

TERRESTRIAL ENERGY

Delivering Carbon-free Thermal and Electrical Energy

Terrestrial Energy Progress Overview

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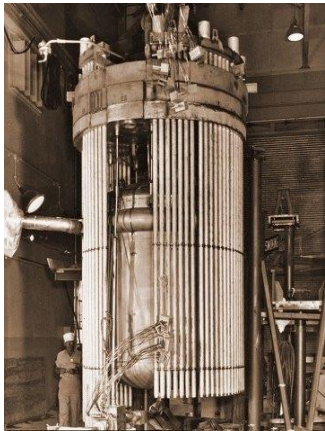
Agenda

- I **Introduction to Terrestrial Energy**
- II **Integral Molten Salt Reactor Plant Overview**
- III **Design Development Progress**
- IV **R&D Progress**
- V **Regulatory Engagements**
- VI **Supply Chain**

Introduction to Terrestrial Energy

IMSR design is built on proven MSR technology demonstrated at the Oak Ridge National Laboratory (ORNL):

1958 -1969, 1980



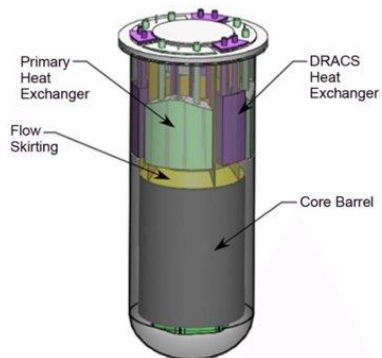
First Molten Salt Reactor (MSR) research program (1960)¹

and

Denatured Molten Salt Reactor (DMSR) conceptual design (1980)²: use of Low Enriched Uranium (LEU) with a once-through fuel cycle

2010

Small Modular Advanced High-Temperature Reactor (Sm-AHTR) design, using solid fuel and molten salt cooling ³: cartridge core design



Terrestrial Energy IMSR
Gen IV Advanced Modular Reactor

>2012

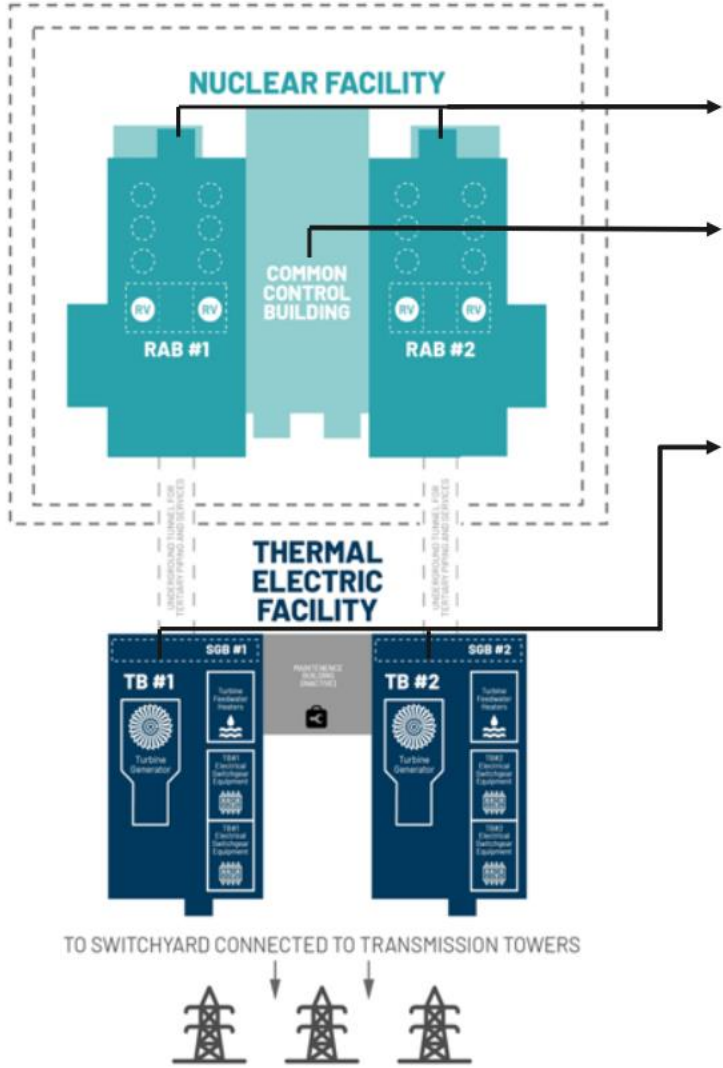


IMSR is a molten salt reactor that uses:

