8120-08-P

**TENNESSEE VALLEY AUTHORITY**

**Production of Tritium in Commercial Light Water Reactors**

**AGENCY:** Tennessee Valley Authority.

**ACTION:** Record of decision.

**SUMMARY:** This notice is provided in accordance with the Council on Environmental Quality's regulations and the Tennessee Valley Authority's (TVA) procedures for implementing the National Environmental Policy Act (NEPA). TVA has decided to implement the preferred alternative identified in the Final Supplemental Environmental Impact Statement (SEIS) for the Production of Tritium in a Commercial Light Water Reactor, issued March 4, 2016, prepared by the U.S. Department of Energy National Nuclear Security Administration (DOE/NNSA). The decision allows for the production of tritium using TVA reactors at both the Watts Bar and Sequoyah sites in eastern Tennessee and continues an interagency agreement with DOE/NNSA under The Economy Act to provide irradiation services for producing tritium in TVA light water reactors.

**FOR FURTHER INFORMATION CONTACT:** Matthew Higdon, Tennessee Valley Authority, NEPA Specialist, 400 West Summit Hill Drive (WT11D), Knoxville, Tennessee 37902; telephone (865) 632-8051; or email mshigdon@tva.gov.

**SUPPLEMENTARY INFORMATION:** TVA adopted the Final SEIS on March 4, 2016 (81 FR 11557-11558) in accordance with 40 CFR 1506.3. As a cooperating agency, TVA provided subject matter expertise, independent review and evaluation, and close coordination with DOE/NNSA during the environmental review process, including preparation of the Draft SEIS and the Final SEIS. DOE/NNSA issued a Record of Decision (ROD) based on the Final SEIS on June 22, 2016 (81 FR 40685). By this notice, TVA is providing notification of its decision and agency reasoning.

**Background**

The DOE is responsible for supplying nuclear materials for national security needs and ensuring that the nuclear weapons stockpile remains safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other nuclear materials used in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the Nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically.

In March 1999, DOE/NNSA published the Final EIS for Production of Tritium in a Commercial Light Water Reactor, which addressed the proposed interagency agreement with TVA to produce tritium at TVA reactors using tritium-producing burnable absorber rods (TPBARs). In May 1999, DOE published the ROD for the 1999 EIS, identifying its decision to implement the agreement for tritium production at the Watts Bar Unit 1 reactor (Watts Bar 1) in Rhea County, Tennessee, and Sequoyah Units 1 and 2 reactors (Sequoyah 1 and 2) in Hamilton County, Tennessee. Under the proposal, TVA would irradiate up to 3,400 TPBARs per reactor per fuel cycle, which lasts about 18 months. The agreement was needed by DOE/NNSA because at the time the U.S. nuclear weapons complex did not have the capability to produce the amounts of tritium that were needed to support the Nation's current and future nuclear weapons stockpile.

Following the environmental review, an agreement with DOE/NNSA was approved by the TVA Board of Directors in late 1999 and, in May 2000, TVA issued a ROD and adopted the DOE/NNSA's EIS (65 FR 26259). In 2000, TVA entered into an interagency agreement with DOE/NNSA under The Economy Act to provide irradiation services for producing tritium in TVA light water reactors through November 2035.

In explaining its decision in the ROD, TVA noted that the preamble to the TVA Act of 1933 identifies national defense as one of the purposes for its enactment, that Sections 15d(h) and 31 of the TVA Act declare that the Act should be liberally construed to aid TVA in discharging its responsibilities for the advancement of national defense, and that there have been numerous occasions on which TVA supported the Nation's defense efforts. In the ROD, TVA stated that this mandate to support the national defense was among the factors for consideration in approving the production of tritium.

