What's New in Reactors?

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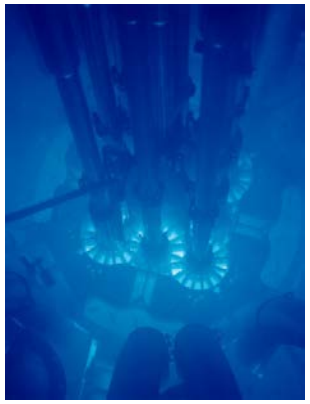
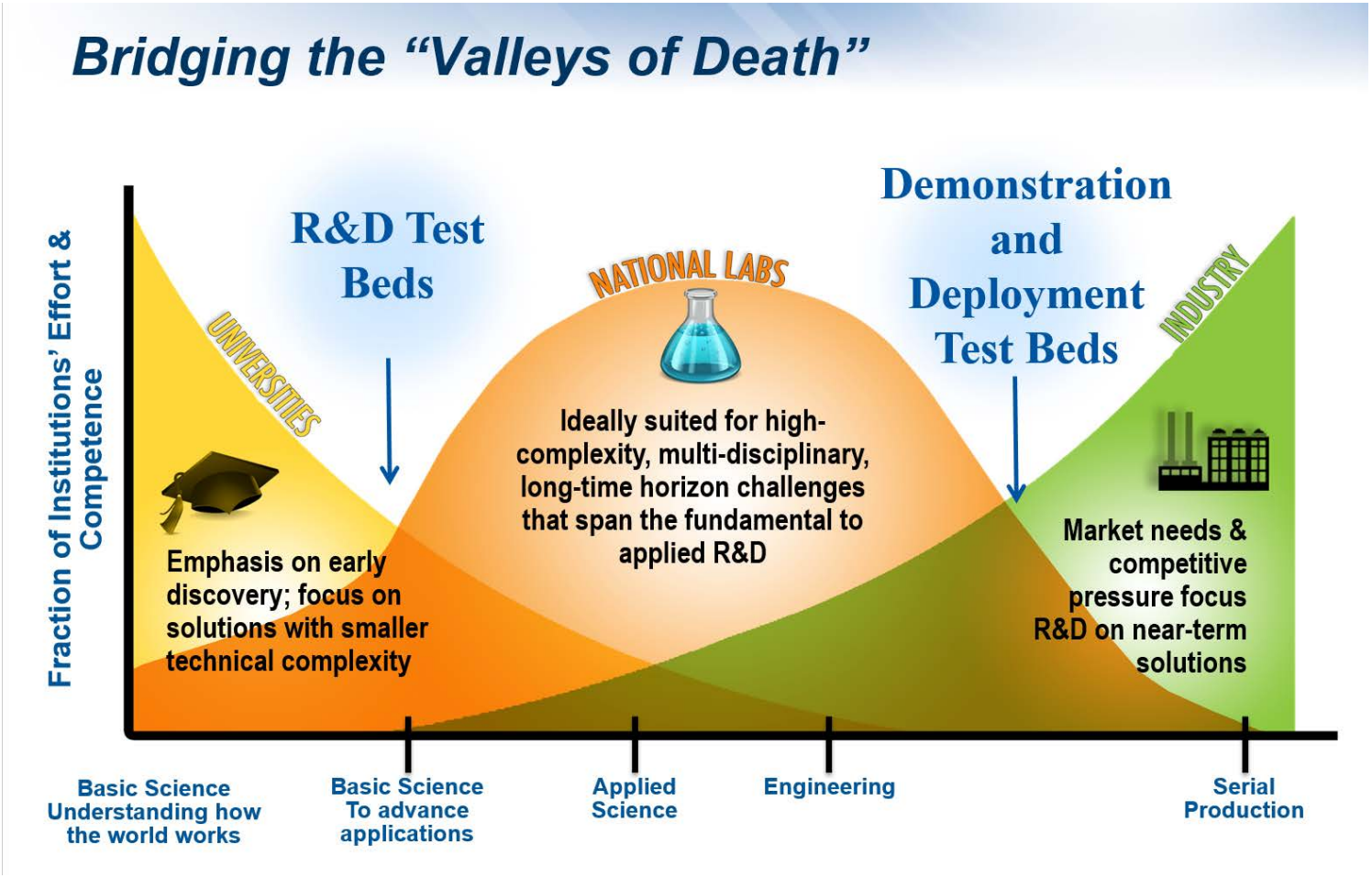
National Lab Capabilities

