Versatile Test Reactor Update
Nuclear Energy Advisory Committee

March 28, 2019

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VTR Program Director
Office of Nuclear Fuel Cycle and Supply Chain
Office of Nuclear Energy

U.S. DEPARTMENT OF ENERGY

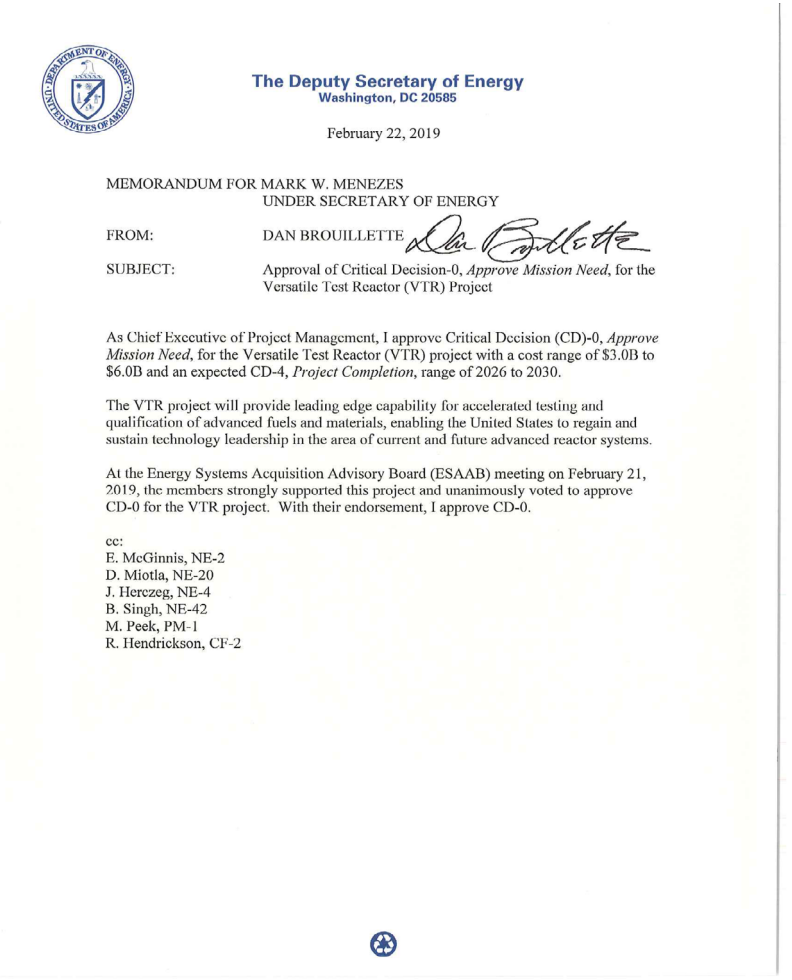
Mission Need and Capability Gap

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

Mission Need: 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.



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) Project

As Chief Executive of Project Management, I approve Critical Decision (CD)-0, *Approve Mission Need*, for the Versatile Test Reactor (VTR) project with a cost range of $3.0B to $6.0B and an expected CD-4, *Project Completion*, range of 2026 to 2030.

The VTR project will provide leading edge capability for accelerated testing and qualification of advanced fuels and materials, enabling 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 February 21, 2019, the members strongly supported this project and unanimously voted to approve CD-0 for the VTR project. With their endorsement, I approve CD-0.

cc:
E. McGinnis, NE-2
D. Miotla, NE-20
J. Herczeg, NE-4
B. Singh, NE-42
M. Peek, PM-1
R. Hendrickson, CF-2

Project Estimates:

- Cost Estimate: $3.0 to $6.0 Billion
- Completion Estimate: 2026 to 2030

Milestone	Fiscal Year
CD-0	FY 2019
CD-1	FY 2021 (1st Qtr)
CD-2/3	FY 2022
CD-4	FY 2026

