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Radioactive Tank Waste from the Past Production of Nuclear Weapons: Background and Issues for Congress

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Summary

How to safely dispose of wastes from producing nuclear weapons has been an ongoing issue. The most radioactive portion of these wastes is stored in underground tanks at Department of Energy (DOE) sites in Idaho, South Carolina, and Washington State. There have been concerns about soil and groundwater contamination from some of the tanks that have leaked. DOE proposed to remove the "pumpable" liquid waste, classify the sludge-like remainder as "waste incidental to reprocessing," and seal it in the tanks with a cement grout. DOE has argued that closing the tanks in this manner would be a cost-effective and timely way to address environmental risks. Questions were raised as to how much waste would be left in the tanks and whether the grout would contain the waste and prevent leaks. After considerable debate, the 108th Congress included provisions in the Ronald W. Reagan National Defense Authorization Act for FY2005 (P.L. 108-375) authorizing DOE to grout some of the waste in the tanks in Idaho and South Carolina. Congress did not provide such authority in Washington State. This report provides background information on the disposal of radioactive tank waste, analyzes waste disposal authority in P.L. 108-375, and examines potential implications for environmental cleanup. It will be updated as developments warrant.

Background

DOE is responsible for managing defense nuclear waste and cleaning up contamination at sites involved in the past production of nuclear weapons. Among these challenges are the management and disposal of radioactive waste stored in underground tanks at sites in three states: Hanford in Washington, Savannah River in South Carolina, and the Idaho National Laboratory (INL). The production of radioactive materials for nuclear weapons generated 53 million gallons of radioactive waste stored in 177 tanks at Hanford, 37 million gallons in 49 tanks at Savannah River, and nearly 1 million gallons in 11 tanks at the INL. Some of these tanks are deteriorating and are known or suspected to have leaked, contaminating soil and groundwater. Of greatest concern are the tanks at Hanford, 67 of which are known or suspected to have leaked radioactive waste that has migrated through groundwater into the Columbia River. At this time, monitoring data

indicate that the level of radionuclides in the Columbia River meets federal and state water quality standards. There are similar concerns about the possible contamination of the Snake River in Idaho and the Savannah River in South Carolina.

How to decommission (i.e., close) the tanks in a cost-effective and timely manner that mitigates environmental risk and potential exposure of workers has been the subject of controversy. DOE has argued that removing all of the waste in the tanks would take too long to respond to environmental risks from leaking tanks. DOE favors removal of the "pumpable" liquid waste and immobilizing (i.e., binding up) the sludge-like residual waste by filling the tanks with a cement grout to prevent leaks. The waste removed from the tanks classified as "high-level" would be stored for future disposal in a deep geologic repository (see below). Potentially affected states and environmental organizations have raised questions regarding how much waste would be left in the tanks and whether the grout would thoroughly mix with the residual waste to solidify and contain it safely. Although the sludge-like consistency of the residual waste likely would not be as prone to leakage because of its semisolid form, whether pockets or layers of liquid waste may exist within the sludge-like residues and present greater risk of leakage is uncertain.

Although removing all of the waste in the tanks would eliminate the risk of contamination, this alternative poses other risks and challenges. DOE has argued that methods to extract the residual waste after the pumpable liquid waste is removed would generate a new hazardous waste stream that would need to be managed and disposed of safely to protect the environment. DOE also asserts that there would be significant risks of exposure to workers who would remove the residues and manage and dispose of the resulting new waste stream. Once a tank is cleaned, there also would be additional risks to workers who would extract the tank from the ground, and there would be environmental risks from the management and disposal of the contaminated tank metal.

Applicability of the Nuclear Waste Policy Act

How to dispose of the tank waste is further complicated by the legal issue of how much of the waste is "high-level." Under the Nuclear Waste Policy Act of 1982 (NWPA),[1] high-level radioactive waste must be disposed of in a deep geologic repository. Consequently, the tank waste classified as high-level must be removed from the tanks, processed, and stored for disposal in such a repository. In July 1999, DOE issued internal agency Order 435.1 to classify residual tank waste as "waste incidental to reprocessing," rather than as high-level.[2] In effect, this order would exempt the residual tank waste from NWPA requirements for disposal in a geologic repository. DOE proposed to dispose of the residual tank waste at Hanford, Savannah River, and the INL by grouting it in place, as discussed above. Sealing a tank using this method would depend on state concurrence, as DOE must obtain a permit from the state where the tank is located before it can be closed with no further action to be taken.

