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Report to the Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives

October 2010

NUCLEAR WEAPONS

National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile

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GAO-11-100

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Highlights

Highlights of GAO-11-100, a report to the Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives

NUCLEAR WEAPONS

National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile

Why GAO Did This Study

The National Nuclear Security Administration's (NNSA) Tritium Readiness Program aims to establish an assured domestic source of tritium—a key isotope used in nuclear weapons—in order to maintain the U.S. nuclear weapons stockpile. Because tritium decays at a rate of 5.5 percent annually, it must be periodically replenished in the stockpile. However, since 2003, NNSA's efforts to produce tritium have been hampered by technical challenges. In this context, GAO was asked to (1) determine the extent to which NNSA has been able to overcome technical challenges producing tritium, (2) determine the extent to which NNSA is able to meet current and future nuclear weapons stockpile requirements for tritium, and (3) assess the management of NNSA's Tritium Readiness Program. To do this, GAO visited facilities involved in tritium production and reviewed tritium requirements established by NNSA and the Department of Defense, among other things.

What GAO Recommends

GAO recommends that NNSA develop a plan to manage tritium releases from reactors, analyze alternatives to its current tritium production strategy, ensure its contracting complies with appropriate contracting procedures, and ensure its future budget requests account for the program's large unexpended balances. NNSA generally agreed with our recommendations.

View GAO-11-100 or key components.
For more information, contact Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

What GAO Found

NNSA has been unable to overcome the technical challenges it has experienced producing tritium. To produce tritium, stainless steel rods containing lithium aluminate and zirconium —called tritium-producing burnable absorber rods (TPBAR)—are irradiated in the Tennessee Valley Authority's (TVA) Watts Bar 1 commercial nuclear power reactor. Despite redesigns of several components within the TPBARS, tritium is still leaking—or "permeating"—out of the TPBARs into the reactor's coolant water at higher-than-expected rates. Because the quantities of tritium in the reactor coolant are approaching regulatory limits, TVA has been significantly restricting the number of TPBARs that it will allow NNSA to irradiate in each 18-month reactor fueling cycle, and, consequently, NNSA has not been producing as much tritium as it planned. NNSA and TVA officials are continuing to develop plans to increase the number of TPBARs that will be irradiated, as well as, if necessary, the number of reactors participating in the program. However, these plans have not been coordinated with the Nuclear Regulatory Commission (NRC), which ultimately must approve any changes to the operation of the TVA reactors.

NNSA currently meets the nuclear weapons stockpile requirements for tritium, but its ability to do so in the future is in doubt. NNSA officials told us that they will be able to meet future requirements through a combination of harvesting tritium obtained from dismantled nuclear warheads and irradiating TPBARs. Although the number of nuclear weapons in the U.S. stockpile is decreasing, these reductions are unlikely to result in a significant decrease of tritium requirements and will not eliminate the need for a reliable source of new tritium because of the need to periodically replenish it in the remaining nuclear weapons stockpile due to tritium's decay. While NNSA has not, to date, been required to use tritium from a reserve that it maintains, use of this reserve in the relatively near future may be necessary if NNSA is unable to increase tritium production beyond its current level.

Although NNSA has attempted to ensure a reliable long-term supply of tritium, GAO's review found two problems with NNSA's management of the Tritium Readiness Program. First, NNSA could not provide us with evidence that it adhered to the appropriate contracting procedures when purchasing components and services for the program. Second, due to, among other things, the way the program's contracts with its suppliers are structured, the program is spending its funds more slowly than planned and is accumulating large unexpended balances. The program is subject to thresholds established by the Department of Energy of acceptable levels of unexpended funds that may be carried over from one fiscal year to the next. However, the program exceeded these thresholds by more than $48 million in 2008 and by more than $39 million in 2009. While large unexpended balances are not necessarily an indication that the program is being mismanaged, it does indicate that the program is requesting more funding than it needs on an annual basis—funds that could be appropriated for other purposes.

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Abbreviations

DOD	Department of Defense
DOE	Department of Energy
NNSA	National Nuclear Security Administration
NRC	U.S. Nuclear Regulatory Commission
SRS	Savannah River Site
TVA	Tennessee Valley Authority
TPBAR	tritium-producing burnable absorber rod

Accountability * Integrity * Reliability
United States Government Accountability Office
Washington, DC 20548

October 7, 2010

The Honorable James R. Langevin
Chairman
The Honorable Michael R. Turner
Ranking Member
Subcommittee on Strategic Forces
Committee on Armed Services
House of Representatives

The National Nuclear Security Administration (NNSA), a separately organized agency within the Department of Energy (DOE), is working to re-establish the country's capability to produce tritium—a key radioactive isotope used to enhance the power of nuclear warheads and bombs. Because tritium has a relatively short half-life of 12 years and therefore decays at a rate of about 5.5 percent per year, tritium in existing weapons must be periodically replenished, and an assured source of tritium is necessary to maintain the U.S. nuclear weapons stockpile. During the Cold War, tritium was produced in nuclear reactors at DOE's Savannah River Site (SRS) in South Carolina and the Hanford Site in Washington. However, due to safety concerns, the last reactor used for tritium production was shut down in 1988. Since that time, as the United States decreased the size of its nuclear arsenal, NNSA has been able to meet its tritium requirements by harvesting and recycling it from dismantled nuclear warheads. However, because of tritium's short half-life, NNSA cannot meet its tritium needs in this manner indefinitely and is attempting to re-establish new tritium production.

Nuclear weapons stockpile requirements for tritium are established jointly by the Department of Defense (DOD) and NNSA. To meet these requirements, the Tritium Readiness Program was established in 1996. It is now a subprogram of NNSA's Readiness Campaign that develops nuclear weapons component manufacturing technologies. The Tritium Readiness Program operates with an annual budget of about $70 million.

To produce tritium, stainless steel rods containing lithium aluminate and zirconium—called tritium-producing burnable absorber rods (TPBAR)—are irradiated in the Tennessee Valley Authority's (TVA) Watts Bar 1 commercial nuclear power reactor in Tennessee. Once inserted into the reactor core during refueling, the TPBARs are irradiated for approximately 18 months, after which they are transported to SRS, where they are processed in a specialized facility to extract the tritium and prepare it for nuclear warheads. However, since the first regular production TPBARs were irradiated in TVA's reactor in 2003, NNSA has experienced technical challenges. Specifically, tritium has been leaking—or "permeating"—out of the TPBARs at higher-than-expected rates into the reactor's coolant water, where it is eventually released to the environment under controlled and monitored conditions. Although tritium decays relatively quickly and, in small amounts, poses little risk to human health and the environment, large amounts of tritium released into the environment could expose the public to slightly higher radiation doses. To ensure that any releases do not exceed safe amounts, releases of radioactive materials, including tritium, from nuclear power plants are regulated by the Nuclear Regulatory Commission (NRC) using limits established by the Environmental Protection Agency.

In this context, in response to your request that we review the Tritium Readiness Program, we (1) determined the extent to which NNSA has been able to overcome technical challenges producing tritium, (2) determined the extent to which NNSA is able to meet current and future nuclear weapons stockpile requirements for tritium, and (3) assessed the management of NNSA's Tritium Readiness Program.

Scope and Methodology

To determine the extent to which NNSA has been able to overcome technical challenges producing tritium, we visited and interviewed officials from the Pacific Northwest National Laboratory, where the TPBARs were designed and where work continues to overcome technical problems, and WesDyne Corporation, NNSA's contractor that fabricates the TPBARs. In addition, we reviewed TVA tritium management plans and reports. We examined amendments to TVA's operating license for the Watts Bar plant issued by NRC that approved TVA's irradiation of TPBARs. We also reviewed relevant NRC regulations and documents related to TVA tritium activities and interviewed officials from NRC and the Defense Nuclear Facilities Safety Board, an independent agency established in 1988 to oversee the safety of DOE's nuclear facilities. We also visited and interviewed officials at TVA's Watts Bar 1 nuclear power plant, where TPBARs are irradiated, and SRS, where the TPBARs are processed to extract tritium for nuclear warheads.

