DISPOSING OF WEAPONS-GRADE PLUTONIUM

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Abstract

A U.S. Department of Energy project to convert excess weapons-grade plutonium into fuel for commercial nuclear reactors to fulfill an international agreement with Russia is billions over budget and well over a decade behind schedule. This in and of itself is a problem, but the larger problem is that failure to complete the project endangers worldwide nonproliferation and disarmament efforts and leaves one of the biggest stockpiles of weapons-grade plutonium unaddressed. This decision memo reviews several technical reports that have been conducted and recommends pursuing a new strategy to renegotiate the agreement with Russia to allow for the dilution and disposal of the excess plutonium at the Waste Isolation Pilot Plant in New Mexico.

Advisor: Professor Paul Weinstein

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Amy Thomas
Decision Memo
To: Department of Energy Secretary Ernest Moniz
From: Senior DOE Staff
Re: Disposing of Weapons-Grade Plutonium

Action-Forcing Event

After extensive analysis, the Plutonium Disposition Red Team ("Red Team") issued a final report laying out the technical and economic implications of two options for the United States to fulfill its commitment to dispose of 34 metric tons of surplus weapons-grade plutonium as agreed in 2000 Plutonium Management and Disposition Agreement (PMDA) with Russia.[1] The Department of Energy (DOE) must make a decision on how to proceed so that funding for the selected option can be correctly allocated in the Department's budget submission to the Office of Management and Budget (OMB) and renegotiation of the Agreement with Russia can begin, if necessary.

Statement of the Problem

Under the 2000 Plutonium Management and Disposition Agreement (PMDA), the United States and Russia each committed to dispose of 34 metric tons of excess weapons-grade plutonium.[2] In the United States, "disposing" meant processing the plutonium into Mixed Oxide Fuel (MOX) that could be used to power commercial nuclear reactors, rendering waste that is much less easily repurposed into nuclear weapons. Originally scheduled for completion in September 2016 at an estimated cost of $1 billion, the MOX

[1] "Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015.
[2] Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation, United States-Russia, September 2000.

project is an estimated 15 years away from completion and will cost $30 billion over the life of the project.[3]

The fact that the project is billions over budget and well over a decade behind schedule is a problem in and of itself. However, the larger problem is that failure to complete the project endangers worldwide nonproliferation and disarmament efforts and leaves one of the biggest stockpiles of weapons-grade plutonium unaddressed. The Nuclear Threat Initiative advocacy group notes that, "From a nonproliferation standpoint, plutonium is of the greatest concern because only 8 kilograms are needed to make a nuclear bomb."[4] While the material is securely stored at the Savannah River Site (SRS) in South Carolina and other DOE facilities, the longer it remains in its unaltered state, the longer it remains a security threat. Moreover, even in the event that the project is finished and starts producing MOX fuel, there are currently no utilities who have definitively said that they will buy it to fuel their power plants.

History

A 1994 report published by the National Academy of Sciences stated that the surplus of nuclear material resulting from the "many thousands of U.S. and Russian nuclear weapons [slated] to be retired" pursuant to the first and second Strategic Arms Reduction Treaties and other commitments made by the United States and Russia represented a "clear and present danger to national and international security."[5] This danger was intensified by the "political and economic crises" that characterized the years

[3] "Audit Report: Cost and Schedule of the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site," *Office of Inspector General, U.S. Department of Energy, Office of Inspector General*, May 2014, 2.
[4] Elena Sokova,"Plutonium Disposition," *Nuclear Threat Initiative*, July 1, 2002.
[5] "Management and Disposition of Excess Weapons Plutonium," *National Academy of Sciences*, 1994, 1.

immediately after the dissolution of the Soviet Union.[6] It was in this context that the U.S. and Russia began exploring mutual means to secure and dispose of excess weapons-grade plutonium.

The 1994 National Academy of Sciences report explored three disposition options: spent fuel, vitrification and deep-borehole. The first option, spent fuel, involved mixing the excess plutonium with uranium to create MOX fuel that would then be used to power commercial nuclear reactors, resulting in waste that cannot easily be repurposed into nuclear weapons. The next option, vitrification, involved immobilizing the excess plutonium by encasing it in glass and burying it at a secure high-level waste site. In the third option, deep borehole, the waste is buried deep underground.

