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# Nuclear Energy R&D Facility Requirements

Nuclear Energy Advisory Committee

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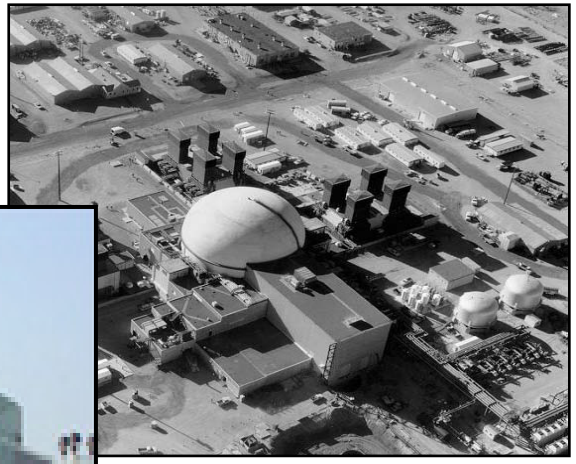
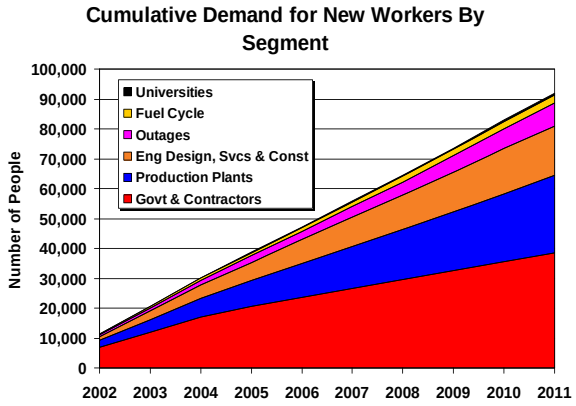
# The Facilitization of the US Nuclear R&D Infrastructure

- Three step study process:
  - First, The ASNE has requested The Battelle Memorial Institute to develop an industry and University supported list of facilities housing specialized equipment necessary to conduct a comprehensive nuclear R&D program.
  - Second, The INL using input from all DOE and other sources will determine what facilities currently exist, their relative condition and likely availability to support the next twenty years of nuclear R&D.
  - Third, Recommendation on priorities and which facilities exist that should be maintained/preserved or otherwise supported by NE regardless of location or ownership.

# Our World continues to Change

- Facilities that used to exist and are gone
- Condition of US R&D facilities capabilities
- Foreign investment in nuclear R&D facilities
- Human infrastructure
- New ideas - advanced computation and simulation applied to R&D, design and licensing?





# Source Materials

- Section 955 of the Energy Policy Act of 2005 – INL Infrastructure Plan
- BEA Proposal Commitment - 2005
- DOE Complex-Wide Capability Report – 2006
- IAEA Human resource issues related to an expanding nuclear power programme - 2006
- GNEP Strategic Plan - 2007
- DOE Complex-Wide Nuclear Infrastructure Update - 2007
- INL 10-Year Site Plan – 2007
- Strategic Plan for LWR R&D – 2007
- NEA/CSNI Nuclear Safety Research in OECD Countries – 2007
- NEI Workforce Report – 2007
- AFCF Existing Facilities Data Report - 2008
- Required Assets for a NE Applied R&D Program - 2008 (in preparation)

# Open Questions

- Evolution of U.S. Nuclear Policy
- Use of International Facilities
- NE stewardship of Facilities
- How to reduce the mortgage associated with underutilized and/or excess facilities
- Investments for major R&D facilities – and general infrastructure requirements
- University Nuclear Infrastructure

# Battelle Task

Mr. Spurgeon requested: Input for “a complete and definitive index of the capabilities needed to support research and development within domestic nuclear power industry over the next 20 years.”

To be used to establish long-range planning and budget projections.