- Fluoride-based fuel salt mixture
- Under 5% LEU once-through fuel cycle
- Thermal spectrum
- Graphite moderator
- Integral core architecture

1. ORNL, [Molten Salt Reactor History](#) and ORNL-2474 [Quarterly Progress Reports 1958-1976](#)
 2. ORNL, [Conceptual Design Characteristics of a Denatured Molten-Salt Reactor with Once-Through Fueling](#)
 3. ORNL, [Pre-Conceptual Design of a Fluoride-Salt-Cooled Small Modular Advanced High-Temperature Reactor](#)

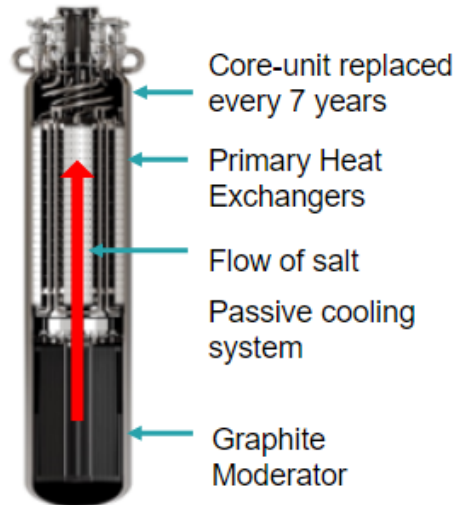
Design Development Progress



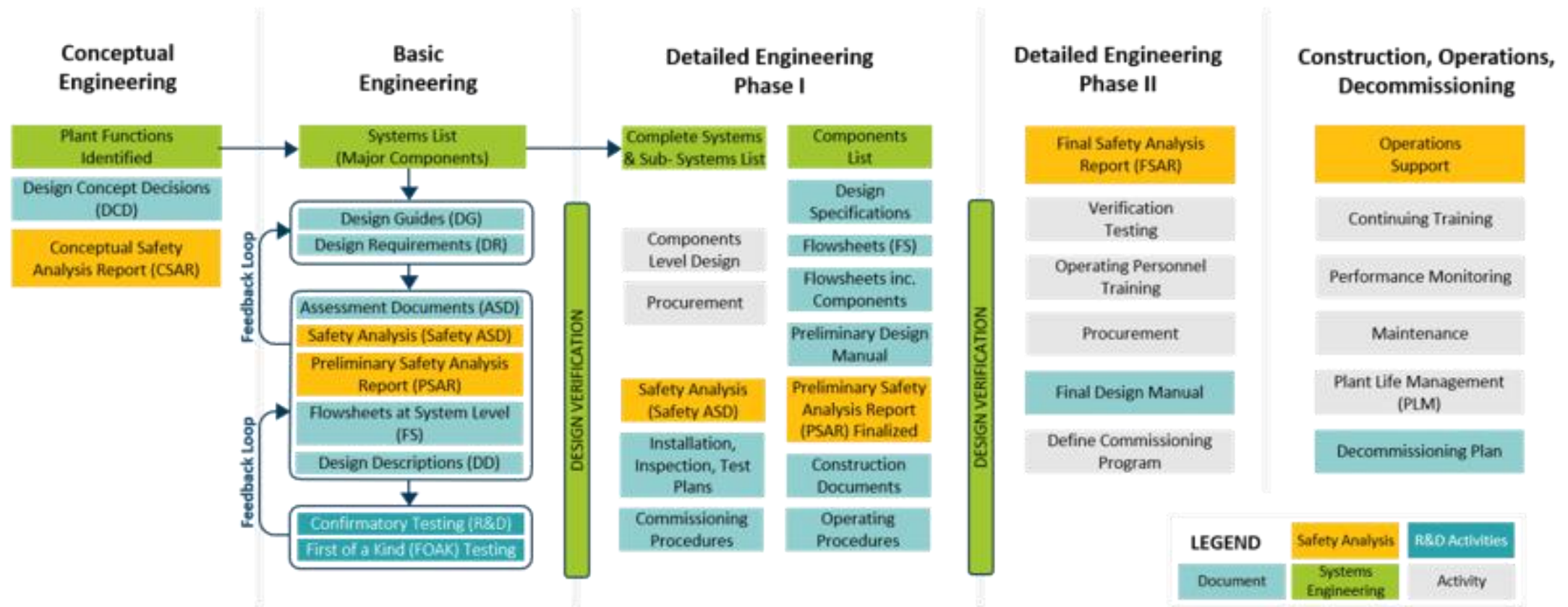
<p>RAB Buildings</p>	<ul style="list-style-type: none"> Reactor Auxiliary Buildings (RAB), each containing an operating IMSR Core-unit and associated nuclear and support systems necessary to transfer heat in the reactor to the associated Thermal Electricity Facility.
<p>Common Control Building</p>	<ul style="list-style-type: none"> Located between the two RAB structures, supports and provides services to both RAB units. Utilizes a common Main Control Room (MCR) for both RABs, Class 1 battery systems, Secondary Coolant Systems and Tertiary Coolant Salt pump motors for the RAB's.
<p>Turbine Buildings</p>	<ul style="list-style-type: none"> Each Turbine Building (TB) with its associated Steam Generation Building (SGB). Contains non-nuclear-grade, industry standard power equipment. The TB design utilizes conventional structural steel siding supported by a reinforced concrete basement. The TB houses the Turbine Generator Set (TG), Condenser, and the associated feedwater, steam systems, electrical systems and other required equipment

