EVALUATION REPORT

Evaluation of NRC's Oversight of Tritium Production at Commercial Nuclear Power Plants

OIG-11-A-19 September 21, 2011

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

OFFICE OF THE
INSPECTOR GENERAL

September 21, 2011

MEMORANDUM TO: R. William Borchardt
Executive Director for Operations

FROM: Stephen D. Dingbaum **/RA/**
Assistant Inspector General for Audits

SUBJECT: EVALUATION OF NRC'S OVERSIGHT OF TRITIUM PRODUCTION AT COMMERCIAL NUCLEAR POWER PLANTS (OIG-11-A-19)

Attached is the Office of the Inspector General's (OIG) audit report titled, *Evaluation of NRC's Oversight of Tritium Production at Commercial Nuclear Power Plants.*

The report presents the results of the subject evaluation. Agency comments provided at the September 9, 2011, exit conference have been incorporated, as appropriate, into this report.

We appreciate the cooperation extended to us by members of your staff during the evaluation. If you have any questions or comments about our report, please contact me at 415-5915 or Sherri Miotla, Team Leader, Nuclear Materials and Waste Safety Audit Team, at 415-5914.

Attachment: As stated

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EXECUTIVE SUMMARY

BACKGROUND

The Nuclear Regulatory Commission (NRC) is responsible for ensuring that nuclear power plant licensees operate nuclear power plants in a manner that protects public health and safety and the environment. Tritium is a radioactive isotope of hydrogen used in U.S. nuclear weapons. In 1999, Federal law authorized tritium production at two commercial nuclear power plants owned by the Tennessee Valley Authority (TVA).

The Department of Energy (DOE) works with the Department of Defense to maintain the quantity and quality of the U.S. nuclear weapons stockpile. Tritium production at commercial nuclear power plants involves the redesign of an important reactor core component as well as coordination between NRC and DOE. To produce tritium, the normal absorbing material in the reactor core, boron, is replaced by an isotope of lithium, requiring a redesign of the absorber rods. That isotope of lithium is an absorber like boron, but the nuclear reaction it undergoes during the absorption process also produces tritium. Such rods are called tritium producing burnable absorber rods (TPBARs).

On May 22, 1996, the Secretary of Energy and the NRC Chairman signed a memorandum of understanding that established the basis for NRC review and consultation regarding DOE's use of commercial nuclear reactors for producing tritium. NRC reviewed DOE's proposal to test fuel assemblies containing TPBARs in a commercial nuclear reactor and DOE's safety assessments on tritium production. In May 1999, NRC issued its own safety evaluation. Subsequently, NRC also issued license amendments to TVA allowing loading of TPBARs at Watts Bar Nuclear Power Plant Unit 1 and Sequoyah Nuclear Power Plant Units 1 and 2, although tritium production has only occurred at Watts Bar Unit 1.

RESULTS IN BRIEF

NRC's oversight of tritium production at commercial nuclear power plants is generally effective. The Office of the Inspector General (OIG) also concluded that NRC's licensing of tritium production at two nuclear power plants owned by TVA is permitted under Federal law and although tritium

effluents have increased from TVA's Watts Bar Unit 1 during tritium production, they are still well below regulatory limits. However, there are some areas that merit management's consideration. OIG determined that:

- It is unclear to stakeholders whether TVA needs subsequent NRC authorization to produce tritium at Sequoyah Units 1 and 2.

- NRC's communication with stakeholders regarding tritium production could be improved.

AGENCY COMMENTS

Agency comments provided during a September 9, 2011, exit conference have been incorporated, as appropriate, into this report. The agency declined to provide formal comments.

ABBREVIATIONS AND ACRONYMS

Ci	Curie
CFR	Code of Federal Regulations
DOE	Department of Energy
OIG	Office of the Inspector General
mrem	millirem
NRC	Nuclear Regulatory Commission
µCi/ml	Micro curries per milliter
TVA	Tennessee Valley Authority
TPBARs	Tritium Producing Burnable Absorber Rods

TABLE OF CONTENTS

I. BACKGROUND

The Nuclear Regulatory Commission (NRC) is responsible for ensuring that nuclear power plant licensees operate nuclear power plants in a manner that protects public health and safety and the environment. Tritium is a radioactive isotope[1] of hydrogen used in U.S. nuclear weapons. Traditionally, U.S. commercial nuclear power production has been independent of the Nation's nuclear weapons program. However, in 1999, Federal law authorized tritium production at two commercial nuclear power plants owned by the Tennessee Valley Authority (TVA).[2] As NRC continues to provide oversight of tritium production, the agency may need to identify new approaches to licensing and communications.