Tasking also indicates:

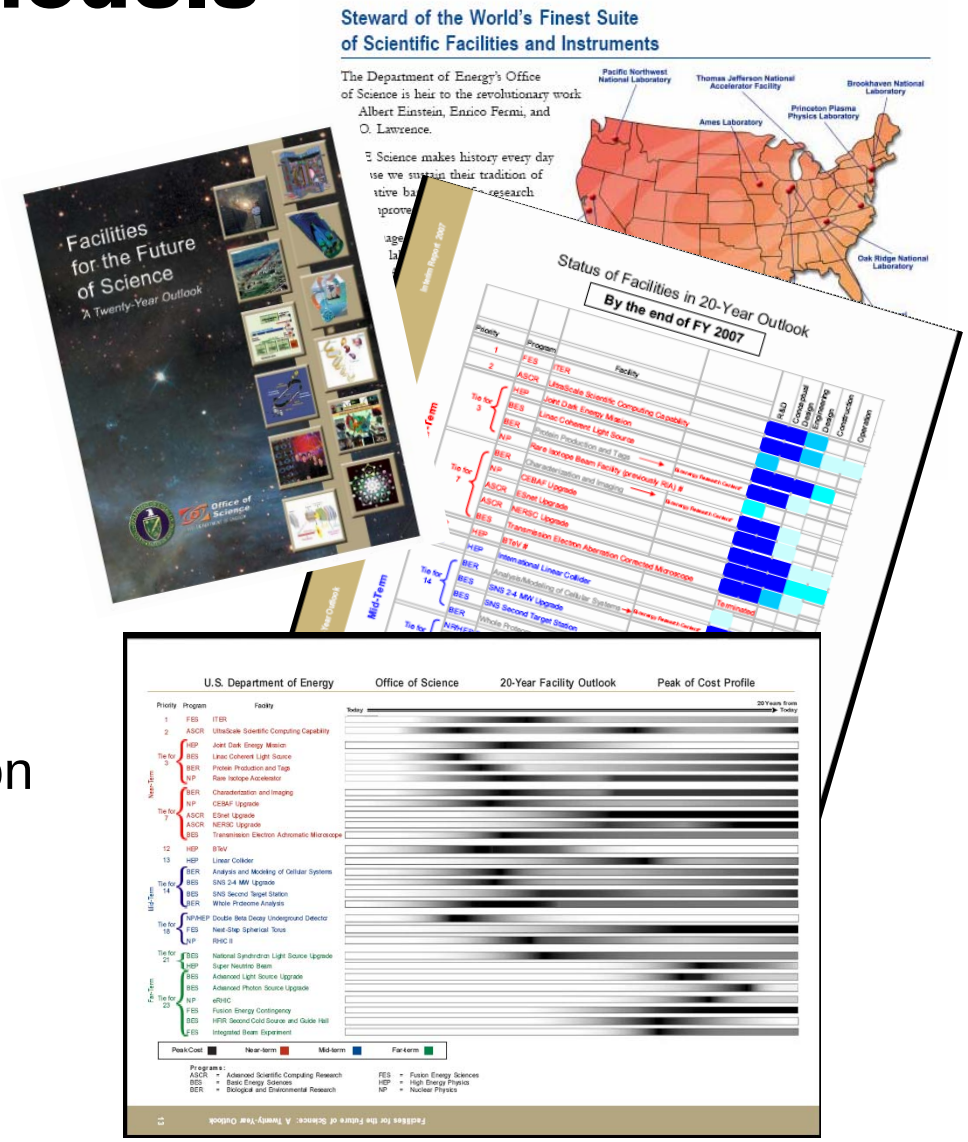
- Important that the product is supported by industry & academia
- Seek insights from universities, customers, suppliers and competitors
- Consider other models used to build support for R&D capabilities
- Consider Global capabilities

# Battelle Study Process

- Learn from what others have done
  - SC Scientific Capability & Infrastructure Planning; NE capability studies; AFCF
  - Others including International studies
- Establish working group
  - Battelle, Industry, NRC, Academia
- Outreach to Industry & Academia Leaders to seek input and support
- June 30 Delivery

# Office of Science Models

- *Facilities for the Future of Science: A Twenty-Year Outlook*
  - Initially published in 2003; progress report in 2007
  - Focused on new facilities and upgrades to existing facilities
  - Served as “a roadmap, providing an overarching framework and long-term vision to guide year-to-year DOE policy and funding decisions”
  - Widely Recognized as Successful



