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Mixed-Oxide Fuel Fabrication Plant and Plutonium Disposition: Management and Policy Issues

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Summary

The Mixed Oxide Fuel Fabrication Facility (MFFF) in South Carolina has been a key component of the current U.S. strategy for disposing of surplus weapons plutonium from the Cold War. That strategy called for the surplus plutonium, in oxide form, to be blended with uranium oxide to make mixed oxide (MOX) fuel for U.S. commercial nuclear reactors. The plutonium in MOX fuel would be mostly destroyed in the reactors by fission (splitting into other isotopes). At the same time, isotopes of plutonium undesirable for weapons would be created, along with highly radioactive fission products. As a result, after several years in a reactor, spent MOX fuel would have less total plutonium than when it was freshly loaded, and the remaining plutonium would be degraded for weapons purposes. Moreover, the fission products would make the material difficult to handle, in case of future attempts to use the plutonium.

Because of sharply rising cost estimates for the MOX project, the Obama Administration is proposing to place MFFF in "cold standby" and study other plutonium disposition options. The federal plutonium disposition program is run by the National Nuclear Security Administration (NNSA), a semiautonomous agency of the Department of Energy (DOE). NNSA estimated in 2002 that MFFF would cost about $1 billion to design and build. DOE said in its budget justification for FY2014 that the MFFF contractor had estimated the project's total construction cost would rise to $7.78 billion, and that construction would not be completed until November 2019. DOE's FY2015 budget justification said the life-cycle cost estimate for the MOX program had risen to $30 billion.

Disposition of surplus plutonium is required by a 1998 agreement, amended in 2010, between the United States and Russia. Each country agreed to convert 34 metric tons of surplus weapons-grade plutonium to a form that could not be returned to nuclear weapons. The two countries agreed to begin plutonium disposition in 2018. The United States is to pay a maximum of $400 million to support the Russian plutonium disposition effort. The Russian government is to fund the remainder of Russia's approximately $2.5 billion in estimated costs. The United States and Russia are now negotiating a verification agreement and a "Milestones" plan that would outline how the U.S. contribution of $400 million to the Russian program would be spent.

Differing sharply from the U.S. MOX strategy, Russia is planning to use its BN-600 and BN-800 fast breeder reactors for plutonium disposition. According to the World Nuclear Association, the BN-800 construction is expected to "start up in 2014 and be operational in 2015," and the reactor is "capable of burning 1.7 metric tons of plutonium per year from dismantled weapons." The DOE FY2015 budget includes no funds for support of the Russian plutonium disposition program. As in FY2014, NNSA plans to use prior-year funds to support these activities in FY2015. The $400 million in U.S. assistance is to be paid to Russia after FY2018 when plutonium disposition is to begin.

The Administration's review of the U.S. plutonium disposition strategy raises several issues for Congress. A fundamental question is whether the rising cost estimates for MFFF are sustainable in the current budget environment. And if the MFFF is not sustainable, what should replace it? However, any delay or major change to the program could affect the planned disposition of Russian weapons plutonium. The effects of budget cuts on DOE's Savannah River Site in South Carolina, where MFFF is located, will also be an important element of the debate.

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Introduction

With the end of the Cold War and breakup of the Soviet Union in the early 1990s, control of surplus nuclear weapons material became an urgent U.S. foreign policy goal. Particular U.S. concern focused on plutonium from Soviet nuclear warheads, which it was feared posed a major nuclear weapons proliferation risk. The United States supported a successful effort to consolidate the storage of Soviet nuclear weapons and materials in Russia, and then began negotiating reductions in weapons material stockpiles.

Congress has been closely involved in formulating U.S. policy on surplus plutonium disposition, as well as funding the necessary facilities, operations, and Russian assistance to implement the program. Congressional debate is now focusing on the U.S. program's escalating costs and the Obama Administration's FY2015 proposal to halt construction of plutonium disposition facilities in South Carolina and prepare a new strategy.

