

# Versatile Test Reactor

December 7, 2020

Thomas J. O'Connor  
VTR Program Director  
Office of Nuclear Energy



U.S. DEPARTMENT OF  
**ENERGY**

Note: All information regarding VTR technology selection and site location is **preliminary**. The decision for technology and site location is determined via DOE National Environmental Policy Act and acquisition processes that have not yet been completed.

# VTR: Mission Need and Capability


The Office of Nuclear Energy mission is to advance nuclear power to meet the nation's energy, environmental, and national security needs.

VTR Mission: to provide high performance testing capability, specifically, a fast neutron source to develop, test and qualify advanced fuels and materials to NRC standards for the next generation of Advanced Reactors.

Capability Gap: do not have the testing capability to move forward in the development of next-generation nuclear reactors.

CD-0 approved by Deputy Secretary Brouillette February 22, 2019.


CD-1 approved by Deputy Secretary Menezes September 11, 2020.



The Deputy Secretary of Energy  
Washington, DC 20585

February 22, 2019

MEMORANDUM FOR MARK W. MENEZES  
UNDER SECRETARY OF ENERGY

FROM: DAN BROUILLETTE 



SUBJECT: Approval of Critical Decision-0, *Approve Mission Need*, for the Versatile Test Reactor (VTR)

As Chief Executive of Project Management, I approve *Mission Need*, for the Versatile Test Reactor (VTR) project with a cost range of \$6.0B and an expected CD-4, *Project Completion*, range of September Fiscal Year 2026 to August Fiscal Year 2031.

The VTR project will provide leading edge capability qualification of advanced fuels and materials, enabling sustain technology leadership in the area of current and future advanced reactor systems.

At the Energy Systems Acquisition Advisory Board (ESAAB) meeting on February 8, 2019, the members strongly supported this project and voted to approve CD-0 for the VTR project. With their endorsement, I approve CD-0.

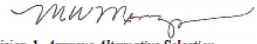
cc:  
G. McGinnis, NE-2  
D. Mintia, NE-20  
J. Herzog, NE-4  
B. Singh, NE-42  
M. Peck, PM-1  
R. Hendrickson, CF-2



The Deputy Secretary of Energy  
Washington, DC 20585

September 11, 2020

MEMORANDUM FOR RITA BARANWAL  
ASSISTANT SECRETARY FOR NUCLEAR ENERGY

FROM: MARK W. MENEZES 

SUBJECT: Approval of Critical Decision-1, *Approve Alternative Selection and Cost Range*, for the Versatile Test Reactor Project

As Chief Executive of Project Management, I approve Critical Decision (CD)-1, *Approve Alternative Selection and Cost Range*, for the Versatile Test Reactor (VTR) project with a cost range of \$2.6 billion to \$5.8 billion and an expected CD-4, *Project Completion*, range of September Fiscal Year 2026 to August Fiscal Year 2031.

The VTR project will develop a fast spectrum neutron irradiation capability to address the testing capability gap in the U.S. nuclear energy research and development infrastructure. The project will design and construct a sodium-cooled, fast neutron spectrum test reactor in the 300 megawatt thermal power range. This flexible, reconfigurable testing environment will enable the United States to regain and sustain technology leadership in the area of current and future advanced reactor systems.

At the Energy Systems Acquisition Advisory Board (ESAAB) meeting on September 8, 2020, the members supported this project and voted to approve CD-1 for the VTR project. With their endorsement, I approve CD-1.

cc: Tom O'Connor, NE-4  
Paul Bosco, PM-1  
Mark Arenaz, FPD  
ESAAB Members  
Project Management Risk Committee Members

# VTR: Compelling Mission – Operated as a User Facility

## COMMERCIAL

- Accelerated testing for fuels, materials & sensors for advanced reactors: Na, Pb, LBE, MS, He
- Accelerated testing for materials
- Clean energy market share

## NATIONAL SECURITY

- Safeguard detectors/safeguards by design
- Global safety and security policies
- Export of reactors and reactor services

**VTR**

## SCIENCE & TECHNOLOGY

(High-Energy Neutrons over Large Volumes)

