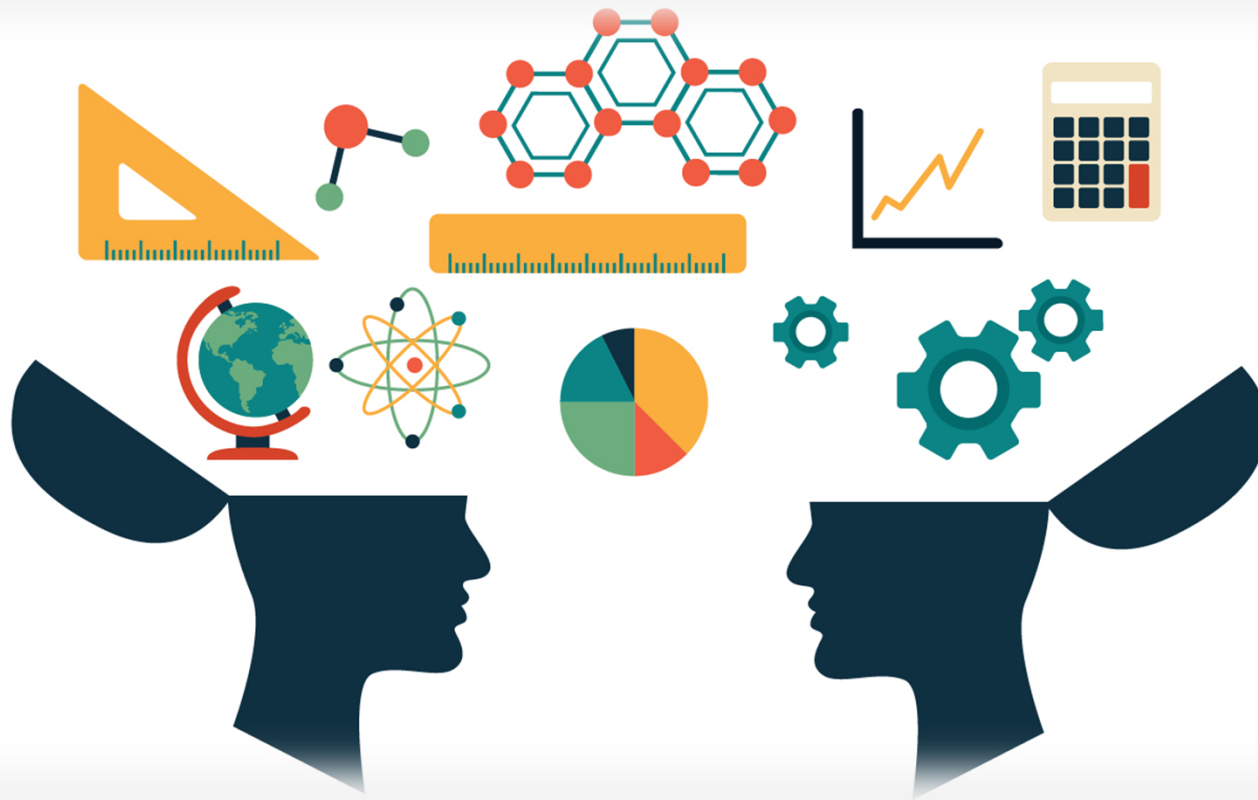
Marilyn Diaz, Chemical Engineer
Division of Fuel Management
Office of Nuclear Material Safety and Safeguards

Improving and Informing Our Processes



- Smarter licensing with focus on safety
- Continue assessing the current regulatory framework
- Collecting additional information through research

