



**UNITED STATES  
NUCLEAR WASTE TECHNICAL REVIEW BOARD**

2300 Clarendon Boulevard, Suite 1300  
Arlington, VA 22201-3367

December 8, 2016

Dr. Monica Regalbuto  
Assistant Secretary for Environmental Management  
U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585

Mr. John Kotek  
Acting Assistant Secretary for Nuclear Energy  
U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585

Dear Dr. Regalbuto and Mr. Kotek:

The U.S. Nuclear Waste Technical Review Board (Board) held its 2016 Summer Meeting in Washington, D.C., on August 24, 2016, to review progress in U.S. Department of Energy (DOE) activities to develop an integrated program for transporting and disposing of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). DOE's early planning for the development of a separate repository for defense wastes was also discussed briefly. The meeting included presentations by representatives of the DOE Office of Nuclear Energy (DOE-NE), the DOE Office of Environmental Management (DOE-EM), two DOE national laboratories, the Naval Nuclear Propulsion Program, and the Nuclear Energy Institute. Following the discussions at the meeting, the Board considered the information presented in the context of the need to develop an integrated program for managing and disposing of SNF and HLW.

The Board extends its gratitude to your staff members who worked with Board staff to plan the meeting, to Mr. Kotek for making the opening presentation, and to Mr. Mark Whitney for representing Dr. Regalbuto. We also appreciate the investment of time and effort by DOE and national laboratory personnel who presented posters following the public meeting. The meeting agenda is attached to this letter, while the presentations, transcript, and an archived recording of the webcast are available on the Board's website at <http://www.nwtrb.gov/meetings/meetings.html>.

**Integration of a Nuclear Waste Management and Disposal Program**

The meeting agenda was crafted to guide discussion on the development and implementation of an *integrated system* for the management and disposal of SNF and HLW managed by three organizations: DOE-NE (SNF and HLW managed by DOE-NE plus SNF produced by the commercial nuclear power industry), DOE-EM (mainly wastes associated with the production of nuclear weapons), and the Naval Nuclear Propulsion Program (naval SNF). In an integrated

system, the component sub-systems are brought together into a functional framework in which the sub-systems work together safely and efficiently. The major sub-systems in the planned U.S. waste management system include waste treatment, packaging, and storage at the sites generating wastes; transfer to and disposal at one or more repository sites; and transportation of waste between sites. The system may also include one or more consolidated interim storage facilities and one or more SNF repackaging facilities. Safe and efficient operation of the integrated system can best be achieved if the system is managed using an “end-to-end” process—*i.e.*, a process that optimizes (improves cost efficiency, timeliness, etc.) the complete system from beginning to end.

A key aspect of developing and integrating a waste management system is analyzing the interfaces between the different sub-systems (system analysis) to determine whether the wastes from one sub-system can be feasibly (*e.g.*, meet size, weight, and heat load criteria), efficiently (*e.g.*, require minimal repackaging), and safely (*e.g.*, are not unacceptably degraded) managed by subsequent sub-systems. These attributes can be analyzed with the aid of computer simulation, which projects, as a function of time, the movement and characteristics of SNF and HLW, indicating characteristics such as location, age, quantity, size, composition, radiation dose, heat load, and packaging. By imposing constraints on the simulation (*e.g.*, maximum heat load for transportation), realistic assessments of the attributes can be completed for different scenarios, which the system integrator utilizes to identify corrective actions as needed and preferred scenarios.

The starting point for analyzing an integrated system is to define the required outcomes (*e.g.*, all naval and commercial SNF plus some HLW emplaced in a deep geologic repository; all other SNF and HLW emplaced in a separate repository for only DOE wastes) and the sub-systems that will be needed to achieve the outcomes. Defining the outcomes is influenced by other factors such as clearly identifying:

- Decision-makers and their roles and responsibilities
- The changing condition of the wastes over time (*e.g.*, corrosion, reduced heat load)
- National policies related to radioactive waste management
- Federal regulations that apply to sub-system design and operation
- State and tribal regulations and agreements that DOE must meet.