NRC's Mission

NRC's mission is to regulate the Nation's civilian use of nuclear materials to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment. NRC's regulatory mission covers regulation of commercial reactors generating electric power and research and test reactors used for research, testing, and training. Currently, there are 104 nuclear power reactors licensed to operate in the United States, and these reactors generate about 20 percent of the Nation's electrical use.

What is Tritium?

Tritium, a radioactive isotope of hydrogen, is produced naturally in the upper atmosphere when cosmic rays strike nitrogen molecules in the air. Like hydrogen, tritium reacts with oxygen to form water. However, when tritium reacts with oxygen, it forms tritiated water. Tritiated water is water in which some of the non-radioactive hydrogen atoms in the water are replaced by tritium. Tritium can enter the human body when people swallow tritiated water. People are exposed to small amounts of tritium every day since it is widely dispersed in the environment and in the food chain. As with all ionizing radiation, exposure to tritium increases the risk

[1] Atoms that have the same number of protons but different numbers of neutrons are isotopes.

[2] TVA is a Federal corporation set up by Congress and is the Nation's largest public power company, supplying electricity to people in parts of seven southeastern States.

of developing cancer. However, because tritium emits very low energy ionizing radiation and leaves the human body relatively quickly, tritium is one of the least dangerous radioactive isotopes.

Tritium is a crucial component of U.S nuclear weapons; it is used in U.S. nuclear warheads to enhance the explosive yield. Tritium has a relatively short half-life[3] of approximately 12 years – it decays at a rate of about 5 percent per year. Tritium's relatively short half-life makes it necessary for routine replenishing in U.S. nuclear weapons.

Tritium Production

Although tritium occurs naturally in the environment and as a byproduct of electricity production at commercial nuclear reactors, the amounts of tritium from these sources are too small for practical use. Therefore, tritium must be produced in larger quantities. The production of tritium requires the generation of energetic neutrons. One way of producing these neutrons is through the use of a nuclear reactor.

To produce tritium in a nuclear reactor for use in nuclear weapons, a redesign of an important reactor core component is required. Some commercial nuclear reactors contain burnable absorber rods in the reactor core that control the production and distribution of heat in the core by absorbing excess neutrons that would otherwise produce fission reactions. To produce tritium in a nuclear reactor, the normal absorbing material, boron, is replaced by an isotope of lithium, requiring a redesign of the absorber rods. That isotope of lithium is an absorber like boron, but the nuclear reaction it undergoes during the absorption process also produces tritium. Such rods are called tritium producing burnable absorber rods (TPBARs).

The National Nuclear Security Administration, a semi-autonomous agency within the Department of Energy (DOE), works with the Department of Defense to maintain the quantity and quality of the U.S. nuclear weapons stockpile. On December 5, 1995, DOE issued a Record of Decision in which it committed to ensuring adequate tritium production capability for

[3] Half-life is the time in which one half of the atoms of a particular radioactive substance disintegrate into another nuclear form. Measured half-lives can vary from millionths of a second to billions of years.

the Nation's nuclear weapons.[4] The decision initiated DOE's lease of irradiation services from an existing commercial nuclear reactor. On May 7, 1999, DOE selected commercial nuclear power plants, TVA's Watts Bar Unit 1 and Sequoyah Units 1 and 2, as its long-term sources for tritium production.

NRC Oversight of Tritium Production

Commercial nuclear power plants are required to operate in accordance with NRC regulations and their NRC operating licenses. NRC licenses contain technical specifications that are derived from a nuclear power plant's safety analysis and NRC regulations. Technical specifications impose safety limits on power plant operations and require certain surveillance activities, design features, and administrative controls under which a licensee must operate its nuclear power plant. Changes to technical specifications require NRC approval via a license amendment.