Preparing Our Staff



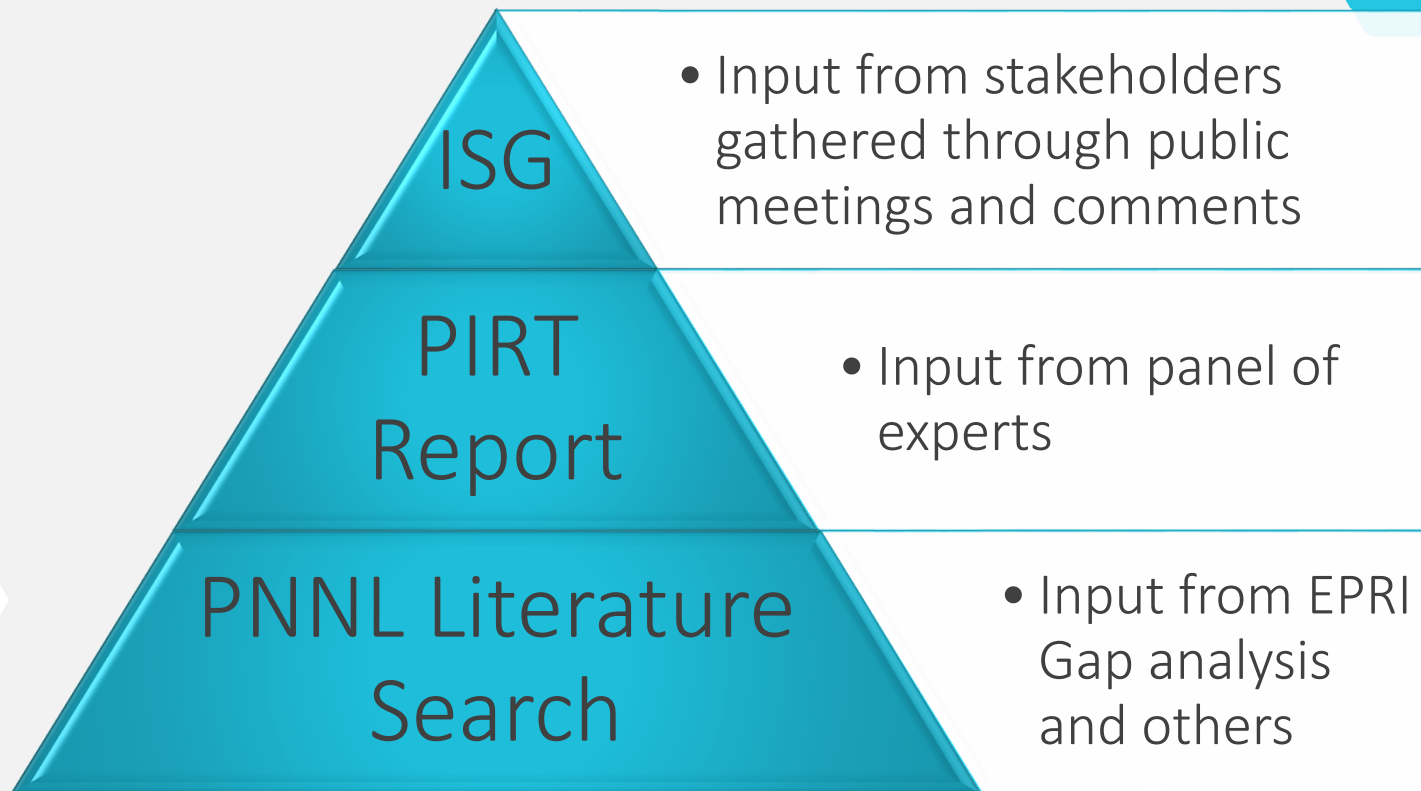
Ensuring workforce is equipped for HALEU and ATF applications.