In September 1998, the United States and Russia each agreed to convert 34 metric tons of surplus weapons-grade plutonium to a form that could not be returned to nuclear weapons under the Plutonium Management and Disposition Agreement (PMDA). The agreement was designed to ease concerns about the possible theft or diversion of weapons-grade plutonium by nations or others seeking to develop their own nuclear weapons. According to the agreement, the parties could use two methods for disposing of the plutonium—they could either convert it to mixed oxide (MOX) fuel for nuclear power reactors or immobilize it and dispose of it in a way that would preclude its use in nuclear weapons. However, Russia has expressed little interest in the permanent immobilization and disposal of plutonium, or burning it in conventional reactors, preferring to use the material as fuel for its civilian fast reactor program. The United States initially intended to pursue both immobilization and MOX fuel for conventional 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 convert almost all its surplus plutonium to MOX fuel.

The PMDA was amended with a Protocol which entered into force on July 13, 2011. The PMDA Protocol renews the commitment of each side to dispose of 34 metric tons of weapons-grade plutonium. It also lays out conditions for Russian use of the plutonium as fast reactor fuel, including restrictions on breeding additional plutonium in fast reactors.[1] The two countries agreed to begin plutonium disposition in 2018. The United States is to pay $400 million to support the Russian plutonium disposition. The Russian government is to fund the remainder of the approximately $2.5 billion in estimated costs. The plutonium disposition program, including U.S. assistance for the Russian program, is administered by the National Nuclear Security Administration (NNSA), a semiautonomous agency of the Department of Energy (DOE).

A key component of the U.S. strategy for disposing of surplus weapons plutonium has been the Mixed Oxide Fuel Fabrication Facility (MFFF) at DOE's Savannah River Site in South Carolina. NNSA estimated in 2002 that MFFF would cost about $1 billion to design and build. That estimate had risen to $4.8 billion when the construction of MFFF began in 2007. According to DOE's FY2014 budget request, the MFFF contractor then estimated that the project's total

[1] 2000 Plutonium Management and Disposition Agreement as amended by the 2010 Protocol, Article III, http://fissilematerials.org/library/PMDA2010.pdf.

construction cost would rise to $7.78 billion, and that construction would not be completed until November 2019. DOE has slowed construction during FY2013 and FY2014 while other disposition options are evaluated.

DOE's FY2015 budget justification says the total lifecycle cost of the MOX fuel program for plutonium disposition—including construction, operations, waste management, and facility decommissioning—has risen to $30 billion. Because of that increase, according to DOE, "the MOX fuel approach is not viable within the available resources." DOE plans to put MFFF and related facilities currently under construction in "cold standby," reducing funding for the U.S. plutonium disposition program from $560.3 million in FY2014 to $286 million in FY2015. DOE plans to "further analyze options to complete the plutonium disposition mission more efficiently."[2]

Russian Program

The Russian Surplus Fissile Materials Disposition program, run by NNSA, is to provide $400 million to help Russia dispose of its surplus weapons plutonium.[3] The DOE FY2015 congressional budget request says that putting the U.S. facility in cold standby "does not diminish" the commitment to the U.S.-Russia Plutonium Management and Disposition Agreement (PMDA), and that the United States will continue to work with Russia to achieve the program's primary goal of Russian disposition of equal quantities of plutonium.

The United States and Russia, along with the International Atomic Energy Agency (IAEA), are negotiating an agreement on verification of plutonium disposition in each country. IAEA will have a role in verifying the quantities of weapons-grade plutonium converted to fuel in both countries. The United States and Russia are also negotiating a "Milestones" plan, which would outline how the U.S. assistance to the Russian plutonium disposition effort would be spent. Negotiations related to the plutonium disposition agreement are led by the Department of State's Bureau of International Security and Nonproliferation together with NNSA. According to DOE's FY2015 budget request, Russia has made "significant progress" toward its PMDA commitments.[4]

Russia is planning to use its BN-600 and BN-800 fast neutron reactors for plutonium disposition. According to the World Nuclear Association, the BN-800 construction is "well-advanced," and the reactor is "capable of burning 1.7 metric tons of plutonium per year from dismantled weapons."[5]

As shown in **Table 1**, DOE requested $10.174 million for the Russian plutonium disposition program for FY2012. The Senate Appropriations Committee recommended $1 million for

[2] DOE, *FY 2015 Congressional Budget Request*, Vol. 1, March 2014, pp. 523, 525, 543, http://energy.gov/sites/prod/files/2014/03/f12/Volume%201%20NNSA.pdf.

