Site Alerts & Response

You may encounter one of three types of alerts at HRR:

1. Criticality Alert – Site wide
   Klaxon horns (repeating AH-OO-GAH)
   • **Response**: Walk directly to evacuation assembly area in West parking lot – do **not** leave site

2. Fire Alert – Typically by building
   A series of high-pitched (morse-code style) sounds alternated with a voice message, “Attention, attention, an emergency has been reported in the building...”
   • **Response**: Exit building by most direct route and wait for further instructions

3. Public Address Alert
   Spoken message over PA system
   • **Response**: Stop and listen – follow instructions

Follow your hosts!
Parking Lot Badging Stations (Posts 7, 8, or 9)

Wait for yellow lights to illuminate before attempting to scan badge.

Place badge over red "PLACE BADGE HERE" sticker. A good badge read is indicated by a green LED and a beep. A bad badge read is indicated by a flashing red LED and several quick beeps.
Fuel Performance Meeting Objectives

• Increase NRC knowledge of Framatome’s fuel activities, facilities, products and strategies
• Discuss Framatome’s submitted and planned topical reports and associated customer needs
• Increase NRC understanding of Framatome’s:
  • Advanced codes & methods development
  • Fuel designs, operating experience, observations and solutions
• Beneficial to NRC and Framatome
  • Exchange ideas and expectations on fuel issues
  • Open communication and questions encouraged
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 – 8:15</td>
<td>Arrival and Security Access Process</td>
<td>Alan Meginnis</td>
</tr>
<tr>
<td>8:15 – 8:25</td>
<td>Evacuation Plan and Introductions</td>
<td>Alan Meginnis</td>
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<tr>
<td>8:25 – 8:30</td>
<td>Welcome</td>
<td>Ernie Hockens</td>
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<tr>
<td>8:30 – 9:15</td>
<td>Plant Overview and Safety Briefing</td>
<td>Ernie Hockens</td>
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<td>9:15 – 10:30</td>
<td>Manufacturing Plant Tour</td>
<td>Ernie Hockens</td>
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<td>10:30 – 11:30</td>
<td>Test Facility Tour with Fuel Product Displays</td>
<td>Kelly Duggan, Steve Cole</td>
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<tr>
<td>11:30 – 12:00</td>
<td>Framatome Advanced Fuel Management Plans (Program Overview)</td>
<td>Steve Cole, Norm Garner</td>
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<td>12:00 – 12:45</td>
<td>Lunch</td>
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<tr>
<td>12:45 – 13:30</td>
<td>AFM Implementation at Richland Fuel Fabrication Facility</td>
<td>Gannon Johnson</td>
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<tr>
<td>13:30 – 14:45</td>
<td>BWR Fuel Designs, Operating Experience, and Fuel Performance</td>
<td>Stephen Mazurkiewicz</td>
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<td>14:45 – 15:00</td>
<td>Break</td>
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<tr>
<td>15:00 – 16:15</td>
<td>PWR Fuel Designs, Operating Experience, and Fuel Performance</td>
<td>George Borum</td>
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<td>16:15 – 16:30</td>
<td>ARCADIA Virtual Interface</td>
<td>Steven Fink</td>
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<td>16:30 – 16:45</td>
<td>Upcoming Submittals and Priorities</td>
<td>Paul Clifford</td>
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<td>16:45 – 17:00</td>
<td>Discussion / Closing Remarks</td>
<td>All</td>
</tr>
<tr>
<td>17:00</td>
<td>Adjourn Day</td>
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Framatome Advanced Fuel Management Plans (Program Overview)

Steven COLE, AFM Project Manager, Fuel Business Unit
Norman GARNER, Technical Sales Manager, Fuel Business Unit

ACRS / NRC Fuel Performance Meetings
September 20 – 23, 2022
Purpose

- Explain the background and motivation for Framatome’s ‘Advanced Fuel Management’ project (AFM)
- Provide a high level overview of the project and status of key milestones
AFM Project: Background

- Recognizing that obtaining efficient 24-month cycle operation is a key business driver for a large segment of the domestic fleet, Framatome formally launched its ‘Advanced Fuel Management’ project in 2018
  - Enable safe and efficient 24-month cycles using technology levers of burnup and enrichment
  - Create customer value to sustain our fuel business for the long term
  - Improve viability of nuclear energy