DOE is not new to developing integrated systems and system analyses. For example, DOE’s now disbanded Office of Civilian Radioactive Waste Management employed the Total System Model to analyze integration of the U.S. SNF and HLW management program in the early 2000s in support of the Yucca Mountain repository project. In addition, other organizations have considered integration of radioactive waste systems, and these efforts can provide valuable insights and lessons learned. In this regard, the International Atomic Energy Agency (IAEA) review of interface issues in SNF management<sup>1</sup> (TECDOC-1774) is particularly relevant. TECDOC-1774 results from an international effort to provide support to entities developing integrated systems for managing radioactive waste and offers valuable examples, observations, and recommendations from the international community that should be considered when

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<sup>1</sup> IAEA TECDOC SERIES, *Potential Interface Issues in Spent Fuel Management*, IAEA TECDOC No. 1774, 2015.

developing an integrated waste management system. TECDOC-1774 also reinforces the points noted above by recommending that key elements of a system, including regulatory and decision-making elements, need to be identified, and then the interfaces between the elements need to be characterized and carefully managed. Specific examples of preferred practices found in TECDOC-1774 that are relevant to integration in DOE's waste management program include the following:

- Ensure the compatibility of schedules, equipment, and acceptance criteria at each interface within the waste management system. (TECDOC-1774, §6.)
- Establish radioactive waste policies that are stable over long time frames. The IAEA report elaborates: “Availability of an endpoint (... disposal) affects the need for storage capacity and its duration. Duration of [the] storage period affects condition of fuel and fuel package – which may limit and/or add costs/constraints to future options. The length of the storage period and associated requirements depends upon the availability and actual implementation of national policy relative to closure of the nuclear fuel cycle.” (TECDOC-1774, §4.3.2.)
- Exercise early integration: “Effective integration begins early in the planning process. Opportunities are lost if interfaces are not identified and addressed in the early stages of each of the [back end of the fuel cycle] phases.” (TECDOC-1774, §6.)
- Establish integrated decision-making. For example, “The various phases and operational steps in the [back end of the fuel cycle] may be performed by a number of different entities that require close coordination. To assure safe and effective operations, interactions among [entities] are necessary to address issues related to contractual arrangements, schedule coordination, records management, transfer of ownership, assuring compatibility (tooling, physical geometry, acceptance criteria, *etc.*), specifying performance requirements, as well as numerous other transfers of information and materials needed.” (TECDOC-1774, §4.3.7.)

The Board recognizes that the IAEA report reflects experiences gained during the development of waste management systems in other countries, and that not all of the conclusions and recommendations in the report will apply in the United States. Moreover, given the uncertainties that exist with respect to the timing, location, and design of the repository or repositories that will be constructed for final disposal of SNF and HLW in the United States, it is clear that DOE will need to retain flexibility in developing an integrated system for managing and disposing of HLW and SNF in a manner that was not foreseen in the IAEA report. Nevertheless, the Board views the insights offered by TECDOC-1774 as relevant to the development of an integrated waste management system in the United States.

DOE is in the process of developing a radioactive waste management system and the analysis tools to evaluate it. Discussion of these efforts was a point of particular focus of the Board meeting. In the sections that follow, the Board provides observations about DOE's system analysis tools and DOE's progress in integrating a waste management system in the United States.

## **DOE's Program for the Management of SNF and HLW**

DOE's Waste Management System. In his opening presentation, Mr. Kotek described DOE's "Integrated Waste Management System." As planned and presented by DOE at the meeting, the Integrated Waste Management System includes the following sub-systems: a pilot consolidated interim storage facility for commercial SNF; a larger consolidated interim storage facility for commercial and DOE SNF and possibly HLW; a deep geologic repository that could accept all types of SNF and HLW; possibly separate disposal options for defense-related SNF, HLW, and some naval SNF; and a transportation system to move the waste materials between sub-systems. The waste management system may also include a repackaging facility.

Mr. Kotek stated his office is responsible for leading the overall integration effort for coordinating with other organizations involved in the management, possible interim storage, transportation, and disposal of SNF and HLW. He also noted that he is taking action to consolidate into one office within DOE-NE the sub-organizations that have responsibilities related to the development of DOE-NE's Integrated Waste Management System. *The Board believes this reorganization, which was completed in October 2016, could strengthen sub-system integration within DOE-NE, and help DOE-NE as it works to improve organizational interfaces with DOE-EM, the commercial nuclear industry, and the Naval Nuclear Propulsion Program.*

Integration in Packaging for SNF and HLW. From the presentations and discussions of SNF casks and canisters and HLW canisters at the meeting, it is clear that DOE-NE, DOE-EM, and the Naval Nuclear Propulsion Program use a wide variety of waste canister designs. It is also clear that the transportation, storage, and disposal of all of them will need to be managed as part of the Integrated Waste Management System.

