



## Life-Cycle Cost Estimate for Department of Energy's Mixed Oxide (MOX) Plutonium Fuel Program

### ***Remaining \$22.11 Billion Must Not be Spent on Mismanaged Program***

*This aerial shot of the MOX plant construction at the Savannah River Site in South Carolina, legally taken at the end of March 2013, reveals that the roof of the facility has been finished, a good stopping point to suspend construction of the \$7.7-billion facility once openings into the building are sealed.*



*Photo by High Flyer, provided to Friends of the Earth – available for use with permission*

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The U.S. Department of Energy's (DOE) program to dispose of surplus weapons-grade plutonium has centered on the construction of a facility at DOE's Savannah River Site (SRS) to fabricate mixed oxide plutonium fuel (MOX) for possible use in commercial nuclear power reactors. In spite of MOX construction costs increasing rapidly, no new construction cost estimate has been prepared by DOE since an estimate of \$4.8 billion was released in 2008.<sup>2</sup>

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<sup>1</sup> Friends of the Earth, see short bio in staff listing, <http://www.foe.org/about-us/our-team>

<sup>2</sup> Department of Energy budget request for Fiscal Year 2008, page 498, [http://www.cfo.doe.gov/budget/08budget/Content/Volumes/Vol\\_1\\_NNSA.pdf](http://www.cfo.doe.gov/budget/08budget/Content/Volumes/Vol_1_NNSA.pdf)

Despite an obligation to do so under sound project management practices, no DOE life-cycle cost estimate for the overall MOX program has ever been prepared and finalized, prompting Friends of the Earth to make the rough calculation that \$22.11 billion is left to be spent on the overall MOX program.

The MOX project consists of not only construction of the Mixed Oxide Fuel Fabrication (MFFF) plant itself, but also includes a host of other expenses, including administrative buildings and administrative costs, yearly MOX plant operating costs, MOX plant start-up costs, plutonium feedstock preparation, a facility to treat MOX waste (Waste Solidification Building) and waste disposal costs, payment to utilities to use MOX fuel in their nuclear reactors and decommissioning of facilities.

The DOE's National Nuclear Security Administration (NNSA) continues to use a MOX plant cost estimate of around \$4.8 billion, which, contrary to good project management, has not been updated since the estimate of 2008. Likewise, NNSA has staunchly refused to release any life-cycle cost estimate, which appears to have been done to cover up both the soaring costs of the project and the mismanagement of it.

DOE has failed miserably in complying with DOE order 403.3B, *Program and Project Management for the Acquisition of Capital Assets*<sup>3</sup>, when managing all aspects of the MOX program. The order states that "the purpose of this Order is to a) provide the Department of Energy (DOE) Elements, including the National Nuclear Security Administration (NNSA), with program and project management direction for the acquisition of capital assets with the goal of delivering projects within the original performance baseline (PB), cost and schedule, and fully capable of meeting mission performance, safeguards and security, and environmental, safety, and health requirements." Revealing just how feeble management is, DOE has not met the requirements of the order, including failure to develop new performance and cost baselines.

Despite claiming for two years to Friends of the Earth that the cost of the MOX plant is being "rebaselined," DOE continues to block release of the new cost estimate. Additionally, DOE has failed to comply with legal requirements of the Freedom of Information Act by refusing to provide the rebaselined cost. If DOE cannot even develop a cost estimate how can it manage such a complex project or be allowed to do so?

In a hearing on "Major Construction Projects of the Department of Energy" before the House Energy and Water Development Subcommittee on March 20, 2013, DOE witnesses declined to speak on costs of the MOX project. The witnesses, Paul Bosco, DOE's Director of Acquisition and Project Management<sup>4</sup> and Robert Raines, Associate Administrator for Acquisition and

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<sup>3</sup> DOE Order 413.3 B, *Program and Project Management for the Acquisition of Capital Assets*, , <https://www.directives.doe.gov/directives/0413.3-BOrder-b/view>

<sup>4</sup> Testimony of Paul Bosco, House Energy & Water Subcommittee, March 20, 2013, <http://appropriations.house.gov/uploadedfiles/hmtg-113-ap10-wstate-boscop-20130320.pdf>

Project Management, National Nuclear Security Administration,<sup>5</sup> claimed that DOE was doing much better in project management but seemed to indicate that new project management oversight had been implemented too late to significantly change the situation with the MOX program. Failure by the DOE project managers to reveal the MOX costs underscores on-going project management failure and an official cover-up of the exploding costs of the program.

