Fast Reactor Working Group

- Multiple developers working on multiple technologies
- Spans variety of fast reactor technologies in development

<table>
<thead>
<tr>
<th>ARC</th>
<th>Columbia Basin</th>
<th>Elysium Industries</th>
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<tbody>
<tr>
<td>General Atomics</td>
<td>GE</td>
<td>Hydromine</td>
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<td>Oklo</td>
<td>TerraPower</td>
<td>Westinghouse</td>
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<td>Duke</td>
<td>Exelon</td>
<td>Southern</td>
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<td>Studsvik</td>
<td>EPRI</td>
<td>NEI</td>
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<td>Scandpower</td>
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Fast Reactor Overview

A fast reactor is a nuclear reactor in which the fission chain reaction is sustained by fast neutrons (higher energy), as opposed to thermal neutrons (lower energy) used in water cooled and most gas cooled reactors.
Types of Fast Reactors

- Gas Cooled
- Lead Cooled
- Sodium Cooled (Pool)
- Molten Salt Cooled
Fast Reactor I&C Architecture

- Organized by following the IAEA model for quality, safety class, & defense lines
- Powered by appropriate quality/safety class
- Platforms are chosen to be diverse by and aligned to safety class and defense lines
- Controlled by hardware/software of appropriate quality and safety class

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<thead>
<tr>
<th>Safety Class 1 Functions</th>
<th>Safety Class 2 &amp; 3 Functions</th>
<th>Non Safety Functions</th>
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<tbody>
<tr>
<td>Divisional &amp; Diverse Power</td>
<td>Non Divisional Power</td>
<td>Non Divisional Power</td>
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<tr>
<td>Defense line 3</td>
<td>Defense line 2</td>
<td>Defense lines 1,4</td>
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<tr>
<td>Safety Related Controls</td>
<td>SIL 3 Controls</td>
<td>SIL 2 Controls</td>
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<td>~12 Functions</td>
<td>~40 Functions</td>
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I&C Innovations – New Features

- Safety-related functions few and simple
- SCRAM not required for safety
- 1E power is not required
- High dose rates
I&C Innovations – Sensors & Actuators

- Diverse needs for I&C
- Ways to remotely and non-invasively measure elemental and isotopic composition, temperature, pressure, flow rate
- High temperature neutron flux detectors
Primary function status relies on in-service-inspection of secondary indications. E.g. internal core damage can be determined by inspection of physical safety structures, and there is newer, better technology and algorithms that can be used to achieve this.
I&C Innovations Op Concepts

- Inherently safe and passive core designs need to be credited so that I&C can be simplified further
- Reactor long term control by fuel salt temperature rather than neutron power level
I&C Innovations Work/Risk Management

- Trending and analytical diagnostics, Predix
- Sodium refueling machine leveraging I&C innovations to validate fuel moves and speed refueling times
- High rad robotics
- Remote operations
Fast Reactor I&C Questions?