- In 2021, the DOE renewed its EATF contract with Framatome (Phase 2C), which explicitly directed funding for the development of technologies enabling increased fuel rod burnup (>62 GWd/MTU) and enrichment (LEU+)

- The AFM project is planned and financed to provide ‘reload ready’ capability for PWR and BWR plants by end of 2026
AFM Project: Objectives & Scope

**AFM Project Perimeter**

- Enrichment
- UF6 Transport
- Fuel Design
- Licensing Methods
- Manufacturing
- Fresh Fuel Transport
- Operation & Backend

**Framatome Direct Responsibility**
Orientation of AFM within the DOE EATF program
<table>
<thead>
<tr>
<th>PWR Topical Report</th>
<th>Submittal (actual or planned)</th>
<th>Approval (actual or planned)</th>
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<tr>
<td>GALILEO Fuel Rod Thermal Mechanical Method (75 GWd/MTU)</td>
<td>June 2018</td>
<td>December 2020</td>
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<td>Cr-doped for PWR (62 GWd/MTU)</td>
<td>June 2021</td>
<td>February 2023</td>
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<td>ANP-10304P Supp 1</td>
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<td>LEU+ Umbrella (8 wt%)</td>
<td>January 2021</td>
<td>February 2023</td>
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<td>ANP-10353P</td>
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## AFM Project: BWR Licensing Topical Report Vision

<table>
<thead>
<tr>
<th>BWR Topical Report</th>
<th>Submittal (actual or envisioned)</th>
<th>Approval (actual or envisioned)</th>
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<tr>
<td>Cr-doped for BWR (62 GWd/MTU) ANP-10340P</td>
<td>March 2016</td>
<td>May 2018 ✓</td>
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<tr>
<td>Neutronics Base Topical (ARTEMIS-B)</td>
<td>June 2022 ✓</td>
<td>August 2024</td>
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</tbody>
</table>
Fresh Fuel Transport

PWR (GAIA 17x17)
- In December 2021, the MAP12/13 container was approved for fresh fuel transport with enrichments up to 8 wt% U235
  - No RAI

BWR (ATRIUM 11)
What are the benefits of AFM?

Enrichment >5 wt% U235 & rod burnup >62 GWd/MTU

Enabling 24M cycles

Reducing batch size

Supporting ATF adoption

What is required for AFM?

- >32 US PWRs can shift to 24-month cycles with AFM
  - Eliminates 1 outage for every 6 years of operation
  - Average generating capacity increases by ~5 days/year
- Decreases in reload batch size can be realized

Fuel fabrication facility upgrades and methods submittals are underway to support AFM reload readiness in 2026
Acknowledgement

This material is based upon work supported by the Department of Energy under Award number DE-NE-0009034, DE-NE0008818 and previously DE-NE0008220.

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CONTENT

01. AFM Facility Upgrade Scope
02. Review of Key Industry Decisions
03. Fuel Manufacturing Equipment Impact Summary
04. Timeline and Progress to Date
Richland Fuel Fabrication Facility Introduction

This AFM Fabrication Facility sub-task is limited to existing processes and building inside the facility secure boundary. It excludes:

- UF6 transport to the facility
- Transport of finished fuel to NPP customers
- Construction of new facilities for CAT II HALEU
- Out of Service Uranium Processes / Buildings

The Richland Fuel Fabrication Facility is currently capable of producing the mechanical fuel designs targeted AFM.

Scope is limited to the changes on existing manufacturing processes for the new enrichment target of \[ \underline{\text{[ ]}} \text{wt}\%-\].
Framatome has chosen to relicense the entire Richland facility to a higher enrichment limit to support AFM products

- All uranium processing and storage areas will be upgraded for the new enrichment limit
- No areas restricted to enrichment ≤ 5wt% U235
- No down blending

This Approach has 2 major benefits:

- Risk reduction for ongoing operations
  - This approach mitigates the risk of LEU+ being mistakenly moved into areas only analyzed for ≤ 5wt% U235
- Allows to continue other uranium related business lines in LEU+ enrichments (uranium scrap recovery processing and cylinder washing / recert)
Richland Fuel Fabrication Facility Scope for AFM (2/3)

Other Key Objectives:

