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UNITED STATES NUCLEAR REGULATORY COMMISSION

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U.S. Nuclear Regulatory Commission (the Commission or NRC) is considering issuance of an amendment to Facility Operating License No. NPF-90, issued to Tennessee Valley Authority (TVA), for operation of the Watts Bar Nuclear Plant, Unit 1 (WBN), located in Rhea County, Tennessee.

ENVIRONMENTAL ASSESSMENT

Identification of the Proposed Action:

TVA has requested a change to the current WBN Technical Specifications (TSs) to provide for insertion of four lead test assemblies (LTAs) containing 32 tritium producing burnable absorber rods (TPBARs) into the WBN reactor during Fuel Cycle 2. After a single cycle of operation the TPBARs will be removed from the reactor and stored in the spent fuel pool. Then the TPBARs will be placed in shipping casks and transported off-site under Department of Energy (DOE) control.

The Need for the Proposed Action:

As discussed in the NRC staff report, NUREG-1607, "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," May 1997, DOE is responsible for establishing the capability to produce tritium, an essential material used in U.S. nuclear weapons, by the end of 2005, in accordance with a Presidential

decision directive. Tritium is an isotope of hydrogen that decays at a rate of approximately 5 percent per year (a 12.3-year half-life). The United States has not produced tritium for use in nuclear weapons since 1988, when DOE closed its production facility at Savannah River. Resumption of tritium production for weapons will be essential for maintaining the U.S. nuclear weapons stockpile and the U.S. nuclear deterrent. DOE has selected a dual-path strategy to meet its schedule, one of which proposes to produce tritium in commercial light water reactors (CLWRs), either through acquisition of reactor(s) under Government ownership or by contracting for target irradiation services at a plant under private ownership.

DOE has developed a design for burnable poison rods using lithium, rather than the boron which is currently used in reactor fuel assemblies. As a result of irradiation by neutrons in the rector core, some of the lithium in the target rods would be converted to tritium. The irradiated burnable poison rods can then be removed from the fuel assemblies and shipped to another location for tritium extraction. The first phase of the tritium program involving CLWRs is a lead test assembly (LTA) demonstration. LTA irradiation would serve as a confirmatory test of the design for TPBARs that DOE has developed over the past [illegible] years. For this purpose, DOE has selected TVA as a host utility to perform LTA irradiation. Accordingly, TVA proposes to insert four LTAs into the WBN reactor during Fuel Cycle 2 to provide irradiation services to support DOE investigations into the feasibility of using commercial light water reactors to maintain the nation's inventory of tritium. The proposed action is in accordance with TVA's application for amendment dated April 30, 1997, as supplemented by letters dated June 18, July 21 (3 letters), and August 7 and 21, 1997.

ALTERNATIVES TO THE PROPOSED ACTION:

As stated in the NRC staff report, NUREG-1607, the second phase of DOE's tritium production program that would involve CLWRs and require NRC review would be DOE's submittal of a topical report for production irradiation in mid-1998. The staff plans to initiate review of that report concurrently with the irradiation of the LTAs and anticipates that it will document its review in a safety evaluation report to be issued in early 1999. DOE has stated that, because the primary purpose of the LTA demonstration is to build confidence among prospective licensees, completion of the LTA demonstration is not an essential precursor to submittal of the topical report. The NRC staff could initiate review of the production topical report independent of the LTA demonstration. However, the staff may need information from the LTA demonstration before it can complete its review of the production topical report.

No Action Taken

The principal alternative would be to take no action to approve the LTA program in the WBN during Fuel Cycle 2. That alternative would avoid any environmental impacts which may be associated with this action, but as indicated herein, there are no significant environmental impacts associated with this action. Denial of this proposed action would have the result that further CLWR tritium production activities, including any NRC staff review of subsequent proposals for production of tritium in a CLWR, would then be made without the benefit of the results of the LTA program. This could result in additional uncertainties affecting DOE's choice of alternatives in the tritium production program, as well as the NRC staff's review, and is not considered a desirable option.

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION:

Radiological Impact

The WBN has waste treatment systems designed to collect and process waste that may contain radioactive material. The radioactive waste treatment systems were evaluated in the WBN Final Environmental Statement (FES) and its supplement. Results are reported in Tables 5.2 and 5.3 of NUREG-0498, Supplement 1, April 1995. The proposed amendment will not involve any change in the radioactive waste treatment systems or flowrates described in the FES and its supplement.