Though DOE management of the MOX project has failed on all counts, the DOE's Office of Management does acknowledge MOX project problems and admits in the "project management dashboard" that the "project is expected to breach its Performance Baseline cost, schedule, or scope."<sup>6</sup> (DOE states that "the scorecard for the previous month is usually posted by the 5th workday of each month" but the last available "dashboard" is for February 2013.)

Unfortunately, too little oversight has come far too late as the Office of Management has not complied with its own stated guidelines: "Project Directors are responsible for the planning, programming, budgeting and acquisition of capital assets. One of the principal outcomes in exercising this responsibility is the delivery of projects on schedule, within budget, with the required performance capability, and compliant with quality, environmental, safety and health standards."<sup>7</sup> The MOX project may never be "delivered" and is already far over budget and far behind schedule. Improper management by DOE and inadequate oversight by Congress has allowed the project to spin so far out of control that the problems will likely only grow, if it is allowed to continue.

In response to NNSA's refusal to update the cost estimate for the MOX plant, the Government Accountability Office (GAO) released a new cost estimate on March 20, 2013, in a document entitled *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*.<sup>8</sup> The document stated that "DOE is currently forecasting an increase in the total project cost for the MOX facility from \$4.9 billion to \$7.7 billion and a delay in the start of operations from October 2016 to November 2019."

NNSA has refused since before start of construction of the MOX plant in 2007 to release a life-cycle cost estimate for the overall MOX program. In response, GAO stated on March 20 that:

In addition to setting the cost and schedule performance baselines of the MOX facility and Waste Solidification Building, NNSA has developed a life-cycle cost estimate for the overall effort of the Plutonium Disposition Program to dispose of at least 34 metric tons

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<sup>5</sup> Testimony of Robert Raines, House E&W Subcommittee, March 20, 2013, <http://appropriations.house.gov/uploadedfiles/hmtg-113-ap10-wstate-rainesb-20130320.pdf>

<sup>6</sup> DOE's Office of Management, Project Dashboard - February 2013, <http://energy.gov/sites/prod/files/Project%20Dashboard%20-%20February%202013.pdf>

<sup>7</sup> DOE's Office of Management, Project Management description, <http://energy.gov/management/office-management/operational-management/project-management>

<sup>8</sup> Government Accountability Office, *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*, Statement of David C. Trimble, Director Natural Resources and Environment, March 20, 2013, <http://www.gao.gov/assets/660/653154.pdf>

of surplus weapons-grade plutonium. NNSA officials told us that there has never been a review of this life-cycle estimate by an outside entity but that they are conducting an independent assessment of portions of the life-cycle cost estimate, including the operating cost of the MOX facility. As part of our ongoing work, we are reviewing NNSA's preliminary life-cycle cost estimate and the steps NNSA is taking to validate this cost estimate.

Why is this secret life-cycle estimate being withheld by NNSA from the public and Congress?

Shaw AREVA MOX Services is designing and constructing the MOX plant. AREVA evidently will start up the facility and hopes to secure the lucrative long-term operating contract.

Due to the refusal of NNSA to release a life-cycle cost estimate, a figure which is needed by the public and Congress to make decisions about the program, this rough estimate is hereby presented. These figures simply present a snapshot of some remaining costs and is an update of an estimate of \$17.5 billion presented in early 2012, a figure which was not challenged by NNSA or DOE during the year despite repeated requests for comments and for an official estimate to be released.