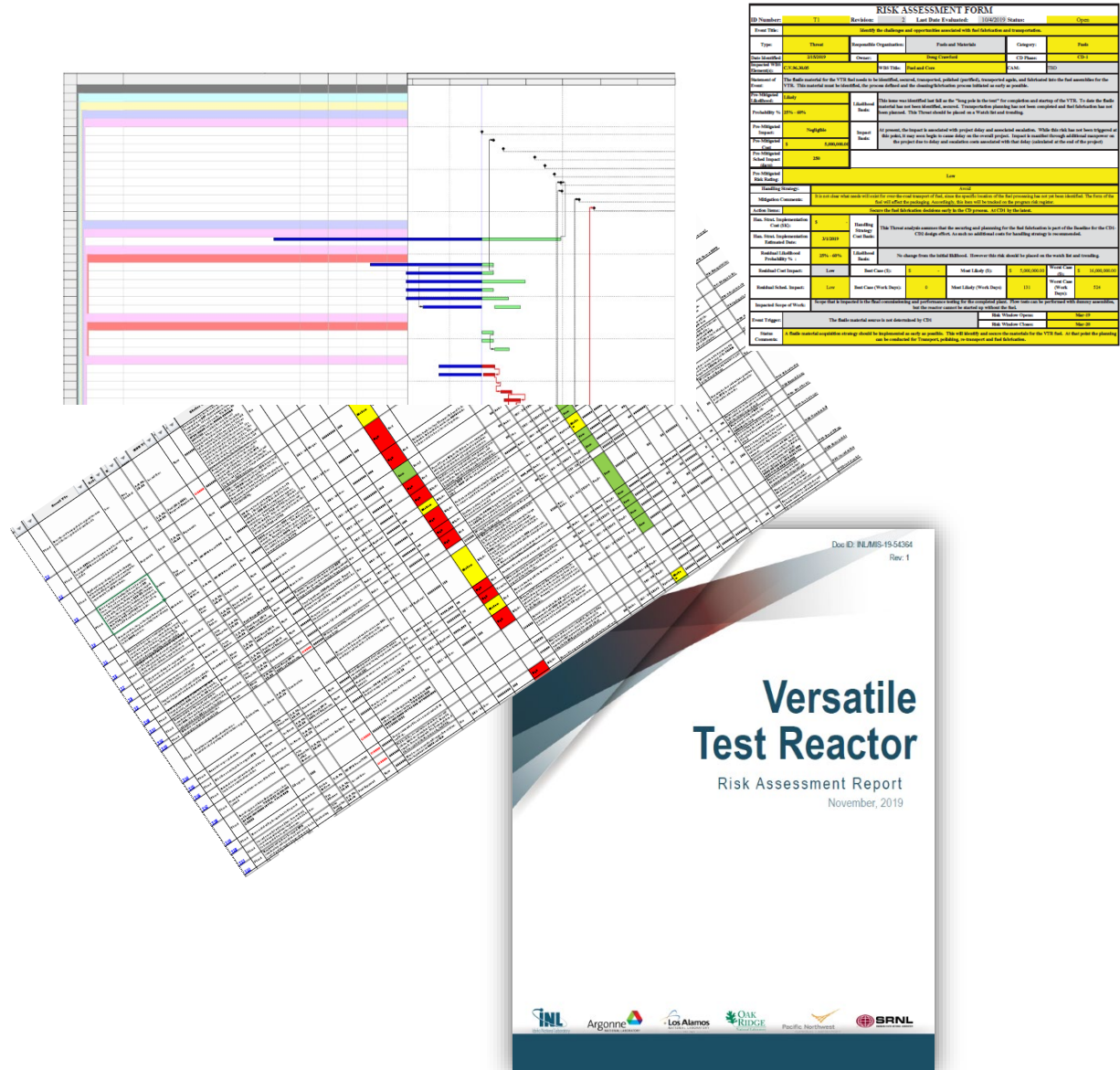
- Fast reactor physics
- Materials in extreme environments
- Neutrino science

**VTR is a state-of-the-art TEST REACTOR to enable continuous innovation in advanced nuclear energy technologies during its 60 years lifetime.**

# VTR Project: DOE Capital Acquisition – Order 413.3B

## Key elements:

- Acquisition Strategy
- Integrated resource-loaded schedules; earned value management
- Risk Management Plan; Risk Register
- Technology Maturation Plan
- Cost, schedule, and risk are based on the stable plant design and plant safety basis
- Key milestones (critical decisions)
- Project Management Reviews and Audits