Tritium produces less dose per unit of radioactivity taken into the human body than many other nuclides because tritium (a) decays by the emission of a low-energy beta radiation, (b) passes through the human body in a short period of time, and (c) does not concentrate in a single organ. Furthermore, tritium in liquid effluents from Watts Bar is diluted to a relative low concentration before it reaches even the most highly exposed member of the public: i.e. the release of the entire 214 Ci (7.93 TBq) in a year's cooling water would produce an average concentration of only about 0.24 pCi/gm (8.9 Bq/kg) in the receiving water. Consequently, the maximum annual dose to a member of the public would be less than 0.02 mrem (0.2 micro-Sievert). This dose is less than 1 percent of the NRC criterion for liquid effluents and only about 0.007 percent of the average annual dose resulting from naturally occurring radionuclides.

The tritium would be further diluted before it reached the substantial number of people (about 216,000) residing in population centers downstream of Watts Bar so the resulting individual doses would be small, averaging about 0.4 micro-rem (4 nano-Sievert). The resulting population dose would be less than 0.09 person-rem (person-cSv).

A portion of the tritium might be released to the atmosphere. The amount would depend on plant conditions and the manner in which it is operated. If the entire 214 Ci (7.93 TBq) were released to the atmosphere, individuals could be exposed via a variety of pathways. These pathways include inhalation and skin absorption, as well as the consumption of meat, vegetables and milk. The total dose by all pathways to the most highly exposed member of the public is calculated to be less than 0.05 mrem (0.50 micro-Sievert). This is less than 1 percent of the NRC criterion for airborne effluents and less than 0.02 percent of the average person's annual dose resulting from naturally occurring radionuclides.

Tritium in the atmosphere also could reach the more highly populated areas in the vicinity of Watts Bar, but the airborne tritium would be diluted even more than would water-borne tritium. Thus the population dose would be smaller from a release to the atmosphere than from a release to the river.

It is concluded that the releases from Watts Bar, and the resulting off-site doses, will not be significantly affected by releases of tritium from the TPBPRs.

The proposed amendment is not expected to significantly affect the doses to the workers in the fuel storage area. The TPBARs are designed to have minimal effect on plant operations, including refueling operations. Since the unirradiated TPBARs are essentially not radioactive, they will produce no increase in exposure, occupational or non-occupational. After irradiation, the TPBARs are expected to contain some 370,000 Ci (13.7 PBq) of tritium (^3H). This is far more tritium, but far less radioactivity, than that produced by the reactor core. The tritium does not pose a particular threat because (1) tritium emits only a low-energy (E_{max} = 18.6 keV) beta and (2) the tritium is bound in the TPBARs. Some of the tritium beta energy is converted into x-rays

(bremsstrahlung) but 370,000 Ci of tritium produces less photon energy than is produced by 1 Ci (37 GBq) of ^{137}Cs and the ^{137}Cs radiation is much more penetrating. The spent fuel removed for refueling contains about a million curies of ^{137}Cs and many other nuclides. Thus, the effect of tritium as a source of external radiation in the reactor environment is negligible.

The TPBARs are designed to minimize the leakage of tritium and DOE experience indicates that leakage will be less than 6.7 Ci (0.248 TBq) per rod annually. If all 32 of the TPBARs were to leak at this rate, the annual tritium release to the reactor coolant would be less than 214 Ci (7.93 TBq). This quantity is consistent with the nominal amounts of tritium expected in pressurized water reactor (PWR) coolant systems. The NRC licensing calculation, the GALE code, predicts about 250 Ci (9.25 TBq) of tritium in the reactor coolant and tritium releases to the environment from large PWRs are averaging over 600 Ci (22.2 TBq) per year per reactor and ranging as high as 4,000 Ci (148 TBq) per year without exceeding regulatory limits. Thus, the TPBARs might produce an observable but not dramatic increase in the tritium concentration in the spent fuel pool. Increasing the tritium in the spent fuel pool could increase occupational exposure but, since tritium exposure is not an important contributor to occupational exposure (according to NRC data summarized in NUREG-0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1995", January 1997), the increase would be expected to be negligible. This is consistent with the results reported in the DOE report.