Russia, viewing its' "…excess plutonium as an asset that should be used to produce energy," favored the spent fuel/MOX strategy.[7] Moreover, Russia did not view "immobilization alone to be an acceptable approach because immobilization, unlike irradiation of MOX fuel, fails to degrade the isotopic composition of the plutonium," meaning that, in Russia's opinion, the waste could more easily be dug up by the United States and reused for nuclear weapons.[8] The countries struck a compromise in the Plutonium Management and Disposition Agreement (PMDA), signed in September 2000: each country committed to dispose of 34 metric tons of excess weapons-grade plutonium, the U.S. took a hybrid approach, agreeing to dispose of 25.57 metric tons of plutonium material by MOX irradiation and 8.43 metric tons by immobilization, while Russia

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[6] "Management and Disposition of Excess Weapons Plutonium, *National Academy of Sciences*, 1994, 19.
[7] Anatoli Diakov, "Disposition of Excess Russian Weapon HEU and Plutonium," *Center for Arms Control, Energy and Environment Studies*, February 2012, 5.
[8] Surplus Plutonium Disposition Program, 67 Fed. Reg. 76 (April 19, 2002). *Federal Register: The Daily Journal of the United States.*

agreed to dispose of all 34 metric tons of plutonium material by MOX irradiation. [9] However, in April 2002, the Department of Energy announced that only one method of plutonium disposition could be supported with the funds available.[10] To ensure Russia's continued participation in the PMDA, DOE decided that it would only pursue the MOX approach.[11]

In 1999, in anticipation of the U.S.-Russian agreement, the National Nuclear Security Administration (NNSA), a semi-autonomous agency within the DOE, contracted with a consortium now known as CB&I AREVA MOX Services, LLC, to design, build and operate a MOX Fuel Fabrication Facility (MFFF) at the DOE-owned Savannah River Site (SRS) in Aiken, South Carolina.[12] At the time, the MFFF was estimated to cost $1 billion to design and build and expected to begin operation in 2016.[13]

Though often referred to as one facility, the MFFF originally consisted of three large projects: a Pit Disassembly and Conversion Facility (PDCF), where nuclear weapons pits are disassembled and the resulting plutonium metal is converted into an oxide form; a Mixed Oxide Fuel Fabrication Facility, to produce the MOX fuel for irradiation in domestic reactors; and a Waste Solidification Building to handle the waste from the MFFF. [The PDCF, a "first-of-its-kind" facility in the United States, was

[9]Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation, United States-Russia, September 2000.
[10] Surplus Plutonium Disposition Program, 67 Fed. Reg. 76 (April 19, 2002). *Federal Register: The Daily Journal of the United States.*
[11] Ibid.
[12] "About the MOX Project," *CB&I Areva MOX Services, LLC*. http://www.moxproject.com/about/, ND.
[13] Mark Holt and Mary Bet D. Nikitin, "Mixed Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues," *Congressional Research Service*, March 2, 2015, 9.

cancelled in June 2012 in an effort to slow increased costs after DOE determined that it could use existing facilities to perform this segment of the process.][14]

The *Fiscal Year 2003 Defense Authorization Act* included a provision inserted at the behest of Senator Lindsay Graham (R-SC) stipulating that if the MFFF did not start processing at least one ton of plutonium a year by 2016 the Department of Energy must begin removing it from the state or pay up to $100 million in penalties annually for up to five years.[15] In 2005, the Nuclear Regulatory Commission (NRC) issued a construction permit for work to begin at the MFFF. That same year, however, DOE reported in its FY 2006 budget request what was to become the first of many delays due to a "disagreement with Russia over liability protection for contractor work performed in [Russia]."[16] By July 2005, the estimated price tag had been revised to $3.5 billion.[17] The liability issue was eventually resolved, but by the time construction at the Savannah River Site began in 2007, the estimated cost had risen to approximately $4.7 billion, an increase that NNSA attributed to revisions to the original cost baseline and "underestimates of design costs and inflationary increases of the cost of materials during the time interval between project estimates."[18] The project suffered another blow in late 2008 when Duke Energy, the only utility that had agreed to test MOX fuel in two of its reactors, let its contract to buy MOX produced at the MFFF expire, due to concerns about cost and the availability of a steady

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[14] "Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options," *U.S. Department of Energy*, April 2014, 10.
[15] "Bob Stump Defense Authorization Act for Fiscal Year 2003," (Section 3181 of P.L. 107-314 as amended by P.L. 112-239).
[16] U.S. Department of Energy, *National Nuclear Security Administration Fiscal Year 2007 Congressional Budget Request* (Vol.1,534), February 2006.
[17] Mark Holt and Mary Bet D. Nikitin, "Mixed Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues," *Congressional Research Service*, March 2, 2015, 8.
[18] "National Nuclear Security Administration Fiscal Year 2007 Congressional Budget Request (Volume I)," *U.S. Department of Energy*, February 2006, 496.

