

## WM2017 Conference Panel Report

### **PANEL SESSION 126: Thursday Topical Session International Management of Used Nuclear Fuel: Present and Future**

**Co-Chairs:** **Larry Camper**, *Advoco Professional Services, LLC*  
**George Dials**, *Pajarito Scientific Corporation*

**Panel Reporter:** **Rateb (Boby) Abu-Eid**, *US NRC*

#### **Panelists:**

1. **Andrew Griffith**, *Deputy Assistant Secretary for Spent Fuel & Waste Disposition, US DOE*
2. **Michael Ford**, *Vice President, Licensing & Corporate Compliance, Waste Control Specialists LLC*
3. **Yves Brachet**, *Westinghouse Electric (France)*
4. **Joy Russell**, *Vice President, Business Development, Holtec International*
5. **Andrea Kock**, *Deputy Director, Division of Decommissioning, Uranium Recovery and Waste Programs, US NRC*
6. **Ian Gordon**, *Section Head-Waste Technology, IAEA (Austria) [Presented by Andrew Orrell, IAEA]*
7. **Kapila Fernando**, *Director, WMS Australia Foundation Limited, Australia*

Session Co-Chairs, **Larry Camper** and **George Dials**, introduced this session's panel members and provided a summary of the purpose of the session. This panel included senior executives and long-term experts worldwide with extensive and vast experience in spent fuel management, storage, and disposal. The panel addressed key issues pertaining to management of used nuclear fuel from national and international perspectives focusing on regulatory and policy issues associated with interim storage, deep geologic disposal, and reprocessing of nuclear fuel. Stakeholders' perspectives and the potential for Yucca Mountain repository application to become active in the near term were issues addressed during discussion by the panelists. New storage transportation cask designs were addressed, including implications for development of a consolidated interim storage facility. Approximately 50 people attended this session.

#### **Summary of Presentations**

**Andrew Griffith** presented an overview of the current status of commercial and DOE nuclear waste storage showing location of shutdown nuclear facilities, defense waste sites, DOE managed waste sites, and commercial onsite storage sites. He indicated that there is approximately 75,000 metric tons high level waste (HLW) of commercial heavy metals (MTHM) and 12,000 MTHM of DOE managed HLW, in addition to 2,450 MTHM of defense and research and commercial origin spent fuel. He closed his presentation by showing an illustration of how the waste management system could look like.

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In this context, he showed components of transport to a consolidated interim storage facility, a pilot of interim storage facility, and facilities of geologic repositories for ultimate disposition of spent fuel (SF) and HLW. He also showed a parallel path for disposition into a geologic repository of waste generated from defense nuclear material production sites. His presentation was followed by immediate questions regarding status and future of Yucca Mountain geologic repository.

**Michael Ford** described the WCS site which includes ~14,000 acres (~23 square miles) area licensed by Texas Commission on Environmental Quality (TCEQ) as an Agreement State and it includes rail access for large components, and large scale D&D projects. He indicated that an environmental impact analysis has been conducted for the site to allow a consolidated interim storage facility (CISF) to accommodate storage of 40,000 MTHM for 40 years at 8 separate phases with a storage of up to 5,000 MTHM in each phase. The facility is designed for WCS partners' storage systems namely AREVA NUHOMS and NAC International. He iterated of the continuing discussions with DOE on how CISF intersects with their UNF strategy and addressing prioritizing for shutdown sites. He also mentioned that additional systems and sites to be added in a future license amendments. For phase I, it includes storage of UNF from over 9 shutdown/decommissioned NPPs. The NAC (Used Nuclear Fuel) UNF and GTCC will include: Maine Yankee (PWR), Connecticut Yankee (PWR), Yankee Rowe (PWR), La Crosse (BWR), and Zion (PWR). For AREVA, the UNF and GTCC would include: Rancho Seco (PWR), SONGS Unit 1 (PWR); Millstone Unit 1 (BWR); and Oyster Creek (BWR). Phase I CISF would include AREVA Cask Systems (NUHOMS MP 187), Standardized NUHOMS, Standardized Advanced NUHOMS, NAC International Cask Systems, NAC-MPC, NAC-UMS, and MAGNASTOR). The current timeline for CISF was given as: April 2016 – License application submitted; November 2016 – Commencement of ER; January 2017 – LA accepted by NRC for docketing; May (mid) 2017 – ER RAIs issued; responses mid-July; July 2017 – SAR RAIs issued; response mid-September 2017; mid 2019 – Licensing Decision; and 2021 – Operations anticipated to commence.

