



Savannah River Site Watch

## A PROJECT IN DISARRAY: MOX

**U.S. Department of Energy's Mismanaged Plutonium Fuel (MOX) Project:  
Will the Doom or Gloom Scenario Play Out as the Downward Spiral Continues?**

*Chronic Funding Problems and Construction Challenges have Determined the Project's Fate*

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Tom Clements, Director, Savannah River Site Watch, Columbia, South Carolina  
tel. 803-240-7268, [srswatch@gmail.com](mailto:srswatch@gmail.com), [www.srswatch.org](http://www.srswatch.org)



*Photo: A view from 2000 feet - the recommended Federal Aviation Administration altitude over DOE facilities - of the Mixed Oxide Fuel Fabrication Facility (MFFF) under construction at the U.S. Department of Energy's Savannah River Site (SRS) in South Carolina, November 10, 2016,*

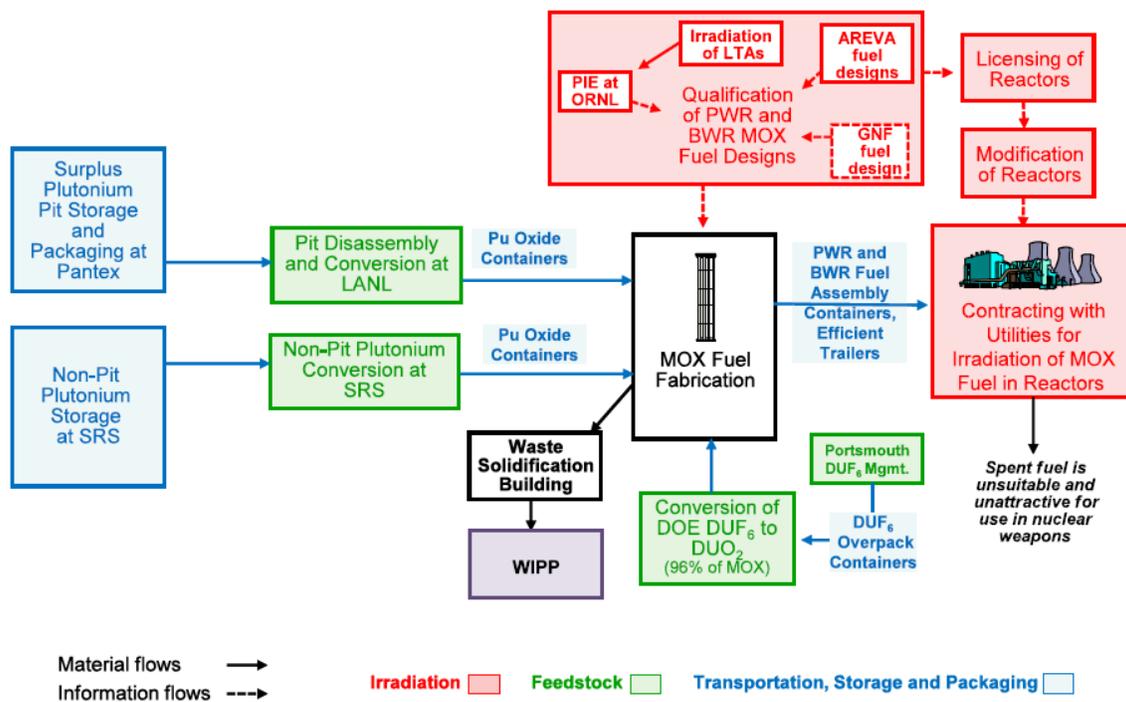
*Credit: "@High Flyer, special to Savannah River Site Watch;" more photos at <http://www.srswatch.org>*

## Introduction to a Boondoggle

As a method to irreversibly dispose of 34 metric tons of surplus weapons plutonium, the U.S. Department of Energy (DOE) is pursuing construction of a facility to make commercial reactor fuel from that plutonium, with the goal for that fuel to be irradiated in commercial nuclear reactors. Toward that end, the Mixed Oxide Fuel Fabrication Facility (MFFF) is now under construction at the DOE's Savannah River Site (SRS) in South Carolina by the contractor Chicago Bridge & Iron AREVA MOX Services.

The project has languished for years and has become one of the most costly and challenging construction projects ever undertaken by DOE or the U.S. Government. The ultimate fate of the badly bungled project is unknown but all indications are that the successful completion of it is in doubt.

**Overview of one MOX-Use Concept – from *Final Report of the Plutonium Disposition Red Team, August 2015***



**Figure 1. Definition of MOX Program Elements**

Given the massive cost overruns, lengthy schedule delays, design problems, chronic construction problems and an enduring need for the disposal of surplus weapons plutonium, it is critical to determine if the MOX project is viable and if it should continue or be terminated and other plutonium disposal options pursued. Due to persistent technical challenges and inadequate funding on a yearly basis, the project has been placed by Congress on an unofficial shut-down track.

The goal of this paper is not to review technical aspects of various plutonium disposition options or to review more than a brief history of the MOX program but rather to examine questions concerning the

viability of the MOX project. As no plan of any sort has been presented to fund or continue the project in even the short term and given unresolved construction problems the project continues to teeter on the brink of official termination.

In spite of all the historic challenges, only now are chronic management problems by DOE - including by the National Nuclear Security Administration \*(NNSA), the Office of Project Management Oversight and Assessments (PM) and the Office of Acquisition Management (OAM) - being better addressed. While some effort seems to be finally underway to internally address DOE's management and oversight problems, there has been no case made by anyone that there is a successful path forward for the MOX contractor, CB&I AREVA MOX Services.

Mismanagement and construction problems by CB&I AREVA MOX Services and some of its contractors appears to be ingrained. A major project shake-up, including removal of the main contractor, may be essential to possibly salvage the troubled project or to allow the project's closure in an orderly fashion. (

This paper will address a number of key project areas, including:

- **CB&I AREVA MOX Services Dealt Devastating Blow by NNSA in FY 2016 Award Fee**
- **Plutonium Management and Disposition Agreement (PMDA) between the U.S. and Russia**
- **Massive, Uncontrolled & Unconstrained Cost Increases Since Project's Inception**
- **Sufficient Appropriations for Project Survival?**
- **Fixed-Cost Contract to Reduce Risk and Cost to DOE?**
- **Construction Challenges & the "Rework" Problem**
- **Smoking Rework Gun – "Rework Definitions" Memo**
- **Hints of Design Problems**
- **Oversight and Accountability Lacking: MOX Waste, Fraud, Abuse, Mismanagement & Corruption?**
- **Fate of MOX Madness - The Doom or Gloom Option?**

## **Prelude to Termination? CB&I AREVA MOX Services Dealt Devastating Blow by NNSA for “Unsatisfactory” Construction Performance and Dealing in Inaccurate Information in Fiscal Year 2016**

For the Fiscal Year 2016 (October 1, 2015 – September 30, 2016) the performance of the MOX plant design and construction contractor, CB&I AREVA MOX Services (MOX Services), was assessed by the NNSA.<sup>1</sup> The “Award Fee Determination” made the stunning conclusion that the performance of MOX Services in its construction “project execution” activities was “unsatisfactory.”

NNSA excoriated the company for a host of construction management and execution matters and revealed that it has little confidence in its contractor to carry out the project in order to meet any schedule or budget. NNSA questioned the contractor’s accuracy in providing information and labeled its claim of the project being “70% complete” as “patently false.” In other words, NNSA essentially determined that MOX Services has been lying to NNSA, politicians and local media near SRS about how far along the project is.

NNSA clearly states that contractual obligations were not met in several areas. NNSA reveals, despite claims by MOX Services that it had an accurate cost estimate and project completion date, that MOX Services refused to enter into a “firm fixed price contract” to prove its faith in its own estimates.

Given how honestly the NNSA assess construction problems and the contractor’s performance, the award fee assessment could prove to be a decisive blow in removing MOX Services from the project.

The Award Fee Determination, dated December 6, 2016, was not posted on line by NNSA (even though other award fees for NNSA are generally posted). Savannah River Site Watch filed a Freedom of Information Act (FOIA) request for the award fee documents on December 13, 2016 and received a response on February 21, 2017.

The Award Fee Determination is one the harshest appraisals that the NNSA could render. MOX Services only garnered 8.9% of the possible fee of \$3 million (an amount far less than in past years), so received a paltry award fee of \$267,000.<sup>2</sup> Due to better performance in other aspects of the project MOX Services somehow was able to secure a “satisfactory” rating for the overall project.

The language of the award fee is clear, that NNSA had no faith in MOX Services in Fiscal year 2016 to carry out the project in the manner stipulated in its contract:

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<sup>1</sup> U.S Department of Energy’s National Nuclear Security Administration (NNSA), “Contract DE-AC02-99CH10888, FY 2016 Award Fee Determination,” December 5, 2016, obtained on February 21, 2017 via Freedom of Information Act request, <https://tinyurl.com/hffcldq>

<sup>2</sup> See award fee information for FY 2015 in SRS Watch news release, with links to NNSA’s award fee assessment: [http://www.srswatch.org/uploads/2/7/5/8/27584045/srs\\_watch\\_news\\_on\\_mox\\_award\\_fee\\_april\\_21\\_2016.pdf](http://www.srswatch.org/uploads/2/7/5/8/27584045/srs_watch_news_on_mox_award_fee_april_21_2016.pdf) (Linked in Project on Government Oversight (POGO) blog of May 2, 2016, “MOX Contractor Slammed for Poor Performance,” <http://www.pogo.org/blog/2016/05/mox-contractor-slammed-for-poor-performance.html>)

During the evaluation period, the contractor's overall cost, schedule and technical performance was unsatisfactory. While the contractor's team continued to evolve and make tactical improvements within management system (primarily construction) processes, procedures, and personnel; overall implementation of an integrated project plan including project initiatives and improvements took longer and cost more to implement. The contractor was unable to balance project technical baseline requirements with other elements of project performance, such as cost and schedule. The contractor lacked the fiduciary will to plan and execute work to fully benefit the project and taxpayer considering the current state of the project and overall programmatic uncertainty. Key contract and project deliverables such as Estimate at Complete (EAC), Integrated Project Schedule (IPS) and monthly progress reports continued to reflect inaccurate cost/schedule data and inappropriately forecasted successor activities and corrective actions. This Project Management control System breakdown has currently led to the MOX Services Earned Value Management System decertification. There continued to be a lack of transparency and openness in external communication with key project stakeholders by the contractor including continued release of misleading and inaccurate project information. The contractor continued to increase the amount of legal positioning and posturing throughout many of the project deliverables and activities including the submission of additional REAs, claims and notices of impact/change under the contract that did not have valid or plausible bases.

NNSA's inquiries and concerns into the basis of the contractor's decisions and the manner in which those decisions were communicated forced additional Government engagement to ensure the contractor's actions were prudent. This is aptly illustrated by the contractor's management of its procurement system, whereby it continued to spend resources proposing procurement activities that have not been defined within the schedule, integrated with the functional line organization, and are not critical to the overall project completion. This was further reinforced by the contractor's concerted focus on annual spending and reaching "75% complete" versus appropriate spending on project critical activities, finishing work, and reducing future risk. The over 70% physical project completion figures reported by the contractor are patently false. The contractor also spent considerable effort and resources contending that NNSA's cost estimates, estimated percentage completion, and estimated project completion dates are inaccurate. However, when the contractor was provided the opportunity to establish a commitment to its asserted cost/schedule performance capabilities via a firm fixed price proposal, it did not provide a proposal, or commit to a date by which a proposal would be provided.

Although there were some areas where the contractors' performance could have otherwise met the award fee criteria and reasonably justified some level of award fee; the small, incremental improvements it achieved had no demonstrable

material positive impact on overall cost, schedule, or technical performance. Further, any such improvements were entirely subsumed and outweighed by the contractor's overall non-satisfactory performance across the most important contractual requirements.

The contractor's Management Team continued to impose unnecessary activities upon the Government due to poor functional performance, lack of planning, lack of attention to detail, and continued misaligned corporate posturing. The contractor's actions to date do not appear to have improved from the concerns NNSA documented in the FY2015 Award Fee report of the FY2015 Contractor Performance Reporting System (CPARS) report.

Until now, NNSA has not been so openly critical of the performance of CB&I AREVA MOX Services. It has appeared that NNSA was taking somewhat of a hands-off approach. This new, more productive and critical approach should have been deployed years ago and not after so much more money has been wasted to no clear end.

