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ARITA

Evaluation Model for Non-LOCA Safety Analysis

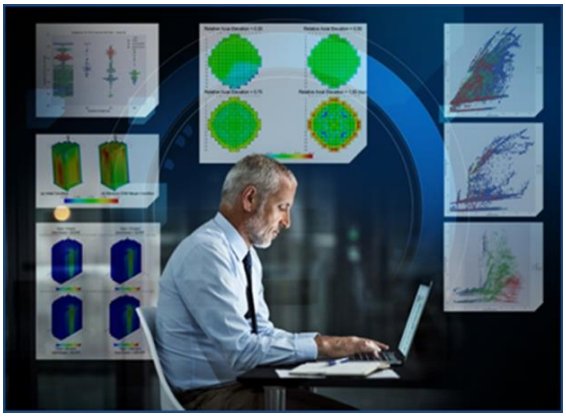
ARITA is an industry leading model for performing non-LOCA safety analysis

Challenge

As the nuclear industry has matured, new safety concerns and regulations have arisen that were patched into past safety analysis methods. The combined impact of penalties taken for these outdated models can constrain plant operation. In addition, nuclear plants are continually challenged to improve economic performance to compete with other energy sources. This has led to a demand for an updated methodology that addresses regulatory issues but also provides utilities increased margin and flexibility.

Solution

The ARITA method harnesses the capability of modern programming to couple the ARTEMIS 3D core simulator with the S-RELAP5 plant simulator, resulting in a 3D coupled transient evaluation model. This coupling allows for improvements in modeling of plant phenomena and the ability to credit additional features in transient analysis. These capabilities substantially improve safety analysis margins while addressing current and emergent US regulatory concerns.



Customer benefits

- Address emergent regulatory concerns
- Industry leading safety analysis margins can be used in many areas:

Operational Margins
Operating Flexibility
Enhance Cycle Economics
Bound cyclic variation

- Remove obstacles to significant economic performance improvement initiatives
- Improve understanding of plant behaviour
- Perform high fidelity operability assessments
- Implement cutting-edge ARCADIA code package

Key figures

>50% margin gains through combination of Coupled Evaluation Model and Statistical Process

100% of the large collection of non-LOCA events analyzed have seen significant margin gain

Comprehensive non-LOCA methodology supporting fuel and plant related acceptance criteria (except rod ejection - see AREA)

Your performance
is **our** everyday **commitment**

Technical information

A Coupled Evaluation Model to Improve Operating Margins

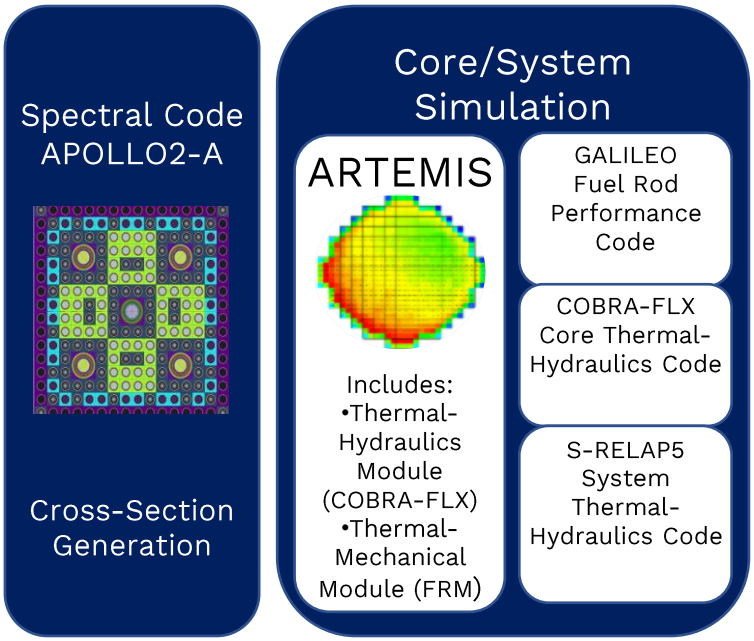
The ARITA non-LOCA methods will provide margin with regards to historically limiting events principally via utilization of the high fidelity coupled transient evaluation model. For example, ARITA explicitly models control rod movement during a scram. In this manner the effects on core power and core power distribution are seen as soon as rods enter the core. In the legacy methods no change in power shape is considered with the scram and bounding scram worth vs. rod insertion curves are used such that near full rod insertion is required to turn core power. In addition, the ARITA model resolves the effect of changing system conditions on fuel temperature and moderator feedback. This capability reduces the magnitude of reactivity changes in simulations relative to legacy methods.

Automated Analysis Tools to Improve Quality and Efficiency

An advanced process execution tool, PROSPECTOR, was developed to shepherd the coupled transient evaluation process and simplify analyst interaction with the underlying codes. Extensive post-processing tools also allow the analysts to quickly and easily assess transient results. PROSPECTOR ensures that minimal changes are required to transient inputs between events or to evaluate an anomaly at the plant. PROSPECTOR is designed to be widely adaptable to a variety of processes and computer codes.

A Statistical Evaluation Process to Streamline Non-LOCA Safety Analysis

Coupling these codes improves accuracy but also increases the complexity of transient analyses. The statistical aspects of the ARITA methodology are designed to address this increased complexity. With a coupled model it is difficult to identify the bounding direction of many parameters. A statistical evaluation process is able to assess the interactions between these various parameters across all non-LOCA transient events in a streamlined manner.



References

- August 2018 – Topical submitted for NRC review
- December 2018 – Official acceptance for NRC review
- March 2019 - Response to a request for supplemental information
- September 2019 – Audit for Understanding
- December 2019 – Round 1 Regulator Requests for Additional Information Received
- March 2020 – Response to Round 1 Requests for Additional Information
- April 2020 – Round 2 RAI from NRC
- July 2020 – Planned response to part of Round 2 RAI
- December 2020 – Planned response to remainder of Round 2 RAI
- **August 2021 – Expected final U.S NRC approval**

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