TVA received license amendments from the U.S. Nuclear Regulatory Commission (NRC) in 2002 to produce tritium in Watts Bar 1 reactor and both Sequoyah reactors and has been producing tritium at the Watts Bar 1 reactor since 2003 (TVA has not produced tritium in Sequoyah 1 or 2; that has remained a viable option). Since 2003, irradiation experience at Watts Bar has shown that the permeation rate per TPBAR per year has been higher than the estimate that was included and analyzed in the 1999 EIS by DOE/NNSA. In the 1999 EIS, DOE/NNSA estimated that tritium permeated through the wall of the TPBARs into the reactor coolant at a rate of one curie per TPBAR per year. However, experience at Watts Bar has shown that the actual permeation rate is 3–4 curies per TPBAR per year (there are approximately 10,000 curies of tritium produced by a TPBAR). The higher-than-expected permeation rate has resulted in limitations on the number of TPBARs that TVA can irradiate in its reactors to meet DOE/NNSA's projected tritium requirements. Watts Bar Unit 2 (Watts Bar 2), which began commercial operation in late 2016, is not currently licensed for tritium production.

DOE/NNSA initiated the SEIS in 2011 to supplement its previous analysis to address the higher rates of permeation of tritium from TPBARs at TVA sites and to evaluate increasing tritium production quantities to meet requirements. In the SEIS analysis, DOE/NNSA used a conservative (i.e., bounding) estimate of tritium permeation rate, as well

as a conservative interpretation of the DOE/NNSA's revised estimate of the maximum number of TPBARs necessary to support current tritium supply requirements.

Six alternatives were analyzed in the SEIS, including alternatives to utilize Watts Bar 2. *The No Action Alternative* assumed irradiation of up to a total of 2,040 TPBARs every 18 months using Watts Bar 1 and Sequoyah 1 and 2. This alternative was based on the estimate in the 1999 EIS that a maximum of 3,400 curies of tritium would be released from any reactor in a given year, combined with an assumption of a conservative release of 5 curies for each TPBAR annually, or a total of 680 TPBARs in any given reactor. *Alternatives 1 and 2* assumed TVA would irradiate up to a total of 2,500 TPBARs every 18 months at only one site—only at the Watts Bar site under Alternative 1 and only at the Sequoyah site under Alternative 2. *Alternative 3* assumed TVA would irradiate up to a total of 2,500 TPBARs every 18 months using both the Watts Bar and Sequoyah sites. *Alternatives 4 and 5* assumed TVA would irradiate up to a total of 5,000 TPBARs every 18 months at only one site—only at the Watts Bar site using Watts Bar 1 and 2 under Alternative 4 and only at the Sequoyah site using Sequoyah 1 and 2 under Alternative 5.

In its Final SEIS, DOE/NNSA identified *Alternative 6* as the preferred alternative. Under this alternative, TVA would irradiate up to a total of 5,000 TPBARs every 18 months using both the Sequoyah and Watts Bar sites. Because TVA would irradiate a maximum of 2,500 TPBARs in any one reactor, one or both reactors at each of the sites may be involved. In discussing its preference, DOE/NNSA acknowledged that while the irradiation of a total of 2,500 TPBARs every 18 months is likely to continue to meet near-term national security requirements, implementing Alternative 6 provides DOE/NNSA with the greatest flexibility to address potential future scenarios because it encompasses the full numerical range of TPBARs that could, under any currently foreseeable circumstances, be irradiated in an 18-month period at the TVA reactors to satisfy national security requirements.

**Environmental Consequences**

In the SEIS, DOE/NNSA provided supplemental analysis of the potential impacts of each alternative on land use, aesthetics, climate and air quality, geology and soils, water resources, biological resources, cultural resources, transportation, infrastructure and utilities, socioeconomics and environmental justice, and human health and safety. Also addressed were impacts associated with potential accidents and intentional destructive acts and those associated with waste and spent nuclear fuel management. The potential environmental impacts of each alternative are summarized for comparison in the Summary and Section 2.5 of the Final SEIS.

The key findings of the SEIS are (1) Tritium releases from normal operations with TPBAR irradiation would have an insignificant impact on the health of workers and the public; (2) tritium releases from TPBAR irradiation would increase tritium concentrations in the Tennessee River in comparison with not irradiating TPBARs; however, the tritium concentration at any drinking water intake would remain well below the maximum permissible Environmental Protection Agency drinking water limit of 20,000 picocuries per liter; (3) TPBAR irradiation would not have a significant adverse impact on the operation and safety of TVA reactor facilities, and the potential risks from accidents would remain essentially the same whether TPBARs were irradiated in a TVA reactor or not; and (4) irradiation of 2,500 TPBARs in a single reactor would increase spent nuclear fuel generation by about 24 percent per fuel cycle and irradiation of 5,000 TPBARs at a single site would increase spent nuclear fuel generation at either Watts Bar or Sequoyah by about 48 percent per fuel cycle; however, TVA has a plan to manage the increased volume of spent nuclear fuel assemblies.

