Exhibit 12

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MEMORANDUM October 20, 2015

To: Senator Tim Scott
Attention: Spencer B. Pederson

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Subject: **U.S.-Russia Plutonium Management and Disposition Agreement**

Information in this memorandum may be used in other products for general distribution to Congress. Your confidentiality as a requester will be preserved in any case.

This memorandum was prepared in response to your request for an expansion of the scope of information CRS provided in a previous memorandum, dated October 1, 2015, regarding the disposition of surplus weapons-grade plutonium under the Plutonium Management and Disposition Agreement (PMDA). We have included two additional topics you selected: (1) time frames of negotiations between the United States and Russia for past changes to the PMDA and (2) limitations on the disposal of transuranic wastes at the Waste Isolation Pilot Plant (WIPP) in New Mexico. This memorandum also elaborates upon the procedural mechanisms for changes to the PMDA, and references selected statements at a hearing held on October 7, 2015, by the Subcommittee on Strategic Forces of the House Committee on Armed Services.[1]

As discussed in this and the previous memorandum, the current U.S. disposition pathway under the PMDA is to convert the surplus weapons-grade plutonium into mixed oxide (MOX) fuel for use in nuclear power reactors. The "dilute and dispose" option would involve the dilution of the radioactivity of the surplus plutonium, and the permanent disposal of the material at WIPP. This option would be subject to negotiation of the PMDA with Russia, and other federal and state decisions regarding the use of WIPP.

The Department of Energy (DOE) has commissioned multiple studies to compare the potential costs and risks of the current U.S. disposition pathway of MOX fuel conversion to the dilute and dispose option. These studies outline similar challenges, but vary somewhat in their assumptions and conclusions. A DOE Plutonium Disposition "Red Team," appointed by the Oak Ridge National Laboratory, issued the most recent study in August 2015.[2] The Red Team examined cost estimates and conclusions of a DOE Plutonium Disposition Working Group study issued in April 2014,[3] and two independent reviews.

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[1] U.S. Congress, House Committee on Armed Services, Subcommittee on Strategic Forces, *Plutonium Disposition and the MOX Project*, 114th Cong., 1st sess., October 7, 2015.

[2] U.S. Department of Energy, Oak Ridge National Laboratory, *Final Report of the Plutonium Disposition Red Team*, August 13, 2015.

[3] U.S. Department of Energy, *Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options*, April 2014, http://www nnsa.energy.gov/sites/default/files/nnsa/04-14-inlinefiles/SurplusPuDispositionOptions.pdf. This study referred to the dilute and dispose option as "downblending and disposal."

As you requested, the scope of information presented in this memorandum includes:

- terms and conditions of the PMDA and a chronology of past changes to the agreement;
- procedures for negotiation of changes to the PMDA;
- dilute and dispose option to MOX fuel conversion; and
- limitations on waste disposal at WIPP.

If you have any additional questions, please feel free to contact the authors of this memorandum for assistance with the following topics:

- Mary Beth Nikitin (7-7745, MNikitin@crs.loc.gov), regarding the terms and conditions of the PMDA and related diplomatic and procedural issues;
- Mark Holt (7-1704, MHolt@crs.loc.gov) or James Werner (7-3862, JWerner@crs.loc.gov), regarding scientific and technical issues related to the management and disposition of surplus weapons-grade plutonium; and
- David Bearden (7-2390, DBearden@crs.loc.gov), regarding the proposed use of WIPP for the dilute and disposal option, and limitations on waste disposal.

