FEDERAL COMMITMENTS REGARDING USED FUEL AND HIGH-LEVEL WASTES

EXECUTIVE SUMMARY

At the request of the Blue Ribbon Commission Staff,[1] Van Ness Feldman examined the following question: What commitments has the Federal Government made to states, communities, private companies, and others related to the disposal of used fuel and high-level wastes?

Spent nuclear fuel (referred to herein as "used fuel") and high-level radioactive waste ("HLW") are the by-products of commercial nuclear energy generation, defense production of nuclear weapons materials, and research and medical activities that utilize nuclear reactors or fission product nuclides. The following table provides an overview of the inventories of used fuel and HLW in the United States.

Table 1. Overall Used Fuel and HLW Inventory.

Material	Approximate Quantity (2010)
Commercial Used Fuel	~ 65,000 MTHM[2]
DOE-Managed Used Fuel	~ 2,458 MTHM[3]
DOE-Managed High Level Waste	~ 8,000 – 17,000 MTHM[4]

The Federal Government has a variety of commitments related to the cleanup and stabilization of used fuel and HLW. Ultimate disposal of these wastes has long been considered a Federal responsibility.

This paper describes the Federal Government's legal obligations related to used fuel and HLW from: (1) Commercial Reactors; (2) U.S. Department of Energy ("DOE")-Managed Sites; and (3) Foreign and Domestic Research Reactors. The paper also describes Federal transportation commitments related to used fuel and HLW.

I. COMMERCIAL REACTORS SUMMARY

In 1982, Congress enacted the Nuclear Waste Policy Act ("NWPA").[5] The NWPA made geologic disposal a national policy and established the Federal Government's responsibility for the permanent disposal of used fuel and HLW. It also made clear that the cost of such disposal would be the responsibility of the generators and owners of such waste and used fuel. The NWPA lays out the process for selecting, siting, licensing, and constructing a repository for permanent disposal, which the 1987 amendments to the NWPA limited to Yucca Mountain, Nevada.

The NWPA established the Nuclear Waste Fund ("NWF") and authorized DOE to enter into Standard Contracts with commercial reactor licensees. During the 1980's, DOE entered into 76 such contracts. Under the Standard Contract, DOE agreed to take title to used fuel and HLW and, in return for a payment of fees to the NWF (1 mil ($0.001) per kilowatt hour ("1mil/kWH")), dispose of the materials beginning not later than January 31, 1998. The NWPA

also provided that the Nuclear Regulatory Commission ("NRC") may not issue or renew a commercial reactor license without a Standard Contract in place. In 2008, DOE amended the Standard Contract for new reactors. Under the amended Standard Contract, DOE is not required to complete disposal of the used fuel until 20 years after the expiration of the reactor's operating license and any extensions thereto.

Despite DOE's statutory and contractual deadlines to begin accepting used fuel and HLW for delivery to and disposal at a permanent repository no later than January 31, 1998, no permanent repository has yet been licensed by the NRC. As of June 2010, 72 lawsuits have been filed by utilities against DOE for missing the 1998 contractual deadline. The U.S. Government's estimated liability for judgments and settlements currently stands at approximately $2 billion, of which approximately $750 million has been paid to date. Under current law, all payments must be made out of the U.S. Department of Treasury's Judgment Fund.

DOE estimates that its potential liability related to the breach-of-contract cases could reach approximately $13.1 billion, assuming a projected date of 2020 for DOE acceptance of fuel for disposal. If that projected 2020 date is delayed, the potential breach-of-contract liability amount could increase by approximately $500 million annually.[6] Because most of the major recurring issues have been resolved in litigation and the outcomes are increasingly predictable, the Federal Government is exploring the possibility of reaching a standard settlement or using an administrative claims process with utilities with pending claims.