Tritium production at commercial nuclear reactors involves coordination between NRC and DOE. On May 22, 1996, the Secretary of Energy and the NRC Chairman signed a memorandum of understanding that established the basis for NRC review and consultation regarding DOE's use of commercial nuclear reactors for producing tritium. As such, NRC assisted DOE in assessing and resolving technical and licensing issues involved in using commercial reactors for tritium production. More specifically, NRC reviewed DOE's proposal to test irradiation of a limited number of fuel assemblies containing TPBARs in a commercial nuclear reactor. NRC documented its safety review of DOE's proposal to test a limited number of fuel assemblies in NUREG-1607,[5] which was published in 1997. NRC also reviewed DOE's safety assessments on tritium production and issued its safety evaluation[6] in May 1999.

[4] Historically, tritium for replenishment of existing nuclear weapons was produced in a nuclear reactor – the K reactor, at DOE's Savannah River Site in South Carolina. In 1988, the reactor was shut down for safety reasons and no additional tritium was produced by DOE for weapons purposes.

[5] NUREG-1607 is titled, "Safety Evaluation Report related to the Department of Energy's proposal for the irradiation of lead test assemblies containing tritium-producing burnable absorber rods in commercial light-water reactors."

[6] NUREG-1672 is titled, "Safety Evaluation Report related to the Department of Energy's topical report on the tritium production core."

NRC Licensing of Tritium Production at Watts Bar Unit 1

Watts Bar Nuclear Plant, Unit 1, is located near Spring City, Tennessee – 60 miles southwest of Knoxville, Tennessee. Watts Bar Unit 1 is a Westinghouse four-loop pressurized water reactor. Watts Bar Unit 1's operating license was issued February 7, 1996, and expires November 9, 2035. Watts Bar Unit 1, the last commercial nuclear unit in the United States to come online in the 20th century, began commercial operation in May 1996.

Since Watts Bar Unit 1 came online, NRC has issued multiple license amendments allowing irradiation of TPBARs. In August 2001, TVA filed an application to amend the Watts Bar Unit 1 operating license to allow for irradiation of up to 2,304 TPBARs in the reactor core each fuel cycle. NRC issued a license amendment in September 2002 approving irradiation of 2,304 TPBARs as requested by TVA in the Watts Bar Unit 1 reactor. In its May 1999 safety evaluation on DOE's tritium production program, NRC explained that DOE established a permeation goal of less than 1 curie[7] per year per TPBAR. However, the actual permeation rate[8] was up to 4.2 curies per year per TPBAR. Therefore, if Watts Bar Unit 1 irradiated 2,304 TPBARs, the permeation of tritium might have been approximately 9,600 curies into the reactor coolant annually. There are no regulatory requirements governing the amount of tritium allowed in the reactor coolant. In May 2003, TVA requested another license amendment to reduce the amount of TPBARs to be irradiated to 240 TPBARs per cycle in Watts Bar Unit 1. NRC approved that request in October 2003. In May 2009, NRC issued another license amendment, number 77, which authorized TVA to irradiate up to 704 TPBARs at Watts Bar Unit 1. Table 1 depicts the license amendments issued by NRC to TVA allowing irradiation of TPBARs at Watts Bar Unit 1.

[7] A curie (Ci) is a unit used to measure the intensity of radioactivity. It refers to the amount of ionizing radiation released when an element spontaneously emits energy as a result of the radioactive decay (or disintegration) of an unstable atom. Radioactivity is also the term used to describe the rate at which radioactive material emits radiation, or how many atoms in the material decay (or disintegrate) in a given time period. One Ci is equal to 37 billion (3.7×10^{10}) disintegrations per second.

[8] The permeation rate is the amount of tritium that leaks into the reactor coolant annually.

Table 1: NRC License Amendments Allowing TPBARs at Watts Bar Unit 1

Date	License Amendment Number	Number of TPBARs (upper limit permitted)
September 15, 1997	8[9]	32
September 23, 2002	40	2,304
October 8, 2003	48	240
January 18, 2008	67	400
May 4, 2009	77	704

Source: Office of the Inspector General (OIG) analysis of NRC documents.