To determine the extent to which NNSA is able to meet current and future nuclear weapons stockpile requirements for tritium, we reviewed NNSA's tritium production plans as well as requirements documents prepared by DOD and NNSA, such as the 2010 Nuclear Posture Review. We also reviewed NNSA's strategic plans for the Tritium Readiness Program, including program execution and implementation plans; past and planned schedules for completing TPBAR fabrication, transportation, irradiation, and extraction activities; and the program's risk management plan. We also interviewed NNSA officials responsible for developing these plans.

Finally, to assess the management of NNSA's Tritium Readiness Program, we reviewed contracts between NNSA and WesDyne, as well as budget and expenditure data obtained from DOE's Office of Programming, Planning, Budget, and Evaluation. In addition, we examined past expenditure projections, contracts and subcontracts for TPBAR fabrication, and NNSA's planned and actual work schedules for conducting and completing TPBAR fabrication, transportation, irradiation, and extraction activities. We determined that the data used was sufficiently reliable for the purposes of our report. We conducted this performance audit from October 2009 to September 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Tritium is a radioactive isotope of hydrogen that exists naturally in the environment, but in amounts that are too small for practical recovery. Tritium is produced artificially when lithium-6 is bombarded with neutrons (particles within an atom that have no electrical charge) in the core of a nuclear reactor. When present in the center of a nuclear weapon at the instant of its detonation, tritium undergoes nuclear fusion, releasing enormous amounts of energy and significantly increasing the explosive power, or "yield," of the weapon.[1]

From 1954 until 1988, the United States produced the majority of its tritium using nuclear reactors at SRS.[2] When the last of SRS's reactors ceased operations for safety reasons in 1988, the United States lost its capability to produce tritium for the nuclear weapons stockpile. In August

[1]Nuclear fusion—the reaction that powers the sun—occurs when extreme temperatures and pressures force the nuclei of two or more atoms together.

[2]Smaller amounts of tritium were also produced using nuclear reactors at DOE's Hanford Site in Washington.

1993 we reported that significant reductions in the U.S. nuclear weapons stockpile as a result of, among other things, arms reduction treaties signed with Russia would result in sufficient supplies of tritium through 2012 without the need to produce any new tritium.[3] We reported, however, that after that date a new source of tritium would be required for the stockpile.

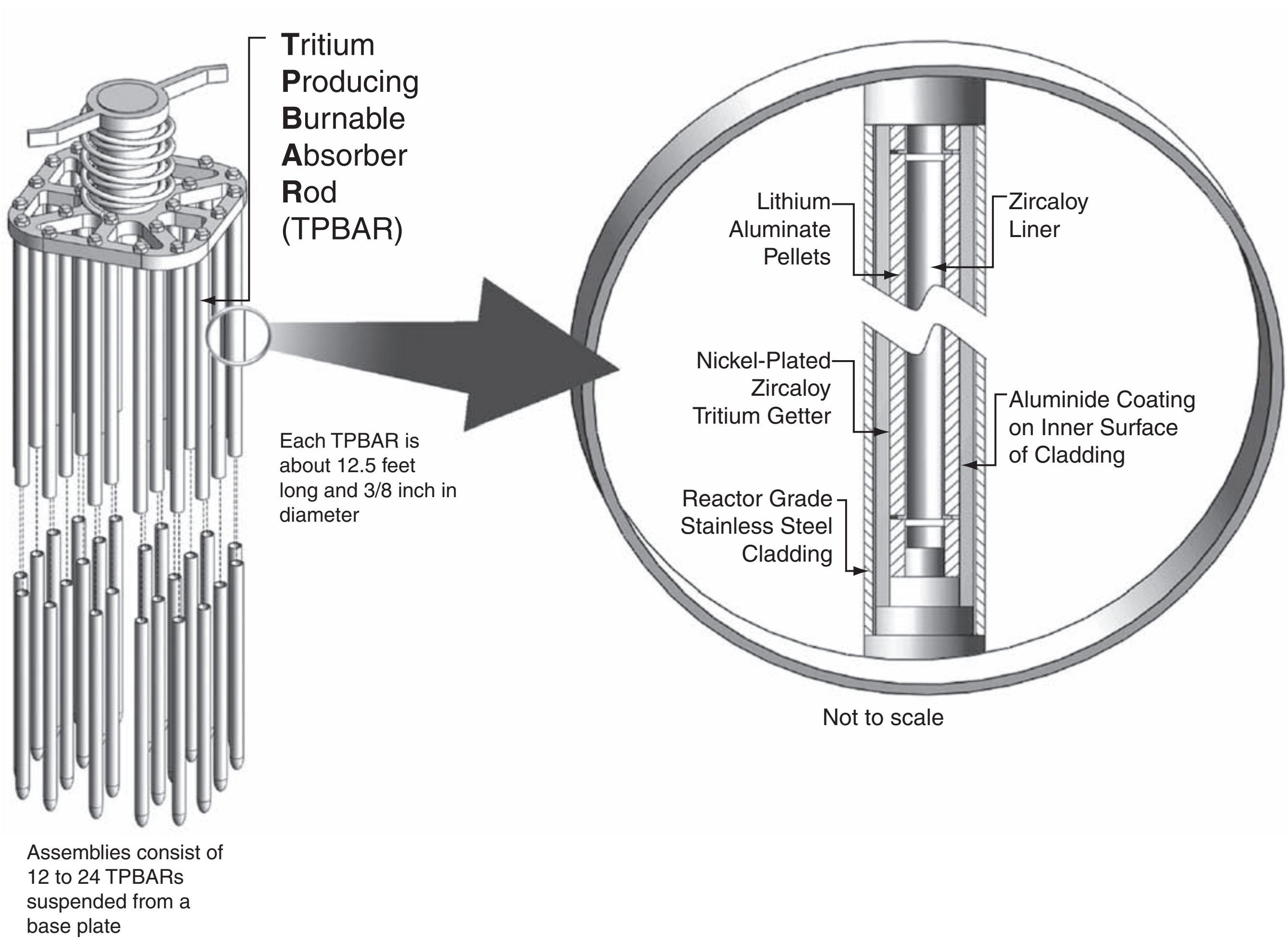
To re-establish the nation's tritium production capability, NNSA's predecessor—DOE's Office of Defense Programs—studied two different approaches to make tritium. The first involved building an accelerator to produce tritium. This device would accelerate protons (particles within an atom that have a positive electrical charge) to nearly the speed of light. The protons would be crashed into tungsten, releasing neutrons through a process called spallation, which can be used to change helium into tritium. After extensive research and development of accelerator-based tritium production technology, DOE abandoned this approach.[4]

The second approach DOE pursued was to produce tritium using commercial nuclear power reactors. In such a reactor, components called burnable absorber rods are used to control the reactivity of the core in a nuclear reactor during power production. With the support of Sandia National Laboratories and the Idaho National Laboratory using Idaho's Advanced Test Reactor, the Pacific Northwest National Laboratory designed a new rod—called a TPBAR—that could be substituted for standard burnable absorber rods in the reactor. As the commercial reactor produces power, the TPBARs are irradiated, controlling the nuclear reaction while simultaneously producing tritium. The tritium produced within the TPBAR is stored within the rod by a nickel-plated component known as a "getter." (See figure 1.)

[3]GAO, *Nuclear Materials: Nuclear Arsenal Reductions Allow Consideration of Tritium Production Options*, GAO/RCED-93-189 (Washington, D.C.: Aug. 17, 1993).

[4]For additional information on accelerator-based tritium production, see GAO, *Nuclear Science: Consideration of Accelerator Production of Tritium Requires R&D*, GAO/RCED-92-154 (Washington, D.C.: June 15, 1992).