Plutonium Management and Disposition Agreement

In September 1998, the United States and Russia each agreed to convert 34 metric tons of surplus weapons-grade plutonium[4] to a form that could not be returned to nuclear weapons under the PMDA. According to the original agreement, the parties could use two methods for disposing of the plutonium—they could either convert it to MOX fuel for use in nuclear power reactors, or immobilize it and dispose of it in a way that would preclude its use in nuclear weapons.[5] The PMDA has been amended twice with the conclusion of two protocols. Negotiations that led to the 2006 Protocol lasted approximately two years (2003-2005). The negotiations on the 2010 Protocol were conducted from approximately 2008-2010. The 2006 Protocol established liability protections for U.S. workers and companies working on the project in Russia. The second negotiation resulted in the 2010 Protocol, which adjusted the allowable disposition pathway for Russian plutonium.[6]

The United States initially intended to pursue both immobilization[7] and MOX fuel for conventional light-water reactors. However, after reviewing U.S. nonproliferation policies in 2001, the Bush Administration concluded that the dual approach would be too costly. Instead, it outlined a plan for the United States to

[4] "Weapons grade" plutonium is distinguished from the much larger inventories of "weapons usable" plutonium because of the high concentrations of Pu-239 isotopes and lower concentrations of neutron absorbing isotopes (e.g., Pu-240). The weapons-usable plutonium stockpiles result from the chemical separation of nuclear power reactor spent fuel.

[5] The widely recognized criterion for acceptability of a Pu disposition method is the so-called "spent fuel standard." This standard compares any final Pu disposition form to commercial spent fuel and assesses whether it is at least as difficult to use as a source for fissile material as standard spent nuclear fuel from a nuclear power plant in which fissile isotopes are blended with mixed fission products, which renders it intensely radioactive and difficult to process into weapons-usable material. This standard arose from a 1994 National Academy of Sciences study: *Management and Disposition of Excess Weapons Plutonium*. See http://www nap.edu/catalog/2345/management-and-disposition-of-excess-weapons-plutonium.

[6] The official signed versions of the PMDA, the 2006 and 2010 protocols, and a composite version incorporating both protocols, are available on the U.S. Department of State website for treaties and agreements related to international security and nonproliferation: http://www.state.gov/t/isn/trty.

[7] Under the immobilization, or "melt and dilute," option, surplus plutonium (Pu) would be combined with high-level waste and blended into molten borosilicate glass logs inside stainless steel canisters, which are currently being produced, without excess Pu, at the Defense Waste Processing Facility at the Savannah River Site in South Carolina. In this way, the excess Pu would essentially be combined with mixed fission products, and further stabilized in the borosilicate glass in a waste form that was presumed to be acceptable for a deep geologic repository, such as the Yucca Mountain site, which was planned at the time.

convert almost all its surplus plutonium to MOX fuel, and not to pursue immobilization.[8] This change still matched the allowed disposition pathways agreed to in the PMDA.

After its own review, the Russian government decided the disposition options were not suitable for its long-term nuclear energy plans, which did not include MOX fuel for light-water reactors.[9] Instead, it decided to use the resulting material as fuel for its civilian fast reactor program. This change required an amendment to the agreement. The 2010 Protocol laid out conditions for Russian use of the plutonium as fast reactor fuel, including restrictions on breeding additional plutonium in fast reactors.[10]

Procedures for Changes to the Agreement

DOE is currently exploring alternatives to the MOX fuel disposition path. This has led to a discussion about whether and how the Russian Government would need to agree to a change in the U.S. surplus plutonium disposition program. The amendments made to Article 3 of the PMDA by the 2010 Protocol may have provided for more flexibility in adjusting the disposition paths chosen by each country in the future. Nevertheless, any future change still would be subject to a written agreement by both parties.

Article 3.1 states that the parties may agree "in writing" if they choose "other measures" of disposition: "Disposition shall be by irradiation of disposition plutonium as fuel in nuclear reactors or any other methods that may be agreed by the Parties in writing." Article 12 of the PMDA established a Joint Consultative Commission (JCC) to address implementation issues, and the JCC is the forum where any changes would be decided. The Department of State chairs the JCC on the U.S. side and DOE participates, in coordination with the White House. The Russian Atomic Energy Agency (ROSATOM) and the Russian Ministry of Foreign Affairs participate on the Russian side.

