[H.A.S.C. No. 114–54]

PLUTONIUM DISPOSITION AND THE MOX PROJECT

HEARING

BEFORE THE

SUBCOMMITTEE ON STRATEGIC FORCES

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

HEARING HELD
OCTOBER 7, 2015

U.S. GOVERNMENT PUBLISHING OFFICE
97–197 WASHINGTON : 2016

For sale by the Superintendent of Documents, U.S. Government Publishing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

SUBCOMMITTEE ON STRATEGIC FORCES

MIKE ROGERS, Alabama, *Chairman*

TRENT FRANKS, Arizona
DOUG LAMBORN, Colorado, *Vice Chair*
MIKE COFFMAN, Colorado
MO BROOKS, Alabama
JIM BRIDENSTINE, Oklahoma
J. RANDY FORBES, Virginia
ROB BISHOP, Utah
MICHAEL R. TURNER, Ohio
JOHN FLEMING, Louisiana

JIM COOPER, Tennessee
LORETTA SANCHEZ, California
RICK LARSEN, Washington
JOHN GARAMENDI, California
MARK TAKAI, Hawaii
BRAD ASHFORD, Nebraska
PETE AGUILAR, California

DREW WALTER, *Professional Staff Member*
LEONOR TOMERO, *Counsel*
MIKE GANCIO, *Clerk*

CONTENTS

Page

STATEMENTS PRESENTED BY MEMBERS OF CONGRESS

Cooper, Hon. Jim, a Representative from Tennessee, Ranking Member, Subcommittee on Strategic Forces 2
Rogers, Hon. Mike, a Representative from Alabama, Chairman, Subcommittee on Strategic Forces 1

WITNESSES

Klotz, Hon. Frank G., Administrator, National Nuclear Security Administration 2
MacWilliams, John J., Senior Advisor to the Secretary of Energy, U.S. Department of Energy 4
Mason, Thom, Ph.D., Director, Oak Ridge National Laboratory 5

APPENDIX

PREPARED STATEMENTS:
Cooper, Hon. Jim 42
Klotz, Hon. Frank G. 44
Mason, Thom 50
Rogers, Hon. Mike 41

DOCUMENTS SUBMITTED FOR THE RECORD:
Letter to Mr. Wilson from CB&I Power 63

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING:
Mr. Forbes 67
Mr. Garamendi 70
Mr. Norcross 70
Mr. Rogers 67

QUESTIONS SUBMITTED BY MEMBERS POST HEARING:
Mr. Garamendi 73
Mr. Wilson 75

PLUTONIUM DISPOSITION AND THE MOX PROJECT

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON STRATEGIC FORCES,
Washington, DC, Wednesday, October 7, 2015.

The subcommittee met, pursuant to call, at 3:34 p.m., in room 2118, Rayburn House Office Building, Hon. Mike Rogers (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. MIKE ROGERS, A REPRESENTATIVE FROM ALABAMA, CHAIRMAN, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. ROGERS. Good afternoon. The subcommittee will come to order.

Welcome to our hearing on Plutonium Disposition Program and the MOX Project.

To our witnesses, thank you for being here. We know it takes a lot of time to prepare and get ready for these things, and I really appreciate your investment. Your contributions make a big difference to our ability to do our jobs.

Our distinguished witnesses today are the Honorable Frank Klotz, Administrator, National Nuclear Security Administration [NNSA]; Mr. John MacWilliams, Associate Deputy Secretary, U.S. Department of Energy [DOE]; and Dr. Thom Mason, Director, Oak Ridge National Laboratory.

This hearing is examining one of the Department of Energy's largest and highest profile construction projects. The MOX Project and the broader Plutonium Disposition Program have been the subject of several recent reviews. The leaders of two of those reviews are at the witness table today: Mr. MacWilliams and Secretary Moniz' internal assessment team, and Dr. Mason led the independent Red Team. They have both also been involved in figuring out what DOE should do about key uranium capabilities that are critical to our national security.

Gentlemen, you seem to get all the easy issues.

They are joined by General Klotz, who is no stranger to difficult challenges. General Klotz has the overall responsibility for executing the program as head of the NNSA.

We look forward to hearing from all of you about the Department's current status on this program as the committee looks to help the Nation determine what is in the best interests of the taxpayer and our national security.

With that, let me turn to our ranking member for any statement that he might like to make.

[The prepared statement of Mr. Rogers can be found in the Appendix on page 41.]

STATEMENT OF HON. JIM COOPER, A REPRESENTATIVE FROM TENNESSEE, RANKING MEMBER, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. COOPER. Thank you, Mr. Chairman.

I ask unanimous consent that my opening statement would be put into the record. And I would like to make some additional oral remarks.

Mr. ROGERS. Without objection, so ordered.

Mr. COOPER. Thank you.

Welcome to the witnesses.

And I am glad we are having this oversight hearing. It has been a long time since this committee has had one—by some counts, almost 10 years. A lot has happened in that time. And I am worried that, as we enter the month of October and head toward Halloween, that really the subject of this hearing is a horror story for the American taxpayer. Because we all want a good outcome, and yet this has been way more expensive and way slower than anybody really could have imagined 10, 15 years ago.

I almost want to dedicate this hearing to a former colleague of ours, a Republican Congressman named Dave Hobson, who spotted the trouble way back 10 or 15 years ago. He wanted to do something about it; he was unable to. And then he later reported in 2007 he was politically pressured not to do anything about it.

So there have been various people for a long time trying to do the right thing for the American taxpayer. I hope that we can do it today. Dr. Mason's testimony, I think, will make clear that, whatever we decide, we need to decide something. We can't let the day of decision just keep on waiting.

So I am hopeful that we will read the studies. I congratulate the Department of Energy and NNSA for having followed Congress' mandate to do these studies and to report, you know, what we can expect unless we take a prompt decision.

So I thank the witnesses, and I look forward to your testimony.

[The prepared statement of Mr. Cooper can be found in the Appendix on page 42.]

Mr. ROGERS. Thank you.

We will now ask each of our witnesses to make an opening statement and summarize their opening statements in 5 minutes. Your written testimony will be accepted for the record.

General Klotz, I understand you have one written statement for the Department of Energy.

And, Mr. MacWilliams, no statement?

Mr. MACWILLIAMS. That is correct.

Mr. ROGERS. Okay.

General Klotz, you are recognized for a verbal opening statement.

STATEMENT OF HON. FRANK G. KLOTZ, ADMINISTRATOR, NATIONAL NUCLEAR SECURITY ADMINISTRATION

General KLOTZ. Thank you, Chairman Rogers, Ranking Member Cooper, other members of the subcommittee. It is an honor, as al-

ways, to appear before you on behalf of the Department of Energy and the National Nuclear Security Administration. Again, we thank you for your continued support for our nuclear security mission and for our people.

We also appreciate the opportunity to discuss plutonium disposition and the Mixed Oxide, or MOX, Fuel Fabrication Facility project with you today. And I appreciate the fact you will put our written statement into the record.

Let me state at the outset that the Department remains committed to the Plutonium Management and Disposition Agreement, or PMDA, between the United States and Russia and will continue to support the mission to dispose of 34 metric tons of excess U.S. weapons-grade plutonium.

At the same time, the Department has been working to determine if there are opportunities to make the current MOX fuel approach for plutonium disposition more efficient since it has become clear that this approach will be significantly more expensive than originally anticipated.

There have been, as you noted, several efforts over the last 2 years to analyze the current MOX fuel approach and alternatives, including a 2014 internal Department of Energy review; the 2015 congressionally mandated independent assessments by The Aerospace Corporation; and, most recently, a 2015 Red Team review, tasked by the Secretary of Energy and conducted by a team of U.S. and U.K. experts led by Dr. Thom Mason, the Director of Oak Ridge National Laboratory.

Consistently, these analyses have concluded that the projected lifecycle costs of the MOX fuel approach for plutonium disposition will be in the range of $30 billion to $50 billion and possibly higher and will require approximately a billion dollars a year, in escalated dollars, for decades for construction and for the operational expenses for the life of the project.

With the challenging and uncertain budget environment and with a lifecycle cost in excess of $30 billion, we believe there will be insufficient long-term funding available to support the MOX fuel approach and do all the other things which the administration and the Congress have called upon the Department of Energy and NNSA to do in its full portfolio of activities.

Further, these analyses have all concluded that there is an alternative option that would be less than half the cost of the MOX fuel approach and have far lower risks, the so-called dilution and disposal approach.

The fiscal year 2015 appropriations and authorization acts directed that construction of the MOX Project continue in fiscal year 2015 at a level of $345 million. The fiscal year 2016 continuing resolution, which funds the Department through December 11, 2015, maintains the status quo for this project. As such, the Department has been continuing construction of the MOX facility despite the fact that, in our view, this funding level is too low to make any significant progress in completing the project.

While these studies were underway throughout the last two calendar years, the Department has been discussing with individual Members of Congress and with staff the best path forward.

We have also raised our ongoing analysis of plutonium disposition options with our Russian counterparts. The U.S.-Russian PMDA provides for disposition by irradiation or any other method as may be agreed by the two parties to the agreement. As we determine our path forward as a Nation, we will continue these discussions with the Russians.

So, again, Mr. Chairman, thank you for the opportunity to be here. And I look forward to answering your questions and Mr. Cooper's questions as well as the other members of the subcommittee.

[The prepared statement of General Klotz can be found in the Appendix on page 44.]

Mr. ROGERS. Thank you, General.

Mr. MacWilliams, you are recognized for 5 minutes.

STATEMENT OF JOHN J. MACWILLIAMS, SENIOR ADVISOR TO THE SECRETARY OF ENERGY, U.S. DEPARTMENT OF ENERGY

Mr. MACWILLIAMS. Thank you, Chairman Rogers, Ranking Member Cooper, and members of the subcommittee. I appreciate the opportunity to appear before you today to discuss the Department of Energy's efforts to dispose of surplus weapon-grade plutonium, which is a topic of great importance to Secretary Moniz and to Deputy Secretary Sherwood-Randall.

I am, as was mentioned, the Department of Energy's Associate Deputy Secretary, and I also serve as the Secretary's senior finance advisor. I have a private-sector background and have focused most of my career on investment and financing in the energy sector since about the mid-1980s. I joined the Department in June of 2013, and I have had the opportunity since then to work closely with Administrator Klotz on a variety of national security issues, including the Plutonium Disposition Program.

Shortly after I joined the Department, the Secretary asked me to lead a new special working group that he established in June of 2013 focused on plutonium disposition. As part of our efforts to determine ways to improve the efficiency of the plutonium disposition mission—which, as General Klotz just mentioned, it remains a critical and very important mission—the working group undertook a detailed analysis of our disposition options.

The Plutonium Disposition Working Group includes the Office of the Administrator as well as the Offices of Defense Nuclear Nonproliferation, Nuclear Energy, Acquisition and Project Management, General Counsel, and Congressional and Intergovernmental Affairs.

And the Department issued a report with the working group's analysis of surplus weapon-grade plutonium disposition options in April of 2014. The analysis concluded that the projected lifecycle costs of the MOX fuel approach for plutonium disposition would be approximately $30 billion.

I think it is important at the outset to clarify that the MOX fuel approach lifecycle cost includes much more than just the MOX Fabrication Facility, which is located at Savannah River. Rather, it is the entire disposition program, which starts with pit disassembly and conversion, then moves into the MOX Fabrication Facility. Wastes come out in the Waste Solidification Building. We then

have waste qualification and, ultimately, reactor modifications necessary to burn the fuel in light-water reactors.

The analysis also concluded that there is an alternative option that would be less than half the cost of the MOX fuel approach and have far fewer risks, and that is the dilution and disposal approach, which we will discuss today at length.

Our efforts to reexamine the ways that we are implementing our plutonium disposition mission are part of a larger focus in the Department on improving our performance of major projects across the enterprise. As you are well aware, we manage some of the most truly one-of-a-kind projects, very difficult projects, often handling radioactive conditions. And, in light of these, we have struggled, and we have been on GAO's [Government Accountability Office's] high-risk list since the inception of that list in the 1990s.

To meet those challenges, the Secretary has instituted a number of changes to improve our performance on major projects, and he has made improving management performance at the Department of Energy a top priority, which has been recognized by GAO and others. In fact, in 2013, GAO narrowed its DOE focus to only the contracts and projects over $750 million in the Department's Office of Environmental Management and also in NNSA.

In addition, since the creation of NNSA's Office of Acquisition and Project Management in 2011, they have delivered on an $800 million project portfolio, approximately $60 million or 7½ percent below budget.

In the last year, the Secretary has issued two significant decision memos. One of those created the Project Management Risk Committee, which I chair.

So the reforms and processes that we are instituting at DOE with respect to project management are critical steps to ensuring we continue to be responsible stewards of taxpayers' dollars. We are encouraged by the work that we have done over the last 2 years, but we recognize that many challenges remain, including the Plutonium Disposition Program. We look forward to working with Congress to ensure that the program is on the best path forward.

Thank you. And I will be pleased to answer your questions.

Mr. ROGERS. Thank you.

And, Dr. Mason, you are recognized for 5 minutes.

STATEMENT OF THOM MASON, PH.D., DIRECTOR, OAK RIDGE NATIONAL LABORATORY

Dr. MASON. Chairman Rogers, Ranking Member Cooper, and members of the committee, thank you for this opportunity to appear before you today.

My name is Thomas Mason. I am Director of the U.S. Department of Energy's Oak Ridge National Laboratory. And, as General Klotz has told you, Secretary Moniz tasked me with assembling and leading a Red Team to assess options for disposing of surplus weapons-grade plutonium.

We were directed to consider the mixed oxide fuel, or MOX, approach that is the current baseline, an alternative entitled "dilute-and-dispose," and any other alternatives that we viewed as meriting consideration. In particular, we were asked to evaluate the previous assessments of plutonium disposition options and rec-

oncile cost differences among them, analyze ways that the MOX approach might be modified to reduce its cost, and examine risk assumptions and their impact on the cost.

The Red Team reviewed a number of previous assessments of plutonium disposition options, and, as part of the process, we interviewed several members of the teams that conducted these assessments. We heard topical presentations on the MOX approach and potential alternatives. We were briefed by Ambassador Michael Guhin of the U.S. State Department and Dr. Siegfried Hecker, the former Director of Los Alamos National Lab, on the terms and history of the Plutonium Management and Disposition Agreement and interactions with Russian scientific leaders that led up to this agreement. We conducted site visits and interviews at Los Alamos, the Waste Isolation Pilot Plant, or WIPP, and the Savannah River Site. And, finally, we reviewed the prior cost analyses to assess annual funding needs for a successful disposition program, focusing on the three most recent assessments.

We quickly screened out most of the potential alternatives, including some that were addressed in the Plutonium Working Group [PWG] assessment that John MacWilliams was involved in, primarily because they had sufficient uncertainties in terms of cost and schedule that we concurred with the prior assessments that did not consider them near-term options for an alternative pathway.

The two remaining alternatives, the baseline MOX approach and the dilute-and-dispose, are those addressed in the Phase 1 Aerospace assessment of the PWG report.

The Aerospace team reached four primary conclusions: The PWG cost and schedule estimates were performed in reasonable accord with accepted best practices. The programmatic risks were generally underestimated for both the MOX approach and the dilute-and-dispose alternative; and that the dilute-and-dispose alternative cost less than the MOX. Finally, they concluded that the MOX approach is essentially nonviable at anticipated capital funding levels because of the time needed to complete construction of the MOX Fuel Fabrication Facility, up to 86 years at $350 million a year.

We agreed with the first three conclusions and, importantly, the conclusion that the best-case scenario for MOX was substantially more expensive than the worst-case scenario for dilute-and-dispose. We did find that the assertions regarding the time needed to complete the MOX Fuel Fabrication Facility at reduced funding levels were not able to take into account possible optimization of the project effort at reduced funding levels. However, as I said, we concurred with the primary conclusion regarding the relative cost.

We also reviewed the High Bridge critique of the Aerospace report, and the primary concern expressed by High Bridge was that the MOX risk elements and resulting impact costs are overstated and inconsistent and that the dilute-and-dispose, which they refer to as "downblend," risk elements are understated.

While we concurred with findings that the MOX lifecycle costs in the Aerospace report were overstated, as described, due to the extension of the project over very long durations and the impacts of escalation, we disagreed with their contention that dilute-and-dispose should have a risk profile commensurate with a complex nu-

clear facility construction project in its early stages, given that it can begin already in existing facilities and has much smaller capital investment requirements in order to optimize its production rate.

And, in fact, the simplest statement that we can arrive at in terms of understanding the cost differences is that the dilute-and-dispose option is essentially a subset of what is needed for MOX. All of the requirements for pit disassembly and oxidization are necessary in either scenario. In the case of MOX, you then have to go on to convert that into nuclear fuel in the MOX Fuel Fabrication Facility, hence the additional cost.

And, in particular, the dilute-and-dispose uses much simpler technology than MOX, so the technical risks are reduced. And it has already been demonstrated in the dispositioning of weapons plutonium material from the Rocky Flats facility.

So the primary risks associated with the dilute-and-dispose option are not so much cost and schedule risks; they are risks associated with getting Russian concurrence with the modification of the PMDA. Such modification is allowed for in the agreement, but, of course, it does require concurrence. We believe there is a sufficient technical basis to constitute a good starting point for those negotiations, although there can be other factors beyond technical merits that could influence their outcome.

And, also, receiving agreement from the State of New Mexico for the optimal regulatory pathway for dilute-and-dispose is another factor that can impact the overall viability, particularly due to its impacts on the WIPP capacity.

The bottom line in terms of relative cost we analyzed in terms of the operating cost requirement on an annual basis in unescalated dollars, the dilute-and-dispose option, we believe, can be executed at basically the current funding level of roughly $400 million a year, whereas successful execution of the MOX plan would require ramping up over the next 2 years or so to more like $700 million to $800 million a year. In both cases, you would have to sustain that funding over the multi-decade operating life of the facility against inflation, so it would escalate over time.

So, I think at that point, I am over my time, so I will conclude, and we can turn to questions.

[The prepared statement of Dr. Mason can be found in the Appendix on page 50.]