Figure 1: Diagram of a TPBAR



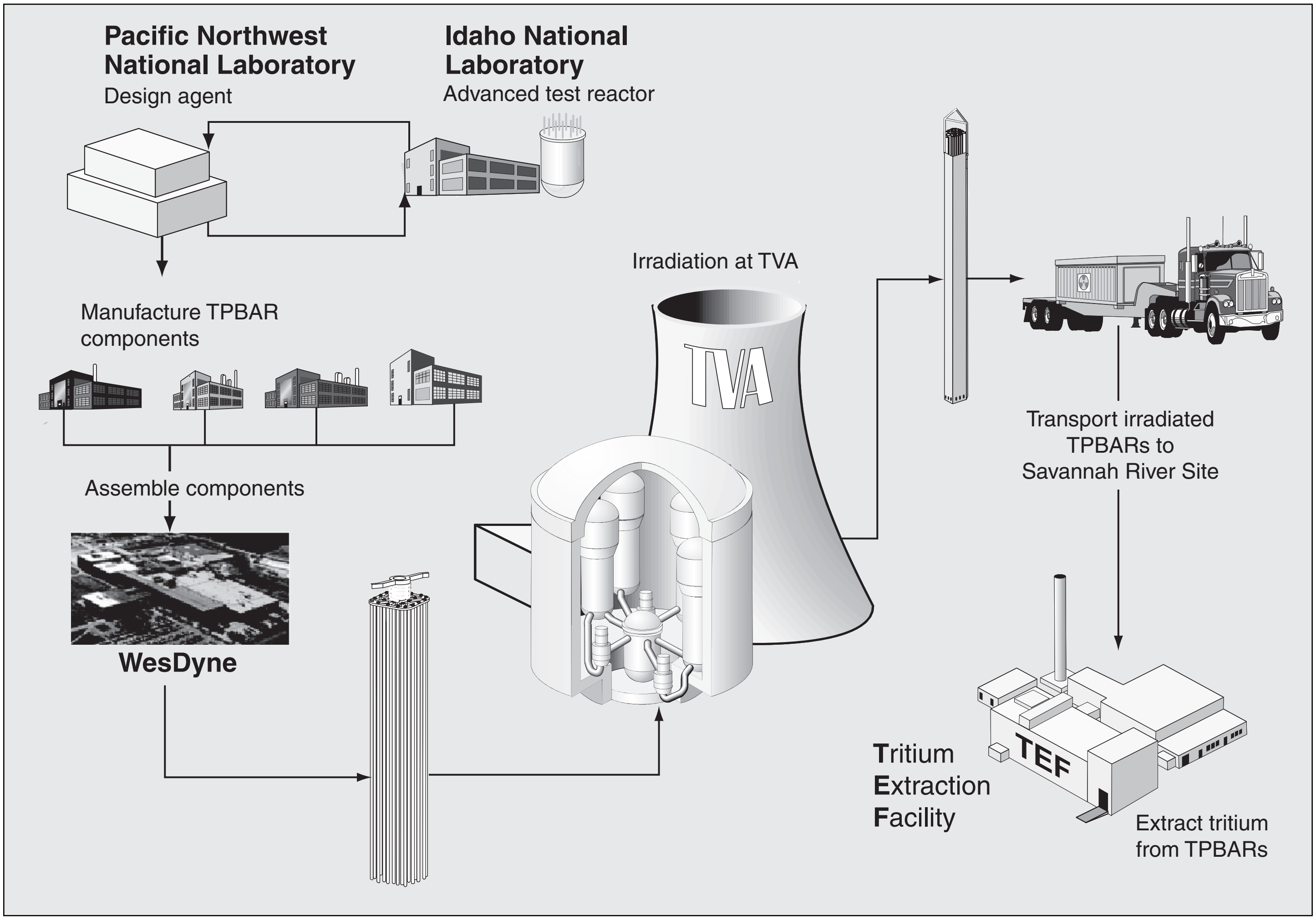
Source: NNSA.

In 1999 DOE entered into an interagency agreement with TVA to irradiate TPBARs in TVA's Watts Bar and Sequoyah nuclear power reactors. DOE, and subsequently NNSA after its establishment in 2000, pays TVA an irradiation fee as well as reimburses TVA for any additional costs associated with TPBAR irradiation. The agreement anticipates that TVA would be paid approximately $1.5 billion for its costs over the agreement's 35-year term. To allow it to irradiate TPBARs in the reactor, TVA applied to NRC for an amendment to its operating license. After completing a safety evaluation, NRC issued a license amendment in 1997 that allowed TVA to irradiate 32 TPBARs for testing purposes and, following successful testing, issued another amendment in 2002 that allowed TVA to load up to 2,304 TPBARs in the Watts Bar 1 reactor per reactor operating cycle. In 2003 the first TPBARs intended to produce tritium for the nuclear weapons stockpile were loaded into the Watts Bar 1 reactor and were removed approximately 18 months later as part of the reactor's normal refueling cycle. To date, only the Watts Bar 1 reactor has been used to irradiate TPBARs.

The first TPBARs were fabricated by the Pacific Northwest National Laboratory, which designed the rods as well as the tritium production processes associated with them. In 2000 NNSA contracted with WesDyne International—a subsidiary of Westinghouse—to fabricate TPBARs. WesDyne procures and maintains an inventory of TPBAR components and assembles TPBARs at a Westinghouse facility in Columbia, South Carolina. This facility also supplies nuclear fuel for TVA's Watts Bar 1 reactor. The Pacific Northwest National Laboratory continues to serve as the TPBAR design agent, developing design changes as needed and supporting WesDyne's fabrication of TPBARs. The laboratory also maintains a backup capability to produce TPBARs in the event WesDyne becomes unable or unwilling to fulfill its contract with NNSA.

Once fabricated, the TPBARs are shipped to Watts Bar where they are loaded into the reactor core during a normal refueling outage. After being irradiated for approximately 18 months, the TPBARs are removed from the reactor core and, after cooling for several months, are transported to SRS. The TPBARs, which are now highly radioactive because of the time spent inside the reactor, are processed at a specialized new Tritium Extraction Facility at SRS. This facility, which began operations in 2007 at a cost of nearly $500 million, cuts the tops off the TPBARs and processes them to extract tritium. Waste from the extraction process, such as scrap pieces from cut-apart TPBARs, is permanently disposed of as low-level radioactive waste. The steps involved in NNSA's tritium production enterprise are illustrated in figure 2. Tritium extracted from TPBARs is then loaded into specially designed reservoirs that are shipped to DOD for installation into nuclear weapons. Tritium reservoirs are periodically removed from each weapon in the stockpile as part of their routine maintenance and then shipped to SRS, where any remaining tritium that has not decayed is recovered. The reservoirs are then refilled with tritium and returned to DOD.

Figure 2: NNSA's Tritium Production Enterprise



Sources: NNSA and Art Explosion (images).

NNSA Continues to Face Technical Challenges Producing Tritium

Despite the fact that the Pacific Northwest National Laboratory has redesigned several components within the TPBARs to reduce the amount of tritium permeating into the reactor coolant at the Watts Bar 1 reactor, tritium is still leaking from the TPBARs at higher-than-expected rates. As a result, significantly fewer TPBARs than planned are being irradiated in the reactor, which has considerably reduced the amount of tritium NNSA is producing. NNSA and TVA officials told us that they are developing plans to increase the number of TPBARs being irradiated and the number of reactors participating in tritium production, as well as plans to modify the reactors to better manage tritium releases to the environment. However, to date, these plans have not been actively coordinated with NRC, which ultimately must approve any modifications to reactor operations.

Tritium is Still Permeating at Higher-Than-Expected Rates From TPBARs Into the Reactor Coolant at TVA's Watts Bar 1 Reactor

NNSA has been unable to solve the technical challenges it has been experiencing producing tritium. Specifically, tritium is permeating from the TPBARs at higher-than-expected rates into the water used to cool the reactor core at TVA's Watts Bar 1 nuclear plant rather than being captured in the TPBARs as designed. Watts Bar's operating license is based on the assumption that 2,304 TPBARs would be loaded into the reactor and that tritium would permeate from the TPBARs into the reactor coolant at an average rate of 1.0 curie of tritium per year per TPBAR.[5] However, according to NNSA reports, tritium is permeating from the TPBARs at levels of up to 4.2 curies of tritium per year per TPBAR out of a total of 10,000 curies produced by one TPBAR.