NRC issued a violation to TVA because TVA did not inform NRC of the higher than expected permeation rate in a license amendment request for Watts Bar Unit 1. In March 2010, NRC inspectors reported that TVA failed to submit complete and accurate information for the license amendment. The failure to submit complete and accurate information was determined to be a minor violation because TVA configured the core TPBAR loading in a conservative manner. According to NRC, this lack of information resulted in NRC giving TVA allowance to change the configuration of the core, which NRC may not have otherwise permitted. The higher than expected permeation rate of tritium from TPBARs into the reactor coolant at Watts Bar Unit 1 and the actual number TPBARs were not known by NRC until the program was reviewed by the Government Accountability Office.[10]

[9] License amendment number 8 permitted Watts Bar Unit 1 to load 32 lead test assemblies containing TPBARs in the reactor core.

[10] GAO-11-100, "Nuclear Weapons: National Nuclear Security Administration Needs to Ensure Continued Availability of Tritium for the Weapons Stockpile" (October 2010).

Table 2 depicts the actual number of TPBARs irradiated at Watts Bar Unit 1. Watts Bar Unit 1 had 240 TPBARs installed from fall 2003 to spring 2008. That number was increased to 368 in spring 2008, and then reduced to 240 again in fall 2009, then increased to 544 in the fuel cycle that started in spring 2011.

Table 2: Actual TPBARs Irradiated at Watts Bar Unit 1 Per Cycle

Approximate Fuel Cycle Dates	Fuel Cycle	Number of TPBARs Irradiated
Fall 1997 - Spring 1999	2	32
Spring 1999 - Fall 2000	3	0
Fall 2000 - Spring 2001	4	0
Fall 2001 - Fall 2003	5	0
Fall 2003 - Spring 2005	6	240
Spring 2005 - Fall 2006	7	240
Fall 2006 - Spring 2008	8	240
Spring 2008 - Fall 2009	9	368
Fall 2009 - Spring 2011	10	240
Spring 2011 - Present	11	544

Source: OIG analysis of TVA documents.

NRC Licensing of Tritium Production at Sequoyah Units 1 and 2

Sequoyah Nuclear Power Plant Units 1 and 2 are located near Soddy-Daisy, Tennessee – 9.5 miles northeast of Chattanooga, Tennessee. Both Sequoyah Units 1 and 2 are Westinghouse four-loop pressurized water reactors. Sequoyah Unit 1's operating license was issued September 17, 1980, and expires September 17, 2020. Sequoyah Unit 2's operating license was issued September 15, 1981, and expires September 15, 2021.

In September 2001, TVA filed an application to amend the Sequoyah Units 1 and 2 plant licenses to allow for the irradiation of up to 2,256 TPBARs in the reactor core each fuel cycle. In September 2002, NRC issued license amendment numbers 278 and 269, to Sequoyah Units 1 and 2, respectively, approving irradiation of up to 2,256 TPBARs. On December 1, 2003, NRC issued license amendment numbers 289 and 279 for the Sequoyah Units 1 and 2, respectively, revising the plants' technical specifications, but still allowing up to 2,256 TPBARs to be irradiated each fuel cycle. Tritium production has not commenced at either of the Sequoyah units.

II. PURPOSE

The evaluation objective was to determine the effectiveness of NRC's oversight of tritium production at commercial nuclear reactors.

III. RESULTS

NRC's oversight of tritium production at commercial nuclear power plants is generally effective. However, there are some areas that merit management's attention. OIG determined that:

- NRC's licensing of tritium production is permitted under Federal law.
- Tritium effluents from Watts Bar Unit 1 have increased during tritium production, although they are still well below regulatory limits.
- It is unclear to stakeholders whether TVA needs subsequent NRC authorization to produce tritium at Sequoyah Nuclear Power Plant Units 1 and 2.
- NRC's communication with stakeholders regarding tritium production could be improved.

A. NRC's Licensing of Tritium Production Is Permitted Under Federal Law

On October 5, 1999, President Clinton signed the National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65, into law. Of particular significance to NRC are the provisions authorizing and appropriating funds for DOE's use of commercial light water reactors for the production of tritium for weapons purposes. The act expressly requires DOE to meet its tritium production needs by using TVA's Watts Bar and Sequoyah nuclear sites, commercial facilities licensed by NRC. Specifically, section 3134(a) of subtitle C provides that the Secretary of Energy "shall produce new tritium to meet the requirements of the DOE at the TVA Watts Bar and Sequoyah nuclear power plants." By specifically authorizing and appropriating funds for DOE's production of tritium at TVA facilities, Congress has eliminated any prior statutory ambiguity as to whether these particular commercial facilities may be used for tritium production for nuclear weapons purposes. NRC license amendments were required to reconfigure the TVA facilities to allow for the production of tritium.