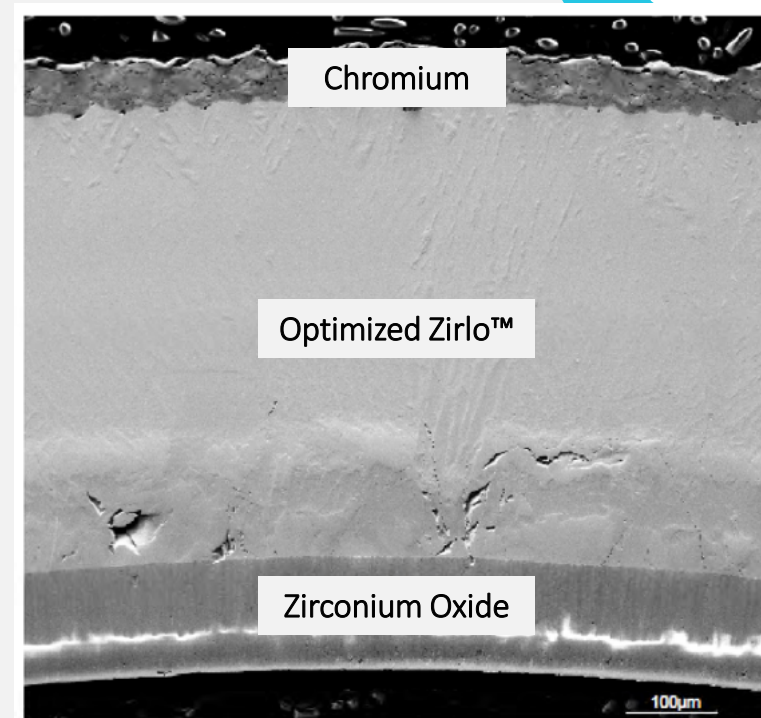
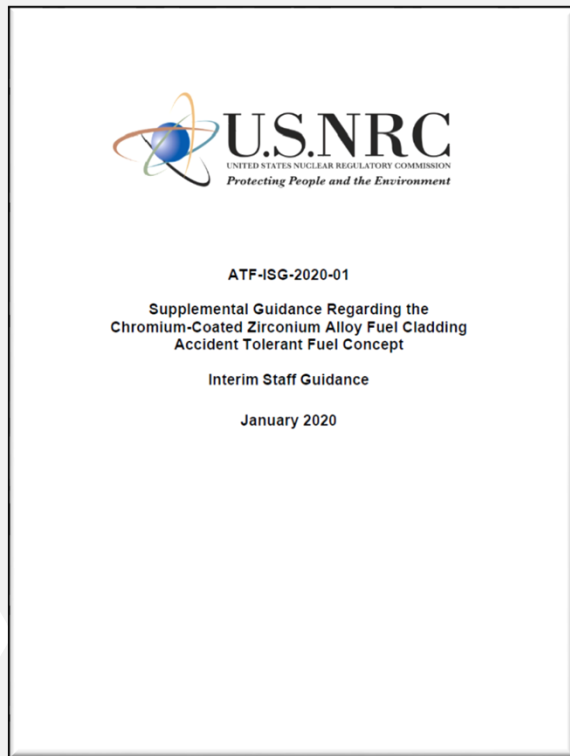
Technical Bases for Review of Chromium-Coated Cladding and In-reactor Burnup Extension

Josh Whitman, Nuclear Engineer
Technical Lead – ATF Working Group
Division of Safety Systems
Office of Nuclear Reactor Regulation