To keep the total amount of tritium released into the reactor coolant below regulatory limits, TVA has limited the number of TPBARs being irradiated in the Watts Bar 1 reactor, according to TVA officials. NNSA's original plans called for irradiating 1,160 TPBARs per reactor fueling cycle by 2010 before ramping up to nearly 2,700 TPBARs per fueling cycle by 2013 using both the Watts Bar 1 reactor and TVA's Sequoyah 1 reactor. However, as a result of the tritium permeation problem, TVA currently irradiates only 240 TPBARs per fueling cycle using only the Watts Bar 1 reactor. While the interagency agreement between DOE and TVA allows NNSA to use the two Sequoyah reactors to irradiate TPBARs, TVA officials told us that TVA is reluctant to allow NNSA to use these reactors because, among other things, TVA would prefer to meet tritium requirements using only a single reactor.

The Pacific Northwest National Laboratory has redesigned several components within the TPBARs in an attempt to reduce the amount of tritium permeating into the reactor coolant. For example, national laboratory researchers have modified the nickel-plated "getter" in the TPBAR to better capture tritium within the rod. However, despite this redesign, no discernable improvement in TPBAR performance was made and tritium is still permeating from the TPBARs at higher-than-expected

[5]A curie is a measure of radioactivity equivalent to 37 billion nuclear disintegrations per second.

rates. NNSA, TVA, and national laboratory officials told us that the obvious design changes to address the tritium permeation problem have been made and that scientists and engineers charged with investigating the issue and identifying solutions have not been able to identify the root cause of the permeation problem. NNSA officials told us that it is unknown whether any technical breakthrough will be made to substantially correct the problem. However, scientists and engineers at the Pacific Northwest National Laboratory are continuing to conduct research to identify the root cause of the permeation problem and to determine whether a technical solution can be found.

Because significantly fewer TPBARs are being irradiated than NNSA originally called for, much less tritium is being produced than NNSA planned. As a result, SRS's Tritium Extraction Facility, which began operations in 2007 and cost nearly $500 million to build and approximately $30 million per year to operate, sits essentially idle for 9 months out of the year. During this time, equipment and systems must be routinely maintained while NNSA prepares for the 3 months the facility operates during the year. At congressional direction, NNSA investigated shutting down the Tritium Extraction Facility completely for an extended period until sufficient TPBARs had been irradiated to justify continuous operations. However, NNSA determined that shutting down the facility for an extended period would cost at least $60 million more over 10 years than continuing to maintain it for limited operations. According to NNSA officials, these additional costs consist of, among other things, costs to replace and/or recertify the operational readiness of equipment that would degrade during the time the facility was shut down.

NNSA and TVA Are Developing Plans to Increase Tritium Production but Have Not Actively Coordinated These Plans With NRC

Faced with significantly lower tritium production than originally planned due to tritium permeation, NNSA and TVA have been developing plans to increase the number of TPBARs being irradiated at Watts Bar 1 during each reactor fueling cycle as well as the number of reactors irradiating TPBARs, according to NNSA and TVA officials. Planning continues to be adjusted based upon changes to tritium requirements that are still being determined. Although these plans have changed several times over the past year and are still subject to significant uncertainty, current plans call for the number of TPBARs being irradiated in the Watts Bar 1 reactor to increase from 240 per cycle to 544 per cycle for the next three fueling cycles beginning in 2011, according to NNSA officials. In addition, NNSA and TVA are developing plans to irradiate TPBARs, using TVA's Sequoyah 1 and Sequoyah 2 reactors—as provided for in the interagency agreement between DOE and TVA—beginning in 2017 if this proves necessary to meet tritium requirements. NNSA and TVA officials also told us that they discussed the option of using the Watts Bar 2 reactor, which is currently under construction. However, this reactor will not be operational until 2012 at the earliest and is not included in the interagency agreement between DOE and TVA. Moreover, TVA likely would not attempt to irradiate TPBARs in it until its second or third fueling cycle—18 to 36 months after the reactor begins operations. Therefore, according to TVA officials, Watts Bar 2 is no longer being considered to irradiate TPBARs.

NNSA and TVA are also discussing a number of modifications to the Watts Bar reactor to ensure that any tritium released from the reactor coolant into the environment stays below regulatory limits, according to NNSA and TVA officials. Specifically:

- NNSA and TVA officials told us that they are considering the construction of a large holding tank at the Watts Bar 1 reactor that could be used to more effectively manage the presence of tritium in the reactor coolant. A large holding tank will enable TVA to better control the timing of releases of coolant containing tritium over time to stay within NRC and EPA limits. NNSA's initial cost estimate for the construction of a large holding tank is approximately $13 million and may increase annual operations costs by as much as $500,000.

- NNSA and TVA officials also told us that they considered constructing a tritium removal system at the reactors to remove excess tritium from reactor coolant water before it is released into the Tennessee River. NNSA's initial cost estimate for the construction of a tritium removal system is approximately $50 to $60 million per reactor and would add $9 to $10 million in annual operations costs. According to NNSA officials, NNSA and TVA are continuing to monitor the development of this technology.

According to NNSA and TVA officials, NNSA, with the cooperation of TVA, is assessing the environmental impacts associated with irradiating increased numbers of TPBARs with higher-than-expected rates of tritium permeation. Such an increase would have to be approved by NRC and incorporated into an amendment to the reactors' operating licenses. TVA officials told us that reactor license amendments cost up to $5 million. In addition, NNSA officials told us that completing this environmental analysis could cost between $2 million and $5 million.

NNSA and TVA officials, however, have not been actively coordinating their plans with NRC, which ultimately must approve these plans and incorporate them into operating license amendments for the TVA reactors. At the time we spoke with them, NRC officials were not aware that fewer TPBARs than planned were being irradiated in the Watts Bar 1 reactor. Subsequently, in a February 2010 letter from TVA, the NRC was officially informed of how many TPBARs were being irradiated in the reactor. With regard to plans that were discussed to irradiate TPBARs in the Watts Bar 2 reactor when it is completed, NRC officials pointed out that technical issues that usually accompany any new reactor startup may not be resolved in time for TPBARs to be irradiated by the reactor's second fueling cycle. NRC officials were also not informed of proposals being developed to install reactor coolant holding tanks or tritium removal systems at the reactors and of potential future license amendment applications to increase the amount of tritium the reactors would be allowed to release into the environment. NRC's approval of these modifications, such as the construction of tritium removal systems at the TVA reactors, is uncertain because, according to NRC officials, there is currently no regulatory framework for the construction and operation of tritium effluent management technologies in the United States.

NNSA Is Currently Meeting Tritium Requirements, but Uncertainty Exists in Its Ability to Continue Doing So In the Future

DOD is responsible for implementing the U.S. nuclear deterrent strategy, which includes establishing the military requirements associated with planning for the nuclear weapons stockpile. NNSA and DOD work together to produce the Nuclear Weapons Stockpile Memorandum. This memorandum outlines a proposed plan for the President to sign to guide U.S. nuclear stockpile activities. This plan specifies the size and composition of the stockpile and other information concerning adjustments to the stockpile for a projected multi-year period. While the exact requirements are classified, NNSA uses the detailed information included in the memorandum on the number of weapons to be included in the stockpile to determine the amount of tritium needed to maintain these weapons. In addition, NNSA maintains a reserve of additional tritium to meet requirements in the event of an extended delay in tritium production. Small quantities of tritium are also needed by the national laboratories and other entities for scientific research and development purposes.

According to NNSA officials, NNSA is meeting current requirements through a combination of harvesting tritium obtained from dismantled nuclear warheads and producing lower-than-planned amounts of tritium through the irradiation of TPBARs in the Watts Bar 1 reactor. However, tritium in the stockpile as well as in NNSA's tritium reserve continues to decay, making increased production of tritium critical to NNSA's ability to continue meeting requirements.

