

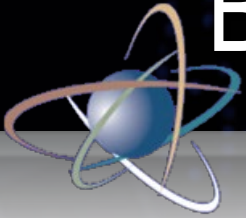
Advanced Reactor Readiness and Collaboration on Licensing and Research Activities



Raymond Furstenau

Director, Nuclear Regulatory Research

U.S. Nuclear Regulatory Commission



Broad Landscape of Advanced Reactor Designs

**EVOLVING
LANDSCAPE**

Research and
Test Reactors

Molten Salt
Reactors

SMRs and
Microreactors

High-
Temperature
Gas-Cooled
Reactors

Liquid Metal
Cooled Fast
Reactors

20+

Current and potential applications by 2027

6+

Potential operating licenses by 2027

15+

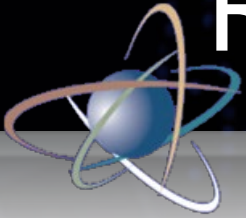
Entities actively engaged in pre-application activities

51

Topical reports and white paper reviews completed for 7 vendors

33

Topical reports and white papers under evaluation from 8 vendors



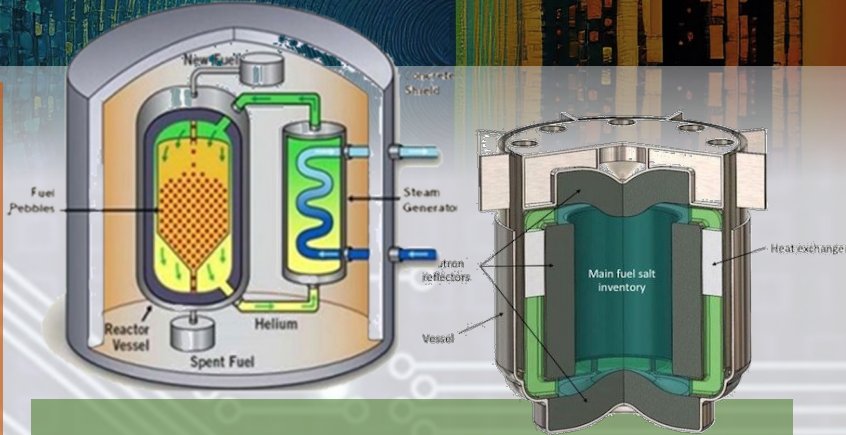
Reactor Licensing Pathways



10 CFR, Part 52

Vogle AP-1000, NuScale

Early Site Permit, COL, Design Certification, Manuf. License



10 CFR, Part 53

New licensing framework under development

Technology-inclusive, risk-informed, performance-based framework

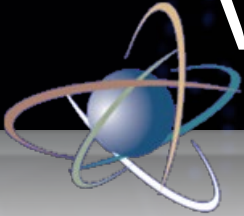
Publish by mid-2025

10 CFR, Part 50

Large majority of operating power reactor and NPUF fleet

Construction Permit + Operating License





Vendor Engagement Status

SMR Design
Certification Issued



Advanced Reactor (Non-Power)
Application Review Ongoing



Kairos Power



Potential SMR or Advanced Reactor Application Submittal Within Two Years



HITACHI

TERRESTRIAL
ENERGY



Westinghouse



Kairos Power



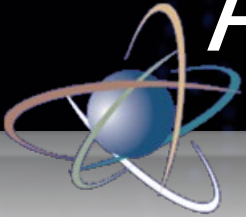
OKLO



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



Advanced Reactor Readiness - Research



**RESEARCH
SUPPORT**

**ENSURING READINESS
OF TECHNICAL BASES**



**REGULATORY
SUPPORT**

**STANDARDS &
GUIDANCE**



**COMPUTER
CODES**

**ENSURING CODE
READINESS**



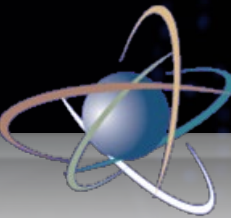
**KNOWLEDGE
& SKILLS**

**BUILDING CAPACITY
& CAPABILITIES**

ACHIEVING READINESS THROUGH RESEARCH NOW AND INTO THE FUTURE



National Laboratory Collaboration



- **YELLOWJACKET**
- **MCNP**
- **Disposal**



**Sandia
National
Laboratories**

- **MELCOR**
- **MACCS**
- **DAKOTA**
- **Security & Safeguards**



Pacific Northwest
NATIONAL LABORATORY

- **FAST**
- **RAMP**
- **NDE Modeling
& Simulation**

Argonne
NATIONAL LABORATORY

- **Creep-Fatigue
Tool**
- **NEK5000**
- **SAM**

OAK RIDGE
National Laboratory

- **SCALE**
- **VERA**
- **SHIFT**
- **Probabilistic
Fracture Mechanics**



Idaho National Laboratory

- **MOOSE**
- **GRIZZLY**
- **EMERALD**
- **SAPPHIRE**
- **Graphite Tool**



Value of Japan-U.S. and International Cooperation

- **Opportunities Highlighted in November Visit to JAEA**

- High Temperature Engineering Test Reactor (HTTR)
- IS Process Facility (Hydrogen Production Test Facility)
- JOYO (Experimental Sodium-Cooled Fast Reactor)