B. Watts Bar Unit 1 Tritium Effluents Increased, and Are Below Regulatory Limits

During the time tritium has been produced at Watts Bar Unit 1, levels of tritium being released into the environment have increased, although the levels remain below regulatory limits.

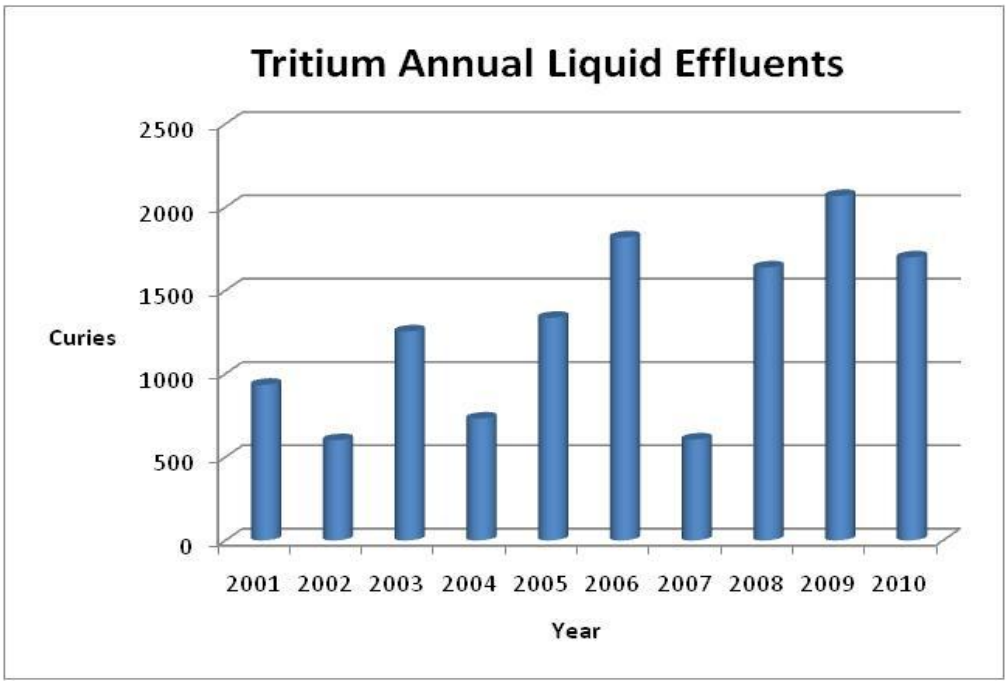
Tritium Effluent Releases from Watts Bar Unit 1 Have Increased

Effluent releases are the controlled, monitored radioactive liquid or gaseous discharges from nuclear power plants. Licensees are required to submit annual effluent release reports to NRC. These reports are publicly available.

The trend of tritium effluents released each year by Watts Bar Unit 1 has generally increased over the 10-year period beginning in 2001. Although tritium effluents are increasing, this cannot be attributed only to the irradiation of TPBARs at Watts Bar Unit 1 because tritium is a byproduct at all nuclear power plants, including those without TPBARs. According to

OIG analysis of TVA effluent reports, the average of annual tritium releases from 2001 through 2005 was 971 curies per year, and the average of annual tritium releases from 2006 through 2010 was 1,565 curies per year, an increase of about 61 percent. Table 3 shows the total curies of tritium annual liquid effluents released from Watts Bar Unit 1.

Table 3:



Source: OIG analysis of TVA reports.

Tritium effluent releases from nuclear power plants generally do not cause ground water contamination. Tritium in ground water at or near nuclear power plants has been of increased concern at some plants in the United States. Typically, tritium ground water contamination at commercial nuclear power plants is a result of a leak in a below-ground system, such as a pipe, tank, or valve. Normally, liquid effluents, including diluted tritium from nuclear power plants, are released into bodies of water, such as the Tennessee River in the case of Watts Bar Unit 1, and do not contaminate ground water.

