

Callaway Unit 1 Presentation  
Information for Planned  
Pre-Application Meeting  
(Public Meeting)

An aerial photograph of a nuclear power plant facility. A large, dark, conical cooling tower is prominent on the right side, emitting a thick plume of white steam. The plant itself is a complex of various buildings, including a large central structure and several smaller ones. In the foreground, there are several large, circular storage tanks. The surrounding area is a mix of open fields and some trees. A road or path runs through the lower part of the image.

# Callaway VQP Pre-Submittal Meeting





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## Callaway VQP Pre-Submittal Meeting

*Stephanie Banker – Ameren - Vice President Nuclear Engineering & Support*

- Welcome
- Meeting Purpose – to provide the NRC with information on the Vendor Qualification Program (VQP) of Framatome as a supplier of nuclear fuel to Callaway Energy Center
- Desired Outcomes – to solicit questions / comments and gain insight from the NRC regarding the VQP information presented.

## Team Members

*Presenters in Bold*

Ameren Team Members	Titles
<b>Stephanie Banker</b>	<b>Vice President Nuclear Engineering &amp; Support</b>
Steve Meyer	Manager, Regulatory Affairs
Tom Elwood	Supervising Engineer, Regulatory Affairs
<b>Jim Little</b>	<b>Regulatory Affairs Engineer</b>
Don Rickard	Regulatory Affairs Engineer
Brian Richardson	Supervising Engineer, Reactor Engineering / Safety Analysis / Fuels
Jim Knaup	Reactor Engineer / Core Design
Justin Vinyard	Reactor Engineer / Fuels
Jim McInvale	Consultant Reactor Engineer

Framatome Team Members	Titles
Rick Williamson	Contract Manager
Tom Gardner	Project Manager
<b>Christy White</b>	<b>Technical PM</b>
<b>Greg Borza</b>	<b>Thermal-Hydraulics</b>
Morris Byram	Licensing
Jerry Holm	Licensing
Kevin Segard	Neutronics
Philippe Bellanger	Thermal-Mechanics
Tom George	Safety Analysis
Gordo Wissinger	LOCA Analysis
Pam Reed	Mechanical Design
Brian Painter	Mechanical Analysis

## Agenda

- Purpose of Meeting / Desired Outcomes
- Background
- GAIA Fuel Assembly Design Description
- GAIA Experience
- Analyses
- Summary of NRC Approved Methods
- Technical Specification Changes
- Schedule

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## Background



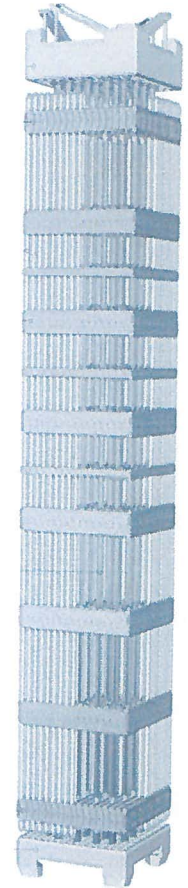
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- Callaway LFA / VQP Program for Framatome Fuel
  - Lead Fuel Assemblies (LFA) – 4 Fuel Assemblies
    - 3 cycles starting in Cycle 25
    - Non-Limiting Operation
  - Vendor Qualification Program (VQP)
    - Fuel Transition Licensing Submittal
  - VQP Lead Fuel Assemblies – 4 Fuel Assemblies
    - 3 cycles starting in Cycle 27
    - Fully Licensed Operation
- GAIA Fuel Design
- Based on currently approved methods (with some changes)
- Technical Specification changes to add Framatome methods

# Fuel Assembly Design Description

(ANP-10342P-A Revision 0, GAIA Fuel Assembly Mechanical Design)

- Standard Reconstitutable Top Nozzle
- M5 Fuel Rods
- M5 GAIA Mixing Grid (6x)
- M5 Intermediate GAIA Mixer (IGM) Grids (3x)
- Alloy 718 HMP Top (Relaxed) and Bottom Spacer Grids
- Q12 MONOBLOC Guide Tubes (24x)
- Q12 Instrument Tube
- GRIP Bottom Nozzle



## Operating Experience (GAIA 12 ft. Design)

- LTAs have successfully completed failure-free performance in US and European reactors.