fuel supply.[19] Following Duke's announcement, the Tennessee Valley Authority (TVA), a federally-owned utility, signed an Interagency Agreement with DOE to "investigate the potential for use of MOX fuel in TVA reactors."[20] Five years later, TVA continues to hedge on whether it can and will accept MOX.[21]

In 2010, the Plutonium Management Disposition Agreement was amended because the "Russian program set forth in 2000 proved incompatible with Russia's nuclear energy strategy and was, thus, not financially viable."[22] The amended Protocol, which became effective on July 13, 2011, "laid out conditions for Russian use of the plutonium as fast reactor fuel, including restrictions on breeding additional plutonium in fast reactors," and stipulated that both countries would begin disposition in 2018.[23] But the 2018 target date quickly began to look overly ambitious for the United States. At the end of Fiscal Year 2012, the contractor submitted an updated baseline change proposal that increased the total project cost from $4.8 billion to $7.7 billion and pushed the start date from October 2016 to November 2019.[24] NNSA's FY 2011 – FY 2013 budget requests to Congress listed several chronic problems on the project that got progressively worse, including difficulty finding suppliers and subcontractors with sufficient technical and safety expertise and very high personnel turnover.

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[19] Bruce Henderson, "MOX fuel testing expires," *The Herald*, March 20, 2009.
[20] "Potential Use of MOX in TVA Reactors Supplemental Environmental Impact Statement," *Tennessee Valley Authority*, April 29, 2015.
[21] Dave Flessner, "TVA awaits decision on getting fuel made from surplus nuclear warheads," *Times Free Press*, May 6, 2015.
[22] "2000 Plutonium Management and Disposition Agreement," *Office of the Spokesman, U.S. Department of State*, April 13, 2010.
[23] Mark Holt and Mary Bet D. Nikitin, "Mixed Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues," *Congressional Research Service*, March 2, 2015, 4.
[24] "National Nuclear Security Administration Fiscal Year 2014 Congressional Budget Request (Vol. I*)," U.S. Department of Energy*, April 2013, DN-119.

The project's fiscal situation did not improve and NNSA, while saying it remained "committed to the plutonium disposition mission," sought to "slow down the MOX project" and other associated activities while it examined alternative methods in its Fiscal Year 2014 budget request.[25] A Plutonium Disposition Working Group was tasked with reviewing the cost and feasibility of five disposition options, including the current MOX option. After reviewing the Working Group's extensive assessment, DOE announced in its Fiscal Year 2015 budget request that, "Based upon ongoing analysis, [it had] determined that the MOX fuel approach is significantly more expensive than anticipated, even with consideration of potential contract restructuring and other improvements… due to these increases, the MOX fuel approach is not viable within available resources. As a result, MOX will be placed in cold standby while further studied. Upon selecting a preferred option, DOE will commission an independent assessment of the option."[26] The total lifecycle cost of the project was now an estimated $30 billion. The budget request went on to say that DOE would not meet the deadline to start processing at least one ton of plutonium by 2016, as directed in the *Fiscal Year 2003 Defense Authorization Act*, and therefore had stopped transferring plutonium into South Carolina and stated that it would prepare a report for Congress on options for removing plutonium from the state.[27]

State leaders and South Carolina's congressional delegation were up in arms. On March 18, 2014, the State of South Carolina filed a lawsuit to block DOE from putting

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[25] "National Nuclear Security Administration Fiscal Year 2014 Congressional Budget Request (Vol. I*), " U.S. Department of Energy*, April 2013, DN-119.
[26] *"*National Nuclear Security Administration Fiscal Year 2015 Congressional Budget Request (Vol.1)," *U.S. Department of Energy,* March 2015, 527).
[27] Ibid.

the MFFF in cold standby. The *Fiscal Year 2015 National Defense Authorization Act* and *Fiscal Year 2015 Further Continuing Appropriations Act* each directed DOE to conduct independent assessments of the Plutonium Working Group report. $345 million was appropriated to continue construction at the MFFF and an explanatory statement barred the NNSA from placing the project in cold standby.