***The challenge to DOE, NNSA and AREVA still remains: review this estimate and respond with a life-cycle estimate of your own, including sunk costs and amount yet to be spent.***

**Estimate of amount yet to be spent on the overall MOX program:**

<b>MOX plant construction (remaining to be spent)</b>	<b>\$3.7 billion</b>
<b>MOX feedstock preparation</b>	<b>\$1.8 billion</b>
<b>MOX plant start-up cost</b>	<b>\$450 million</b>
<b>MOX plant operating cost</b>	<b>\$10 billion</b>
<b>MOX Program Administrative costs and "other project costs"</b>	<b>\$3.9 billion</b>
<b>Waste Treatment Building and waste disposal</b>	<b>\$1.47 billion</b>
<b>Cost for MOX irradiation by Tennessee Valley Authority or other utilities</b>	<b>\$338 million</b>
<b>Deactivation, Decontamination &amp; Decommissioning of MOX plant</b>	<b>\$350 million</b>
<b>Decontamination &amp; Decommissioning - Waste Treatment Building</b>	<b>\$100 million</b>

**TOTAL estimated life-cycle cost (to be spent):** **\$22.11 billion**

## Justification for Life-Cycle Cost Calculation

### MOX Plant Construction (remaining to be spent): \$3.7 billion

Based on a review of DOE budget requests to Congress from Fiscal Year 2002 through Fiscal Year 2013<sup>9</sup>, it appears that around \$4 billion has already been spent on design and construction of the MOX plant. Though the roof is finished, more construction is yet to be done. Finishing the inside and outside of the plant and installing equipment will result in significant costs. Press reports indicate that the construction is about 60% complete.

The DOE's Fiscal Year 2013 budget request estimated \$3.6 billion was to be requested on the overall MOX program from Fiscal Year 2014 through Fiscal Year 2017, or about \$900 million per year.<sup>10</sup> A large percentage of this would be for MOX construction and start-up costs. While the GAO has presented a figure of \$7.7 billion for the total cost of the MOX plant construction, it is unknown how the GAO analyzed additional costs due to "a delay in the start of operations from October 2016 to November 2019." The three-year delay could add hundreds of millions of dollars or more in additional costs.

Changes in the scope of the MOX plant mission - addition of furnaces to process plutonium "pits" from weapons into MOX feedstock - and an addition of a MOX pellet fabrication line to make "boiling water reactor" fuel has added to costs. Problems with obtaining nuclear qualified material from suppliers, design problems (especially with critical components such as glove boxes), problems with transferring a French design to U.S. regulatory circumstances and the challenge in finding and keeping qualified personnel have all added to spiraling costs and chronic delays.

**Based on the \$7.7 billion GAO figure for MOX plant construction, which could prove to be conservative given accelerating costs, it appears that around \$3.7 billion is left to be spent (if the building were to be finished and equipped and could start operation, none of which is not a given).**

### MOX Plant Plutonium Oxide Feedstock Preparation: \$1.8 billion

NNSA is currently planning on three options to process plutonium to provide plutonium oxide "feedstock" to the MOX plant for fabrication into MOX fuel pellets: the Advanced Recovery and Integrated Extraction System (ARIES) at Los Alamos National Laboratory, processing in the H-Canyon reprocessing plant at SRS and via the addition of furnaces into MOX plant itself. It is unknown how the feedstock preparation would be divided amongst those three facilities.

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<sup>9</sup> Department of Energy, Office of Budget, Budget Justifications and supporting Documents, Fiscal Years 2002-2013, <http://www.cfo.doe.gov/croorg/cf30.htm>

<sup>10</sup> DOE budget request for FY 2013, NNSA budget volume 1, page 433, <http://www.cfo.doe.gov/budget/13budget/Content/Volume1.pdf>

Some plutonium which is not in the form of a “pit” from a weapon will need to be purified but the bulk of plutonium preparation would consist of oxidizing pits in furnaces to produce plutonium oxide power, or processing them through the H-Canyon reprocessing plant.