Mr. ROGERS. I thank all the witnesses.

And now I will recognize myself for questions.

The Plutonium Management Disposition Agreement between the U.S. and Russia, as amended, requires the U.S. to pay Russia $400 million to help Russia hold up its end of the deal. That is pretty hard to believe, given what Russia is up to around the world right now.

How much of this assistance has been paid to Russia so far? Will any current or prior-year funding be paid to Russia for these purposes in 2016? How much of these funds are currently available and on your books? And what is the plan for the $400 million in U.S. assistance mentioned in fiscal year 2017–2018?

General Klotz, I guess you are the perfect person for this question.

General KLOTZ. I am. And thank you. And anticipating that you might ask this question, Mr. Chairman, I carefully quizzed our staff.

The United States has not provided Russia with any funding towards the $400 million commitment. No funds will be paid to Russia in current or prior-year funding towards this commitment. And, in accordance with recent congressional direction, all Russia program funds that were appropriated to meet U.S. PMDA obligations were rescinded, and there are currently no funds available within the NNSA available to support Russian plutonium disposition.

Mr. ROGERS. Great. Well, given that so many senior U.S. military leaders are saying they are our biggest threat, it is going to be a virtual impossibility to get more money out of Congress for Russia.

The Waste Isolation Pilot Program, or WIPP, in New Mexico is a key part to making the dilute-and-dispose option work, but WIPP has been shut down for over a year and a half due to a radiation leak. What risks are in the dilute-and-dispose option given the uncertainty surrounding WIPP?

Dr. Mason.

Dr. MASON. WIPP is a critical asset for a number of programs. It is required for the ongoing operations of facilities, a lot of the cleanup activity, so it is certainly urgent that it be restarted.

We estimated that it would take roughly 5 years to prepare for initial shipments to WIPP, assuming that a decision was made to transition to that pathway. And you have to go through a termination process, obviously, in the MOX Fuel Fabrication Facility. That will entail some cost.

And, also, there is some preparatory work in terms of reaching an agreement with the Russians and establishing the framework for monitoring of the agreement, which would be done under the auspices of the International Atomic Energy Agency.

And based on the visit that we made to WIPP and the discussions with the Federal officials there, we believe 5 years is consistent with the timeframe that is envisaged for not only the restart of WIPP, which is within the next year or so, but also dealing with the backlog and getting back up to a full operational status. So we don't see a major inconsistency there.

Mr. ROGERS. Are the costs of expanding WIPP as well as redoing the regulations and agreements with New Mexico included in the dilute-and-dispose option? And how much will that cost?

Dr. MASON. What you might call the baseline approach to dilute-and-dispose would be following the protocols and procedures that were used to disposition the Rocky Flats material, which included diluting the plutonium oxide to 10 percent with the diluent, the details of which are classified, but it is often referred to as "stardust" as a sort of shorthand. And that pathway is currently permitted in terms of both the transportation to WIPP and the emplacement in WIPP.

However, it would be optimal to explore the possibility of increasing the fraction of plutonium oxide. That has the effect of reducing the duration and therefore the cost of the project and reducing the consumption of volumetric capacity at WIPP. That would require additional regulatory approval both from NRC [Nuclear Regulatory

Commission] for transportation and also permitting actions in the State of New Mexico to permit disposition in WIPP.

Mr. ROGERS. Well, this is kind of a follow-up to that. Your Red Team says that, quote, "Perceived fundamental barriers to dilute-and-dispose approach, namely WIPP capacity limits and the PMDA compliance, are not viewed as insurmountable by the Red Team but should be retired as early as possible in the planning phase for this option as possible," closed quote.

How quickly could you know if these fundamental barriers can be resolved successfully?

Dr. MASON. Well, as I said, in terms of the WIPP and New Mexico, you can initiate within the already-approved framework at this 10 percent dilution. What you would like to do is, as quickly as possible, get to a more optimal pathway at higher concentration and also explore with the State possibly changing the basis for calculating the amount of waste deposited in WIPP.

At the moment, per the agreement with the State, it is calculated based on the volume of container rather than the volume of the waste. And if you could get an agreement to actually look at the waste volume, that would obviate the need for any modification to the Land Withdrawal Act.

As I said, those aren't a barrier to starting the process but would have to happen in a timely way in order to avoid consuming the full capacity of WIPP at the lower dilution rate. So, given that it would take 5 years to be ready to begin emplacement, there is probably time for such discussions, although, obviously, the near-term focus is on restart.

In terms of the Russian agreement, that is a little harder to assess the duration, because, quite frankly, there are factors around getting an agreement with the Russians that may have nothing to do with plutonium disposition and the technical merits. And it is a little bit hard for us to, you know, consider all the possible geopolitical scenarios that might slow that down or speed it up.

As we stated in the report, we believe that the U.S. has a solid negotiating position to initiate those discussions based on the fact that, from a technical point of view, in our judgment, this is an acceptable disposition, in that it puts the material beyond use by state or non-state actors, which is the intent of the agreement. And the fact that there has been prior modification, you know, is a good basis for the discussion.

But it is a little hard for us to project, you know, how other extraneous factors, be they, you know, Ukraine, Syria—pick your problem—could slow down or, you know, if things improved, speed that up. Although 5 years is probably not an unreasonable window.

Mr. ROGERS. All right. Thank you.

Before I turn it over to the ranking member, I ask unanimous consent that non-committee members be allowed to participate in today's hearing after all subcommittee members have had an opportunity to ask questions. Is there objection?

Hearing none, the Members will be recognized at the appropriate time for 5 minutes.

With that, I turn it over to my friend and colleague from Tennessee, the ranking member, Mr. Cooper.

Mr. COOPER. Thank you, Mr. Chairman.

The topic of today's hearing is extraordinarily technical, so let me try to simplify it.

I think the real news of this hearing is that most all the experts agree that there is a new and better and cheaper way to dispose of this plutonium. That is good news. Now, that option is called the dilute-and-dispose option. That is good news.

But, Congress being Congress, there is a lot of inertia, and there are some folks who may prefer what is now the worst and more expensive and slower option, which is the one we have been fooling with all these years.

The key thing, politically, is to realize that no one here today is talking about taking money away from South Carolina. Because, as the Red Team testimony says on page 5 here—let me quote. "The Red Team concluded that the dilute-and-dispose alternative could be executed at current annual funding levels," about $400 million per year in fiscal year 2015 dollars.

The real question of this hearing is, if we are forced, due to the fact that we are in love with the older, worse, more expensive technology—force American taxpayers to double or triple their commitment to South Carolina and the other parts of the supply chain, I think they are okay where they are. You know, $300 million or $400 million a year, let's get the new and better technology, let's dispose of this in the new, more affordable, more reliable, more enlightened way, and let's kiss the old technology goodbye. Because we simply cannot afford to double or triple the commitment.

So I have the utmost respect for my friends from South Carolina, all of them. The delegation is awesome. Mr. Wilson is particularly awesome. He does a great job supporting his constituents. But $300 million or $400 million a year is enough, on top of the $12 billion that various government agencies—DOE, DOD [Department of Defense]—are already spending in direct support to South Carolina.

So if you look at it on a chart—and we have a chart of this, if my colleagues would be interested—the MOX money is almost insignificant. But do they have a right to force that MOX money to go up to double or triple? I just don't think so. We are doing enough already. The MOX money is the little dark part on the very top there. You see it is a rising slope.

So why can't we just maintain current funding levels, maintain current employment levels, maintain current job levels, but get the technology right as we dispose of this plutonium? That should do no injury to our friends in South Carolina. That should preserve our nonproliferation goals. That should help us prevent this terrible squeeze on the DOD/DOE nuclear budget. Because we don't know where the funding is going to come from.

I believe, General Klotz, didn't you say the funding is insufficient to continue the MOX facility? Didn't you use the word, adjective, "insufficient"?

General KLOTZ. If I could quote my boss, the Secretary of Energy, it is less than optimal for completing the project.

Mr. COOPER. Well, I love euphemisms.

So, again, the question is whether we embrace this new and better approach, this more affordable, more reliable approach that is at the same cost—no one is talking about taking away money from South Carolina or from Savannah River or anything like that. The

only real question for this committee is whether we force ourselves and the American taxpayer to double or triple that commitment by sticking with this old, largely outmoded technology.

So I would urge my committee members to put it in that light. We are not hurting anybody here. We are just trying to choose the better technology to achieve our national security goals.

Mr. MacWilliams.

Mr. MACWILLIAMS. Thank you, sir. A couple points.

We absolutely agree with the comments you made about Savannah River. General Klotz and I and the Secretary have made repeated trips to Savannah River, and the Department very strongly believes that Savannah River is not a closure site. We want to see it have a long and prosperous future. And we are very open to work with Congress and to look for new mission, to expand existing infrastructure, to look at things like creating a strategic plan, overall strategic plan, for the site; finding investment to expand the mission of the lab, which has done truly extraordinary work for the country in the last couple of years. So, certainly, on that point.

With respect to the costs, the Secretary has said numerous times that MOX, you know, will accomplish the mission technically. And so, if money were not an issue, MOX would be a straightforward way to go. But, unfortunately, as you have indicated, it is an issue.

One can look at different assumptions. I am happy to get into and explain any of those different assumptions. But whether it is Dr. Mason's group talking about $700 million to $800 million in unescalated dollars or whether it is the number that the Secretary and the Department has used recently, that essentially we believe it is about a billion dollars each year for the lifecycle of the project.

Because we used inflation, which I believe Aerospace also used, using the Engineering News-Record, which goes back to 1915, so it was a 40-year construction average, which uses about 4.2 percent inflation—but one can differ on inflation assumptions, which I believe is why Dr. Mason chose not to inflate.

But, essentially, a billion dollars a year to get this done, it just doesn't seem to be within the scope of what is practical. Whereas the dilution-and-disposal approach, we believe, would take about $400 million a year, and we would agree with Dr. Mason's report that there may be opportunities to lower that.

General KLOTZ. Mr. Cooper, if I could, let me just add to what Mr. MacWilliams said about the importance of Savannah River in South Carolina to us.

Looking at it strictly from the NNSA perspective, Savannah River is the site of where we do most of our tritium operations, which is one of the most important commodities that we have to deal with within the weapons program of the NNSA.

In addition, other aspects of Savannah River and South Carolina are extraordinarily important to our nonproliferation mission. L Basin, K Area, H Canyon are extraordinarily important in carrying out efforts that we undertake across the globe to reduce materials that might be attractive to terrorists or would-be proliferators.

So we are in it for the long haul with Savannah River. And I agree with Mr. MacWilliams and the Secretary that there are a lot of neat and interesting and worthy things that we would love to

be doing at Savannah River over not just the short term but the long-term future.

Mr. COOPER. Thank you, General.

And, to reiterate, this hearing should be good news for America and good news for South Carolina. We can do both at current funding levels, but not if we double or triple it. So let's keep it where it is.

Thanks.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes Chairman Forbes for 5 minutes.

Mr. FORBES. Mr. Chairman, first of all, I want to thank you for your unbiased and analytical approach to this issue and so many more that come before this subcommittee.

I thank Mr. Cooper for his persistence and passion on this issue, and just acknowledge that what seems to some as inertia may be to others due diligence. And I think the goal of everyone on this subcommittee and on this full committee is to get it right. But many of us also heard voices coming over here telling us that reducing our military significantly over the last several years was the right thing to do. When they look at the world today, they realize they were dramatically wrong on that. So we want to get it right.

And, Dr. Mason, the question I would ask for you is kind of following up on what the chairman asked, but in the Red Team report you state that the WIPP capacity limits and the PDMA compliance are not viewed as insurmountable. Who did the Red Team consult with at the State Department and in New Mexico State government to come to this conclusion?

Dr. MASON. With the State Department, it was Ambassador Guhin, who has had responsibility for the agreement, who briefed us. And, as I mentioned, we also spoke with Sig Hecker, who had a lot of early experience interacting with the Russians in some of the discussions leading up to the agreement.

And, you know, the takeaways from those discussions were that, you know, first off, as I noted, there has been modification to the agreement in the past to accommodate what you might characterize as Russian national interest with their desire to proceed with the fast reactor program. And so it is not unreasonable, if the decision were made to proceed down a different pathway in the U.S. national interest, to propose that.

However, according to Ambassador Guhin, the Russians were not interested in negotiating a hypothetical. They were aware that there were discussions going on about possible——

Mr. FORBES. And I don't want to cut you off because I would love for you to have time. I just have 3 minutes.

So, basically, you talked to two people?

Dr. MASON. Well, of course, in addition to relying on the expertise on the Red Team, that is correct.

Mr. FORBES. Yeah, but the Red Team was consulting with two people with the State Department.

How about the New Mexico State government?

Dr. MASON. With New Mexico, our primary interactions were at WIPP with the contractors and Federal officials on the site who have been the ones dealing with the State.

Mr. FORBES. So you were talking to the contractors there that would be doing——

Dr. MASON. And to the DOE officials who were responsible for the negotiations that are ongoing at the moment in terms of WIPP restart, yes.

Mr. FORBES. Okay. So, then, basically, your report suggesting this was not viewed as insurmountable was two people at the State Department and the contractors and the people at Department of Energy and New Mexico State government.

Let me move on to a second question the chairman raised to you. How can you be confident that using a downblending option at the Waste Isolation Pilot Plant in New Mexico will only cost $400 million annually, given its capacity limits and with it currently being closed?

Dr. MASON. Well, as I noted, the likely timeline for being ready to initiate shipments to WIPP is 5 years down the road, which allows sufficient time for the current plans for restart and resumption of full-scale activities to unfold. So, from that point of view, the current restart schedule does not interfere with the likely timeline for dilute-and-dispose.

In terms of the capacity limits, there are a number of options. At the current mechanism for disposal, using the 10 percent dilution that was demonstrated for the Rocky Flats material, there is not sufficient capacity at WIPP to accommodate all 34 metric tons based on the calculations of the needs for the EM program.

However, there are a couple of options for addressing that prior to even consideration of whether or not there is any need to modify the Land Withdrawal Act, which defines that limit. Those options include some things that are within the purview of the Department, in terms of making more efficient use of the resource by packing containers more fully. And some of the options would require negotiation with the State of New Mexico, in terms of the methodology for calculating the volume of waste that is in place and——

Mr. FORBES. And my time is about—I have 20 seconds left. But if you could, for the record, just submit to us, if you would, the analysis that you did to make sure those options could actually be done, instead of just recognizing there are potential options. We always have a lot of options.

Dr. MASON. Sure.

Mr. FORBES. We need to run down to make sure that we actually can do them and what the analysis that went behind them to do. And, again, just talking to a couple people, we need a little bit more than that.

[The information referred to can be found in the Appendix on page 67.]

Mr. FORBES. So thanks, Dr. Mason.

With that, Mr. Chairman, I yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes the gentleman from California, Mr. Aguilar, for 5 minutes.

Mr. AGUILAR. Thank you, Mr. Chairman.

Thank you, gentlemen.

Director Mason, if you could just expand a little bit on that. In your testimony, you mentioned that 75 percent of the money, under the dilute-and-dispose option, the WIPP option, 75 percent of the money appropriated over the next 3 years would go toward the MOX facility, while the rest would go toward WIPP prep. You have also mentioned a 5-year window, a 5-year transition and termination.

So can you kind of walk me through the difference between the 3- and 5-year window?

Dr. MASON. Sure.

The 5 years is how long we would estimate it would take to be ready to make a shipment to WIPP. And part of the reason for that is, for the first 3 years of that period, a substantial fraction of the funds would be required to, in an orderly and responsible way, close out the activities at the MOX Fuel Fabrication Facility.

So that would decline over the 3 years, and you would use the funds that were made available then to begin ramping up the activities towards WIPP emplacement, which would then occur, you know, at the end of the 5 years.

Mr. AGUILAR. Conversely, then, 75 percent of the allocation would go toward ramping down——

Dr. MASON. Yes.

Mr. AGUILAR [continuing]. The existing operation. Can you talk a little bit about, you know, what goes into that cost structure and why that is?

Dr. MASON. Sure. And recognize this is a rough estimate based on termination costs associated with other large capital projects. And, obviously, it would be the subject of a negotiation, but it is our best estimate.

Some of the cost is just associated with the fact that you would want to leave the project in an appropriate physical condition, prevent egress of water and so forth, so that the asset there would be preserved. We did not consider possible alternative uses for the facility, but, obviously, you would want to leave the facility in a state where the investment that has been made in a, you know, seismically qualified, high-security facility would be preserved in the event that an alternative use was identified. So that involves some physical work, to put the facility in that state, since it is open to the environment now to allow access for construction purposes.

There would also be termination costs associated with the various contractual requirements for procurement of equipment and construction. Those all have to be negotiated. And you have to continue to pay project staff during the time period that you are going through that process.

So that would be the rough mix of things, should the decision be made to pursue that.

Mr. AGUILAR. I guess that kind of leads into the—my next question would be, you also discussed the worst-case scenario in your testimony, and you mentioned that the worst-case scenario from the WIPP side—the costs associated are better than the best-case scenario for MOX.

So can you walk us through what some of the complications could be? I am hearing you say that those negotiations to, kind of,

ramp down, that could be a potential variable within the wind-down cost structure.

Dr. MASON. Yeah, there is obviously uncertainty associated with the termination costs. The other sorts of risks that we considered in looking at that is, as we have seen, you know, the existing facilities that would be used, you know, can be subject to perturbations in their operations. PF4, for example, which would be used for disassembling the pits, is coming out of a process where it has been down for a period of time. And, obviously, over a multi-decade operating activity, that sort of thing can interrupt the operation and extend the duration.

And there are some capital investments needed in order to optimize the throughput on the dilute-and-dispose. And, obviously, those are projects that have associated with them risks and contingencies. Kind of ballpark estimate for adding the additional lines to K Area is around $200 million, but that is a preconceptual number, so it could increase.

And then there are the standard uncertainties associated with the fact that there will be escalation of salaries and everything else over the operating life. Those are hard to estimate over that long period of time. And, you know, obviously, from year to year, you can have budget fluctuations that you have to adapt to in your schedule, and those can translate into project risks in terms of cost and duration.

Mr. AGUILAR. I appreciate you walking me through this.