Concurrently, the Aerospace Corporation was tasked with conducting the independent assessment of the Working Group. Its "Phase 1" report examining disposition options – the MOX and dilute and dispose (also known as "down blend") was published on April 13, 2015 and concluded that, "…even the best case scenario for the remaining MOX approach would be more expensive and riskier than the worst case scenario for the dilute and dispose approach, assuming that the latter approach is sufficient for compliance with the PMDA and is efficiently enabled in cooperation with the State of New Mexico."[28] Again, the South Carolina delegation contested the validity of the report. To quell the protests, the Department of Energy requested Thomas Mason, Director of the Oak Ridge National Laboratory, assemble a "Red Team Review" to "[evaluate] and [reconcile] previous cost estimates of plutonium disposition options; [analyze] ways to modify the MOX fuel approach, specifically the MOX Fuel Fabrication Facility Protect, to reduce costs if feasible; and [examine] how different risk assumptions can impact the total lifecycle cost estimates."[29]

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[28] "Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, xi.
[29] Memorandum from U.S. Department of Energy Secretary Ernest Moniz to Oak Ridge National Laboratory Director Thomas Mason, June 25, 2015.

Background

Current State of the Problem

The Red Team report found that in order for the MOX approach to be successful, "…annual funding for the whole program (MFFF plus other activities that produce feed material and support fuel licensing and reactor availability) would have to increase from the current ~$400 million per year to ~$700-$800 million per year over the next 2-3 years, and then to remain at ~$700-$800 million per year until all 34 megatons are dispositioned (in FY15 dollars)."[30] The report goes on to say that "The dilute and dispose option could be executed at approximately the current $400 million annual program funding level over roughly the same timeframe as the MOX approach."[31]

The Department of Energy has adeptly sidestepped taking a position on whether or not to pursue the MOX strategy to plutonium disposition by insisting that alternative approaches needed to be fully evaluated before next steps could be taken. The Red Team has produced an authoritative report on the issue and it is time now to make a decision and move forward.

Players/Actors

- Russian President Vladimir Putin, the Russian Duma and the Russian Ministry of Foreign Affairs
- Secretary of State John Kerry
- Senator Lindsay Graham (R-SC)

[30] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, x.
[31] Ibid.

    - *Member, Senate Committee on Appropriations, Subcommittee on Energy and Water Development*
- Senator Tim Scott (R-SC)
- Congressman Joe Wilson (R, SC-02)
    - *Most of the Savannah River Site is in his district*
- Congressman Jim Clyburn (D, SC-06)
    - *Assistant House Democratic Leader; House Democratic leadership liaison to the Appropriations Committee*
- South Carolina Governor Nikki Haley (R)
- Senator Martin Heinrich (D-NM)
    - *Member, Senate Committee on Energy and Natural Resources*
- Senator Tom Udall (D-NM)
    - *Member, Senate Committee on Appropriations, Subcommittee on Energy and Water Development*
- Congressman Steve Pearce (R, NM-02)
    - *Waste Isolation Pilot Project is in his district*
- New Mexico Governor Susan Martinez (R)
- Senator Dianne Feinstein (D-CA)
    - *Ranking Member, Subcommittee on Energy and Water Development, Senate Committee on Appropriations*
- Senator Lamar Alexander (R-TN)
    - *Chairman, Subcommittee on Energy and Water Development, Senate Committee on Appropriations*

- Senator Lisa Murkowski (R-AK)
    - *Chairman, Senate Committee on Energy and Natural Resources*
- Senator Maria Cantwell (D-WA)
    - *Ranking Member, Senate Committee on Energy and Natural Resources*

Policy Proposal

Abandon the MOX effort in South Carolina and pursue the dilute and dispose approach, with final disposition at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

Policy Authorization

Abandoning the MOX effort in favor of the dilute and dispose approach to plutonium disposition will require renegotiation of the Plutonium Management and Disposition Agreement (PMDA) with Russia. The *Waste Isolation Pilot Plant Land Withdraw Act of 1992* will also need to be amended to increase the statutory capacity for waste disposal at WIPP.[32]

Policy Implementation

To implement this change in policy, the U.S. Department of State, with the assistance of the Department of Energy, would need to renegotiate of the PMDA with the Russian Ministry of Foreign Affairs. A renegotiated PMDA would need to be ratified by the Russian Duma. Congress would need to approve, and the President would need to

[32] Hendrick, Scott, "Waste Isolation Pilot Plant," *NCSL.org*, last modified March 8, 2016.