Although the number of nuclear weapons in the U.S. stockpile is decreasing, these reductions are unlikely to result in a significant decrease to tritium requirements. Specifically, the New Strategic Arms Reduction Treaty signed in April 2010, if ratified by the Senate, will reduce the number of deployed strategic nuclear warheads by 30 percent. However, it has not yet been determined whether some or all of these warheads will be maintained in reserve—where the warheads would continue to be loaded with tritium—or dismantled—where the tritium could be removed from the weapons. Moreover, even if some or all of the warheads reduced under the treaty were dismantled, tritium requirements are unlikely to decrease by a significant amount. While the specific reasons for this lack of decrease in tritium requirements are classified, NNSA officials we spoke with said that the additional tritium supply that would be available as a result of increased warhead dismantlements is unlikely to fill what they estimate will be a steady tritium demand in the future.

To date, NNSA has not had to use tritium in the reserve it maintains. However, according to NNSA officials, use of some of the tritium reserve in the relatively near future may be necessary if NNSA is unable to increase tritium production beyond its current level of 240 TPBARs being irradiated in a single reactor. In addition, if NNSA takes longer than expected to increase tritium production, even reserve quantities may be insufficient to meet requirements for an extended period of time. Information on the dates when NNSA will need to begin using the tritium reserve and when the reserve will be depleted is classified. Nevertheless, NNSA officials told us that they were confident that NNSA will be able to meet tritium requirements in the future without substantially reducing the nation's tritium reserve and are not considering alternative ways of producing tritium for the stockpile.

NNSA Could Not Provide Us With Evidence That It Adhered to the Appropriate Contracting Procedures for the Tritium Readiness Program and is Accumulating Large Amounts of Unexpended Funding

Although NNSA has attempted to ensure a reliable long-term supply of tritium, our review found two problems with NNSA's management of the Tritium Readiness Program. First, NNSA was unable to provide us with evidence about its adherence to the appropriate contracting procedures when purchasing components and services for the Tritium Readiness Program. Second, because of, among other things, the contract structure NNSA has entered into with suppliers of components and services for the Tritium Readiness Program, program funds are being expended much more slowly than planned. As a result, the program is accumulating large unexpended funding balances beyond thresholds established by DOE.

NNSA Could Not Provide Us With Evidence That It Adhered to the Appropriate Contracting Procedures When Entering Its Long-Duration TPBAR Procurement Contract

NNSA relies largely on commercial suppliers to provide TPBARs, TPBAR components, and other services to the program through fixed price contracts. Although the Pacific Northwest National Laboratory originally designed the TPBARs and fabricated initial supplies, NNSA believed that the commercial sector was better able to meet nuclear industry quality requirements at lower cost. Therefore, in 2000, NNSA entered into a contract with WesDyne International to manufacture TPBARs. WesDyne International is a subsidiary of Westinghouse which is owned by the Japanese company Toshiba. Because of the relatively few companies capable of manufacturing TPBAR components, and to minimize the possibility of one of these companies exiting the industry or losing interest in working with the program, the contract was structured as a 44-year fixed price contract with an approximately 4-year initial phase and a 40-year second phase consisting of a 10-year base period and three 10-year options.

According to NNSA officials, a 44-year fixed price contract with lengthy options was intended to assure companies that there would be sufficient work required far enough into the future to make a contractor's initial investment in new facilities and capabilities worthwhile. Because of the highly specialized manufacturing processes involved in fabricating TPBARs, the relatively low production quantities planned by the program, and the length of time required to set up facilities for manufacturing classified components, NNSA identified the loss of one or more component suppliers as a major program risk. For example, several components can only be obtained from a single supplier, and if any of these companies were to decide it was no longer profitable to continue working with NNSA or were acquired by foreign firms, it could take NNSA several years and millions of dollars to find and develop a new supplier.

While these considerations led NNSA to use a 44-year contract to procure TPBARs, NNSA did not provide us evidence that it adhered to the appropriate contracting procedures typically involved when entering into a contract of this length. Federal statutes as implemented by the Federal Acquisition Regulation are the principal set of rules that govern the process through which the federal government acquires and purchases goods and services. NNSA officials did not document the legal authority used in entering into a contract of this length.[6] In contrast, NNSA waived application of a statutory provision prohibiting contract awards under certain circumstances to foreign-controlled entities—by permitting a foreign-owned company to produce TPBARs—and provided us with evidence of its compliance with the waiver requirements.[7]

In its comments on a draft of this report, NNSA stated that it provided documentation of a solicitation review that was conducted as well as its explanation of its legal authority to enter into contracts with periods of performance in excess of 5 years. While we agree that a review of the solicitation took place, the documentation NNSA provided contained no evidence that the long period of performance of this contract—a period of performance that NNSA agreed in its comments was unusually long—was considered as part of this solicitation review. NNSA asserts that it followed the appropriate procedures when approving a contract of this length. However, the procedures NNSA cited in its comments were not implemented until about 10 years after the contract with WesDyne was initially awarded. Moreover, while NNSA claimed that it had the legal authority to enter into a contract of this length, none of the documentation NNSA provided to us before we sent our draft report to NNSA for its comments stated the specific legal authority that was used to enter into a contract of this length. In fact, it was not until NNSA's comments on our

[6]See, e.g., Federal Acquisition Regulation 17.104(a) (limiting multi-year contracts to 5 years, unless otherwise authorized by statute).

[7]10 U.S.C. § 2536(b)(1)(A); 48 C.F.R. § 904.7102(a).

draft report that it provided us with its explanation of its legal authority to enter into contracts with periods of performance in excess of 5 years.

NNSA is Spending Program Funds More Slowly Than Planned And Has Accumulated Large Amounts of Unexpended Funding

NNSA is spending program funds more slowly than planned and has accumulated large amounts of unexpended funding. NNSA receives "no-year" appropriations from Congress that have no limit on how long the agency may take to obligate and expend those funds. However, to ensure large amounts of unexpended funding do not accumulate that could be better used for other purposes, DOE has established thresholds of acceptable levels of unexpended funds that may be carried over from one fiscal year to the next. DOE also analyzes individual program budgets to determine a percentage of program funds which each program can reasonably be expected to carry over each year. For example, in fiscal year 2009, DOE determined that NNSA's Tritium Readiness Program could expect to carry over 16 percent—or approximately 2 months worth—of funding, or $20.7 million. However, the program has routinely exceeded DOE's threshold for unexpended funds. For example, it exceeded the threshold by $23.4 million at the end of fiscal year 2006, $27.6 million at the end of fiscal year 2007, $48.4 million at the end of fiscal year 2008, and $39.1 million at the end of fiscal year 2009. Officials with the Tritium Readiness Program estimate that the program will exceed DOE's threshold by approximately $50 million by the end of fiscal year 2010. Table 1 outlines the Tritium Readiness Program's unexpended funds.

Table 1: Tritium Readiness Program Unexpended Funds, Fiscal Years 2006-2009

Fiscal year	Unexpended funds at end of fiscal year	DOE threshold	Difference
2006	$38,324,160	$14,891,346	$23,432,814
2007	42,710,961	15,127,566	27,583,396
2008	67,963,852	19,554,741	48,409,111
2009	59,798,262	20,680,935	39,117,327

Source: GAO presentation of data from NNSA.

The contract structure NNSA has entered into with suppliers of components and services contributes to these high unexpended funding balances. An agency must generally obligate the full amount of a contract at the time it enters into the contract. These obligated funds are then expended over time as components and other services are delivered to NNSA by the contractor. Although NNSA's TPBAR fabrication contract is structured as a 44-year contract with 10-year options, the program has been funding each option in 5-year increments. Under this arrangement, the program obligates sufficient funds for 5 years at the beginning of each increment, which NNSA officials told us should result in high unexpended funding balances during the first year which are gradually reduced over the following 5 years as the program pays out the funds to its contractors. NNSA also uses a number of 3-4 year subcontracts to procure TPBAR components, which also require funding at the time NNSA enters into the contract and are often awarded in different years than the main contract's 5-year periods. Consequently, NNSA's contracting strategy periodically results in high levels of unexpended funds as funds for different awards are obligated and expended at different times.