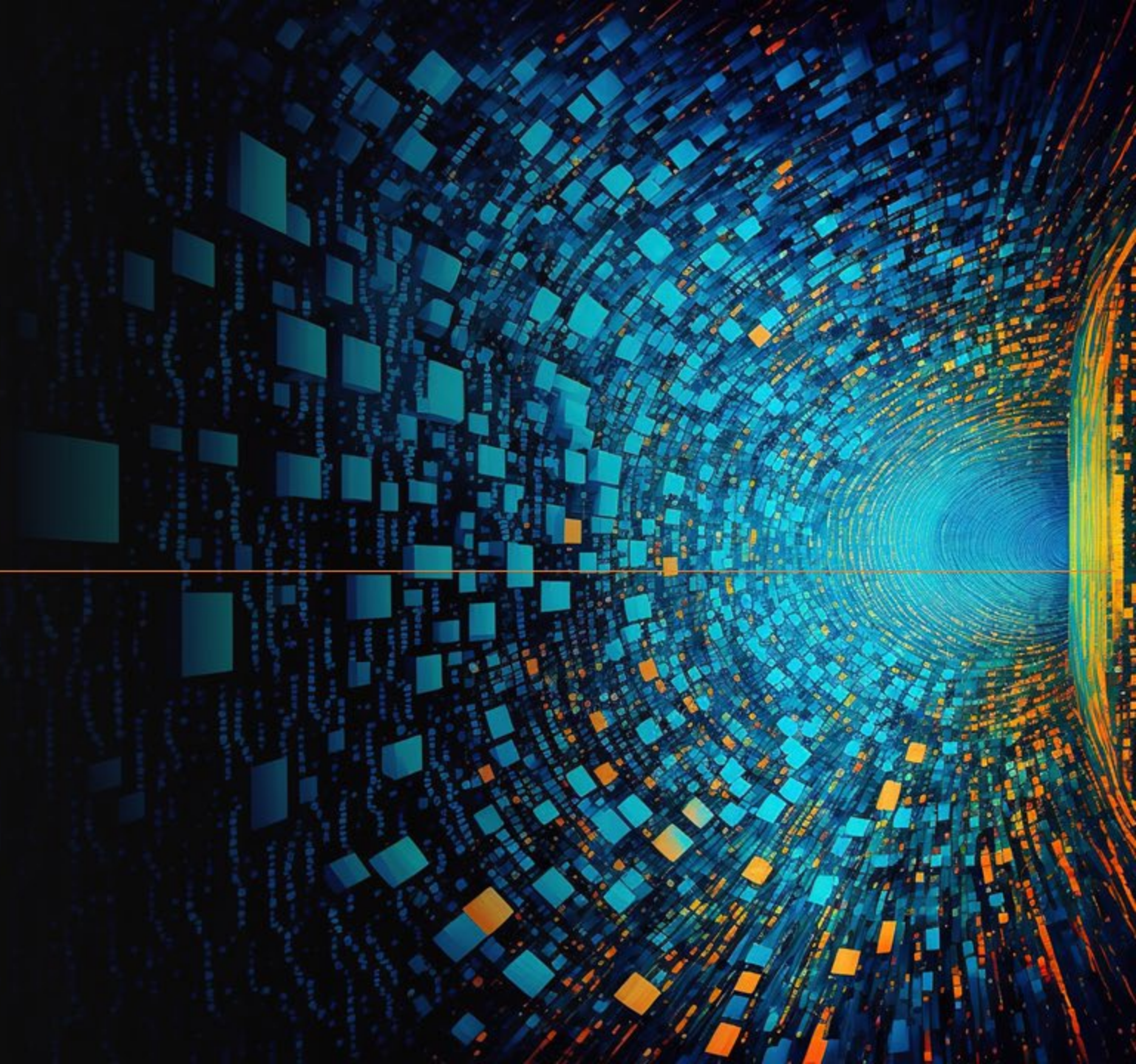


- **High-Burnup Experiments in Reactivity-Initiated Accidents (HERA)**

- Framework for cooperation



Backup Slides



Future Focused Research Program

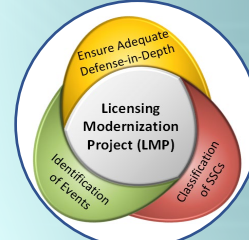
- Supports NRC vision of becoming a modern, risk-informed regulator
- Transformative, innovative ideas that close technical gaps ahead of regulatory needs