[3] This is a sub-program of the NNSA's Defense Nuclear Nonproliferation budget, Fissile Materials Disposition program.

[4] DOE, *FY 2015 Congressional Budget Request*, Vol. 1, March 2014, p. 536, http://energy.gov/sites/prod/files/2014/03/f12/Volume%201%20NNSA.pdf.

[5] The reactor's rated thermal power is 2,100 megawatts (MWt), generating 880 megawatts of electricity (MWe), http://www.world-nuclear.org/info/Current-and-Future-Generation/Fast-Neutron-Reactors/.

FY2012, and that level was enacted. The Senate Committee included this reasoning in its report (S.Rept. 112-75):

> *Russian Surplus Materials Disposition.*—The Committee recommends $1,000,000, a reduction of $9,174,000. No funding shall be used to support research and development of the Gas Turbine-Modular Helium Reactor in Russia. The Committee understands that the United States committed $400,000,000, subject to future appropriations, to help Russia dispose of 34 metric tons of excess weapon-grade plutonium, but the Committee will not provide funding for this effort until NNSA can explain how the United States would spend the $400,000,000 and the milestones that Russia must meet before the United States releases any of those funds.

The FY2013 budget justification said that the requested funds would be used to "provide technical support to the DOE in meeting U.S. obligations to support disposition of weapon-grade plutonium in Russia; provide U.S. technical oversight of work in Russia associated with the disposition of surplus Russian weapon-grade plutonium in the BN-600 and BN-800 fast reactors; and support the implementation of IAEA verification activities in both the U.S. and Russia."

The FY2014 and FY2015 budget requests included no funds for the Russian plutonium disposition program. NNSA plans to use prior year funds to support these activities in FY2015. The $400 million in U.S. assistance is to be paid to Russia after FY2018, when plutonium disposition is to begin. The Russian Federation is to fund the remaining costs of $2 billion, including through contributions from other international donors under the G8 Global Partnership.

Table 1. Funding for the NNSA Russian Plutonium Disposition Program

(in $ thousands)

	FY2012	FY2013	FY2014	FY2015 Request	FY2016-FY2019 (projected)
DOE Request	10,174	3,788	0	0	30,000
Senate Appropriation	1,000	3,788	n/a	n/a	n/a
House Appropriation	10,174	0	n/a	n/a	n/a
Enacted	1,000	922	n/a	n/a	n/a

Source: Department of Energy Congressional Budget Justifications; S.Rept. 112-164, H.Rept. 112-462.

Notes: All of the above funds are to be spent in the United States. Appropriations for FY2013, FY2014, and FY2015 are to be supported from prior-year uncosted balances.

U.S. Program

The U.S. Plutonium Disposition Program is also conducted by NNSA. The program had long planned to blend surplus plutonium from the U.S. nuclear weapons program with uranium to make MOX fuel for commercial nuclear reactors. After fueling a reactor for several years, the plutonium in MOX fuel would be mostly destroyed by fission, and remaining plutonium would be isotopically undesirable for weapons use. In addition, the used MOX fuel would contain highly radioactive fission products that would make it difficult to divert for weapons purposes.