▪ Plant upgrades shall not impact on the time delivery or quality of existing reload contracts
▪ Plant upgrades will be completed safely following our standard processes
▪ Modifications to existing equipment, as required, will be replacement with like kind or proven equipment used at other Framatome fuel fabrication facilities
▪ Use Global Framatome best practice technologies will be used (No FOAK for Framatome)
▪ Decommissioning footprint will remain unchanged
▪ Modifications will not impact bottleneck process capacities during modifications
▪ Batch sizes in some processing areas may be reduced but plant capacity will remain unchanged
▪ Return to service for 5% fuel fabrication after modifications and prior to higher enrichment approval
These Objective Require:

- Updating our computer code benchmarks to support \([ \text{wt\% U235} \] \text{ wt\% U235} \) (This is referred to as establishing the Minimum Margin of Sub-Criticality) **Complete**
- Updating all nuclear criticality safety analyses for LEU+ license target
- Designing of equipment modifications to meet new enrichment safety limits and evaluating those changes for potential impact to accident sequences
- Updating manufacturing software to support higher enrichments
- Performing all Integrated Safety Analysis (ISA) activities to support NRC license submittal
- Performing required plant modifications
- Updating required operating procedures and documentation
- Testing and qualifying plant modifications
- Receiving approval from various state and local regulatory agencies
- Receiving NRC approved updated plant license
- Implementing higher enrichment limit plant wide (Preferably with pre-license NRC Onsite Review)
Key Industry Decisions that Affect Scope

The following decisions have a direct impact on the scope of the project:

1. Transport license of the DN30 with the standard 30B Cylinder for LEU+
   • Currently assuming Urenco will be successful with exemption request to 10CFR71.55(b) (water ingress into containment for more than 5wt% U235 in UF6 package) that will likely be submitted to the US NRC at the end of 2022

2. The material code E1 / E2 definitions for safeguards and nuclear accountability as defined by the US government's Nuclear Materials Management and Safeguards System (NMMSS).
   • The NRC's current position is that they will not change the definitions, but rather will grant licensees a one-time exemption on a licensee-by-licensee basis
   • NEI Sr. Director of Fuel and Radiation Safety is confident rules will be clarified in 2023
Types of Equipment Modifications Expected

- Passive control changes to reduce manufacturing equipment geometry where feasible with existing chemical processes
  - Safe slab limit for uranium dioxide reduced from [ ] inches to [ ] inches
  - Safe cylinder diameter reduced from [ ] inches to [ ] inches
- Passive control for increased equipment spacing
- Passive control for additional fixed neutron absorbing materials
- Additional active engineered controls to further mitigate existing accident sequences
  - e.g. adding additional isolation valves to ensure back-flow in liquid chemical process is prevented that is currently safe for 5wt% U235
- Existing administrative controls will be adjusted for [ ]
  - Critical mass limit in batch-controlled processes changes from 18 kgU to [ ]
Process Impacts Summary
System Evaluations - Summary

Areas Requiring Significant Effort but Minor Operational Impact
System Evaluations - Summary

Areas Requiring Significant Effort but Minor Operational Impact
System Evaluations - Summary

Other Key Activities
Timeline and progress to date
Thank You
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AGENDA

- Objectives

- Framatome BWR Fuel Operating Experience
  - Fuel Performance Summary
  - Status of Product Implementation
    - Advanced Debris Filters
    - ATRIUM 11
    - Z4B BQ Channels

- Status of Framatome BWR Fuel Failures and Investigations
  - Fuel Reliability Statistics
  - Status of Recent Fuel Failures Discharged

- Poolside Surveillance Results and Plans
  - Recent BWR Poolside Surveillance and Hot Cell Campaigns
  - Upcoming BWR Poolside Inspection Campaigns

- Summary / Conclusions
Objectives

- Refresh key aspects of current BWR fuel product features
- Provide a status update of the overall performance of Framatome’s BWR designs
- Provide an updated status of ATRIUM 11 fuel and Z4B BQ (β–quench) channel programs
- Provide an overview of BWR fuel examinations and results of recent surveillance campaigns
- Provide an overview of anticipated BWR fuel examinations
AGENDA

▪ Objectives

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▪ Summary / Conclusions
## Fuel Reliability Status | Framatome supplied Plants with Leaker Free Cores in Operations (United States)

### Leak Free Cores in Operation (Current)

<table>
<thead>
<tr>
<th>United States</th>
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<tbody>
<tr>
<td>PWR</td>
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<tr>
<td>BWR</td>
<td>75%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>90%</td>
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</table>