However, the fact that fewer than expected numbers of TPBARs are being irradiated in the Watts Bar 1 reactor is also contributing to NNSA's accumulation of large unexpended funding balances. Irradiating fewer than expected TPBARs impacts the program's costs by lowering the total irradiation fees NNSA pays to TVA for each reactor cycle. Specifically, NNSA pays TVA an irradiation fee of $4,950 per year per TPBAR irradiated. Irradiating fewer than expected TPBARs has also lowered expenses associated with operating the Tritium Extraction Facility at SRS. In addition, funds under NNSA's contract for TPBAR fabrication are being expended much more slowly than planned. In 2008 and 2009, the program planned to order 812 TPBARs from WesDyne, but due to the permeation problem at Watts Bar, the program eventually reduced that number to 240. Furthermore, NNSA's contract with WesDyne originally planned for fabricating more than 2,500 TPBARs between 2004 and 2009, but NNSA had ordered fewer than half that many by the end of fiscal year 2009. Because fewer TPBARs are being ordered than originally planned for, the price to fabricate each TPBAR has increased over time from about $700 per TPBAR in 2000 to approximately $1,300 per TPBAR today. NNSA and WesDyne officials told us that the price per TPBAR is likely to increase further when the next contract increment is finalized later this year.

While large unexpended funding balances do not necessarily indicate that the tritium program is being mismanaged, the fact that they have been increasing indicates that NNSA is requesting more funding than it needs on an annual basis—funds that could be appropriated for other purposes. From fiscal year 2006 to fiscal year 2008, NNSA's unexpended balances in the Tritium Readiness Program exceeding DOE's threshold more than doubled from $23.4 million to $48.4 million, and as a result, Congress reduced the program's funding by $10.4 million for fiscal year 2009. Although the program's unexpended funds were lower at the end of fiscal year 2009, this was largely due to $8.7 million which was deobligated at the end of the year because of an ongoing subcontract proposal audit. These funds were returned to the program in fiscal year 2010, and had they not been deobligated, the program's unexpended balances would have remained approximately the same from fiscal year 2008 to fiscal year 2009, even with the congressional reduction in funding. Finally, by the end of the second quarter of fiscal year 2010, NNSA had spent less than half the funds it had originally planned to spend by that time, and NNSA officials stated that the program will likely end fiscal year 2010 with even higher levels of unexpended funds. Thus, while NNSA's contracting approach does contribute to its high unexpended funds, the fact that these unexpended funds are increasing each year indicates that the program is receiving more funding than it is able to execute due to the reduced scope of work caused by the tritium permeation problem.

Conclusions

NNSA's inability to overcome the technical challenges and meet its original tritium production goals has raised serious questions about the agency's ability to provide a reliable source of tritium to maintain the nation's nuclear weapons stockpile in the future. While NNSA has taken steps to attempt to solve the tritium permeation problem, it is unlikely that anything less than a complete redesign of the TPBARs will solve the problem. Unfortunately, existing supplies of tritium in the stockpile and the tritium reserve are unlikely to fulfill requirements for the time a complete redesign would take. It is also not clear that a redesign would solve the problem since NNSA does not fully understand the reasons behind tritium permeation. Therefore, NNSA and TVA are working together to not only increase the number of TPBARs being irradiated in the Watts Bar 1 reactor but also to increase the number of reactors being used for the program. Increasing the number of TPBARs irradiated will also require substantial and costly modifications to TVA facilities to ensure that tritium emissions comply with applicable nuclear safety and environmental regulations. Because such modifications to the operation of TVA's reactors must be approved by NRC, it is important that NNSA and TVA coordinate their efforts closely with the regulatory agency. In addition, it is critical that DOD—the ultimate customer of NNSA's tritium production program—is also kept informed of the challenges facing the program and the impact of these challenges on current and future availability of tritium for the nuclear weapons stockpile.

NNSA's Tritium Readiness Program has taken a number of steps to ensure the long-term availability of critical components needed for tritium production. We are concerned, however, that NNSA was unable to provide evidence that it adhered to the appropriate contracting procedures when purchasing components and services for the Tritium Readiness Program. In addition, the contract structure NNSA has put in place for the program in conjunction with lower than expected rates of tritium production has led the program to accumulate large amounts of unexpended funding. These large balances make it difficult for NNSA management and Congress to accurately determine the amount of funding the program actually requires, what the program is accomplishing with the appropriated funding, and how much could potentially be appropriated for other priorities.

Recommendations for Executive Action

To increase confidence in the nation's continued ability to produce a reliable supply of tritium in the future and to improve the management of NNSA's Tritium Readiness Program, we recommend that the Secretary of Energy direct the Administrator of NNSA to take the following four actions:

- In cooperation with TVA and NRC, develop a comprehensive plan to manage releases of tritium from TVA's Watts Bar 1 and any other reactors chosen to irradiate TPBARs in the future.
- Conduct a comprehensive analysis of alternatives to the current tritium production strategy in the event that NNSA continues to be unable to meet its tritium production goals. This alternatives analysis should be coordinated closely with DOD and take into account current and future nuclear weapons stockpile requirements for tritium.
- Complete an acquisition strategy that reflects the outcome of the analysis of alternatives and aligns the contracting structure to that plan and, if necessary, ensures adherence to the appropriate contracting procedures for long-duration contracts.
- Ensure NNSA's future budget requests account for the large unexpended balances in the Tritium Readiness Program and better reflect the amount of funding the program is able to spend annually.

Agency Comments and Our Evaluation

We provided NNSA, TVA, and NRC with a draft of this report for their review and comment.

In its comments, NNSA generally agreed with the facts in the report and the recommendations. However, NNSA noted that, in its view, it has a high probability of meeting its tritium mission requirements without risk of using reserve inventories. In response to the draft report's discussion of the Tritium Readiness Program's TPBAR manufacturing contract with WesDyne, NNSA commented that the program's unique contracting structure enables the program to leverage and maintain a commercial supply chain over a period of more than 40 years while providing some assurances of cost controls for the life of the contracts. Finally, NNSA noted that it provides responsible financial stewardship of government resources by adjusting future budget requests for changes in the Tritium Readiness Program planning requirements and risks.

With regard to meeting tritium requirements, NNSA commented that irradiating 544 TPBARs in the Watts Bar 1 reactor per reactor fueling cycle until fiscal year 2016 will provide proof of NNSA's ability to meet near term requirements without using reserves. Our draft report discussed NNSA's plans to increase the number of TPBARs being irradiated in the Watts Bar 1 reactor from 240 per fueling cycle to 544 per fueling cycle. However, it is important to note that NNSA's plans have changed several times and are still subject to considerable uncertainty. In particular, NNSA's original plans called for irradiating 1,160 TPBARs per fueling cycle by 2010 before ramping up to nearly 2,700 TPBARs per fueling cycle using both the Watts Bar 1 reactor and the Sequoyah 1 reactor. While we are encouraged that NNSA and TVA are working together to increase the number of TPBARs being irradiated, continued uncertainty about NNSA's and TVA's ability to irradiate additional TPBARs in a single reactor while not exceeding limits on the amount of tritium released into the environment raises doubts about the program's ability to provide a reliable supply and predictable quantities of tritium over time.

Regarding its TPBAR manufacturing contract with WesDyne, NNSA stated that it provided documentation of a solicitation review that was conducted as well as its explanation of its legal authority to enter into contracts with periods of performance in excess of 5 years. We modified our draft report to clarify that, although we agree that a review of the solicitation took place, the documentation of the review that NNSA provided to us contained no evidence that the long period of performance in this contract—a period of performance that NNSA agreed in its comments was unusually long—was considered as part of this solicitation review. Although NNSA asserts that it followed the appropriate procedures when approving a contract of this length, the procedures NNSA cited in its comments were not implemented until about 10 years after the contract with WesDyne was initially awarded.