We Issued Interim Staff Guidance for Review of Chromium-coated Cladding



ISG Provides Framework for Licensing Submittals and Reviews



After Steam Oxidation for 20 minutes @ 1200°C

We Are Ready to Review Coated Cladding Topical Reports

- LTA insertion
 - Little to no irradiated data
 - Small number of assemblies

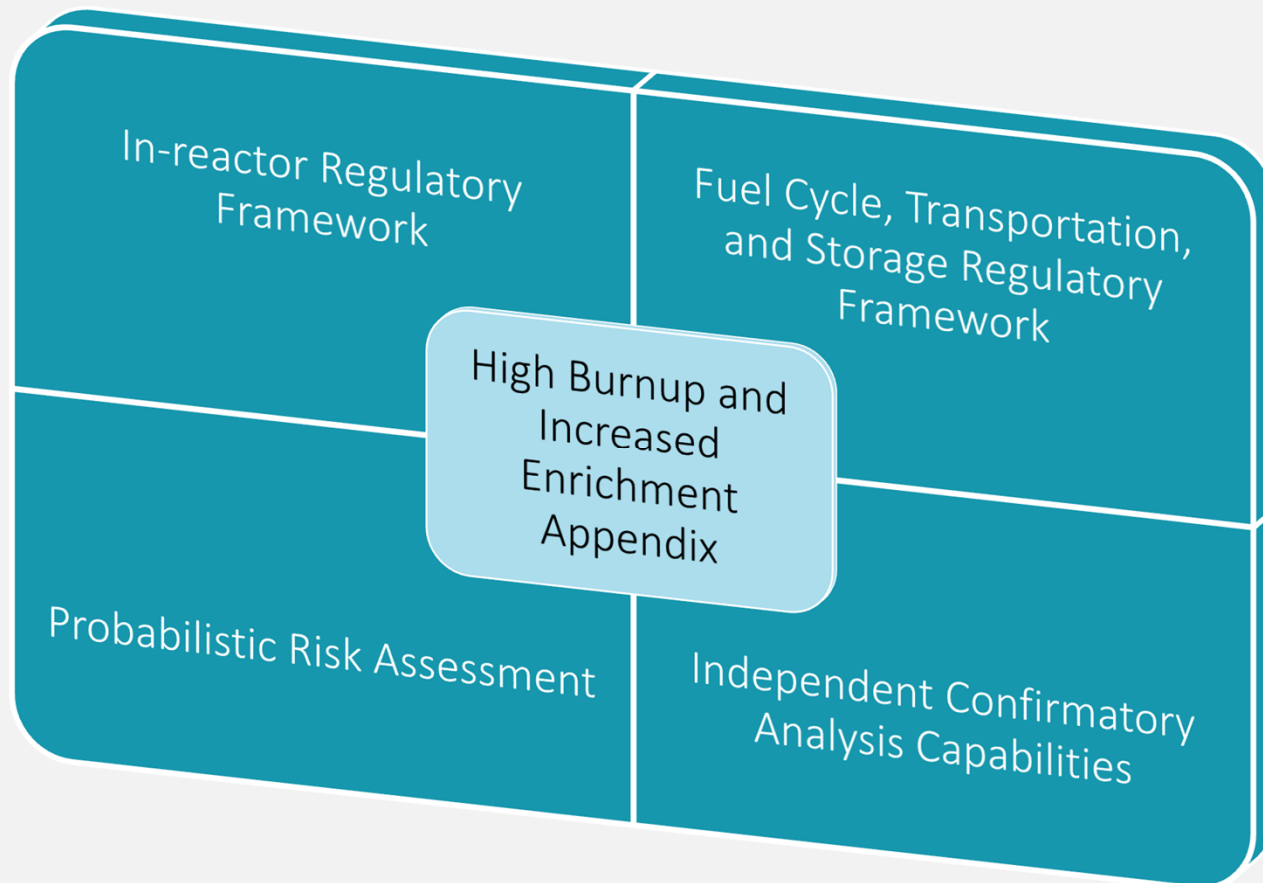
- First Batch Loads
 - Data from first cycle of LTA burnup
 - Conditions & Limitations on burnup or quantity

- Full Core
 - Additional data from LTAs

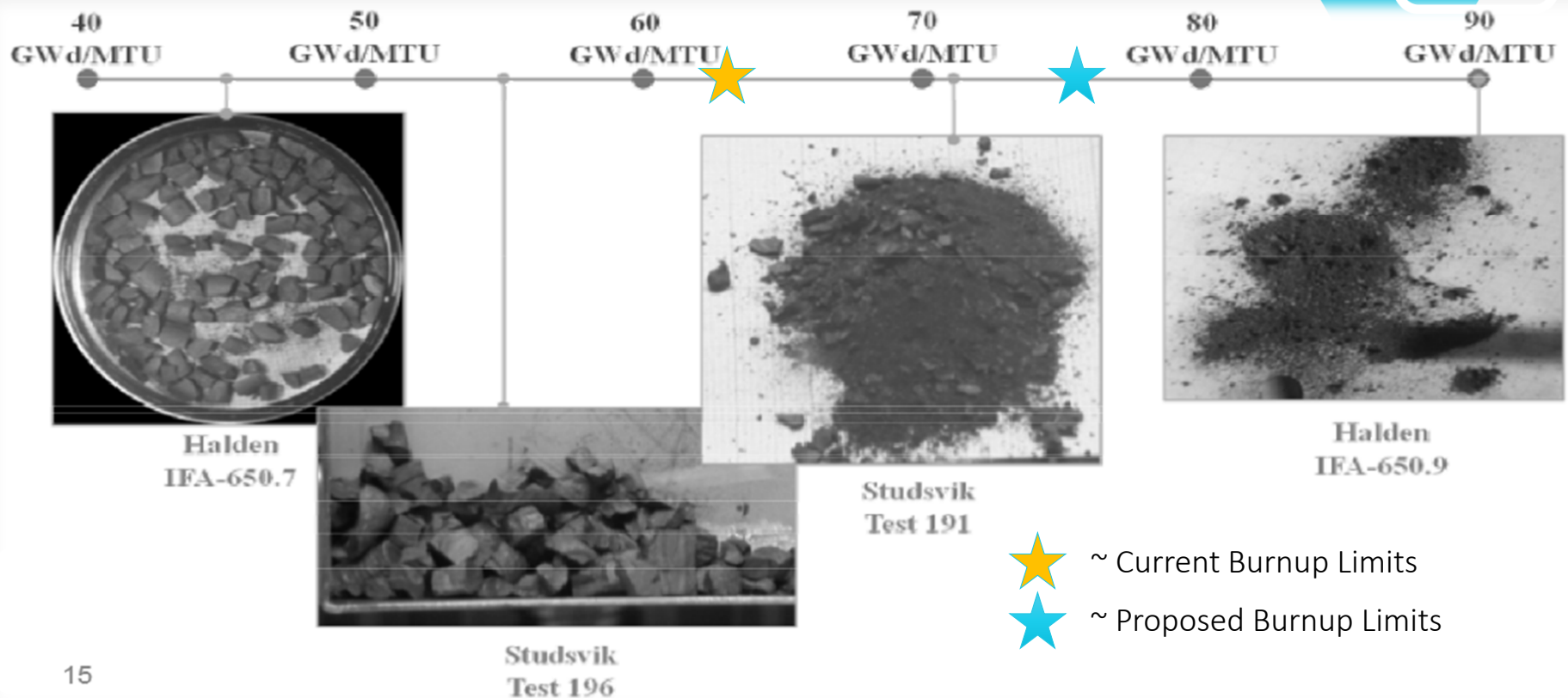
- Benefits Claimed
 - Full suite of data from experiments and LTAs