# Office of Science Models (con't)

- Science Laboratory Infrastructure (SLI) Modernization Initiative
  - General Purpose Infrastructure Improvements – 10-year initiative
  - Intended to address backlog of needs due to aging infrastructure by increasing SLI funding from $84M in FY 2009 to $200M in FY 2013
  - Direct funded GPP goes away as labs move to Institutional GPP
  - Consensus Process led by SC, Ops Offices & Labs
  - Proposed in the FY 2009 President's Budget

# Industry & Academia Outreach

## Employing a Multi-step Process to Provide Opportunity for Input

# Working Group Membership

**John Goossen**
Westinghouse

**Charles Tuck**
Entergy

**Steve Melancon**
Entergy

**Richard Hill**
Southern Company

**Bob Varrin**
Dominion Engineering

**John Jolicoeur**
NRC

**Jack Lance**
EPRI/INL

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Univ. of Florida

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**John Marra**
SRNL

**John Ireland**
LANL

**Bob Wham**
ORNL

**Harold McFarlane**
INL

**Roger Anderson**
Battelle

**Paul Kearns**
Battelle

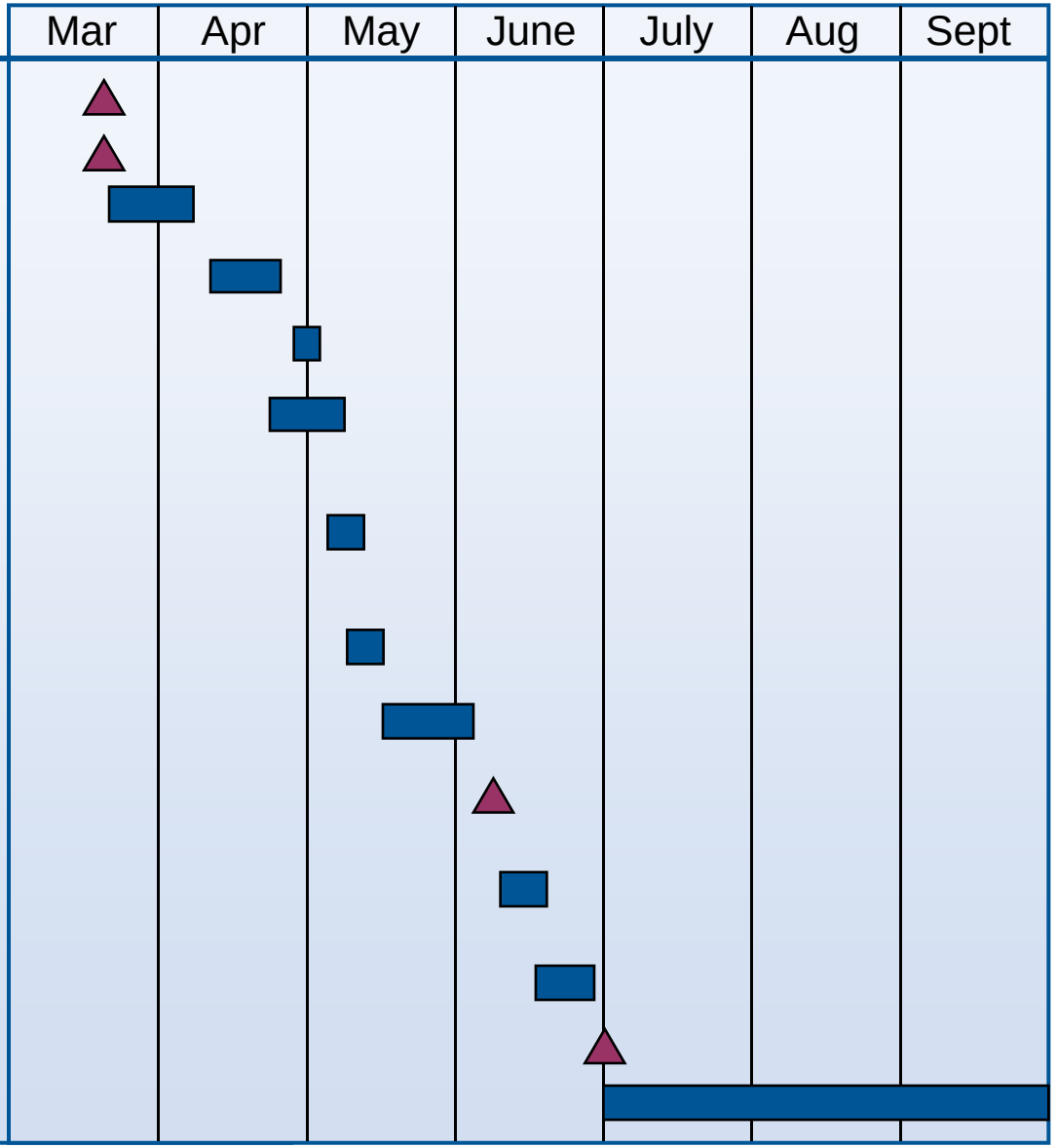
# Nuclear Energy R&D Capabilities
# 20-Year Outlook Template