**Conclusion:** The FY 2016 award fee narrative is a crippling blow dealt by NNSA to CB&I AREVA MOX Services. It is unknown how the extremely poor performance by MOX Services in the MOX plant construction activities in Fiscal Year 2016 will impact its participation in the project going forward but it should be grounds for its contract being revoked.

#### **Plutonium Management and Disposition Agreement (PMDA) between the U.S. and Russia: In Decline before Russian Withdrawal**

Beginning in 1994, the reports on plutonium disposition by the National Academy of Sciences stimulated an in-depth discussion on the matter and prompted the DOE to begin analyzing various disposition options. Utilizing the process under the National Environmental Policy Act, DOE chose a dual-track method for plutonium disposition: via MOX use and also via immobilization of the plutonium in vitrified high-level nuclear waste, with both tracks being carried out at SRS.

In 2000, the decision to dispose of 34 metric tons of surplus plutonium by each party was legally embodied in the Plutonium Disposition and Management Agreement (PMDA) with Russia.<sup>3</sup> That agreement, which does not have the status of a treaty, as has been erroneously stated by politicians, the media and even officials with DOE's National Nuclear Security Administration, embodied DOE's dual-track approach. The 2000 agreement stipulated that operation of the plutonium disposition facilities referenced in the agreement would begin operation by December 31, 2007, with a disposition rate in each country of no less than 2 metric tons per year.

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<sup>3</sup> 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, signed in 2000, <https://www.state.gov/documents/organization/213493.pdf>

DOE officially halted research and development of immobilization in 2002, incorrectly claiming that a MOX-only option was the cheapest method of plutonium disposition. But it was not until 2010 that the PMDA was amended, in agreement with Russia, eliminating the immobilization option by the U.S. and stipulating that the U.S. would pursue a MOX-only disposition option for the plutonium covered under the agreement<sup>4</sup>. The U.S. agreed to Russia adding the BN-800 plutonium breeder reactor to the agreement. With the changes in the agreement, the proliferation concerns with processing weapon-grade plutonium into MOX fuel in a DOE-owned facility regulated by the U.S. Nuclear Regulatory Commission and introducing that fuel into commerce were again ignored.

Even before the agreement was amended in 2010 it was clear that the MOX-only option of the U.S. posed significant challenges. The amended agreement stated that the U.S. would use at least four light-water reactors for MOX irradiation, with a target of 2016 for completion of construction of the MOX plant and 2018 for commencement of MOX irradiation. Even before 2010 these dates were highly suspect and no reactors were committed to the MOX mission (which remains the case today).

Additionally, the 2010 agreement increased on paper the amount of funding available from the U.S. to Russia to carry out its program, from \$200 million to \$400 million. No money was ever transferred.

Most importantly, the amended agreement kept the same language (Article IX.6) pertaining to the dependency of disposition on funding: “The activities of each Party under this Agreement shall be subject to the availability of appropriated funds.” Thus, the congressional role was key in overseeing the U.S. MOX project’s demise.

Though Russia stated on October 3, 2016 that it was withdrawing from the agreement, it was clear long before that date that the agreement was in trouble. Though blame was placed on Russia for the termination of the agreement, even the DOE’s Red Team stated in 2015 that the “Russians may consider the agreement abrogated” due to the failure to achieve the “agreed timeline for disposition of the 34 MT.”<sup>5</sup>

Up until the withdrawal of Russia, it appeared Russia was open to change in the text of the agreement and had less concern about the U.S. plutonium disposition methods as it was pushing forward no matter what with its new BN-800 breeder reactor, included in the agreement amended in 2010.

The requirements in the agreement for verification by the International Atomic Energy Agency (IAEA) of disposition activities in both countries is perhaps the most important non-proliferation aspect lost if the agreement remains inoperative. But a blow to nuclear non-proliferation was included in the agreement itself via U.S. sanction of the BN-800 sodium-cooled plutonium breeder reactor as Russia’s central plutonium disposition method. That sodium-cooled reactor, which first became operative in 2014, could be operated in the future in such a manner as to produce yet more weapon-grade plutonium, adding to the already massive weapon-usable plutonium stockpile now held by Russia.

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<sup>4</sup> PMDA, April 2010, <https://www.state.gov/documents/organization/182688.pdf>

<sup>5</sup> Final Report of the Plutonium Disposition Red Team, August 2015, page 29, <https://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/Pu-Disposition-Red-Team-Report-081315vFinal-SM.pdf>

Other problems with the agreement aside, the U.S. had perhaps already quietly dealt a debilitating blow to the agreement before Russia withdrew. These things could perhaps be seen as having rendered the agreement inoperable:

1. Complete inability by the U.S. to meet target goals for facility operation and processing stipulated in the 2010 agreement, and no ability or known will to establish new, realistic target goals;
2. Total failure by the U.S. Congress to appropriate sufficient funds to carry out the MOX program on a year-to-year basis and inability by Congress and DOE to guarantee adequate construction, start-up or operational funding in future years. Congress thus sealed the fate of the role of the U.S. in the PMDA by justifiably underfunding MOX and it on a termination track.

Neither prior to Russia's withdrawal from the agreement, nor until now, has there been an explanation given by NNSA or the State Department as to how the U.S. was planning to meet the schedule and funding requirements of the amended agreement or how those matters could be resolved and presented to Russia. At best, it could be interpreted that the U.S. had simply allowed its agreement obligations to lapse and saw no way forward in further amending the PMDA. Russia's interest in the agreement has obviously waned and it is unknown if it could be revived under any new climate of U.S.-Russia cooperation. Even if the PMDA gains new life that will not change the dire facts on the ground facing the U.S. MOX program.

Though it is unknown if there are grounds to revive the agreement and/or establish an alternative agreement addressing IAEA verification matters, the U.S. indicated in December 2016 that it will place 6 metric tons of non-MOXable plutonium under IAEA "monitoring and verification."<sup>6</sup> This material falls outside the 34 MT covered in the PMDA. Initial amounts of this plutonium are now being downblended at the Savannah River Site in a single limited-capacity glovebox in the old K-Reactor, via mixture with an inert ingredient known as "stardust," for eventual disposal as transuranic waste in DOE's Waste Isolation Pilot Plant (WIPP) in New Mexico.

It is worth mentioning that though DOE has stated that the MOX plant would only be used for the plutonium disposition mission and nothing else, whispers about using the MOX plant for purposes beyond manufacture for MOX fuel for light-water reactors were in the air during the project's earlier years. Some have seen the MOX plant as a foot in the door for commercial spent fuel reprocessing or fast reactors, ideas that have stalled in the U.S. and which reflect a certain "BN-800 envy" by some in the U.S.

A document obtained by SRS Watch via a Freedom of Information Act request reveals that In an April 2009 meeting, almost two years after the MOX plant construction began and while the PMDA was being renegotiated, that AREVA, MOX Services, DOE and the Tennessee Valley Authority (TVA) met and discussed "the need to make fast reactor fuel for the first core of a Advanced Recycle Reactor and the MFFF ability to fabricate this fuel if it is oxide fuel. BWXT is also considered an option for building fast

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<sup>6</sup> DOE news release "United States Commits to IAEA Monitoring for the Verifiable Disposition of Six Metric Tons of Surplus Plutonium," December 5, 2016, <https://energy.gov/articles/united-states-commits-iaea-monitoring-verifiable-disposition-six-metric-tons-surplus>

reactor fuel.”<sup>7</sup> Nothing more has been heard of that idea but the half-baked and unfunded scheme of an “energy park” at SRS, with commercial reprocessing, a MOX plant and fast reactors is still brought out of the closet on occasion in the SRS area.

Also, NNSA is believed to have completed a “Critical Decision-0” (CD-0) document package on expanding plutonium downblending at SRS, a process through which both non-MOXable and MOXable plutonium could be treated. SRS Watch filed a Freedom of Information Act (FOIA) request for those documents in late November 2016 but to no surprise NNSA has delayed a response to the request.

**Conclusion:** At this point the PMDA is inoperative. The U.S. has presented no way forward with how it could revive the agreement or how it could meet its current or amended agreement obligations if Russia was open to such a discussion. Likewise, Congress has not explained how it would meet long-term funding requirements to meet PMDA obligations. Due to the agreement’s canceled or suspend status and lack of adequate funding for MOX, the U.S. is no longer constrained by the PMDA’s stipulation that the U.S. pursue the MOX option.

### **Massive, Uncontrolled & Unconstrained Cost Increases since Project’s Inception**

Since the program’s beginning, the skyrocketing cost projections for the MOX project make it a case study in what can go wrong with a large, complex, mismanaged DOE construction project. Low-balled estimates used to convince Congress to fund the project have over time not only been revealed to be grossly inaccurate but have also raised deep questions about DOE’s ability to manage such a project, as warned by various reports by the Government Accountability Office (GAO). Questions about cost-estimate methodology and project management grow ever deeper as the project continues to languish.

An October 1999 report by Oak Ridge National Laboratory (ORNL) entitled *LIFE CYCLE COSTS FOR THE DOMESTIC REACTOR-BASED PLUTONIUM DISPOSITION OPTION* projected a 20-year life-cycle cost for plutonium disposition at “approximately \$1.4 billion for a 33-MT plutonium disposition mission.”<sup>8</sup> That cost included the MOX plant construction and operation as well as MOX irradiation in light-water reactors, plus irradiation costs and minus the supposed value of MOX fuel.

A November 1999 report by DOE’s Office of Fissile Material Disposition entitled *Plutonium Disposition Life Cycle Costs and Cost-Related Comment Resolution Document* reveals how unreliable and wildly wrong DOE has been in assessing the cost of the MOX project.<sup>9</sup> The report states that “design and construction for the MOX FFF, including plutonium polishing processes, totals \$620 million in FY 2000 dollars.” According to one inflation calculator, that amount would be about \$865 million in current dollars.

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<sup>7</sup> “Summary of TVA Meeting held 22 April 2009,” memo on meeting to discuss “TVA’s activities working with DOE-NE to study recycle MOX fuel use in the US and develop a MOX Qualification Plan,” obtained by Tom Clements from the Tennessee Valley Authority via a FOIA request and available on request.

<sup>8</sup> DOE’s Oak Ridge National Laboratory, *LIFE CYCLE COSTS FOR THE DOMESTIC REACTOR-BASED PLUTONIUM DISPOSITION OPTION*, October 1999, page 1, [http://www.srswatch.org/uploads/2/7/5/8/27584045/mox\\_life\\_cycle\\_cost\\_1998\\_ornl.pdf](http://www.srswatch.org/uploads/2/7/5/8/27584045/mox_life_cycle_cost_1998_ornl.pdf)

<sup>9</sup> DOE’s Office of Fissile Material Disposition, *Plutonium Disposition Life Cycle Costs and Cost-Related Comment Resolution Document*, November 1999, page 2-8

For MOX plant construction and operation together, DOE's estimate in the ORNL document was about \$1.4 billion (FY 2000 dollars). In the November 1999 document, DOE presented an operational start-up of the MOX plant in FY2006 and the facility would operate until 2016, a predication also hugely incorrect and likely, in part, unfortunately responsible for the project's early support. Based on suspect estimates in that document, the commercial operation of the MOX plant has already been delayed 11 years.

As what appears to be a matter of policy, the presentation of unreliable cost estimates for MOX plant construction continued during the 2000s. In 2007, an estimate of \$4.7 billion was presented, with a MOX plant start-up date of 2016.<sup>10</sup> In 2014, an estimate of \$7.7 was given with start-up in 2019.<sup>11</sup>

Shortly after the 1999 estimate and well before the 2007 estimate, the George W. Bush administration made a decision in 2002 to terminate the immobilization option, with a false claim that a single-track MOX option was cheaper.<sup>12</sup> It was clear to some at the time of the decision that immobilization-only well could have been cheaper and that the decision was politically motivated to favor MOX. It was likewise known at the time that non-MOXable plutonium not covered in the PMDA would have to be dealt with, thus in reality necessitating multi-track options and increasing plutonium disposition costs.

A critical mistake of DOE/NNSA was to bifurcate disposition of plutonium managed by the NNSA versus that managed by DOE's Office of Environmental Management. This mistake has not only resulted in a lack of a comprehensive plutonium disposition plan and but has also been exploited by those who earlier claimed that MOX was cheaper. Plutonium disposition project bifurcation continues until today and that hurdle needs to be eliminated and a wholistic plutonium-disposition approach adopted.