DOE grouted residual waste in two tanks at the Savannah River site in 2000, with state concurrence. In 2002, DOE issued a Record of Decision to apply Order 435.1 to the

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[1] 42 U.S.C. 10101 et seq.

[2] DOE Order 435.1: Radioactive Waste Management. See CRS Report RL32163, *Radioactive Waste Streams: An Overview of Waste Classification for Disposal*, by Anthony Andrews.

closure of the remaining 49 tanks at the site, and to grout the residual waste it classified as incidental to reprocessing.[3] The Natural Resources Defense Council (NRDC) legally challenged DOE's authority to dispose of the waste in this manner. The state of South Carolina and others filed as "friends of the court," due to concern that states would not have a role under Order 435.1 in determining how much of the residual waste would be left in the tanks. In 2003, a federal district court determined that DOE does not have the authority to classify any of the waste in the tanks as other than high-level, nor to dispose of it permanently on site through grouting or other means.[4]

DOE appealed the 2003 ruling, and in 2004, the U.S. Court of Appeals for the Ninth Circuit reversed the above district court opinion, ruling that the challenge to Order 435.1 was not "ripe" for review.[5] The court noted that DOE had *planned* to implement Order 435.1 to grout the 49 tanks, but had not yet done so. Thus, the court determined that DOE had not violated the NWPA because it had not yet taken such action. The circuit court opinion resulted in allowing DOE to pursue activities under Order 435.1, and NRDC or others then could bring suit if they believed actions *taken* by DOE violate the law.

Waste Disposal Authority in P.L. 108-375

Prior to the appeals court decision, DOE had asked Congress to enact legislation to clarify its authority for Order 435.1 and allow it to proceed with grouting the waste in tanks at Hanford, Savannah River, and the INL. After considerable debate, the 108th Congress included provisions in Section 3116 of the Ronald W. Reagan National Defense Authorization Act for FY2005 (P.L. 108-375) authorizing DOE to classify some of the tank waste in South Carolina and Idaho as incidental to reprocessing and to grout it in place. Congress did not provide this authority in Washington State, where most of the leaking tanks are located. Although this targeted authority is permanent, unless repealed by Congress, funding to implement it is subject to annual authorization and appropriation. An examination of provisions in Section 3116 of P.L. 108-375 follows.

Section 3116(a) authorized the Secretary of Energy, in consultation with the Nuclear Regulatory Commission (NRC), to classify tank waste in South Carolina and Idaho as other than high-level, upon making certain determinations. These determinations are (1) that the waste "does not require permanent isolation in a deep geological repository," as is required for high-level waste, and (2) that highly radioactive radionuclides have been removed from the waste to the "maximum extent practical." Assuming these requirements are met, the Secretary must determine if the radioactivity of the waste will exceed concentration limits for Class C low-level waste.[6] However, the waste could be disposed of according to Class C performance objectives for human *exposure*,[7] regardless

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[3] 67 *Federal Register* 160.

[4] NRDC v. Abraham, 271 F. Supp.2d 1260, 1266 (D. Idaho 2003).

[5] NRDC v. Abraham, No. 03-35711, 2004 WL 2480949 (Nov. 5, 2004). For a case to be ripe, there must be present "injury" (i.e., damage or violation) or significant threat of imminent injury.

[6] 10 C.F.R. 61.55. Low level waste suitable for near surface disposal is classified according to Class A, B, and C. Class C contains the greatest concentration of radionuclides.

[7] 10 C.F.R. Part 61, Subpart C.

of whether the *concentration* exceeds allowable limits. If the concentration does exceed allowable limits, the Secretary must consult with the NRC to develop a plan for the disposal of such waste. In any case, disposal also would be subject to a state-approved closure plan and state permit authorized under other law.