Finally, with regard to NNSA's management of the Tritium Readiness Program's finances, NNSA commented that it monitors its unexpended funding and meets quarterly with DOE to discuss and justify its unexpended balances. NNSA also stated that adjustments to its budget requests and refinements to its acquisition strategy will continue as part of its efforts to accommodate changes to the nuclear weapons stockpile. We are encouraged by NNSA's pledge to adjust its budget requests in response to changes in program needs and by other actions NNSA is taking to reduce its unexpended funding balances. However, as our draft report notes, unexpended funding balances in excess of DOE's threshold for unexpended funds increased every year since fiscal year 2006 with the exception of fiscal year 2009 and NNSA estimates the program will exceed DOE's threshold by approximately $50 million by the end of fiscal year 2010. In our view, these increases in unexpended funding call into question the effectiveness of NNSA's monitoring of the program's financial management.

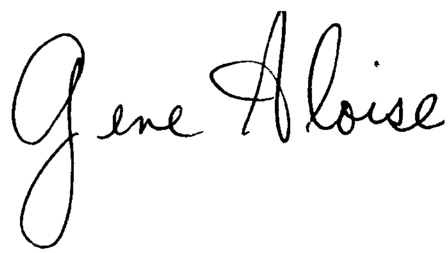
NNSA also provided technical comments that we incorporated as appropriate. NNSA's comments are presented in appendix I.

TVA commented that it shared our perspectives regarding the importance of NNSA's ability to assure that the nuclear weapons stockpile requirements for tritium will be met in the future. TVA noted that it has been and continues to be dedicated to working with NNSA in evaluating and deciding among alternative approaches to help better assure that future tritium production will be a the necessary levels. TVA also provided technical comments that we incorporated as appropriate. TVA's comments are presented in appendix II.

In its comments, NRC agreed with our findings, conclusions, and recommendations. NRC also provided technical comments that we incorporated as appropriate. NRC's comments are presented in appendix III.

We are sending copies of this report to the appropriate congressional committees, Secretary of Energy, Administrator of NNSA, Chairman of NRC, President and Chief Executive Officer of TVA, Director of the Office of Management and Budget, and other interested parties. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or aloisee@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix IV.



Gene Aloise
Director, Natural Resources
and Environment

Appendix I: Comments from the National Nuclear Security Administration

NNSA National Nuclear Security Administration

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

Mr. Gene Aloise
Director
Natural Resources and Environment
Government Accountability Office
Washington, D.C. 20548

Dear Mr. Aloise:

The National Nuclear Security Administration appreciates the opportunity to review and provide comments on the Governmental Accountability Office's (GAO) draft report, *NUCLEAR WEAPONS: National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile*, GAO-10-817. I understand that this review was performed at the request of the Strategic Forces Subcommittee, Committee on Armed Services, United States House of Representatives. GAO was asked to: (1) determine the extent to which NNSA has been able to overcome technical challenges producing tritium; (2) determine the extent to which NNSA is able to meet current and future nuclear weapons stockpile requirements for tritium; and (3) assess the management of NNSA's Tritium Readiness Program.

NNSA generally agrees with the facts in the report and the recommendations. NNSA would like to clarify some of the context in which these facts are used and, therefore, the conclusions contained in this report. The recommendations are in line with actions already being taken by the Tritium Readiness Program to ensure that it has the technology and infrastructure to meet the stockpile requirements as they are being understood to support the post-Nuclear Posture Review (NPR) stockpile. NNSA understands GAO's concerns; however, current direction and actions, being taken by the program, should soon alleviate these concerns and provide clear indications of mission success.

To address three key points from the draft report, NNSA provides the following comments:

1. NNSA has a high probability of meeting its tritium mission requirements, without risk of using reserve inventories.

   NNSA's ability to meet the tritium requirements of the future hinges primarily on the Tennessee Valley Authority's (TVA) notification to the Nuclear Regulatory Commission (NRC) inserting 544 Tritium Producing Burnable Absorber Rods (TPBARs) into the next Watts Bar reactor cycle. Currently, TVA is designing its reactor core for 544 TPBARs and plans to provide the required NRC notification soon.

   Once 544 TPBARs are being irradiated at Watts Bar, NNSA will have proof positive of its ability to meet near term requirements. Future production plans call for irradiation of 544 TPBARs at Watts Bar until FY 2016. Continuing at this level is

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neither a programmatic nor technical challenge. However, without appropriate funding this level of irradiation and necessary increases in the future cannot be sustained.

Looking to the future, NNSA has three reactors available under the Interagency Agreement with the TVA. With this available infrastructure, the production capacity is sufficient to provide about 1,500 TPBARs per cycle. This production rate will meet the planned steady-state requirement needed in FY 2017.

Both TVA and NNSA would experience programmatic and operational benefits from keeping tritium production in one reactor, and will be working to achieve this goal. Nevertheless, NNSA does have this backup plan that can meet mission requirements with existing technologies and assets. NNSA has sufficient inventory to support stockpile requirements for several more years without using reserves. Thus, irradiating 544 TPBARs in the next cycle will demonstrate the capability to support the mission and provide an assured supply in the future.

The rate of permeation of tritium into the reactor coolant water, which is higher than expected, is a constraint, but it does not imperil accomplishment of the mission. Consistent data on tritium releases accumulated from tritium production since late 2003 provides a high degree of confidence that tritium production plans can be executed with currently available technologies and infrastructure, while maintaining margins to protect public safety and the environment.

2. The Tritium Program's unique contracting structure enables the program to leverage and maintain a commercial supply chain - where low rates of production quantities are involved - over a period of more than 40 years while providing some assurances of cost controls for the life of the contracts.

TPBARs are similar to a nuclear industry item, i.e. equivalent to burnable poisons used in reactors. On the other hand, TPBARs have some very unique specifications as well as being a classified item. During the original contractor solicitation, it was recognized that few vendors would bid on the contracts because of required initial investments and potential for low production rates. As the solicitation progressed, it was clear that the Department would be limited in the number of bidders willing to make these required investments given the low rates of production compared to similar commercial items. At the same time, the program was expected to continue for 40 years, presenting challenges to contain cost growth over the life of the program. As acknowledged in the GAO report, these considerations formed the basis for the contractor solicitation and are still relevant conditions today.

At program inception, the fabrication contract for TPBARs was awarded as a 44 year contract, structured into ten-year option periods after the startup period. This is an unusually long option period, and GAO found what they considered to be insufficient documentation of the review and approval process conducted in the late 1990's. NNSA would politely disagree with this conclusion, having provided documentation of the solicitation review conducted by the then-acting Department of Energy (DOE) Senior Procurement Executive who is the individual authorized to make such determinations. In addition, the Source Selection Plan for the Selection of a Contractor for Tritium Producing Burnable Absorber Rod (TPBAR) Fabrication, RFP

No. DE-RP02-99DP0029, indicates DOE Headquarters reviewed the solicitation on May 13, 1999. The Source Selection Plan also indicated the period of performance was a maximum of 44 years in duration. Therefore, the conditions of FAR 7.105 and FAR 17.204e requiring programs to justify any required deviations from the FAR in an acquisition plan prepared prior to contract award have been met. Current DOE procedures for approving periods of performance in excess of 5 years are described in DOE Acquisition Letter AL 2010-05.

Because of the attention surrounding the uncosted balances, the program is looking into the feasibility of partially exercising the remaining options in one- or two-year increments after the current option periods expire. If such contracting actions will retain continuity in meeting program requirements, protect the viability of the commercial supply base, and provide some assurance of cost control over the life of the contract, the actions will be implemented after the current option period expires. All actions will continue to be made in accordance with the FAR, DEAR, and acquisition guidance.

3. NNSA provides responsible financial stewardship of government resources by adjusting future budget requests for changes in planning requirements and program risks.