Thank you, Mr. Chairman. I will yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes Mr. Coffman for 5 minutes.

Mr. COFFMAN. Thank you, Mr. Chairman.

My questions are to the cost overruns on the construction of the MOX facility, in that, originally, in 2002, cost estimates to build the MOX facility were $1 billion; by 2007, when construction began, the cost estimate rose to $4.8 billion; and, in 2014, the total design and construction costs rose to $7.8 billion.

I just had an issue back home with the building of a veterans hospital that was dramatically over budget. And the VA [Department of Veterans Affairs], clearly, is not a construction management entity, and they demonstrated that on this project. The Army Corps of Engineers has since taken over this project, a project that started out at $600 million that wound up to, I think, almost $1.7 billion.

And part of the legislation to fully fund the hospital was to strip the Veterans Administration of their construction management authority for any project in excess of $100 million and give that to entities like the Army Corps of Engineers who do it for a living. It is their day job; it is their focus.

And I want to know—I think I heard something, projects over $750 million. That seems like an awfully high number to me. Could you comment on that further?

Mr. MACWILLIAMS. Yes, sir. I did say that the GAO had removed us from the high-risk list for projects of that size. And you are correct, that is a large number.

Essentially, as I came in and started to look at our project performance, to say it has been challenging would be overly polite, ac-

tually. And I would be happy to discuss some of the reasons behind these overruns, if that would be helpful to you, sir.

But what I was referring to is that, subsequent to NNSA putting in their Office of Acquisition and Project Management 3 years ago, which was designed to deal with some of these problems, their performance on their smaller projects, the rest of their portfolio, has been quite good.

Mr. COFFMAN. How do you define smaller projects?

Mr. MACWILLIAMS. The $800 million, below 750.

Mr. COFFMAN. Oof. That—okay.

Mr. MACWILLIAMS. No, and so the—you are correct, sir, that when you look at where the money is in these projects—and this is the problem that we face, and we face this across the Department——

Mr. COFFMAN. Right.

Mr. MACWILLIAMS [continuing]. That if you look at where the money is in these four or five large projects, they are historical projects, and we do have problems. And I can get into the reasons if you——

Mr. COFFMAN. There are entities in the Federal Government, whether GSA [General Services Administration], whether NAVFAC [Naval Facilities Engineering Command], whether the USAC or the Army Corps of Engineers, that they are professionals. I mean, this is what they do. And there are agencies, like the VA, who have just lost this construction management authority, and agencies, you know, like the DOE, that choose to go out on their own. And I think it is the taxpayers that suffer for this.

And I really think that—I wish agencies in the Federal Government would focus on what their core mission is and not venture out to areas that they have redundant, inefficient capability on.

I wonder if you could respond to that.

Mr. MACWILLIAMS. Yes, sir. And I would point out that, as we began to look, when we started looking at this a couple years ago, this project, one of the first things we did was bring the Army Corps of Engineers in to look at estimates of the MOX Fabrication Facility construction cost. At the time—this was almost 2 years ago, and it was a preliminary analysis—they concluded that they felt the MOX Fabrication Facility would cost $10 billion at that point. There has been underfunding for 2 years, so I am sure that if they were to look at it again it would be higher than that.

But you are raising a very legitimate point, given the history of the Department. The reason that we put in very substantial project management changes is because of these problems. I will just point out one, not to take away from your point, the value of your point, sir, is that NNSA, for example—immature design is one of the biggest problems we face——

Mr. COFFMAN. And let me——

Mr. MACWILLIAMS. Okay.

Mr. COFFMAN. The Army Corps of Engineers was not brought in at the beginning. Am——

Mr. MACWILLIAMS. No, sir.

Mr. COFFMAN [continuing]. I correct? So, yeah, of course, they are pricing the mismanagement that has already been done on the project into that figure.

Go ahead, please.

Mr. MACWILLIAMS. No, I was just going to make one point, and then we can get into others as you wish.

The immature design, so we get into design-build-design, is a huge problem. And so, actually, NNSA now has a rule that is mandated that we will not get into nuclear projects unless we have 90 percent design complete. So I recognize that is only one point, but that is to address one of the biggest issues that we have had.

Mr. COFFMAN. It is just unnecessary and inefficient to have these redundant abilities created in every department of the Federal Government. It is unnecessary. There are elements in the Federal Government that do this for a living.

And I hear the same thing in the VA, when we were going through this process, about how they were going to get better, about how they were working through it. And if we look back at the VA historically, you will find throughout the decades they made the same commitments and never delivered. And, again, it is just—it is a waste of taxpayer dollars to have this redundant capability, and it needs to go away.

And, with that, Mr. Chairman, I yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes the gentleman from California, Mr. Garamendi, for 5 minutes.

Mr. GARAMENDI. Thank you.

First, a quick question: AREVA has claimed that construction is nearly 70 percent complete. Do you agree? And how much work would have to be redone to move into this dilute process?

Mr. MACWILLIAMS. Thank you, sir, for the question.

We don't agree. And the reason we don't agree is that we are required to look at cost to complete. So——

Mr. GARAMENDI. How much would have to be redone if you are going to this other dilute process?

Mr. MACWILLIAMS. Well, we are at 35 to 41 percent. That is where we are, sir. And if you are referring to rework, sir, currently, the contractor is running at a rate of 25 percent rework.

Mr. GARAMENDI. Thank you. Wanted to get that on the record.

Russia is using a fast reactor system. Is that correct?

Mr. MACWILLIAMS. Yes, sir.

Mr. GARAMENDI. How far along are they on their process?

Mr. MACWILLIAMS. The BN–800 is nearing operations as we speak, sir.

Mr. GARAMENDI. I see.

All right. What is the U.K. doing in its disposition of plutonium?

Dr. MASON. Actually, one reason that we included on our team some representatives from the U.K. is because they are also going through a process of trying to analyze their options for dealing with a considerable quantity of civil plutonium, 120 tons. At the moment—or, actually, it may be 140. I correct myself.

At the moment, their current plans have not been fully finalized. They are considering a MOX option for a portion of that inventory, although there is some that will be unsuitable for MOX due to its chemical composition. But they are also pursuing R&D [research and development] into geological disposition pathways in parallel. They are not as far along in terms of their decision process, but——

Mr. GARAMENDI. Are they considering a fast reactor?

Dr. MASON. Not to my knowledge, no.

Mr. GARAMENDI. The analysis here indicates that an American fast reactor doesn't exist. Is that correct? It doesn't exist for this purpose.

Dr. MASON. In fact, there isn't an operating fast reactor in the U.S. The last facility, the Fast Flux Test Reactor at Hanford, was shut down——

Mr. GARAMENDI. Is that the integral fast reactor?

Dr. MASON. The FFTF, no, it is a different facility. We have not operated one for a number of years.

Mr. GARAMENDI. Did we have an integral fast reactor operating in the United States?

Dr. MASON. Idaho has in the past operated fast breeder reactors but not for a number of years.

Mr. GARAMENDI. So we actually had the technology. Is that technology in existence today?

Mr. MACWILLIAMS. Arguably, the technology was developed in the U.S. originally—actually, as was most of the technology behind the MOX option. However, we are not currently aggressively pursuing other possible reactor technologies in general.

Mr. GARAMENDI. Does GE [General Electric] have the license for the integral fast reactor?

Mr. MACWILLIAMS. We will have to check that. I don't want to make something up——

Mr. GARAMENDI. It does.

Mr. MACWILLIAMS [continuing]. On the fly.

Mr. GARAMENDI. It does. I am surprised you don't know.

In fact, I am not at all surprised. I guess I should not be surprised because the Department seems to have dismissed the fast reactor as an option and moved on to study the MOX and the downblend-and-dispose option. Is that correct?

Mr. MACWILLIAMS. Actually, sir, when we did our 2014 study as part of that, we did a very actually comprehensive study, NE [Office of Nuclear Energy] did, on the fast reactor. Because, as the Russians are showing, a fast reactor would accomplish the mission. The issue became that it would be a new start. The cost estimate was approximately $50 billion, and it would take many, many years with complexity.

But it was looked at. We have a study which I think——

Mr. GARAMENDI. Is Russia willing to sell its fast reactor to us?

Mr. MACWILLIAMS. I can't answer that. I haven't asked them that.

Mr. GARAMENDI. Well, apparently they have one. Apparently they are using it for the very same purpose that we would use this. And you didn't bother asking Russia or didn't bother looking at their technology. Is that correct?

Mr. MACWILLIAMS. To my knowledge, we have not asked Russia whether——

Mr. GARAMENDI. Why?

Mr. MACWILLIAMS [continuing]. We could buy a reactor.

Mr. GARAMENDI. Why?

Mr. MACWILLIAMS. I don't have an answer for that, sir.

Dr. MASON. I could comment if I——

Mr. GARAMENDI. I find that unacceptable. But, please, tell me why, since there is a technology available, a fast reactor available in Russia—you cited the name of it—why didn't you look at that as an option? Any of the three of you.

Dr. MASON. I can comment on the Red Team. We did consider the fast reactor option in our analysis——

Mr. GARAMENDI. Did you consider the Russian fast reactor?

Dr. MASON. Our consideration was not a specific fast reactor design——

Mr. GARAMENDI. Thank you.

Dr. MASON [continuing]. So it was——

Mr. GARAMENDI. General, did you consider it?

General KLOTZ. No, I did not.

Mr. GARAMENDI. Why not?

General KLOTZ. I wasn't part of this review, and the NNSA doesn't build reactors. That is another part of the Department of Energy. But what I understand——

Mr. GARAMENDI. I find it incomprehensible. We are looking at tens of billions of dollars here. And we know that there exists in Russia a fast reactor that is operating or will very soon be operating to dispose of plutonium. And the brilliant scientists and generals didn't bother to ask if maybe the Russian reactor or something similar to it could be used to this purpose? Is that correct?

Mr. ROGERS. The gentleman's time has expired.

The Chair now recognizes the gentleman from South Carolina, Mr. Wilson, for 5 minutes.

Mr. WILSON. Thank you, Mr. Chairman, and thank you, Ranking Member Cooper, for your leadership.

And I am grateful to be here with NNSA, with DOE, with National Labs. I have a unique perspective of your professionalism. I am the only Member of Congress who has actually worked at the Savannah River Site and worked at DOE, and so I know the professionalism of the people that you work with.

In fact, it is my humble opinion that an indication of your success has been the level of completion of the Mixed Oxide Fuel Fabrication Facility. Indeed, it has been completed 67.3 percent. We have 160,000 cubic yards of structural concrete in place. I remember the first time I visited, it looked like a forest of rebar. And so I have seen it come to life. And the thought of creating a facility that can take weapons-grade plutonium and convert it into fuel, I sincerely hope that we can proceed.

And, further, 19 of 31 of the modules are installed in the pipe gallery. We have the gloveboxes received in place. Over and over again, there actually has been, I believe, tremendous success and achievement.

And, with that in mind, too, General Klotz, the State of South Carolina, I feel like, is—I am concerned about South Carolina. This is, of course, adjacent to our beloved Georgia, Peach State. And so this is a concern of both States, that the agreement of our State was to accept the highly radioactive weapons-grade plutonium and to process it and move it out. And it is a concern for the people that I represent. That is the greatest concern that we have.

With that in mind, what has been proposed is to use the Waste Isolation Pilot Plant in New Mexico. But, General Klotz, is the

commitment still to South Carolina, to the people of our State, Georgia, our neighbors, that indeed this weapons-grade plutonium will be removed from our presence?

General KLOTZ. Yes, Congressman, it most definitely is. And, of course, one of the questions becomes, you know, which pathway will get there sooner and quicker.

Mr. WILSON. But, gosh, to convert weapons-grade plutonium into fuel as opposed to some inert storage facility that—and that goes to WIPP itself.

And another person who has an extraordinary clarity on this issue is Bill Richardson, the former Governor of New Mexico, former Secretary of Energy. And in the Aiken Standard newspaper on August 21st, he had a letter, which was printed, to Senator Harry Reid saying, quote, "As a former Secretary of Energy and Governor of New Mexico, I can assure you that WIPP in our lifetimes has the same chance of accepting weapons-grade plutonium that Yucca Mountain has for accepting spent nuclear fuel. It is self-deluding to claim otherwise."

Is the Secretary correct or not?

Mr. MACWILLIAMS. Well, we have great respect for the Secretary and his service to the country. He may have forgotten that there is already 4.8 metric tons of plutonium that has been delivered in exactly this format into WIPP.

Mr. WILSON. But we also know, too, as we are talking about this technology, the MOX facility that currently exists in France. And so, as we were talking about the technology, it has been proven, and it will work.

With that in mind, at the WIPP site, there was an incident where there was airborne radiation particles in February 2014 at the WIPP site. It has certainly, General, been placed in a closed facility. Is it currently open or not?

General KLOTZ. It is not currently operational. The expectation is by sometime during next year, the year 2016, it will be up and operational again.

This is a very, very important site to the Department of Energy, to the Nation, because it is where we can store transuranic waste. And so the Secretary and the entire Department are seized with the importance of returning WIPP to full operation as soon as we possibly can.

Mr. WILSON. And so you indicated it will be open within the next 2 years?

General KLOTZ. By the end of 2016.

Mr. WILSON. And, as I conclude, I appreciate your service, but I can't wait to invite my colleagues to visit the mixed oxide fuel facility, MOX facility. It is adjacent to the Augusta National Golf Course, Sage Valley Golf Course. It is a world-class place. I want John Garamendi to be there and see it.

So thank you very much.

General KLOTZ. Well, I can attest, Congressman, you give a great tour through the facility.

Mr. ROGERS. The gentleman's time has expired. I thank the gentleman.

The Chair now recognizes Mr. Norcross for 5 minutes.

Mr. NORCROSS. Thank you, Mr. Chairman and certainly Ranking Member Cooper, for allowing me to sit in.

Having spent the better part of my life in the industry, I hear much of the testimony, and it is not unique to this project, but the MOX facility, when it first started to put a shovel in the ground, how much of the project was design-finished? What percentage?

Mr. MACWILLIAMS. Sir, obviously, I wasn't there, but from my understanding, it was about 20 to 25 percent design-incomplete, which is obviously a significant problem.

Mr. NORCROSS. So the original cost estimates were based on a 20 percent completed design.

Mr. MACWILLIAMS. Somewhere between 20, 25, yes, sir.

Mr. NORCROSS. We usually call that throwing darts in the night and hoping you hit a bull's-eye. So the original premise here was horrible at least.

How far along—you said it was 90 percent design-completed. Now, from when it actually started, how many design changes took place in that time? What I am trying to ascertain here is the incremental increases and why they occurred.

Mr. MACWILLIAMS. Sure. I can't give you the exact number, though I will take it for the record and get you——

Mr. NORCROSS. Round numbers.

Mr. MACWILLIAMS [continuing]. The exact number, but the issue that you are referring to is exactly on point, which is it is this design-build-design problem.

[The information referred to can be found in the Appendix on page 70.]

Mr. MACWILLIAMS This project was originally based on, as Congressman Wilson mentioned, some French designs. The problem is that this is a weapon-grade plutonium, and the French design is civil plutonium. And there are a number of complexities, including NRC licensing and other things, robotics, the way we approach safety in this country. And so the complexities of the design were not properly appreciated, in addition to the regulatory costs, and that is one of the major issues.

But the issue that you are focusing on was one of the first issues that we focused on when we put together our review, which is why the NNSA now requires 90 percent design-complete before it will go forward.

Mr. NORCROSS. And we understand, we want to get things completed very quickly. Just start and we'll figure it out——

Mr. MACWILLIAMS. That is what happened.

Mr. NORCROSS [continuing]. Which is the most expensive way to ever do a project.

Mr. MACWILLIAMS. Yes, sir.

Mr. NORCROSS. So let's move on, the same if we go to WIPP. Is that 100 percent designed, the type of facility we would build?

Mr. MACWILLIAMS. WIPP, first of all, was used in our study, in the 2014 study, as a reference case. And the reason it was a reference case is it was the only existing repository that could accept defense true waste. And, as I mentioned, 4.8 metric tons of this plutonium using dilute-and-dispose has been shipped there, including a small amount from Savannah River.

So the process is proven. Dr. Mason could speak in more technical terms about the technical risk there, if you wish, but it is a proven process that we have been using. In fact, until the incident that was referred to at WIPP, plutonium was scheduled to be continued to be shipped.

Mr. NORCROSS. So when we look at that—and the agreement is with Russia. And it was mentioned earlier. What makes us think that they will agree to this change?

Mr. MACWILLIAMS. The—and General Klotz can speak to this.

We did have, in addition to what Dr. Mason said, we did, about a year ago, have a DOE-State Department team go over and talk with the Russians. And, basically, the message—it was a good conversation, because the agreement, as I think we are all aware, provides disposition by reactor or other methods as agreed to by the parties, which is what the Russians availed themselves of in 2010.

So the team went over, had the conversation. And, basically, the message that came back was the Russians were willing to have a conversation, but they said you need to figure out what direction you want to go in, then come back, and we will have a conversation.

But I think General Klotz also can give you some firsthand——

General KLOTZ. No, I think Mr. MacWilliams, sir, has given a very fair rendition of the response we have gotten from technical people on the Russian side.

As recently as a couple weeks ago, Secretary Moniz raised it in conversation with Mr. Sergey Kiriyenko, who is the head of Rosatom in Russia, and, basically, it was the same response. You know, we recognize that you acceded to our desire to amend the agreement in 2010 to allow for the approach which the Russians are now pursuing; when you have a plan, come back to us, and we will sit down and negotiate.

But, also, I think as Dr. Mason laid out, there are a lot—I have spent most of my lifetime in negotiations with the Soviet Union and Russia. There are a lot of other political, economic, strategic variables that get injected into any discussion with them on any issue in this area.

Mr. NORCROSS. Well, you certainly said a mouthful there, because you are suggesting that the Russians are going to be reasonable. And I guess we all hope that, but, certainly, that is a large mountain to climb.

I yield back my time. Thank you.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes Dr. Wenstrup for 5 minutes.

Dr. WENSTRUP. Well, thank you, Mr. Chairman.