**Environmentally Preferable Alternative**

In its June 2016 ROD, DOE/NNSA identified the No Action Alternative as the environmentally preferable alternative after considering the potential impacts to each resource area by alternative. TVA concurs with this determination. Fewer environmental impacts would result from the No Action Alternative because the alternative would have the lowest limiting value considered for the total number of TPBARs proposed to be irradiated (no more than 2,040 TPBARs every 18 months).

**Decision**

In its June 2016 ROD, DOE/NNSA stated its intent to implement the preferred alternative, Alternative 6, under the terms of the existing interagency agreement with TVA. TVA has decided to implement Alternative 6 as well, which allows for the irradiation of a total of 5,000 TPBARs every 18 months using both the Watts Bar and Sequoyah sites. Because TVA could irradiate a maximum of 2,500 TPBARs in any one reactor, one or both reactors at each of the sites could be used. In the SEIS, DOE/NNSA assumed for Alternative 6 that each site would irradiate 2,500 TPBARs every 18 months. However, because the SEIS analyzes the impacts of irradiating up to 5,000 TPBARs at a single site, Alternative 6 is not intended to limit the number of TPBARs irradiated at either the Watts Bar or Sequoyah site, so long as no more than a total of 5,000 TPBARs is irradiated every 18 months, with no more than 2,500 TPBARs in any reactor core. This decision allows for irradiation of TPBARs at the Sequoyah site in the future; however, TVA does not currently have plans to irradiate TPBARs at the Sequoyah site in the near term.

In June 2016, TVA agreed to assess the potential for tritium production at Watts Bar 2. As a result of that assessment, TVA is planning to submit a license amendment to the NRC in late 2017 to authorize irradiation of up to 1,792 TPBARs in Watts Bar 2. Subject to approval of the license agreement, tritium production in Watts Bar 2 is currently projected to start in the fall of 2020 with the loading of approximately 600 to 704 TPBARs. Plans further

call for Watts Bar 2 to be irradiating approximately 1,500 to 1,792 TPBARs by December 2025.

The basis for TVA's decision is its commitment to provide irradiation services for producing tritium for DOE/NNSA based on the interagency agreement established in 2000 between the two agencies. TVA concurs that the proposal reflects responsible planning on the part of DOE/NNSA and provides the greatest flexibility for DOE/NNSA to meet future tritium production requirements through the potential availability of up to four reactors (i.e., the addition of Watts Bar 2) to assist in meeting national security requirements. No other alternative reviewed in the SEIS provided the desired flexibility. The decision represents TVA's continued commitment to support the Nation's defense efforts and national security requirements.

**Mitigation Measures**

The SEIS identified several mitigation measures that would reduce potential impacts from tritium releases. In the event that TVA decides to irradiate TPBARs at Sequoyah site or facilitate routine tritium management, TVA would construct and operate a 500,000-gallon tritiated water tank system (similar to the system at the Watts Bar site) at Sequoyah to mitigate potential impacts from tritium releases. TVA would use the respective tank systems at both sites to store tritiated water after it passed through the liquid radioactive waste processing system. TVA would release the stored tritiated water to the Tennessee River by the existing pathways at the site. The tank systems would have sufficient capacity to store and release the water to the Tennessee River at appropriate times (that is, TVA will release stored tritiated water from the tank during times of higher river flows for better dilution), and it will enable TVA to minimize the potential impacts of tritiated water releases. The systems would enable TVA to plan fewer releases each year and to ensure that site effluents would continue to remain well below regulatory concentration limits. Additionally, TVA will

continue to monitor its operations for emissions to air and water in accordance with NRC licensing requirements. TVA has adopted all practicable means to avoid or minimize environmental harm from the selected alternative.

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