Initially, the U.S. program planned to dispose of 34 metric tons of surplus weapons plutonium in this manner—"enough for thousands of nuclear weapons," according to NNSA.[6] NNSA subsequently proposed making MOX fuel from an additional 7.1 metric tons of plutonium from retired nuclear weapons and another 6 metric tons of weapons-useable plutonium from other sources, for a total of 47.1 metric tons.[7]

The first step in the plutonium disposition process is to disassemble the plutonium "pits," or cores, from nuclear weapons or other sources. Then the plutonium metal must be converted to plutonium oxide to be useable as nuclear reactor fuel. NNSA announced in 2012 that it had produced 442 kilograms of plutonium oxide at Los Alamos National Laboratory in New Mexico and had begun plutonium oxide production at the Savannah River Site.[8]

Under the MOX disposition approach, the plutonium oxide produced at Los Alamos and Savannah River would be blended with uranium, placed in fuel rods, and connected into fuel assemblies for standard commercial power reactors. This fuel fabrication process would take place at the Mixed Oxide Fuel Fabrication Facility. After receiving a construction permit from the Nuclear Regulatory Commission (NRC) in 2005, MFFF began construction in August 2007.[9] MFFF is designed to convert up to 3.5 metric tons of plutonium per year into MOX fuel and would operate for about 20 years.[10]

Getting utilities to commit to loading MOX fuel into their reactors has been a major problem for the plutonium disposition program. Although MOX fuel has been routinely used in Europe, it has enough differences from the conventional uranium fuel currently used by U.S. nuclear plants that it would require separate NRC licensing and special handling. The use of MOX fuel would also probably create public controversy. Two utilities that had previously planned to use the MOX fuel, Dominion and Duke, are no longer involved. The Tennessee Valley Authority (TVA) subsequently entered into an agreement with DOE "to evaluate the use of mixed oxide fuel in reactors at TVA's Browns Ferry and Sequoyah Nuclear Plants." However, TVA has not yet

[6] NNSA, "Plutonium Disposition," http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/programoffices/fissilematerialsdisposition/plutoniumdisposition.

[7] NNSA, "Surplus Plutonium Disposition Supplemental Environmental Impact Statement," http://www.nnsa.energy.gov/aboutus/ouroperations/generalcounsel/nepaoverview/nepa/spdsupplementaleis.

[8] NNSA, "NNSA Completes Milestones for Initial Steps in Plutonium Disposition," press release, November 16, 2012, http://nnsa.energy.gov/mediaroom/pressreleases/oxideprod111612. A somewhat smaller amount of plutonium metal would be used as feed material for the plutonium oxide, depending on isotopic composition.

[9] NNSA, "NNSA's MOX Fuel Fabrication Facility and U.S. Plutonium Disposition Program," fact sheet, February 14, 2011, http://www.nnsa.energy.gov/mediaroom/factsheets/mox.

[10] Shaw Areva MOX Services, "MOX Fuel Fabrication Facility Construction," http://www.moxproject.com/construction.

committed to using MOX fuel, or indicated which of its reactors would be used.[11] The selection of reactors is important, because MOX fuel assemblies must be fabricated to fit particular reactors. Particularly significant are the design differences between fuel assemblies for boiling water reactors, such as Browns Ferry, and pressurized water reactors, such as Sequoyah.

Management and Cost

NNSA's initial February 2002 report to Congress for the MOX plutonium disposition program estimated construction of MFFF would begin in FY2004 and cost about $1 billion to design and build. By July 2005, the design and construction cost estimate had risen to $3.5 billion, according to the DOE Office of Inspector General (OIG). OIG identified numerous management weaknesses that contributed to the rising costs. However, NNSA contended that much of the cost increase resulted from changes in project scope, such as increases in up-front design work, and delays in Russia over liability issues, which caused parallel delays in the U.S. program.[12]

By the time MFFF construction began in 2007, the construction cost estimate had risen to $4.8 billion. About $100 million of that cost increase was caused by congressional funding holdups, according to NNSA.[13] For example, the Bush Administration requested $653.1 million for fissile materials disposition in FY2006, while Congress appropriated $473.5 million. But for FY2004, in contrast, Congress approved the full request of $656.5 million.