ARIES, which was originally a pilot demonstration project for a canceled pit disassembly facility at SRS, is being expanded to be able to process 2.5 metric tons of plutonium annually. According to an article in the Los Alamos magazine<sup>11</sup>, the plutonium pit oxidation “target for fiscal year 2014 is 300 kilograms, doubling the production target of 2012. At 300 kilograms a year, Los Alamos will have destroyed two metric tons of plutonium pits by 2018 and shipped the proliferation-resistant plutonium oxide to MFFF.”

The operation of the H-Canyon at SRS, which is in search of missions, costs on the order of \$150+ million per year. Given a lack of missions for the H-Canyon, especially if the bulk of spent research reactor fuel stored at the site is not reprocessed, plutonium feedstock preparation could become a dominant mission for H-Canyon.

The DOE budget request for Fiscal Year 2013 indicates a cost of \$1.9 billion for the Fiscal Years 2014-2017 for various activities, with feedstock preparation mission apparently taking the bulk of these funds.<sup>12</sup>

Lacking better information on which to base an estimate, a conservative annual cost for feedstock preparation - via ARIES at Los Alamos, the MOX plant and H-Canyon at SRS - could be on the order of \$150 million per year.

**At an optimistic production rate of 2.5 metric tons per year of plutonium oxide feedstock preparation, some of which has already begun, would be needed for approximately an additional 12 or more additional years to process 34 metric tons of pits. At \$200 million/year, the cost for 12 years of operation is about \$1.8 billion.**

#### **MOX plant Start-up Cost: \$450 million**

Once construction of the MOX plant has concluded, the facility will enter a phase of cold start up, during which time no plutonium will be introduced into the facility. Cold start up is evidently covered under the construction contract for the MOX plant. Then, hot start up would commence and initial fuel assemblies will be produced if things go according to plan.

The DOE budget request for Fiscal Year 2013 mentions adding start-up costs to the MOX contract and indicates in a footnote that there is concern about risks that the facility may be unable to operate as planned:

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<sup>11</sup> Los Alamos publication *National Security Science*, 2012, Transforming Pits into Clean Energy, <http://www.lanl.gov/science/NSS/issues/NSS-Issue2-2012.pdf>

<sup>12</sup> DOE Fiscal Year 2013 budget request, page 438, <http://www.cfo.doe.gov/budget/13budget/Content/Volume1.pdf>

The Government is negotiating Option II of the MFFF contract to add start-up and initial operation of the facility to the current contract scope in order to reduce the government's risk that the facility will be unable to produce specification MOX fuel. NNSA is also negotiating security and other overhead costs with Environmental Management--the SRS landlord. When the process is completed, the project life cycle costs will be updated.<sup>13</sup>

The only indication of the cost of start-up operation is contained in a response to a Freedom of Information Act (FOIA) request from 2008 on "Early Option 2,"<sup>14</sup> which is hot start-up of the MOX plant. The cost listed in the FOIA request is \$400 million in 2008 dollars, which would be \$435 million in 2013 dollars.

**Due to construction delays, cost escalation and potential start-up problems, it would be conservative to assume a cost of \$450 million for hot start-up.**

### **MOX Plant Operating Cost: \$10 billion**

The DOE budget request to Congress for Fiscal Year 2013 includes an estimated yearly operating cost for the MOX plant of \$498.7 million per year.<sup>15</sup> It is noted in the request that this figure is up from a previous figure of \$356.1 million, reflecting a significant jump in the estimated cost in one year.

In the Fiscal Year 2012 budget request, it is indicated that a "previous total estimate" for the yearly operating cost of the MOX plant was \$184.4 million.<sup>16</sup>

In the Fiscal Year 2013 budget request, there is conflicting information about the anticipated operating life of the MOX plant. In one place it is stated that "The nominal design life of the facility is 40 years, however, it will take approximately 13 years to complete the 34 MT mission."<sup>17</sup> In another place in the request, and this is the planning basis that has most often been presented by DOE, it is stated that the MOX plant will have a "20 year planned operating period."<sup>18</sup>

**For the purposes of this cost estimate, a 20-year operating life is assumed. At approximately \$500 million per year for annual operating costs, the total operating costs would be approximately \$10 billion.**