Watts Bar Effluents Are Below Regulatory Limits

NRC incorporated into its regulations the dose recommendations from the International Commission on Radiological Protection.[11] The International Commission on Radiological Protection's recommendation was 100 millirem (mrem)[12] per year for dose to members of the public, and nuclear power plants must now meet that requirement. For liquid effluents, including tritiated water, licensees can demonstrate compliance with the 100 mrem per year dose standard by not exceeding the concentration values specified in Title 10 of the Code of Federal Regulations (CFR), Part 20, Appendix B, Table 2. These concentration values, if inhaled or ingested over the course of a year, would produce a total effective dose of 50 mrem.

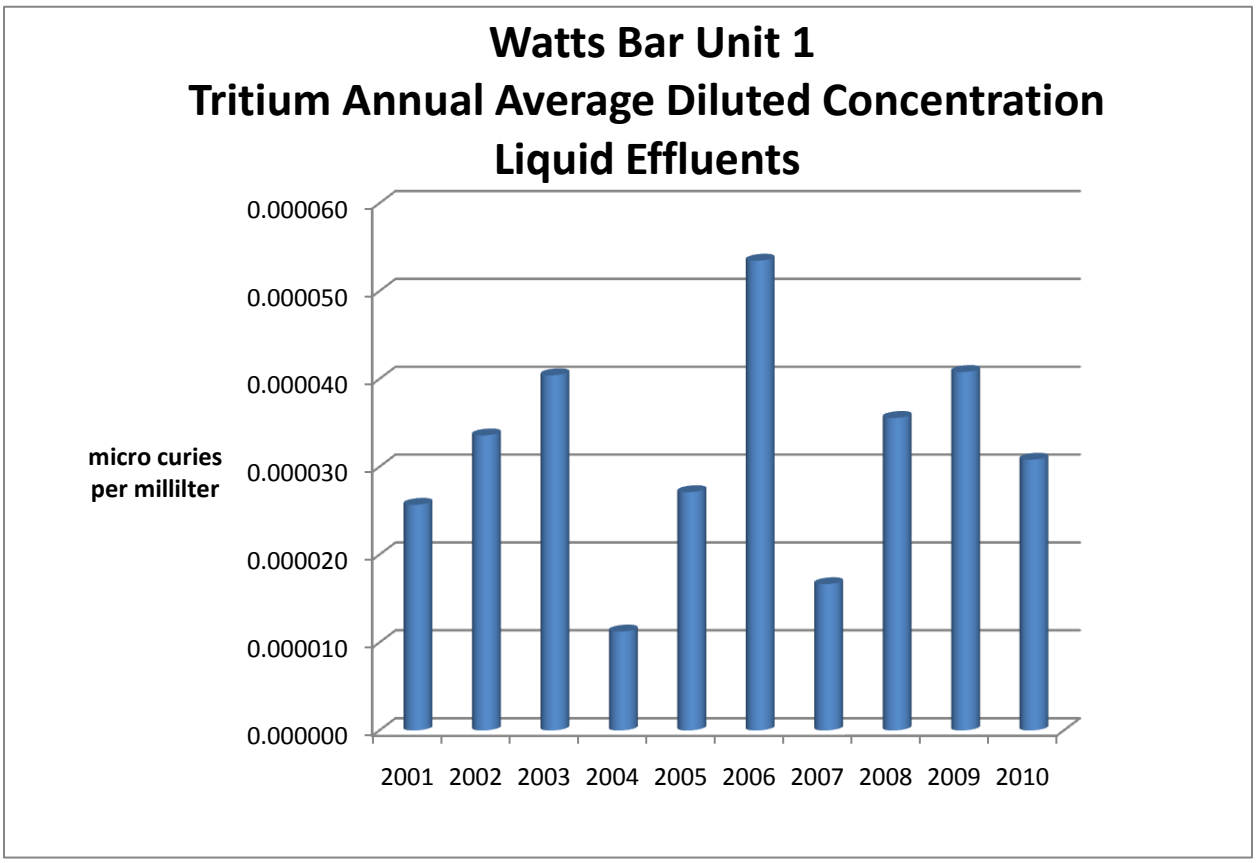
Nuclear power plants are also required to report the average concentrations of diluted effluents. The regulatory limit for liquid tritium effluent releases, as stated in Table 2 of Appendix B to 10 CFR Part 20, is 1E-3 micro curies per milliliter (µCi/ml), or 0.001 µCi/ml.[13] Table 4 in this report depicts the tritium annual average diluted concentration liquid effluents, according to TVA reports for Watts Bar Unit 1, for 2001 through 2010. The annual effluent releases ranged from 0.00001125 µCi/ml, to 0.00005347 µCi/ml, well below the regulatory limit of 0.001 µCi/ml.