While a decision has not yet been made to change the disposition path agreed to in the present PMDA, U.S. officials appear to interpret the proposed change to a dilute and dispose method as falling under the Article 3.1 category of "any other methods." After a policy decision has been made about how to proceed with the U.S. program, the U.S. side would bring its proposal, and interpretation of whether it would require an amendment, to the Joint Consultative Commission. The Russian government would then evaluate the proposed change and would render its own interpretation of whether it would require an amendment. If the Russian side determines that a change falls within the scope of the current agreement, then an exchange of diplomatic notes or other written agreement would suffice. If the Russian government determines that the new proposed disposition path does not fall within the agreement's parameters, then it is possible that a new protocol to the PMDA would need to be negotiated.

At a hearing held by the Subcommittee on Strategic Forces of the House Committee on Armed Services on October 7, 2015, Lieutenant General Klotz, Administrator of the National Nuclear Security Administration (NNSA), testified that Secretary of Energy Ernest Moniz has discussed this issue recently

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[8] The U.S. decision not to pursue immobilization raised concern in the state of South Carolina about the availability of an alternative, if MOX fuel conversion were not successful and the surplus plutonium were to remain within the state. In 2002, a former Governor of South Carolina, James Hodges, filed litigation against DOE under the Administrative Procedure Act and National Environmental Policy Act, challenging the U.S. decision to send surplus plutonium to the Savannah River Site. The U.S. Court of Appeals for the Fourth Circuit ruled in favor of DOE, and in January 2003, the U.S. Supreme Court denied the petition of the state to review the decision. See the U.S. Supreme Court docket: http://www.supremecourt.gov/search.aspx?filename=/docketfiles/02-544 htm. A more recent March 2014 press account reported that acceptability to the state originally was premised upon potential economic benefits (e.g., creation of jobs) at the Savannah River Site, including the construction of a MOX fuel conversion facility. See: http://www.aikenstandard.com/article/20140323/AIK0101/140329768.

[9] The Russian Ministry of Atomic Energy (Minatom), which was the primary technical negotiating partner with the United States Government, had been rapidly changing during the 1990s in the wake of the breakup of the Soviet Union and the evolution of the Ministry of Medium Machine Building and associated fleet of reactors, from which it was derived.

[10] 2000 Plutonium Management and Disposition Agreement, as amended by the 2010 Protocol, Article III.

with ROSATOM head Sergei Kiriyenko.[11] Lieutenant General Klotz said that in that conversation, the Russians recognized that the United States had been flexible when Russia wanted to change its disposal method in 2010, and said, "When you have a plan, come back to us and we'll sit down and negotiate."

Some reports are skeptical of the Russian government's flexibility while others are optimistic. The current poor political climate between the United States and Russia may be another factor which may influence the Russian side's acceptance of the change. In its report, the DOE Red Team stated, "The combination of evolving international circumstances and the fact that the U.S. has already 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 to enter PMDA negotiations."[12] Lieutenant General Klotz in his October 7 testimony stated that, "there are a lot of other political, economic, strategic variables that get injected into any discussion with them [the Russians] on any issue in this area."

Dilute and Dispose Option

The primary surplus plutonium disposition alternative DOE currently is considering is the dilute and dispose option. As described in the DOE Red Team report, this option would involve diluting the radioactivity of surplus weapons-grade plutonium with inert materials to concentration levels suitable for disposition at the Waste Isolation Pilot Plant (WIPP), administered by the DOE Office of Environmental Management. WIPP is located near Carlsbad, NM, and is a deep geologic repository that serves as the centralized site for the permanent disposal of defense-related transuranic wastes generated at other DOE sites, including plutonium-bearing material. The DOE Red Team report, and earlier reports that DOE commissioned, have concluded that the dilute and dispose option would be substantially less costly than the current MOX approach, although both options face significant uncertainty and technical risk.