Plant (Year)	Cycle Length
US Plant (2015-2019)	3x 18-month cycles
Europe Plant (2012-2017)	5x 12-month cycles

- In the US, GAIA fuel assemblies in batch quantity will be in operation in 2021, as will GAIA LFAs at Callaway. GAIA LFAs with EATF features are in operation at another US Plant since 2019.
  - Callaway LFAs (4) – Begin operation in Cycle 25, 3 cycles
  - Callaway VQP LFAs (4) – Begin operation in Cycle 27, 3 cycles
- In Europe, GAIA fuel assemblies in batch quantity are in their first cycle of operation at two plants.



## VQP Analyses



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- Fuel rod thermal-mechanical
- Fuel assembly mechanical
- Neutronics
- Thermal-hydraulics
- Non-LOCA
  - Rod Ejection Analysis – Method meets new RG 1.236
- LOCA

## Summary of Methods (1 of 2)



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Functional Area	Topical Report
Neutronics	ARCADIA (ANP-10297 Supplement 1P-A Revision 1)
Power Distribution Control	PDC-3 (ANF-88-054P-A)
Thermal-Hydraulic	XCOBRA-IIIC (XN-NF-82-21P-A and XN-NF-75-21P-A Revision 2), COBRA-FLX (ANP-10311P-A Revision 1)
Non-LOCA	S-RELAP5 (EMF-2310P-A Revision 1)
DNBR Correlation	GAIA (ANP-10341P-A)
Control Rod Ejection	AREA (ANP-10338P-A) GALILEO (ANP-10323P-A)
SB LOCA	S-RELAP5 (EMF-2328P-A and S1P-A)
LB LOCA	S-RELAP5 (EMF-2103P-A Revision 3)

## Summary of Methods (2 of 2)



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Functional Area	Topical Report
Fuel Performance Code	COPERNIC (BAW-10231P-A ), CROV (BAW-10084PA Revision 3)
External Loads	ANP-10337P-A and Supplement 1P-A
GAIA Mechanical Design	ANP-10342P-A
Cladding	BAW-10240PA, BAW-10227P-A Rev 1
Statistical Setpoints	EMF-92-081P-A
Fuel Rod Bow	XN-75-32P-A
DNB Propagation	XN-NF-82-06P-A



# Technical Specification Changes

- Tech Spec 2.1.1 – Reactor Core Safety Limits
  - Revise to add Framatome DNBR and FCM limits
- Tech Spec 3.2.1 – Heat Flux Hot Channel Factor (FQ(Z))
  - Revise to reflect PDC-3 for power distribution control
- Tech Spec 3.2.3 – Axial Flux Difference (AFD) (Relaxed Axial Offset Control Methodology, RAOC)
  - Revise to reflect PDC-3 for power distribution control
- Tech Spec 4.2.1- Reactor Core
  - Revise to refer to Zirconium clad
- Tech Spec 5.6.5 – Core Operating Limits Report (COLR)
  - Revise to add Framatome methods to list of methods used to support COLR
- Tech Spec 3.7.17 – Spent Fuel Assembly Storage and Tech Spec 4.3 – Fuel Storage
  - Potentially impacted, an evaluation of the fuel storage rack subcriticality analysis is ongoing. Dependent upon the results of the evaluation of the analysis, these Tech Specs may require revision.

## Exemption Request



- M5 Cladding 10 CFR 50.46 and 10 CFR 50 Appendix K Exemption Request
- Similar to M5 cladding exemption requests for other plants

## Schedule



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- **LAR submittal**

- Pre-submittal Meeting – January 2022
- Ameren/Framatome can support NRC Audit, if requested

**March 31, 2022**

- **LAR Supplemental Submittal (Rod Ejection)**

- Ameren/Framatome can support NRC Audit, if requested
- Supplemental submittal schedule to incorporate RG 1.236 approved method

**September 30, 2022**

- **Requested NRC approval of LAR**

- Supports Fuel Cycle 27, RFO begins October 2, 2023

**September 30, 2023**

## Questions





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