Congress required in 2002 that MFFF produce at least 1 metric ton of MOX fuel by the end of 2008 and complete the then-planned program of 34 metric tons of plutonium conversion by January 1, 2019 (P.L. 107-314, Section 3182). Section 3116 of the National Defense Authorization Act for FY2013 (P.L. 112-239) extended the deadline for starting MOX production to January 1, 2014 (50 U.S.C. 2566).

DOE announced a major reevaluation of the plutonium disposition program in its FY2014 budget submission to Congress. According to the budget request, the MFFF contractor then estimated that the project's total construction cost would rise from $4.8 billion to $7.78 billion, and that construction would not be completed until November 2019. Moreover, MFFF's operating costs were estimated at $543 million per year, up from $100.5 million estimated in 2002.[14] The Government Accountability Office (GAO) in a February 2014 report said NNSA had provided several major reasons for the most recent cost increases, including DOE's approval of a cost and schedule estimate in 2007 when the overall design was only about 58% complete. Other problems included higher-than-anticipated equipment installation costs, difficulties in finding qualified suppliers, high staff turnover, and further changes in project scope.[15] GAO had found in 2010 that

[11] NNSA, "Surplus Plutonium Disposition Supplemental Environmental Impact Statement," op. cit.

[12] DOE Office of Inspector General, *Audit Report: Status of the Mixed Oxide Fuel Fabrication Facility*, DOE/IG-0713, December 2005, http://energy.gov/sites/prod/files/igprod/documents/CalendarYear2005/ig-0713.pdf.

[13] Daniel Horner, "Hill-Imposed Delay in MOX Program Costing $115 Million, DOE Says," *NuclearFuel*, April 23, 2007.

[14] DOE, *FY 2007 Congressional Budget*, Vol. 1, p. 558, http://energy.gov/sites/prod/files/FY07Volume1.pdf.

[15] GAO, Plutonium Disposition Program: DOE Needs to Analyze the Root Causes of Cost Increases and Develop Better Cost Estimates, GAO-14-231, February 2014, http://www.gao.gov/assets/670/660927.pdf.

MFFF had experienced consistent delays during the previous two years, partly because of the installation of nearly 4,000 tons of substandard reinforcing bars.[16]

Because of the cost increases, the Obama Administration slowed the project in FY2013 and FY2014 to consider "alternative plutonium disposition strategies." A Plutonium Disposition Working Group established by the Secretary of Energy began comparing the MOX option with plutonium destruction in fast neutron reactors and non-reactor disposal options, such as blending and spiking with highly radioactive materials.

DOE's FY2015 budget justification says the total lifecycle cost of the MOX disposition option has risen to $30 billion—from $24.2 billion in April 2013.[17] "Due to these increases, the MOX fuel approach is not viable within available resources," according to the DOE justification. "As a result, the MOX project will be placed in cold stand-by while we further study implementation and costs of options to complete the plutonium disposition mission more efficiently."

Total funding for plutonium disposition would drop from $560.3 million in FY2014 to $286.1 million in FY2015, under the Administration's request. No funding would be provided for operations and maintenance related to the MOX Waste Solidification Building, plutonium disposition and infrastructure, and management and integration. Preparation of plutonium material for disposition would continue. Construction funding for MFFF would be cut from $402.7 million (including reprogrammed funds) to $196.0 million as the facility is placed into "cold standby," or indefinite suspension. Contract personnel at the MOX project declined from 2,271 at the beginning of April 2013 to 1,523 by the end of December, according to the budget justification.[18]

MOX and Nonproliferation

The extent to which the plutonium disposition programs help or harm nonproliferation goals has been debated since their inception. Some analysts have criticized the MOX option on the principle of opposing any use of plutonium in power generation. From this point of view, nations that do not possess nuclear weapons could use a plutonium-based fuel cycle for power reactors as a cover for developing nuclear weapons. If weapons states such as Russia and the United States used plutonium for power generation, according to this argument, it would be more difficult to persuade non-weapons states not to do so.