Key Attributes
for Remote
Operation of
NPPs



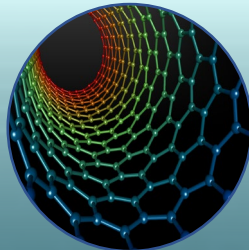
High Entropy
Alloys



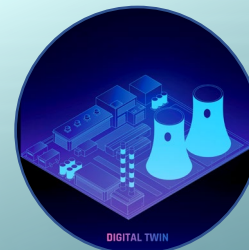
Licensing
Modernization
Project - Operating
Reactors



Integration of
Safety, Security,
and Safeguards



Nuclear Nano
Technology –
Advanced Fuel
Applications



Digital Twins –
Regulatory
Viability

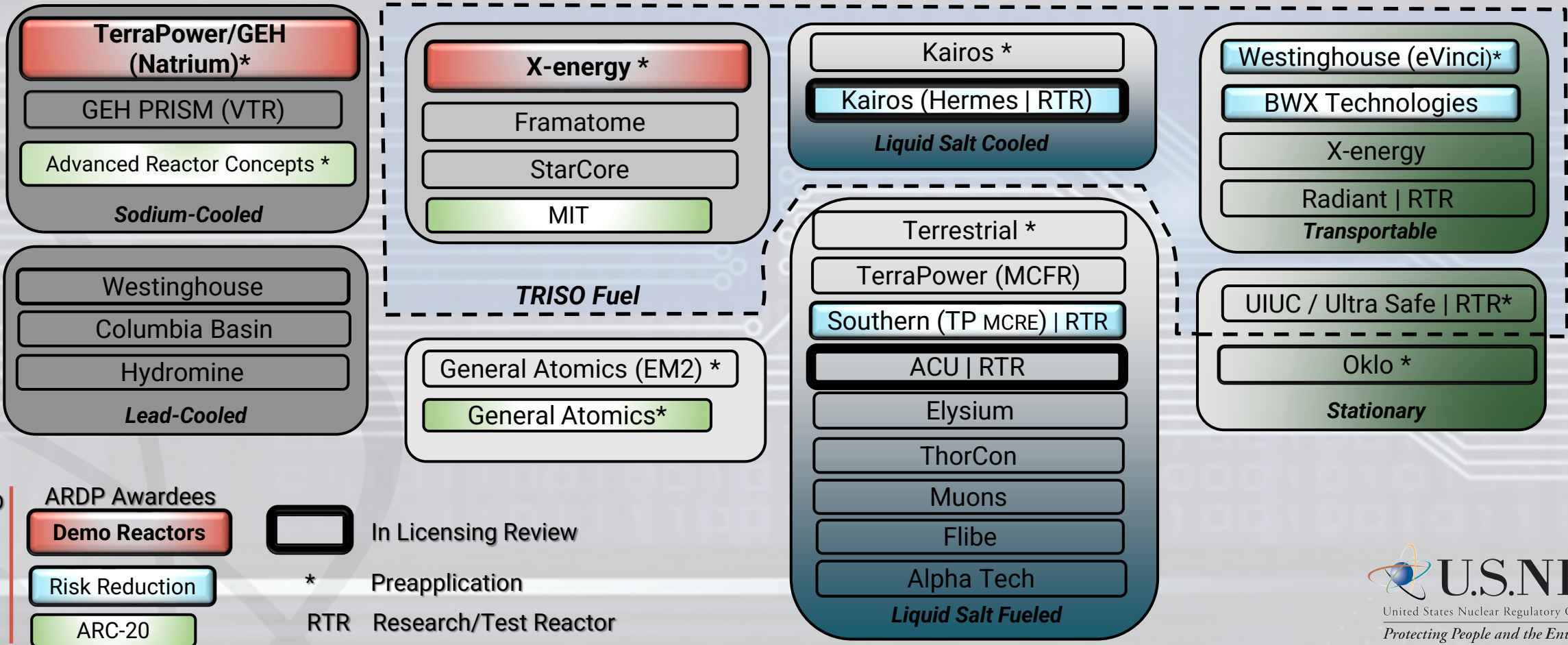
Broad Landscape of Advanced Reactor Designs

Liquid-Metal-Cooled Fast Reactors (LMFR)

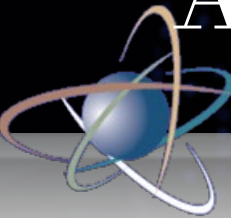
High-Temperature Gas-Cooled Reactors (HTGR)

Molten Salt Reactors (MSR)

Micro Reactors



Advanced Reactor Licensing



Licensing Modernization Project

- Licensing basis events
- Structures, systems and components classification
- defense in depth features

NRC vision and strategy and implementation action plans

Transformed regulatory framework

- embodiment of a risk-informed, consequence-oriented approach to licensing