Scope Area: LWR (Example) Participant Name: _____

| Current State | Capability Requirements "Filling the Gap" | | | Future State (2028-2048) |
|---|---|---|---|---|
| | Near * (2008-2014) | Mid * (2015-2021) | Long * (2022-2028) | |
| • NRC licenses of existing LWRs 20-40 years | • Data gathering of relevant Lab and field data on corrosion and other materials degradation<br>- Materials Science & Eng. disciplines<br>- 2008-2014 | • Mechanism-based component life predictors for critical structures<br>- Materials Science & Eng. , Computational Science disciplines<br>- 2015-2021 | • Development of components with longer life or life extension methods<br>- Materials Science & Eng., Computational Science disciplines<br>- 2022-2028 | • Extend NRC licenses of existing LWRs to 80 years |

* Include the following: **What** [types of disciplines/processes/facilities] and **When** [start and duration].

# R&D Capabilities Report Schedule




1. Scoping Meeting with NE – 3/19
2. Office of Science Model Meeting – 3/19
3. Establish Working Group – 3/20-4/4
4. Develop Industry Input for Workshop – 4/10-22
5. Working Group Workshop – 4/30-5/1
6. Conduct interviews with Industry & Academic – 4/18-5/9
7. Conduct Focus Group discussions with Industry & Academic experts – 5/5-9
8. Consolidate Interview & Focus Group comments – 5/10-13
9. Develop Draft Report – 5/14-6/3
10. Document Review Focus Group meeting – 6/10
11. Incorporate Focus Group comments – 6/12-16
12. Finalize (edit and format) Report – 6/17-27
13. Deliver Draft Report – 6/30
14. 90-day comment period – 6/30-9/30

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# Required Assets for a Nuclear Energy Applied R&D Program

Idaho National Laboratory task

# INL Approach

- Focus on the final goal—DOE's facility plan
- Anticipate R&D requirements
- Consider DOE, university, industry and foreign assets
- Use previous and concurrent reports as well as expert knowledge
- Screen facility data base to focus on the ones that matter
- Develop consensus evaluation of facility utility for each major R&D element

# INL report structure

- Anticipated R&D needs
  - Developing Gen-IV reactors
  - Closing the fuel cycle
  - Supporting current fleet of LWRs
  - Producing nuclear hydrogen and industrial heat
  - Modeling and simulating nuclear systems
  - Supporting nuclear-enabled space & defense missions
- Required assets for a 20-year applied R&D program
  - People, plants and processes
  - Cross-walk of programs and facilities

# Participation will expand as report is drafted

- Initial input

  John Sackett  Bruce Matthews  George Imel

  Andy Klein  Harold McFarlane

- First facility evaluation workshop 4/17

  Bob Wham  John Ireland  Cal Ozaki

  Mike Goff  Terry Todd  Jack Lance

- Post-workshop input
- Draft partial report
- Web site for stakeholder input
- Updated draft report

# Screening and binning rules

*Class 1 and Class 2 facilities will be included in the evaluation.*
*Class 3 facilities will not be included in the evaluation.*