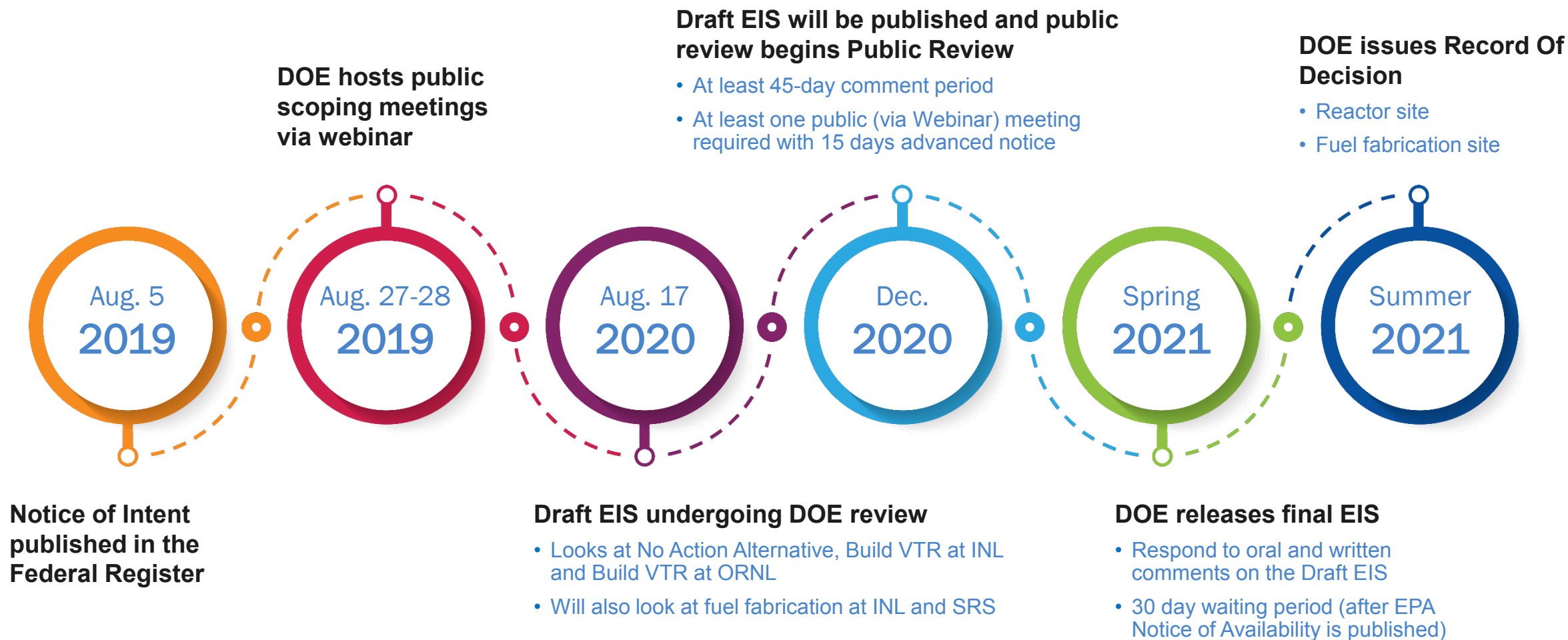
# VTR: Cost and Schedule Ranges Approved at CD-1

	Critical Decision Schedule	Approved at CD-0	Actual*/ Projected**
CD-0	Approve Mission Need	Feb 22, 2019	Feb 22, 2019*
CD-1	Approve Alternative Selection and Cost Range	1 <sup>st</sup> Qtr FY 2021	September 11, 2020*
CD-2/3	Approve Performance Baseline / Approve Start of Construction	FY 2022	2 <sup>nd</sup> Qtr FY 2023**
CD-4	Approve Start of Operations or Project Completion	FY 2026 – FY 2030	4 <sup>th</sup> Qtr FY 2026**

Cost Range	CD-0	CD-1
TPC Point Estimate	\$4,500 M	\$3,600 M
Low End of Range	\$3,000 M	\$2,600 M
High End of Range	\$6,000 M	\$5,800 M

Schedule Completion	Date
CD-0	2026 to 2030
CD-1	2026 to 2031

# VTR: National Environmental Policy Act



# VTR: Authorization Basis

- Legal Authority: Authority to develop and operate reactors
  - Atomic Energy Act of 1954 / Energy Reorganization Act of 1974
- DOE Process:
  - Authorization basis consists of those documents, permits and plans required to satisfy state, and federal requirements for a facility to operate.
  - DOE requirements very similar to NRC. Both require: Safety Analysis Reports (SAR), Technical Safety Requirements, Emergency Plans, Security Plans, environmental permits
- DOE /NRC MOU – Signed September 18, 2019
  - NRC can supplement DOE's review of safety basis and documentation
  - Affords NRC extensive opportunities to listen and learn.
    - Implementation of recently published licensing modernization project regulatory guides
  - Developing joint approach for treatment of accident analysis for EIS use.