- Enable Deployment– (NRIC)
- Data Acquisition – (GAIN)
  - Materials testing
  - Critical experiments
  - Heat transfer analysis
  - Transient capabilities
- Fuel Fabrication and Development Capabilities (HALEU)
- Non-Light Water Reactor Licensing Options Development
  - Licensing Modernization Project (LMP)
  - Technology Inclusive Content of Application (TICAP)
- Cyber Security / Super Computing
- Next Generation Design Development

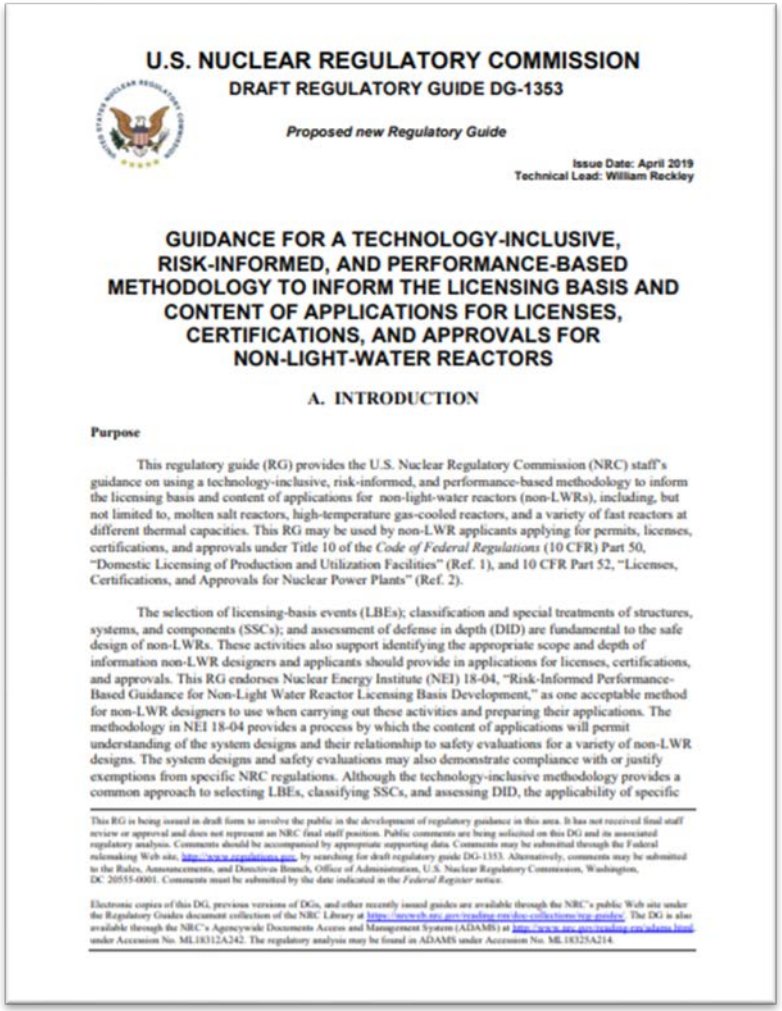


Enabling New Reactor Development



NRC Licensing Challenges and Initiatives

- Existing Regulatory Structure focuses on large light water reactors.
  - Methodologies and approaches are prescriptive for this type of reactor.
  - Supporting requirements such as emergency planning, operator staffing, quality requirements, etc. are structured based upon these assumptions.
- New proposals for reactors involve a variety of sizes and technologies not currently licensed by the NRC.
- Industry and NRC recognize this need and are working in collaboration to address the issues.
- Licensing Modernization Project worked on Risk-Informed DBA and Safety SSC Selection.
- Technology Inclusive Content of Application Project is currently working on proposed technical application content.