The DOE Red Team observed that the dilute and dispose option involving disposal at WIPP would not meet the PMDA and therefore would need Russian agreement to a modification. The weapons-grade plutonium covered by the PMDA consists of more than 93% of the isotope Pu-239 and less than 7% of the isotope Pu-240. The PMDA specifies that the plutonium remaining after irradiation must consist of at least 10% Pu-240. Irradiation of MOX fuel in a reactor would destroy most of the initial plutonium through nuclear fission and transmute much of the remaining Pu-239 to Pu-240, meeting the PMDA specification. Without irradiation, the isotopic composition of the initial weapons-grade plutonium would remain the same (less than 7% Pu-240), even if it were greatly diluted with other elements.

Another issue is that diluted plutonium considered for disposal at WIPP may not comply with a longstanding National Academy of Sciences recommendation, embodied in the PMDA, that plutonium disposal packages be at least as radioactive as spent nuclear fuel,[13] to provide a barrier against diversion for weapons use. The intense gamma (highly penetrating) radiation emitted by spent fuel comes primarily from the fission products resulting from the splitting of uranium, plutonium, and other heavy nuclei. After irradiation, MOX fuel would be thoroughly infused with fission products and thus be difficult to divert. Diluted plutonium would not undergo fission and would not contain such fission products. Gamma emitters possibly could be added to the diluted plutonium to address the spent nuclear fuel parameters of the existing PMDA. However, the increased radioactivity may make it unsuitable for disposal at WIPP. See the discussion of limitations on waste disposal in the next section of this memorandum.

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[11] U.S. Congress, House Committee on Armed Services, Subcommittee on Strategic Forces, *Plutonium Disposition and the MOX Project*, 114th Cong., 1st sess., October 7, 2015.

[12] U.S. Department of Energy, Oak Ridge National Laboratory, *Final Report of the Plutonium Disposition Red Team*, August 13, 2015, p. xi.

[13] National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium*, 1994.

The DOE Red Team noted that the dilute and dispose option may not comply with the PMDA, but contended that "based on the history of modifications negotiated to date under the framework of the PMDA it is reasonable to conclude that a new modification could be successfully negotiated on the basis of a Dilute and Dispose approach, provided a strong U.S. commitment is maintained with regard to timely disposition."[14]

Limitations on Waste Disposal

If the PMDA were amended to allow the use of the dilute and disposal option, the viability of this approach would rely upon the availability of WIPP for disposal of the diluted material as transuranic wastes. If WIPP were unavailable, the costs of a new repository could offset some of the potential cost-savings offered by the dilute and dispose option compared to MOX fuel conversion. The time to construct a new repository also would affect the timing of disposition. In its August 2015 report, the DOE Red Team noted that if WIPP were to "become unavailable due to budget, capacity, or operational reasons" the U.S. surplus plutonium disposition program "would be compromised."[15]

WIPP is not currently accepting shipments of transuranic wastes. Incidents in February 2014 involving a fire resulting from a truck hauling accident inside the repository, and a radiological release, have resulted in the temporary closure of the facility and suspension of waste shipments to WIPP.[16] The timing of the re-opening of WIPP therefore would affect the timing of disposition for the dilute and dispose option. In September 2014, DOE issued a recovery plan to resume operations at WIPP.[17] The plan outlines measures that are intended to allow the resumption of limited waste disposal operations sometime during the first quarter of calendar year 2016. Once operations resume, whether diluted surplus plutonium may be suitable for disposal at WIPP would depend on compliance with statutory limitations on the volume and radioactivity of wastes that are eligible for disposal, and federal and state regulatory approval.

As amended, the Waste Isolation Pilot Plant Land Withdrawal Act (hereinafter referred to as the Land Withdrawal Act) authorized the withdrawal of federal land from public domain uses to reserve it for WIPP.[18] The act also establishes limitations on the volume and radioactivity of wastes that are eligible for disposal at WIPP. If the diluted surplus plutonium were to exceed these limitations, the dilute and dispose option would present a legislative issue of whether the statute should be amended to revise the limitations. In its August 2015 report, the DOE Red Team suggested that certain disposal efficiency techniques "may obviate the perceived need to amend" the Land Withdrawal Act for the dilute and dispose option.[19] However, the DOE Plutonium Disposition Working Group concluded in its April 2014 report that an amendment to the act would be necessary to carry out this option.[20] If issues regarding the statutory limitations on waste disposal at WIPP were resolved, disposal of the diluted surplus plutonium still would be subject to federal and state regulatory approval under the act.