II. SITES MANAGED BY THE DEPARTMENT OF ENERGY SUMMARY

For many years, the AEC and then DOE produced used fuel and HLW for national defense and other programmatic missions. During most of that period, the United States did not have the environmental regulatory structure or cleanup technologies that exist today. Today, DOE's remediation activities at the various contaminated sites are mainly governed by the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"),[7] the Resource Conservation and Recovery Act ("RCRA"),[8] the National Environmental Policy Act ("NEPA"),[9] and the Federal Facility Compliance Act ("FFCA").[10]

In 1989, DOE established the Office of Environmental Management ("EM") to clean up the legacy of five decades of nuclear weapons development and government-sponsored nuclear research. In addition to the statutes noted above, DOE's cleanup work at most sites is governed by one or more regulatory agreements or orders that set forth schedules, milestones, and cleanup processes. As described in greater detail below, agreements applicable to DOE facilities in Colorado and Idaho require removal of used fuel from the state by 2035.[11] No removal dates are specified for used fuel or HLW from other states.[12]

DOE-Managed Used Fuel

DOE's used fuel was mainly produced at the Hanford Site ("Hanford"), the Idaho National Laboratory ("INL"), and the Savannah River Site ("SRS"). Numerous other sites also produced smaller quantities of used fuel, including Oak Ridge National Laboratory, Brookhaven National Laboratory, and various universities. Hanford, INL, and SRS are the primary storage locations

for DOE used fuel. DOE manages used fuel from defense and non-defense activities. Defense materials include used fuel from DOE production reactors and research reactors. Non-defense materials include core debris from the Three Mile Island Unit No. 2 reactor; commercial power demonstration projects (*i.e.*, Shippingport, Peach Bottom, Fort Saint Vrain); domestic research reactors; and foreign research reactors.

Table 2. DOE Used Fuel Inventory: Defense and Non-Defense.[13]

DOE Facility	Quantity of Used Fuel (in MTHM)	Description
Hanford, WA	2, 130 *Defense: ~ 2,102* *Non-Defense: ~ 27*	• Diverse inventory of used fuel include both DOE-origin and commercial used fuel. • Diverse storage facilities, including both numerous dry storage methods and wet storage pool.
Idaho National Lab, ID	280 *Defense: ~ 36* *Non-Defense: ~ 246*	• Diverse inventory includes both DOE-origin and commercial used fuel. • Diverse storage facilities include wet storage pool and numerous dry storage methods. • Sodium-bonded used fuel stored and may require treatment. • INL will continue to receive foreign research reactor (until 2019) and domestic research reactor used fuel. ***Batt* Settlement Agreement** • **Used fuel into dry storage by Dec. 31, 2023.** • **Used fuel out of Idaho by Jan. 1, 2035.** • **Penalty for missed deadline is payment to State of $60,000/day (subject to appropriations) and potential suspension of used fuel receipts into Idaho.**
Fort St. Vrain, CO	15 *Defense: 0* *Non-Defense: 15*	• Used fuel in NRC-licensed dry storage facility. • Decommissioned commercial scale high-temperature gas-cooled reactor plant. **Agreement** • **Used fuel out of Colorado by Jan. 1, 2035.**
SRS, SC	~ 30 *Defense: ~ 19* *Non-Defense: ~10*	• Used fuels contained in wet storage. • Disposition alternatives for aluminum-clad used fuel under consideration. • Current plan to receive used fuel from foreign research reactors (until 2019) and domestic research reactors.
Other Sites	2 *Defense: <1* *Non-Defense: ~2*	• Oak Ridge National Laboratory, Brookhaven National Laboratory and the National Institute of Standards Testing.
Total	**~ 2,458** ***Defense: ~ 2,149*** ***Non-Defense: ~ 309***	

DOE-Managed HLW

DOE's HLW (as well as low-activity and mixed waste ("LAW")) consists of 88 million gallons of tank waste located in 230 underground storage tanks at Hanford, SRS and INL. One of DOE's most significant environmental, safety and health threats, tank waste is also the most expensive to process and clean up.[14] DOE's current plans call for processing HLW into stable long-lasting glass-type materials or other solid waste forms at various sites and then storing it until accepted at a geologic repository.[15] **Table 3** describes DOE's key HLW obligations.