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<sup>13</sup> DOE FY2013 budget request, page 461

<sup>14</sup> NNSA MOX contract document provided in response to FOIA request, approved September/October 2008

<sup>15</sup> DOE Fiscal Year 2013 budget request, page 461,  
<http://www.cfo.doe.gov/budget/13budget/Content/Volume1.pdf>

<sup>16</sup> DOE Fiscal Year 2012 budget request, page 399,  
<http://www.cfo.doe.gov/budget/12budget/Content/Volume1.pdf>

<sup>17</sup> DOE Fiscal Year 2013 budget request, page 461

<sup>18</sup> DOE Fiscal year 2013 budget request, page 436

## **MOX Program Administrative Costs and “Other Project Costs”: \$3.9 billion**

It is extremely difficult to determine what costs would be to administer all aspects of the MOX program, often listed under “other project costs” which are separate from construction funding. A host of costs that have to be considered would include such things as DOE oversight costs, training, security and “program planning and management” and “scheduling, reporting, staffing, administrative support, and information management for the program” and performance of “ vendor/contractor surveillance/audits; conduct condition and regulatory compliance.”<sup>19</sup>

The FY2013 budget request for plutonium disposition is \$888 million, of which only \$388 million is for construction. As major construction of the building itself winds down, DOE presents estimated “outyear projections” for the overall fissile material disposition program (which includes plutonium and highly enriched uranium) of about \$3.88 billion for the period FY2014-2017 and lists “other project costs” for plutonium disposition for Fiscal Year 2013 as \$141.6 million and for Fiscal Year 2014 as \$228.6 million.<sup>20</sup>

**While it must be left to NNSA to eventually present the construction and non-construction cost estimates of the MOX project - estimates which will not be taken for granted given the huge mismanagement of the project and massive cost overruns - all that someone who does not have access to contractor and NNSA documents can do is make a rough estimate for administrative and other project costs. Erring on the side of conservatism, a cost of \$150 million per year, averaged over remaining 6 years of construction and start-up and the 20-year operating life, appears conservative. Thus, a cost of about \$3.9 billion does not sound unreasonable.**

## **Waste Treatment Building (WTB) and Waste Disposal: \$1.47 billion**

The Waste Treatment Building (WTB) is under construction adjacent to the MOX plant and would handle waste streams from the MOX plant, solidifying them for disposal as transuranic waste (TRU), either via shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico or for on-site disposal at SRS (an option which may be cheaper but which poses problems).

Just as for the MOX plant itself, the WTB faces growing costs and schedule delays. GAO states in its *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA* document that “DOE approved in December 2012 a revised performance baseline to increase the cost from the initial estimate of \$344.5 million to \$414.1 million and a delay in the start of operations from September 2013 to August 2015.”<sup>21</sup>

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<sup>19</sup> DOE Fiscal Year 2013 budget request, page 442

<sup>20</sup> DOE Fiscal Year 2013 budget request, pages 433, 437 and 458

<sup>21</sup> Government Accountability Office, *Concerns with Major Construction Projects at the Office of Environmental Management and NNSA*, Statement of David C. Trimble, Director Natural Resources and Environment, March 20, 2013, page 7, <http://www.gao.gov/assets/660/653154.pdf>



A construction cost increase of about \$70 million and a 2-year delay in start-up will have cost impacts. (It must be noted that the facility won't be needed until the MOX plant is in a start-up phase.) The Fiscal Year 2013 DOE budget request states that \$211.5 million would be needed for various start-up aspects of the facility.<sup>22</sup>

There are no hints in the DOE budget request of either the operating costs of the WTB or the cost for waste disposal. Wanting to at least include a place-holder figure, it is assumed that operational costs over the period of start-up testing, processing of waste streams from the MOX plant during cold and hot start-up and waste disposal will be on the order of \$50 million per year. For the next six years while the MOX plant is being finished and undergoing testing and for a 20-year life of the WTB, a cost of \$1.3 billion is assumed. Yearly waste management and disposal costs are unknown but assumed to be \$5 million per year, or \$100 million. To this would be added to the additional construction costs of \$70 million, for a figure of \$1.47 billion.