(As of August 2022)

Framatome PWR fuel has operated leaker free since Spring 2019
Advanced ATRIUM 11 fuel product continues to perform well

- 12 ATRIUM 11 lead assemblies in US BWRs reached discharge burnup in 2021
  - Poolside inspections have been completed and showed as-expected performance
- First US ATRIUM 11 reload completed its 1st cycle of operation in February 2022
- 5 ATRIUM 11 reloads in operation with all continuing customers transitioning to ATRIUM 11

3rd Generation FUELGUARD debris filter now most common filter in operation

Full reloads of distortion-resistant Z4B β-quenched channels currently being delivered

BWR additive manufactured components loaded in US reactor in spring 2021

BWR EATF LTRs loaded in a US commercial reactor in spring 2021
ATRIUM Product Platform

- Upper Tie Plate Quick Release Locking Mechanism
- ULTRAFLOW Spacer
- Central Water Channel
- Lower Tie Plate FUELGUARD Debris Filter
- ATRIUM 10XM
  - Connecting End Plug Compression Spring
  - Fuel Rod
  - Part Length Fuel Rod

Framatome/NRC Fuel Performance Meeting – September 2022
Summary of Current ATRIUM Product Line | Primary Design Differences
Global ATRIUM Product Line Supply
Global ATRIUM Irradiation Experience
Domestic ATRIUM Product Supply
BWR Fuel Product Line – Advanced Channel Materials
The ATRIUM 11 is the latest evolution of Framatome’s ATRIUM product line for BWRs

- 11x11 fuel rod array to enhance enrichment utilization efficiency and increase thermal-mechanical margins
- Vaned ULTRAFLOW spacer grids and increased fuel rod surface area to improve dryout performance
- Debris protection at inlet with 3GFG filter, entrapment resistant spacer grids, and top entry grid lattice
- Cr-doped pellets to reduce PCI failure risk
- Z4B BQ fuel channels to minimize channel distortion risk

The ATRIUM 11 is the most efficient BWR fuel assembly in reload operation
BWR Fuel Product Line
Advanced Fuel Pellet Materials
ATRIUM 11 Reloads | United States
AGENDA

- Objectives

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  - Upcoming BWR Poolside Inspection Campaigns

- Summary / Conclusions
Level 2 Industry Event Report (IER) 19-6, “Preventing Debris-Induced Fuel Failures” was issued by INPO in response to declining fuel performance.

- Implementation of IER recommendations correlated with improved leaker-free fuel performance across the industry.
BWR Industry Fuel Leaker Update
United States
Framatome BWR Fuel Failures (10 Years)
United States
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures

ATRIUM 11 spacer grid with debris resistant features
ATRIUM 10/10XM spacer grids
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
AGENDA

▪ Objectives

▪ Framatome BWR Fuel Operating Experience
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  ◆ Status of Product Implementation
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  ◆ Fuel Reliability Statistics
  ◆ Status of Recent Fuel Failures Discharged

▪ Poolside Surveillance Results and Plans
  ◆ Recent BWR Poolside Surveillance and Hot Cell Campaigns
  ◆ Upcoming BWR Poolside Inspection Campaigns

▪ Summary / Conclusions
Domestic BWR Poolside Surveillances
Domestic BWR Poolside Surveillances
ATRIUM 11 Fuel Assembly Growth
ATRIUM 11 Fuel Rod Growth
ATRIUM 11 Fuel Rod Diametral Creep
ATRIUM 11 Span Maximum Liftoff
ATRIUM 11 Spacer Maximum Liftoff
Z4B BQ Fuel Channel Growth
Z4B BQ Channel Bow
Domestic BWR Poolside Surveillances
Domestic BWR Poolside Surveillances
Domestic BWR Poolside Surveillances
ATRIUM 10XM Fuel Rod Diametral Creep
ATRIUM 10XM Span Maximum Liftoff
ATRIUM 10XM Spacer Maximum Liftoff
Domestic BWR Poolside Surveillances
Fuel Rod Hot Cell Program
Hot Cell Examination | Status
Hot Cell Examination | Results (Preliminary)
LaSalle Hot Cell Schedule
AGENDA

▪ Objectives

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  ◆ Status of Recent Fuel Failures Discharged

▪ Poolside Surveillance Results and Plans
  ◆ Recent BWR Poolside Surveillance and Hot Cell Campaigns
  ◆ Upcoming BWR Poolside Inspection Campaigns

▪ Summary / Conclusions
Summary/Conclusions

- Framatome BWR fuel continues to perform well, recent failures notwithstanding.