Mr. Joe Carter, Savannah River National Laboratory, presented information on the casks and canisters currently in use, and new designs being introduced, for storage and transportation of commercial SNF. Mr. Carter highlighted the large variations in canister lengths, diameters, and SNF capacities. He also noted a wide range of other design constraints for the canisters, such as thermal (heat) limits, dose rate limits, and limited capacity for damaged SNF.

Mr. Carter also identified an additional complexity presented by some commercial SNF canisters having an NRC-approved thermal limit for storage that is significantly higher than the thermal limit approved for transportation. As a consequence, unless the transportation thermal limit can be increased, these canisters will have to remain in storage at the nuclear power plant sites until the SNF they contain has cooled sufficiently to meet the thermal limit for transportation. In some cases, this may impact the schedule for final decommissioning of the site. An alternative course of action for SNF canisters with high heat loads is to repackage the SNF into smaller canisters in order to meet the thermal limit for transportation earlier. This example highlights the recommendation in TECDOC-1774 for integration to begin early in developing a waste management system so that the implications of operations in one sub-system on the interface with another sub-system can be identified and taken into account.

Mr. Ken Picha, DOE-EM, presented information about the packaging of SNF and HLW managed by DOE-EM, which similarly includes a number of different canister types and sizes. Furthermore, DOE-EM also has a number of waste types that still need to be packaged or treated and packaged, including more than 250 types of SNF, 90 million gallons (340,000 cubic meters) of HLW stored in underground tanks, and HLW in glass and granular forms. This represents an opportunity for DOE-EM to consider the impact of how these wastes are packaged on operations at the interfaces between sub-systems of an integrated waste management system.

As an example, Mr. Picha indicated that the canister designed for packaging the sodium-bearing waste to be processed at the Idaho National Laboratory (INL) is 26 inches in diameter and 10 feet long. A canister with these dimensions should fit in the RH-72B cask used to transport certain transuranic wastes to the Waste Isolation Pilot Plant (WIPP), which would be appropriate if this waste can be disposed of as transuranic waste. However, the final waste classification of the sodium-bearing waste has not yet been determined, with the possibility that this waste will need to be disposed of as HLW. By comparison, the canisters being used for HLW are all 24 inches in diameter and, from the discussion at the meeting, it was not clear whether consideration had been given to the consequences of using 26-inch diameter canisters for the processed sodium-bearing waste, if it is subsequently determined that this waste needs to be disposed of as HLW. It was for this reason that the Board recorded in a letter to DOE in 2012<sup>2</sup> that “it would be prudent to formalize the classification of this material prior to processing to ensure that it meets the applicable final disposal requirements.” Similarly, IAEA TECDOC-1774 points to the need for early coordination to define the interfaces between sub-systems and ensure efficient operations.

In an attempt to limit the number of additional variations in canister designs that may be introduced in the future, DOE has initiated the development of “standardized” canister designs for different applications. Mr. Carter discussed the Standardized Transportation, Aging, and Disposal Canister concept that could be used for commercial SNF and Mr. Picha discussed the DOE SNF Standardized Canister intended for DOE-managed SNF. However, neither DOE-NE nor DOE-EM is actively pursuing implementation of these systems. *The introduction of standardized canister systems may offer significant benefits for the development of an integrated waste management system, although the Board notes that, even if they were introduced today, the interfaces between waste management sub-systems would have to be designed to accommodate many different designs of casks and canisters for SNF and HLW.*

Integration in System Analysis. As indicated above, a key element in integrating the waste management system is the use of system analysis tools. DOE-NE is developing system analysis tools although, based on discussions at the meeting, the Board understands that these efforts are focused almost exclusively on transportation of commercial SNF and are not currently being applied in an integrated fashion to include wastes from DOE-EM or the Naval Nuclear Propulsion Program.