Critical Decisions ("CDs")	CD-0 Approve Mission Need	CD-1 Approve Alternative Selection and Cost Range	CD-2 Approve Performance Baseline (PB)	CD-3 Approve Start of Construction or Execution	CD-4 Approve Start of Operations or Project Completion

Cost & Schedule to Develop CD-1

- Cost and schedule estimate to advance from CD-0 to CD-1 is $120M, FY2020
- This includes an independent Analysis of Alternatives and subsequent conceptual design:
  - Reactor conceptual design, cost estimate, schedule
  - Core conceptual design, fuel design, fuel line
  - Experiment concept development
  - Support facilities, utilities, NEPA, security

National Environmental Policy Act

- Notice of Intent published in the Federal Register
  - Minimum 30 day comment period
- Public Scoping Meetings
  - At least one public meeting required with 15 days advanced notice
  - DOE shall consider all comments on the scope of the EIS
- Public Review of Draft EIS
  - At least 45 day comment period
  - At least one public meeting required with 15 days advanced notice
- DOE releases Final EIS
  - Shall respond to oral and written comments on the Draft EIS
  - 30 day waiting period (after EPA Notice of Availability is published)
- DOE publishes Record of Decision
  - 10CFR1021.315(d) – “No actions can be taken until the decision has been made public”

Overall Strategy: Three Major Areas for Current Phase

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

VTR TASK FORCE UNDER NEI ADVANCED REACTOR WORKING GROUP IS ESTABLISHED.
PROGRAM KICK-OFF MEETING: March 14, 2018

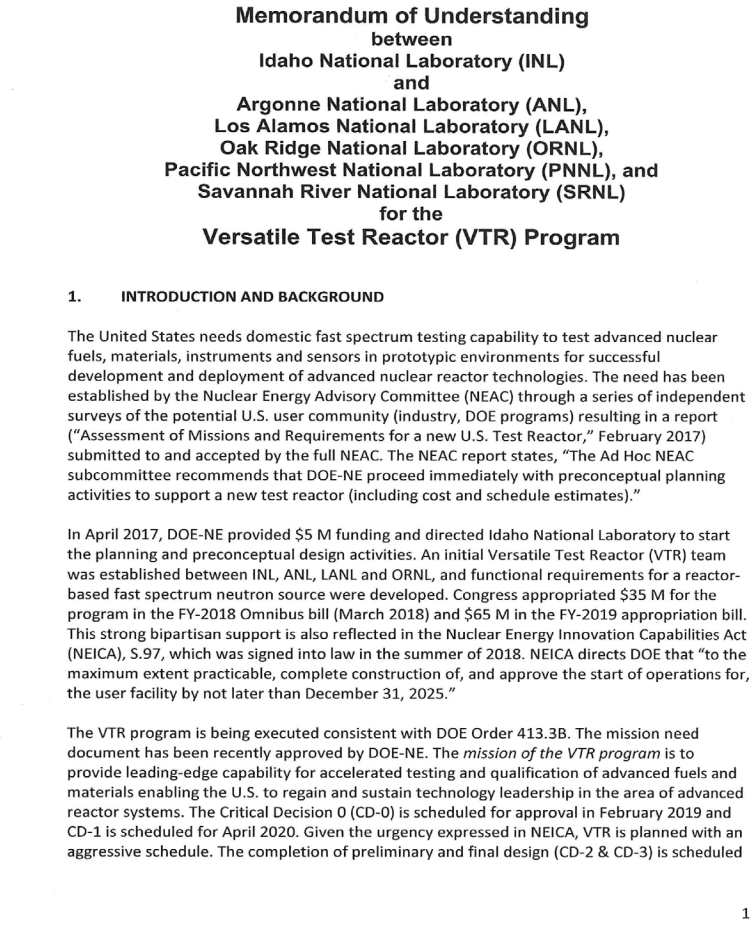
Experiment development approach – University & Industry Collaborations

- Subcontracts are in place with 12 Universities (13 Awards) under 9 collaboration areas.
- An additional call went out, expecting ~5-7 additional subcontracts.
- Industry stakeholders will be engaged to participate in the development of experimental vehicles for sodium, lead, gas fast reactor, and molten salt reactor fuels, industry groups have important engagement
- First year goal for industry partners is to concepts for test vehicles required to inform core design.