[11] The International Commission on Radiological Protection is an organization of international scientists who provide recommendations regarding radiation protection activities, including doses.

[12] A millirem is a unit of radiation dose. One millirem is one thousandth of a rem. The rem is a standard unit used to measure the dose equivalent (or effective dose), which combines the amount of energy (from any type of ionizing radiation that is deposited in human tissue), along with the medical effects of the given type of radiation.

[13] 1E-3 is a value expressed in engineering notation. 1E-3 equals 1.0 times 10 to the exponent negative 3, or 1.0×10^{-3}.

Table 4:



Source: OIG analysis of TVA reports.

C. It Is Unclear to Stakeholders Whether TVA Is Authorized To Produce Tritium at Sequoyah Units 1 and 2

It is not clear to stakeholders whether Sequoyah Nuclear Power Plant Units 1 and 2 would need subsequent license amendments to produce tritium.[14] Sequoyah Units 1 and 2 license amendment numbers 278, 269, 289, and 279 each contained a clause that the license amendments were effective as of the date of issuance, but are to be implemented no later than the startup from an outage in which TPBARs are loaded into the reactor core. The clause in the license amendments also provided that if changes are made to the reactor that materially affect the basis of the approval of the license amendments, then TVA is not authorized to irradiate TPBARs in the reactor core.

[14] On October 22, 2003, TVA advised NRC that the production of tritium in the Sequoyah reactors had been delayed indefinitely.

Since TPBARs have not been installed in either Sequoyah Unit 1 or 2, the provisions authorizing the loading of TPBARs in license amendment numbers 278, 269, 289, and 279 have not been implemented in Sequoyah's technical specifications. However, NRC's permission allowing up to 2,256 TPBARs to be installed at both Sequoyah units is still in place – as long as TVA determines that no changes have occurred that materially affect the basis for the approval of the license amendment. Because the change in the technical specifications that incorporates the license amendment cannot be made until TPBARs are installed, it is not evident to stakeholders from reading the Sequoyah technical specifications that these nuclear reactors have NRC approval to install up to 2,256 TPBARs in their core.[15] Assuming that TVA has not made any changes to the Sequoyah units that materially affect the basis of approval of the amendments, then TVA has NRC approval to load up to 2,256 TPBARs into Sequoyah Units 1 and 2.

Some NRC and TVA staff have said that to produce tritium at either Sequoyah unit, TVA would need to seek another license amendment. However, other NRC staff stated that Sequoyah is authorized to produce tritium, by irradiating up to 2,256 TPBARs. To know whether Sequoyah is authorized to produce tritium at Sequoyah Units 1 and 2, a stakeholder would need to be aware of the clause in the license amendments and whether TVA has made any changes to Sequoyah that materially affect the basis for NRC approval of the amendments.

Issue for management consideration:

NRC management should consider clarifying to stakeholders whether Sequoyah Nuclear Power Plant Units 1 and 2 would need a subsequent license amendment to be authorized to produce tritium.

[15] In contrast, the Watts Bar Unit 1 technical specifications include language making it clear to a stakeholder that tritium production at the plant is permissible.

D. NRC's Communication Regarding Tritium Production Could Be Improved

NRC's communication with stakeholders regarding tritium production could be improved. A communication plan for Watts Bar Unit 1 and Sequoyah Units 1 and 2 tritium production was issued August 28, 2001, but it has not been updated and is not an active communication plan. NRC's communication plan Web page states that a communication plan should be kept up to date, referred to routinely, and revised if necessary. A communication plan is the strategy component that outlines what tools to use to ensure a consistent and accurate message to all stakeholders regarding a response, action, or initiative.

NRC guidance states that there are several circumstances when a communication plan may be needed, for example, when an NRC project, program, or event is controversial or highly visible, which may provoke a reaction from stakeholders such as Congress or the public, or when the results of the decisions will affect the environment or public health and safety.