Another issue has been whether the Russian disposition program that will make fuel for fast reactors will result in more or less plutonium in the long run. Fast reactors can "breed" or "burn" plutonium as a net output. The reactor acts as a breeder (producing more plutonium than it destroys) if the core includes sufficient amounts of uranium-238, which can absorb a neutron and then decay into the fissile isotope plutonium-239. Without uranium-238, the reactor would consume the original plutonium fuel without producing new plutonium in its place. The potential for breeding new plutonium was a major concern of the United States in negotiations over the

[16] GAO, "Nuclear Nonproliferation: DOE Needs to Address Uncertainties with and Strengthen Independent Safety Oversight of Its Plutonium Disposition Program," GAO-10-378, March 2010, p. 9, http://www.gao.gov/assets/310/302279.pdf.

[17] GAO, 2014, *op. cit.*

[18] DOE, *FY 2015 Congressional Budget Request*, *op. cit.*

PMDA Protocol and resulted in restrictions on producing new plutonium in these fast reactors using this material. The verification agreement negotiations include discussions of how to technically verify this. In the 2010 Protocol, Russia agreed to restrictions on the reactors that are intended to prevent the creation of more plutonium than is destroyed.[19]

An additional criticism of the program from a nonproliferation perspective is that the high cost required to date for the plutonium disposition program in the United States is funded out of the Defense Nuclear Nonproliferation budget. There is concern that money is being taken away from other programs which some consider to have a more direct impact on preventing the proliferation of weapons-usable nuclear materials. Programs cited include the Second Line of Defense border security program or the Global Threat Reduction Initiative. Non-governmental nonproliferation experts have made recent public statements.[20] For example, Joe Cirincione of the Ploughshares Fund has said, "funding for the plutonium fuel facility falls within the nuclear nonproliferation budget. That means that every dollar spent on unnecessary programs like MOX is one dollar less for vital nonproliferation programs that keep nuclear material and technology out of the hands of terrorists."[21] In light of this concern, in June 2012 the House passed an amendment to the FY2013 Energy and Water Appropriations bill proposed by Representative Fortenberry to reprogram money from the U.S. MOX program to the Global Threat Reduction Initiative.[22] The provision ultimately was not enacted, however.

Other observers, including within the executive branch, note that the purpose of this program is nonproliferation—rendering weapons-grade plutonium unusable for nuclear weapons on the basis of mutual verification. The American Nuclear Society has come out strongly in favor of the program for nonproliferation reasons.[23]

Issues for Congress

Recent public debate surrounding the U.S. plutonium disposition program has centered on the budget trade-offs of funding the U.S. plutonium disposition program in light of sequestration and other funding limitations. Local concerns have focused on potential economic losses in the region and the possibility that plutonium brought to Savannah River for use as nuclear fuel will end up being stored there indefinitely. National concerns have been raised that a halt or serious delay to the U.S. program would cause the Russians to reconsider their obligations to dispose of their excess weapons plutonium.

[19] Governments of the United States and the Russian Federation, 2000 Plutonium Management and Disposition Agreement as Amended by the 2010 Protocol, Article III.3, http://fissilematerials.org/library/PMDA2010.pdf.

[20] Reif Kingston, "New Obama Budget Slashes Nonproliferation," The Center for Arms Control and Non-Proliferation, March 6, 2014, http://armscontrolcenter.org/issues/nuclearterrorism/articles/new_obama_budget_slashes_nonproliferation/.

[21] Joe Cirincione, "The Federal Government's $10 Billion Plutonium Boondoggle," *The Atlantic*, April 27, 2012, http://www.theatlantic.com/politics/archive/2012/04/the-federal-governments-10-billion-plutonium-boondoggle/256470/.