U.S. NUCLEAR REGULATORY COMMISSION

DRAFT REGULATORY GUIDE DG-1353

Proposed new Regulatory Guide

Issue Date: April 2019
Technical Lead: William Reckley

GUIDANCE FOR A TECHNOLOGY-INCLUSIVE, RISK-INFORMED, AND PERFORMANCE-BASED METHODOLOGY TO INFORM THE LICENSING BASIS AND CONTENT OF APPLICATIONS FOR LICENSES, CERTIFICATIONS, AND APPROVALS FOR NON-LIGHT-WATER REACTORS

A. INTRODUCTION

Purpose

This regulatory guide (RG) provides the U.S. Nuclear Regulatory Commission (NRC) staff's guidance on using a technology-inclusive, risk-informed, and performance-based methodology to inform the licensing basis and content of applications for non-light-water reactors (non-LWRs), including, but not limited to, molten salt reactors, high-temperature gas-cooled reactors, and a variety of fast reactors at different thermal capacities. This RG may be used by non-LWR applicants applying for permits, licenses, certifications, and approvals under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 1), and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 2).

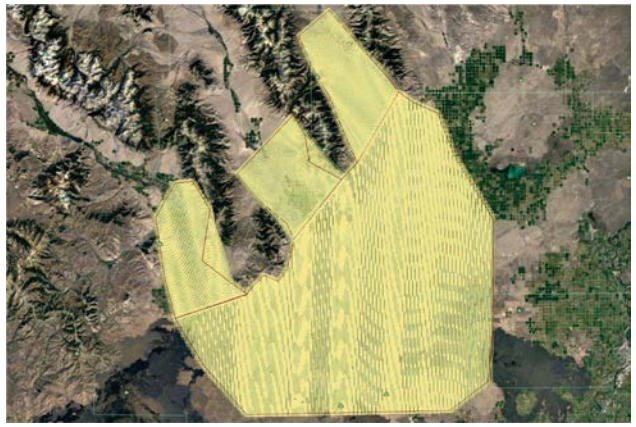
The selection of licensing-basis events (LBEs); classification and special treatments of structures, systems, and components (SSCs); and assessment of defense in depth (DID) are fundamental to the safe design of non-LWRs. These activities also support identifying the appropriate scope and depth of information non-LWR designers and applicants should provide in applications for licenses, certifications, and approvals. This RG endorses Nuclear Energy Institute (NEI) 18-04, "Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development," as one acceptable method for non-LWR designers to use when carrying out these activities and preparing their applications. The methodology in NEI 18-04 provides a process by which the content of applications will permit understanding of the system designs and their relationship to safety evaluations for a variety of non-LWR designs. The system designs and safety evaluations may also demonstrate compliance with or justify exemptions from specific NRC regulations. Although the technology-inclusive methodology provides a common approach to selecting LBEs, classifying SSCs, and assessing DID, the applicability of specific

This RG is being issued in draft form to involve the public in the development of regulatory guidance in this area. It has not received final staff review or approval and does not represent an NRC final staff position. Public comments are being solicited on this DG and its associated regulatory analysis. Comments should be accompanied by appropriate supporting data. Comments may be submitted through the Federal rulemaking Web site, http://www.regulations.gov, by searching for draft regulatory guide DG-1353. Alternatively, comments may be submitted to the Rules, Announcements, and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments must be submitted by the date indicated in the *Federal Register* notice.

Electronic copies of this DG, previous versions of DGs, and other recently issued guides are available through the NRC's public Web site under the Regulatory Guides document collection of the NRC Library at https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/. The DG is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under Accession No. ML18312A242. The regulatory analysis may be found in ADAMS under Accession No. ML18325A214.

INL is taking steps to prepare for potential new reactor activities.

- "Well Characterized Site"
  - Working with NuScale on SSHAC Level 3
  - LiDAR Data Acquisition for entire site
    - Support NPH evaluation
    - NEPA
- DOE Reactor Authorization
  - Defining regulatory basis
  - Methodology
- Bounding evaluations for potential siting facilities
- Staffing
  - Nuclear Safety
  - Criticality Safety