Key University and Industry Experiment Development Collaborations			
Collaboration Area	Lead Lab	University Collaborator	Industry Collaborator
Sodium Cooled Fast Reactor	ANL	University of Wisconsin Madison	Framatome
Lead/Lead LBE-cooled Fast Reactor	LANL	University of New Mexico	Westinghouse
Molten Salt Reactors	ORNL	University of Utah, University of Idaho	TerraPower
Gas Cooled Fast Reactor	INL	Texas A&M University	General Atomics
Virtual Design & Construction	INL	North Carolina State University	General Electric - Hitachi
Structural Materials Testing	LANL	Oregon State University	EPRI
Data Analytics Combined with M&S	INL	Abilene Christian University, Colorado School of Mines, Georgia Tech, Massachusetts Institute of Technology	Hierarchical Data Format (HDF) Group
Rabbit Systems	PNNL	Texas A&M University	
Strategic Initiatives	INL	University of Pittsburgh	

Memorandum of Understanding

- Signed by INL, ANL, LANL, ORNL, PNNL & SRNL
- Defines how the project will be managed.
- Commits to work in a safe, environmentally benign, security conscious, high-quality, timely, responsible and cost-effective manner.
- Commits to make resources available and be accountable for deliverables.
- Establishes a VTR Executive Board
- Culture: VTR will only be successful through a team effort, using the best resources, and striving for excellence



Memorandum of Understanding
between
Idaho National Laboratory (INL)
and
Argonne National Laboratory (ANL),
Los Alamos National Laboratory (LANL),
Oak Ridge National Laboratory (ORNL),
Pacific Northwest National Laboratory (PNNL), and
Savannah River National Laboratory (SRNL)
for the
Versatile Test Reactor (VTR) Program

1. INTRODUCTION AND BACKGROUND

The United States needs domestic fast spectrum testing capability to test advanced nuclear fuels, materials, instruments and sensors in prototypic environments for successful development and deployment of advanced nuclear reactor technologies. The need has been established by the Nuclear Energy Advisory Committee (NEAC) through a series of independent surveys of the potential U.S. user community (industry, DOE programs) resulting in a report ("Assessment of Missions and Requirements for a new U.S. Test Reactor," February 2017) submitted to and accepted by the full NEAC. The NEAC report states, "The Ad Hoc NEAC subcommittee recommends that DOE-NE proceed immediately with preconceptual planning activities to support a new test reactor (including cost and schedule estimates)."

In April 2017, DOE-NE provided $5 M funding and directed Idaho National Laboratory to start the planning and preconceptual design activities. An initial Versatile Test Reactor (VTR) team was established between INL, ANL, LANL and ORNL, and functional requirements for a reactor-based fast spectrum neutron source were developed. Congress appropriated $35 M for the program in the FY-2018 Omnibus bill (March 2018) and $65 M in the FY-2019 appropriation bill. This strong bipartisan support is also reflected in the Nuclear Energy Innovation Capabilities Act (NEICA), S.97, which was signed into law in the summer of 2018. NEICA directs DOE that "to the maximum extent practicable, complete construction of, and approve the start of operations for, the user facility by not later than December 31, 2025."

The VTR program is being executed consistent with DOE Order 413.3B. The mission need document has been recently approved by DOE-NE. The *mission of the VTR program* is to provide leading-edge capability for accelerated testing and qualification of advanced fuels and materials enabling the U.S. to regain and sustain technology leadership in the area of advanced reactor systems. The Critical Decision 0 (CD-0) is scheduled for approval in February 2019 and CD-1 is scheduled for April 2020. Given the urgency expressed in NEICA, VTR is planned with an aggressive schedule. The completion of preliminary and final design (CD-2 & CD-3) is scheduled

1