Mr. MacWilliams, thank you for being here today. I know we have had some of these discussions before that I would like to talk about today.

Mr. MACWILLIAMS. Yes, sir.

Dr. WENSTRUP. And I know you understand that I am frustrated with DOE's recent decision to demobilize the uranium enrichment D&D [decontamination and decommissioning] project in Piketon, Ohio. And I think it is incredibly shortsighted to do this, especially in light of the Iran deal, where we are seeing that the world's larg-

est sponsor of state terrorism is now maintaining 6,000 centrifuges and continue to enrich uranium.

DOE's decision to demobilize this project was based on data that was collected for a report that DOE was mandated by Congress to complete in April and which we received Monday night.

And my question is, if the United States must have the technology for a fully domestic source of enriched uranium to support our nuclear Navy, what is DOE's long-term plan to ensure that we do not lose the research and the workforce gains that were made in Piketon, Ohio, while also maintaining immediate production capabilities for a domestic source of enriched uranium?

It seems like we are diving into a black hole, shutting things down when they are spinning things up. And for our national security interest, we need to keep this maintained and ready to run.

Mr. MACWILLIAMS. Thank you, sir. And I want to answer that. I also wanted to say in a related subject that we have been discussing that, per conversations that we had with you this week, we have been working to finalize our plan for spending under the CR [continuing resolution], pursuant to direction from the Secretary.

We will be giving updated funding guidance and direction to FBP [Flour-BWXT Portsmouth], the contractor, today to spend at a higher level to avoid involuntary layoffs for D&D [decommissioning and demolition] activities at Portsmouth, which I recognize is separate, sir. And so the contractor is going to issue a notice to employees later today.

To go to your exact question, sir, as we talked about last week, the first important point here is these potential layoffs are clearly regrettable, but the administration remains committed to reestablishing a domestic enrichment capability——

Dr. WENSTRUP. Okay. My question, though, originally—and I appreciate that——

Mr. MACWILLIAMS. Yeah.

Dr. WENSTRUP [continuing]. Is we are going to have a time down——

Mr. MACWILLIAMS. Yes, sir.

Dr. WENSTRUP [continuing]. Where we do not have this capability up and running, and that is my concern.

Mr. MACWILLIAMS. Yeah.

Dr. WENSTRUP. The other thing is, when I spoke to Secretary Moniz last night, I said, do you have an estimate of what the cost is to shut down the ACP [American Centrifuge Project], this project?

Mr. MACWILLIAMS. Yeah.

Dr. WENSTRUP. And he said, "No, I don't know. Let me get back to you." Now, to me, that is a huge component to the equation.

Mr. MACWILLIAMS. Sure.

Dr. WENSTRUP. If it cost a billion dollars to shut it down——

Mr. MACWILLIAMS. No, it does not.

Dr. WENSTRUP. I am just throwing this out as an example.

Mr. MACWILLIAMS. Yeah.

Dr. WENSTRUP. But you don't know. He didn't know—and it cost $350 million, say, to maintain it for 7 years, and we are able to flip a switch and produce what we need to protect our country at a moment's notice——

Mr. MACWILLIAMS. Right.

Dr. WENSTRUP [continuing]. Then that is the wise business decision.

Mr. MACWILLIAMS. Right.

Dr. WENSTRUP. He didn't even know.

Mr. MACWILLIAMS. Okay. Well, I can——

Dr. WENSTRUP. So I am very concerned about that. You are making decisions on a report we were supposed to have in April that we didn't get——

Mr. MACWILLIAMS. Yes, sir.

Dr. WENSTRUP [continuing]. And didn't get a chance to weigh in, and you don't even know what these costs are, and you are making a decision. And I just—I am sorry, I find that really irresponsible and a threat to our national security capabilities.

Mr. MACWILLIAMS. So, sir, as we discussed, what we are talking about doing is having to stand down 120 test centrifuges. We do not have a capability—those centrifuges don't have a capability today to provide us the material that we need.

But the cost that you are referring to is approximately $100 million to $150 million. Under our agreements with Centrus, they have obligations to pick up a very large portion of that, obviously provided they have the financial means to do that. That is the answer.

Dr. WENSTRUP. So let me ask you this. So when it comes to, say, tritium, I mean, you say that the AC–100 design, that technology is as good as we can have right now, right?

Mr. MACWILLIAMS. Yes, sir. That is the technology that we plan to use.

Dr. WENSTRUP. Okay. And the report indicates that building out a national security plan based on that technology would require 1,400 centrifuges.

Mr. MACWILLIAMS. Yes, sir.

Dr. WENSTRUP. So how can we meet our tritium needs and build out these 1,400 centrifuges if we are dismantling the 120 that we have?

Mr. MACWILLIAMS. Because the 120 that we have, the purpose of those was to continue to prove out the technology, and they have essentially neared the end of their useful life. They would not be centrifuges that we would add into the 1,400 for a variety of reasons.

So what we are doing immediately, because we are not standing down—this is important to say this, that we are continuing with the program, we are not putting a cold standby. We are issuing—we will issue a RFI [request for information] to build out. The issue, however, sir, is that it is going to take 5 to 7 years to reestablish that capability, but we are starting that now.

Dr. WENSTRUP. What is our capability, when this plan is played out, on a moment's notice to produce enriched uranium that we may need based on whatever may happen in the——

Mr. MACWILLIAMS. That capability does not exist today. It does not exist today. It will take us 5 to 7 years to reestablish, but the standing down of the 120 centrifuges does not affect that.

Dr. WENSTRUP. You say that they are at the end, but they are the only thing that we have.

Mr. MACWILLIAMS. But they are not—they are running on—they are not producing material for this purpose.

Dr. WENSTRUP. But they could.

My time has expired. Thank you.

Mr. MACWILLIAMS. Thank you, sir.

Mr. ROGERS. The gentleman's time has expired.

The Chair now recognizes the gentleman from Nebraska, Mr. Fortenberry, for 5 minutes.

Mr. FORTENBERRY. Thank you, Mr. Chairman, for accommodating my interest in sitting on the committee. And I thank the members of the committee for your consent in allowing me to testify before you today and ask you questions.

I am Jeff Fortenberry from Nebraska. I am on the Appropriations Committee and the Energy and Water Subcommittee, so we see this issue, as well. And, frankly, if I could be just right up front with you, this conversation would be very boring if it wasn't so essential, because we keep talking about the same things over and over again.

And it has been repeated today, but I want to go back through the numbers. In 2002, the initial cost estimate was $1 billion; 2007, it is now $4.8 billion; today, it is estimated to be $7.8 billion.

So every year we go through this debate. This year, the Appropriations Committee allocated and the committee marked $345 million, which is not enough to build it out, not enough to close it down. So we are kind of saying, sort of, maybe, we will continue to think about it, if it is possible in the time that we have while we are serving, but then somebody else might have to deal with it later. We will punt.

You are doing that, we are doing that, everybody is doing that. So a decision has to be made whether or not this is a viable project or whether the alternatives are real enough to continue an alternative, to pursue an alternative pathway.

From my perspective, this is a fragile program with a very unclear future. And the alternatives that have been laid out, they are a responsible way to look at the diversion of limited public resources to deal with a very significant problem.

Now, I was very interested in the line of questioning that Mr. Garamendi, who is gone now, was asking about, alternative disposal through fast reactors.

But, first, let me ask you this. How much funding has been spent to date on the MOX facility and its related programs and infrastructure? We have various numbers floating out there, so could you give us your number?

And then what percentage of completion are we in regarding the facility? What percent complete are we in? And do you and the contractors agree on these figures?

Mr. MACWILLIAMS. Thank you, sir.

The amount of funding on the MOX facility itself, through July, was about $4.8 billion. When you add in the rest of the program, you are north of $6 billion because that adds in the Waste Solidification Building, which is essentially complete, and some of the other program——

Mr. FORTENBERRY. So, totally completed, the cost would be what?

Mr. MACWILLIAMS. Totally, for the whole lifecycle—for the whole program?

Mr. FORTENBERRY. However you define it.

Mr. MACWILLIAMS. Yeah. Well, it is important that we look at the whole program, not just the MOX Project. There are various estimates. Our number was north of $30 billion, but estimates range as high as $50 billion.

Mr. FORTENBERRY. Okay. So appropriating $345 million a year, what does that buy?

Mr. MACWILLIAMS. Nothing.

Mr. FORTENBERRY. How could that money be better used?

Mr. MACWILLIAMS. $400 million—well, I think we agree with the Red Team's conclusions, essentially. And General Klotz——

Mr. FORTENBERRY. Now, by the way, during the appropriations debate, I offered an amendment to reduce the program by a very small amount, simply to divert the money to other nonproliferation programs, more so as a statement to begin to try to have a reasoned debate about the quality of this investment.

And I really did appreciate, frankly, up front, the conversation about how you successfully—if we went another direction—successfully transition this commitment to the South Carolina-Georgia community in other ways. And I think that is very important. But I think we have to look at the mission of this particular policy and whether or not it is feasible.

General KLOTZ. I agree. And, as I said at the outset, you know, from looking at it from the perspective of NNSA and the whole range of portfolio that we have that includes a rather large weapons program as well as nonproliferation, emergency response, and counterterrorism, it is a question of, in a constrained budget, you know, how can you afford to cover the many tasks which the administration and the Congress have asked us to do.

So if we can achieve the disposition of 34 metric tons of excess weapons-grade plutonium through a less costly way than the path that we are currently embarked upon, then that is why this is of such interest to——

Mr. FORTENBERRY. Can I ask one other question? Who has the prime contract for building the facility?

Mr. MACWILLIAMS. CB&I Shaw. And then AREVA is also involved. It is MOX Services, which is a joint venture between both companies. AREVA, going forward, if we built the project, would handle the marketing as well.

Mr. FORTENBERRY. AREVA is a French company?

Mr. MACWILLIAMS. Yes, sir.

Mr. FORTENBERRY. And they purchased Shaw or have partnered with Shaw?

Mr. MACWILLIAMS. No, no, they are a separate company. They have a joint venture, which they call MOX Services.

Mr. FORTENBERRY. But it is my understanding AREVA took over some major component recently. Is that correct? Changed the nature of the agreement in relation to——

Mr. MACWILLIAMS. Well, AREVA has had some reorganization in other areas. They have had some financial issues, and so they have had reorganization——

Mr. FORTENBERRY. How much of the $345 million goes to a French company?

Mr. MACWILLIAMS. I can't answer that, sir.

Mr. FORTENBERRY. All right. Thank you, Mr. Chairman.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes the vice chairman of the committee, Mr. Lamborn, for 5 minutes.

Mr. LAMBORN. Thank you, Mr. Chairman.

I know we have touched on this some already, but let me get into a little more detail, because this is so important.

And, Dr. Mason, I would like to direct a few questions to you.

About the PMDA, the Plutonium Management and Disposition Agreement, with Russia, depending on who you talk to, it seems like you get different answers about whether it is even possible to renegotiate that or how difficult it might be. Can you elaborate on that, please?

Dr. MASON. Sure.

I think the first point that we considered was, did we ourselves consider in particular the dilute-and-dispose alternative an acceptable disposition? Because if you can't convince yourself, you would obviously have little chance of convincing the Russians. And so our conclusion was that it was an acceptable pathway, in the sense that it did put the material beyond use for all practical purposes and therefore met the intent of disposition.

So, having satisfied ourselves on that question, you then have to ask, okay, if we have convinced ourselves, what are the prospects for reaching an agreement with the Russians?

As I noted in my remarks, and I think General Klotz has made similar remarks, from the point of view of entering into the discussion, we judge that there is a reasonable negotiating position for the U.S. based on the fact that, first, as I said, it is an acceptable disposition pathway in terms of putting the material beyond use, akin to what has been called the spent-fuel standard, which was first discussed in a 1994 National Academy study, not identical but meeting many of the same kind of characteristics, and the fact that there has been prior modification to the agreement to accommodate Russian national interests.

And so the difficulty is, that may all be true and you still might not reach a conclusion for reasons that have nothing to do with the merits of the argument. That is a little harder for us to judge as a technical committee. We are not diplomats, and so, to some extent, we viewed that broader question as one that was a little bit beyond our purview and really restricted our analysis to, is this a viable technical pathway and is there a good basis for negotiation. And, on those two points, we felt that there was reasonable basis for negotiation.

Mr. LAMBORN. Now, for any one of you, then, if there was a renegotiation, would there be any risk to the whole issue of proliferation?

If you are saying, Dr. Mason, that some of these things were beyond what you felt really comfortable, I would like to know from the rest of you, who might be a little more comfortable with that question, is proliferation being brought into question?

General KLOTZ. I think there are—you know, the major concern we have with and the reason why we pursue disposing of excess weapons-grade plutonium is, if you have no need for it, it is best to get rid of it so that it does not fall into the wrong hands, whether that would be would-be proliferators at some point or if it turns out to be terrorists who would use special nuclear materials for their activities. So that is fundamentally why both sides in this agreement have pursued getting rid of this excess weapons-grade plutonium.

At the same time, we have also been getting rid of excess high-enriched uranium that is no longer necessary for weapons programs. And, in fact, through a very successful program we have with the Russians that is referred to as, you know, Megatons to Megawatts, we have actually been burning that uranium in U.S. civil nuclear reactors for a number of years for purposes beyond which it was originally intended.

Dr. MASON. I think there is another important point on this which has to do with the timing.

The original agreement had an objective of beginning the process by 2018. Our understanding is the Russians are close to that, maybe delayed a little bit. But even in, you know, the event that they are successful in their current schedule and start their fast reactor, it is highly unlikely that they would begin dispositioning their weapons plutonium until the U.S. was dispositioning its. They have other sources of plutonium that they would use. So you will not begin the disposition in either country until both countries are prepared to move.

So there is a certain urgency in beginning, just because, as General Klotz mentioned, the whole point is to not have it sitting around, susceptible to any sort of untoward use. And, obviously, you know, the shorter the duration before you get rid of it, the greater the reduction in risk.

Mr. LAMBORN. Thank you, Mr. Chairman. I yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes himself for a second round of questions.

General Klotz, the Russians sought an amendment to the PMDA with the United States, and the Obama administration signed off on it, allowing Russia to use its 34 metric tons of excess plutonium in a, quote, "fast breeder," close quote, reactor.

Is such a reactor technically capable of producing additional plutonium for Russia? How much plutonium will Russia put into this reactor? And has the U.S. been able to gain access to the reactor to make sure we know what they are up to?

General KLOTZ. If I could, Mr. Chairman, not being a nuclear scientist, if I could defer that to Dr. Mason, I think he would probably give you a more technically correct and precise answer than I could possibly give.

Mr. ROGERS. I thank you.

Dr. Mason.

Dr. MASON. I think that the first point on the Russian program and the reason that the Russians proposed it is it was their intent to build a fast reactor anyway, so, in some sense, there was no additional cost incurred to build a special-purpose facility.

Of course, that reactor could be fueled on either civil plutonium or weapons-grade plutonium. And it is intended, by its design, to be a breeder—in other words, to produce more fissile material as part of its operation for energy purposes. So, through its operation, you will be making more plutonium.

The modification to the PMDA provides requirements for the operating cycle under which the weapons-grade plutonium is burned in order to change the isotopic composition in a way that the plutonium produced in the reactor is not suitable for use in weapons. And that is part of the agreement as amended in 2010.

Mr. ROGERS. Okay.

General Klotz, as a rough order-of-magnitude estimate, how much did it cost the U.S. to produce the 34 metric tons of plutonium that we are talking about in the PMDA? And what were the production costs in dollars, human health, and environmental damage?

General KLOTZ. I don't know the cost of how much it cost us to produce 34 metric tons. I could take that for the record and will give you an estimate of that process, which took place, unfolded over years during the cold war period.

[The information referred to can be found in the Appendix on page 67.]

Mr. ROGERS. Do you have a——

General KLOTZ. No.

Mr. ROGERS. No rough estimate?

General KLOTZ. No, sir.

Mr. ROGERS. Okay.

With that, I will yield to the ranking member for any questions he may have.

Mr. COOPER. Thank you, Mr. Chairman.

Although this has been a technical and calm hearing so far, I think a couple of bits of testimony are truly startling. I, at least, was amazed.

One was the difference in outlook on completion of the MOX facility. The company seems to think it is 67 percent complete. The owner, the United States Government, seems to think it is 35 to 41 percent complete.

Whoa. The contractor is supposed to be working for us, and we see things so differently? Like, whoa. That is a big failure of communication, at the very least.

Mr. MacWilliams.

Mr. MACWILLIAMS. Yes, sir. Well, we do have a longstanding difference with the contractor on this point.

Let me explain our numbers in a little more detail.

We are required to look at percentage completion, so cost to complete. So our current estimate is $12 billion to $14 billion for the MOX Fabrication Facility. As I mentioned, the Army Corps of Engineers, when they looked at it a couple years ago, were around $10 billion and up, but that was preliminary, and now there have been delays for 2 years. So I can't speak for them, but I am sure it would be a little bit north of that.

So if we spent $4.8 billion so far, you know, you just do the math and you put that over $12 billion to $14 billion, and you get the range that I gave you of 35 to 41 percent.

Now, in addition, Congressman Wilson is, you know, absolutely right and the picture shows that there has been a lot of work done, and some very good work, in terms of civil engineering, et cetera. This is a very, very complex project, and the difficult work, the more difficult work remains to be done. And that tends to be the instrumentation; the piping is very complicated.

I mentioned the 25 percent rework rate. The contractors estimated a 2.5 percent rework rate, and we are running 25 percent at this point. So there is a difference in view, and that is the reasons.

Dr. MASON. And if I could add, we noted in our report that the relationship between the NNSA, the project staff, and the contractor is not good. There is little trust, in both directions. You know, there are reasons that both parties to that disagreement will point to for their distrust, but it does mean that, should the decision be made that it is necessary to stick with MOX, that has to be addressed, because it is not functioning well in terms of their relationship at the moment.

And the disagreement about the percent complete is really just one manifestation of that disconnect. And, actually, it is both—you know, a percent is a fraction. And the disagreement is both in the numerator, how much work has been done, and in the denominator, how much work is it going to take to complete the project.