DOE presented MOX and plutonium disposition cost estimates in these tables in two more recent reports, both revealing MOX is far more expensive than earlier anticipated and that it's much cheaper and technically less challenging to dispose of plutonium as waste:

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<sup>10</sup> GAO, *Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays*, March 27, 2007, pages 10-11, <http://www.gao.gov/assets/260/258104.pdf>

<sup>11</sup> GAO, *Plutonium Disposition Program - DOE Needs to Analyze the Root Causes of Cost Increases and Develop Better Cost Estimates*, pages 2 and 24, <http://www.gao.gov/assets/670/660927.pdf>

<sup>12</sup> DOE's *Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options*, April 2014, page 8, <http://fissilematerials.org/library/doe14a.pdf>

1. *Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options*, Table 6-1, April 2014<sup>13</sup>

Table 6-1: Normalized Cost Comparison of Options \*

Option	Capital Project Point Estimate	Operating Cost Estimate	Estimate of Other Program Costs	Total Life Cycle Cost To-Go Estimate**
Option 1: Irradiation of MOX fuel in LWRs	\$6.46 billion to go	\$10.26 billion	\$8.40 billion	\$25.12 billion
Option 2: Irradiation of Plutonium Fuel in Fast Reactors (Single-Module ADR)	\$9.42 billion	\$33.41 billion	\$7.62 billion (\$1.2 billion offset from metal not included)	\$50.45 billion
Option 3: Immobilization (Ceramic or Glass) with HLW	\$10.67 billion	\$11.58 billion	\$6.39 billion	\$28.65 billion
Option 4: Downblending and Disposal	\$290 million	\$3.00 billion	\$5.49 billion	\$8.78 billion
Option 5: Deep Borehole Disposal	Not Estimated	Not Estimated	Not Estimated	Not Estimated

\* Based on \$500 million annual capital costs constraint and escalating capital and operating costs.

\*\* Based on Capital Point Estimate

2. *Final Report of the Plutonium Disposition Red Team*, August 2015, citing a summary of information from the *Plutonium Disposition Study Options Independent Assessment Phase 2 Report*, Table 3, August 2015<sup>14</sup> - including cost ranges with two funding caps:

Table 3. Aerospace Estimate Summary (\$billions – FY14/RV)

Cost Element	Option 1: MOX Fuel	Option 4: Dilute and Dispose
PWG LCC Estimate	18.6 / 25.1	8.2 / 10.3
Assessment of Changes	2.7 / 5.6	1.9 / 2.9
<b>\$500M Cap</b>		
Assessment of Cost Risks	5.9 / 16.8	3.0 / 4.0
<b>Total Life Cycle To-Go Cost w/ \$500M cap</b>	<b>27.2 / 47.5</b>	<b>13.1 / 17.2</b>
<b>\$375M Cap</b>		
Assessment of Cost Risks	8.5 / 79.7	3.0 / 4.0
<b>Total Life Cycle To-Go Cost w/ \$375M cap</b>	<b>29.8 / 110.4</b>	<b>13.1 / 17.2</b>

<sup>13</sup> Ibid.

<sup>14</sup> DOE's *Plutonium Disposition Study Options Independent Assessment Phase 2 Report*, by Aerospace, August 2015, [https://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/Plutonium Disposition Phase 2 TOR 082015 FINAL.pdf](https://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/Plutonium%20Disposition%20Phase%20TOR%20082015%20FINAL.pdf)

In 2016, the NNSA presented what seems to be a more realistic figure of \$17 billion for the MOX plant construction, with \$5 billion of that amount already having been spent.<sup>15</sup> The \$17-billion figure is based on the project being funded at an “annual funding constraint” of \$350 million/year, which is slightly above the congressionally appropriated funding level of about \$340 million/year from Fiscal Year 2014 through Fiscal Year 2017.

The U.S. Army Corps of Engineers analysis on which much of the document is based estimates the date of the completion of construction of the MOX plant to be the year 2048. This does not include the period of start-up testing or operation nor does it include costs to further modify the design to meet 2048 regulations. It also does not include costs to replace equipment and commodities that will be obsolete or non-functional at the time construction is finished.

**Table of costs from the report by NNSA and the U.S. Army Corps of Engineers report entitled *Mixed Oxide Fuel Fabrication Facility at the Savannah River Site: Overview of DOE’s 2016 Updated Performance Baseline with a Comparison to the Contractor’s Estimates and Data*:**

**Table ES-1: Comparison of the 2016 Updated Performance Baseline and Contractor’s 2016 Estimate At Completion – Assuming \$350M Annual Funding Constraint (\$000)**

	<b>2016 Updated Performance Baseline</b>	<b>Contractor’s July 2016 Estimate at Completion</b>
Actual Cost of Work Performed (ACWP) <sup>1</sup>	\$ 4,628,452	\$ 4,855,812
Base Estimate to Complete (“to go” cost)	5,656,605	3,447,991
Escalation	5,144,027	373,595
Management Reserve (MR)/Contingency	1,444,987	1,048,211
Fees	<u>295,187</u>	<u>264,516</u>
<b>Total Project Cost</b>	<b>\$ 17,169,258</b>	<b>\$ 9,990,125</b>
<b>Projected Completion Date</b>	<b>2048</b>	<b>2029</b>

<sup>1</sup> Contractor’s ACWP includes actual costs through March 2016; updated PB’s ACWP includes actual costs through January 2016. Projected February and March 2016 costs were included in the Updated PB “to go” cost estimate.

Any figures for the MOX plant cost and operational dates have been demonstrated to be highly suspect, but one thing is clear: the cost estimates have skyrocketed and the start-up dates drifted continuously into the future. Such startlingly negative estimates could lead one to conclude that the project will end up with an infinite cost at an ever-delayed start-up date far into the future (if it’s allowed to continue).

<sup>15</sup> U.S. Department of Energy (DOE) Office of Project Management Oversight and Assessments (PM), partnering with the U.S. Army Corps of Engineers (USACE), *2016 Updated Performance Baseline for the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, 2016, page 2, [https://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/2016\\_updated\\_performance\\_baseline\\_for\\_mox.pdf](https://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/2016_updated_performance_baseline_for_mox.pdf)

**Summary of some cost estimates for MOX plant construction and estimated operation dates**

Source of information, date	Cost of MOX plant construction	Operation of MOX plant
DOE 1999	\$620 million	2006
GAO 2007	\$1.4 billion	2016
GAO 2010	\$4.9 billion	2016?
Pu Disp. Working Group 2014	\$7.7 billion	2019
NNSA/USACE 2016	\$17.2 billion	2048

To underscore the lack of both a project budget and schedule, AREVA affirmed in a stunning admission in a news release of February 8, 2017, that there are debilitating unknowns facing the MOX construction project, including no project budget or schedule: “Regarding the budget, four years ago the US Department of Energy (DOE) decided to allocate a reduced annual budget, so this is reviewed and revisited each year. As a result, the consortium does not have an overall budget and clearly the timing of the project, and hence its advancement, are strongly conditioned by the decision.”<sup>16</sup>

To further amplify funding problems, the costs associated with MOX Irradiation, Feedstock, and Transportation (MIFT), a vital part of the overall MOX program, will be significant and in addition to construction and operation costs on the MOX plant. These costs are unknown and largely unpredictable given that the MOX plant may not be operable until decades from now.

In DOE’s *Final Report of the Plutonium Disposition Red Team* it was stated that MIFT funding “has not been able to realize funding levels sufficient to support eventual MFFF operations and final Pu disposition” and that “inadequate MIFT funding threatens certain fundamental Pu disposition strategies.”<sup>17</sup> The record does not reflect any current DOE cost estimates for this key part of the MOX program and neither Congress nor pro-MOX politicians such as Senator Lindsey Graham (R-SC) and Representative Joe Wilson (R-SC) have presented a way forward.

**Conclusion:** Given that there is no schedule for construction of the MOX plant and that there is extremely constrained funding as costs skyrocket, it is impossible to predict what may happen to the cost of the project in the future. Past cost estimates have been wildly inaccurate and all indications at the moment are that the project is simply not viable from a cost or schedule perspective.

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<sup>16</sup> AREVA news release, Update on situation with the MFFF recycling plant in the United States, February 8, 2017, <http://www.aveva.com/EN/news-10914/update-on-situation-with-the-mfff-recycling-plant-in-the-united-states.html>

<sup>17</sup> DOE’s Red Team report, 2015, page 5

## Sufficient Appropriations for Project Survival?

Since Fiscal Year 2014 (October 1, 2014 – September 30, 2015), funding for MOX plant construction has been on the order of \$340 million per year, an amount just above the “hotel load” (enough to keep the lights on and the partially completed infrastructure maintained).<sup>18</sup> Given that the \$340-million funding level is insufficient to correct past problems and make necessary progress on the project for it to be viable effectively means that Congress is keeping the project on an unofficial termination track.

Congress has directed DOE, via authorization and funding legislation, to keep construction going. For example, the report with the National Defense Authorization Act of Fiscal Year 2017 states “the Secretary of Energy shall carry out construction and project support activities relating to the MOX facility.”<sup>19</sup>

While construction continues - construction and design problems and lack of customers aside - the current funding level would have to be increased dramatically for the project to progress at a level to be viable. Reflecting the strain that the constrained budget of \$340 million has on the project, the Aerospace Phase I report of April 2015 states that “the MFFF construction cannot be completed at current (FY14) funding level (350M RY\$ / year cost cap on construction/capital) and the assumed escalation rates (4% construction and capital, 2% labor).”<sup>20</sup>

Historical funding levels have never gone above about \$500 million, reached in 2010, and since then funding has fallen to a stable decade-low amount of around \$340 million. This is far below the funding level to make the project viable. There is no indication from any politician or MOX booster that Congress will fund the project to the massive increase it needs.

It is generally accepted that funding dedicated to the MOX plant construction alone (excluding a host of support activities since the mid-1990s) has now reached over \$5 billion. This amount will be lost if the MOX project is canceled but it could be but a fraction of what is yet to be spent. In the event of project abandonment, repurposing the MOX building other purposes should be pursued.

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<sup>18</sup> See, for example, DOE’s budget request to Congress for Fiscal Year 2017, page 538, <https://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume1.pdf>

<sup>19</sup> Report accompanying national Defense Authorization Act (NDAA) for Fiscal Year 2017, page 1934 and onward, November 29, 2016, NDAA signed into law December 23, 2016, <http://docs.house.gov/billsthisweek/20161128/CRPT-114HRPT-S2943.pdf>

<sup>20</sup> DOE’s *Plutonium Disposition Study Options Independent Assessment Phase 1 Report*, April 2015, page 4, <http://fissilematerials.org/library/doe15a.pdf>

**Yearly and Cumulative Spending on MOX Plant Construction**  
(data from Congressional Research Service, 2016)

Fiscal Year	Appropriation amount (unadjusted for inflation)	Cumulative appropriations
1999	\$0	\$0
2000	40,375,000	40,375,000
2001	25,943,000	66,318,000
2002	65,993,000	132,311,000
2003	92,401,000	224,712,000
2004	360,273,000	584,985,000
2005	365,087,000	950,072,000
2006	271,800,000	1,167,872,000
2007	289,510,000	1,457,382,000
2008	231,721,000	1,698,103,000
2009	467,808,000	2,156,911,000
2010	504,238,000	2,661,149,000
2011	475,788,000	3,136,937,000
2012	435,172,000	3,572,109,000
2013	400,990,000	3,973,099,000
2014	343,500,000	4,316,599,000
2015	345,000,000	4,661,599,000
2016	340,000,000	5,001,599,000
2017	\$340,000,000	\$5,341,599,000

As indicated above and contrary to the mentioned Aerospace report, the NNSA's baseline reports does state that the MOX facility can be constructed at a funding level slightly above the current level of \$340 million per year: "At a stable funding profile of \$350 million per year, the MFFF can be completed at a TPC of \$17.17 billion, with a targeted completion date in 2048."<sup>21</sup> The NNSA report also analyzes an annual funding cap of \$500 million, an amount that also severely constrains complete of the project and which leads to a total construction cost of \$14.3 billion.<sup>22</sup>

The usual construction and design problems aside, the Red Team concluded that "DOE could accomplish a MOX Approach to Pu Disposition for about \$700M---\$800M/yr that involves a high level of technical complexity and risk."<sup>23</sup> If funding was ramped up to that level - for which there is no precedent since the project's inception and which could have a negative impact on DOE funding of other projects - it remains unclear how DOE could dramatically increase staffing with properly trained personnel and remains doubtful if debilitating, lingering construction problems can be overcome at any funding level.