Table 3. Key DOE Obligations Related to HLW.[16]

Site	Canisters	Tank Waste (gal.)	Tanks	Agreement
Hanford, WA	0 existing ~ 9,700 projected	53 million	177	• **"Tri-Party Agreement" between DOE, EPA and Washington State.** • Sets forth dates for vitrification of HLW. • Requires retrieval of all single-shell tanks by 2040 and completing treatment of tank waste by 2047 (pending DOE change request). • Removal of HLW from site by date certain not established.
Savannah River, SC	~ 2,900 existing ~6,300 projected	33.1 million	49	• Construction of Salt Waste Processing Facility at site to treat and separate the tank waste. • Federal Facility Agreement, Site Treatment Plan, and Consent Order in place. ➢ Requires all tank waste to be removed from canisters by 2028. ➢ No date certain set to require the removal of HLW from the site.
Idaho National Lab, ID	0 existing ~ 3,590 - 5,090 projected	0.9 million	4	• ***Batt* Settlement Agreement signed Oct. 1995.** • DOE must take specified steps for treatment and storage of HLW. • DOE will treat remaining sodium bearing wastes in the Integrated Waste Treatment Facility, which is currently under construction.
West Valley Demonstration Project, NY	275	600,000	Tank waste converted into 275 glass canisters	• West Valley Demonstration Project Act of 1980 makes DOE responsible for solidifying the HLW, disposing of waste created by the solidification, and decommissioning the facilities used in the process. • Vitrification plant was constructed and converted all of the tank waste into 275 canisters of glass-type materials. • Canisters of vitrified HLW on West Valley site until a geologic repository is available.
TOTAL	**~ 3,175 existing** **~19,865 – 21,365 projected**	**90 million gal. tank waste** **8,000-17,000 MTHM total HLW**		

Naval Nuclear Propulsion Program and Idaho Obligations

The Naval Nuclear Propulsion Program ("NNPP"), an integrated program carried out jointly by the Department of the Navy ("Navy") and DOE, generates additional used fuel from the operation of naval reactors. Although Naval used fuel is a very small percentage of DOE used fuel, unlike other sources, production is ongoing. Upon removal from naval reactors, Naval used fuel is stored at INL. It must be removed from Idaho by 2035.

Special Nuclear Material Obligations

In addition to DOE's obligations related to HLW and used fuel, some special nuclear materials, including plutonium and uranium, may require storage in a geologic repository. In many cases, DOE has not yet issued a record of decision governing processing and ultimate disposition of these materials.

III. FOREIGN AND DOMESTIC RESEARCH REACTORS SUMMARY

Foreign Research Reactors

Under the "Atoms for Peace" program established in the 1950s, the United States began entering into bilateral agreements with other nations to provide nuclear technology for non-weapon applications in exchange for commitments by the recipient nations not to develop nuclear weapons. As a part of the program, the United States first leased and later sold to other nations the highly enriched uranium ("HEU") fuel then required to fuel research reactors. Under the lease agreements, used fuel would be returned to the United States.

In 1964, the United States established the "Off-Site Fuels Policy," which continued the policy that the United States would accept used fuel of U.S. origin (including sold fuel) for temporary storage and separation.[17] Under the Policy, U.S. acceptance of used low-enriched uranium ("LEU") fuel and used HEU fuel ended in 1992 and 1988, respectively.

In 1978, the United States created the Reduced Enrichment for Research and Test Reactors ("RERTR") Program to reduce the danger of proliferation by promoting the conversion of research reactors from HEU to LEU. Many foreign reactors made the conversion to LEU fuel contingent upon the continued willingness of the U.S. to accept used fuel.

In 1996, the United States adopted the Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel ("Nuclear Weapons Nonproliferation Policy"), under which U.S. acceptance of spent fuel of U.S.-origin was reinstated through May 12, 2009. The eligible material, then in storage at or anticipated to be generated and discharged by 107 reactors in 41 countries, was estimated to be equivalent to 19.2 metric tonnes of heavy metal ("MTHM") of used nuclear fuel (contained in up to 22,700 individual fuel elements) and up to an additional 0.6 MTHM of target material.

In 2004, DOE extended the foreign reactor used fuel acceptance policy for an additional ten years (through May 12, 2019) for eligible fuel that was irradiated by May 12, 2016. The

extension was justified on the grounds that, as of 2004, the United States had received only approximately 35% of the eligible material due to slower than expected fuel usage, alternative arrangements for used fuel processing, and technical delays in the development of the LEU fuels needed to allow HEU reactors to convert.