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[14] U.S. Department of Energy, Oak Ridge National Laboratory, *Final Report of the Plutonium Disposition Red Team*, August 13, 2015, p. 29.

[15] Ibid., p. x. The DOE Red Team noted that WIPP would be essential for the surplus plutonium disposition program, either for the dilute and dispose option or for the disposal of radiological wastes that would be generated from MOX fuel conversion.

[16] For information on the February 2014 incidents, see: http://www.wipp.energy.gov/wipprecovery/accident_desc html.

[17] The WIPP recovery plan is available on the DOE website: http://www.wipp.energy.gov/wipprecovery/path_forward html.

[18] P.L. 102-579, as amended by P.L. 104-201, Division C, Title XXXI, Subtitle F.

[19] U.S. Department of Energy, Oak Ridge National Laboratory, *Final Report of the Plutonium Disposition Red Team*, August 13, 2015, p. x. However, the Red Team also observed that "given the tremendous value" of WIPP to both DOE and the state of New Mexico "it may eventually become desirable to explore expansion of WIPP's capacity beyond the current [Land Withdrawal Act] LWA limit" regardless of the need for the disposition of surplus plutonium.

[20] U.S. Department of Energy, *Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options*, April 2014, p. 18.

Selected provisions of the Land Withdrawal Act that establish limitations on waste disposal at WIPP, and related provisions that address regulatory compliance, are summarized briefly below.

Waste Volume and Radioactivity

Section 2 of the Land Withdrawal Act establishes the general radiological characteristics of wastes eligible for disposal at WIPP. DOE has developed waste acceptance criteria for WIPP based on these statutory criteria and other applicable requirements.[21] Section 2 defines:

- "transuranic waste" to mean "waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with halflives greater than 20 years" but excluding high-level wastes and other radiological wastes that meet certain criteria;
- "contact-handled transuranic waste" to mean "transuranic waste with a surface dose rate not greater than 200 millirem per hour;" and
- "remote-handled transuranic waste" to mean "transuranic waste with a surface dose rate of 200 millirem per hour or greater." [22]

Section 7 of the act limits the total disposal capacity of WIPP by volume to 6.2 million cubic feet of all transuranic wastes, and limits the total radioactivity of remote-handled transuranic wastes to 5.1 million curies. The act does not specify a limit on the total radioactivity of contact-handled transuranic wastes. Section 7 establishes additional limitations on remote-handled transuranic wastes, specifying that:

- no remote-handled transuranic waste received at WIPP may have a surface dose rate in excess of 1,000 rems per hour;
- no more than 5 percent by volume of remote-handled transuranic waste received at WIPP may have a surface dose rate in excess of 100 rems per hour; and
- remote-handled transuranic waste received at WIPP shall not exceed 23 curies per liter maximum activity level (averaged over the volume of the individual canister).

Section 12 prohibits the transport of high-level waste or spent nuclear fuel to WIPP, or the emplacement or disposal of such waste or fuel at WIPP. If surplus weapons-grade plutonium were treated to meet the spent nuclear fuel standard for nonproliferation, disposal of wastes with these radiological characteristics at WIPP therefore may be inconsistent with the act.

Regulatory Approval

In their respective reports, both the DOE Red Team and DOE Plutonium Disposition Working Group acknowledged that federal and state regulatory approval would be a critical factor for the use of WIPP to carry out the dilute and dispose option. The Land Withdrawal Act makes the use of WIPP subject to compliance with applicable federal and state regulations. In addition, federal waste disposal decisions at WIPP have been subject to environmental review under the National Environmental Policy Act (NEPA).[23]

Section 7 of the act made the disposal of transuranic wastes at WIPP dependent upon certification by the Environmental Protection Agency (EPA) that the operations would comply with federal transuranic waste

[21] U.S. Department of Energy, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, DOE/WIPP-02-3122, Revision 7.4, April 22, 2013, available on the DOE WIPP website: http://www.wipp.energy.gov/library/wac/WAC.pdf.