AREVA, acting in its own self-interest, jumped in to affirm Red Team's the \$700 million funding figure, stating in a September 2015 blog that "Increasing funding to the report's identified \$700 million level would accelerate the facility's completion, allowing it to more quickly meet the program's

<sup>21</sup> DOE's 2016 Updated Performance Baseline for the Mixed Oxide Fuel Fabrication Facility, page 4

<sup>22</sup> Ibid, page 28

<sup>23</sup> DOE's Red Team report, page 27

nonproliferation goals.”<sup>24</sup> Obviously, AREVA’s self-serving efforts to get Congress to increase MOX funding above the project-termination level of \$340 million per year have so far failed.

No known plan by AREVA or anyone else exists to show how the job could be done at the \$700 million to \$800 million per year funding level. Unfortunately for MOX supporters, the only thing in support of that funding level is simply rhetoric such as the type in the AREVA blog cited above.

At present, given past funding profiles, especially in the last three years, there is no indication that Congress is motivated to more than double funding for MOX construction, especially given what is perceived to be extremely poor performance by the design and construction contractor, CB&I AREVA MOX Services. If Congress is so-motivated, where’s the proof? And, where is any plan by Congress to fund the project for decades at a \$700+ million level?

The construction performance by MOX Services in FY 2016 has, in NNSA’s assessment, been “unsatisfactory,” as can see the FY 2016 “award fee” documents mentioned earlier. SRS Watch believes that NNSA or the U.S. Comptroller General should explore options to halt the waste of taxpayer money and immediately remove the company from the project due to chronically poor performance, massive cost overruns and significant schedule delays.

It is clear that progress with MOX construction at the current funding level, or even at the \$500 million/year funding level, essentially dooms the project to never being completed. At a funding level at \$500 million or lower, costs will be so high at estimated construction-completion dates that the project will be rendered not viable. And, no funding level can regain the lost schedule or make up for debilitating, costly construction errors.

In addition to dramatic overall costs associated with completion of construction over a decade or more from now, the questions of staffing and obsolescence remain. As funding on the \$700 million to \$1 billion per year level is the only way to perhaps show progress with the project, no case had been made by any MOX supporters or any member of Congress that funding will be increased significantly. Congress has consistently been misled about costs and is likely wary about current cost estimates and unsubstantiated arguments that the project can be salvaged. Congress has wisely taken the deliberate step over the past few years to keep construction funding on a termination level that has rendered the project not viable. Keeping it going now just for the 1500 or so job involved makes it one costly earmark for Senator Lindsey Graham and Representative Joe Wilson and the small cadre of MOX boosters.

**Conclusion:** There are no signs that Congress will substantially increase funding for MOX construction and no entity has made a case that the project is viable without a massive jump in annual funding. As Congress has kept the project on an unofficial termination track, Congress must now cut the losses to the taxpayer and quickly formalize the official termination of the MOX boondoggle.

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<sup>24</sup> AREVA blog “Opinions Shouldn’t Cloud 5 Key Facts about the MOX Project,” September 21, 2015, <http://us.arevablog.com/2015/09/21/opinions-shouldnt-cloud-5-key-facts-about-the-mox-project/>

## Fixed-Cost Contract to Reduce Risk and Cost to DOE?

The report associated with the passage of the National Defense Authorization Act (NDAA) of Fiscal Year 2017 stipulates in “SEC. 3116. DISPOSITION OF WEAPONS-USABLE PLUTONIUM” that the U.S. Army Corps of Engineers “shall prepare a report on the contract for the construction, management and operations of the MOX facility.”<sup>25</sup>

The NDAA report goes on to require an assessment on the timeline concerning changes to the contract with CB&I AREVA MOX Services and assess options for a fixed-price contract, a fixed-price incentive fee or another “contractual mechanism.” That assessment on “construction, management and operations of the MOX facility” must include “milestones, cost, schedules, and any damage fees for those options” in order to “reduce risk and cost to the Department of Energy while preserving a fair and reasonable contract.”

Once the Corps of Engineers report is delivered to DOE, DOE must then determine if the contractor - evidently CB&I AREVA MOX Services - will agree or not agree to contract changes and also consider other contract modifications. Then, DOE will deliver the report and its conclusions to Congress and the U.S. Comptroller General.

AREVA, the company designing the MOX plant and a 30% partner in the consortium with Chicago Bridge & Iron (CB&I) – CB&I AREVA MOX Services – has faced extreme financial stress in France, resulting in a reorganization of all its branches a massive subsidy to stay afloat in France. It is unknown how that on-going financial crisis and issues concerning adequacy of the design of the MOX plant will impact any negotiations for a new contract.

Likewise, CB&I has faced problems in the U.S. at the Westinghouse AP1000 reactor construction projects in South Carolina. CB&I was removed in January 2016 from the project due to construction problems and large cost overruns, being replaced by the Fluor Corporation.<sup>26</sup> For unexplained reasons CB&I has been allowed to remain the lead construction contractor at MOX, via CB&I Project Services Group. Due to the company’s miserable performance at the reactor construction projects in the U.S. and due to historical and on-going problems at the MOX project, questions have arisen as to why the company should continue be involved in the MOX project.

It is unknown if DOE has presented contract options to CB&I AREVA MOX Services or if the company has analyzed which option it would chose if presented a new contract. Given failure to meet any schedule in the past, the consortium would have to have a complete reversal of course in order to earn incentive fees based on completing construction milestones with no errors in construction or documentation.

As we have seen in the FY 2016 award fee narrative, MOX Services has been averse to a fixed-price contract offer by NNSA: “...when the contractor was provided the opportunity to establish a

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<sup>25</sup> Report with NDAA for Fiscal Year 2017, page 1935, <https://www.gpo.gov/fdsys/pkg/CRPT-114hrpt840/pdf/CRPT-114hrpt840.pdf>

<sup>26</sup> News release “Fluor Corporation Awarded Contract by Westinghouse Electric Company to Manage Construction Workforce for Nuclear Power Projects,” January 4, 2016, <http://newsroom.fluor.com/press-release/company/fluor-corporation-awarded-contract-westinghouse-electric-company-manage-constr>

commitment to its asserted cost/schedule performance capabilities via a firm fixed price proposal, it did not provide a proposal, or commit to a date by which a proposal would be provided.”<sup>27</sup>

It is not known if the MOX Services solicitation of February 13, 2017 for a fixed-cost HVAC contract is related to the required review of the MOX Services’ contract by DOE.<sup>28</sup> This Request for Proposal for a “Fixed Price HVAC Installation Subcontract” (RFP # 10888-R-71465) was posted by NNSA In December 2016 and updated in February 2017. The goal of the RFP may be to replace Superior Air Handling as HVAC contractor, via non-renewal of its short-term contract.

Superior Air Handling is rumored to have had a very negative impact on the overall MOX construction project due to possibly shoddy work and improper signing off on work incorrectly performed. It is not known but merits full investigation if Superior Air Handling exploited its contract conditions resulting in questionable financial enrichment. If its work has to be redone - so-called rework (or reinstallation) - then Superior (or its parent Harris Companies) should be billed for the rework and not tax payers. (See discussion below about rework.)

As President Obama signed the National Defense Authorization Act for FY 2017 into law on December 23, 2016, DOE has 120 days to deliver its contract-options report to Congress, which means around April 23, 2017. But it is unknown if the contract review is actually taking place.

Given the lack of cost controls and lack of project oversight to this point, it is unclear what fixed price or fee-based contract could entice CB&I AREVA MOX Services to continue on the project. Continuing in a constrained manner, possibly with more provisions for accountability, would be a complete change from DOE’s hands-off contract approach that has been applied until now.

**Conclusion:** The results of any review of contract options is unknown but it is unlikely that MOX Services will not want to abandon work that has been so lucrative and with so little accountability. If strict financial and accountability guidelines and strict milestones are included in any new contract to be offered to CB&I AREVA MOX Services it would not be a surprise if they refused such a deal as being disadvantageous to them. It is likewise unknown if this contract-review process is a way for NNSA to force MOX Services off the project and shut the project down, as has been rumored.

### **Construction Challenges & the “Rework” Problem**

Rumors have long abounded about the extent and impact of improper installations of “commodities” at the MOX plant. This incorrect installation includes things such as duct work, piping, electrical cables, embed plates and the failure to properly inspect and certify that such work has been done correctly. The rework issues and the mismanagement of them, a matter largely hidden from public view, may well be at the core of unfettered cost overruns and the downward spiral of the project.

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<sup>27</sup> NNSA’s MOX FY 2016 award fee narrative, “Integrated Project Execution” section, page 3

<sup>28</sup> Federal Business Opportunities, revised Request for Proposal by DOE, Fixed Price HVAC Installation – MOX Project - Savannah River Site - Aiken SC, Solicitation Number: 10888-R-71465, December 28, 2016, amended February 13, 2017,

<https://www.fbo.gov/index?s=opportunity&mode=form&id=d04b9af9484be8ee6b30b6fcc50f4e1c&tab=core&view=1>

NNSA has publicly documented that the commodity “rework” issue - the tearing out of improperly installed commodities and reinstalling them - is a serious problem but details are sparse. Likewise, NNSA has confirmed that some concrete walls within the MOX plant are in the wrong location and must be removed and replaced.

In general, NNSA has avoided in-depth discussion of the rework issue given its serious impacts to the project’s viability and that it reveals poor project management and oversight. A few hints at the extent of the problem are in the public record, as will be discussed below. CB&I AREVA MOX Services has been even quieter about the rework problems, a tactic that gives the appearance that it has something to hide. Both NNSA and MOX Services have recently gone silent about the status of the overall MOX project and both entities uniformly refuse to answer SRS Watch questions about the project, giving the appearance of a cover-up.

The rework issue is briefly touched on in DOE documents analyzing the MOX project since 2014. Lack of in-depth discussion of rework and construction and cost impacts is a major weakness in the various DOE reports. While little is revealed about rework, some discussion in documents of problems confirm that rework is significant and merits in-depth investigation.

The Red Team report states (page 17) that there is “inadequate specification of construction sequencing and potential significant rework” but does not include much discussion on the extent of those problems.

Numerous *Monthly Cost, Schedule, & Variance Reports* prepared by MOX Services and obtained by SRS Watch via FOIA requests, include frequent mention of “rework” but it’s hard to gain an understanding of the depth of the problem by reading the reports.<sup>29</sup> For example, the monthly report from October 2015 includes the mention of rework and design-change implications, but they are but a glimpse into far-reaching negative impacts of the rework:

- HVAC Duct Installation - Type 1 Rework - Type 1 Rework – Incorrect Installation. There is no budget for this account with actuals of \$219,997.
- Construction Rework - Summary Historical Variance - The ACWP covers the sunk costs resulting from design changes and incorrect installations. The charge numbers have been closed and future work will be charged to the installation accounts.
- The original design specifications required that each Complete Joint Penetration (CJT) be verified by visual examination only. MOX-CR-12-548 was generated to investigate weld penetrations and it revealed that welds using the MIG process were incomplete (partial penetration) and would require rework (Type II). This process was immediately discontinued and the TIG welding was qualified and implemented to be used on the project. Trend 14-1034 / PCN 14-0884 was submitted to request EAC only to track these reweld repairs.
- Negative variance for 50% of the cost to resolve this issue. Note: CPSG and Superior Air Handling agreed to share the rework/repair cost 50/50 to resolve the defective welds that were identified

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<sup>29</sup> CB&I AREVA MOX Services, *Monthly Cost, Schedule, & Variance Reports*, for various months 2014-2016, obtained via FOIA request by SRS Watch, can be provided on request.

in MOX-CR- 12-548 (ref. Letter of Agreement dated 11Dec13). Trend 14- 1034 was presented and approved for EAC only

- HVAC Duct Installation - Type 2 Rework - Type 2 Rework - Design Changes. There is no budget for this account with actuals of \$124,646.
- HVAC Duct Support Installation - Superior Air Handling - Other factors contributing to the duct support negative variance are the availability of fabricated duct supports provided by others and the duct supports fabricated onsite by the subcontractor to meet sequencing requirements. The actual cost for the onsite support fabrication were applied to the installation account in error. These charges cannot be differentiated from install work therefore this account will carry a variance.
- BAP1 - Pipe & Pipe Supports Installation - Performance - Installation unit rates have been negatively impacted for the following reasons. A. High level of rework due to completion work to achieve final attributes (supports that were installed using coordinates on the drawings years ago are having to be reworked) B. Cumbersome conditions in room C145 C. Complex installation of skids in room C139 requiring numerous design changes
- BAP1 - Rework - Pipe and Support Installation - The EAC has been increased in Trend 15-EA08 to account for rework experienced to date plus forecasted rework to completion.
- BAP1 - Rework - Pipe and Support Installation - Higher than budgeted levels of rework in BAP 1 are expected to continue until rooms started prior to FY14 are completed. - The EAC has been increased in Trend 15-EA08 to account for rework experienced to date plus forecasted rework to completion.
- Type 3 Rework for Ledger Plates- The welds for the ledger Plates were inadequate. We will write a trend and request budget from MR for the actual costs in excess of the settlement once we have a final settlement and the final settlement amount is known. We will make sure that the credit for the settlement will go back against the work package component/alias it was bought under.
- NCR - Scrap Processing - Upper and Lower glovebox rework is ongoing to fix outer and inner weld issues. This is approximately 90% complete.
- 17.11.8778 - LLP - Pneumatic Transfer (33mm, PuO2 cans) Equipment - The non-availability of obsolete components and long lead times for the replacements of those items for the Transfer Stations, along with the delays due to fabrication design changes for the skids has resulted in LLP's percent complete being unchanged for an extended period of time while billing has continued for the rework being completed on the skids.