- ~400 MWt (thermal)
- 44 % efficiency
- 56 years operation life (7 years per Core-unit)
- Load-following capability

IMSR Core-unit



Design Development Progress

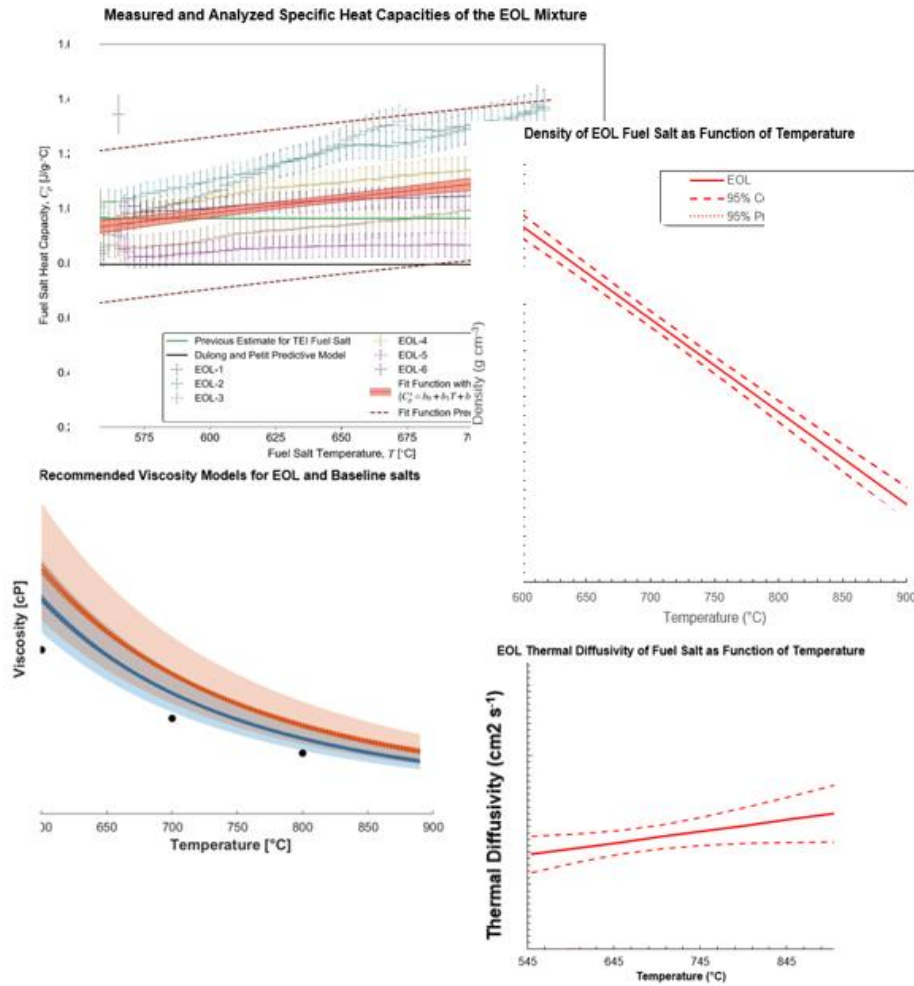


We are at this point of development

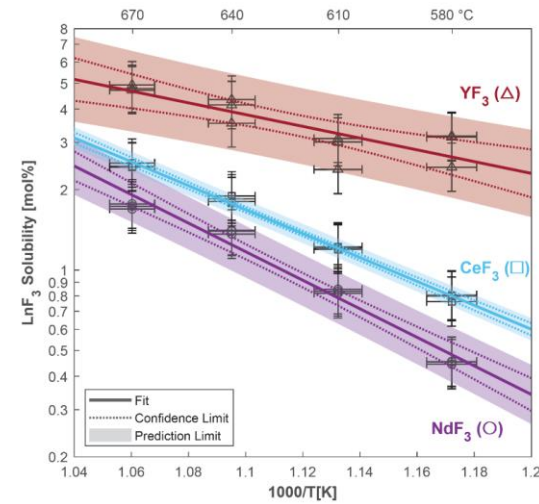
R&D Progress

Fuel Salt Qualification

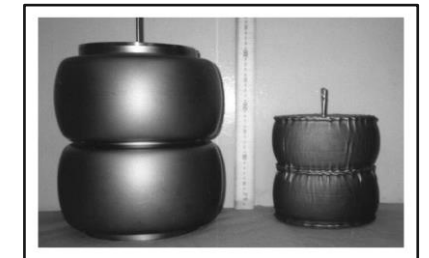
Fuel Salt Thermo-physical Properties



Fission Product Retention

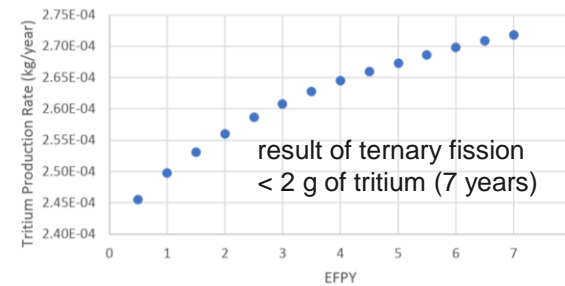


Handling of Waste Fuel Salt



Strategy is aligned with the Durable Fuel Waste Handling Concept of NWMO.