- Framatome BWR customers are actively transitioning to advanced debris filter technology which are more effective solutions for in-reactor debris mitigation.

- Framatome is committed to proactively monitor for and resolve conditions adverse to fuel reliability consistent with customer support.

- Framatome is successfully implementing next generation products incorporating proven and effective design features.

- Framatome’s active Post Irradiation Examination program continues to validate fuel performance.

Framatome is committed to proactively addressing conditions adverse to fuel reliability and supporting our customers with leaker free performance.
BACKUP
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Recent Framatome BWR Fuel Failures
Hot Cell Examination | Results (Preliminary)
## Acronyms/Nomenclature

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<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>3GFG</td>
<td>3rd Generation FUELGUARD</td>
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<tr>
<td>AM</td>
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<td>Improved FUELGUARD</td>
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<td>Institute of Nuclear Power Operators</td>
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<tr>
<td>LTA</td>
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<td>LTL</td>
<td>Lower Tolerance Limit</td>
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### Acronyms/Nomenclature

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PWR Fuel Performance Update

George Borum

Framatome/NRC Fuel Performance Meeting

September 22, 2022
AGENDA

• Objectives
• Framatome PWR Fuel Operating Experience
  • Status of Product Implementation
  • Fuel Reliability Statistics
• Status of Framatome PWR Fuel Failures and Investigations
  • Cause of Failure Examinations
• EATF PROtect Summary
• Poolside Surveillance Results and Plans
  • Recent PWR Poolside Surveillance Campaigns
  • Upcoming PWR Poolside Surveillance Campaigns
• Summary / Conclusions
Objectives

• Summarize key aspects of current PWR fuel product features
• Provide a status update of the overall performance of Framatome’s PWR designs
• Provide an updated status of GAIA program
• Provide an overview of the current EATF projects
• Provide an overview of PWR fuel examinations and results of recent surveillance campaigns
• Provide an overview of anticipated fuel examinations
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HTP Fuel - Proven Features

- Reconstitutable Upper Nozzle/End Fitting / Tie Plate
- $M_{\text{Framatome}}^5$ Fuel Rod Cladding
  - Low oxidation compared to Zry-4
    - Low hydrogen pick up
- HTP Spacer Grid
  - Exceptional GTRF performance
- HMP Lower Grid
- FUELGUARD Bottom Nozzle/End Fitting / Tie Plate

Mark-B HTP
CE HTP
W HTP
Mark-B HTP has effectively eliminated past performance issues associated with GTRF, growth and fuel assembly distortion.
Framatome PWR Reloads
CE Plants
Framatome PWR Reloads Westinghouse Plants

Second domestic GAIA Reload will begin operation in Fall 2022
HTP Irradiation Experience

Over 26,000 HTP assemblies irradiated in 51 reactors worldwide
  • Arrays from 14x14 to 18x18
  • Operating in a variety of reactor platforms
    • B&W, CE, Framatome, Siemens, and Westinghouse
GAIA Fuel Assemblies
Key Design Features & Irradiation Experience
Framatome PWR Fuel Performance Summary
United States

- All PWRs with Framatome fuel in-core operating defect free in US
- HTP continues to demonstrate improved performance over predecessor designs
- 4 EATF GAIA Assemblies are completing their 3rd cycle of irradiation in September 2023
- First GAIA reload in the United States began irradiation in May 2021. Second GAIA reload begins irradiation in the Fall 2022
PWR Fuel Failure Mechanisms (United States 2018-Current)
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# Recent US PWR Failed Fuel Exams

## 2021 Cause-of-Failure Exams

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Cycle</th>
<th>Assembly</th>
<th>Fuel Product</th>
<th># Rods</th>
<th>Exam</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>No PWR Failures</td>
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</tbody>
</table>