Dr. Josh Jarrell of the Oak Ridge National Laboratory presented information on the system analysis tools DOE-NE is developing and using, such as the Next Generation System Analysis Model (NGSAM). Using output from NGSAM, he showed the impact of setting different

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<sup>2</sup> Ewing, R. C., to Huizenga, D., December 11, 2012.

priorities for the removal of commercial SNF from nuclear power plant sites. If DOE were to remove SNF in the order of oldest fuel first, which is the current plan, rather than in the order of shutdown sites first, the analysis predicted that the cumulative amount of time the SNF would remain at shutdown sites would be significantly extended, potentially delaying the final cleanup at the sites. Dr. Jarrell noted that the new tools, like NGSAM, have the capability to include detailed SNF and cask information, such as where specific SNF assemblies are loaded in dry-storage canisters for commercial SNF, which will be needed to support approving the canisters for transportation. Including this type of information is consistent with the need to analyze the interfaces between sub-systems in support of developing an integrated waste management system, as discussed above.

The Board commends DOE-NE for continuing to develop and improve its system analysis tools, such as NGSAM, which allow DOE to identify and address the challenges that will be faced in designing and implementing an integrated waste management system for commercial SNF. *The Board encourages DOE-NE to expand the use of its system analysis tools so that it has the capability to include SNF managed by DOE-EM, all HLW, and SNF from the Naval Nuclear Propulsion Program in its analyses.*

Integration in Planning the Transportation of SNF and HLW. The Board heard from DOE-NE, DOE-EM, and the Naval Nuclear Propulsion Program about plans and equipment for the transportation of radioactive waste. *Based on the presentations, it is not clear to the Board how DOE-NE responsibilities for planning the transportation of commercial SNF are integrated with DOE-EM responsibilities in the areas of packaging certification and transportation of wastes or with Naval Nuclear Propulsion Program transportation of naval SNF.*

Mr. Mike Wangler, DOE-EM, presented information on DOE-EM's packaging and transportation program for hazardous and non-hazardous materials. He pointed out that DOE-EM's Office of Packaging and Transportation administers the policies and procedures for the DOE packaging certification program that applies to all offices of DOE. However, the Board understands that the Naval Nuclear Propulsion Program conducts its own packaging certification and that the DOE-EM packaging certification program does not apply to packaging of SNF and HLW that is now assigned to DOE-NE. In response to a Board question about senior-level coordination of transportation responsibilities between DOE-EM and DOE-NE, Mr. Wangler stated that there was formerly a Senior Executive Transportation Forum, with coordination of transportation issues as its main charge, but it was no longer active.

Mr. Wangler described and demonstrated the Web-based Transportation Geographic Interface System (WebTRAGIS), highlighting its routing analysis capabilities and showing how it can link to a computer program that estimates radiation doses along transportation routes. Given the capabilities of WebTRAGIS, the Board asked why DOE-NE had not adopted it, rather than developing the Stakeholder Tool for Assessing Radioactive Transportation (START) as a separate routing analysis tool. A representative of DOE-NE stated that, following an assessment of the capabilities of WebTRAGIS, DOE-NE had decided to develop the START program using commercially-available software. *It is not clear to the Board why this approach was preferable to one of coordinating with DOE-EM to take advantage of a well-developed tool like WebTRAGIS.*

At the meeting, Mr. Barry Miles of the Naval Nuclear Propulsion Program presented the history and current status of its SNF management program. This program includes loading canistered or bare (uncanistered) naval SNF into casks at the shipyards, transporting the SNF to the Naval Reactor Facility at the Idaho National Laboratory (INL), and packaging or repackaging the SNF into welded canisters for dry-storage. Following storage, the canisters are also intended for direct disposal of the naval SNF in a repository. Mr. Miles noted that the Naval Nuclear Propulsion Program had recently introduced into service a new transportation cask and a new railcar, which have been designed to be used both for the transportation of canistered or bare naval SNF to INL and for transportation of canisters of SNF from INL to a deep geologic repository for disposal. He also showed, in his presentation, that the newest naval SNF canister is similar in size and weight to the largest SNF dry storage canisters being used today in the commercial nuclear power industry.