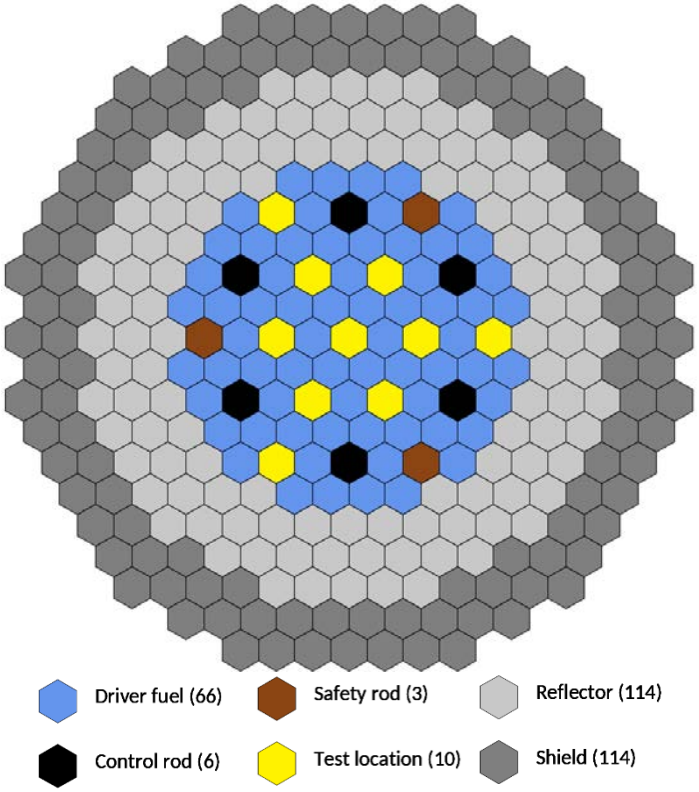


New Reactors at INL – NRC Licensed

- NUSCALE - Small Modular Reactor
  - 60 MWe modules upto 12 modules
  - DOE Site Use Permit
  - Design Certification under NRC Review.
- OKLO Aurora – Micro Reactor
  - 1.5MWe units
  - DOE Site Use Permit
  - HALEU Fuel Fabrication Supply
  - Pre-Application Discussions with NRC
- Preparing for potential additional activities.

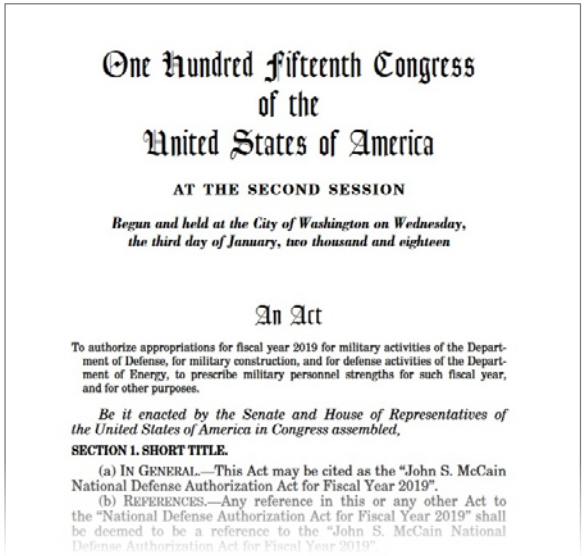
New Reactors at INL – DOE Authorized

- ***Versatile Test Reactor (VTR) - Sodium Cooled pool type fast reactor for testing of fuels and materials in a fast neutron environment.***
  - DOE Owned and DOE Authorized
  - Locations at INL and ORNL currently being evaluated
  - Final Decision on siting will be determined after NEPA is complete.
- ***DOD Project PELE***
  - Focused on Design and Demonstration of a forward deployable microreactor for DOD applications.
- ***Additional Microreactor Capabilities***
  - Adding staff to support development of micro reactor safety bases
  - Development of bounding NEPA for additional reactor sites
  - Establishment of a DOE-NRC MOU on Advanced Reactors
  - Generalized Reactor Authorization Approaches
  - Evaluating possibilities for microreactor test envelopes and facilities.