Mr. COOPER. Well, the second most startling bit of information was the one that Mr. MacWilliams just referenced again. Any project that has 25 percent rework? Like, oh, my gosh. Because that means you build it, then you have to tear it down 25 percent and redo it. So we get to pay twice, as a taxpayer? Like, whoa.

And then it turns out there is even a disparity there, because the company says it is only 2.5 percent.

Well, this is unbelievable. This really gets to core competency and viability of the project, I would think.

Mr. MacWilliams.

Mr. MACWILLIAMS. Sir, just to clarify one thing, I can't speak for the contractors, whether they would today say that it is 2.5 percent. The numbers we are seeing is 25 percent. What I was saying is, in their original planning, which produced some of these cost estimates, the assumption was 2.5 percent.

Mr. COOPER. Dr. Mason was telling me earlier about the faulty incentive structure that NNSA or someone had put out there, where it was fee based on placement of equipment. So, in some cases, apparently, the company would go ahead and place the equipment, even though it blocked access to other equipment, just so they get their fee. So we would pay to place the equipment, to move the equipment, and then replace the equipment. So, in that case, we got to pay three times for the same work. That seems too unbelievable to be true.

Dr. MASON. Well, and I think that is an origin of some of the distrust. And, as you know, you do wind up essentially paying 3X in those instances.

The contractual arrangement, as it stands right now, is really not functioning for the management of the project. The project has been without a baseline for really nearly 3 years. And so, again, as we stated in the report, if the decision is to continue with the

MOX, there would have to be what I would judge to be a rather difficult negotiation take place. It is not a case where you can simply, as might occur, you know, if you were building a home, fire the contractor and hire a new one. AREVA actually owns the IP [intellectual property] associated with it, and so there would have to be significant restructuring of the contractual arrangement in order to provide a rational basis for future work.

General KLOTZ. I think, if I could, Mr. Cooper, I think this goes—part of the distrust which exists has a lot to do with uncertainty. I mean, this is a program, this is a project of which there has been some great uncertainty over the past couple years. It is uncertainty that is felt, you know, by the Federal force down there that has responsibility for oversight. It is uncertainty that is felt by the contractor and the labor force, and some uncertainty felt by the good citizens of South Carolina and Georgia.

Mr. COOPER. This brings me to a final point that wasn't revealed in testimony yet but it was in General Klotz's written testimony, where he says, "If a decision were made to complete construction of the facility"—the MOX facility—"the contractor would be requested to provide a baseline change proposal to complete the facility, a specified annual funding level, and a new contract cost proposal would be negotiated."

This just gets us to the point that Dr. Mason was just talking about. In a homeowner situation, you don't like the contractor, you fire him, you get somebody new. Here, AREVA owns the IP. You essentially can't fire them. They are already failing to communicate or on a completely different page, maybe a different planet, on this. And then we would have to enter into new contract cost negotiations with them.

These wouldn't be negotiations; this would be a hostage-taking. And we are already the hostage here. We would have no leverage at all in this situation, would we?

Mr. MACWILLIAMS. Sir, the reason we haven't done a baseline change proposal is, essentially, we have been waiting to do studies to see where we are. Because, as you are aware, that is a multiple-year process, many million dollars required. And so, at this point, at least in our perspective, there have been numerous studies, and it is pretty clear that the MOX Project is going to be very, very expensive.

I would also say that we have been talking about AREVA a lot, but it is MOX Services, which is a joint venture. And so I think that the purpose here is certainly not to demonize the contractor in any way, but it is a joint venture between CB&I and AREVA.

Dr. MASON. And I would also like to point out that, in noting that there was little trust, that was in both directions——

Mr. MACWILLIAMS. Yeah.

Dr. MASON [continuing]. In the sense that the contractor does not feel that they have the trust and confidence in the Department either, partly for the reasons of uncertainty that were mentioned. And so, you know, like any relationship, it is not working in both directions.

Mr. COOPER. Failure to communicate is usually two ways.

A final point. When it comes to not dealing with NNSA but with the NRC, it was my impression from talking to Dr. Mason that the

MOX joint venture approach was to engage in redundancy. When they wanted to lower risk, they would have redundant or backup systems. So, that way, essentially, we get to pay twice, but that had the net effect of lowering risk. But it is completely a different approach than we use in this country to solve problems.

Could you elaborate, Dr. Mason?

Dr. MASON. Actually, the redundancy that you refer to, I think, even predates the contract award. It goes back to some of the original design thinking. And, you know, it is illustrative of a challenge that I have seen, for example, when we looked at the uranium production facility in a different exercise. It has been mentioned already, some of the difficulties that the Department has encountered in setting requirements.

And I am reminded of a remark that I saw attributed to General Odierno when asked why some of the DOD major acquisitions have not yielded weapons systems. The phrase he used was "utopian requirements." And I think that is very apt in this instance. And sometimes fear of what the regulator might do, whether it is the Nuclear NRC or DOE and its self-regulating mode for other facilities, has on occasion led to very conservative decisionmaking that gives the appearance of reducing risk but may actually increase it because of the cost that is occurred in avoiding difficulties that may or may not actually materialize.

Mr. COOPER. Uh-huh.

Well, thank you, Mr. Chairman.

Mr. ROGERS. The Chair now recognizes the gentleman from California, Mr. Garamendi, for 5 minutes.

Mr. GARAMENDI. Thank you.

From the previous testimony, there was no discussion with Russia about the BN–800. Is that correct?

Mr. MACWILLIAMS. To my knowledge, sir, there wasn't, but I would be happy to go back to NE and find out.

Mr. GARAMENDI. Thank you.

Was there any discussion with General Electric Hitachi about their fast reactor design?

Dr. MASON. The analysis that we looked at of the fast-reactor option was actually based on work that had been done by the Department's Office of Nuclear Energy, which had been doing an analysis of a potential fast reactor as a component of the nuclear energy mission. That did include consideration of a number of the different designs that have been proposed, including those that have been mentioned.

And the reason that our group, the Red Team, did not further pursue that option is because, were you to pursue a fast-reactor option, you would have to build both a fuel fabrication facility, which is the, you know, current topic, and a reactor. So, because of that, it did not offer any obvious——

Mr. GARAMENDI. Did you explore the potential for doing both of those?

Dr. MASON. Yes, we did, relying on the analysis that has been done by the Office of Nuclear Energy, which I would leave it to my colleagues to——

Mr. GARAMENDI. Mr. MacWilliams.

Mr. MACWILLIAMS. Yes, sir. The Office of Nuclear Energy did have conversations with GE. I can get you more information if that would be helpful for you, sir. In our studies——

Mr. GARAMENDI. Well, the question is, was it helpful to your analysis?

Mr. MACWILLIAMS. It was incorporated into the study. There was a——

Mr. GARAMENDI. And how was it helpful to your analysis?

Mr. MACWILLIAMS. The analysis that our working group, which included representatives from NE, did—and they did a very comprehensive study on the fast reactors, which we would be happy to give you another copy of. And the essential conclusion was that, while it would accomplish the mission, it would be roughly a $50 billion project.

Mr. GARAMENDI. At an expenditure level of $300 million or $400 million a year forever.

Mr. MACWILLIAMS. You are correct, sir, that we——

Mr. GARAMENDI. Did you take——

Mr. MACWILLIAMS. It was $500 million, and the reason we looked at that is so we could compare all options.

Mr. GARAMENDI. Well, I would just simply share with everybody, it is a fool's errand to base all of this analysis on the appropriation level rather than on what it would cost to do the process.

Mr. MACWILLIAMS. We would be happy to give you the unconstrained funding number, which is still very, very substantial, sir, for a brand-new fast reactor.

Mr. GARAMENDI. Well, I will make the point once again. You did not analyze any of this based upon what it would actually cost but, rather, assuming a funding level from the Federal Government that, frankly, would stretch all of these options out to kingdom come.

Mr. MACWILLIAMS. NE did look at an unconstrained case, sir. I just——

Mr. GARAMENDI. Did you?

Mr. MACWILLIAMS. No. Our NE group did a study this thick on this——

Mr. GARAMENDI. I don't care how thick the study is.

Mr. MACWILLIAMS. But they did a very comprehensive—which did look at unconstrained funding, and I would be happy to provide it for the record.

Mr. GARAMENDI. Did anybody ask General Electric Hitachi what it would cost to build the reactor and the fuel fabrication system?

Mr. MACWILLIAMS. My understanding is they had extensive conversations with GE, and I would be happy to provide more information for you.

Mr. GARAMENDI. Please do so. And when will you deliver it to me?

Mr. MACWILLIAMS. Let me go back, and we will do it promptly, sir.

Mr. GARAMENDI. No, that is not an answer. Next week? Week after next?

Mr. MACWILLIAMS. I will get you information by the end of next week, sir.

Mr. GARAMENDI. Thank you.

[The information referred to can be found in the Appendix on page 70.]

Mr. GARAMENDI. I think I still have some more time. Let's talk about the dilute process. What exactly is it? And what is the result of the dilute? What is the nature of the material at the end of the result of the dilute?

Dr. MASON. Sure.

So the first step in the process is to convert the material from whatever form it is in, which is typically metal for the majority of the material, into oxide, which is accomplished in a furnace, an oxidizing furnace.

That oxide then is mixed in a very simple mechanical operation with a diluent that is given the name "stardust." The exact constituents of it are classified because it is intended to make it very difficult to reconstitute the plutonium into a——

Mr. GARAMENDI. Very difficult but possible to reconstitute using a mechanical process?

Dr. MASON. Yes, because in order to get the plutonium out, you would have to do a chemical process, and the constituents of the diluent are designed to make that chemical process very costly and difficult.

So the final material you end up with is a blend of oxides, just loose oxides like—it looks like sand you would find on a beach. It isn't, however, very much like sand you would find on a beach.

Mr. GARAMENDI. Could you please deliver to me a detailed description of what that is and what the end result of that process is and the potential for reconstitution of that material back into a weapons-grade plutonium? Can you do that?

Mr. ROGERS. The gentleman's time has expired.

Mr. MACWILLIAMS. We can do that, sir.

[The information referred to can be found in the Appendix on page 70.]

Mr. ROGERS. The Chair now recognizes Mr. Wilson for the final questions of the afternoon.

Mr. WILSON. Well, thank you so much, Mr. Chairman.

And, indeed, I appreciate the information being provided today. It is really reassuring to me, as a former DOE employee, a person who has worked at the Savannah River Site. Actually, your service gives me confidence, because I know of the health and safety that is at the Savannah River Site, the level of populations of South Carolina and Georgia that really appreciate the record of safety that we have at that site.

And, indeed, I also share with my colleagues a concern about the cost, obviously. And I have been asking about that since day one. And so much of it—and there has been terminology used: percentage of design completion, rework, utopian requirements. So much of the increase in cost, as has been explained to me, has been due to change of specifications.

It is in good faith by everybody involved. It is not because of persons not being interested in health and safety, but because you are interested in health and safety. It is due to changes in technology over the years, the experience that has been with the facility in France, over and over again. And that is my interest, about health and safety.

But, as we do talk about the cost, Dr. Mason, the Red Team had a situation of disagreeing with Aerospace relative to the $47 billion lifecycle cost. And so what was the disagreement?

Dr. MASON. Yes. Of the four primary conclusions of the Aerospace report, the one where we did have a different conclusion related to their analysis under constrained funding scenarios. So, while we agreed with their overall conclusion in terms of the relative cost of the two options in their Phase 1 report, the difficulty was that they did not have access to the detailed resource-loaded schedules that would allow them to reoptimize the schedule at different funding levels.

And so they did what I think any of us would have done with that same limited information and made their best estimate, but it really didn't give them the flexibility to try and reoptimize and replan the work, and, therefore, extended the duration, you know, in the case of $350-million-a-year cap on construction out to 86 years. And we believe that you could do better than that with a proper replan of the schedule and a rebaseline.

Mr. WILSON. And I appreciate that.

And it is always, actually, been frustrating to me about lifecycle cost. By using that terminology, I think of purchasing a car. If you use the lifecycle cost, what the cost of it was and what the cost of maintaining it, filling it with fuel, whatever, insurance, goodness, you would buy no car. Who would know what the cost would be? You would have to have 10 Red Teams to figure out what the cost would be. But the net result is you wouldn't do it, you wouldn't buy a vehicle.

And so that is why I hope we look at this. And that is the reason that I brought the map, or the picture today of the facility. Because whether it is 33 percent completed or, as I think it is, nearly 70 percent completed, if you look at it, hey, it is virtually completed. And the interior equipment is being installed as we are here today.

But it is a testimony to the people that you work with and that you helped train for the health and safety and the appreciation in our State and our neighbors, Georgia, for the Savannah River Site.

And so I would like to, again, conclude by letting everybody know that I can't wait for my colleagues to visit. It is a beautiful community. It is very humbling for me to have the opportunity to represent it. And I can't wait for them to see the actual facility and the percentage of completion.

And, with that, I will yield my time.

Mr. ROGERS. I thank the gentleman.

The Chair wants to, again, thank the witnesses for their time and commitment and your contributions today. You have been very helpful.

I would remind the panelists that we will leave the record open for 10 days. If anybody has any additional questions—I know I have a few that I couldn't get to—we will submit them to you. And if you could just respond to them in a timely manner, I would appreciate that.

And, with that, we are adjourned.

[Whereupon, at 5:20 p.m., the subcommittee was adjourned.]

A P P E N D I X

October 7, 2015

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

OCTOBER 7, 2015

Opening Remarks – <u>As Prepared for Delivery</u>
The Honorable Mike Rogers
Chairman, Subcommittee on Strategic Forces
House Armed Services Committee

Hearing on the "Plutonium Disposition and the MOX Project"

October 7, 2015

Good afternoon. The subcommittee will come to order.

Welcome to our hearing on the Plutonium Disposition Program and the MOX Project.

To our witnesses: thank you for being here today. We know it takes time to prepare for these hearings, and we appreciate it. We also appreciate the contributions you each make to the nation through your service.

Our distinguished witnesses are:

The Honorable Frank Klotz
Administrator
National Nuclear Security Administration

Mr. John MacWilliams
Associate Deputy Secretary
Department of Energy

Dr. Thom Mason
Director
Oak Ridge National Laboratory

This hearing is examining one of the Department of Energy's largest and highest profile construction projects.

The MOX Project and the broader Plutonium Disposition Program have been the subject of several recent reviews.

The leaders of two of those reviews are at the witness table today. Mr. MacWilliams led Secretary Moniz's internal assessment team, and Dr. Mason led the independent Red Team.

They've both also been involved in figuring out what DOE should do about key uranium capabilities that are critical to national security.

Gentlemen, you seem to get all of the easy issues.

They are joined by General Klotz, who is no stranger to difficult challenges. General Klotz has overall responsibility for executing the program as head of the NNSA.

We look forward to hearing from all of you about the Department's current status on this program as the committee looks to help the nation determine what is in the best interests of the taxpayer and national security.

With that, let me turn to our ranking member for any statement he would like to make.

Opening Statement
Ranking Member Jim Cooper
Hearing: Plutonium Disposition and the MOX Project
Strategic Forces Subcommittee
Thursday, October 7, 2015

Thank you, Mr. Chairman, for this hearing. For the first time in over ten years, we are holding oversight hearings on a program that every taxpayer in America should be concerned about. I only regret that the hearing is happening so close to the torrential rains that South Carolina has recently suffered.

The MOX approach to disposing of surplus nuclear weapons plutonium could turn out to be one of the biggest wastes of taxpayer funds in all of U.S. history. No one intended this to happen, but it seems to be happening unless policymakers act promptly.

Simply put, MOX is one of the most expensive processes in the world for making something that no one wants to buy. The question for Congress is whether to cut our losses and move to a cheaper and simpler alternative, such as down-blending, or continue to waste taxpayer dollars.

I ask my colleagues to read what the various expert panels have written about MOX. The verdict is unanimous, except from the foreign company that holds the contract. Unless this project is redirected fast, the harm done to taxpayers will be unforgivable.

For its percentage increases, MOX may be the biggest cost-overrun program in American history. The initial cost estimate in 2002 to design and build the MOX facility was $1 billion, with a projected operations and management cost of $500 million per year for 15 years. Construction costs alone are now likely to exceed $10 billion, but that is only part of the story. Now the total project cost at anywhere from $47 billion to $110 billion! To make matters even worse, these costs do not include the cost of decommissioning the MOX facility, another several billion dollars.

Some may say, out of deference to our colleagues from South Carolina, that construction is 60% complete, that it creates good jobs in a poor area, and that experts are sometimes wrong. Congress has largely believed such arguments, even overlooking the fact that 25% of construction work done today is so defective that it has to be redone. At the current rate, the project may not be completed for a century. America may well have colonized other planets before this project is finished. It has turned into a permanent stimulus program for one part of South Carolina, ironically, defended by elected officials who say they oppose stimulus spending.

In recent Armed Services Committee markups, I called MOX the "zombie earmark" because it is pork-barrel spending that apparently cannot be killed, even by a Congress that claims it has outlawed earmarks. I am hopeful that this hearing will provide the evidence needed to stop this waste of taxpayer dollars.

The Red Team analysis chaired by Oak Ridge National Laboratory Director Dr. Thom Mason estimated MOX would cost $700-800 million per year until completion of the project decades hence, lending support to Energy Secretary Ernie Moniz's claim that MOX would require nearly $1 billion annually for many, many years.

MOX is a failed program to pursue a failed strategy. It is the poster child for NNSA's management and construction incompetence, with $5 billion already wasted and no end in sight.

Cheaper, faster and technically more feasible alternatives, such as down-blending, exist and are the most promising way ahead to fulfill the US obligation of disposing of 34 MT of weapons-grade plutonium.

I join the Chairman in welcoming General Klotz, Mr. MacWilliams and Dr. Mason to this hearing, and look forward to our discussion.

Statement of Lt. Gen. Frank G. Klotz, USAF (Ret.)
Administrator
National Nuclear Security Administration
U.S. Department of Energy
on the
Plutonium Disposition and the MOX Project
Before the
Subcommittee on Strategic Forces
House Committee on Armed Services

October 7, 2015

Chairman Rogers, Ranking Member Cooper, and Members of the Subcommittee, thank you for the opportunity to discuss plutonium disposition and the Mixed Oxide (MOX) Fuel Fabrication Facility project. We value this Subcommittee's leadership in national security, as well as its strong and abiding support for the mission and people of the National Nuclear Security Administration (NNSA).