In 2009, DOE further modified the foreign reactor used fuel acceptance policy to extend the U.S. used fuel acceptance policy to include "gap material" not covered under the existing policy. "Gap material" was defined as material that poses a threat to national security, is susceptible for use in an improvised nuclear device, presents a high risk of terrorist threat, and lacks access to another pathway to mitigate the security threat. The gap material is to be safely stored at SRS pending disposition. The acceptance of gap material is not estimated to affect the original estimates for the quantity of foreign used fuel that could be transferred to the United States under the Nuclear Weapons Nonproliferation Policy. Most foreign reactor fuel is stored at INL, and is required to be removed from that site by 2035.[18]

Domestic Research Reactors

The federal government also accepts spent fuel from domestic research reactors, of which 41 are currently operational. Van Ness Feldman was unable to determine from publicly available documents the quantity of waste that has been or will be generated by domestic research reactors that the United States is responsible for treating and storing.

IV. FEDERAL TRANSPORTATION COMMITMENTS SUMMARY

DOE's transportation program for used fuel and HLW is complicated because it is decentralized and involves a large number of parties in both government and the private sector over which DOE has limited control. There are numerous transportation commitments memorialized in Standard Contracts, transportation protocols, and transportation plans, but specific information – such as the number of shipments, possible routes, time frame, quantity, and type of material being shipped – is not readily available because it is considered by DOE to be too sensitive to be made public.

DOE transportation of used fuel and HLW is governed by a number of Federal, state, and local statutes and regulations. The principal regulatory agencies for the transportation of used fuel and HLW are the U.S. Department of Transportation ("DOT") and the NRC. DOT is responsible for regulating the safety of radioactive material shipments under several statutes, including the Department of Transportation Act[19] and the Hazardous Materials Transportation Act.[20] The NRC is responsible for licensing and regulating the transfer of special nuclear materials under the Atomic Energy Act of 1954 ("AEA") and the Energy Reorganization Act.

States and local governments also play important roles in used fuel and HLW transportation. States have a responsibility to enforce DOT highway safety regulations concerning Federal motor carrier safety and hazardous materials transportation. All 50 States and the District of Columbia retain responsibility for regulating carrier safety and emergency response issues.[21]

DOE's role in the transportation process is described in the Agency's Transportation Manual ("TM"). The TM standardizes the process and framework of DOE's radioactive material shipments by establishing 14 transportation practices. DOE Headquarters organizations oversee the transportation activities for their respective Offices. The Headquarters organizations responsible for shipping include EM; the Office of Nuclear Energy ("NE"); the Office of Science ("Science"); the Office of Civilian Radioactive Waste Management ("OCRWM"); and the National Nuclear Security Administration ("NNSA").

OCRWM is currently responsible for transporting the used fuel and HLW of NRC licensees. (Note, however, that DOE has proposed to terminate OCRWM in the DOE FY 2011 Budget.) In 2009, OCRWM issued a National Transportation Plan that describes the elements of the national transportation system that OCRWM is developing, the phases of that development effort, and how OCRWM will collaborate with stakeholders in the development and implementation of that system.[22] According to the Plan, DOE anticipates shipping to a repository 63,000 MTHM from commercial used fuel, 2,333 MTHM of DOE and NNPP used fuel, and 4,667 MTHM of DOE HLW.

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[1] **Blue Ribbon Commission on America's Nuclear Future Disclaimer:** This material was prepared at the request of the Blue Ribbon Commission on America's Nuclear Future ("the BRC"). The contents herein do not necessarily reflect the views or position of the BRC, its Commissioners, staff, consultants, or agents. Reports and other documents reflect the views of the authors, who are solely responsible for the text and their conclusions, as well as the accuracy of any data used. The BRC makes no warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed, or represents that the use of any information would not infringe privately owned rights. Any reference to a specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or preference by the BRC.

[2] John Kessler, Electric Power Research Inst., Presentation to Blue Ribbon Commission on America's Nuclear Future, Subcomm. on Transportation and Storage (Aug. 19, 2010), *available at* http://brc.gov/Transportation_Storage_SC/docs/TS_SC_08-19_mtg/2_EPRI_Used_Fuel_Inventory-August_2010_final_John%20Kessler.pdf. EPRI projected that, assuming no new nuclear expansion, commercial used fuel inventories could reach 96,000 MTHM in 2025 and 133,000 MTHM in 2050.