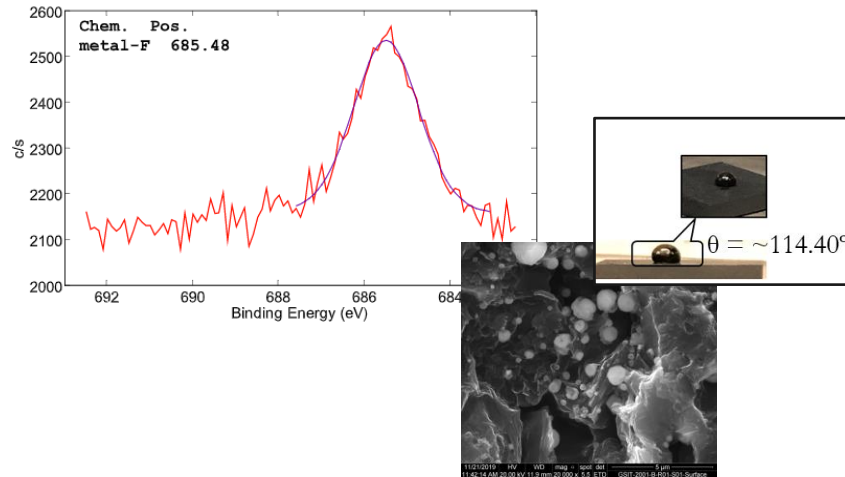
Tritium Production Rate in IMSR400



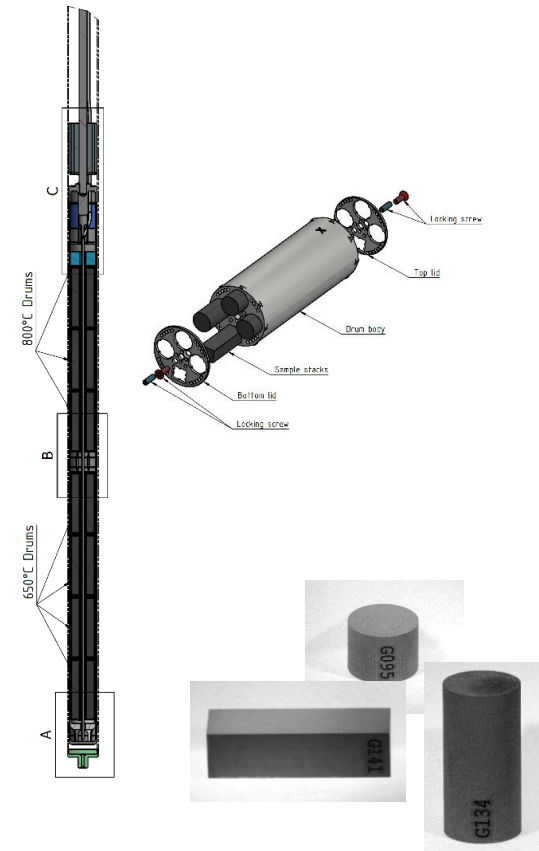
R&D Progress

Graphite Qualification

Fuel Salt – Graphite Interaction

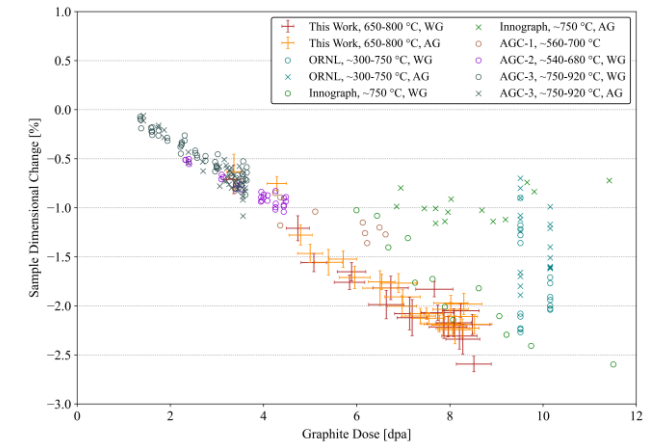


Graphite Irradiation Test Rig



Post-irradiation Graphite Property Measurements (196 samples)

- Dimensions
- Mass
- Coefficient of Thermal Expansion
- Dynamic Young's Modulus
- Thermal Conductivity
- Surface Analysis