[22] "House Accepts Fortenberry Measure to Strengthen Nuclear Security Efforts," Press Release, Office of Representative Jeff Fortenberry, June 6, 2012, http://fortenberry.house.gov/index.php?option=com_content&view=article&id=3662:house-accepts-fortenberry-measure-to-strengthen-nuclear-security-efforts&catid=41:press-releases&Itemid=2; "House Bill Shifts Money from MOX Plant to Nuclear Security," *Global Security Newswire*, June 7, 2012.

[23] American Nuclear Society, Position Statement 47, http://www.new.ans.org/pi/ps/docs/ps47.pdf.

Due to the cost and management challenges of the MOX program, others have raised the possibility of finding an alternative to MOX fuel production as a means to fulfill the U.S.-Russian PMDA.[24] Supporters, however, counter that sunk costs in the current program would make pursuing an alternative path more expensive in the long run.[25]

In testimony before Congress in early 2013, Obama Administration officials reiterated their commitment to the PMDA agreement with Russia.[26] The FY2014 and FY2015 DOE budget justifications state that "NNSA remains committed to the plutonium disposition mission." However, as noted above, the Administration is now considering alternative strategies for achieving that mission.[27] According to the 2010 Protocol amending the PMDA, the United States would have to obtain written agreement with Russia to implement any alternative to irradiating plutonium in nuclear reactors.[28]

In its report on the National Defense Authorization Act for FY2014 (H.R. 1960, H.Rept. 113-102), the House Committee on Armed Services expressed concern about MFFF's "continuing escalating costs" but suggested that the Administration's proposed budget cuts "may not actually reduce costs to the taxpayer and will likely delay the disposition of 34 metric tons of weapons grade plutonium." The Committee directed NNSA to study potential cost savings, consider adding international partners to the program, and study "the potential for achieving greater economic efficiencies by designating additional supplies of surplus plutonium for disposition through the MOX facility." However, the bill as approved by the Committee retained the Administration's proposed construction funding cut.

The Senate Armed Services Committee approved its version of the defense authorization measure (S. 1034) on June 14, 2013. The Committee voted to boost authorized funding for surplus nuclear materials disposition by $80 million over the Administration request.[29] Congress appropriated $526.1 million for Fissile Materials Disposition for FY2014, a cut of $136.7 million from the FY2013 level. However, the FY2014 appropriation was bolstered by a $59.2 million reprogramming from the International Material Protection and Cooperation account, according to DOE's FY2015 justification.

The State of South Carolina filed a lawsuit on March 18, 2014, to block DOE from placing MFFF in cold standby and to require that construction continue in FY2014. The suit maintains that the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (P.L. 107-314) "was enacted

[24] Frank von Hippel, Rodney Ewing, Richard Garwin, Alison MacFarlane, "Time to Bury Plutonium," *Nature,* May 10, 2012. For DOE's analyzed MOX alternatives, see *Draft Surplus Plutonium Disposition Supplemental Environmental Impact Statement*, summary, DOE/EIS-0283-S2, July 2012, http://nnsa.energy.gov/sites/default/files/nnsa/07-12-inlinefiles/Summary.pdf.

[25] http://us.arevablog.com/2013/02/19/answers-to-questions-about-funding-mox-project-budget/.

[26] House Appropriations Subcommittee on Energy and Water Development Hearing on the Proposed Fiscal 2014 Appropriations for the Energy Department's Nuclear Nonproliferation and Naval Reactor Programs and the National Nuclear Security Administration, February 26, 2013.

[27] DOE, *FY 2014 Congressional Budget Request*, Vol. 1, April 2013, p. DN-119, http://energy.gov/sites/prod/files/2013/04/f0/Volume1.pdf.

[28] 2000 Plutonium Management and Disposition Agreement as amended by the 2010 Protocol, Article III, http://fissilematerials.org/library/PMDA2010.pdf.