“Phased Approach”

High Burnup and Increased Enrichment Appendix to ATF Project Plan Issued



We Remain Engaged with Industry on Fuel Fragmentation, Relocation and Dispersal (FFRD)



Staff Has Continued its Early Engagement with DOE and Industry



Oak Ridge National Lab



Framatome Richland





Preparation of Confirmatory Analysis Tools for ATF Concepts

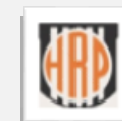
Dr. James Corson, Reactor Systems Engineer
Division of Systems Analysis
Office of Nuclear Regulatory Research

RES Is Supporting NRC's Readiness for ATF

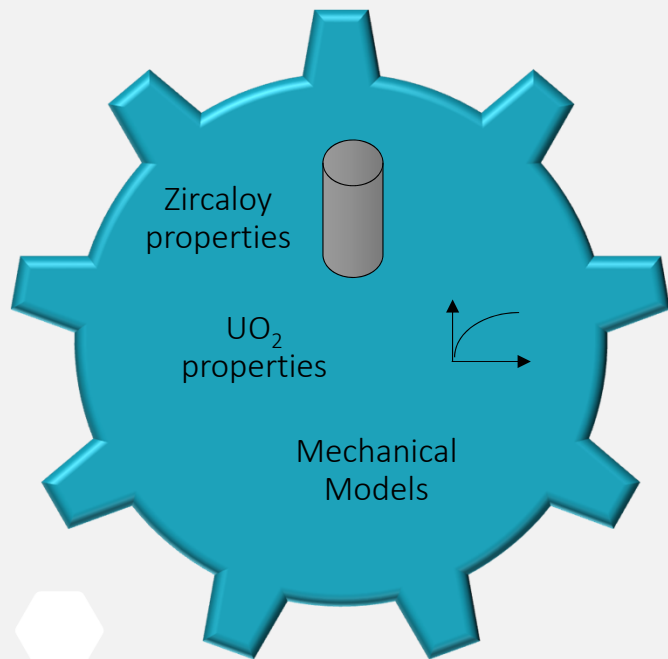
- Preparing confirmatory analysis tools
- Participating in international research programs
- Conducting literature reviews and PIRTs