The performance objectives for Class C waste require "reasonable assurances" that concentrations of radioactive materials that may be released into the environment do not result in human exposure to specific levels of radiation. The ability of the grout to accomplish this objective would depend primarily on the extent to which it mixes with the residual waste to prevent leaks from the tank. However, even if a tank leaks, the performance objectives could still be met if the radioactivity decays to allowable levels before contamination migrates and results in human exposure. The objectives also require that protection of individuals from inadvertent intrusion be ensured after institutional controls are removed. Sealing the tanks with a cement grout could provide a barrier to intrusion, and institutional control of the grouted tanks, presumably would continue as long as the Savannah River site and the INL remain federal facilities. Although grouting of the residual waste would be subject to state approval, the authority of states is limited to the hazardous component of the waste.[8] Thus, South Carolina and Idaho presumably would not have the authority to prevent the grouting of a tank based solely on objections to the radioactivity left in the tank, as long as Class C performance objectives are met.

In effect, Section 3116(a) authorizes DOE to grout the residual waste in tanks in Idaho and South Carolina, if it consults with the NRC in making the determination that the waste is not high-level and if it meets the performance objectives for disposing of Class C waste. Section 3116(b) requires the NRC to monitor DOE's implementation of this authority, in coordination with Idaho and South Carolina. If the NRC determines that DOE is not in compliance, it is directed to inform DOE, the state, and the congressional committees with relevant jurisdiction. Section 3116(c) clarified that the waste classification authority in subsection (a) would not apply to any material transported outside of covered states, which are defined as Idaho and South Carolina in Section 3116(d). In effect, the law does not allow DOE to reclassify waste shipped out of South Carolina or Idaho as "incidental to reprocessing" and to dispose of it as low-level waste in other states.

Section 3116(e) addressed the effect of the entire section on other laws and regulations and their application within Idaho and South Carolina. This provision stated that the authority in Section 3116(a) shall not "impair, alter, or modify the full implementation of any Federal Facility Agreement and Consent Order or other applicable consent decree" for a DOE site. These documents specify federal and state requirements applicable to waste disposal and cleanup, and establish legally binding time frames for disposal and cleanup actions. Thus, it appears that Section 3116 leaves the existing agreements for Savannah River and the INL intact, and would not permit DOE to leave more waste in the tanks than previously agreed to. Other provisions in Section 3116(e) clarified that the authority in subsection (a) is binding only in Idaho and South Carolina and that it does not override certain other statutes relevant to waste disposal.

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[8] There is court precedent regarding the lack of state authority to regulate radionuclides. For example, see United States v. Commonwealth of Kentucky, 252 F.3d. 816 (6th Cir. 2001).

Section 3116(f) clarified the availability of judicial review under the Administrative Procedure Act (APA),[9] for "any determination made by the Secretary or any other agency action taken by the Secretary pursuant to this section,"and for any failure of the NRC to carry out its monitoring and reporting responsibilities. However, environmental organizations have expressed concern that the opportunity for citizen suits may be restricted if public notice of agency actions is not provided. Although Section 3116 does not require public notice of actions taken pursuant to it, DOE may be required to provide notice under other federal laws, such as the National Environmental Policy Act and the APA. The disposal of the tank waste is also subject to a state-approved closure plan, the preparation of which may provide opportunity for public notice under state law.

National Academy of Sciences Study

To inform efforts to dispose of the tank wastes, Section 3146 of P.L. 108-375 authorized DOE to arrange for the National Academy of Sciences (NAS) to study the radioactive and hazardous characteristics of the waste in the tanks at Savannah River, the INL, and Hanford; DOE's plans to dispose of and monitor the waste; and alternatives for disposal. The NAS released its final report in April 2006.[10] In brief, the NAS concluded that DOE's "overall approach" to remove most of the waste from the tanks and grout the residual waste in place is "workable." However, the NAS noted that "clear, definitive" answers to questions about certain elements of this approach were not possible because of a lack of information and technical, economic, and regulatory uncertainties, such as the lack of explicit or targeted authority for grouting tank waste in Washington State.