[Some initialisms used above: HVAC = Heating, ventilation and air conditioning; ACWP = Actual Cost of Work Performed; CPSG = Chicago Bridge & Iron Project Services Group; BAP = Aqueous Polishing Building; EAC = Estimate at Completion; NCR = Non-Conformance Report]

In the *MOX Fuel Fabrication Facility Monthly Status Report* for October 2015, also prepared by MOX Services and obtained via FOIA requests by SRS Watch, a mention of rework is worth noting: “The current month and FY16 actual unit rates include rework due to craft errors as well as rework due to: out-of-sequence installation, stacking of tolerances, and previous management decisions to install ‘at risk’ commodities. A revision to the rework procedure is underway to isolate these conditions from rework caused by craft errors and poor workmanship. This revision will be implemented in the November 2015 reporting cycle.”<sup>30</sup>

Revealing insight into the extent of the rework problem - also called “reinstallation” - was given in testimony to the House Armed Services Subcommittee on Strategic Forces in a hearing on October 7, 2015, entitled “Plutonium Disposition and the MOX Project.”<sup>31</sup> Mr. John J. MacWilliams, Senior Advisor to then-Secretary of Energy Moniz, testified, in response to questions by Representative Jim Cooper (Ranking Member, Tennessee) that there was a 25% “reinstallation” rate on things that have been installed in the MOX plant. MacWilliams, in response to a question by Representative Jeff Fortenberry (R-NB) went on to say that the \$345 million/year budget for MOX was accomplishing “nothing.”

In a 2012 complaint brought by a whistleblower under DOE’s Contractor Employee Protection Program against contractor Shaw AREVA MOX Services, the employee alleged that there was a 50% rework rate for installed piping and pipe supports.<sup>32</sup> The complaint was dismissed but since that time SRS Watch has heard the same undocumented anecdotal reports from other MOX workers about the 50% rate. To our knowledge there has been no external investigation of those more recent worker rework allegations, some of which have been passed to the DOE’s Office on Inspector General.

The list of historic construction-related and rework problems below was reported to SRS Watch by current and former MOX workers is extensive. Even though not fully documented they warrant further investigation. Some of the alleged problems are hinted at in MOX Services monthly reports. Problems with improper wall location and improperly installed piping and cutwork was pointed out to reporters who were allowed to tour the MOX plant in September 2016.<sup>33</sup>

SRS Watch’s running list of allegations of MOX plant construction problems – also from indications in documents and articles and in comments by DOE and MOX staff and in U.S. Nuclear Regulatory Commission documents - all items listed merit investigation:

- Removal of robust concrete walls due to improper placement of walls, penetrations for commodities and inadequate size of rooms and doorways;
- Rusting of installed piping before coating application and internally rusted unreachable sealed, ductwork;

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<sup>30</sup> CB&I AREVA MOX Services, *MOX Fuel Fabrication Facility Monthly Status Report*, for various months 2014-2016, obtained via FOIA requests by SRS Watch, can be provided on request

<sup>31</sup> U.S. House Armed Services Subcommittee on Strategic Forces hearing entitled “Plutonium Disposition and the MOX Project,” October 7, 2015, Youtube video: <https://www.youtube.com/watch?v=kJQsYiY6O1Q>

<sup>32</sup> United States Department of Energy Office of Hearings and Appeals, October 2, 2012, <https://energy.gov/sites/prod/files/WBZ-12-0005.pdf>

<sup>33</sup> *MOX plant at Savannah River Site will cost \$12 billion more than initially thought*, September 8, 2016, The State (Columbia, SC), <http://www.thestate.com/news/local/article100635952.html>

- Carbon steel materials touching stainless steel components unreachable bare, rusted metal supports;
- improperly located placement of HVAC duct work and piping and ductwork not aligned properly;
- Conversion of ductwork from sealed system to use of gaskets, which has caused problems;
- Improper installation of pipe supports;
- Unauthorized stressing of duct work, pipe supports and welds due to the pulling of installations into alignment when they should fit at rest;
- Improper welds, including porosity problems and improper argon gas purging; deliberate effort to conceal weld problems (by welding over improperly done welds rather than removing the welds and redoing them properly); capping off welds with patches;
- Improper pressure tests for welded piping and ductwork;
- Weld problems with large filter boxes and other purchased equipment from vendors;
- Improper signing off on work orders and work package inspections and material acquisition and traceability;
- Improper maintenance of paperwork on work performed;
- Inability to track Unified Tracing Codes (UTCs) of installed materials and commodities, as required;
- Altering of paperwork to indicate work was done properly when it actually wasn't and ignoring known problems to gain "install weight" bonuses for managers;
- Lack of properly trained and qualified personnel to both carry out and inspect key work, including improperly trained and unqualified quality control inspectors and unskilled and new workers with no to little experience as foremen and general foremen;
- Allegations that some site personnel have arrest records that should have invalidated their being involved in the project and workers being allowed to bypass drug tests to allow known drug users to return to work untested;
- Installed components being removed and reinstalled on a regular basis, rate could be well above the DOE's figure of 25%, some reinstallation is taking place several times for the same components and much rework not yet discovered or listed;
- Licensee's corrective action program is not functioning properly and cannot support normal installations given the time needed for reworks;
- Binders with documents on "work packages" lacking all steps in processes and lacking of proper signatures and thus can't be closed properly;
- Some components "locked out" of easy installation due to other items installed first and blocking installation accesses – the "sequencing problem;"
- Records not kept according to Quality Control programs requirements and are not complete, accurate or approved as required;
- Installed and purchased items becoming obsolete due to massive construction delays; equipment will have to be replaced if facility ever is finished and a new generation of workers retrained due to loss of historic memory;
- Gaskets on duct, pipe and other commodities installed improperly, aging and already approaching end of lifespan without ability to be replaced or aligned inside due to locked-in components unable to be moved or spread; installed dirty, with rough flange faces and warped flanges not sealing properly;

- Non-metal items on equipment from vendors and installed components aging and nearing dated usability range such as plastics and rubber parts;
- Roof not yet completed and facility not dried-in yet, large puddles of water after rains, in part due to Temporary Construction Openings (TCOs);
- Much of the needed components, duct, piping, electrical and other items not yet fabricated;
- Massive storage yards of accumulated piping due to installation sequencing and other problems;
- Proper “Procedures and Protocols” not followed - managers and workers should be asked to document their compliance;
- And, of a most serious and encompassing nature - in ability to properly and close “final attributes” work packages.

The above list should rightly be regarded with some skepticism as it is unofficial and based in part on personal confidential conversations. Why isn't NNSA and MOX Services informing the public about the construction problems and details about need for rework? Given the combination of DOE's documented rework concerns and years of rumors about poor construction quality and rework matters, it is perplexing that there apparently has been no in-depth investigation into things listed above (and more). The gravity of situation is starting to leak out and due to cost and schedule and project-termination implications can't be concealed forever.

The MOX facility has a construction license issued by the U.S. Nuclear Regulatory Commission, which is performing cursory inspections of samples of work in the facility. While the NRC has issued violations for a bit of work at the facility it has generally stated that work is being performed in an acceptable manner. It is unknown if NRC inspections are being performed on open “work packages” - packages that may be left open so final inspections don't take place. Likewise, the NRC appears not to have concerned itself with the gravity of the rework issue and may be staying away from inspections of that work until the contractor claims the work is final. The NRC can defend, or not, its inspection methods but investigations into how construction became so rife with problems and so delayed should include a thorough review of the NRC's performance in identify and inspecting construction problems and trends.

A number of the items related to piping and wiring on the list were reported to the NRC by SRS Watch during a NRC meeting reviewing the MOX plant construction on April 16, 2015.<sup>34</sup> The NRC dodged dealing with the report and responded by saying that the items “were not safety-related and did not have a direct impact on safety-related activities or on items related on for safety (IROFS), and thus, were not part of our Construction Inspection Program (CIP).”<sup>35</sup> This response raised concerns about the NRC's inspection program and if it was capable of looking into the troubling “rework” issue.

Due to the significant delays in the project, the NRC was forced to extend the period of “Construction Authorization (CA) CAMOX-001 issued to Shaw AREVA MOX Services” from March 30, 2015, to March 30, 2025, according to a notice in the Federal Register on October 23, 2014.<sup>36</sup> Little justification was

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<sup>34</sup> SRS Watch memo to the NRC on MOX construction problems, MOX meeting, April 16, 2015

<sup>35</sup> NRC letter to SRS Watch, May 15, 2015; also see SRS Watch document “*Update on DOE's Problem-Plagued Plutonium Disposition Program*,” April 9, 2015, [http://www.srswatch.org/uploads/2/7/5/8/27584045/update\\_on\\_mox\\_boondoggle\\_and\\_mfff\\_construction\\_problems\\_and\\_pu\\_disposition\\_at\\_srsapril\\_9\\_2015.pdf](http://www.srswatch.org/uploads/2/7/5/8/27584045/update_on_mox_boondoggle_and_mfff_construction_problems_and_pu_disposition_at_srsapril_9_2015.pdf)

<sup>36</sup> U.S. Federal Register, “Shaw AREVA MOX Services; Mixed Oxide Fuel Fabrication Facility,” October 23, 2014, <https://www.gpo.gov/fdsys/pkg/FR-2014-10-23/pdf/2014-25274.pdf>

given for the license extension but it was due to the overall construction problems and associated schedule delays. It is now apparent that the construction likely can't be completed during the period of this extended license – to 2025. MOX Services may well have difficulty explaining why any further extension of the "Construction Authorization" should be granted beyond 2025.

The MOX Services monthly reports from 2015 indicate that the types of rework to be done are being classified into various categories - Types I and Type II. It is unknown what kinds of rework were placed in those categories or who would pay for the rework. While some rework can be expected on a large construction project such as this the rework appears inordinately high, with the government being billed twice or even three times for work that could have been done correctly with one properly sequenced installation.

NNSA's *Updated Performance Baseline* report reveals the most of any document about construction problems. The report discusses low levels of work having been completed in the various commodities, such as piping, electrical and HVAC and that "work package" closure or "final attributes" - work installed, inspected and accepted – is exceedingly low. The narrative in the document about such things as "actual work completed" and "percent complete" is an informative read. NNSA does not discuss classifying the rework into various categories.

The table below from the NNSA report holds much disturbing information and reveals that the contractor's claimed Quantity Unit Rate Reports (QURR) - "the status of work completed, work remaining, and the rates at which work is progressing compared to planned" - is at significant variance from the "final attributes" calculations in the March 2016 monthly status report. The exceeding low percentages of completed commodity work - almost 10 years after construction began - reveal that work has likely been done incorrectly or only partially completed and that the final quality assurance/control inspections can't be completed so as to "close" the work, or complete it. The percentages for completed work, we are told, should be much, much higher at this phase of the project. Do the figures indicate that project can recover or not from the abysmally low rate of work completion?

