NEAC Fuel Cycle Technologies Subcommittee Report

Presentation to the
Nuclear Energy Advisory Committee
Washington, D.C.
December 19, 2013

Al Sattelberger

Fuel Cycle Technologies Subcommittee Members

- Carol J. Burns
- Margaret Chu
- Ronald P. Omberg
- Joy L. Rempe
- Raymond Juzaitis
- Sekazi K. Matingwa
- Dominique Warin
- Alfred P. Sattelberger (Chair)

Fuel Cycle Technologies Subcommittee

- Charter:
  - To review, comment, and make recommendations to the Assistant Secretary for Nuclear Energy on the R&D, and current and future directions of the Office of Fuel Cycle Technologies.

Agenda

Nuclear Energy Advisory Committee

Fuel Cycle Sub-Committee

November 22, 2013

Location: ANL Offices, L'Enfant Plaza

9:00	Executive Session	Members & DOE Mgmt
9:15	High Burn-up Used Fuel Program Overview	William Boyle
10:15	Break	
10:30	Joint Fuel Cycle Study – ROK: Used Fuel Workshop	William Boyle
11:15	High Level Waste and Spent Fuel Inventory Report	Peter Swift
12:15	Lunch	
1:00	Accident Tolerant Fuel Overview Industry, Laboratory and University progress to date	Andy Griffith/Frank Goldner/Jon Carmack
2:30	NEAMS Update	Steve Hayes
3:15	NRC Proliferation Risk Study Overview	Dan Vega
3:45	Spent Fuel Storage and Transportation R&D	Jeff Williams

Areas Reviewed

- Used Fuel Disposition:
  - High Burn-up Fuel Program
- Fuels Program:
  - Accident Tolerant Fuels R&D (ATF)
- Nuclear Energy Advanced Modeling & Simulation (NEAMS)
- Proliferation Risk Study by the NRC
- Spent Fuel Storage and Transportation R&D

Used Fuel Disposition

General Comment:

- In order to complete plans for developing a dry storage demonstration project for extended storage of used nuclear fuel, R&D must be conducted to benchmark predictive models of system performance, including observation of used fuel in storage.

Recommendations:

- The scope of the high burn-up fuels project is complex and consists of many participants. This raises the concern that all *possible* instrumentation options will be explored/employed, rather than *necessary* instrumentation to meet NRC requirements.
- The Subcommittee believes it is appropriate that DOE work closely with industry and the DOE laboratories to ensure that the scope of the project meets the required programmatic objectives.

Fuels Program – Accident Tolerant Fuels

- General Comment:
  - The ATF program is well structured with an impressive array of industry organizations, laboratories and universities
  - Any reduction in resources for this very ambitious program is likely to place the 2016 and the 2022 milestones at risk.
- Recommendations:
  - ATF should develop contingency plans in the event that resources and milestones are inconsistent.
  - The current program focus on fuel and cladding does not address other lower cost, reactor enhancements. The Subcommittee strongly recommends that the program become cognizant of the implications of severe accidents on other reactor components, such as control material (control rods), by performing reactor system response analyses, rather than just focusing on the fuel and cladding.

Nuclear Energy Advanced Modeling & Simulation (NEAMS)

General Comment:

- The models being developed by the Nuclear Energy Advanced Modeling and Simulation (NEAMS) program, which is funded by another DOE-NE program office but is coordinated with the AFC program, consider atomistic, meso-scale, and engineering scales with the goal of being capable for use outside the limited range of available engineering scale data. Members of the Subcommittee expressed concerns about validation of these tools that are similar to those expressed previously by the NEAMS NEAC Subcommittee:

  "An un-validated product is worthless or worse."

Recommendation:

- Without additional validation data, NEAMS developers should acknowledge the limitations that exist with new Fuel Product Line (FPL) tools, e.g., their applicability may be limited to interpolating between available engineering scale data.

Proliferation Risk Study by the National Research Council

General Comment:

- The subject report was overwhelmingly written from the perspective of policy utility of these quantitative risk assessments, in keeping with the wording of the study charter. Although alternative nuclear energy system technology research and development was mentioned and referenced, the study mostly focused on the value of potential enhanced R&D aimed at improving the assessment methodologies themselves.

Recommendation:

- The decision to embark on advanced proliferation-resistant nuclear energy systems cannot depend on “perfect” proliferation risk assessments. More fundamental high-level decisions derived from non-proliferation and nuclear material security imperatives must be made in order to promote global nuclear energy development, informed at each step of development by the most accurate proliferation resistance (and risk) assessments consistent with design definition and actual data.

Spent Fuel Storage, Transportation and Disposal

General Comments:

- In January of 2013, DOE released the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-level Radioactive Waste". This document provides the framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel and high-level waste in the US.
- The strategy includes a phased, adaptive, and consent-based approach for siting and implementing a management and disposal system. At its core, the strategy endorses a waste management system containing a pilot interim storage facility, a full-scale interim storage facility, and ultimately a geologic repository.

Spent Fuel Storage, Transportation and Disposal

Recommendations:

(1) The Subcommittee is of the opinion that the present scope of the pilot facility may be overly complex for a pilot demonstration. A thorough analysis is recommended to determine what an optimal pilot plant should consist of and how the pilot program can assist in the development of the large-scale storage facility.

(2) The high-level waste and spent fuel inventory and disposal options evaluation provides a good framework to understand the problem in hand in a macro sense. We recommend a conceptually similar study on the entire spent fuel inventory in light of storage and transportation requirements evaluations.

(3) The Subcommittee recommends that the inventory data be rendered flexible so that it can be sliced in different ways, depending upon the activity under consideration. A study such as this can provide guidance to the design of a pilot interim storage as well as the prioritization of R&D activities.

Thank you –

Questions