# VTR: Major Scope Organization and Strategy

## Scope:

- **Integration, Core, Fuel, Safety Analysis, Safety Basis, PRA, Support Facilities:**
  - DOE Laboratories
- **Reactor Concept Design, Cost Estimate:**
  - Industry
- **Experiment Concept Development:**
  - DOE Laboratories
  - Industry
  - Universities

## Strategy:

- **Minimize Risk**
- **Finalize Design**
  - Employ digital engineering
- **Prototype**
  - Re-establish needed supply chain
- **Use of existing, mature technology:**
  - Extensive US and International SFR experience
  - GE Hitachi PRISM design selected as basis for adaptation to test reactor mission
  - Use known fuel system and fabrication capabilities
  - Use proven components from FFTF, others



# VTR: Current Partners






## Universities (includes co-PIs)

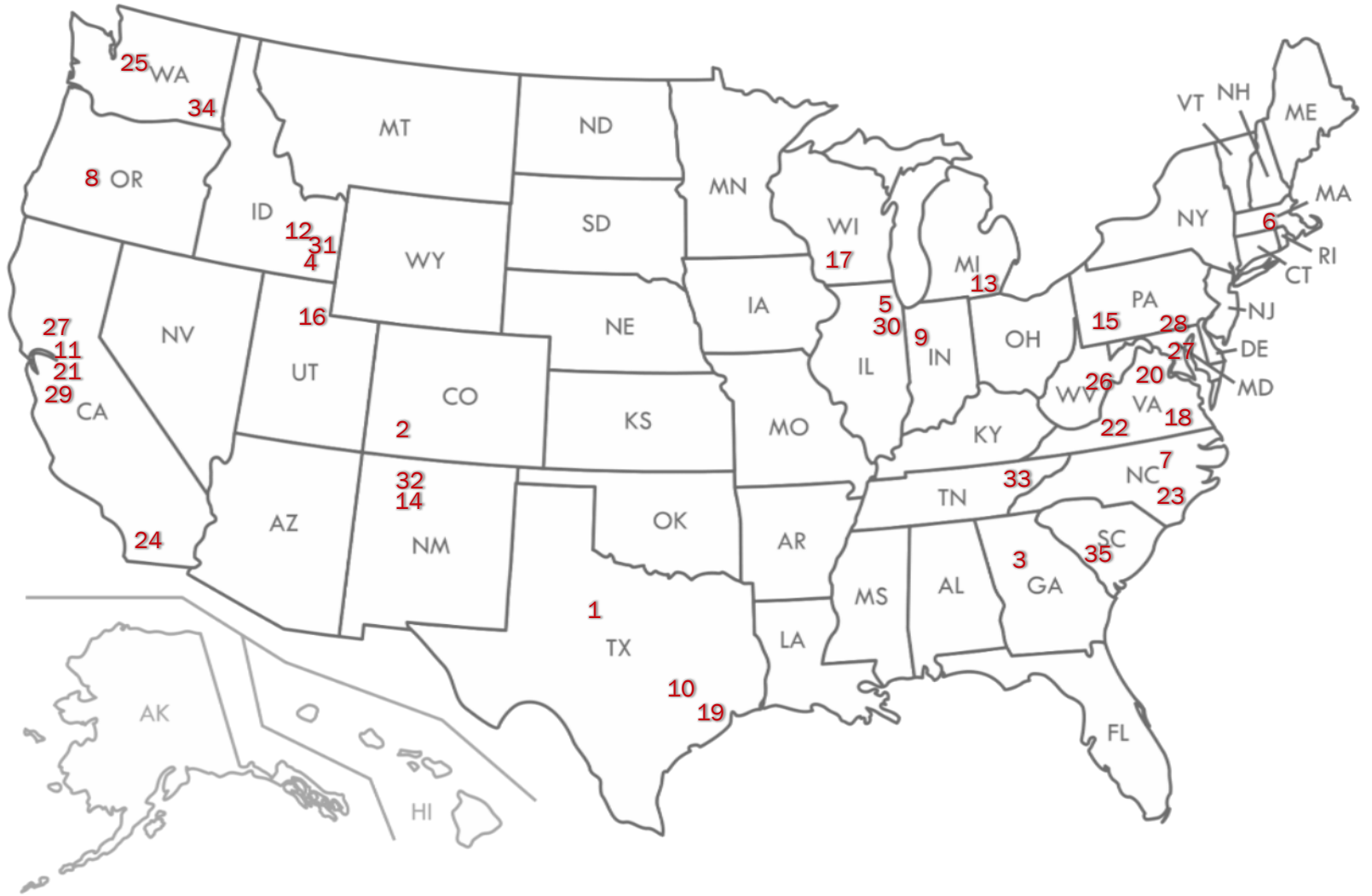
- |   |  |
|---|--|
| 1  Abilene Christian University          | 11  Berkeley University of California, Berkeley |
| 2  Fort Lewis College                    | 12  University of Idaho, Idaho Falls            |
| 3  Georgia Institute of Technology       | 13  University of Michigan                      |
| 4  Idaho State University                | 14  University of New Mexico                    |
| 5  Illinois Institute of Technology      | 15  University of Pittsburgh                    |
| 6  Massachusetts Institute of Technology | 16  University of Utah                          |
| 7  North Carolina State University       | 17  University of Wisconsin - Madison           |
| 8  Oregon State University               | 18  Virginia Commonwealth University            |
| 9  PURDUE UNIVERSITY                     | 19  University of Houston                       |
| 10  TEXAS A&M UNIVERSITY.                |  |