**Table ES-2: Examples of Differences in Percent Complete as Reported by Contractor**

Commodity	February 21, 2016 QURR Cumulative Actuals % Complete	March 27, 2016 Monthly Status Report *Final Attributes % Complete
Active Gallery Pipe & Balance of Pipe	11%	1%
Pen Plates	56%	0%
Duct	28%	3%
Fire Dampers	38%	17%
Cable Tray & Wireway	10%	5%
Conduit	4%	0%
Electrical Equipment	3%	0%

\* *Final Attributes: commodities that have passed quality assurance/control and are not subject to rework.*

The information presented in this table alone warrants a full analysis by investigative agencies. Are such investigations under way? If not, why not?

Perhaps due to pressure from NNSA or Congress, it appears that after being allowed for so many years to engage in what appears to be low-quality construction, the CB&I Project Services group may at last be attempting to address the "rework" issue. That effort has yet to be a ploy or not. Why it has taken so very long for the problems to be addressed remains unknown.

Of special note, the work by Superior Air Handling - the contractor rumored to have badly bungled the HVAC work (and reportedly no longer on the project as of January 2016), thus also impacting the “sequencing” of other commodity installations - merits extremely close scrutiny for waste, fraud, abuse, mismanagement and corruption.

**Conclusion:** The known rework rate at the MOX project and the known lack of completion of commodity installation may be the single largest factor in causing the large cost overruns and schedule delays. This matter merits extensive on-site investigations at SRS, including confidential discussions with MOX workers protected from being identified. Those companies and individuals who knowingly engaged in incorrect work should be held accountable both for the direct cost of necessary rework and indirect costs of impacts to other aspect of the project.

### **Smoking Rework Gun – “Rework Definitions” Memo**

On January 30, 2017, SRS Watch filed a FOIA request for a key rework document being used at the MOX project to classify the severity of rework and who is to be billed for such work. There has been no response to that FOIA request but we have obtained a principal part of that memo, which was apparently sent to CB&I Projects Services Group (CPSG) to staff.

The document - below - stimulates a host of unanswered questions but indicates that much of the rework will be billed to contractors that made the mistakes, such as Superior Air Handling. Vendors may also be responsible for providing subpar equipment and responsible for the costs of that. Some errors may have been due to design changes and some not.

Note the classification of rework into four categories. It is our understanding that work not included in “unit rate calculations” could be billed to the contractor responsible for the problem.

We do not have further information about what charges to “a unique charge code” means but guess it means that charges will be accumulated and billed to vendors or contractors.

Further, we do not know why NNSA and MOX Services are keeping a tight lid of what’s happening on the ground with this rework situation, stimulating thoughts of a cover-up.

## REWORK DEFINITIONS – EFFECTIVE SEPTEMBER 2016

### **Type 1a: Construction Rework**

Rework caused by incorrect construction installation due to 'skill of the craft' issues **since September 2015** (example - installed supports need to be relocated due to incorrect orientation or poor weld quality). Construction installation is defined as MOX self-perform or performed by T&M installation subcontractors (SAHCO, Alberici, APB, Yearout). This is defined as TYPE 1 REWORK and actual craft time spent on construction rework ARE included in the unit rate calculations.

### **Type 1b: Construction Rework**

Rework caused by incorrect construction installation due to 'skill of the craft' issues **prior to October 2015** primarily focused on correcting errors in installation during finalization of work pfor pipine and supports and HVAC duct and supports in preparation for "Final Attributes" approval.

Type 1b rework may be found in:

- BAP and BMP levels 1 & 2,
- BSR rooms D001, D008 and D101 for HVAC
- BSR rooms D108, D107 and D101 for pipe and supports

### **Type 2: Engineering Changes**

**Engineering Changes** (example – HVAC design changes to address heat load requirements, or piping isometric is revised after field installation has started). This is defined as TYPE 2 and actual craft time spent on Engineering changes ARE NOT included in the unit rate calculations but are tracked separately using a unique charge code. The responsible APM must provide authorization for any work being performed due to engineering changes. See 5.2 for further information on APM authorization.

### **Type 3: Vendor/ Supplier Issues**

**Vendor / supplier issues** (example – equipment NCR's due to a vendors failure to follow specifications or fabricating commodities 'at risk' prior to design completion). Vendor / supplier issues are specific to the procurement of a particular commodity or equipment. This is defined as TYPE 3 and actual craft time spent on vendor / supplier issues ARE NOT included in the unit rate calculations but is tracked separately using a unique charge code. The responsible APM must provide authorization prior to any work being performed. See 5.3 for further information on APM authorization.

### **Type 4: Incorrect Sequence**

Rework caused by **incorrect sequence** (example – installed supports need to be removed to allow access to ledger plate repairs or partially installed pipe needs to be relocated to allow HVAC duct to be installed above the pipe.) This is defined as TYPE 4 and actual craft time spent on incorrect sequence ARE NOT included in the unit rate calculations.

It is unknown if the workers' response to the rework memo can facilitate correction of installation problems. Likewise, it is unknown if the memo is only a gesture to show NNSA project management and ill-informed members of Congress that finally some efforts are being made to address the rework problems. The memo may well be "far too little, far too late."

It is likewise unclear how the billing will be done or if an effort is being made by CPSG to determine if contractors fraudulently billed for any work or associated inspections. And, it is unclear how the U.S. Government will recover costs of work incorrectly done - some perhaps being done incorrectly more than one time and thus double or triple billed. Further, who will pay for the negative impact on the sequencing of commodity installations caused by work being improperly done and out of order?

While SRS Watch at this point lacks any documents attached to the “rework definition” memo, we will try to obtain them. We will also try to obtain any lists of rework placed in the various categories but assume that investigators will be able to obtain this information.

**Conclusion:** The extent of the rework problem is extensive and costly and likely has already determined that the MOX project can’t be concluded. Full-blown investigations by the GAO, federal attorneys, FBI, DOE’s Office of Inspector General and others need to be underway to explore the situation and determine if anything was fraudulently billed or authorized or if contractual stipulations were violated.

### Hints of Design Problems

Though the NRC has approved a construction license for the MOX plant we do not assume that the license approval and subsequent construction inspections of a design-in-process is any guarantee that the facility will be able to operate as presented.

We have been told by a former design engineer that the facility will be unable to operate due to design flaws. A former worker at AREVA’s MELOX plant in France - the facility on which the U.S. MOX plant is modeled - claims that the MOX technology purchased by the NNSA is antiquated and will never be able to operate to U.S. operational standards if the facility is ever “completed.”

Going further, it is rumored that AREVA had a clear understanding that it was selling inferior technology to a client - NNSA - that failed to thoroughly review the technology it was purchasing. The unsubstantiated allegation continues that use of older AREVA technology doomed the U.S. MOX project from the very start. We are not aware of an investigation into this matter but suspect that NNSA knows full well the extent of the design problems. Given the benefit of the doubt to NNSA, perhaps they unknowingly bought inferior technology and design as their analytical abilities were clouded by the “dream” to follow France with use of plutonium fuel.

We note that the MELOX plant, which began commercial operation in 1995, is based on 1980s technology. If the MOX plant isn’t finished until the 2029 construction end-date presented to NNSA by MOX Services - in the 2016 NNSA *Updated Performance Baseline* report - and if it takes only two years to become fully operational, the U.S. MOX plant will thus be based on 40-year old technology. Using the NNSA’s 2048 MOX plant finish-date means the technology would be yet further antiquated if an entirely new group of workers trained on the old technology ever attempts to start the plant.

The rumors and age of the technology and equipment raises the specter that the pellet production processes could be based on obsolete techniques possibly using obsolete equipment purchased in the 2000s. Additionally, there has been no demonstration that use of this technology and/or equipment will be able to function so or meet U.S. operational standards of the 2030s and later.

Likewise, equipment stored for extensive periods of time or installed in a humid atmosphere in the MOX plant, maybe be subject to corrosion, deterioration or other aging problems. External air enters the partially finished MOX plant via “Temporary Construction Openings” (TCOs), which have been in place and open for years, posing an unknown risk.

In the MOX plant photo below note the number of Temporary Construction Openings on the south side of the MOX plant. SRS Watch has received unsubstantiated information that pigeons can enter the building through the TCOs, which may have inadequate plastic coverings, and that their droppings on

installed commodities may pose a degradation issue. Reports go further: hawks have entered the building to attack the pigeons. Rain water may also enter the building through the openings, pooling on the floor near them.



*Photo: A view of the south side of the Mixed Oxide Fuel Fabrication Facility (MFFF) under construction at the U.S. DOE's Savannah River Site (SRS) in South Carolina. Note what appear to be 14 Temporary Construction Openings on this facade of the building, open to outside air for many years. Note partially constructed Gabion security wall on outside of facility. More aerial photos available on request. March, 2016, @High Flyer, special to SRS Watch.*

The Government Accountability Office (GAO) flagged potential design concerns in a 2007 report entitled *Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays*.<sup>37</sup>

The design of the Mixed Oxide Fuel Fabrication Facility has presented technical challenges in adapting the design of a similar plant in France to the design needs of this project. Although the technological challenge related to adopting the process designs from the French designs was not the primary contributor to the project's cost increases and

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<sup>37</sup> The Government Accountability Office (GAO), *Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays*, page 14, <http://www.gao.gov/assets/260/258104.pdf>

schedule delays, according to NNSA officials, it has affected the project's complexity. The basic technology—combining plutonium oxide with depleted uranium to form fuel assemblies for use in commercial power reactors—has been previously demonstrated in France. However, the DOE project director told us that the DOE facility design must, among other things, account for processing surplus weapon-grade plutonium, a different type of material than processed in the French facility, and must be adapted to satisfy U.S. regulatory and other local requirements. In addition, the DOE facility faced the technological challenge of reducing the scale of components used in the French facility. Although definitive cost estimates are not yet available, expected costs for completing this project have grown by about \$3.3 billion since 2002, and the schedule has been extended by more than 11 years, in part because the contractor did not initially understand the project's complexity and underestimated the level of effort needed to complete the work.

We are far from convinced that either NNSA or CB&I AREVA MOX Services have worked through all these design and operational issues, especially as related to meeting U.S. nuclear regulations.

The GAO again, in a March 2013 report entitled *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*, pointed out design concerns.<sup>38</sup>

*Critical system components' design adequacy.* According to NNSA officials and the contractor for the MOX facility, one of the primary reasons for the proposed cost increase and schedule delay is due to inadequately designed critical system components, such as the gloveboxes used in the facility for handling plutonium and the infrastructure needed to support these gloveboxes. According to these officials, although the design of the facility is based on a similar facility in France, the cost of adapting the French design to the design needs of this project was not well understood when the project was approved for construction. The performance baseline for the MOX facility was also set several years before NNSA issued guidance in 2012 to set cost and schedule baselines only after design work is 90 percent complete. As part of our ongoing work, we are evaluating whether such guidance would have been useful for NNSA to apply to the MOX facility, as well as the potential impact this guidance might have had on mitigating cost increases and schedule delays.

The DOE's *Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options* also pointed out MOX plant "design risks."<sup>39</sup>

**MOX DESIGN RISK:** Regarding Option 1, irradiation of MOX fuel in LWRs, construction of the MOX facility is more than 50 percent complete, but the project still faces technical challenges to complete construction and start-up the facility. The MOX facility design is largely based on the French LaHague and Melox facilities, operated by AREVA. These reference plants were constructed and operated in a different regulatory environment in France than exists with the NRC in the U.S., and the U.S. facility must be adapted accordingly. In the 1990's, the Melox facility underwent an expansion that resulted in significantly higher costs than

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<sup>38</sup> GAO, *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*, March 20, 2013, page 7, <http://www.gao.gov/products/GAO-13-484T>

<sup>39</sup> DOE's *Plutonium Disposition Working group report*, April 2014, page 30

planned due to difficulties in completing integrated testing of systems in a large, complex facility. To mitigate these risks for start-up of the MOX facility, personnel from the MOX will train at AREVA's facilities, and the U.S. contractor will have personnel from AREVA at SRS to work with U.S. operations staff during start-up. However, with differing regulatory requirements, the construction and operation still remains a significant risk.