sign into law, an amendment expanding the storage capacity of the *Waste Isolation Pilot Plant Land Withdraw Act of 1992*. The State of New Mexico and the Environmental Protection Agency (EPA) would need to agree to issue the required environmental permits for expansion of waste disposal at WIPP. DOE and NNSA will need to move quickly to reopen WIPP and make it capable of accepting the additional waste safely and securely. The States of South Carolina and New Mexico and their congressional delegations will either need to agree to this policy proposal or their objections (and lawsuits) will need to be overcome. After each of these hurdles are overcome, full disposition of the 34 metric tons of the excess plutonium is estimated to cost approximately $400 million per year (in 2015 dollars) for 18 years.[33]

Policy Analysis

The implications of changing course from a MOX approach and to the dilute and dispose method of plutonium disposition have been well-studied and the results have been remarkably similar. The positive aspects of pursuing the dilute and dispose method can be broadly categorized as listed below. The dilute and dispose method is:

- **Technologically simpler –** The nation's top nuclear waste and weapons experts assembled in the Red Team found that the "…risks associated with the dilute and dispose option are far lower than the MOX approach, since

[33] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, x.

both the technology and the disposition process associated with Dilute and Dispose are far simpler;"[34]

- **Offers greater opportunities for efficiency -** "Unlike the MOX approach, the dilute and dispose approach offers opportunities for the introduction of efficiencies which could reduce life cycle duration and cost, many of which could be implemented after the program is underway; [35]

- **Removes the significant risk that DOE will not be able to find a utility to use the MOX fuel -** "From a utility perspective, the risks to MOX fuel use are large and will potentially require a substantial price discount, perhaps to the point of being 'free' in the beginning to incentivize the utility to make modifications to their reactor and go through the NRC license amendments, to use fuel that is less optimum than their current fuel;"[36]

- **Likely to be accommodated by Russia -** "The combination of evolving international circumstances and the fact that the U.S. has already

[34] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, xi.
[35] "Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options," *U.S. Department of Energy,* April 2014, 21.

[36] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, 22.

accommodated a Russian national interest in a previous PMDA modification causes the Red Team to believe that the federal government has a reasonable position with which it enter PMDA negotiations" and, [37]

- **Is significantly less expensive** – As previously stated, the dilute and dispose approach can be executed at current funding levels (about $400 million annually), whereas successful execution of the MOX approach would require doubling that number – something that is extremely unlikely in the very tight current budget environment that is expected to last for the foreseeable future.

While the potential positive implications of switching from a MOX to dilute and dispose approach to plutonium disposition have been found to be numerous, there is one major downside: successful execution is *entirely* dependent on the reopening and expansion of the Waste Isolation Pilot Plant (WIPP). Located outside Carlsbad, New Mexico, WIPP is the United States' only facility for permanent storage of transuranic waste.[38] In February 2014, two unrelated incidents took place: first, a salt truck caught on fire, and a few days later, low levels of airborne radioactive contamination were detected onsite.[39] WIPP has not accepted waste for disposal since these two incidents, though DOE estimates that the facility will be restarted in mid-2016.[40]

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[37] Ibid.
[38] "Waste Isolation Pilot Plant (WIPP)," *EPA.gov*, last modified October 29, 2015.
[39] "What happened at WIPP in February 2014," *wipp.energy.gov*, last modified February 25, 2016.
[40] Mike English, "WIPP will be reopened within a year, U.S. energy chief says," *BizJournals.com*, March 26, 2015.

While reopening WIPP is a short-term obstacle to implementing the dilute and dispose option, the greater challenge is expanding WIPP's capacity. "The WIPP currently has a legislated capacity limit of 176,000 cubic meters and to date has emplaced about 91,000 cubic meters. 66,000 cubic meters of the remaining 85,000 cubic meters is already subscribed by known transuranic (TRU) waste generators, leaving about 19,000 cubic meters for support of future TRU waste generators such as the plutonium disposition program."[41] But disposition could begin immediately as "…well over half of the entire dilute and dispose operation could be completed before facility expansion would be needed." There are no substantive physical or technical constraints on expanding WIPP – the primary risks with this approach are political in nature.

Political Analysis

The broader political implications to the Administration as a whole are limited as President Obama is serving the last year of his second term. But that does not mean the proposal to change plutonium disposition strategy from a MOX approach to a dilute and dispose approach can be made in a political vacuum. On one hand, even just making the decision to pursue the dilute and dispose option before the end of his Administration would be an accomplishment for President Obama, who in announced nuclear security and nonproliferation would be two of his main foreign policy focuses in a 2009 speech in Prague. On the other hand, though this Administration will soon be gone, the Department of Energy will remain and a miscalculation could have long-term political implications for the Department on Capitol Hill and hurt the Department's legitimacy when it sites

[41] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, 7.

future projects. If a Republican wins the White House and Republicans maintain their majorities in Congress, that could give the mostly Republican South Carolina delegation leverage to retaliate against DOE if the dilute and dispose approach is selected. Within this context, a more granular look at the political pros and cons follows.