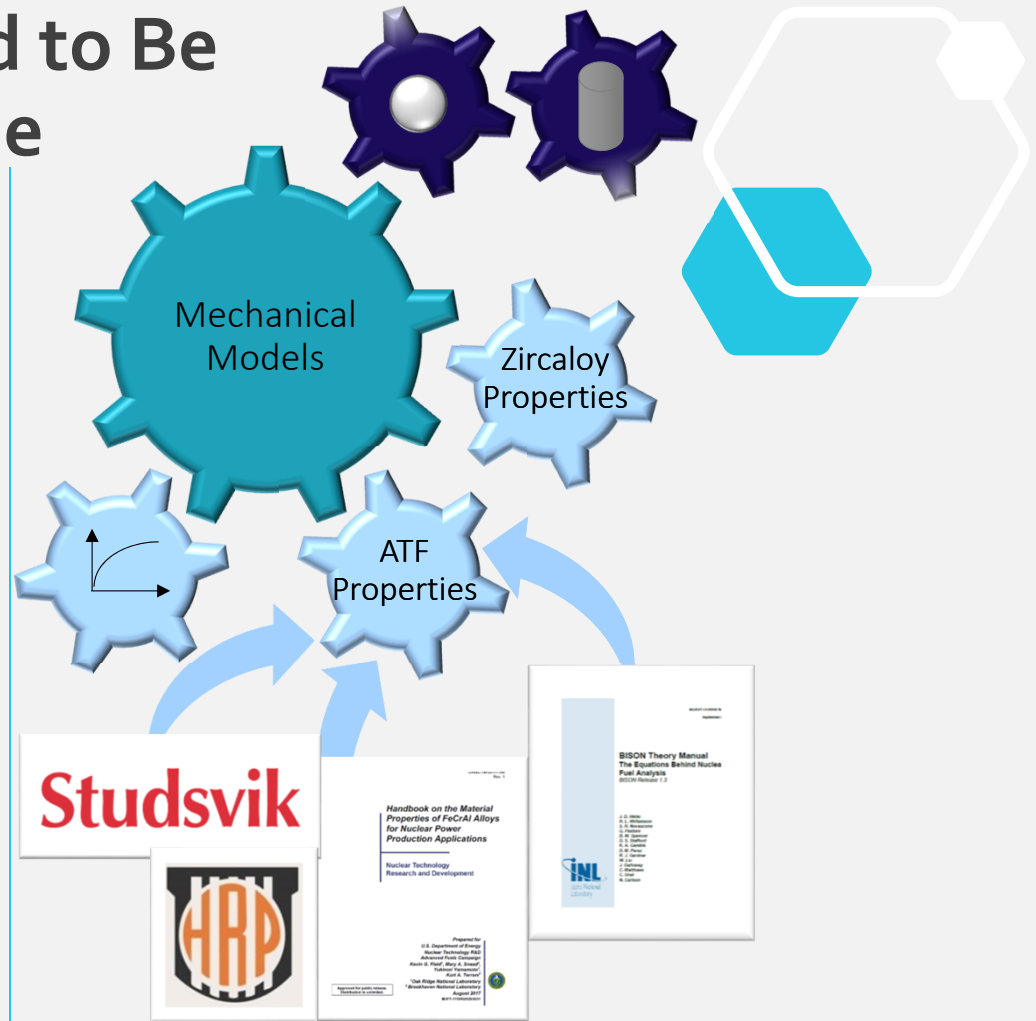
MELCOR



Codes Are Being Updated to Be Modular and Flexible

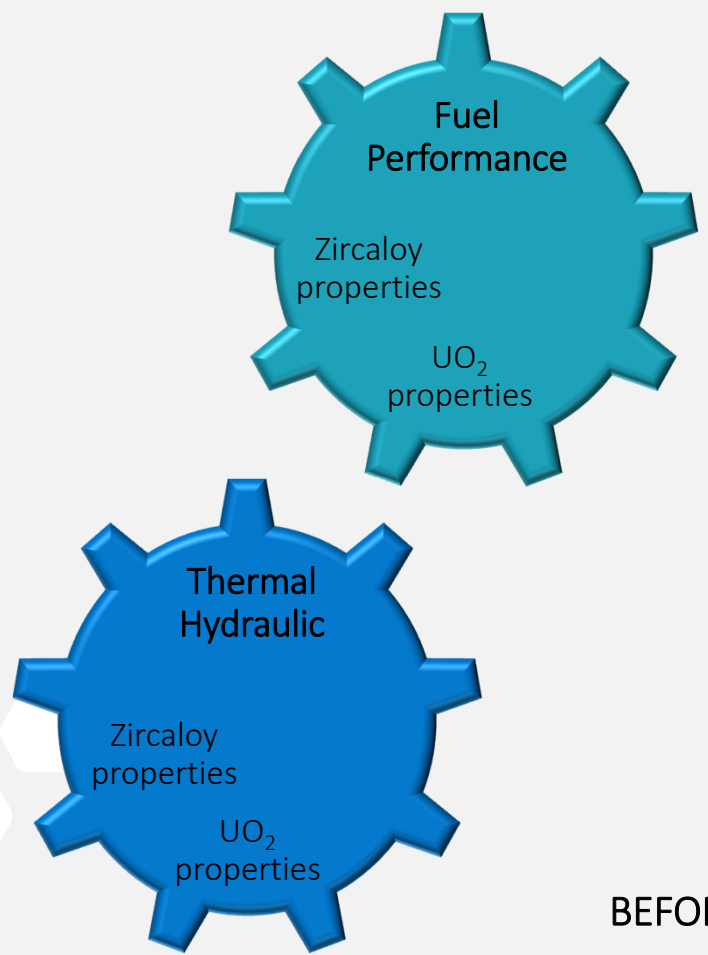


BEFORE

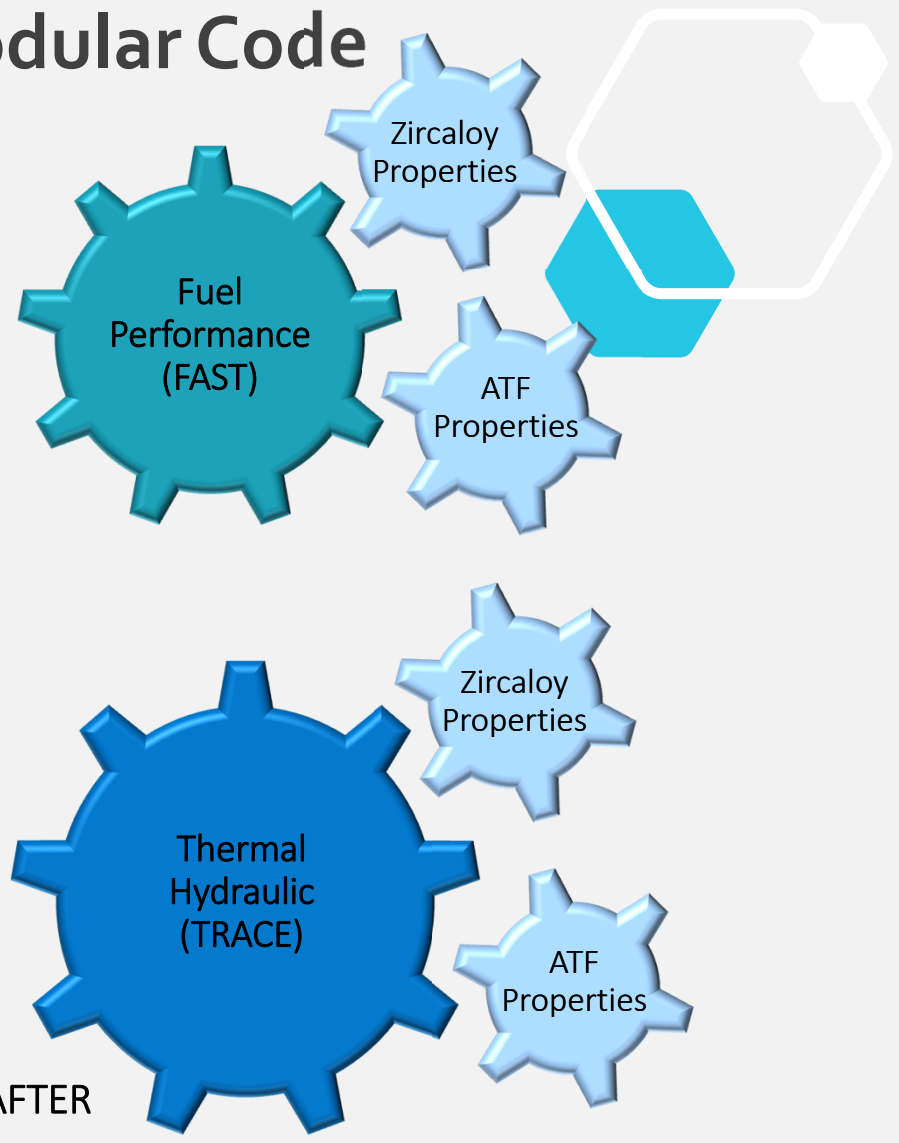


AFTER

Efficiency Is Gained with the Modular Code



BEFORE



AFTER

We Are Following International Research Programs to Obtain Data on ATF

- Studsvik Cladding Integrity Program (SCIP) provides high burnup LOCA data
- Cabri International Project (CIP) and the Nuclear Safety Research Reactor (NSRR) provide RIA data
- QUENCH Programme at the Karlsruhe Institute of Technology (KIT) provides cladding LOCA data

