The Global Nuclear Energy Partnership: Program Integration at the National Laboratories

Phillip J. Finck
Associate Laboratory Director
Idaho National Laboratory

NERAC
Outline

- GNEP Architecture
- Program Integration Challenges
- Review of Multi-lab Activities
  - Technology Demonstration Program Preliminary Plan
  - Insights from the Multi-Lab Process
- Critical Technology Issues
- Review Processes
- Summary
The Deployment of GNEP Requires the Successful Development and Integration of Several Technologies

- Existing LWR Fleet
- Expanded LWR Fleet
- Process Storage
- Advanced Separation
- FR Fuel
- Geologic Disposal
- Advanced Recycling Reactor
- Addl. Recycling Reactors
- Advanced Fuel Cycle Facility
- Technology Development and R&D

Support for Industry-led effort and R&D for GNEP beyond 2020-2025

DOE Lab led, NRC, Universities, Industry, International Partners

(63,000 MTHM)
Integration of Capabilities and Demonstrated Competence are Critical Element for GNEP Success

- A successful GNEP program requires:
  - An integrated program with a clear vision and measurable goals
  - Participation of industry, laboratories, and universities

- INL, as the NE lab, was asked to integrate the early GNEP related activities:
  - Technology Development Requirements based on a systematic Systems Analysis

- Demonstrated competence:
  - Involve the foremost national and international expertise
  - A requirements driven process to systematically organize and execute the GNEP
Integration has Several Challenges

- **U.S. nuclear resources are dispersed and aging**
  - All laboratories need to participate
  - Experienced manpower is becoming scarce
  - Many aging facilities, with capabilities that have declined

- **Diversity of technical alternatives**
  - Strong need for systems analysis
  - Critical role of peer review and quality assurance

- **Need to transform the nuclear R&D approach**
  - Define a path from the current empirical approach to science and simulation-supported research methods

- **Need to enable collaboration with industry**
  - Support industrial needs in the short term, drive the technologies for the long term

- **Need to support the regulatory approach**
  - Framework needs to be redefined for new facilities
  - Regulatory expertise needs to be rebuilt
GNEP Technology Demonstration Program
Preliminary Plan

Key assumptions
- The development model described in the FY 2007 budget request (engineering scale demonstration of reactor and advanced recycling technologies, advanced fuel cycle facility)
  - Assumed a Secretarial decision in Summer 2008
  - Described what needs to be done to demonstrate the GNEP technologies (not who and not where)

10 national laboratories participated in the development of the plan

Red team review by seven senior outside experts representing industry, labs, universities, and the Nuclear Regulatory Commission
- Provided external validation of content
- Membership: Henry Stone, John Sackett, Roger Mattson, Neil Todreas, Salomon Levy, Daniel Wilkins, Doug Chapin
The Multi-Lab Effort Provided Insights for Improved Program Execution

- Need for basis documents to document the technical underpinnings of GNEP
  - Deployment System Architecture
  - Systems Requirements and Criteria
  - Demonstration System Facility Timing
  - Proliferation Risk Assessment (NA-24)
  - Support Facility Assessment
  - Technical Basis for Reference Technologies
    - UREX+1a
    - Sodium Fast Reactor
    - Oxide or Metal fuel for transmutation fuel
  - Selection of Fast Reactor Driver Fuel Type

- Need for an integrated waste strategy
  - Recognizing the role that waste forms play in the success of GNEP

- Need for involving non-traditional (AFCI) elements crucial for success
  - Developed the role of basic science and simulation in formulating the GNEP model
GNEP: Critical Technology Issues

Integrated Waste Strategy

Process Scale-Up or Adaptation

LWR Spent Nuclear Fuel

Process Storage

Uranium and/or Plutonium

Driver Fuel

Spent Nuclear Fuel Separations

Separated Transuranics and Uranium

Transmutation Fuel Fabrication

Transmutation Fuel Separation

Transuranic Destruction

Sodium Fast Reactor

Excess Uranium

Robust Waste Forms

Fabrication Process Losses

Process Losses

Economics

Transuranic Fuel Performance
Program Information Undergoes a Multi-Level Review and Validation Process

- The program inputs, processes, tools, and results all require some level of benchmarking or V&V
- Major reports are first reviewed by the originating laboratory (or laboratories), then independently by peers at other laboratories
- The laboratory peer review is often augmented by university participants
- Significant results are further reviewed by DOE technical staff and managers
- This internal review process is being extended to include independent external reviews
- Independent technical advice is provided by the Nuclear Energy Research Advisory Committee (NERAC) via the Advanced Nuclear Transformation Technology subcommittee chaired by Dr. Burton Richter
- A National Academy of Sciences review of the DOE’s science and technology R&D program is currently in progress
The Role of Integration will Continue to Evolve

- The established requirements-driven process will drive execution
- Peer review is being emphasized
- The technology development plan will continue evolving
  - To account for programmatic and strategic changes
  - To incorporate alternatives
  - To account for industry involvement
- The transformation of the R&D process will require multi-level coordination