### **Cost for MOX Irradiation by Tennessee Valley Authority or Other Utilities: \$338 million**

Despite past discussions between DOE/AREVA and the Tennessee Valley Authority (TVA), it is unclear where negotiations between the entities stand but it appears that little progress has been made to use MOX in TVA reactor. Additionally, DOE and AREVA have stated that other utilities are being pursued to use MOX fuel. MOX made from weapons-grade plutonium has never been used commercially in any reactor and never tested in any "boiling water reactor."

Currently being reviewed in a Supplemental Environmental Impact Statement, DOE is analyzing use of TVA's three Browns Ferry reactors (GE Mark I boiling water reactors - BWRs - Fukushima design) and the two Sequoyah (ice condenser pressurized water reactors, PWRs).<sup>23</sup>

Little is known about costs to modify reactors to use MOX and to irradiate the MOX fuel. Additionally, nothing is known about costs of additional risks posed by MOX during reactor operation or under certain accident scenarios.

A 2008 TVA document entitled *Mixed Oxide Fuel Impact Evaluation - A Review of the Potential Impacts and Cost Associated with the Utilization of a Partial MOX Fuel Core*<sup>24</sup> does have a bit of cost information and states that the "costs required to implement MOX fuel at the Sequoyah plant are estimated to be \$57 million initially with a recurring annual operating cost (excluding fuel) of \$1.35 million in 2008 dollars."

The Sequoyah PWRs are on an 18-month refueling cycle and the Browns Ferry BWRs are on a 2-

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<sup>22</sup> DOE FY 2014 budget request, page 440

<sup>23</sup> *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*, final document scheduled for release in April 2013 but expected to be late, <http://nnsa.energy.gov/aboutus/ouoperations/generalcounsel/nepaoverview/nepa/spdsupplementaleis>

<sup>24</sup> Tennessee Valley Authority, *Mixed Oxide Fuel Impact Evaluation - A Review of the Potential Impacts and Cost Associated with the Utilization of a Partial MOX Fuel Core*, October 2008, page 2 (obtained via FOIA request)

year cycle. For the purposes of this assessment, the costs per reactor for the two plants are assumed to be the same.

While TVA is now seeking a 20-year operating license extension for each of the Sequoyah units, the 20-year life extensions for the Browns Ferry units ends in 2033, 2034 and 2036.<sup>25</sup> Thus, use in Browns Ferry will be curtailed, especially if a 6-year in-reactor test of the experimental MOX fuel is required by the U.S. Nuclear Regulatory Commission (NRC) given that weapons-grade MOX has never been tested before in a BWR and is regarded by the NRC as a “new fuel form.”

If the MOX plant at SRS is not able to produce test MOX fuel (“lead test assemblies”) until 2021, three years behind the 2018 schedule that has been presented, testing in Browns Ferry would be delayed and the six-year test would likely not be able to be concluded until 2027 or later. As this is only a few years before the 20-year licenses extensions start lapsing, it is possible that MOX testing will knock the Browns Ferry reactors out of possible MOX use.

For this assessment, an assumption is made that no testing of MOX will be made in the Sequoyah reactors and that a 6-year test will be needed in Browns Ferry before “batch use” could be licensed by the NRC. The Browns Ferry licenses expiration dates will be ignored for the purposes of this cost assessment. The MOX fuel is assumed to have the same value to TVA as LEU fuel.

In any event, TVA has not agreed to test or use MOX fuel and the current crisis facing the MOX program may well serve to underscore that DOE is not a reliable partner with which to do business.

Given an initial cost of \$57 million to convert the two Sequoyah reactors to MOX use and a \$1.35 million per year operating cost, over 20 years of MOX use, the total cost would be \$27 million. To this, a fee or payment to TVA would have to be added, which is assumed to be \$1 million per reactor per year. Thus, the total cost for irradiation in Sequoyah (ignoring any costs due to problems or accidents) would be \$144 million.