Representative. Pearce and Senators Udall and Heinrich

The WIPP facility lies entirely within the congressional district of Representative Steve Pearce. It is an important economic asset to his district and New Mexico as a whole, employing approximately 200 miners and 300 "technically skilled workers."[42] In recent years, Pearce, fearful that a dwindling amount of DOE-generated waste would lead to lay-offs, has tried to amend the *Waste Isolation Pilot Plant Land Withdraw Act of 1992* to allow WIPP to accept all federally-owned transuranic waste.[43] Most recently, in 2013, an amendment he sponsored to permit this change was added to the *Fiscal Year 2014 National Defense Authorization Act (NDAA)* that passed out of the House.[44] While he has not specifically addressed the possibility of WIPP accepting down blended weapons-grade plutonium, Rep. Pearce's eagerness to allow WIPP to accept non-DOE produced waste indicates that he would be open to do so.

A spokeswoman for Senator Martin Heinrich at the time said that he supported Rep. Pearce's amendment to the *FY14 NDAA* and noted that he had co-sponsored a similar proposal with Rep. Pearce when he was in the House.[45] Senator Heinrich often

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[42] Todd Willens, "Statement to the Radioactive and Hazardous Materials Committee," New Mexico Legislature, July 18, 2011.
[43] "Congressman Pearce Introduces Legislation to Protect WIPP," Office of U.S. Congressman Steve Pearce press release, May 9, 2013.
[44] James Monteleone, "House passes Pearce amendment to expand WIPP's role," *Albuquerque Journal*, June 19, 2013.
[45] Michael Coleman, "Pearce, Udall spar over WIPP measure," *Albuquerque Journal*, December 11, 2013.

speaks highly of WIPP's contribution to the nation's security, saying in late 2014 that "Our nation's security relies heavily on the important work being done at WIPP. Not only is the facility an integral part of the environmental cleanup of Cold War programs at Department of Energy defense sites around the country, including Los Alamos, it also supports many jobs in New Mexico."[46] Senate Democrats have a good chance of taking back the majority of the Senate in the upcoming election, which would allow Heinrich, a member of the Senate Energy and Natural Resources Committee, to exert more influence – either in support of or opposition to – an expansion of WIPP.

Senator Tom Udall has also publicly praised WIPP as "pivotal to both our national security and our energy security."[47] However, as Attorney General of New Mexico in the early 1990s, Udall sued the Department of Energy to prevent the transfer of radioactive waste into WIPP.[48] And Udall was publicly accused by Rep. Pearce of surreptitiously opposing his amendment to expand the type of waste WIPP can accept (which did not ultimately make it into the final version of the bill that became law).[49]

State of New Mexico Local Host Communities

New Mexico, with both the local community and state actively advocating to host a storage site for high-level nuclear waste, embodies what the White House meant when it announced it would prioritize a "consent-base" approach to siting for nuclear waste.[50]

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[46] "Udall, Heinrich Announce $324 Million for WIPP Cleanup, Recovery," Office of U.S. Senator Martin Heinrich press release, December 22, 2014.
[47] Ibid.
[48] State of NM Ex Rel. Udall v. Watkins, 783 F. Supp. 633 (D.D.C. 1992)
[49] Michael Coleman, "Pearce, Udall spar over WIPP measure," *Albuquerque Journal*, December 11, 2013.
[50] "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," *U.S. Department of Energy*, January 2013.

The state and local community have embraced its role as a site for nuclear waste and even lobbied for more disposal projects.

The City of Carlsbad, New Mexico, established a "Mayor's Nuclear Task Force" to "advise Mayor [Dale] Janway on items of interest related to the Waste Isolation Pilot Plant and of opportunities for additional nuclear projects in the area."[51] The City's home page proudly advertises that "In the 1970s, when other communities in the country were mechanically opposing any project with the word 'nuclear' in it, the residents of Carlsbad indicated an interest in getting more information about hosting a repository," and, that "Because the [WIPP] project has gone so well, many Carlsbad residents are now open to the possibility of having additional nuclear projects in the regions remote salt beds."[52] The city lobbied for adoption of Rep. Pearce's amendment to expand the scope of TRU waste that WIPP can accept, and, immediately following the release recommendations of a congressional blue-ribbon panel on nuclear waste, city representatives traveled to Washington to reinforce WIPP's "position as a potential site for future nuclear waste disposal."[53] Carlsbad's county, Eddy County, joined with Lea County to form the Eddy-Lea Energy Alliance, to promote the area as a site for interim nuclear waste storage.[54] The City of Carlsbad has itself spent more than $250,000 lobbying to host the site.[55]

