

Management of High Level Waste and Used Nuclear Fuel at DOE Sites - 11478

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ABSTRACT

With the passage of the Nuclear Waste Policy Act of 1982 (NWPA), the policy of the Department of Energy (DOE) has been to prepare High Level Waste (HLW) and spent nuclear fuel (SNF), referred to here as Used Nuclear Fuel (UNF), generated by its nuclear activities for disposal in a geologic repository. This paper provides an overview of the Office of Environmental Management (EM) plans for managing nuclear waste pending future decisions on the disposal of HLW and UNF.

INTRODUCTION

Prior to 2009, EM planned to dispose of 7,000 Metric Tons of Heavy Metal (MTHM) of EM-managed nuclear waste at Yucca Mountain [1], which was designated as the nation's nuclear waste repository in 2002. This amounted to one tenth of the total repository statutory capacity of 70,000 MTHM allowed under the NWPA. The EM repository allocation was composed of 2,333 MTHM of SNF and 4,667 MTHM (or 9,334 canisters) of defense HLW. Defense HLW is HLW generated in the reprocessing of irradiated fuel to support production of nuclear weapons. (HLW from these activities was assigned a value of 0.5 MTHM for each canister produced using what is called the historical method.) Although all EM UNF could have been accommodated in the repository, only about half of the projected canisters of HLW to be produced (about 21,000) could likely have been accommodated within the statutory limit.

In January 2010, the Secretary formed a Blue Ribbon Commission (BRC) on America's Nuclear Future. The BRC's charter is to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle. The Commission will provide advice and make recommendations on issues including alternatives for the storage, processing, and disposal of civilian and defense spent nuclear fuel and nuclear waste. The BRC is scheduled to submit a draft report recommending options for managing the nation's nuclear waste to the Department of Energy by July 2011. A final report is scheduled to be issued in January 2012. In addition, the Department also determined that Yucca Mountain was no longer a workable disposal option. DOE remains committed to meeting its obligations to manage and ultimately dispose of UNF and HLW, and is thus planning for the on-site storage of these materials pending recommendations of the Blue Ribbon Commission of America's Nuclear Future [2] (BRC) and future decisions on the Nation's ultimate disposal plan.

HIGH LEVEL WASTE

The EM HLW is stored at Hanford in Southeastern Washington, Idaho National Laboratory (INL) in Eastern Idaho, and Savannah River Site (SRS) in Aiken, South Carolina, and EM manages commercial HLW stored at the West Valley Demonstration Project (WVDP). At present, about 15% of the total projected number of canisters of HLW have been produced and are in storage, e.g. about 3,100 canisters at SRS, and 275 at WVDP. Liquid tank waste at SRS is treated to produce two fractions: the high activity or HLW fraction contains 99% of the activity and is vitrified, a process by which the HLW is immobilized by incorporating it into a glass matrix known as borosilicate glass, for eventual off-site storage/disposition. The low activity fraction is solidified using a grout mixture consisting of cement, fly ash, and slag for on-site disposal. Vitrification of WVDP HLW was completed in 2002. At INL, plans are to convert HLW calcine (a granular solid) into a ceramic waste form that meets or exceeds the attributes of borosilicate glass.

EM plans to continue vitrifying tank waste at SRS and storing the HLW canisters according to the requirements developed by the former Office of Civilian Radioactive Waste Management (OCRWM) which are deemed appropriate for use in a future licensing effort. EM will continue to design and construct the Hanford Waste Treatment Plant to vitrify the HLW fraction of Hanford tank waste disposal. Low activity waste is to be treated and disposed of on site. At INL, a facility is being designed to treat the HLW calcine by hot isostatic pressing (a process under which heat and pressure are applied to the calcine to convert it to a ceramic waste form). Plans are to provide storage capacity at these sites to store the treated waste until arrangements can be made to ship it to an interim storage or disposal facility.

USED NUCLEAR FUEL

The EM UNF is currently stored at Hanford (~2130 MTHM), INL (~250 MTHM), Fort St. Vrain, CO (~15 MTHM), and SRS (~30 MTHM). The EM UNF at Hanford, Fort St. Vrain and INL is in dry storage; the UNF at SRS is in wet storage. Several options are being considered for the SRS UNF including continued wet storage; transfer to dry storage; and processing aluminum-clad UNF in H-canyon to recover enriched uranium. H-Canyon is currently operating to complete the blend down of enriched uranium recovered from the dissolution of surplus unirradiated High Enriched Uranium after which it will be placed in standby. EM will continue to receive small quantities of UNF from foreign research reactors (until 2019) and domestic research reactors at both INL and SRS. Non-aluminum clad UNF is received at Idaho and aluminum-clad UNF at SRS, consistent with past DOE decisions for receiving and storing UNFs. Beginning in 1995, DOE decided to consolidate UNF based on fuel type to allow for efficiencies in management and development of technology for stabilization and ultimate disposal. DOE continues to maintain the UNF in safe and secure facilities, pending new direction that may result from recommendations of the BRC.

EM will continue to manage HLW and UNF according to the requirements identified in the Quality Assurance Requirements Document [3] (QARD) that was developed under OCRWM. The QARD provides the requirements needed to implement a quality assurance program, which includes, among other things, periodic audits of site activities and the documenting of audit results. In addition to the QARD, EM is following the most recent requirement documents issued by EM, or concurred in by EM [4-6].

CONCLUSIONS

EM responsibilities are to treat tank waste for eventual disposal and to manage HLW and UNF in a safe, secure manner. EM will continue to implement programs based on requirements developed by OCRWM. EM will extend those requirements to the entire inventory DOE HLW and UNF . In addition, EM will implement any new requirements as directed by the Department.

REFERENCES

¹ Yucca Mountain Repository License Application Safety Analysis Report, Department of Energy, DOE/RW-0573, Rev. 0, June 3, 2008 (see <http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html>).

² Federal Register/Vol. 75, No. 22/Wednesday, February 3, 2010/Presidential Documents.

² Quality Assurance Requirements and Description Document, Department of Energy, DOE/RW-0333P, Rev. 20, January 2008.

⁴ Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms, EM-WAPS Rev. 2, December 1996.

⁵ Waste Acceptance System Requirements Document, Department of Energy, DOE/RW-0351, Rev. 5, March 2008.

⁶ Integrated Interface Control Document, Department of Energy, DOE/RW-0511, Rev. 4, March 2008.