[22] "Rem" refers to "roentgen equivalent man" and is one of two standard units of measure for the dose equivalent (or effective dose) of ionizing radiation. Sievert (Sv) is the other unit. For more information on these units of measure, see the U.S. Nuclear Regulatory Commission glossary: http://www nrc.gov/reading-rm/basic-ref/glossary/rem-roentgen-equivalent-man html.

[23] Related NEPA documentation is available on the DOE WIPP website: http://www.wipp.energy.gov/Documents_NEPA htm.

disposal regulations.[24] Section 8 directs DOE to submit an application to EPA for recertification of WIPP every 5 years to demonstrate continued compliance with these regulations. EPA issued the most recent certification in 2010. DOE applied for recertification in 2014.[25]

Section 9 of the act also specifies the general applicability of a broader body of federal environmental laws and regulations to the operations of WIPP, including:

- federal transuranic waste management and storage regulations;[26]
- Clean Air Act;[27]
- Solid Waste Disposal Act;[28]
- Safe Drinking Water Act;[29]
- Toxic Substances Control Act;[30]
- Comprehensive Environmental Response, Compensation, and Liability Act (commonly referred to as Superfund);[31]
- all other applicable federal public health and safety or environmental laws; and
- all regulations and permits issued under the above laws, with certain exceptions from the Solid Waste Disposal Act for treatment and land disposal of transuranic wastes at WIPP.

Section 9 directs DOE to submit documentation to EPA every two years to determine continued compliance with the above laws and regulations, and to the state of New Mexico for continued compliance with the Solid Waste Disposal Act. Section 9 specifies that these oversight authorities are additional to the enforcement authorities of EPA under other law, and to the state of New Mexico under the Solid Waste Disposal Act and state law. The state of New Mexico Environment Department is responsible for issuing and enforcing the hazardous waste facility permit for WIPP, under delegated Solid Waste Disposal Act authority and the state New Mexico Hazardous Waste Act.[32]

Section 16 also makes the transport of transuranic wastes to or from WIPP subject to U.S. Nuclear Regulatory Commission (NRC) package design certification for quality assurance, and requires DOE to notify states and tribes prior to the transport of transuranic wastes through their respective jurisdictions.

Considering the applicability of the above body of laws, regulations, and permit requirements to the disposal of transuranic wastes at WIPP, some uncertainties about the viability and timing of the dilute and dispose option may remain until federal and state regulatory decisions were made.

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[24] Federal transuranic waste disposal regulations applicable to WIPP are codified in 40 C.F.R. Part 191, Subpart B, with the exception of certain provisions that the Land Withdrawal Act does not apply to WIPP.

[25] The DOE 2014 recertification application, and related certification documents, are available on the DOE WIPP website: http://www.wipp.energy.gov/Documents_EPA htm. Information on the oversight role of EPA at WIPP also is available on the EPA website: http://www2.epa.gov/radiation/waste-isolation-pilot-plant-wipp.

[26] 40 C.F.R. Part 191, Subpart A.

[27] 42 U.S.C. §§ 7401 et seq.

[28] 42 U.S.C. §§ 6901 et seq. The Solid Waste Disposal Act also is commonly referred to as the Resource Conservation and Recovery Act (RCRA), because it substantially amended the statute in 1976 to authorize the regulation of hazardous wastes.

[29] 42 U.S.C. §§ 300f et seq.

[30] 15 U.S.C. §§ 2601 et seq.

[31] 42 U.S.C. §§ 9601 et seq.

[32] The hazardous waste facility permit issued by the state New Mexico Environment Department is available on the DOE WIPP website: http://www.wipp.energy.gov/Documents_HWFP htm.