At the state level, Republican Governor Susanne Martinez has also advocated for New Mexico as a potential interim storage site for the radioactive waste produced by

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[51] "About Us," *The Carlsbad Nuclear Nexus*. http://www.carlsbadnuclearnexus.com/About_Us.html, ND.
[52] Ibid.
[53] Tom Schneider, "CDOD delegation discusses nuclear issues in Washington," *Current-Argus City*, October 1, 2009.
[54] "Eddy-Lea Energy Alliance," Eddy-Lea Energy Alliance, http://www.eddyleaenergyalliance.com/, ND.
[55] Patrick Malone, "New Mexico leaders push for high-level nuclear waste, *Santa Fe New Mexican*, April 25, 2015.

nuclear power plants.[56] In an April 10, 2015, letter to the Department of Energy, Governor Martinez touted southern New Mexico as an ideal storage site, writing that "In one of the most remote areas of the state, they have had the ingenuity and fortitude to carve out a niche in the nuclear industry to broaden their economic base."[57] Martinez's willingness to advocate for her state to host high-level nuclear waste site indicates that she would be open to expanding WIPP to accept down blended plutonium from disassembled nuclear weapons. While she will leave office at the end of 2018 (she is term-limited), she could probably set the state environmental permitting process in motion prior to her departure (expanding WIPP will require a Resources Conservation and Recovery Act (RCRA) permit for hazardous wastes from the New Mexico Department of the Environment).[58]

Senators Graham and Scott; Congressmen Clyburn and Wilson; and the State of South Carolina

As senior legislators sitting in positions of committee and party power, Senator Lindsay Graham (R-SC) and Representative Jim Clyburn (D-SC) are perhaps the most formidable obstacles of scrapping the MOX plant in favor of the dilute and dispose approach. Senator Graham has been the most vocal opponent and has twice wielded his power as a member of the Senate Appropriations Subcommittee on Energy and Water Development to prevent the Administration from putting MOX in "cold standby." He is

[56] "New Mexico lobbies to be high-level nuclear waste storage site," *New York Daily News*, April 27, 2015.
[57]Letter from New Mexico Governor Susana Martinez to U.S. Department of Energy Secretary Ernest Moniz, April 10, 2015.
[58] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, 31.

adamant that the MOX project continue as planned despite the cost overruns and delay, saying "We made a promise to South Carolina and really, the world, to dispose of this material through MOX. There is no viable alternative. There have been some cost overruns that need to be dealt with, but I don't see an alternative that is cheaper or practical."[59] South Carolina's junior senator, Senator Tim Scott (R-SC), has let Senator Graham take the lead on this issue, given his place on the Senate Appropriations Committee, and has echoed Graham's sentiments.

Congressman Jim Clyburn (D, SC-06) has been less vocal in his opposition to the Administration's efforts than Senators Graham and Scott but is nonetheless opposed and, as Assistant House Democratic Leader and the House Democratic leadership liaison to the House Appropriations Committee, is in a position to prevent a shift in strategy on plutonium disposition. Most of the Savannah River Site lies in the congressional district of Representative Joe Wilson (R, SC-02). Like Senator Graham, Congressman Wilson has been a vociferous opponent of abandoning the MOX effort but, unlike Graham, is not an appropriator.

State of South Carolina

Like their congressional delegation, the state of South Carolina has been dogged in its efforts to thwart a change in the plutonium disposition strategy to anything but MOX. As previously mentioned, South Carolina Attorney General Alan Wilson filed a lawsuit in March 2014 to block the Department from putting the MFFF in cold standby,

[59] Mary Troyan, "Graham dismisses search for MOX alternative," *The State*, March 26, 2015.

as the Department requested in its FY15 budget request. Following the release of the Red Team report, Attorney General Wilson again wrote to the Department, "with the support of [South Carolina's] Congressional, State and local representatives," notifying the Department of "potential litigation" should a decision be made to scrap the MFFF.[60]

