

**Technology Innovation and International Partnership
Workshop on DOE Used Nuclear Fuel and High Level Waste**

Date: October 29, 2010

From: Sandy Birk / Barb Beller

To: Distribution

The Technology Innovation and International Partnership Workshop on DOE Used Nuclear Fuel and High Level Waste was held on September 14 and 15, 2010 in Crystal City, VA. Handouts from this workshop are posted on the NSNFP web site at <http://nsnfp.inel.gov/program/>. The following are summary notes from this meeting.

September 14th

1. Introduction (Barb Beller, DOE-ID)

Ms Beller opened the meeting and noted that people are being requested to consider storing fuel for 300 years. She asked that attendees discuss their thoughts on technology gaps and potential future directions with this in mind.

2. Welcome (Gary DeLeon, DOE-EM HQ)

Mr. DeLeon noted the purpose of the meeting is to discuss and better understand used nuclear fuel (UNF) management and to receive input for the management of UNF. He also indicated management's big emphasis on Integration, Collaboration and Communication (IC²), as we move forward with new technology initiatives to improve management of UNF. He stated that EM and the Nuclear Decommissioning Authority (NDA) from the UK have a bilateral agreement to share information.

3. Administration Activities (Joyce Connery, Senior Advisor to Deputy Secretary Daniel Poneman)

Ms Connery said the US needs to decrease nuclear weapons as we increase the use of peaceful nuclear energy. A main concern is having terrorist organizations cause mass casualties by detonating a nuclear device. The US has called for an international effort to secure all weapons with leaders from 47 countries. Nuclear power is important to the US and more than \$8B has been provided for loan guarantees for the first nuclear power plants to be built in the US in three decades. Another \$2B has been provided for uranium enrichment. It is clear that for the Obama Administration, Yucca Mountain is not an option. The Blue Ribbon Commission was created to find a better solution.

4. Blue Ribbon Commission Update (Tim Frazier, DOE-NE) – handout provided

The President and Secretary Chu have made it clear that Yucca Mountain is not a workable option and is "off the table." The President directed the Secretary to establish the Blue Ribbon Commission to conduct a comprehensive review of the back-end of the fuel cycle.

5. Nuclear Waste Technical Review Board – Mission and Focus (Mark Abkowitz, NWTRB) – handout provided

The Board began developing a systems analysis tool (NUWASTE) to support its technical evaluations. It was suggested that the Board meet with Vision people at the INL and those with similar tools. After visiting DOE sites, the Board will prepare a report on “stranded” SNF and HLW. They are also preparing a “white paper” on the technical needs for very-long-term dry storage (extended storage 100 plus years).

6. US Government Accountability Office Update (Janet Frisch, GAO) – handout provided

The GAO is currently conducting fieldwork on two studies related to Yucca Mountain. One study looks at issues related to commercial nuclear waste and the other looks at issues related to waste managed by DOE. The DOE waste study will look at such things as the agreements DOE has with the states if the Yucca Mountain project is terminated. It will also look at the costs incurred to store the SNF and HLW. Ms Frisch said that other studies have been requested and one of them is from Harry Reid and he wants the GAO to look for alternate uses of Yucca Mountain.

7. Office of Nuclear Energy Used Nuclear Fuel Disposition R&D Program (Pat Schwab, DOE-NE) – handout provided

The primary mission of NE is to perform research, development, and demonstration of nuclear energy. As part of this they are to develop sustainable nuclear fuel cycles and used nuclear fuel disposition. The Electric Power Research Institute (EPRI) has initiated the Extended Storage Collaboration Program. The purpose is to provide the technical bases to ensure safe long-term used fuel storage and transportability and it includes representatives from EPRI, NE, EM, the NRC, cask vendors, utilities, NEI, and national labs.