Mr. Miles highlighted the integrated operational nature of the Navy's transportation and storage program, specifically pointing out the operational interfaces between the Naval Nuclear Propulsion Program and INL, the railroads, emergency responders along the transportation routes, and the State of Idaho. *The Board notes that, while the management of naval SNF is integrated as a self-contained program, it is not integrated with transportation of commercial SNF or DOE-managed SNF or HLW.*

Integration between DOE and the Commercial Nuclear Industry. During the meeting, the Board heard presentations from representatives of DOE-NE and the commercial nuclear industry concerning the dry-storage of commercial SNF in large canisters at nuclear power plant sites and the implications of this for the development of an integrated waste management system. Indicative of the challenges that will need to be addressed in developing an integrated waste management system, the presentations by DOE representatives included the disclaimer: "Under the provisions of the Standard Contract<sup>3</sup>, DOE does not consider spent nuclear fuel in canisters to be an acceptable waste form, absent a mutually agreed to contract modification."

Mr. Kris Cummings, of the Nuclear Energy Institute, presented the nuclear industry's perspectives on the storage and future management of commercial SNF. He indicated that the nuclear industry is now using larger canisters for dry-storage of SNF in the interests of improving the efficiency of plant operations. Although these large canisters may not meet the requirements for disposal in all geologic repositories, Mr. Cummings referred to a study by the Electric Power Research Institute (*Feasibility of Direct Disposal of Dual-Purpose Canisters in a High-Level Waste Repository*, Report 1018051, August 2008) and noted that it concluded direct-disposal of large dry-storage canisters is feasible in certain repository designs. Mr. Cummings suggested that DOE should recognize that utility management of commercial SNF today is based on the use of large canisters, and the Integrated Waste Management System, including the repository, should be designed to accept direct disposal of commercial SNF in large dry-storage canisters.

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<sup>3</sup> Title 10, Code of Federal Regulations, Part 961, SUBPART B—*Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste.*

Mr. Cummings acknowledged, however, that in some cases, there are storage-only canisters that may need to be repackaged at the nuclear utility sites prior to transportation. Based on information available from the nuclear industry and DOE as of August 2016, approximately 780 (36 percent) of all loaded commercial SNF dry storage canisters are not currently approved by the NRC for transportation. Of these, approximately 380 canisters are designed as dual-purpose canisters (*i.e.*, designed for storage and transportation) and the nuclear industry expects the canisters will receive NRC approval for transportation when needed. Approximately 400 canisters are of types that were not designed with transportation in mind, and may need additional analyses by the licensees or exemptions from the NRC (or both) to receive approval for transportation. If the canisters cannot be approved for transportation, the SNF in the canisters would have to be repackaged into transportable SNF canisters or into bare-fuel transportation casks at the utility sites.

There are also other issues that may result in the need for repackaging, beyond the need to meet transportation safety regulations as noted by Mr. Cummings. Repackaging might also be necessary because SNF storage casks or canisters do not meet the criticality safety requirements or heat load limits for some designs of a geologic repository. Whatever the cause, repackaging SNF at utility sites, which typically do not have facilities for this activity, would have significant adverse impacts on cost, worker dose, and schedule.

### **Conclusions and Recommendations Regarding Integration**

Based on the presentations and other materials provided by DOE-NE, DOE-EM, and the Navy Nuclear Propulsion Program, DOE will face integration challenges on three levels: the national level, the DOE level, and the DOE-office level.

At the national level, DOE is challenged by issues that limit its ability to develop an integrated waste management program. Uncertainties such as the location and geology of a waste repository, the outcome of negotiations concerning the Standard Contract, and potential changes to federal waste policies create a challenge for the implementer (DOE) in finalizing waste package designs that are best suited for the geochemical and hydrogeologic conditions in the repository.

Within DOE, DOE-NE, DOE-EM, and the Naval Nuclear Propulsion Program each keep their own databases and records of waste inventories, conduct their own analyses of waste management systems, and arrange for transportation of their own wastes. Based on the presentations at the meeting, there appears to be little interaction between the separate programs. Indicative of this is the development of the START program in DOE-NE, even though a similar program, WebTRAGIS, was already fully-developed and in use in DOE-EM. The Board suggests that much could be done now to further coordination within DOE in the interests of integrating the various radioactive waste management sub-systems. More generally, the Board notes that having three separate offices involved in managing SNF and HLW complicates system integration by creating more interfaces, which require additional communications and concurrence to reach and implement technical decisions involving parallel decision-making authorities when the first common management authority is the Secretary of Energy. The Board concludes that system integration efforts would be facilitated if the number of interfaces among



offices can be reduced, perhaps by using the DOE-Navy collaboration in the Naval Nuclear Propulsion Program as a model, or at least continuously coordinated by an appropriate group.