He concluded that although there are manageable risks in the ongoing CISF process; nevertheless, there are inherent advantages to a Private Entity taking on the Front-End activities of Licensing a CISF of 40,000 MTHM. In this context, he emphasized that CISF can de-inventory approximately 51 shutdown sites. Thus, responding to significant “bow wave” of plant closures starting in 2029. He added that CISF is a cost-effective solution that reduces overall Federal Government expenditure by billions of dollars; reduces U.S. Taxpayer liability by \$5.4B, and bring added benefits of \$1B to communities hosting shutdown sites.

**Yves Brachet** described the approach from Westinghouse in France for SF management from Shutdown to a Green Field. In this context, she described steps of initial planning, defueling, inventory characterization, decontamination, dismantling, waste management, waste disposal, and finally site clearance. She indicated that Westinghouse manufactures most common commercial nuclear fuel design parts in use today. Westinghouse has three fuel factories in the U.S. (Columbia), in Sweden (Vasteras), and in UK (Spring-fields); it also holds a partnership in PWR with ENUSA (Spain).

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**Ms. Brachet** showed a visual view of nuclear fuel design for: W-PWR, CE-PWR, KWU/Siemens PWR, NFI PWR, W-BWR, NFI BWR, VVER (PWR), and an advanced design for gas reactors (AGRs). She described Westinghouse fuel and fuel services spanning the nuclear fuel value chain e.g.; Uranium-transport, engineering services, fuel and fuel handling services, used fuel management, used fuel storage installations design and construction, and support for consolidated or interim storage and disposal. She summarized the services provided by Westinghouse which comprised 20% for Nordic Region, 25% for USA, and 55% for Europe. She described the transport and storage of defect fuel rods, and safe storage of leaking rods in fuel pools at NPPs indicating that no special treatment is needed for leaking fuel rods in the final storage. She described the “Trillo Intermediate SF Storage Facility” in Spain as well as ATC Centralized Interim Storage for SF in Spain where Westinghouse provided detailed facility design, licensing support, safety analysis, as well as construction supervision. She also described GLAB Central Intermediate Storage facility for SF (Wet Storage) in Sweden where Westinghouse provided support for design, licensing, equipment supply, safety analysis, and commissioning and installation supervision. She also described Westinghouse support for Sweden’s Final repository in Forsmark, including basic design of canisters and handling system, as well as basic design activity for the radiation monitoring system. For Spanish SF repository, Westinghouse provided performance assessment studies, conceptual design for deep geologic fuel disposal facility in granitic and clay host rocks.

In summary, she indicated that Westinghouse is well recognized as a leading industry with global experience as fuel supplier and with experience and knowledge of advanced technology to cope with specialized services for interim storage of damaged SF. Westinghouse also demonstrated leadership and experience in SF storage for dry and wet solutions. Westinghouse has a large presence in Europe from fuel manufacture, to interim storage of SF and disposal. She closed her presentation emphasizing that Westinghouse is now expanding its capabilities into SF design and licensing.

**Joy Russell** presented Consolidated Storage Facilities of Spent Fuel in Ukraine and U.S. interim Storage Facilities for Used Nuclear Fuel and HLW. She provided an overview of Holtec Company with 72% of its operations involving nuclear aspects. She described Holtec’s shipping packages and manufacturing facilities in the U.S. including its Divisions in Turtle Creek, PA; Orrille, Ohio, Camden, NJ, and Dachi in India. She indicated that their facilities cover an area of 1.3 M ft<sup>2</sup> of shop space. She described Holtec’s pioneer below-grade SNF Storage, Holtec’s worldwide storage and transport experience indicating that 102 NPPs worldwide rely on Holtec storage technology including 53 domestic and 43 international. She went through an elaborative description of Holtec’s canister system as optimized for storage with regard to shielding, physical protection, containment of radioactivity, criticality control, and heat transfer. She also described the maximized below-grade storage system to withstand crashing aircraft and to add additional measures for safety and security She also presented a brief description of management system for Holtec and ELEA (e.g.; Eddy-Lea Energy Alliance, LLC). She then described the two-part approach for licensing of HOLTEC HI-STORE through pre-submittal activities and submitting of NRC site-specific license application under 10CFR 72 by March 31, 2017. She indicated that HI-STORE below-grade site is located between Carlsbad & Hobbs in NM. She added that HOLTEC received support from State, local government, as well as from local communities. The initial application includes 500 canisters, with a future amendment to add up to 10,000 canisters. Finally, she allotted significant portion of her presentation on Ukraine CSFSF project to be located at Chernobyl exclusion zone.