As there are three reactors at Browns Ferry, costs would be higher. For the purposes of this exercise, the cost is assumed to be one-third higher, or \$194 million.

Additional expenses that are likely from storing MOX fuel, which is hotter than LEU fuel, are not included even though costs related to pool storage and more a much more lengthy period of dry cask storage could be substantial.

**With a MOX use cost at Sequoyah of \$144 million and at Browns Ferry of \$194 million, the total costs for MOX irradiation services would be \$338 million.**

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<sup>25</sup> Nuclear Regulatory Commission, website on operating reactors, <http://www.nrc.gov/reactors/operating/list-power-reactor-units.html>

### **Deactivation, Decontamination & Decommissioning of MOX plant: \$350 million**

The costs for deactivation, decontamination and decommissioning of the MOX plant are unknown. The DOE budget request for Fiscal Year 2013 avoids mention of any estimates for these activities.

The budget request mentions that a deactivation contract “can be awarded separately” but does not mention decontamination and decommissioning (D&D):

The procurement strategy for the MOX facility involved awarding a base contract to Duke Cogema Stone & Webster (now Shaw AREVA MOX Services) in March 1999 for design, licensing, and irradiation services associated with fuel qualification activities and reactor licensing. Three options were included in the base contract for: (1) construction and management oversight; (2) hot start-up, operations, and irradiation services; and (3) deactivation—which can be awarded separately. Option 1 was exercised by DOE in May 2008. In January 2009, an Early Option 2 proposal was submitted to NNSA for consideration. The proposed work scope included the fabrication of eight fuel assemblies as a part of the facility hot startup plan. Negotiations on Early Option 2 are currently in process.<sup>26</sup>

Only to present a figure, an estimate for the D&D cost of a nuclear reactors is listed here as a place holder. The Nuclear Energy institute (NEI) has estimated that D&D costs for a single nuclear power plant are in the range of \$300 million to \$500 million.<sup>27</sup> It is recognized that the challenges in the D&D of a MOX plant vs a nuclear power plant are quite different.

A deactivation cost of \$50 million is conservative, especially if carried out by AREVA.

Given the NEI estimate for nuclear power plant decommissioning, a conservative estimate for the MOX plant deactivation, decontamination and decommissioning is chosen to be \$350.

### **Decontamination & Decommissioning – Waste Treatment Building: \$100 million**

No information on costs of D&D of the Waste Treatment Building is available. Based on a general impression of costs of management of other radioactive material handling facilities managed by DOE, a figure of \$100 million is listed as a place-holder amount.

### **Other Project Costs, Escalation, Etc.**

A host of other costs can be imagined, including cost escalation, costs related to problems

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<sup>26</sup> DOE FY 2103 budget request, page 462, <http://www.cfo.doe.gov/budget/13budget/Content/Volume1.pdf>

<sup>27</sup> Nuclear Energy Institute, *Costs: Fuel, Operation and Waste Disposal*, [http://www.nei.org/resourcesandstats/nuclear\\_statistics/costs](http://www.nei.org/resourcesandstats/nuclear_statistics/costs)

with start-up and operation, more delays and contract termination costs but speculation about such costs is not included in this estimate.

### **Conclusion**

Gross negligence in the management of the MOX program has resulted in significant cost overruns and schedule delays and the lack of customers to use MOX fuel. The \$22.11 billion estimate for the amount of money yet to be spent the MOX program gives ample reason for the MOX plant construction to be suspended and the program terminated. Management must be held accountable and NNSA must produce its own life-cycle cost estimate. Until such time as that happens, the estimate provided here is the best and only estimate available. Now that the roof of the MOX plant has been finished, work can be halted once all the penetrations and entrance-ways are closed or sealed. The \$4-billion building must be protected for other use, including methods to dispose of surplus plutonium as waste.

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***Aerial photo of the MOX plant of late March 2013 reveals what a \$7.7-billion tax payer-funded project looks like – who in DOE/NNSA/Shaw AREVA MOX Services will be held accountable for this mismanaged boondoggle?***



Photo by High Flyer, provided to Friends of the Earth

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