Within DOE offices, there are additional challenges, most notably within DOE-EM. DOE-EM needs to complete the treatment and packaging of much of its SNF and HLW, and needs to do so in a manner that takes account of the need for the transportation and disposal of all of its wastes in the integrated waste management system. DOE-EM is also constrained by legal agreements with host states and contractual requirements that vary by site. For example, the Idaho Settlement Agreement between the State of Idaho, DOE, and the Navy requires that all DOE SNF and most naval SNF be removed from Idaho by 2035, although the timescale for developing a facility outside Idaho to accept SNF from INL is uncertain.

*In order to address the need to develop an integrated system for the management and disposal of SNF and HLW in the United States, the Board recommends that DOE, as a matter of priority:*

1. *Establish a comprehensive database of SNF and HLW: Develop a single database containing all of the information on SNF and HLW necessary to support developing an integrated management and disposal system, or the software necessary to successfully integrate the separate databases that contain the necessary information.*
2. *Develop an integrated (end-to-end) system analysis tool for waste management: Develop new, or modify existing, system analysis tools, as described earlier, to allow successful analysis of the full scope of the integrated waste management system.*
3. *Optimize the system using an end-to-end approach: Complete the necessary system analyses to identify actions that can be taken to (i) optimize the complete system against key program objectives (schedule, cost, operator doses, etc.) and (ii) avoid introducing additional complexities by decisions made independently at the facility, site, office or other level.*
4. *Assess and optimize new canister designs for end-to-end compatibility: Avoid the introduction of new canister designs for packaging SNF and HLW unless absolutely necessary. If new designs need to be used, ensure that, as far as possible, they are compatible with the handling, storage and transportation facilities, systems, and equipment already in service or necessary to support the management and disposal of canisters already in use or licensed for use.*

In making these recommendations, the Board understands that DOE cannot require the commercial nuclear utilities to provide information on their activities considered sensitive or proprietary. To the extent the information necessary for developing an integrated system is not available from the utilities, however, the Board considers that sufficient information is publicly available to allow DOE to adopt and act on these recommendations.

Thank you again for the participation of DOE-NE and DOE-EM staff and technical experts from the national laboratories at our August meeting. In particular, we thank Mr. Jack Wheeler of DOE-NE and Mr. Hitesh Nigam of DOE-EM for their efforts in coordinating DOE speakers and

presentations. We look forward to continuing our ongoing review of DOE's technical activities related to the management and disposal of SNF and HLW.

Sincerely,

A handwritten signature in black ink that reads "Rodney C. Ewing". The signature is written in a cursive style with a long, sweeping tail on the "E".

Rodney C. Ewing  
Chairman

Attachment

Attachment  
**AGENDA**  
**SUMMER BOARD MEETING**  
**WEDNESDAY, AUGUST 24, 2016**

THE WESTIN WASHINGTON, DC CITY CENTER HOTEL  
1400 M STREET, NW  
WASHINGTON, DC 20005  
202-429-1700  
[NATIONAL BALLROOM AB]

- 8:00 a.m. Call to Order and Introductory Statement**  
Rod Ewing, Board Chairman
- 8:15 a.m. Department of Energy (DOE) Opening Remarks – DOE’s Integrated Program for the Management and Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste<sup>4</sup>**  
John Kotek, DOE, Office of Nuclear Energy (DOE-NE)
- i. Describe the objectives and status of DOE’s Integrated Waste Management System directed by the DOE-NE Office of Fuel Cycle Research and Development.
  - ii. How does DOE-NE coordinate its commercial SNF activities with DOE Office of Environmental Management (DOE-EM) activities to store, process, and prepare DOE-managed spent nuclear fuel (SNF) and high-level radioactive waste (HLW) for disposal?
    - a. Do the DOE SNF Working Group and the DOE Tank Waste Corporate Board consider integration issues among DOE-NE, DOE-EM, and Naval Reactors? If so, please provide examples.
  - iii. What are the priorities in fiscal years 2017 and 2018 for the DOE Integrated Waste Management System?
  - iv. Generally, how does DOE-NE address recommendations from the Board? More specifically, how has DOE-NE addressed the Board’s recommendations on storing and transporting casks and canisters for commercial SNF? See the Board letters to DOE-NE dated:
    - a. [January 29, 2014](#) (re Board Meeting of Nov. 20, 2013, on DOE-NE research and development programs).
    - b. [October 10, 2014](#) (re Board Meeting of Aug. 6, 2014, on DOE SNF management).
    - c. [August 31, 2015](#) (re Board Meeting of Jun. 24, 2015, on commercial SNF transportation).