## Industry

- |  |
|--|
| 20  Bechtel Corporation               |
| 21  ELECTRIC POWER RESEARCH INSTITUTE |
| 22  framatome                        |
| 23  General Electric                |
| 24  GENERAL ATOMICS                 |
| 25  TerraPower.                     |
| 26  Westinghouse                    |
| 27  THE CAMERON GROUP, INC.         |
| 28  orano                           |
| 29  COSYLAB                         |

## Laboratories

- |  |
|--|
| 30  Argonne National Laboratory               |
| 31  Idaho National Laboratory                 |
| 32  Los Alamos NATIONAL LABORATORY           |
| 33  OAK RIDGE National Laboratory           |
| 34  Pacific Northwest National Laboratory   |
| 35  SRNL SAVANNAH RIVER NATIONAL LABORATORY |



# VTR: International Cooperation

**Scope:** Design and Safety Analysis, Experimental Devices Development, Modeling and Simulation Validation, Sensors and Instrumentation, and others as agreed

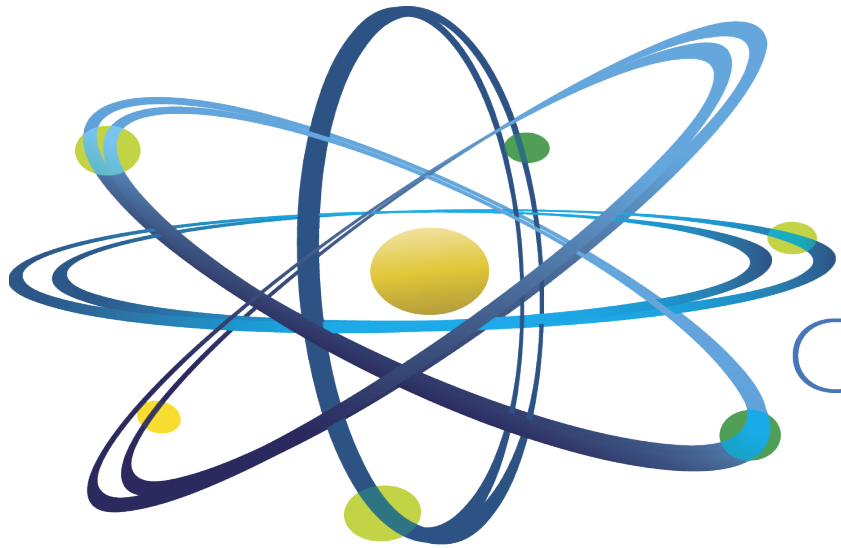
## France:

- Implementing Arrangement
  - Commissariat à l'Energie Atomique et aux Energies Alternatives Français (CEA)
- Signed April 15, 2019
- Established Executive Committee – April 2020 and December 2020

## Japan:

- Memorandum of Cooperation
  - Ministry of Economy, Trade and Industry
  - Ministry of Education, Culture, Sports, Science and Technology
- Signed June 12, 2019
- Workshop held September 10 & 11 at INL

VTR information available at  
<https://www.energy.gov/ne/versatile-test-reactor>



Clean. **Reliable. Nuclear.**