Project PELE

- 2019 NDAA language: DoD prototype and demonstrate a small nuclear reactor.
- Whole of government/industry approach:
  - Memorandum of Understanding between DoD, DOE, and NRC
  - DOE providing authorization, technical demonstrations, transportation regulatory pathway, and siting assistance.
  - Army Corps of Engineers is technical lead on NEPA EIS
  - NNSA will provide fuel, assist on transportation regulations and radiation shielding.
- Initial concept (notional, no site chosen) – deploy at INL, then move on INL site – re-deploy



One Hundred Fifteenth Congress
of the
United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Wednesday, the third day of January, two thousand and eighteen

An Act

To authorize appropriations for fiscal year 2019 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

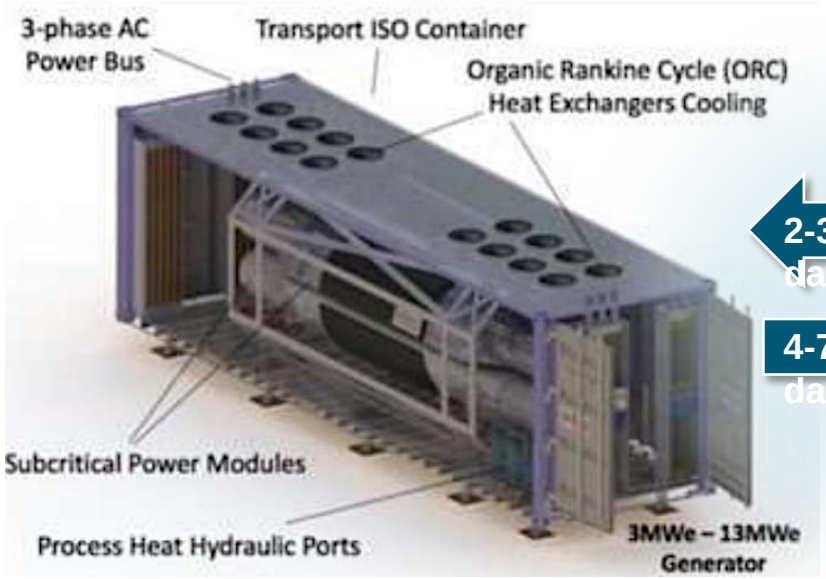
SECTION 1. SHORT TITLE.

(a) IN GENERAL.—This Act may be cited as the "John S. McCain National Defense Authorization Act for Fiscal Year 2019".

(b) REFERENCES.—Any reference in this or any other Act to the "National Defense Authorization Act for Fiscal Year 2019" shall be deemed to be a reference to the "John S. McCain National Defense Authorization Act for Fiscal Year 2019".

Images are for representational purposes only. No federal endorsement intended.

Nuclear Power is an Expeditionary Game Changer



2-3 days

4-7 days

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VTR Timeline

CD-0
Approve mission need, for DOE approval

CD-1/3A
Approve alternative selection and cost range, and long-lead procurement approval, for DOE approval

CD-2/3
Approve performance baseline and approve start of construction, for DOE approval

CD-4
Approve start of operations, for DOE approval

Milestone	Fiscal Year (CD-0 Package Submittal)
CD-0	FY 2019, Q2 (Approved)
CD-1	FY 2021, Q1 (Submittal: FY 2020, Q2)
CD-2/3	FY 2022, Q4
CD-4	FY 2026, Q4 (FY 2028, Q4 with contingency)

CD-0 Approved Range	
Cost:	$3B - $6B
Schedule:	Schedule 2026 to 2030
CD-1 Approval:	First Quarter of 2021

VTR Reactor Plot Plan

Requirements Tailoring --VTR

- NUREG-1537- Basic Topic Outline
  - Chapters 15-18 not relevant (Financial Qualifications, Other License Considerations, Decommissioning, HEU to LEU Conversion)
  - Add additional startup testing chapter (Chapter 15)
- Accident Selection
  - Derived from Probabilistic Risk Analysis
  - Follows DOE/NRC/Industry Licensing Modernization Efforts
  - Consistent with DOE-STD-3009 approach but applies a more quantitative basis
- Safety System Categorization
  - Based upon meeting Evaluation Guidelines
  - Secondary function of meeting identified safety functions
  - Use of DOE categorizations
- Expectation for use of RG 1.232 Advanced Reactor Design Criteria for SFRs.
- NPH Design Requirements
  - Designated based upon DOE O 420.1C and DOE-STD-1020-2016 processes.
- Achieving Regulatory Stability through advancing safety basis documents as early as practical in design process once decisions are made.