For example, the NAS acknowledged that using a cement grout is likely the most effective method currently available to immobilize the waste left in the tanks after all *retrievable* waste is removed, but noted that the long-term performance of the grout to safely contain the waste left in the tanks is uncertain and necessitates further research. However, the ability to reliably predict performance over thousands of years until all radioactivity decays to harmless levels appears doubtful, likely leaving some uncertainty for a substantial period of time, despite efforts to assess performance over the long-term.

The NAS also noted that many of the facilities to process the waste to be retrieved from the tanks are not constructed or have ongoing problems, and that the regulatory deadlines for tank closure are years away, from 2016 to 2032. The NAS concluded that enough time likely remains to explore ways to remove more of the waste from the tanks before closing them. The NAS recommended that DOE delay the grouting of tanks with greater amounts of residual waste to allow for the development of technologies to retrieve a larger portion of the waste. Further, the NAS recommended $50 million annually over 10 years for a research program to develop more effective methods to remove the waste from the tanks and to ensure the immobilization of residues left in them upon closure.

In its report on the National Defense Authorization Act for FY2007 (H.R. 5122, H.Rept. 109-452), the House Armed Services Committee directed DOE to follow the

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[9] 5 U.S.C. 701-706.

[10] National Academy of Sciences. *Tank Waste Retrieval, Processing, and On-site Disposal at Three Department of Energy Sites*. April 2006. See the Academy's website for the full text of the report at [http://fermat.nap.edu/catalog/11618.html].

NAS's recommendation and establish a Tank Waste Cleanup Research and Development Program. The committee approved an authorization of $20 million for this program in FY2007, subject to appropriations. The House passed H.R. 5122 on May 11, 2006. In its report on the Energy and Water Development Appropriations Act for FY2007 (H.R. 5427, H.Rept. 109-474), the House Appropriations Committee recommended $10 million more than the Administration requested for "Technology Development and Deployment" at former nuclear weapons sites. The committee's report noted that the $10 million increase would be for improving cleanup technologies in general, but did not mention the program that H.R. 5122 would authorize. The House passed H.R. 5427 on May 24, 2006.

Potential Implications for Environmental Cleanup

DOE estimates that the cleanup of the Savannah River site will be complete in 2025 at a cost of $32.1 billion, the INL in 2035 at a cost of $15.3 billion, and Hanford also in 2035 at a cost of $60.0 billion. The disposal of the tank waste at these sites is among the greater challenges to completing cleanup, along with remediation of existing soil and groundwater contamination. The authority in Section 3116 of P.L. 108-375 has implications in terms of cost and pace of cleanup at both Savannah River and the INL. DOE continues to assess alternatives and costs for the disposal of the tank waste at Hanford under other authorities, but a final decision has not been made.[11] Based on a 2002 assessment, DOE has estimated that grouting residual tank waste at the Savannah River site would cost between $3.8 million and $4.6 million per tank, compared with a cost of greater than $100 million per tank to remove and dispose of all of the waste and to clean and remove the tank.[12] The per tank closure costs at the INL likely would be lower because the tanks there contain less waste than those at the Savannah River site.

Grouting the tank wastes also has implications in terms of environmental risk. If the grout is effective in solidifying the residual waste and containing it safely, this disposal method could provide a less costly and faster means of addressing risks. On the other hand, the possibility of future leaks and resulting environmental contamination remains if the grout does not mix thoroughly with the residual waste to solidify it completely, as potentially affected states and environmental organizations have noted. Whether contamination resulting from tank leaks could migrate and present a potential risk of human exposure would depend on many factors, including the hydrological conditions of the site and the effectiveness of any engineered or natural geologic barriers to migration. If a grouted tank leaked and contamination resulted, the federal government would remain liable for cleanup according to applicable federal and state requirements. Depending on the extent of contamination, potential risk of human exposure, and remedial actions selected to address such risk, the time and costs to clean up contamination from tank leaks could offset the initial savings from grouting the residual waste.

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[11] In February 2006, DOE issued a Notice of Intent to prepare a new Environmental Impact Statement for tank closure and waste management at Hanford. (See 71 *Federal Register* 5655.)

[12] DOE, *Savannah River Site High-Level Waste Tank Closure Final Environmental Impact Statement*, DOE/EIS-0303, May 2002, p. S-21.