The end of the Cold War left a legacy of surplus weapon-grade fissile materials, both in the United States and the former Soviet Union, with substantial quantities of plutonium no longer needed for defense purposes. Global stockpiles of weapon-grade fissile materials pose a danger to national and international security due to proliferation concerns and potential use by non-state actors for nuclear terrorism purposes, as well as the potential for environmental, safety, and health consequences if the materials are not properly secured and managed.

In 2000, the United States and Russian Federation signed the Plutonium Management and Disposition Agreement (PMDA), which calls for each country to dispose of at least 34 metric tons (MT) of excess weapon-grade plutonium. According to the 2000 agreement, Russia would dispose of its material by irradiating it as MOX fuel in light water reactors (LWRs) or sodium-cooled fast breeder reactors, and the United States would dispose of the majority of its material by irradiating it as MOX fuel in LWRs and the rest through immobilization using a can-in-canister system. The agreement also provided that either party could use other methods agreed to by the Parties. DOE subsequently cancelled the immobilization project due to rising costs, and announced that DOE would proceed with a MOX-only approach after consultations with Russia. At the time, the life cycle costs for the MOX-only approach were estimated at $3.8 billion (in constant FY 2001 dollars) to be implemented over approximately 20 years. This estimate included the construction and operation of the MOX Fuel Fabrication Facility (MFFF) and the pit disassembly and conversion facility.

In addition to the PMDA, between 1998 and 2002 DOE announced a series of decisions to dispose of a variety of plutonium residues, which originated at the Rocky Flats Environmental Technology Site, as transuranic waste at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. This material, which was stored at DOE sites including the Hanford Site, the Savannah River Site, and Lawrence Livermore National Laboratory (LLNL), was dispositioned via the dilution and disposal method at WIPP.

There have been many changes to the plutonium disposition program since the decision to pursue a MOX-only approach, one of which resulted from a Russian Government reassessment of technical options for disposing of its plutonium. As a result of its reassessment, Russia stated its preference to dispose of its material in fast reactors instead of LWRs, an approach that is more consistent with Russia's national energy strategy. This decision led to a renegotiation of key provisions of the PMDA. During the April 2010 Nuclear Security Summit in Washington, DC, the Secretary of State and Russian Foreign Minister signed a protocol amending the PMDA to formalize the shift in each country's plutonium disposition program. The protocol also clarified a number of nonproliferation conditions, including limits on Russia operating its two designated fast reactors for plutonium disposition that would restrict the ability to produce additional weapon-grade plutonium. In July 2011, after ratification by the Russian Duma and formal approval of both governments, the PMDA with its protocols entered into force.

Status of the MOX Fuel Approach

In addition to the evolution of the Russian program, the U.S. program has also changed significantly. The current MOX fuel approach involves construction and operation of a MOX facility, construction and operation of a Waste Solidification Building to handle the wastes from the MOX facility, a capability to disassemble nuclear weapons pits and convert the resulting plutonium metal into plutonium oxide, MOX fuel qualification activities, reactor modifications for utilities willing to irradiate MOX fuel, and packaging and transportation activities.

In 2008, the cost and schedule baseline for the MOX facility was established at $4.8 billion for design, construction, and cold start-up activities with a hot operations start-up date of November 2016. In August 2012, the MOX facility contractor submitted a baseline change proposal for the facility that would increase its cost for design, construction, and cold startup activities to $7.7 billion, assuming an optimal funding profile, and extend the schedule by 3 years to November 2019. After analysis of the proposal by DOE and independent experts, including the Army Corps of Engineers, DOE assessed that the cost of the MOX facility would be substantially higher than the contractor's estimate due to several factors such as omission of several hundred million dollars of equipment procurements and underestimation of schedule impacts and the resulting cost if certain risks were realized.

In addition, the estimates to operate the MOX facility after construction have continued to rise, as well as the costs of other related activities, such as the Waste Solidification Building. According to an independent review of the MOX facility operating costs by the NNSA Office of Defense Programs' Office of Analysis and Evaluation, the annual operating costs of more than $500 million may be underestimated. The analysis indicated that the contractor likely underestimated the cost of maintenance and labor compared to the market values seen at other processing facilities in the NNSA and that issues arising during hot start-up could have costly schedule and production rate impacts during the operations phase.

As a result of the cost increases, DOE announced in April 2013 that it would assess alternatives to the current plutonium disposition approach. An analysis of plutonium disposition options was released by the Secretary's Plutonium Disposition Working Group in April 2014 to serve as a basis for determining the most efficient path forward for plutonium disposition. The report,

"Analysis of Surplus Weapon-Grade Plutonium Disposition Options" included the MOX fuel approach as well as other reactor and non-reactor based approaches.

In accordance with the Consolidated and Further Continuing Appropriations Act, 2015, the Department has continued construction of the facility while alternatives are being evaluated. Nevertheless, a sustained commitment of funds at significantly higher levels would be necessary to complete construction in a timely, cost effective manner. If a decision were made to complete construction of the facility, the contractor would be requested to provide a baseline change proposal to complete the facility at specified annual funding level(s), and a new contract cost proposal would be negotiated. This proposal would be thoroughly reviewed in accordance with the Department's policies and procedures.

Independent Reviews of MOX Fuel Approach

Pursuant to the Consolidated and Further Continuing Appropriations Act, 2015 and the Fiscal Year 2015 National Defense Authorization Act, the Department commissioned the Aerospace Corporation, an independent Federally Funded Research and Development Center (FFRDC), to assess and validate the results of the April 2014 Plutonium Disposition Working Group report. Aerospace Corporation completed two reports documenting the assessment process and findings of the April 2014 analysis. The Phase 1 Report, released in April 2015, provided an independent assessment focused on the MOX fuel option and the option to dilute and dispose of the plutonium in a repository and provided an independently validated life-cycle cost estimate for those options.

Aerospace Corporation concluded that the Department's April 2014 cost estimates were done in a manner consistent with best practices and industry standards, that there was no cost-risk confidence level where the MOX fuel option life-cycle cost-to-go was less than the dilution and disposal option. Aerospace calculated the total to-go cost for the MOX Fuel Option to be 47.5 billion in real year (escalated) dollars versus a total to-go cost of 17.2 billion in real year (escalated) dollars for the dilution and disposal option.

The Phase 2 Report, which examines the other plutonium disposition options included in the 2014 Plutonium Working Group analysis, is complete and has been submitted to Congress accompanied by the required Department report on the assessment. In this report, Aerospace concluded that dilution and disposal in a repository is the least complex in design and operations and has the lowest cost-risk in comparison with the options analyzed in the 2014 Plutonium Working Group Report. Aerospace's findings on the disposition options are:

- Irradiation of plutonium in fast reactors using Advanced Disposition Reactors is more technically challenging and higher in cost-risk than the MOX fuel option;
- Immobilization is similar in complexity to MOX fuel, but carries high cost-risk;
- A cost estimate and an end-to-end design were not provided for the deep borehole option, but the concept is complex due to site selection and characterization, borehole drilling, emplacement of containers, and verification of container state-of-health;
- Dilution and disposal is the least complex in design and operations and has the lowest cost-risk.

MOX Red Team

Additionally, the Energy Secretary requested in June 2015 that Dr. Thomas Mason, Director of Oak Ridge National Laboratory (ORNL), assemble and lead a Red Team to assess options for the disposition of surplus weapon-grade plutonium.

Dr. Mason was selected to assemble and lead the team on the basis of his experience in leading a successful Red Team review on the Uranium Processing Facility (UPF) Project in 2014. The Red Team consisted of 18 experts, including both current and former employees of Savannah River National Laboratory (SRNL), Los Alamos National Laboratory (LANL), Idaho National Laboratory (INL), Sandia National Laboratory (SNL), ORNL, the United Kingdom National Nuclear Laboratory, and the Tennessee Valley Authority (TVA), as well as private nuclear industry and capital project management experts.

The Red Team validated the basic conclusions of the Aerospace report, given the funding profiles that were assumed in that report, and further concluded that even the best case scenario for the MOX approach would be significantly more expensive and riskier than the worst case scenario for the Dilute and Dispose approach. It also assessed that the best-case MOX estimates were truly a "best case," with no prospects for further reductions in cost, while even the nominal case for dilution-burial could potentially offer additional cost savings in the future.

Again, thank you for the opportunity to appear before you today.

Lieutenant General Frank G. Klotz, USAF (Ret)
Under Secretary for Nuclear Security and NNSA Administrator

Lieutenant General Frank G. Klotz, United States Air Force (Ret), was confirmed by the Senate on Tuesday, April 8, 2014, as the Department of Energy's Under Secretary for Nuclear Security and Administrator for the National Nuclear Security Administration (NNSA).

As Under Secretary for Nuclear Security, Lt. Gen. Klotz is responsible for the management and operation of the NNSA, as well as policy matters across the Department of Energy and NNSA enterprise in support of President Obama's nuclear security agenda. Acting Administrator Held will return to his position as Associate Deputy Secretary.

Prior to his Senate confirmation, Lt. Gen. Klotz served in a variety of military and national security positions. As the former Commander of Air Force Global Strike Command, a position he held from 2009 to 2011, he established and then led a brand new 23,000-person organization that merged responsibility for all U.S. nuclear-capable bombers and land-based missiles under a single chain of command. From 2007 to 2009, Lt. Gen. Klotz was the Assistant Vice Chief of Staff and Director of the Air Staff. He served as the Vice Commander of Air Force Space Command from 2005 to 2007 and was the Commander of the Twentieth Air Force from 2003 to 2005.

Lt. Gen. Klotz served at the White House from 2001 to 2003 as the Director for Nuclear Policy and Arms Control on the National Security Council, where he represented the White House in the talks that led to the 2002 Moscow Treaty to reduce strategic nuclear weapons. Earlier in his career, he served as the defense attaché at U.S. Embassy Moscow during a particularly eventful period in U.S.-Russian relations.

A distinguished graduate of the U.S. Air Force Academy, Lt. Gen. Klotz attended Oxford University as a Rhodes Scholar, where he earned an MPhil in international relations and a DPhil in politics. He is also a graduate of the National War College in Washington, DC. Most recently, Lt. Gen. Klotz was a senior fellow for strategic studies and arms control at the Council on Foreign Relations.

John J. MacWilliams
Associate Deputy Secretary of the U.S. Department of Energy

John J. MacWilliams was appointed in August 2015 as Associate Deputy Secretary of the U.S. Department of Energy. He also serves as the Department's Chief Risk Officer and advances Secretarial priorities of enterprise-wide approaches to innovative finance, risk management, project management, nuclear and cyber security.

Mr. MacWilliams joined the Department in May 2013 as a Senior Advisor to the Secretary, serving as his senior finance advisor and a member of his national security team. Prior to DOE, he was a partner of Tremont Energy Partners, LLC, a private investment firm based in Cambridge, Massachusetts that was formed in 2003. Prior to Tremont, he was Vice Chairman, Investment Banking, at JP Morgan Chase and a Partner of JP Morgan Partners. Mr.MacWilliams was a founding partner in 1993 of The Beacon Group, LLC, a private investment firm located in New York, which was acquired by JP Morgan Chase in 2000. He was also Partner and Co-Head of the Beacon Group Energy Investment Funds, a portfolio of more than 30 global private equity investments throughout the energy industry, ranging from traditional (oil and gas, coal mining, petrochemicals, pipelines), to early-stage venture (micro-turbines, power technology, fuel cells, smart grid, and environmental controls). Prior to the formation of The Beacon Group, Mr. MacWilliams was with Goldman Sachs & Co., where he was head of Goldman Sachs' international structured finance group based in London. Prior to joining Goldman Sachs, he was an attorney at Davis Polk & Wardwell in New York.

Mr. MacWilliams is a former member of the Board of Directors of Alliance Resource Partners, LP; Compagnie Generale de Geophysique; Longhorn Partners Pipeline, LP; SmartSynch, Inc., Soft Switching Technologies, Inc., and Titan Methanol Company. He has also served as a Trustee of the Berklee College of Music, and on the Boards of the Christopher and Dana Reeve Foundation, the Massachusetts Mentoring Partnership, and the Alumni Council of Phillips Academy Andover. He holds a B.A. from Stanford University, an M.S. from Massachusetts Institute of Technology, and a J.D. from Harvard Law School.

Statement of Thomas E. Mason
Director, Oak Ridge National Laboratory

Before the
Subcommittee on Strategic Forces
Committee on Armed Services
U.S. House of Representatives
October 7, 2015

Hearing on Plutonium Disposition and the MOX Project

Chairman Rogers, Ranking Member Cooper, and Members of the Subcommittee, thank you for this opportunity to appear before you today. My name is Thomas E. Mason, and I am Director of the U.S. Department of Energy's Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. It is a privilege to present a summary of the findings of the Plutonium Disposition Program Red Team Review.

INTRODUCTION

As General Klotz has told you, in June 2015, I was asked by Energy Secretary Ernest Moniz to assemble a "Red Team" to provide the Department with an assessment of options for disposing of 34 metric tons (MT) of surplus weapon-grade plutonium.

Secretary Moniz specified that the Red Team's assessment should address the mixed oxide fuel (MOX) approach, the Dilute and Dispose alternative, and any other alternatives that the Red Team viewed as meritorious. In particular, the Red Team was directed to (1) evaluate previous assessments of plutonium disposition options and reconcile the cost differences among them; (2) analyze ways to modify the MOX approach, especially the MOX Fuel Fabrication Facility (MFFF), to reduce costs if possible; and (3) examine risk assumptions and their impact on total life cycle cost estimates. The Red Team was also tasked with analyzing the schedule for completing the 34 MT disposition mission, the technical viability of the approaches under consideration, the ability of the various approaches to ensure that the United States can meet its international commitments, and the impacts of regulatory and other issues.

The 18 highly capable members of the Red Team included individuals with past or present work experience at ORNL, Savannah River National Laboratory (SRNL), Los Alamos National Laboratory (LANL), Idaho National Laboratory (INL), Sandia National Laboratories (SNL), the United Kingdom National Nuclear Laboratory, the U.S. Nuclear Regulatory Commission (NRC), and the Tennessee Valley Authority (TVA), as well as several private nuclear industry and capital project management experts. Thanks to their efforts, the Red Team was able to deliver its recommendation to Secretary Moniz on August 13, 2015.

APPROACH

The Red Team reviewed a number of previous assessments of plutonium disposition options and heard several topical presentations on the MOX approach and potential alternatives. We were also briefed by Ambassador Michael Guhin of the U.S. State Department and by Dr. Siegfried Hecker, director emeritus of LANL, on the Plutonium Management and Disposition Agreement (PMDA) and interactions with Russian scientific leaders leading up to it. We conducted site visits and interviews at the Waste Isolation Pilot Plant (WIPP), LANL, and the Savannah River Site (SRS), where the MFFF is under construction and additional work to prepare feedstock will be carried out. We also interviewed members of teams who had conducted recent assessments of plutonium disposition options, and we reviewed prior cost analyses in order to assess annual funding needs for a successful disposition program.

The assessments that we examined included the analysis of plutonium disposition options released by the Secretary's Plutonium Disposition Working Group (PWG) in April 2014, which analyzed five alternatives (after eliminating a large number of previously considered options); an independent review of the PWG report by the Aerospace Corporation (Aerospace) in April 2015, which examined two of the five alternatives considered in the PWG report; and an initial critique of the Aerospace Corporation report by High Bridge Associates, Inc. (High Bridge), that was completed in June 2015. (A more comprehensive critique of the Aerospace analysis by High Bridge was published too late for Red Team consideration.)

FINDINGS

Using the PWG report as a starting point and drawing on input from subject matter experts and our own judgment, the Red Team was able to screen out most of the alternatives except the baseline MOX approach and the Dilute and Dispose alternative (and potential improvements/variants on that alternative). Immobilization is too costly and lacks sufficient high-level waste for encapsulation of all 34 MT of plutonium. The development of an advanced disposition reactor would require a capital investment similar to that needed for MFFF, but with all of the risks associated with construction of a first-of-a kind reactor (specifically, a liquid metal fast reactor). The deep borehole approach was deemed essentially equivalent to the Dilute and Dispose approach, but it lacks the proof-of-principle that Dilute and Dispose enjoys, and it suffers from significant uncertainty related to siting. The remaining alternatives—the baseline MOX approach and the Dilute and Dispose alternative—are also those considered in the Phase 1 Aerospace assessment of the PWG report.

The Red Team next reviewed the four primary conclusions reached in the Aerospace assessment, which were as follows: (1) the PWG cost and schedule estimates were performed in reasonable accord with accepted best practices; (2) programmatic risks were generally underestimated for both the MOX approach and the Dilute and Dispose alternative, (3) the cost of the Dilute and Dispose option is lower than that of the MOX option, and (4) the MOX approach is essentially nonviable at anticipated capital funding levels of $350 million to $500 million per year.

The Red Team agreed with the first three conclusions, but found that Aerospace's assertions about the time needed to complete MFFF construction were not able to take into account possible optimization of the project effort under reduced funding levels. Nevertheless, the Red Team concurred with Aerospace's assertion that even the worst-case scenario for the Dilute and Dispose alternative would be less expensive than the best-case scenario for the MOX approach.

The Red Team also reviewed the findings of the initial High Bridge critique of the Aerospace report (the final version was not released until after we had concluded our deliberations). The primary concern expressed by High Bridge was that "MOX risk elements and resulting impact costs are overstated and inconsistent," while "Downblend [i.e., Dilute and Dispose] risk elements are understated."

The Red Team concurred with the High Bridge finding that Aerospace's depiction of MOX life cycle costs was skewed by escalation of large risks and conservative estimates of highly uncertain operating cost. However, we disagreed with the High Bridge contention that the Dilute and Dispose alternative should have a risk profile commensurate with a complex nuclear facility construction project in its early stages. In fact, Dilute and Dispose represents a very simple technology that is fundamentally a subset of the MOX approach, and as a result both capital and operational risks are lower for the Dilute and Dispose option than for the MOX option.