Aerospace's *Plutonium Disposition Study Options Independent Assessment Phase 1 Report* pointed out specific design and construction-related challenges.<sup>40</sup>

Cost increases could come from several sources. Uncertainty in the remaining design work to go results in uncertainty in the remaining construction work scope to complete the project. Uncertainty exists in the number, unit cost, and availability of specialized materials and hardware. The level of complexity in construction activities associated with the remaining 40-60% of the work is greater than the work accomplished to date. Finish work on plumbing systems and equipment installation has to be done within fine tolerances and requires specialized trades skills, which may require additional time, workforce, and result in the need for re-work. Uncertainty exists in the work scope for the integration of automated systems, control systems, and software. Workforce attrition may occur for both general and specialized construction skills due to competition in the labor market.

That Aerospace report goes on to raise more concerns about designing the facility as construction progresses:

Because construction is initiated prior to completion of design, there is added cost and schedule risk if something in the engineering (interfaces, integration, etc.) was not considered early enough to preclude rework in construction or if there are substantial deviations from the original direction/design. Furthermore, the design-build approach typically compresses the overall construction project schedule, but the variation in available funding and annual funding cap limitations on the MOX project have actually worked to expand the overall schedule timeline, impacting costs. (page 30)

A May 2014 "audit report" by the DOE's Office of Inspector General (OIG) entitled *Cost and Schedule of the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, like earlier GAO reports, cites an initial "immature design" and that review of the design was found by DOE to be "incomplete."<sup>41</sup>

The anticipated cost and time required to complete the MOX Facility were significantly underestimated due to a number of factors. This included, most prominently, the Department's 2007 approval of a project baseline that was developed from an immature design, understating the level of effort to install

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<sup>40</sup> Aerospace Phase 1 Report, April 2015, page 15

<sup>41</sup> DOE's Office of Inspector General (OIG) entitled *Cost and Schedule of the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, May 22, 2014, page 2, <https://energy.gov/sites/prod/files/2014/05/f16/DOE-IG-0911.pdf>

various construction commodity items, and high personnel turnover rates. Prior to approval, the Department's own independent review of the project baseline found that the design review of the MOX Facility was incomplete.

And, the OIG emphasized in the audit that NNSA and MOX Services failed to meet the DOE's accepted design-review practices:

In fact, the review was performed on only the construction package for the MOX Facility structure and did not include all the integral systems, structures and components. Furthermore, the independent review found that the design reviews conducted by NNSA and MOX Services did not meet the intent of Department Manual 413.3-1, *Project Management for the Acquisition of Capital Assets*, for the approval to start construction. Specifically, project construction is to begin when design and engineering activities are essentially complete and final design review and environmental and safety criteria are met. The timing of initiating construction of the MOX Facility violated this basic principle. (page 2)

The Aerospace Phase II report of August 2015 underscored both design and rework risks:

The facility incorporates innovative design features in key building subsystems, such as an extensive system of gravity-flow piping for the transport throughout the building of solvents and solutions used in the aqueous processing of plutonium. This design solution was chosen in order to minimize the use of pumps and valves, which can be prone to failure. However, it requires large quantities and lengths of piping to be engineered and installed to precise slopes and angles to ensure that the aqueous materials flow at the required rates during operation. This system requires fabrication and installation to within tight tolerances, with interfaces to the facility structure and other support systems that may be specified to less stringent tolerances. Other key subsystems, such as glove-boxes, support equipment and automated processing hardware are highly integrated, and interfaces to the facility will require allowances to be planned and built into these systems. (Page 11)

As indicated in a 2014 GAO report, the contractor on the MOX project has had difficulty identifying suppliers and subcontractors able to fabricate and install equipment in accordance with nuclear quality assurance criteria. Consequently, it is anticipated that the design complexity and the challenges related to the supply chain for this option will add cost and schedule risk through completion of construction. (page 11)

Uncertainty in MFFF construction cost arises from several sources. The design-build acquisition approach results in uncertainty in the remaining design and construction work scope to complete the project. Uncertainty exists in the number, unit cost, and availability of specialized materials and hardware elements. The level of complexity in construction activities associated with the remaining 40-60% of the work is higher than for the work accomplished to date. Finish work on the remaining plumbing systems and equipment installations may require additional

time and labor resources and could involve a greater likelihood of need for re-work. Uncertainty exists in the work scope for the integration of automated functions, control systems, and software. Workforce attrition may occur for both general and specialized construction skills due to competition in the labor market. (page 13)

While AREVA on February 8, 2017 made undocumented claims that make it sound like things have taken a dramatic turn-around in the design.<sup>42</sup> AREVA stated that that the project is 70% complete – a claim that NNSA labeled as “patently false” in the FY 2016 award fee narrative discussed earlier. AREVA attempted to make it appear that project completion is just a matter of finishing up construction work, hooking up equipment and then conducting tests. This may sound good and that it will be simple to accomplish but there is no evidence at all to support the misleading construction, engineering and start-up claims of AREVA (which is not in charge of construction):

.....at the beginning of 2017, progress on the project had reached more than 70%, with engineering notably at 100%, building construction work at over 90% (93% of the concreting complete). 72 of the 73 tanks to be devoted to storage of the material are installed, and 212 of the 325 glove boxes have been delivered and 150 are already installed. The tasks remaining to be carried out consist in completing construction and equipment installation, connecting up the entire industrial process and conducting tests. It should be noted that the process glove box systems have already been tested.

The unsubstantiated claim that the projects is 70% complete is strongly disputed in NNSA’s 2016 report, in which it states that “when comparing the actual cost of work performed to the estimate at complete, the project is 48% complete based on MOX Services’ EAC [estimate-at-completion] and 28% complete based on the PM EAC.” Given the huge variance in the 70% vs 28% claim, these figures merit close scrutiny by investigators, appropriators and the public.

Concerning design issues or any other aspect of the project, it appears that CB&I AREVA MOX Services several years ago decided to essentially stop communicating anything about the status of the project. In fitting with that policy, the company refuses to respond to information requests about it. NNSA at SRS likewise rarely communicates about the status of the project.

**Conclusion:** We are left in 2017 with no answers as to the viability of the design of the MOX plant or if the design-during-construction approach has worked or if design problems have been resolved. MOX Services has made unsubstantiated claims about design-completion and a construction-progress turn-around. If the past is any indicator and if documents and information cited in this report are in any way accurate, then the design claims of AREVA and MOX Services should be taken with extreme caution and be put to the test by investigators. Ditto for ability to safely start up the plant, also a matter of concern.

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<sup>42</sup> AREVA news release, February 7, 2017, <http://www.aveva.com/EN/news-10914/update-on-situation-with-the-mfff-recycling-plant-in-the-united-states.html>

## Oversight and Accountability Lacking: MOX Waste, Fraud, Abuse, Mismanagement & Corruption?

One of the most troubling aspects of the massively over-budget MOX project is that nobody in government or with the contractors is being held accountable for causing the problems the project has long been faced with. We are not aware that a single manager has in any way been held responsible for any negative aspect of the project. It's as if this large, complex, mismanaged project has a life of its own with no human decision-makers in charge who are responsible for their actions.

While NNSA and DOE officials have changed during the various administrations since the MOX project began in the Clinton administration, the only MOX Services top official who we know who left the project is Kelly Trice, former president and COO of Shaw AREVA MOX Services. In October 2014, after overseeing spiraling costs increases, he quietly left the project amidst a swirl of management and funding issues but he evidently remained with CB&I Project Services Group.

We have been given a number of names of work-site managers who may have engaged in fraudulent or improper behavior. Many of those employees (or former employees) are associated with the HVAC contractor, Superior Air Handling. Likewise, we have heard of nepotism and problems with drug testing. In this document we are withholding names of the individuals as we can offer no proof but we have shared and will share the names with investigators.

The Government Accountability office has warned many times about DOE's "management weaknesses in major projects," including with the MOX project, which remains on "GAO's list of areas at high risk of fraud, waste, abuse, and mismanagement for major contract and project management," according to March 2013 testimony to Congress.<sup>43</sup> Given rumors we have heard, we would add corruption to that list.

GAO claimed in that 2013 testimony that "we have made recommendations calling on DOE to ensure that project management requirements are consistently followed, to improve oversight of contractors, and to strengthen accountability, among others." This recommendation appears not to have sunk in with NNSA or DOE's Office of Project Management Oversight and Assessments (PM) or the Office of Acquisition Management (OAM). There remains virtually no public information regarding accountability. Based on what we have observed over the last decade, we can only assess, that there is virtually no accountability at the MOX project. We beg to be proven otherwise.

### **Report fraud, waste and abuse with the MOX project to SRS Watch & GAO:**

*(SRS Watch can help with contacts to the OIG, FBI and federal attorneys' offices in GA and SC.)*

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**To Report Fraud,  
Waste, and Abuse in  
Federal Programs**

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

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In its February 2014 report entitled *PLUTONIUM DISPOSITION PROGRAM - DOE Needs to Analyze the Root Causes of Cost Increases and Develop Better Cost Estimates*, the GAO found that "NNSA has not

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<sup>43</sup> GAO, *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*, March 20, 2013, <http://www.gao.gov/assets/660/653154.pdf>

analyzed the underlying, or root, causes of the Plutonium Disposition program construction cost increases to help identify lessons learned and help address the agency's difficulty in completing projects within cost and schedule, which has led to NNSA's management of major projects remaining on GAO's list of areas at high risk of fraud, waste, abuse, and mismanagement."<sup>44</sup> We are not aware that NNSA managers are effectively addressing those concerns and appeal for evidence to the contrary.

In its February 2015 *High-Risk Series: An Update*, the GAO's comptroller general reported to Congress that "We maintain an ongoing program to focus attention on government operations that are high risk due to their greater vulnerabilities to fraud, waste, abuse, and mismanagement or that are in need of transformation to address economy, efficiency, or effectiveness challenges."<sup>45</sup> GAO determined that the MOX project, which remained on the high-risk list:

We found that, among other things, NNSA had not analyzed the root causes of the construction cost increases to help identify lessons learned and to help address the agency's difficulty in completing projects within cost and schedule. We also found that NNSA's most recent cost estimates for the overall plutonium disposition program, of which the MOX facility is a part, did not fully reflect all the characteristics of reliable cost and schedule estimates, placing the program at risk of further cost increases. We recommended that, among other things, DOE conduct a root cause analysis of the program's cost increases and ensure that future estimates of the program's life-cycle cost and cost and schedule for the program's construction projects meet all best practices for reliable estimates.

Though it has continued to report on DOE's questionable project management and cost review practices, GAO now appears to have no MOX-specific reports underway on the MOX situation. Given that the project begs for a host of in-depth investigations and reviews into many aspect of the project, including lack of accountability, cost overruns, schedule delays, construction issues and possible waste, fraud, abuse, mismanagement and corruption, we find it very perplexing that no high-ranking member of Congress has insisted on active GAO reviews. As the MOX project drags on with no schedule or reliable budget and as design and construction and management issues persist, the need for more GAO reports only grows.

The stunning lack of accountability with the MOX project may boil down to professional incompetence or politics. The project has turned into a parochial jobs project for SRS, employing perhaps 1500 people. Some politicians, primarily Senator Lindsey Graham (R-SC) and Representative Joe Wilson (R-SC), appear to have as a priority to keep the money flowing to SRS and CB&I AREVA MOX Services simply for job reasons and to support the local economy in the Aiken, South Carolina area. Though the original plutonium-disposition goal of the MOX project has been lost, the goal now by Graham and Wilson is simply local spending and employment. The beleaguered U.S. taxpayer outside of the bubble of Aiken, South Carolina and Augusta, Georgia are stuck with paying the tab until fiscal conservatives in Congress rein in this debt-inducing spending.

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<sup>44</sup> GAO, *PLUTONIUM DISPOSITION PROGRAM - DOE Needs to Analyze the Root Causes of Cost Increases and Develop Better Cost Estimates*, February 2014, summary page, <http://www.gao.gov/assets/670/660927.pdf>

<sup>45</sup> GAO, *High-Risk Series: An Update*, February 11, 2015, page 300, <http://www.gao.gov/products/GAO-15-290>

Via his seat on the Senate Energy & Water Subcommittee, the subcommittee of Appropriations Committee that funds DOE, Senator Graham has taken on the informal role of protector of the MOX project. Despite his loyal support to CB&I AREVA MOX Services for the continuation of the project neither he nor any other politician - nor CB&I AREVA MOX Services for that matter - has been able to lay out either a short-term or a multi-decade path forward for the project from funding or technical perspectives.