[3] Frank Marcinowski, Office of Envtl. Mgmt., U.S. Dep't of Energy, Overview of DOE's Spent Nuclear Fuel and High-Level Waste (March 25, 2010) ("Used Fuel and HLW Overview"), *available at* http://brc.gov/pdfFiles/Environmental_Management_BRC_03252010.pdf.

[4] U.S. Dep't of Energy, Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War at 24 (Jan. 2009) ("Status Report 2009"); *see also* U.S. Dep't of Energy, The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository 5 (2008) ("Second Repository Report"), *available at* http://www.energy.gov/media/Second_Repository_Rpt_120908.pdf (last visited Aug. 24, 2010) (providing an estimate of 10,300 MTHM).

[5] Nuclear Waste Policy Act of 1982, Pub. Law No. 97-425, 96 Stat. 2201, (1982) (codified as amended at 42 U.S.C. § 10101 *et seq.* (2006)).

[6] Budgetary Implications of Closing Yucca Mountain: Hearing Before the H. Comm. on the Budget, 111th Cong. 5 (2010) (statement of Kim Cawley, Chief, Natural Res. and Physical Res. Cost Estimates Unit, U.S. Cong. Budget Office ("CBO Testimony").

[7] Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-150, 94 Stat. 2767 (1980) (codified as amended at 42 U.S.C. § 9601 *et seq.*).

[8] *See also* Executive Order 12580, Jan. 23, 1987, 52 Fed. Reg. 2923.

[9] National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (1970) (codified as amended at 42 U.S.C. § 4321 *et seq*. (2006)).

[10] Federal Facility Compliance Act of 1992, Pub. L. No. 102-386, 106 Stat. 1505 (1992) (codified at 42 U.S.C. § 6901 (2006)).
[11] *See* Table 2, *infra* n.12 and 120 and pp. 22-24.
[12] *See id*. and Table 3, *infra* n.15 and 147 and Parts II and III.
[13] Used Fuel and HLW Overview, *supra* n.2; *United States v. Batt*, Settlement Agreement at Sec. D (1995), *available at* https://idahocleanupproject.com/Portals/0/documents/1995SettlementAgreement.pdf ("*Batt* Settlement Agreement"); U.S. Dep't of Energy, Kathleen Hain, Idaho Cleanup Project, Idaho Site Spent Nuclear Fuel Management 4 (June 2010) ("Idaho Spent Fuel Management"), *available at* http://www.nwtrb.gov/meetings/2010/june/hain.pdf.
[14] Estimated life-cycle cost of tank waste cleanup is between $87 billion and $117 billion. *See* U.S. Dep't of Energy, Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War at 24 (Jan. 2009) ("Status Report 2009").
[15] Record of Decision for the Dep't of Energy's Waste Management Program: Storage of High-Level Radioactive Waste, 64 Fed. Reg. 46,661 (Aug. 12, 1999).
[16] Used Fuel and HLW Overview, *supra* n.2; *Batt* Settlement Agreement, *supra* n.12; Idaho Spent Fuel Management, *supra* n.12.
[17] Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, Part IV, 61 Fed. Reg. 25,092 (May 13, 1996) .
[18] *See* Part IV.C.2, *infra*, for a description of transportation requirements for this used fuel.
[19] Department of Transportation Act of 1966, Pub. L. No. 89-670, 80 Stat. 931 (1966) (codified at 49 U.S.C. § 1655).
[20] Hazardous Materials Transportation Act of 1975, P.L. 93-633 (1975) (codified as amended at 49 U.S.C. §§ 1801–1812 (2006)).
[21] *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-level Radioactive Waste in the United States*, Nat'l Research Council Comm. on the Transp. of Radioactive Waste at fn 29 (2006), *available at* http://books.nap.edu/catalog.php?record_id=11538 ("National Research Council Study").
[22] U.S. Dep't of Energy, Office of Civilian Radioactive Waste Management, DOE/RW-0603, National Transportation Plan 1 (Jan. 2009), *available at* http://www.csgmidwest.org/About/MRMTP/ShipmentPlanning/NTP_Rev0_January2009.pdf ("2009 National Transportation Plan").