[29] Senate Committee on Armed Services, "Senate Committee on Armed Services Completes Markup of the National Defense Authorization Act for Fiscal Year 2014," June 14, 2013, http://www.armed-services.senate.gov/press/releases/upload/SASC_NDAA_061413.pdf.

to codify the commitments of the United States and DOE to the State of South Carolina that while plutonium may be placed in South Carolina, such placement was not final disposition for long-term storage of plutonium in the State, but rather a temporary storage to implement the disposition method of MOX processing in the MOX Facility."[30]

Some South Carolina lawmakers and officials have also stressed that South Carolina agreed to accept surplus plutonium from other weapons complex facilities with the understanding that it would be removed under a definite schedule. Plutonium that is made into MOX fuel, they point out, would be shipped off-site to commercial nuclear power plants, while alternatives such as immobilization in glass would provide no clear path for removal, given the current lack of a federal high-level waste central storage facility or underground repository.[31]

Section 3181 of the Bob Stump Defense Authorization (50 U.S.C. 2566) would penalize DOE if it misses various MOX fuel fabrication deadlines. As amended by Section 3116 of the National Defense Authorization Act for 2013 (P.L. 112-239), which delayed the previous deadlines by two years, the act requires that at least one ton of MOX fuel be produced each year, starting in 2014, or plutonium transfers into the state must be halted. If plutonium brought into the state since 2002 is not processed into MOX fuel by 2022, DOE must pay the state up to $100 million per year until it is removed.

DOE said in its FY2015 budget justification that it would not meet the 2014 MOX production deadline in P.L. 112-239. In light of the act's requirements, DOE said that it had "suspended any further transfers of defense plutonium and defense plutonium materials to be processed at the MOX facility in the State of South Carolina." DOE also said that it "will submit a report to Congress on options for removing an amount of defense plutonium or defense plutonium materials from the State of South Carolina equal to the amount of defense plutonium or defense plutonium materials transferred to the State of South Carolina after April 15, 2002."

[30] *State of South Carolina v. United States Department of Energy*, United States District Court, District of South Carolina, Aiken Division, March 18, 2014, http://2hsvz0l74ah31vgcm16peuy12tz.wpengine.netdna-cdn.com/wp-content/uploads/2014/03/MOX-complain-3.18.2014-00269474xD2C78.pdf.

[31] Rob Pavey, "Sen. Lindsey Graham Says Reducing MOX Costs Could Save the Project," *Augusta Chronicle*, April 25, 2013, http://chronicle.augusta.com/news/government/2013-04-25/sen-lindsey-graham-says-reducing-mox-costs-could-save-project.

Table 2. Defense Nuclear Nonproliferation Appropriations FY2007-FY2015

(in $ thousands)

	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14 Enacted	FY14 Repro-gram[a]	FY15 Request
Fissile Materials Disposition	470,062	66,235	41,774	701,900	802,198	685,386	663,754	526,057	585,300	311,125
U.S. Surplus Materials Disposition	470,062	66,235	40,774	700,900	802,173	684,386	662,832	526,057	585,300	311,125
U.S. Pu Disposition	57,415	0	0	91,659	200,400	205,632	189,480	157,557	157,557	85,000
U.S. Uranium Disposition	86,898	66,235	39,274	34,691	25,985	26,000	23,958	25,000	25,000	25,000
Supporting Activities	14,960	0	1,500	312	0	0	0	0	0	0
Construct.	310,789	0	0	574,238	575,788	452,754	449,394	343,500	402,743	201,125
MOX Fuel Fab	262,500	0	0	504,238	501.788	435,172	400,990	343,500	402,743	196,000
Pit Dis.	32,789	0	0	0	17.000	0	0	0	0	0
Waste Solid.	15,500	0	0	70,000	57.000	17,582	48,404	0	0	5,125
Russian Materials Disposition	0	0	1,000	1,000	25	1,000	922	0	0	0

Source: CRS-compiled information from DOE annual budget requests to Congress, H.Rept. 112-118, and S.Rept. 112-75.

a. Reflects a reprogramming of $59,242,760 from FY2013 International Material Protection and Cooperation funding to Fissile Material Disposition in FY 2014.

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