As Attorney General Wilson noted in his letter, he has the full support of Republican Governor Nikki Haley. Haley has repeatedly said that the MOX plant is "…a promise made to those people [the MFFF employees] and it was a promise made to the state of South Carolina," and made clear that cancelling the plant would elicit a fight from the state, saying "It's only right that we turn around and we show D.C. you can't break promises with the people of South Carolina."[61]

Capitol Hill

By and large, the major players on this issue on the Hill, aside from the South Carolina delegation, have been Senate Appropriations Subcommittee on Energy and Water Development Chairman Lamar Alexander (R-TN) and Dianne Feinstein (D-CA); Senate Energy & Natural Resources Chairman Lisa Murkowski (R-AK) and Ranking Member Maria Cantwell (D-WA), and House authorizers and appropriators have not definitively weighed in on the subject. Oversight of three big Department projects plagued with cost-overruns and delays, including the MOX plant, have been a priority for Senators

[60] Letter from South Carolina Attorney General Alan Wilson to U.S. Department of Energy Secretary Ernest Moniz, September 4, 2015.
[61] Sammy Fretwell, "Gov. Nikki Haley: Finish MOX plant," *The State*, April 21, 2014.

Alexander and Feinstein.[62] Senator Alexander was the one who originally pushed for the "Red Team" report, so it is likely that he will, at a minimum, give heavy weight to its recommendations to end the MOX program in favor of dilute and dispose. For her part, Senator Feinstein has expressed concern with the implications of breaking the PMDA agreement, saying that "…it presents a huge dilemma to this country in terms of keeping its word in agreements, and particularly with a very powerful country that is at sixes and sevens with us and everybody else."[63] However, more recent comments indicate that she is becoming more amenable to a change in strategy, saying "The goal of disposing of weapons-grade plutonium is certainly worthy, but the cost is enormous."[64] It is important to note that neither Senator Alexander nor Senator Feinstein have outright rejected the idea of ending the MOX project to switch to a dilute and dispose method with final disposition at WIPP. This fact, along with their public acknowledgement of the increasing budget-busting price estimates of the project, indicates that they are willing to stand firm against fellow subcommittee member Lindsay Graham's demands to keep the project going.

Recommendation

Based on the evidence provided, the author recommends adopting the policy proposal to abandon the MOX effort in South Carolina and pursue the dilute and dispose approach, with final disposition at the Waste Isolation Pilot Plant (WIPP) in New Mexico. The world has changed much since the decision was made to pursue the MOX

[62] Statement of Senator Lamar Alexander, "The National Nuclear Security Administration's Fiscal Year 2016 Budget Request," *Senate Appropriations Energy and Water Subcommittee*, March 11, 2015.
[63] Douglas Guarino, "Lawmakers Want New Cost Analysis for Mixed-Oxide Facility In Two Weeks," *Nuclear Threat Initiative*, May 2, 2014.
[64] Mary Troyan, "Lawmakers question funding for plutonium facility," *The Tennessean*, March 11, 2015.

approach to plutonium disposition. First, down blending was not available at the time but has since been successfully demonstrated in the United States (surplus plutonium oxide materials from other Department facilities have been disposed at WIPP).[65] Second, threats to our national security have changed. The Red Team report notes that "Nonproliferation policy has been increasingly focused on potential threats from non-state actors, which increases the sense of urgency for timely disposition and potentially offers greater flexibility in the final form of the material to prevent future use."[66] Disposal of weapons-grade plutonium at WIPP can be done much faster than it can be processed at the yet-to-be finished MOX facility. Over a dozen former arms negotiators and diplomats reinforced this point in a September 2015 letter to DOE, writing that "DOE can uphold its obligation to safely dispose of this material [weapons-grade plutonium] without implementing the MOX program. More important, in addition to saving money, ending the current MOX program would be in the nation's national security interest."[67] The PMDA will need to be renegotiated even if we continue on the current MOX path, as we will not meet the deadlines already laid-out. Finally, the government's fiscal situation has changed dramatically and we can no longer afford to justify using MOX to dispose of excess plutonium when another approach will accomplish the same goals in a shorter time period at about half the lifetime cost. As previously noted, there are no technical obstacles to switching to a dilute and dispose method. There are some policy and political challenges, but the author believes that they can be overcome.

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[65] "Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options," *U.S. Department of Energy,* April 2014, 18.
[66] Final Report of the Plutonium Disposition Red Team," *Oak Ridge National Laboratory, U.S. Department of Energy*, August 2015, ix.
[67] Letter from Peter Bradford et al. to U.S. Department of Energy Secretary Ernest Moniz, September 8 2015.

Curriculum Vita

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