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<sup>4</sup> Note: Questions were provided to the speakers in advance to convey the Board’s primary interests in the agenda topics and to aid in focusing their presentations.

**8:45 a.m. Questions/Discussion**

**9:00 a.m. Containers for Commercial Spent Nuclear Fuel<sup>5</sup>**  
(“container” is used generically to mean canister, cask, or overpack)  
Joseph Carter, Savannah River National Laboratory

- i. The commercial nuclear power industry uses more than 25 types of dry-storage casks and canisters for commercial SNF, and the number is growing. In addition, DOE is evaluating several options for “standardized” containers that may be used for storing, transporting, or disposing of commercial SNF. The standardized containers include small, medium, and large Standardized Transportation, Aging, and Disposal (STAD) canisters. Reusable, bolted-lid transportation-only cask concepts were also recently developed (designs by AREVA and EnergySolutions). Briefly describe the in-use containers and recently proposed container concepts. Discuss the integration issues known or anticipated—in particular, focus on:
  - a. Challenges presented by the physical dimensions and capacity of the containers.
  - b. The scope of commercial SNF types that can be loaded.
  - c. The ability to accommodate damaged SNF (in “damaged fuel cans”).
  - d. Challenges for licensing for storage and transportation.
  - e. Limitations for the transportation casks and trailers/railcars to be used (if applicable) and the status of design and procurement of the transportation casks.
- ii. Explain whether any of the SNF containers may exceed storage or transportation limits for temperature, criticality safety, radiation dose, or weight. If the limits are challenged or exceeded, how will containers be managed and what is being done to mitigate the problems in the future?

**9:30 a.m. Questions/Discussion**

**9:50 a.m. System Analysis Tools used to Evaluate the Integrated Waste Management System**  
Josh Jarrell, Oak Ridge National Laboratory

- i. What is the status of the development and implementation of DOE’s system analysis tools for evaluating options for commercial SNF management?
  - a. Explain how these tools can be used to examine the pros and cons of using different types and sizes of SNF canisters at different points in the back end of the fuel cycle (e.g., storage, transportation, and disposal).

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<sup>5</sup> This and the following presentations will consider containers for nuclear waste storage and transportation, but will not include disposal overpacks that may be used when disposing of wastes in a deep geologic repository.

- b. Has DOE-NE assessed the time, cost, dose, and radioactive waste implications of repackaging SNF at different locations? If so, what are the results of the assessment?
- c. Did DOE-NE coordinate with DOE-EM in developing START (the Stakeholder Tool for Assessing Radioactive Transportation) and use lessons learned from DOE-EM's Web-based Transportation Geographic Interface System (WebTRAGIS)?
- d. In the early application of these tools, has DOE learned anything significant about the projected integration and management of SNF storage and transportation systems?

**10:15 a.m. Questions/Discussion**

**10:30 a.m. Break**

**10:45 a.m. Nuclear Industry Perspective on Commercial SNF Management and Transportation**

Kris Cummings, Nuclear Energy Institute

- i. Discuss the nuclear industry's perspective on DOE efforts to integrate commercial SNF and DOE waste management and transportation. What are the perceived impacts to the nuclear industry of integrating defense and non-defense wastes? In particular, what is the impact on the industry's ongoing efforts to package and store commercial SNF?
- ii. If DOE introduces relatively small standardized canisters for commercial SNF to gain efficiencies in the waste management system, how will this action be received by industry?
- iii. It may not be possible to dispose of SNF in the large canisters being used by utilities today and DOE has developed the initial concepts for a range of smaller canister designs. What could be done to minimize or offset the impact of loading smaller canisters at nuclear power plant sites to avoid the need for repackaging later?