## 2022 Cause-of-Failure Exams

<table>
<thead>
<tr>
<th>Reactor</th>
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EATF PROtect Summary
GAIA Fuel Assemblies with EATF PROtect Fuel Rods Vogtle-2
ANO-1 EATF PROtect Fuel Rods
Calvert Cliffs EATF PROtect Fuel Assembly
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Domestic PWR Poolside Surveillances
Domestic PWR Poolside Surveillances
GAIA Fuel Assemblies with EATF PROtect Fuel Rods

Good overall performance of lead assemblies confirmed
GAIA Fuel Assemblies with EATF PROtect Fuel Rods
Visual Inspection
GAIA Fuel Assemblies with EATF PROtect Fuel Rods
Visual Inspections
GAIA Fuel Assemblies with EATF PROtect Fuel Rods
Visual Inspections
GAIA Fuel Assemblies with EATF PROtect Fuel Rods
Fuel Assembly Length Inspections
GAIA Fuel Assemblies with EATF PROtect Fuel Rods Oxide Assessment
Palo Verde-2 CE16-HTP PIE
Palo Verde-2 CE16-HTP Fuel Assemblies
Fuel Assembly Length Inspections
Palo Verde-2 CE16-HTP Fuel Assemblies
Fuel Rod Liftoff Inspections
Millstone-2 CE14-HTP Grid-to-Rod Fretting Inspections
Millstone-2 CE14-HTP Grid-to-Rod Fretting Inspections
ANO-1 EATF PROtect Fuel Rods
ANO-1 EATF PROtect Fuel Rods
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Summary/Conclusions

- HTP and GAIA continue to demonstrate improved performance over predecessor designs
- All US PWR customers have transitioned to advanced cladding ($M_5^{\text{Framatome}}$) with low oxidation, growth, and hydrogen pickup
- Framatome is successfully implementing next-generation PWR products (via LFA programs) incorporating proven and effective design features
- Framatome is committed to resolving conditions adverse to fuel reliability
- Framatome’s active PIE program continues to validate the successful performance of Framatome PWR fuel products

Framatome is committed to proactively addressing conditions adverse to fuel reliability and supporting our customers with leak-free performance
## Acronyms/Nomenclature

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANO</td>
<td>Arkansas Nuclear One</td>
</tr>
<tr>
<td>B&amp;W</td>
<td>Babcock and Wilcox</td>
</tr>
<tr>
<td>CE</td>
<td>Combustion Engineering</td>
</tr>
<tr>
<td>DNB</td>
<td>Departure from Nucleate Boiling</td>
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<tr>
<td>EATF</td>
<td>Enhanced Accident Tolerant Fuel</td>
</tr>
<tr>
<td>EOC</td>
<td>End of Cycle</td>
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<tr>
<td>FA</td>
<td>Fuel Assembly</td>
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<tr>
<td>FR</td>
<td>Fuel Rod</td>
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<tr>
<td>GTRF</td>
<td>Grid-to-Rod Fretting</td>
</tr>
<tr>
<td>ID</td>
<td>Inside Diameter</td>
</tr>
<tr>
<td>IFM</td>
<td>Intermediate Flow Mixer</td>
</tr>
<tr>
<td>IGM</td>
<td>Intermediate GAIA Mixer</td>
</tr>
<tr>
<td>LFA</td>
<td>Lead Fuel Assembly</td>
</tr>
<tr>
<td>LOCA</td>
<td>Loss of Coolant Accident</td>
</tr>
<tr>
<td>NRC</td>
<td>Nuclear Regulatory Commission</td>
</tr>
<tr>
<td>PIE</td>
<td>Post Irradiation Examination</td>
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<tr>
<td>PWR</td>
<td>Pressurized Water Reactor</td>
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<tr>
<td>RCCA</td>
<td>Rod Control Cluster Assembly</td>
</tr>
<tr>
<td>TMI</td>
<td>Three Mile Island</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>W</td>
<td>Westinghouse</td>
</tr>
<tr>
<td>Zry-4</td>
<td>Zircaloy-4 alloy</td>
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</tbody>
</table>
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**MYARCADIA**

What is **ARCADIA**?

An advanced suite of codes for PWRs and BWRs analysis of both normal and postulated accident conditions

The package contains advanced physical simulations, advanced GUI interfaces and process automation

**POWERFUL** suite of NRC-Approved codes
MYARCADIA

What is MYARCADIA?