8. Commercial Power Reactor Experience in Getting Fuel from Wet to Dry Storage (Matt Marston, TSSD Services) – handout provided

The primary focus was on Connecticut Yankee with additional data coming from Maine Yankee and Yankee Rowe. Connecticut Yankee was decommissioned in 2007 and the used nuclear fuel (UNF) and GTCC waste is stored in 43 containers in an on-site ISFSI. The main lessons learned from this effort came from the drying of the UNF. The drying time turned out to be related to fuel and canister design and not the decay heat. The UK asked if the vacuum pumps became contaminated and it was said that they did and later designs had remote operation of the skid instead of close manual operation.

9. UK HM Nuclear Installations Inspectorate and Future Directions (Neil Blundell, UK NII) – handout provided

HSE (Health and Safety Executive) Nuclear Directorate is an UK Government Agency that regulates the construction, commissioning, operation, and decommissioning of nuclear facilities in Great Britain. Nuclear Installations Inspectorate (NII) regulates safety and health of nuclear workers and the public, regulates radioactive waste management, inspects work activities, and represents the UK at international groups such as the IAEA. The NII was formed after there had been a pile fire in 1957 which melted

fuel and released radioactivity across northern England and Europe. England is working toward having a deep geological repository and there is a possibility that they will have 10 new reactors, the first being built in 2018-2020. There is currently no waste disposal site for SNF although HLW has a planned route in 2075.

10. US Regulatory Perspectives and Future Directions for Commercial Spent Fuel (Mike Waters, NRC) – handout provided

There are over 1,300 loaded dry storage casks and over 50 approved storage cask design variations. The dry cask license period has been extended to 60 years and the license will be extended on a case-by-case basis. The NRC has been looking at SNF cladding and the impact of temperature and higher burnup. They are also looking at SNF canisters and long term corrosion and basket properties (criticality control). For overpacks they are evaluating long-term degradation and the severity of external natural phenomena.

11. DOE's Nuclear Safety Framework (James O'Brien, DOE-HQ) – handout provided

There is a hierarchical set of government documents that starts with Policies, goes down to Rules (Regulations) and Orders, and on down to Guides and Standards. At the top is the policy SEN-35-91 which says “DOE facilities will be designed, constructed, operated, and decommissioned to assure the protection of the public, workers, and the environment.” Below that are regulations 10 CFR 830, Subpart A (QA) and Subpart B (Safety Basis). Most DOE nuclear facilities operate under a Government Owned Contractor Operated (GOCO) framework.

12. Defense Nuclear Facilities Safety Board (Ray Daniels, DNFSB) – handout provided

The DNFSB is an Executive Branch Agency dedicated to providing independent nuclear safety oversight of DOE defense nuclear facilities. The Board can make recommendations to the Secretary of Energy and has provided 52 recommendations and 230 sub-recommendations. DOE defense nuclear facilities include Hanford, Savannah River Site, WIPP, Oak Ridge, the INL, Savannah River National Lab, and many labs. The Board visited the CPP-666 basin at the INL in July 2009 and the L-Basin at SRS in August 2010. The Board is interested in the Waste Treatment Plant (WTP) new construction at Hanford and they plan to visit there soon.

September 15th

13. EM FY-2011 R&D Funding (Skip Chamberlain, DOE-HQ) – handout provided

The EM mission is to close facilities and work themselves out of a job. They plan to use science and technology development to improve cost and schedule performance (reduce cost of cleanup work by 20 to 25 percent). The mandate is to have 2% of the EM budget for technology development. In addition to technology development, EM plans to leverage investment with international partners and other DOE offices.

14. Panel Discussion DOE Used Nuclear Fuel

A. Sen Moy (Hanford Irradiated Nuclear Fuel Disposition Overview) – handout provided

Hanford SNF contains over 2,100 MTHM, which is over 80% of the DOE inventory by weight. The N-Reactor SNF is stored in about 400 MCOs and an MCO is designed for a life of 75 years. The canister storage building that stores the MCOs is also designed for a life of 75 years. Other SNF is stored in dry cask storage which has a design life of 40 to 50 years. It was asked how Hanford would know that the SNF is transportable after years of storage and it was said that 9 MCOs are in the sampling/monitoring program.