The first steps for both options are basically the same: surplus plutonium pits stored and packaged at the National Nuclear Security Administration's Pantex Plant are transferred to LANL for disassembly and conversion to plutonium oxide, while non-pit plutonium stored at SRS is converted to plutonium oxide on site. At this point, the paths of the two options diverge. The MOX approach calls for the conversion of this plutonium oxide to MOX fuel in the MFFF, as General Klotz has described in his testimony. Under the Dilute and Dispose alternative, plutonium oxide is diluted and blended in the K Area Material Storage (KAMS) facility at SRS, and then transferred to WIPP. As I mentioned, Dilute and Dispose uses far simpler technology than MOX. It also relies on a proven pathway for disposal (demonstrated in the removal of weapon-grade plutonium from the Rocky Flats Environmental Technology Site and other locations), utilizes existing facilities, and creates no new long-term physical liability for the Department.

The Dilute and Dispose approach does entail some risk, but it differs from the high-consequence operational risk associated with the MOX approach. Risks associated with Dilute and Dispose tend to be programmatic rather than operational; overcoming these risks will therefore require the exercise of executive will and leadership. The resumption of waste emplacement operations at WIPP is clearly a necessity for this approach, but it is also essential to support transuranic waste operations across the Department of Energy complex, both for cleanup and for ongoing science and security missions, and given the ~5 year time frame for MFFF contract termination and development of the Dilute and Dispose approach, WIPP restart is not expected to be a limiting factor. Disposal of the diluted plutonium oxide at WIPP may require a Class III modification to the facility's

Resource Conservation and Recovery Act (RCRA) permit (for which a precedent exists) in order to avoid modification of the WIPP Land Withdrawal Act to ensure sufficient capacity. The Red Team report identifies several opportunities to improve on the basic Dilute and Dispose approach, so that this endeavor would not necessarily represent a driver for increasing the capacity of WIPP; it also identifies opportunities to reduce the duration with attendant reduction in total cost for the disposition program.

Another programmatic risk is the necessity to modify the PMDA, which currently references only the MOX approach. However, the PMDA has been modified in the past to accommodate Russian national interests, and this establishes a basis for a future modification as long as the United States can demonstrate to Russia that the end state of the material is sufficiently proliferation resistant.

The Red Team's view is that all of these risks are manageable: they tend to be "go/no-go" in nature, and it should be possible to retire them early through a focused and coordinated executive effort. The U.S. Department of Energy and the State of New Mexico have both made a firm commitment to restarting WIPP. Ensuring adequate WIPP capacity (and/or enhancement of disposal efficiency) will require high-level, transparent, and cooperative discussions with the State of New Mexico, but the Red Team believes that the constructive ongoing engagement with the State regarding WIPP restart bodes well for such discussions. With respect to the PMDA, the evolving threat and international climate, combined with the fact that the United States has already accommodated a Russian national interest in a previous modification, caused the Red Team to believe that the United States has a reasonable position with which to enter PMDA negotiations. In the end, securing an agreement on modification of the PMDA will be as much a political as a technical decision, and assessing those political drivers was beyond the scope of the Red Team. However, in our judgment the technical basis for modification is sound.

As General Klotz stated in his testimony, the Red Team concluded that once the "go/no-go" programmatic issues are sufficiently resolved, the cost of a reasonable worst-case scenario for execution of the Dilute and Dispose option is not likely to exceed the cost of the best-case scenario for the MOX approach. This primary conclusion is only one of several key messages that I would now like to communicate to you.

KEY MESSAGES

The Red Team concluded that the MOX approach could be executed at a cost of $700 million to $800 million per year (in FY15 dollars). We conservatively estimated that completion of MFFF construction would take about 15 years, plus 3 years for commissioning. Our estimate includes some contingency to account for uncertainty over the current status of the MFFF project and for risk associated with remaining construction scope. The MOX approach clearly satisfies the existing PMDA (except for the timeline), and while there are no "silver bullets" for reduction of MOX life cycle costs, the Red Team identified some options for process improvement. However, once MOX facilities go operational, the U.S. Department of Energy is committed to long-term surveillance and maintenance costs and has adopted a complex new environmental liability, regardless

of whether the Plutonium Disposition Program is ever completed using the MOX approach.

The Red Team concluded that the Dilute and Dispose alternative could be executed at current annual funding levels (~$400 million per year in FY15 dollars) within a time frame similar to that for the MOX approach. In addition, Dilute and Dispose offers several opportunities for process improvement (and associated life cycle cost reduction), some of which could be implemented after this alternative is under way.

If the U.S. Department of Energy chooses to implement a Dilute and Dispose option, implementation could proceed immediately. During the first 3 years, 75% of the current $400 million budget could be devoted to MOX demobilization and contract termination, with the remainder invested in activities such as pilot-scale dilution using the existing glovebox at KAMS to exercise the process, followed by shipment to WIPP to demonstrate the disposal path (or by storage pending WIPP restart); detailed planning of full-scale, optimized Dilute and Dispose operations and acquisition; pursuit of a written deviation from the PMDA methodology under Article III; discussions with the State of New Mexico on WIPP capacity and utilization, with potential pursuit of a Class III permit modification; and the completion of any additional National Environmental Policy Act (NEPA) documentation.

On the question of whether the MOX approach is worth the extra cost and risk that it entails, the Red Team did not formally characterize the "external" benefits of proceeding with the current baseline approach. These benefits, however, might reasonably include preservation of jobs and lower regional unemployment, positive overall economic impact to the region, enhancement to the domestic credibility of the nuclear industry, bolstering of the domestic nuclear industrial base, sustainment of U.S. international credibility in nonproliferation and the broader nuclear arena, provision of an important training ground for nuclear workers, the preservation and extension of institutional knowledge in nuclear materials handling and processing, and revenue arising from MOX fuel sales of up to $1 billion.

CLOSING POINTS

With sufficient executive will and leadership, a much less costly and less risky approach to meeting the nation's existing obligations for disposing of excess plutonium can be implemented. However, choosing to pursue the Dilute and Dispose approach rather than the baseline MOX approach, on which the United States and the Russian Federation previously reached agreement, represents both a value judgment and a political decision. The Red Team is convinced that chemical blending and disposal at WIPP is akin to the "spent fuel standard" in protecting 34 MT of excess weapon-grade plutonium from future use in nuclear weapons by both the United States and non-state actors. Confirming this conviction with the Russian Federation as soon as possible would be a precursor to establishing IAEA protocols for verification and could take place in parallel with discussion with other stakeholders.

I would like to emphasize that regardless of the chosen path forward, the Red Team believes that it is vitally important to make a decision as soon as possible and secure consistent funding to prevent further degradation of the Plutonium Disposition Program. In particular, the Department needs to improve its management approach to this program by providing dedicated executive leadership at its headquarters that cuts across programs and organizations, and integrates the various program elements (including major capital projects). The Red Team observed a serious gap between the Department and the contractor in the understanding of remaining work on MFFF, as well as an unfavorable ratio of nonmanual to manual labor.

Another point of vital importance is the need to manage WIPP, the H-Canyon at SRS, and the PF-4 plutonium processing building at LANL as precious national assets. The ongoing need for a national repository for transuranic waste makes it imperative to make use of remaining WIPP capacity as efficiently as possible, regardless of the method selected for plutonium disposition. The Red Team strongly encourages the Department to recognize this need and enter into discussions with stakeholders to ensure that it can be met. In addition, funding practices need to be reconsidered to remove threats to the health of critical nuclear infrastructure; for example, the viability of the H-Canyon after FY16 is uncertain, and the Red Team suggests that the Department should recognize its stewardship role and adequately fund the base operating cost of this essential nuclear chemical separation facility within its Environmental Management budget.

Thank you again for the opportunity to testify. I welcome your questions on this important topic.

Thomas E. Mason
Director, Oak Ridge National Laboratory, and President and CEO, UT-Battelle, LLC
P.O. Box 2008
Oak Ridge, Tennessee 37831-6255
(865) 576-2900 (Phone) • (865) 241-2967 (Facsimile) • masont@ornl.gov (E-mail)

Thom Mason is a native of Dartmouth, Nova Scotia, in Canada. He graduated from Dalhousie University in Halifax, Nova Scotia, with a Bachelor of Science degree in physics and completed his postgraduate study at McMaster University in Hamilton, Ontario, Canada, receiving a Doctor of Philosophy degree in experimental condensed matter physics.

After completing his PhD, he held a postdoctoral fellowship at AT&T Bell Laboratories in Murray Hill, New Jersey, and then became a Senior Scientist at Risø National Laboratory in Denmark. In 1993 he joined the faculty of the Department of Physics at the University of Toronto.

Thom joined Oak Ridge National Laboratory (ORNL) in 1998 as Scientific Director for the Department of Energy's Spallation Neutron Source (SNS) project. In April 2001 he was named Associate Laboratory Director for SNS and Vice President of UT-Battelle, LLC, which manages ORNL for the Department. In 2006 he became Associate Laboratory Director for Neutron Sciences, leading a new organization charged with delivering safe and productive scientific facilities for studying of structure and dynamics of materials. In May 2007, Thom was named Director of Oak Ridge National Laboratory.

Thom's research background is in the application of neutron scattering techniques to novel magnetic materials and superconductors using a variety of facilities in North America and Europe. As director of the U.S. Department of Energy's largest science and energy laboratory, he has an interest in advancing materials, neutron, nuclear, and computational science to drive innovation and technical solutions relevant to energy and global security. He is a Fellow of the American Association for the Advancement of Science (2001), the American Physical Society (2007), and the Neutron Scattering Society of America (2010). He also holds honorary doctorates from Dalhousie University (2011) and McMaster University (2013).

Thom and his wife, Jennifer MacGillivray, also a native of Nova Scotia, live in Oak Ridge. They have two sons, William and Simon.

DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the U.S. House of Representatives for the 114th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), or contracts or payments originating with a foreign government, received during the current and two previous calendar years either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. This form is intended to assist witnesses appearing before the House Committee on Armed Services in complying with the House rule. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number) will be made publicly available in electronic form not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary.

Witness name: Thomas Edward Mason

Capacity in which appearing: (check one)

○ Individual

◉ Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: Oak Ridge National Laboratory

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, please provide the following information:

2015

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
UT-Battelle, LLC	U.S. Department of Energy	$1.4B	Management and operation of ORNL
Contract DE-AC05-00OR22725			

2014

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
UT-Battelle, LLC	U.S. Department of Energy	$1.4B	Management and operation of ORNL
Contract DE-AC05-00OR22725			

2013

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
UT-Battelle, LLC	U.S. Department of Energy	$1.4B	Management and operation of ORNL
DE-AC05-00OR22725			

Foreign Government Contract or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or payments originating from a foreign government, please provide the following information:

2015

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2014

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2013

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

DOCUMENTS SUBMITTED FOR THE RECORD

OCTOBER 7, 2015

Kelly Trice
President, Power

CB&I
128 S. Tryon Street, Suite 1000
Charlotte, NC 28202
Tel: +1 980-321-8790
kelly.trice@cbi.com

October 9, 2015

Congressman Joe Wilson
2229 Rayburn House Office Building
Washington, DC 20515-4002

Dear Congressman Wilson,

Thank you for all that you have done for the Mixed Oxide (MOX) Project at Savannah River Site. Your efforts, and those of your staff, have kept the project alive. We have never stopped construction, even in hard times, and continue an exemplary safety and quality record.

We recently surpassed 23 million safe work hours without a lost day due to injury, have received the Nuclear Regulatory Commission's highest rating for five years in a row, and have never had an environmental violation since the start of construction. We currently have approximately 1, 800 men and woman working on the MOX Project, and they are proud to be part of a team that is building such an important national security facility. Businesses in 43 states have contributed or are currently contributing to the project.

I'd like to set the record straight on some issues that were discussed at the congressional hearing earlier this week.

The main MOX facility that CB&I AREVA MOX Services is constructing has a rework rate, which is less than typical large projects. According to industry studies, on a typical project, rework costs between 2 percent and 20 percent of the project cost. The MOX project record shows that rework cost is less than 0.5 percent. In total, the rework on this project has been approximately $8 million of the $4.5 billion spent to date and we continually work with the craft personnel to improve this performance.

The MOX facility is more than *two-thirds complete*, at just over 68 percent. When we say the project is over 68 percent complete, we mean what most people would think of as complete – *engineered, procured, and physically built*. That's according to a certified Earned Value Management System in place measuring progress.

Through sometimes difficult circumstances we are getting the job done. While more money would certainly speed up construction, we have been able to build and complete 4 percent of the structure every year at $345 million, proving that we can indeed make progress at that level. Our goal next year is to exceed 75 percent physically complete.

We intend on continuing construction of this critical facility to the plutonium disposition mission as long as Congress authorizes and funds the work. Our hallmarks are safety, quality and professionalism, and we will continue bringing those attributes every day as we support our client and finish the job.

Again, many thanks for your support. Please feel free to call or email me any time.

Sincerely,

Kelly Trice
President, CB&I Power
128 South Tryon Street
Suite 1000
Charlotte, NC 28202

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

OCTOBER 7, 2015

RESPONSE TO QUESTIONS SUBMITTED BY MR. ROGERS

General KLOTZ. Following the Cold War, the United States stopped producing plutonium for weapons purposes and, as such, no longer assigns a value for the plutonium. Dealing with the environmental legacy of the Cold War remains a significant challenge, but the Department of Energy (DOE) is committed to cleaning up the environmental legacy of nuclear weapons production by decontaminating and decommissioning facilities that provide no further value, remediating soil and ground water contaminated with radioactive and hazardous constituents, and fulfilling its commitments to reduce risk and complete cleanup across all DOE sites. [See page 29.]

RESPONSE TO QUESTION SUBMITTED BY MR. FORBES

Dr. MASON. The current administrative capacity of the Waste Isolation Pilot Plant (WIPP), as established by the Land Withdrawal Act (LWA), is 6.2 million cubic feet (176,000 cubic meters) of waste, although a much greater capacity is physically possible. According to subject matter experts interviewed by the Plutonium (Pu) Disposition Red Team (Red Team) at WIPP, this administrative capacity limit was derived from the U.S. Department of Energy's (DOE) early estimates of a transuranic (TRU) waste disposal rate over the course of the then-anticipated WIPP operating life. The current method for volume accounting established in the WIPP Resource, Conservation, and Recovery Act (RCRA) permit is based on the external container volume, regardless of how much waste is actually contained within that volume. Thus, of the 176,000 m^3 capacity, approximately 91,000 m^3 of waste (based on the sum of external container volumes) has already been emplaced. Of the 85,000 m^3 left, 60,000 m^3 are already subscribed to other DOE programs based on waste forecasts from around the DOE complex, leaving just 25,000 m^3 to potentially host the dilute and dispose Pu disposition option without modifying the LWA.

If criticality control overpacks (CCOs, see Figure 1) with a 380 g fissile material limit are used as an authorized payload container within the TRUPACT–II, and Pu is blended to less than 10% by mass, then the 34 MT of excess Pu discussed in the Pu Management and Disposition Agreement (PMDA) would be packaged into approximately 89,500 CCOs, each taking up 55 gallons of WIPP's administrative capacity despite the fact that only a small percentage of the container volume is actually waste (see Figure 1). In total, approximately 18,600 m^3 of the remaining 25,000 m^3 of unsubscribed remaining capacity would be utilized (about 75%).

However, this assumes no buffer in the fissile gram loading, and the Red Team learned that it is more likely that an administrative limit of 300–320 g per CCO would be used to ensure compliance with the package limit. With a conservative 300 g limit, 23,600 m^3 would be utilized at WIPP. After adding ancillary TRU waste generated during processing, one could reasonably conclude that all of the remaining 25,000 m^3 of unsubscribed remaining WIPP administrative capacity would be utilized by the dilute and dispose option. Thus, in theory no modification of the LWA would be needed to support the dilute and dispose option.

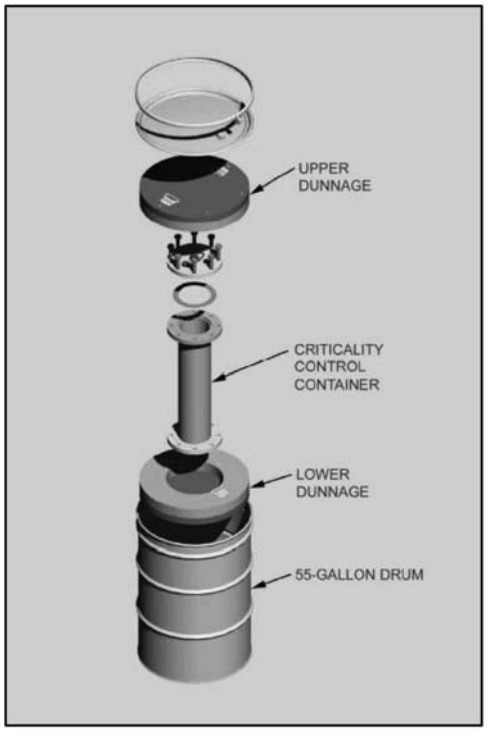

Figure 1: The Criticality Control Overpack

However, as discussed in the Red Team report, there may not yet be a full accounting of volumes of future TRU waste requiring disposal at WIPP. Thus, it would be wise to preserve as much of the existing capacity as possible to support on-going and future programs beyond the immediate Pu Disposition Program. One option for doing this could potentially be within the control of the Pu Disposition Program: Increasing Pu loading per container. The Pu Disposition Working Group (PDWG) report discussed this augmentation of the dilute and dispose option in some detail, and the Red Team described it as a potential efficiency improvement that could be implemented at any point during a dilute and dispose project. In brief, the PDWG report suggested that individual container loading up to 1 kg of Pu could be feasible, albeit with certain security considerations. This larger quantity of blended plutonium would be packaged into 35-gallon 9975 Type B shipping containers for shipment instead of CCOs. Assuming an administrative limit of 900 g per 9975 container, only about 6,000 m^3 (about 24%) of the remaining unsubscribed administrative capacity at WIPP would be utilized (including ancillary waste), leaving the rest to support future DOE operations, and far fewer shipment and handling evolutions would be required. However, the 9975 container would require certification for shipment to WIPP, and the quantity of material involved in each shipment may require additional safeguards and security measures which could offset some of the cost savings. Even without any cost savings though, the preservation of valuable existing WIPP administrative capacity would be worth investigating the feasibility of this potential enhancement.