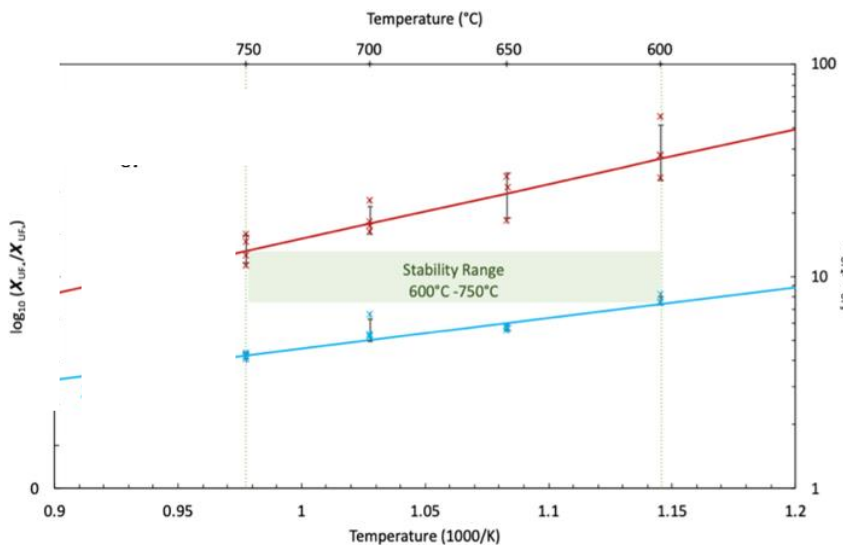


R&D Progress

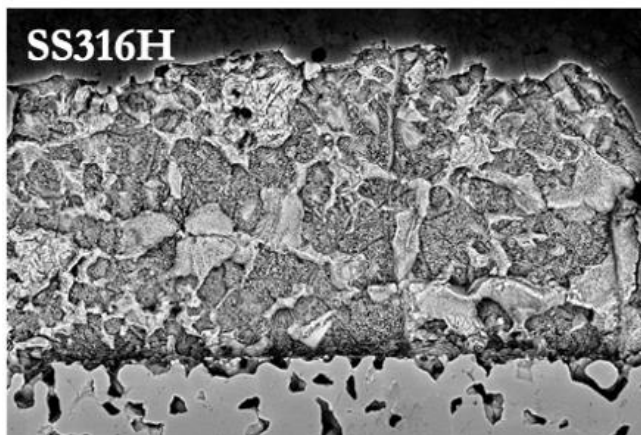
Alloy Qualification

ASME Section III, Div. 5

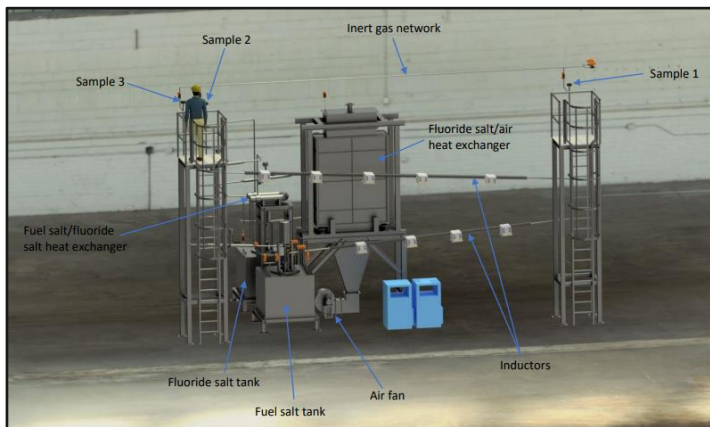
Salt Electrochemical Potential



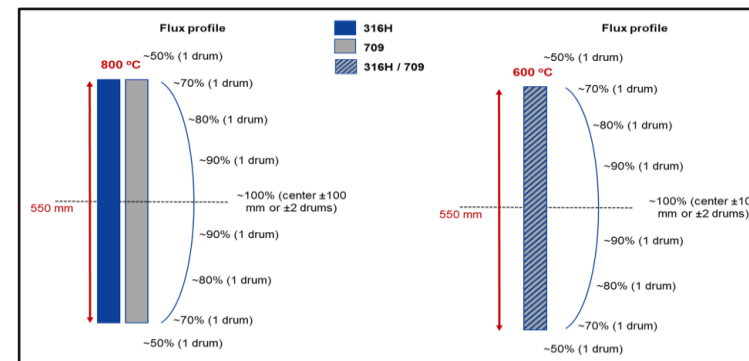