B. Barb Beller (Idaho SNF Stabilization and Disposition) – handout provided

The Idaho Cleanup Project (ICP) is responsible for storing SNF from EM, NE and the Navy. The 1995 Idaho Settlement Agreement requires that all SNF be placed in dry storage by 2023 and shipped out of Idaho by 1/1/2035. The EM SNF has already been placed in dry storage, but some NE SNF remains in the pool. Navy SNF is being returned to the NRF for dry storage and these transfers are currently scheduled to be completed prior to 2018. Several technology needs have been identified and some of these are to improve monitoring capabilities and the understanding of material properties in service over time and to improve welding techniques of SNF canister poison baskets.

C. Dawn Gillas (SRS SNF Storage)

SRS has 29 MT of SNF and over 80% is aluminum based. The baseline is to ship non-aluminum SNF to the INL and reprocess the aluminum SNF. There is currently no funding for this reprocessing and transfer of SNF. Without reprocessing, the L-Basin will be filled by 2018 with current receipts and by 2015 if they receive SNF from South Africa. If aluminum SNF is reprocessed, there will no longer be a pool storage problem and the basin would be closed in 2019. All of the HFIR positions will be filled by next year. If SNF reprocessing takes place, they could take additional HFIR SNF in 2015 or they could add additional storage racks. The L-Basin is 60 years old and there are monitoring coupons in the basin. Ms Gillas said that they are looking at water quality and performing underwater inspections (observed some concrete cracking and coating degradation).

15. Overview of Used Nuclear Fuel Management in the UK (Paul Gilchrist, UK NDA) – handout provided

The Nuclear Decommissioning Authority (NDA) has accountability for the UK's Legacy Nuclear Facilities (19 sites) and is performing the largest and most important environmental clean-up program in Europe. The UK is planning for long term wet storage out to 2120 and assumes a repository in 2075. Their overall strategy is to reprocess all SNF. They are now making significant investments in fuel drying (have looked at Hanford SNF drying) and dry fuel storage projects. The Geological Disposal Facility (GDF) is being developed with no site yet selected (two communities have expressed an interest).

16. Australia Used/Spent Nuclear Fuel Issues (Kath Smith) – handout provided

Australia does not use nuclear power to produce electricity but has operated research reactors since 1958. The SNF is stored wet and/or dry prior to shipment to another

country. They have shipped their SNF to the UK, France and the U.S. They will ship SNF to the U.S. until the lapse of the FRR SNF program (shipments accepted till 2019). SNF generated post-2016 will be sent to France for reprocessing. Legislation exists for the storage of Intermediate Level Waste (ILW) but there is no plan for the storage of SNF. The ANSTO Hot Isostatic Pressing (HIP) process will be applied to Mo-99 wastes and this process is expected to be on line in 2014.

17. Canada SNF (Mark Chapman) – handout provided

Approximately 85-90% of used CANDU fuel is stored in Dry Storage Container (DSC) systems. Chalk River Laboratories was established in 1943 and has multiple mandates such as research reactor operation, medical isotope production, fuel development, R&D, CANDU services, and the Nuclear Legacy Liability Program. Field inspections from 1998-2000 of historic fuel (irradiated 1947-1962) observed some fuel degradation, contamination, hydrogen generation, and potentially pressurized storage containers. A facility to disposition this historic fuel has been built and is scheduled to be transferred to operations in March 2011. US-origin HEU research reactor UNF is being sent back to the US. The Nuclear Waste Management Organization (NWMO) purpose is to develop a management approach for long-term care of Canada's UNF. They have been working closely with the public on a repository. The repository is an investment of \$16B to \$24B and will be implemented locally in an informed, willing host community.

18. HFIR Domestic Reactor (David Rosine, DOE-OR/ORNL) – handout provided

The HFIR is part of the Oak Ridge National Laboratory complex and is operating with HEU fuel. HFIR SNF is currently shipped to the SRS L-Basin. SRS has the potential for closing all SNF shipments at the end of the FRR SNF program in 2019. The bottom line is that HFIR will continue operation beyond 2019 and needs a place to send their SNF.