A technically simpler and less expensive approach would be to change the current method of accounting for waste volume disposed at WIPP. WIPP subject matter experts have estimated that a typical disposed container may only be filled to less than 70% of its volume, often due to other limitations. In the case of CCOs, only a maximum of 3.3 gallons of the 55-gallon CCO volume would actually contain waste material. The rest is interior packaging and dunnage. A Class III RCRA permit modification allowing capacity accounting at WIPP to be based on actual waste

volume instead of external container volume would greatly increase the available remaining administrative capacity at WIPP (by nearly 90%) after excess Pu disposition is completed, as shown in Figure 2.

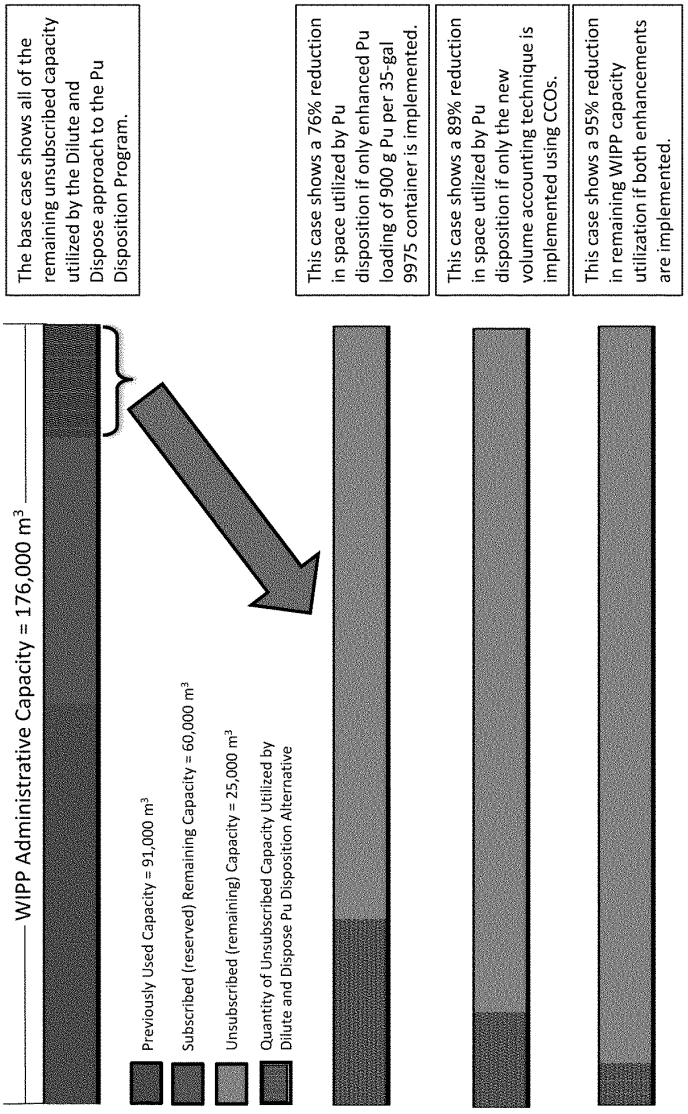

Figure 2: Effect of Different Enhancements of the Base Dilute and Dispose Option on WIPP Space Utilization

While it was evident to the Red Team that modification of the LWA is not a prerequisite to implementation of the dilute and dispose alternative, without implementing the enhancements discussed above there is a risk that Pu disposition may eventually stimulate such a consideration. It is important to realize, however, that the dilution process would take many years to complete. Thus, even if the diluted volume ultimately threatens to exceed the remaining administrative capacity at WIPP under the LWA, mitigating actions, such as the improvement of disposal efficiency via higher Pu loading per container or an enhanced volume accounting tech-

nique at WIPP, would not have to be executed in the near term. But the Red Team noted that these kinds of enhancements should be implemented as a matter of national policy regardless of the excess Pu disposition approach in order to preserve WIPP as a national resource. Efforts to improve container volume utilization and/or WIPP volume accounting practices are best implemented as soon as possible to optimize the utilization of precious WIPP disposal space. [See page 13.]

RESPONSE TO QUESTIONS SUBMITTED BY MR. GARAMENDI

Mr. MACWILLIAMS. The Department of Energy is providing a copy of the April 2014 Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options, which includes the unconstrained funding case for the fast reactor option for plutonium disposition in Appendix B. [The report is retained in committee files and can be viewed upon request. The report is also available at http://www.nnsa.energy.gov/sites/default/files/nnsa/04-14-inlinefiles/SurplusPuDispositionOptions.pdf] [See page 33.]

RESPONSE TO QUESTIONS SUBMITTED BY MR. NORCROSS

Mr. MACWILLIAMS. There have been two NNSA-directed changes to the U.S. MOX Fuel Fabrication Facility (MFFF) project. In 2010, a change to the facility was requested by MOX Services and approved by NNSA to allow for the manufacture of multiple types of MOX fuel. The modifications would provide MFFF with the capability to produce fuel for both Boiling Water Reactors (BWR) and Pressurized Water Reactors (PWR) as well as the next generation of nuclear reactors. The contract with MOX Services was modified in December 2010 to add this scope of work for a cost of $34 million. In addition, part of the Pit Disassembly and Conversion Facility (PDCF) scope was identified to be added to the MFFF. The $242 million estimate for adding this work to the MFFF was included in the 2012 Baseline Change Proposal but has not been added to the contract. It is important to note that this is a design-build contract in which MOX Services initiates design changes as it completes design. One of the lessons learned by the Department from this project and other projects is ensuring that the design is at least 90 percent complete before baselining complex nuclear work. Since this project was baselined, MOX Services has made approximately 33,050 design changes as they have completed their design due to design maturity issues, discovery of design omissions, and constructability issues. The design changes initiated by MOX Services have had a much larger impact on total project cost than the Department's requested changes. [See page 21.]

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

OCTOBER 7, 2015

QUESTIONS SUBMITTED BY MR. GARAMENDI

Mr. GARAMENDI. Did you consider the use of existing Fast Reactor technology, such as the Russian BN–800, when doing your analysis of Advanced Disposition Reactors? If not, why not?

General KLOTZ and Mr. MACWILLIAMS. Yes, in the Department's April 2014 Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options, the Department analyzed the use of a fast reactor. The Department used the DOE-owned Advanced Liquid Metal Reactor design as a reference case for the analysis.

Mr. GARAMENDI. Did you discuss the use of PRISM reactors with GE during the course of your analysis of Advanced Disposition Reactors? If not, why not?

General KLOTZ and Mr. MACWILLIAMS. The Plutonium Disposition Working Group considered using the GE-owned design as a data point. However, inclusion of the GE-owned design may have adversely impacted GE's ability to compete in a future procurement if that option was ultimately pursued. Thus, the Department used DOE-owned Advanced Liquid Metal Reactor design information as a reference case in the fast reactor analysis. In addition, the Department performed reactor core design work to optimize the plutonium disposition aspects of the reference case.

Mr. GARAMENDI. Did you consider the use of existing Fast Reactor technology, such as the Russian BN–800, when doing your analysis of Advanced Disposition Reactors? If not, why not?

Dr. MASON. The Pu Disposition Red Team considered fast reactor technology as a potential alternative to the MOX baseline approach, but elected not to include it in the options for more detailed analysis: "An early consensus was struck within the Red Team on the ability to screen out most alternative approaches to Pu disposition based on the available background reading … The [Advanced Disposition Reactor] ADR option involves a capital investment similar in magnitude to the MFFF but with all of the risks associated with first-of-a kind new reactor construction (e.g., liquid metal fast reactor), and this complex nuclear facility construction has not even been proposed yet for a Critical Decision (CD)-0. Choosing the ADR option would be akin to choosing to do the MOX approach all over again, but without a directly relevant and easily accessible reference facility/operation (such as exists for MOX in France) to provide a leg up on experience and design." To reach this conclusion, the Red Team received a detailed briefing from Deputy Assistant Secretary John Herczeg of DOE's Office of Nuclear Energy on the ADR option ("The Advanced Disposition Reactor Study: An Analysis of Plutonium Disposition Options Using Advanced Fast Reactors, July 10, 2015"), and consulted an extensive library assembled specifically for the Red Team, including the following relevant documents:

- DOE Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options, April 2014 (Final Options Report)
- Excess Plutonium Disposition: The Failure of MOX and the Promise of Its Alternatives, E.S. Lyman, December 2014
- Alternatives to MOX: Direct-disposal options for stockpiles of separated plutonium, F. von Hippel and G. MacKerron, International Panel on Fissile Materials, April 2015
- Management and Disposition of Excess Weapons Plutonium, Committee on International Security and Arms Control, National Academy of Sciences report, 1994 (NAS Report on Management and Disposition of Excess Weapon Pu)
- Business Case, DOE's Proposed Baseline Approach for Disposing of Surplus Plutonium, April 2007 (Plutonium Disposition Business Case FINAL—April 30, 2007)
- Progress on approaches to the management of separated plutonium—Position paper, Nuclear Decommissioning Authority, January 2014
- DOE/MD–0002, Summary Report of the Screening Process To Determine Reasonable Alternatives For Long-Term Storage And Disposition Of Weapons-Usable Fissile Materials, DOE Office of Fissile Materials Disposition, March 29, 1995

- 2010 PMDA Protocol—Protocol to the 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
- (OUO) SE&PID–13–0003, Revision D, Preliminary Program Execution Plan for the National Nuclear Security Administration Fissile Materials Disposition Program, July 31, 2013
- 2014 Plutonium Disposition Working Group Analysis of Surplus Weapon-Grade Plutonium Disposition Options, presentation by Sachiko McAlhany, July 8, 2015
- UK Plutonium Disposition Programme Overview, presentation by United Kingdom National Nuclear Laboratory, July 2014

We examined the fast reactor option generically without focusing on any one reactor design such as the Russian BN–800 or GE PRISM designs referenced in the questions. Our conclusions about the level of detail on cost, licensing, and overall feasibility as well as the observation that switching to a fast reactor option implies construction of both a fast reactor and a MOX Fuel Fabrication Facility with the resulting implications for overall program cost are not affected by the specific fast reactor design considered.

Mr. GARAMENDI. Did you discuss the use of PRISM reactors with GE during the course of your analysis of Advanced Disposition Reactors? If not, why not?

Dr. MASON. The Pu Disposition Red Team considered fast reactor technology as a potential alternative to the MOX baseline approach, but elected not to include it in the options for more detailed analysis: "An early consensus was struck within the Red Team on the ability to screen out most alternative approaches to Pu disposition based on the available background reading . . . The [Advanced Disposition Reactor] ADR option involves a capital investment similar in magnitude to the MFFF but with all of the risks associated with first-of-a kind new reactor construction (e.g., liquid metal fast reactor), and this complex nuclear facility construction has not even been proposed yet for a Critical Decision (CD)-0. Choosing the ADR option would be akin to choosing to do the MOX approach all over again, but without a directly relevant and easily accessible reference facility/operation (such as exists for MOX in France) to provide a leg up on experience and design." To reach this conclusion, the Red Team received a detailed briefing from Deputy Assistant Secretary John Herczeg of DOE's Office of Nuclear Energy on the ADR option ("The Advanced Disposition Reactor Study: An Analysis of Plutonium Disposition Options Using Advanced Fast Reactors, July 10, 2015"), and consulted an extensive library assembled specifically for the Red Team, including the following relevant documents:

- DOE Report of the Plutonium Disposition Working Group: Analysis of Surplus Weapon-Grade Plutonium Disposition Options, April 2014 (Final Options Report)
- Excess Plutonium Disposition: The Failure of MOX and the Promise of Its Alternatives, E.S. Lyman, December 2014
- Alternatives to MOX: Direct-disposal options for stockpiles of separated plutonium, F. von Hippel and G. MacKerron, International Panel on Fissile Materials, April 2015
- Management and Disposition of Excess Weapons Plutonium, Committee on International Security and Arms Control, National Academy of Sciences report, 1994 (NAS Report on Management and Disposition of Excess Weapon Pu)
- Business Case, DOE's Proposed Baseline Approach for Disposing of Surplus Plutonium, April 2007 (Plutonium Disposition Business Case FINAL—April 30, 2007)
- Progress on approaches to the management of separated plutonium—Position paper, Nuclear Decommissioning Authority, January 2014
- DOE/MD–0002, Summary Report of the Screening Process To Determine Reasonable Alternatives For Long-Term Storage And Disposition Of Weapons-Usable Fissile Materials, DOE Office of Fissile Materials Disposition, March 29, 1995
- 2010 PMDA Protocol—Protocol to the 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
- (OUO) SE&PID–13–0003, Revision D, Preliminary Program Execution Plan for the National Nuclear Security Administration Fissile Materials Disposition Program, July 31, 2013
- 2014 Plutonium Disposition Working Group Analysis of Surplus Weapon-Grade Plutonium Disposition Options, presentation by Sachiko McAlhany, July 8, 2015
- UK Plutonium Disposition Programme Overview, presentation by United Kingdom National Nuclear Laboratory, July 2014

We examined the fast reactor option generically without focusing on any one reactor design such as the Russian BN–800 or GE PRISM designs referenced in the questions. Our conclusions about the level of detail on cost, licensing, and overall feasibility as well as the observation that switching to a fast reactor option implies construction of both a fast reactor and a MOX Fuel Fabrication Facility with the resulting implications for overall program cost are not affected by the specific fast reactor design considered.

QUESTIONS SUBMITTED BY MR. WILSON

Mr. WILSON. in your reply to the question of what $345 million a year for MOX Fuel Fabrication Facility construction "would buy," you stated "nothing." However, 1,800 men and women are currently at work on the MOX Project, the physical structure being completed, glove boxes being delivered, tested and installed, progress being made even at the rate of $345 million per year. How does your statement square with MOX Services' claim that 4 percent construction progress has been made per year even at $345 million, and that the facility is nearing 70 percent construction completion this year—which until recently DOE has defined as engineered, procured and physically built according to a certified Earned Value Management System? In fact, in testimony earlier this year, General Klotz stated that that construction of the MOX Fuel Fabrication Facility is "over 60 percent" complete, but you now claim 35 to 41 percent. Why has DOE changed its definition of percentage completion to one based on DOE's estimated costs to complete—is there any basis for this metric, and does DOE define project percentage completion for any other construction project by this basis, such as for UPF? If in fact 4 percent construction progress is being made at $345 million per year, even by the most conservative measures wouldn't construction be MFFF complete in under 10 years, not in more than 50 years?

Mr. MACWILLIAMS. Standard Earned Value Management practice measures project completion percentage by dividing the value of work completed against the total budget to complete a project. Given the latest estimates of total cost to complete the project, the lowest case is $9.4 billion and the highest case is $21 billion. Assuming that the $4.5 billion spent to date was all earned towards project completion, the percent completion is 21–48 percent.

Additionally, MOX Services' June 30, 2013 estimate, at $350 million annual funding assumption without the additional project scope needed to oxidize metal, was $9.4 billion. Given this estimate, and in accordance with MOX Services' earned value reporting, the MOX project is significantly less than the 70 percent complete.

Mr. WILSON. In your testimony you claim that by DOE's measure, the MOX Project has a rework rate of 25 percent. Would you explain how you get to those figures? According to industry studies, on a typical project, rework costs between 2 percent and 20 percent of the project cost, but the MOX Project record shows that the rework cost to date is less than 0.5 percent—far less than that which is typical of large construction projects. In fact, the rework on this project has been approximately $8 million of the $4.5 billion spent to date. Do you care to comment on this discrepancy?

Mr. MACWILLIAMS. Until recently, MOX Services has not tracked re-work. Based on field observations, NNSA believed that there was significant re-work that needed to be better managed. In the fiscal year (FY) 2015 Award Fee Plan, NNSA included a specific criterion for rework to drive the management and minimization of unnecessary rework. In anticipation of the Award Fee criterion, MOX Services issued the initial version of a procedure for the tracking and trending of re-work in September 2014. The $8 million reported for re-work was only for re-work in direct accounts in FY 2015. Supporting work (e.g., engineering, construction management, quality assurance) is not tracked and would be in addition to the $8 million. HVAC, pipe and electrical were the primary commodities being installed in FY 2015 and these items had a re-work rate of approximately 25 percent. These re-work rates are significantly higher than what MOX Services is utilizing in their budget projections, which included a re-work rate of 2.5 percent.

Mr. WILSON. In 2013, DOE and the contractor completed a critical milestone in the advancement of the mission of the MOX Fuel Fabrication Facility with finalization of the Blanket Commercial Agreement (BCA), providing the necessary framework from which AREVA can begin negotiating contracts for MOX fuel sales with U.S. nuclear utilities. However, while DOE has claimed that no customers have signed contracts for the fuel that will be produced by the MOX Fuel Fabrication Facility, to date DOE has refused to sign the BCA that will allow the contractor to negotiate those very sales contracts. In fact, several U.S. utilities have invited the

contractor to discuss the purchase of MOX fuel once the BCA is signed, and the Red Team agrees that there will be customers for the MOX fuel—sales for which would provide a significant benefit to American ratepayers and offset some of the costs of the non-proliferation program. Why does DOE refuse to sign the BCA?

Mr. MACWILLIAMS. NNSA negotiated and finalized a blanket commercial agreement with Areva to market the fuel that would be fabricated at the U.S. MOX Fuel Fabrication Facility to Areva's customers. However, NNSA has deferred signing the agreement since the Department is currently analyzing options to complete the plutonium disposition program more efficiently.

Areva has indicated that it has identified U.S. utilities interested in MOX fuel, but thus far will not share the names of the utilities with the Department despite repeated requests and the Department's offer to sign a nondisclosure agreement. Regardless, depending on the uranium market prices, the Department has calculated the potential revenue stream from the sale for MOX fuel to be between $500 million and $1 billion over the lifetime of a program with a total cost exceeding $30 billion.