Static Corrosion Data



Corrosion Test Rig



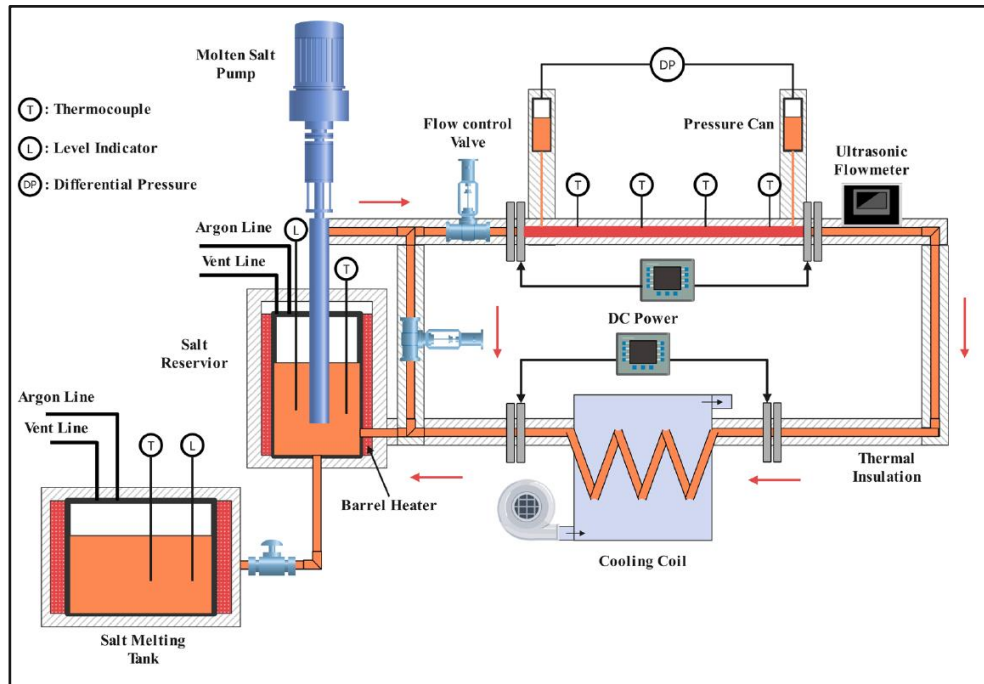
Alloy Irradiation Calculated Flux Profile



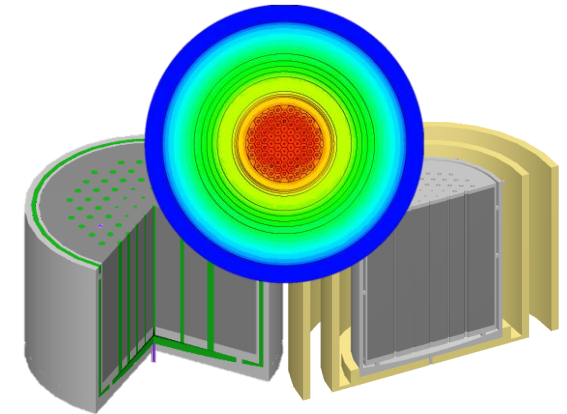
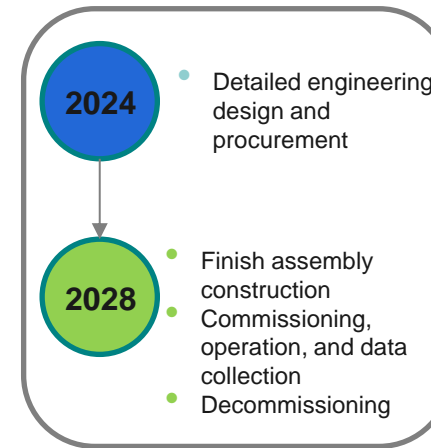
R&D Progress