**Class 1**: **Major high-value nuclear facility** with attendant support functions. Examples are: research, prototype and demonstration nuclear reactors (e.g. ATR, HFIR, JOYO); large hot cell facilities (e.g. HFEF) or complex of smaller hot cells (e.g. Actinide Science and Separation Laboratories); Large multipurpose, multiple capability radiochemistry laboratories; large glovebox facilities (e.g. TA-55 Plutonium Facility)

**Class 2**: **Major non-rad facility** with nuclear application (e.g. a components test facility); a multipurpose facility with some nuclear application use (e.g. a high temperature materials development laboratory); or radiological support facility

**Class 3**: Facilities of a type that are either **ubiquitous** or would play a modest supporting role in an R&D program, or which have been removed from consideration by the responsible landlord (e.g. computer clusters, generic non-rad materials laboratories, facilities being decommissioned)

# Stoplight evaluation for 6 criteria

| | |
|---|---|
| **Condition** | **Physical condition, age, and maintenance status of the facility and its supporting infrastructure** |
|  | Good physical condition with 20 years or more of useful life; capable of performing mission |
|  | Capable of performing function with modest investment of ~$25M or less |
|  | Capable of performing most aspects of function after substantial investment of $25M-$250M over several years |
|  | Requires major investment exceeding $250M |
| **Capability** | **Capacity, flexibility, location and accessibility** |
|  | Proven capability for intended function |
|  | Proven capability limited by one or more attributes |
|  | Significant limitations for proposed function without major modification |
|  | Lacks most needed capabilities for mission |

# Evaluation criteria, cont'd.

| **Availability** | **Projected availability in needed time frame** |
|---|---|
|  | Currently available or performing intended function |
|  | Has some competing missions but some available capacity; may require operational readiness assessment |
|  | Not currently available, fully subscribed by alternate mission; limited lifetime; or requires restart with an operational readiness review |
|  | Not available; e.g., currently scheduled for D&D |
| **Regulatory** | **Safety basis, EIS, safety management program, environmental management program, community support** |
|  | Fully compliant |
|  | Can be brought into compliance within 2 years with an investment of $5M or less |
|  | Significant compliance issues that requires more than 2 years and sustained investment of several million dollars per year |
|  | Serious safety and environmental liability |

# Evaluation criteria, cont'd.

| | |
|---|---|
| **Security** | DOE security requirements for type of facility and materials handled: PIDAS, guard force, nuclear materials management system, cyber security, etc. |
|  | Compliant with current S&S requirements and has implementation plan for emerging requirements |
|  | Compliant with current requirements; significant effort to meet emerging design basis threat |
|  | Unable to meet security requirements for mission without substantial capital and annual investment |
|  | Unable to meet security requirements because of unfixable conditions such as proximity to public areas |
| **Staffing** | Requisite skills including R&D, operations, maintenance and support personnel on site or readily available |
|  | Fully staffed with no projected cuts in critical skills |
|  | All required skills available but augmentation needed to perform mission as well as staffing plan to deal with critical retirement issues |
|  | Some but not all critical skills available for mission |
|  | Requires essentially complete new workforce |

# Partial example for fast reactor R&D

| Facility | Class | Condition | Capability | Availability | Regulation | Security | Staffing |
|---|---|---|---|---|---|---|---|
| Fuel Manufacturing Facility, INL | 1 | | | | | | |
| Transient Test Reactor, INL | 1 | | | | | | |
| Sodium Process Facility, INL | 3 | | | | | | |
| TA-55, PF-4, LANL | 1 | | | | | | |
| Materials Test Station, (LANCE), LANL | 1 | Planned, new | | | | | |
| REDC-7920, ORNL | 2 | | | | | | |
| Zero Power Physics Reactor, INL | 1 | | | | | | |
| High Flux Isotope Reactor, ORNL | 1 | | | | | | |

Actual result from 4/17 workshop with input by INL, ORNL, LANL, and consultants

Security ratings can change rapidly with the next few months depending on new DOE order implementation

# Next steps

- Assemble brief facility descriptions
- Evaluate facilities against missions
- Complete a 95% draft of report
- Open web site for stakeholder input
- Change evaluations for documented evidence

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Comments & Questions