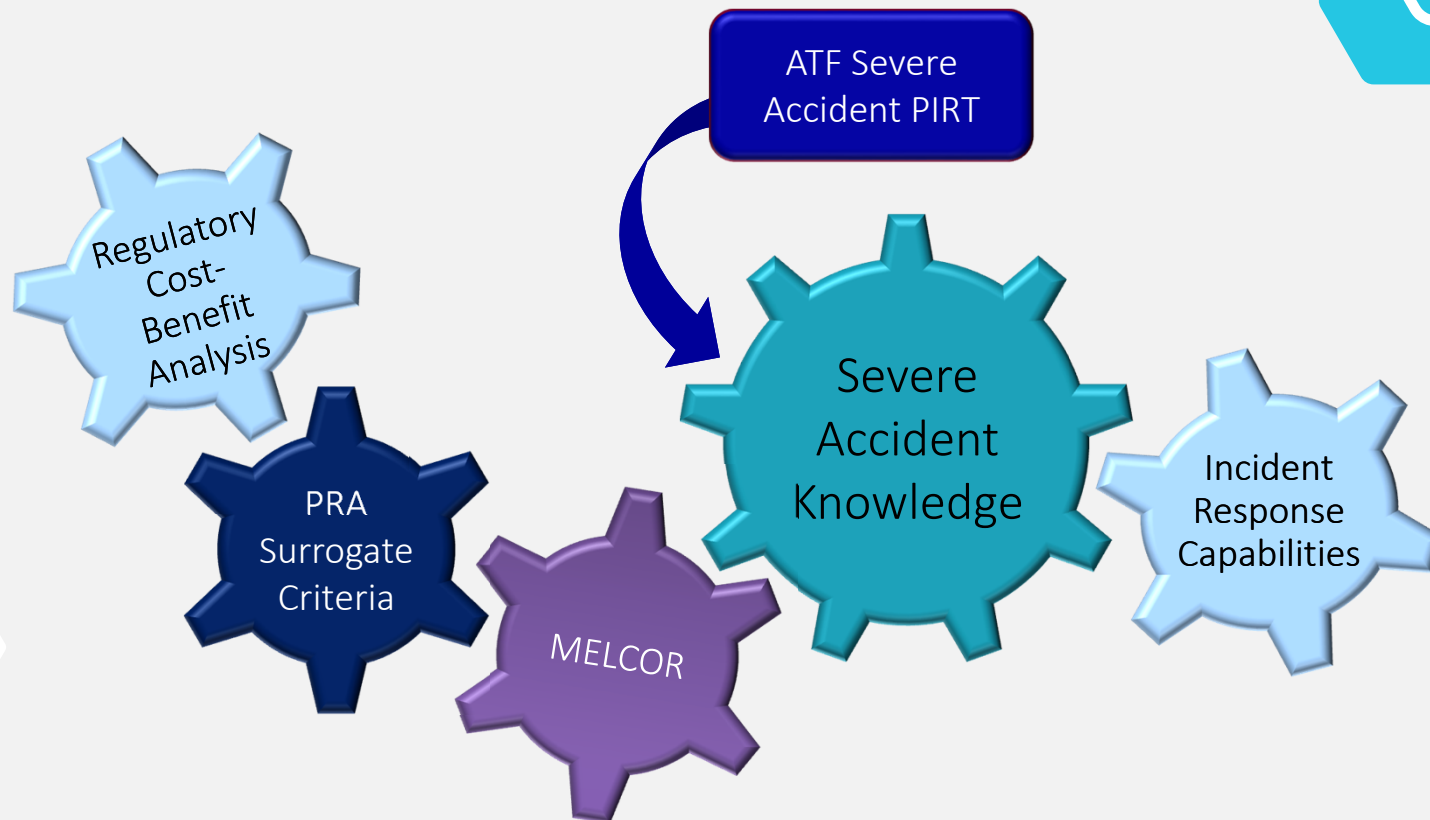


We Are Increasing Our Knowledge Ahead of Submittals

- Cr-coated cladding PIRT completed
- HBU literature review completed
- Several other literature reviews in progress
- Severe accident PIRT coming this year



Our Next Area of Focus Is Increasing Knowledge about Severe Accident and Source Term Behavior



NRC Staff Working on ATF