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She mentioned that this project would save Ukraine approximately \$100M per year of SF transport costs and alternate to shipping SF to the Russian Federation. She described further in elaborative manner CSFSF storage technologies to be applied in Ukraine including HI-STORM 190 System indicating that CSFSF is planned to be operational by 2019.

**Andrea Kock** described NRC's regulatory role in Spent Fuel management including storage, transportation, and disposition. She showed on a map locations of Independent Spent Fuel Storage Installations (ISFSI) under NRC regulatory control. Subsequently, she described storage cask certification process for compliance with NRC's required operating conditions and designs. In this context, she described what licensee is authorized to store in cask up to 40 years. She indicated that, currently NRC granted 14 cask Certificates of Compliance (CoC). Ms. Kock presented a preliminary review schedule of Waste Control Specialist application as follows: NRC Acceptance Review of WCS' application was completed on January 26, 2017; NRC issued Federal Register Notice of Opportunity to request hearing and petition for leave to intervene (82 FR 8773) on January 30, 2017; issued a Federal Register Notice of Intent to Prepare EIS and Conduct Scoping Process (81 FR 79531) on November 14, 2016; the EIS Scoping Comment Period was on November 14, 2016 to March 13, 2017. A Safety Review/Safety Evaluation Report should be completed in approximately 21 months. The Environmental Review/Final EIS should be completed in ~ 26 months; and lastly, license decision would be anticipated in the spring of 2019. Regarding SF shipping packages, she indicated that the NRC regulates the design and construction of packages to ensure the public is protected. She added that 12 packages currently have been certified by NRC for transportation of commercial spent fuel. She noted that the NRC certified transportation packages are designed to withstand severe accidents; thus containers must be able to survive four tests involving impact, puncture, fire, and submersion in water.

**Andrew Orrell** (IAEA Section Head for Waste and Environmental Safety) delivered **Ian Gordon's** presentation on "International Management of Used Nuclear Fuel as insights from the IAEA". He outlined the different fuel cycle (FC) phases and the volume of accumulated SF Spent fuel which is being accumulated at the rate of ~10 000 t(HM)/year. He indicated that by the end of 2016 there was an approximately 405 kt of HM of which about 270 kt are currently stored in facilities at either AR or AFR sites, and the remainder is being reprocessed. He added that there are 151 AFR storage facilities in 27 countries of which approximately 80% are dry (the majority being deployed over the last 25 years). The storage duration was planned for 50 years in 1990s, which was extended to >100 years in 2016. The requirements for SF disposal included compatibility of deployed storage systems with disposal system design. However, when the end point is unknown, more information is required to facilitate spent fuel disposal using ongoing data development on SF characteristics. He iterated IAEA activities to support member states in SF management. He summarized SF processing informing that approximately 30% of SF is being processed by countries including France, Japan, UK, Russian Federation, India, and China. Subsequently, he summarized solutions for SNF or HLW through deep geological disposal giving examples of Sweden, Finland, France, and the USA (YM). In this context, he emphasized the importance of coordination among of different authorities to reach consent and inputs of the public and the stakeholders in the decision making. Regarding IAEA position on a multi-national repository, he reiterated the Joint Convention conclusion that "radioactive waste should, as far as is compatible with the safety of the management of such material, be disposed of in the State in which it was generated, whilst recognizing that, in certain circumstances, safe and efficient management of spent fuel and radioactive waste might be fostered through agreements among

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Contracting Parties (e.g.; of the Joint Convention) to use facilities in one of them for the benefit of the other Parties, particularly where waste originates from joint projects.

He closed his presentation by informing of current IAEA work on cooperation in the nuclear fuel cycle and describing INPRO ongoing study on “Cooperative Approaches to the Back End of the Nuclear Fuel Cycle,” which includes consideration of Multinational Disposal.