   As noted by the GAO report, the fixed price contract with lengthy options was intended to assure companies of sufficient work into the future to make investments in new facilities and processes worthwhile. That long-term contract contributes to the higher than average uncosted as those funds will be costed out over a longer period than normal. In appreciation of that fact, NNSA monitors the uncosted and meets quarterly with the Department to discuss and justify Tritium's uncosted balances. Transferring all the related TPBAR and component contracts from the design agent, Pacific Northwest National Laboratory (PNNL), to the commercial TPBAR fabrication contractor, WesDyne International, over the last several years, has resulted in these larger than usual unexpended funds on a number of multi-year contracts.

   In addition, earlier plans to irradiate up to 800 TPBARs in cycle 10 at Watts Bar were changed to irradiate only 240 TPBARs currently in the reactor. Accordingly, the FY 2011 budget request was reduced from an earlier estimate of $69M to $50.2M. Adjustments to the budget requests and refinements to the acquisition strategy will continue in our efforts to accommodate the post-NPR stockpile and to minimize unexpended funds while at the same time minimizing risks to the highly specialized supply chain for TPBARs and components.

Our responses to the recommendations are:

1. In cooperation with TVA and NRC, develop a comprehensive plan to manage releases of tritium from TVA's Watts Bar 1 and any other reactors chosen to irradiate TPBARs in the future.

NNSA Response: NNSA has two initiatives underway that will address this recommendation. First, NNSA in conjunction with TVA, is beginning an update of the Environmental Impact Statement for tritium production in TVA reactors. This will document in very specific and quantitative terms the expected environmental releases and how they relate to allowable limits to maintain the safety of the public and workers at the plants. In addition, PNNL and TVA have collaborated on the development of a quantitative model of the flow of reactor cooling water and associated dilution, hold-up, and release management process to enable assessment of impact of tritium permeation on a range of variables including numbers of TPBARs, measured permeation, and flow in the river that may vary throughout the year.

With regards to the NRC, NNSA defers to TVA to submit appropriate documentation to NRC for licensing and regulation of its reactors.

2. Conduct a comprehensive analysis of alternatives to the current tritium production strategy in the event that NNSA continues to be unable to meet its tritium production goals. This alternatives analysis should be coordinated closely with the Department of Defense (DOD) and take into account current and future nuclear weapons stockpile requirements for tritium.

   NNSA Response: NNSA has been coordinating with DOD on determining Post-NPR Stockpile requirements and continues to provide annual updates to DOD on the tritium production status. NNSA interprets this recommendation to address contingency plans should the program not be successful in gaining approval for 544 TPBARs in cycle 11 at Watts Bar. The fuel assemblies containing the 544 TPBARs required for cycle 11 operations are scheduled for delivery to the Watts Bar site in January 2011. Cycle 11 begins in the spring of 2011, so the best response will be to confirm that cycle 11 is irradiating 544 rods. At this time, TVA is designing its reactor core for 544 TPBARs and has approved the technical basis for notifying the NRC for this quantity. In the unlikely event that cycle 11 does not load 544 rods, NNSA will embark on development of contingency plans to ensure that mission requirements are met without using reserves. By spring of 2011, the program will conduct a comprehensive risk assessment to ensure that all potential program risks have been identified and that any risk mitigation steps have been incorporated into the program plans.

3. Complete an acquisition strategy that reflects the outcome of the analysis of alternatives and aligns the contracting structure to that plan and, if necessary, ensures adherence to the appropriate contracting procedures for long-duration contracts.

   NNSA Response: NNSA is currently reviewing the acquisition strategy and approach for sourcing TPBARs and components to meet the post-NPR stockpile requirements. This review will balance minimizing uncosted balances together with minimizing risks to the TPBAR supply chain, as determined from the risk assessment. The contracts will then be revised, as appropriate, to implement the outcome of this review. All contracting modifications will continue to comply with appropriate contracting procedures.

4. Ensure NNSA's future budget requests account for the large unexpended balances in the Tritium Readiness Program and better reflect the amount of funding the program is able to spend annually.

   NNSA Response: NNSA has recently reduced budget requests to account for the utilization of unexpended funds and will continue to do so in the future. However, it should be noted that production plans show increased numbers of TPBARs scheduled for fabrication and irradiation in the future to meet inventory requirements. As such, overall budget requirements for tritium production should be expected to increase over the next several years until the steady-state production rate is reached.

Enclosed are more detailed comments on specific topics from the draft report. We believe the NNSA responses to these topics will help the reader appreciate that the challenges we have are being well managed, that the mission requirements will be met, and that the program is working hard to manage its contracts well and to steward financial resources responsibly.

If you have any questions concerning this response, please contact JoAnne Parker, Director, Office of Internal Controls, at 202-586-1913.

Sincerely,

Gerald L. Talbot, Jr.
Associate Administrator
for Management and Administration

Enclosures

cc: Donald L. Cook, Deputy Administrator for Defense Programs

Appendix II: Comments from the Tennessee Valley Authority

TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

July 23, 2010

Mr. Ryan T. Coles
Assistant Director
U.S. & International Nuclear Security and Cleanup
U.S. Government Accountability Office
Natural Resources & Environment
441 G Street, NW
Washington, DC 20548

REFERENCE: GAO Draft Report -- GAO-10-817 Tritium Production

Dear Mr. Coles:

We appreciate the opportunity to provide the comments of the Tennessee Valley Authority (TVA) on the subject draft of GAO's report entitled "National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile."

Because all four of the draft report's recommendations are directed to the Secretary of Energy, and none are directed to TVA itself, the enclosed comments which we offer are made in the spirit of helping assure that the final version provides the audience for this report with clear and complete descriptions of:

- the performance-related issues regarding the irradiation of tritium-producing burnable absorber rods (TPBARs) at TVA's Watts Bar Unit 1 that GAO has reviewed in this performance audit; and
- the appropriate relationship between considerations by the National Nuclear Security Administration (NNSA) and TVA of possible options for increasing tritium production to expected levels and the Nuclear Regulatory Commission's (NRC) regulatory responsibilities in connection with Watts Bar Unit 1.

TVA shares GAO's perspectives regarding the importance of NNSA's ability to assure that our Nation's nuclear weapons stockpile requirements for tritium will be met in the future. TVA has been, and continues to be, dedicated to working with NNSA in evaluating and ultimately becoming able to decide among alternative approaches to help better assure that future tritium production will be at the necessary levels.

With regard to our specific comments set forth in the Enclosure, TVA respectfully requests that GAO modify its draft report to accommodate those comments in order to help assure that the final report will provide as clear and complete descriptions as are possible when discussing this matter of critical importance. Further, it is our

Mr. Ryan T. Coles
Page 2
July 23, 2010

understanding that this letter and our enclosed comments will be set forth in the final report. If there are any questions, please contact Wayne R. Gildroy, Assistant General Counsel, at 865/632-7361.

Sincerely,

Ashok S. Bhatnagar
Senior Vice President
Nuclear Generation Development & Construction

Enclosure

Appendix III: Comments from the Nuclear Regulatory Commission

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 23, 2010

Mr. Gene Aloise, Director
Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Aloise:

I would like to thank you for the opportunity to review and submit comments on the July 2010 draft of the U.S. Government Accountability Office (GAO) report, "National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile" (GAO-10-817).

In general, the U.S. Nuclear Regulatory Commission (NRC) agrees with GAO's findings, conclusions, and recommendations. However, the NRC has certain comments in the enclosure.

Should you have any questions about these comments, please contact Mr. Jesse Arildsen of my staff at (301) 415-1785 or Jesse.Arildsen@nrc.gov.

The NRC appreciates the opportunity to comment on GAO-10-817.

Sincerely,

R. W. Borchardt

R. W. Borchardt
Executive Director
for Operations

Enclosure:
NRC Comments Regarding GAO
Draft Report GAO-10-817

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Gene Aloise, (202) 512-3841 or aloisee@gao.gov

Staff Acknowledgments

In addition to the individual named above, Ryan T. Coles, Assistant Director; Allison Bawden; Will Horton; Jonathan Kucskar; Alison O'Neill; Tim Persons; Peter Ruedel; Ron Schwenn; and Rebecca Shea made key contributions to this report.