The purpose of the communication plan for oversight of tritium production is to ensure that internal and external stakeholders understand NRC's licensing role and its responsibility to ensure that TVA maintains reactor safety while providing irradiation services. The secondary goal of the communication plan is to assist DOE in its efforts to increase public confidence in DOE use of commercial nuclear power reactors as irradiation facilities to produce tritium. This plan helps ensure that NRC informs internal and external stakeholders about the program to produce tritium.

NRC's Office of Nuclear Reactor Regulation[16] would consider the communication plan on tritium production complete when NRC issues the license amendments and completes any other tritium production program licensing reviews for Watts Bar and Sequoyah, or when DOE determines that it no longer wants to use a commercial power reactor as part of its

[16] The Office of Nuclear Reactor Regulation supports the NRC mission to protect public health, safety, and the environment by developing and implementing rulemaking, licensing, oversight, and incident response programs for reactors.

tritium production program. Although the communication plan is inactive, these licensing and production activities were still ongoing as of July 2011.

Changes Since the Communication Plan Was Issued

Much has changed with respect to DOE's tritium production program since the 1996 memorandum of understanding was approved and the 2001 communication plan was written:

- Public interest has increased, especially regarding tritium leaks at nuclear power plants.
- Due to the permeation rate per TPBAR being higher than originally anticipated, TVA chose to request a lower limit of TPBARs to be irradiated at Watts Bar than initially approved.
- DOE tritium requirements have been reduced due to the reduction in the number of nuclear weapons.

Additionally, according to TVA staff, DOE plans to supplement the Environmental Impact Statement for its continued tritium production at commercial nuclear power plants. This will likely result in public meetings and other regulatory and licensing activities of interest to stakeholders. Due to the revised Environmental Impact Statement, there will likely be increased stakeholder interest in regulatory activities related to tritium production over the next few years, and NRC would benefit from an updated tritium production communication plan.

Issue for management consideration:

NRC management should consider updating and reissuing a communication plan for the tritium production program.

IV. AGENCY COMMENTS

On August 25, 2011, OIG issued a discussion draft to the Executive Director for Operations. On September 8, 2011, Agency staff provided informal comments to the draft report. OIG subsequently met with NRC management on September 9, 2011, for an exit conference. On September 12, 2011, OIG provided the agency a revised discussion draft and on September 15, 2011, the agency declined to provide formal comments. The final report incorporates revisions made, as appropriate, as a result of comments provided by NRC and meetings with NRC staff.

Appendix

SCOPE AND METHODOLOGY

OIG conducted this evaluation to determine the effectiveness of NRC's oversight of tritium production at commercial nuclear power plants. OIG reviewed law applicable to NRC's oversight of tritium production at commercial nuclear reactors, including the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974; and the National Defense Authorization Act for Fiscal Year 2000. OIG also reviewed all license amendments allowing insertion of TPBARs in Watts Bar Unit 1 and Sequoyah Units 1 and 2; the Core Operating Limits Reports for those fuel cycles at Watts Bar Unit 1 in which TPBARs were irradiated; and Watts Bar Nuclear Power Plant Annual Radioactive Effluent Release Reports for 2001 to 2010. OIG also reviewed NRC's Safety Evaluation Reports – NUREGs 1607 and 1672 – relative to the insertion of TPBARs into a commercial nuclear reactor. Additionally, OIG reviewed NRC's "Communication Plan for NRC's Role in DOE's Program to Produce Tritium" and a 1996 Memorandum of Understanding between NRC and DOE.

OIG interviewed NRC staff in the Office of Nuclear Reactor Regulation, Region II, and the Office of the General Counsel. OIG also interviewed staff from TVA. On April 28, 2011, OIG attended a meeting in Athens, Tennessee, to discuss the 2010 performance assessment for Watts Bar Unit 1 Nuclear Power Plant and construction inspections for Watts Bar Unit 2. On June 7, 2011, OIG observed a pre-submittal meeting on TPBARs for Watts Bar Unit 1 between TVA staff and NRC staff.

We conducted this evaluation at NRC headquarters and Athens, Tennessee, from April 2011 through July 2011. The evaluation work was conducted by Sherri Miotla, Team Leader; Michael Zeitler, Audit Manager; Kevin Nietmann, Senior Technical Advisor; Mitzi Lorette, Senior Auditor; and Kristen Lipuma, Management Analyst.