**Kapila Fernando** presented an overview of South Australia (SA) proposed project “South Australia Fuel Leasing and Disposal of Spent Fuel.” He indicated that SA needed an economic ‘Game-Changer,’ thus there was an inquiry by the Royal Commission in March 2015, to investigate the potential risk and opportunities in development of “Nuclear Fuel Cycle Processing” in SA. This investigation was conducted with integrity and transparency. The investigation also includes potential for SF leasing and disposal. The investigation was independent of the government conducted by a Royal Commission which is the highest level of inquiry that be conducted in Australia which has the power to compel witness and regarded as non-partisan. The process involved developing issue papers from consultants, consultation with the public and NGOs for acceptance, and also using the Commission fact finding missions. Mr. Fernando presented the final report which was issued in 2016 with 12 recommendations. The main conclusions included that conversion, enrichment, fuel fabrication was not viable, in SA; however, fuel leasing could be viable. Importantly, it also reported that storage /disposal of spent fuel could be undertaken and will be financially attractive. Subsequently, he described the scenarios adopted for the financial assessment study which included global generation of > 1 million tHM spent fuel by 2090. The baseline assessment considered: (a) customer base of 138 000 tHM of spent fuel over about 100 years with a potential price of \$1.75 million (AUD) per tHM. The waste imported for storage was considered at year 11 of the project, with disposal initiated from year 28. He described the process of engagement with stakeholders and the public through a Consultation and Response Agency (CARA). He presented statistical results of public consultation and feedback as follows: 43% of supported or strongly supported continuing to explore this opportunity; 20% were unsure or didn’t know enough and wanted to find out more; 37% were opposed or strongly opposed. He summarized that in total, 63% were in favor or wanted to know more. The main reasons from people who supported were 49% financial benefit to the state; 36% thought SA was one of the safest places for storage and disposal. Nevertheless, from the people who opposed 30% cited safety concerns. He also described a “Citizen Jury” process, which was composed of 350 randomly chosen citizens who heard from 100 “expert witnesses” whom they selected. Finally, he summarized the current status at this point in time by having three reports with recommendations for the way forward including: (a) the Royal Commission report; (b) the CARA community views report; and (c) the Citizen’s Jury report. He indicated that the Government took these three reports into consideration and provided a response. As such, it supported nine out of the twelve recommendations of the Royal Commission. In other words, it supported continued investigation of the proposal for a waste storage and disposal facility, provided that they maintain bipartisan support. He closed the presentation noting the driving forces for and against this proposal. He also identified some possible opportunities and future actions associated with this proposed project.

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### Discussion and Conclusion:

A great deal of discussion and comments were made regarding the status of Yucca Mountain Geologic Repository under the current administration and how decision makers can revive addressing YM licensing for long term SF and HLW disposal or for a long-term storage of spent fuel. Several issues were raised regarding budget allocation and consent with the State and status of DOE license application to NRC particularly the YM Safety Evaluation Report. It was indicated that the ultimate strategy goal is disposition of SF and HLW in a geologic repository. The issue of interaction with the public and stakeholders was raised which requires a special innovative approach to communication. The issue of DOE responsibility and funding for long-term centralized storage of SF was discussed. It was indicated that DOE would be contractually obligated to fund an operational centralized SF storage facility. A question was raised regarding double wall canister and drop test. A question was raised regarding status of WCS application and ongoing licensing review schedule. Other questions were raised regarding transportation of packages and canisters and NRC's responsibility. A question was raised regarding IAEA help and support for developing a regional repository. It was indicated that a multinational repository is difficult to implement. Other questions to IAEA regarding reprocessing of spent fuel. Audience requested elucidation of SF definition and how long is the risk assessment period required for long-term storage. A question was raised regarding current Secretary of Energy position for storage and disposal of HLW and spent fuel. Finally, the audience asked about IAEA role to establish a policy for SF storage and disposal and to document research by leading countries regarding geologic repository performance assessment and sharing of research results.

In summary, Session 126 was well attended, well organized, comprehensive, and covered several aspects regarding planning and strategies for disposition of SF and HLW. The discussion was lively regarding YM geologic repository and status of DOE license application. In some cases, the Session was a platform to present SF industries progress in technology development and summary of experience gained worldwide. The panel members' presentations and the discussion showed good illustrations of regulatory perspective as well as international perspectives and status of ongoing technology development. Social media interaction and communication as well as stakeholders and public participation were well demonstrated for most of the presentations particularly for the ongoing project in South Australia. The discussion at the end of the Session was quite useful especially the remarks made on the ongoing licensing activities for WCS and for the HI-STORE below-grade site located between Carlsbad & Hobbs in NM. In brief, the Session provided an opportunity for addressing potential future actions and recommendations from different perspectives to address national and international issues regarding SF storage, design of canisters, transport, and ultimate disposition in a geologic repository.