Physics and Thermal Hydraulics Test Programs

Schematic Representation of Thermal-hydraulics Test Rig

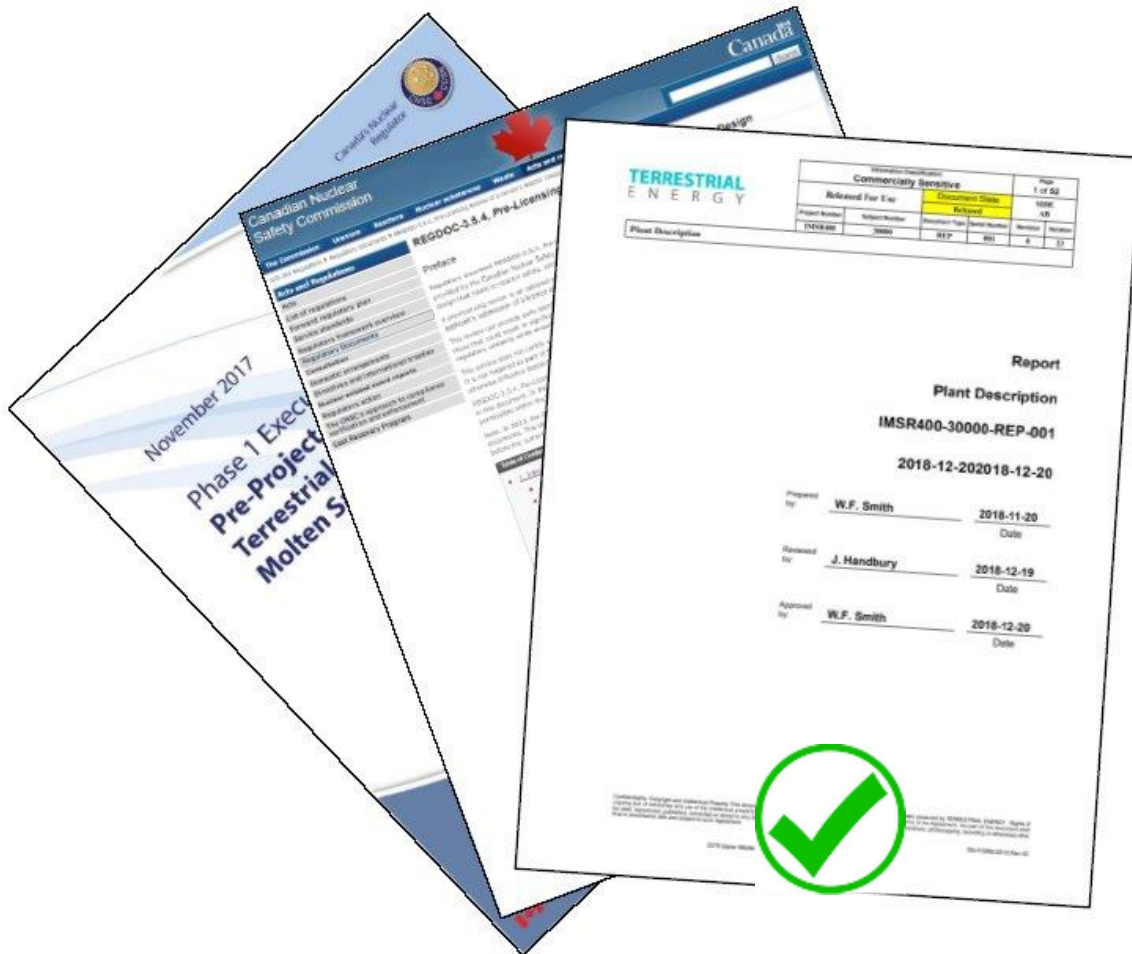


Physics Test – Core Model



Regulator Engagements

Regulatory reviews



Canadian Nuclear Safety Commission (CNSC)

2023: “no fundamental barriers to licensing” the IMSR Plant for commercial operation were identified in the Vendor Design Review (VDR)

Scope of VDR

- 19 Focus Areas were addressed, relating to the “Safety and Control Areas” of a future license application
- Review and audit of Terrestrial Energy’s engineering processes, design and analysis procedures and methodologies

United States Nuclear Regulatory Commission
















2024: Working on standard design approval (PDC review)

United Kingdom Office for Nuclear Regulation

2025: Generic Design Assessment

Supply Chain

Terrestrial Energy's Contracted Supplier Network

Plant & Infrastructure	Nuclear fuel	R&D	Graphite	Services
		 <p>Nuclear. For life.</p>		
		 		
		 		
				
	<p>* Tier 2 supplier; subcontractor to Westinghouse</p>	  		

Supply Chain

Fuel Salt Supply

Process Step	Evidence and Justification
UF ₆ enrichment to 2.4 or 4.9 wt%	Urenco (Capenhurst, UK)
eUF ₆ Transportation package	30B cylinders
eUF ₆ to eUO ₂ deconversion, eUO ₂ storage and handling	Springfields fuels Ltd (since 1996)
eUO ₂ storage and handling	Springfields fuels Ltd. have an automated buffer store in the oxide fuel complex (which has been operational since 1996). UO ₂ is stored in sealed drums to keep dry and free from contamination.
eUO ₂ to UF ₄ conversion, eUF ₄ storage and handling	Springfields fuels Ltd (Kiln Plant)
Fuel Salts synthesis	National Nuclear Lab (UK)
Fuel Salts transportation	BU-D (outer drum = 213L, inner drum = 65 L); Container (ISO-certified, 20-foot, capacity is 70 BU-D packages); Container Vessel (Capacity is 4 containers or 280 BU-D packages)

BU-D



ISO-certified 20-foot Container