**11:15 a.m. Questions/Discussion**

**11:35 a.m. Public Comment**

**12:00 p.m. Lunch Break**

**1:00 p.m. DOE-EM Program Overview; Integration of DOE-managed SNF and HLW**  
Mark Whitney, DOE, Office of Environmental Management

- i. Cleanup Mission.
  - a. What is DOE-EM's legacy cleanup mission?
  - b. How does management of DOE-EM's SNF and HLW help DOE-EM achieve cleanup success?
  - c. What is the current status and key milestones relevant to DOE-EM's tank waste management and SNF management activities?

- ii. Office of Environmental Management Reorganization.
  - a. How does the recent DOE-EM reorganization impact oversight and implementation of its key SNF and HLW mission and functions?
- iii. Current plans for packaging DOE-managed SNF and HLW.
  - a. What are DOE-EM's current plans for packaging its SNF and HLW following termination of the Yucca Mountain project and start of a new consent-based siting process?

1:15 p.m.

**DOE-EM Transportation Overview and Integration**

Mike Wangler, DOE, Office of Environmental Management

- i. Transportation Office Overview & Integration.
  - a. What is the overall scope and responsibilities of DOE-EM's packaging and transportation activities?
  - b. What organizations within and external to the Department integrate with DOE-EM on packaging and transportation activities?
  - c. What shipments of SNF and HLW have occurred or are planned?
  - d. What integration occurs for such shipments?
  - e. What factors, based on DOE-EM's past operational experience, are important to consider in meeting future needs for transport of DOE-managed SNF and HLW as part of an integrated waste management system?
- ii. WebTRAGIS demonstration and discussion of its capabilities and usage.

1:45 p.m.

**DOE-Managed SNF Integration**

Ken Picha, DOE, Office of Environmental Management

- i. DOE-EM Complex-wide SNF Overview.
  - a. What current activities related to DOE-managed SNF management are occurring at DOE-EM sites?
- ii. Integration of Near-Term Activities at Idaho.
  - a. How are SNF-related activities at DOE sites being integrated? Focus on how SNF activities at DOE-Idaho demonstrate integration between DOE-EM, DOE-NE, and the Navy.
- iii. Planning for and Integration Supporting DOE-managed SNF Disposition.
  - a. What are the different canister designs and characteristics for packaging DOE-managed SNF for disposal in an integrated, commercial/defense waste management system developed by the previous repository organization?
  - b. What are DOE's plans for packaging SNF for transportation and disposal in a future repository?
  - c. What continuing or new integrating activities and tools are available to support future disposition of SNF?
  - d.

- 2:10 p.m. HLW Integration**  
Ken Picha, DOE, Office of Environmental Management
- i. DOE-managed HLW Overview.
    - a. What current activities related to tank waste management are occurring at DOE-EM sites?
    - b. What are the different canister designs and characteristics for disposal of immobilized HLW for disposal?
  - ii. Tank Waste Integration among DOE sites.
    - a. How are HLW-related activities at DOE sites being integrated?
- 2:35 p.m. Questions/Discussion**
- 2:55 p.m. Break**
- 3:10 p.m. U.S. Navy Spent Nuclear Fuel Transportation**  
Barry Miles, U.S. Navy
- i. Describe the U.S. navy program for transporting Naval SNF.
    - a. What are the primary organizations with which the Navy integrates?
    - b. What are the biggest challenges to transporting Naval SNF?
    - c. What lessons learned can the Navy offer DOE?
- 3:35 p.m. Questions/Discussion**
- 3:50 p.m. Planning for a Separate Repository for Defense Waste**  
Andrew Griffith, DOE, Office of Nuclear Energy
- i. Describe the plans, objectives, and status of the development of a separate repository for defense waste.
- 4:15 p.m. Questions/Discussion**
- 4:35 p.m. Public Comments**
- 5:00 p.m. Adjourn Public Meeting**
- 5:00 – 6:00 p.m. Poster Session [NATIONAL BALLROOM C]**
- Posters on the characteristics of canisters and casks for commercial SNF.
  - Posters on the integrated system analysis tools being used by DOE-NE to evaluate the storage and transportation of commercial SNF.