Online access to state-of-the-art codes
- No additional infrastructure needed
- No support personnel needed
- Remote maintenance and upgrades

EASY access to the platform
The MYARCADIA Code System

BROAD functionality

- ARGOS
  Core Monitoring System

- LADON
  Productivity enhancement suite

- S-RELAP
  CATHARE 2 Plant Simulator

- ARTEMIS
  next-generation core simulator

- COBRA-FLX
  Core Thermal-Hydraulics

- APOLLO2-A
  Advanced industrial spectral code

- GALILEO/CARO
  Fuel Rod Perform.

- CORE MONITORING
  System

- Fuel Rod Module
  GALILEO/CARO
  Fuel Rod Perform.

- (Future version)
MYARCADIA

Why MYARCADIA?

Flexible pricing based on
- Your number of users
- The functions you use
- Your volume

Safety
- Easy access to an additional V&V platform
- Improved recommendations for plant operators

Computing Power
- Instant Access to HPC – no IT requirements

SCALABLE to meet any need
MYARCADIA

OK, SO WHAT?
In addition to enabling access for educational institutions, Utilities, and research labs, Framatome would like to create a special regulator access

PARTNERSHIPS available for regulators
FOR MORE INFORMATION

Contact:
Steven Fink (steven.fink@framatome.com)
Dr Nico Vollmer (nico.vollmer@framatome.com)
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Licensing Actions
Paul Clifford
Richland, WA  September 2022
01 Topical Reports Under Review

02 Upcoming Topical Reports

03 Upcoming License Amendment Requests
# Topical Reports Under Review

<table>
<thead>
<tr>
<th>Topical Report</th>
<th>Description</th>
<th>Submittal Date</th>
<th>Completion Date</th>
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<tbody>
<tr>
<td>ANP-10339P, ARITA – ARTEMIS/RELAP Integrated Transient Analysis Methodology</td>
<td>• ARITA is an analytical framework which couples previously approved codes: ARTEMIS, S-RELAP5, and GALILEO, within a Monte Carlo statistical approach for analyzing AOOs and postulated Non-LOCA events (except CRE)</td>
<td>3Q 2018</td>
<td>1Q 2023</td>
</tr>
</tbody>
</table>
| BAW-10227 Rev. 2, Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel | • Update M5 cladding material properties for up to 75 GWh/MTU  
• Updated LOCA fuel rod balloon / rupture models | 4Q 2019 | 1Q 2023 |
## Topical Reports Under Review (cont.)

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<tr>
<td>ANP-10353P, Increased Enrichment for PWRs</td>
<td>• Umbrella topical report requested approval of Framatome methods out to 8.0 wt% 235U</td>
<td>1Q 2021</td>
<td>3Q 2022</td>
</tr>
<tr>
<td>ANP-10340P Supplement 1, Chromia-Doped UO2 Fuel - PWRs</td>
<td>• Chromia-doped UO2 fuel pellets for PWRs</td>
<td>2Q 2021</td>
<td>4Q 2022</td>
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<td></td>
<td>• Follows earlier approval for BWRs</td>
<td></td>
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<tr>
<td>ANP-10311 Supp. 1, New PWR CHF Correlation for Low Pressure Conditions</td>
<td>• Supplement to COBRA-FLX</td>
<td>4Q 2021</td>
<td>4Q 2022</td>
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<tr>
<td></td>
<td>• Low pressure CHF correlation</td>
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<tbody>
<tr>
<td>EMF-2310 Supplement 2, SRP Chapter 15 Non-LOCA Methodology for PWRs</td>
<td>• CHF correlation design limit for HTP fuel</td>
<td>1Q 2022</td>
<td>3Q 2022</td>
</tr>
</tbody>
</table>
| ANP-10350P, Framatome Methodology for Boiling Water Reactors: Evaluation and Validation of APOLLO2-A / ARTEMIS-B | • The APOLLO2-A/ARTEMIS-B code system is the extension of the ARCADIA® code system to boiling water reactors. The code system includes the APOLLO2-A spectral code, the ARTEMIS-B core simulator, and the cross-section functionalization code HERMES-B.  
• This report consists of the methodology, V&V, and uncertainty analysis for the APOLLO2-A/ARTEMIS-B code system. | 2Q 2022 | 3Q 2024 |
Upcoming Topical Reports
Upcoming Topical Reports (cont.)
Upcoming License Amendment Requests
Upcoming License Amendment Requests (cont.)
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