19. Current Status of Gap and U.S.-Origin Nuclear Fuel Removal in 2010 (Chuck Messick, DOE/NA-21) – handout provided

The Global Threat Reduction Initiative (GTRI) is the key organization responsible for implementing the U.S. HEU minimization policy. They want to remove the need for HEU. Its mission is to convert reactors from HEU to LEU, remove and dispose of excess nuclear materials, and protect nuclear materials from theft and sabotage. Gap removal facilitates the disposition of high risk, vulnerable nuclear material not covered by other removal efforts. Currently the returned aluminum SNF is sent to SRS and the stainless steel clad TRIGA SNF is returned to the INL.

20. Panel Discussion on International Activities

A. Vijay Sazawal (USEC) – handout provided

Vijay made it clear that he is speaking on his own and not on behalf of the Government of India or others. The India nuclear program was started in 1944 and in 1994 India began a partnership with the US. By 2017 they plan to build 10 new reactors (6 domestic and 4 imported LWRs). India currently generates about 600 MTU of used fuel annually

and it is cooled/stored in reactor pools. They have three reprocessing plants and plan to build two new plants under the U.S.-India 123 Agreement. They also have vitrification facilities to treat the HLW. They use monitored interim storage for the HLW and have a pilot program for a repository. India had little uranium but lots of thorium so their reactors use both thorium and uranium.

B. Natraj Iyer (SRNL) – handout provided

The Savannah River National Laboratory has had extensive activities through IAEA initiatives in UNF management of research reactor UNF. The focus has been on interim wet and dry storage of UNF, used fuel performance in storage, transportation and lessons learned, and used fuel and facility life management. The transportation lessons learned report will be out this year and deals with the return of UNF to the U.S. Extended wet and dry storage are needed for the continued safe storage of research reactor UNF until disposition paths are identified. Opportunities exist for sharing information and lessons learned in this area with the IAEA and other countries.

C. Robert Einzinger (NRC)

The NRC is active in international areas and they are looking at international standards, extended storage programs, and reactor research applicable to SNF storage. They have met with Germany to discuss the behavior of cladding in storage. The NRC has been active in the IAEA especially in transportation and the burnup credit issue. On the issue of damaged SNF, the NRC is determining how it is defined, handled, and remediated. The NRC is evaluating how high burnup fuel and MOX fuel affect the rest of the system (storage and transportation).

D. Paul Gilchrist (UK NDA) – handout provided

The National Nuclear Laboratory (NNL) R&D projects range from reviews of international spent fuel management techniques to assessing innovative storage techniques for legacy metallic fuel. They are reviewing all of the internationally available proliferation resistance assessment methodologies and will recommend how best to measure proliferation resistance in the UK fuel cycle. They will use the chosen methodology to assess UK spent fuel management options.

21. EM Research & Development Plans – SNF & HLW

A. Nancy Buschman (EM R&D Plan) –handout provided

EM R&D is prioritized and two of the top priorities are Spent Nuclear Fuel Storage, Receipt and Disposition and Special Nuclear Material Consolidation, Processing and Disposition. The EM wide R&D Plan is to be issued sometime near the end of the month. EM is formalizing collaboration with NE and is starting to work on a Memorandum of Understanding (MOU). Other potential areas of collaboration could be with the UK.

B. Nick Machara (Tank Waste Processing R&D Program) –handout provided

The active tank waste sites are Hanford, SRS and the INL. At Hanford they are looking at a new glass composition and optimized process, a next generation melter, an

alternative LLW process, aluminum removed from the feed, and reduced IHLW. At SRS they are looking at such things as improved waste loading and process at the DWPF and Saltstone process enhancements. The basis for the tank waste R&D plan is the National Academy of Sciences (NAS) recommendation on engineering and technology roadmap (looking at the gaps) and support for enhanced strategies for Hanford and SRS.