In spite of his chronic inability to make a case for the project's viability and continued funding at least Senator Graham has pointed out lack of accountability with the project. In an exchange with NNSA Administrator Frank Klotz at a hearing by the Senate Armed Services Subcommittee on Strategic Forces on February 23, 2016, Senator Graham made statements about the need to fire those responsible for the situation, as reflected in the hearing's transcript.<sup>46</sup>

*Who the hell decided that it would work, to begin with? And not one person's been fired.*

*I don't know how we fix this, but somebody needs to be fired for putting this in motion.*

*So, we're in a mess. It's not the General's fault, like you all. But, this is an example of the government just completely out of touch with reality. Anybody in the private sector would be fired. If you had a company, and they made this proposal to the company board, and, halfway through, 60 percent through, you said, "Well, it won't work," somebody would be fired. Somebody needs to be fired.*

Despite his strong statements we are not aware of any follow-up on this matter by Senator Graham. Unfortunately, it appears that Senator Graham is actually the main politician protecting DOE, NNSA and MOX Services managers from being held responsible for their bad decision. Thanks to Senator Graham, accountability at MOX has been just as elusive as a schedule or accurate cost estimates.

DOE, NNSA, the Office of Project Management Oversight and Assessments (PM) or the Office of Acquisition Management (OAM) and the Office of Inspector General may be able to make some case that managers of the run-away project have been held accountable and that current project management is much better now than earlier. Unfortunately, we have been able to learn nothing about such steps. DOE and NNSA managers must be challenged to break their silence and let the public know if there has been or will be any accountability, including firings, for the grave problems with the project.

Likewise, Congress needs to finally demand accountability of DOE, NNSA, CB&I AREVA MOX Services and all subcontractors. The congressional strategy of continuing to fund the project while observing its demise from afar has led to a failed project for which not a single person is responsible. Congress must end its hand-off approach, live up to its responsibilities to the taxpayers and determine who is responsible for the MOX boondoggle and hold them accountable.

While Congress sleeps and NNSA hides in shadows, it is encouraging to see the two MOX fraud cases are moving in federal court. One case involves a False Claims Act claim filed in the Northern Georgia district federal court for improperly qualified rebar supplied for the facility's foundation, a case which has been joined by the federal attorney's office. The federal attorney's news release of September 23, 2016 and

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<sup>46</sup> U.S. Senate, Armed Services Committee, Strategic Forces Subcommittee hearing on DOE budget, transcript, February 23, 2016, [http://www.armed-services.senate.gov/imo/media/doc/16-15\\_02-23-16.pdf](http://www.armed-services.senate.gov/imo/media/doc/16-15_02-23-16.pdf)

entitled “Government Intervenes in Suit Against Energy & Process Corporation Alleging Use of Defective Steel Rebar and Quality Control Failures in Connection with Construction of Nuclear Processing Facility”<sup>47</sup> indicates that the DOE’s Office of Inspector General was involved in the case:

ATLANTA – The government has intervened in a False Claims Act lawsuit against Energy & Process Corporation (“E&P”), of Tucker, Georgia, alleging that E&P knowingly failed to perform required quality assurance procedures and supplied defective steel reinforcing bars (“rebar”) in connection with a contract to construct a Department of Energy (“DOE”) nuclear processing facility, the Justice Department announced today.

“To ensure that the nuclear facility would be safe, the Government paid E&P a sizable premium for exhaustive quality control procedures,” said U.S. Attorney John Horn of the Northern District of Georgia. “This lawsuit alleges that E&P intentionally failed to perform the quality control work, and then concealed its failing by providing false certifications to the government. In intervening in this lawsuit, the U.S. Attorney’s Office seeks to ensure that entities that defraud the Government are identified and held responsible.”

“The Department of Justice is committed to ensuring that construction suppliers who are paid a premium to meet high safety standards actually supply the goods and perform the work for which they are paid,” said Principal Deputy Assistant Attorney General Benjamin C. Mizer, head of the Justice Department’s Civil Division. “When contractors cut corners, they not only cheat American taxpayers, but they also can put public safety at risk, particularly when their misconduct affects a facility that houses and processes nuclear materials.”

The lawsuit alleges that, although the DOE – in connection with the construction of the Mixed Oxide Fuel Fabrication Facility at the DOE’s Savannah River Site near Aiken, South Carolina – paid E&P a premium to supply rebar meeting the stringent quality assurance standards promulgated by the United States Nuclear Regulatory Commission (“NRC”), E&P failed to perform most of the necessary quality assurance work, and then concealed this failing by falsely certifying that the quality assurance requirements had been met. As a result, one-third of the rebar supplied by E&P and used in the construction was found to be defective.

The lawsuit was filed by Deborah Cook, a former employee of the prime contractor building the DOE facility, under the *qui tam*, or whistleblower, provisions of the False Claims Act. Under the act, private citizens can bring suit on behalf of the government for false claims and share in any recovery. The act permits the government to intervene in such lawsuits, as it has done in this case. Defendants found liable under the act are subject to treble damages and penalties.

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<sup>47</sup> U.S. Attorney’s Office, Northern Georgia District, news release, September 23, 2016, <https://www.justice.gov/usao-ndga/pr/government-intervenes-suit-against-energy-process-corporation-alleging-use-defective>

This matter was investigated by the Civil Division's Commercial Litigation Branch, the U.S. Attorney's Offices of the Northern District of Georgia and the District of South Carolina, and the DOE's Office of Inspector General.

The case is captioned *United States ex rel. Cook v. Shaw Areva Mox Services, LLC, et al.*, Case No. 01:13-cv-4023 (N.D. Ga.).

The claims asserted against E&P are allegations only, and there has been no determination of liability.

This matter is being handled by Assistant United States Attorneys Paris A. Wynn and Gabriel Mendel.

The other case was brought by the South Carolina federal attorney's office for wire fraud involving fake receipts. Both cases are actively moving in federal court and perhaps moving towards settlement.

It is interesting to note that in the wire fraud case - case number 1:15-cr-00888 - according to a December 2015 news release from the federal attorney, entitled "Two Men Charged with Wire Fraud," that not only the DOE's Office of Inspector General (OIG) was involved but also the Federal Bureau of Investigation.<sup>48</sup>

**Columbia, South Carolina**---- United States Attorney Bill Nettles announced the indictment of Aaron Vennefron of Hamilton, Ohio and Phillip Thompson of Augusta, Georgia for conspiracy to commit wire fraud, and theft of government funds. The indictment alleges that the two conspired to defraud the government by creating fraudulent invoices for payment of what appeared to be goods needed for work at the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site. The indictment further alleges that no goods were ever received and that Vennefron and Thompson received over \$4,000,000.00 in payments based on the fraudulent invoices.

The case was investigated by Special Agents with the U.S. Department of Energy Office of Inspector General and the Federal Bureau of Investigation. Assistant United States Attorney John Potterfield is prosecuting the case.

The United States Attorney stated that the charges alleged in the Indictment are merely accusations and that all defendants are presumed innocent until and unless proven guilty.

The fact that the OIG was involved in both cases and that the FBI was involved in the wire fraud case could indicate that other joint investigations are possible. We remain ever hopeful about that.

While the approach of NNSA to get the project under control is to terminate it, this approach is totally inadequate given that the project continues at the insistence of Congress. In a GAO report issued in

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<sup>48</sup> U.S. Attorney's Office, District of South Carolina, news release, December 16, 2015, <https://www.justice.gov/usao-sc/pr/two-men-charged-wire-fraud>

February 2017 and entitled *HIGH-RISK SERIES - Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others* the “mange by termination” approach was addressed.<sup>49</sup>

DOE has taken significant steps to address cost and schedule problems. For example, NNSA proposed, in its fiscal year 2017 budget request, to terminate the MOX project and pursue an alternative path for disposing of plutonium, under which DOE would dilute plutonium for disposal in a geologic repository...

While pursuit of non-MOX plutonium disposition alternatives is essential, as long as the project continues, the NNSA must be actively involved in its management and oversight. What appears to now be a disengagement approach serves only the end of dragging the project out, leading to more potential waste, fraud, abuse, mismanagement and corruption.

**Conclusion:** Senator Graham, Representatives Wilson and Congress and NNSA must demonstrate to the public that they will act forcefully to identify and hold accountable those managers in government and with MOX contractors that have allowed the MOX boondoggle to develop and continue. Absent accountability, the last shreds of faith in the project will continue to diminish to yet lower levels, further debilitating the project as it spirals ever downward.

#### **Conclusion: DOOM or GLOOM Option?**

No matter what happens with the project in the long- or short-term, it is URGENT that a host of investigations into waste, fraud, abuse, mismanagement and corruption explore aspects of the project raised in the paper. The stunning lack of accountability cannot be tolerated by DOE, Congress or the public. Managers within DOE and MOX Services are indeed responsible for the MOX boondoggle and they must not be allowed to get away with their performance.

Based on the host of problems outlined above, the odds appear heavily stacked against the MOX project becoming viable. Due to huge funding shortfalls, massive cost overruns, significant schedule delays, construction challenges, a large rework backlog, design issues, potential lack of trained workers, no reactors to use MOX fuel, inadequate funding for essential support aspects and total lack of accountability it is extremely difficult to see a path forward for the project.

Given the financing and technical issues, the mere fact of a change in administrations will do little to salvage the project in more than the short-run. Congress has kept the project on a shut-down track and DOE has attempted to terminate it for good reasons. Mere politics and associated rhetoric can't save MOX.

We concur with the Red Team's plea in 2015, though more “degradation” has occurred since it was made: “...it is vitally important to make a decision as soon as possible and secure consistent funding to prevent further degradation of the Pu Disposition Program.”<sup>50</sup>

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<sup>49</sup> GAO, *HIGH-RISK SERIES - Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, February 17, 2017, page 465, <http://www.gao.gov/assets/690/682765.pdf>

<sup>50</sup> DOE's Plutonium Red Team report, page xii

Even the most optimistic interpretations about the status of the project and the belief that politics can save the MOX project likely will only be a short-term fix for its survival – the so-called “GLOOM OPTION.”

There is no rosy outcome for MOX given that the problems facing it are insurmountable. Only in the mind of those that profit or lack understanding of the dire situation facing the project does the MOX project move steadily forward to a functioning facility envisaged 20 years ago.

**The facts about the MOX project and our analysis of them lead us to the conclusion that the mismanaged project should be terminated - the so-called “DOOM OPTION.”**

The mismanaged project has dragged on for far too long and has wasted more than \$5 billion just on the MOX plant construction alone. It's time for fiscal conservatives and even MOX supporters to step up and halt the endless waste of taxpayer money and pull the plug on the MOX debacle.

**Overall Conclusion:** The MOX project is doomed and is no longer viable and should be officially terminated by any means possible, including halting funding as well as removing CB&I AREVA MOX Services from the project. Investigations into waste, fraud, abuse, mismanagement and corruption should delve into a host of concerns related to the project and should proceed no matter if the project continues or is terminated.

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**Questions and comments on this “MOX Chaos” working draft are welcome; likewise, documents and information about the MOX boondoggle at SRS are solicited:**

Tom Clements  
Director  
Savannah River Site Watch  
1112 Florence Street  
Columbia, SC 29201  
USA  
tel. 1-803-834-3084  
cell 1-803-240-7268  
srswatch@gmail.com  
<http://www.srswatch.org/>  
<https://www.facebook.com/SavannahRiverSiteWatch>

**Appendix A:** Photos of Mixed Oxide Fuel Fabrication Facility (MFFF) construction site, U.S. DOE's Savannah River Site (SRS), @High Flyer, special to SRS Watch, <http://www.srswatch.org>

1. A view of the eastern facade of the MOX plant, November 10, 2016, credit: “@High Flyer, special to SRS Watch;” more photos at <http://www.srswatch.org> and at <http://www.srswatch.org/photos.html> and available on request.



2. MOX plant at SRS in South Carolina with Georgia Power's Plant Vogtle in Georgia in the background, across the Savannah River. Vogtle is the site of two operating

*commercial nuclear reactors, with two Westinghouse AP1000 reactors under construction, a project also facing significant cost overruns and schedule delays, due to chronic problems; CB&I was removed from the Vogtle project as construction contractor in January 2016 but for unknown reasons has been allowed remain at MOX, April 21, 2016, credit: "@High Flyer, special to SRS Watch," <http://www.srswatch.org>*