The staff concludes that the TPBARs could cause some increase in occupational radiation exposure. However, this increase would be negligible and would not constitute a safety, or an "as low as is reasonably achievable" (ALARA) concern.

Based on the above, the staff concludes that there are no significant radiological environmental impacts associated with the proposal.

Non-radiological Impact

The proposal does not affect non-radiological plant effluents and no changes to the National Pollution Discharge Elimination System (NPDES) permit are needed. The proposal does not result in any significant changes to land use or water use, or result in any significant changes to the quantity or quality of effluents and no effects on endangered or threatened species or on their habitat are expected. Therefore, no changes or different types of non-radiological environmental impacts are expected as a result of the amendment.

ACCIDENT CONSIDERATIONS

In its application, TVA evaluated the possible consequences of postulated accidents and described the means for mitigating these consequences should they occur. This evaluation included the effects of a TPBAR on postulated accidents, including a TPBAR assembly dropped during refueling, radiological consequences of release of reactor coolant (steam generator tube rupture or steamline break), and TPBAR damage and radiological consequences during a design-basis loss-of-coolant accident (LOCA). On the basis of its analysis, TVA concluded that the effect of the TPBAR on accident consequences would be small and that the calculated consequences are within regulatory requirements and staff guideline dose values.

As TVA has reported in its application and the staff has previously evaluated in NUREG-1607, there are increases in the potential radiological consequences resulting from a design basis LOCA; and the LOCA is the most limiting accident with regard to TPBAR failure. The DOE report states that the effect of TPBARs and the additional tritium on the combustible gas inventory following a LOCA is negligible. In addition, the maximum stored

inventory of tritium in TPBAR LTAs is a very small fraction of the hydrogen that would be released from a zirconium-water reaction. Consequently, TPBARs would have no significant contribution to combustible gas in a LOCA. The tritium released to the coolant would not be released as a gas and, therefore, would not produce an increase in hydrogen concentration. The resulting dose at the exclusion area boundary would be about 0.3 mrem (3 μSv). The potential increase in the offsite radiological consequence as a result of accidents has been determined to be negligible. The environmental impacts of any credible accidents are found not to be significant.

Summary

The Commission has completed its evaluation of the proposed action. The change will not significantly increase the probability or consequences of accidents, no changes are being made in the types and no significant increases are being made in the amounts of any effluents that may be released offsite, and there is no significant increase in the allowable individual offsite dose or cumulative occupational radiation exposure. Accordingly, the Commission concludes that there are no significant radiological environmental impacts associated with the proposed action.

With regard to potential nonradiological impacts, the proposed action involves features located entirely within the restricted area as defined in 10 CFR Part 20. It does not affect nonradiological plant effluents and has no other environmental impact. Accordingly, the Commission concludes that there are no significant nonradiological environmental impacts associated with the proposed action.

Alternative Use of Resources:

This action does not involve the use of any resources not previously considered in the FES for WBN Units 1 and 2, dated April 1995.

Agencies and Persons Consulted:

In accordance with its stated policy, on August 20, 1997 the staff consulted with the Tennessee State official, Mr. Eddy Nanney, of the Division of Radiological Health, regarding the environmental impact of the proposed action. The State official indicated that TVA and NRC should consider very carefully anything designed and fabricated by DOE that is to be put into the Watts Bar reactor. As stated herein, the NRC staff does believe that its review carefully considers the impacts of inserting the LTAs containing the TPBARs into Watts Bar during Fuel Cycle 2.

FINDING OF NO SIGNIFICANT IMPACT

The staff has reviewed the proposed lead test assembly program at WBN relative to the requirements set forth in 10 CFR Part 51. Based upon its environmental assessment, the staff has concluded that there are no significant radiological or non-radiological impacts associated with the proposed action and that the proposed license amendment will not have a significant effect on the quality of the human environment. Therefore, the Commission has determined, pursuant to 10 CFR 51.31, not to prepare an environmental impact statement for the proposed amendment.

For further details with respect to the proposed action, see the licensee's letter dated April 30, 1997, as supplemented by letters dated June 18, July 21 (3 letters), August 7 and 21, 1997, which are available for

public inspection at the Commission's Public Document Room, The Gelman Building, 2120 L Street, NW., Washington, DC, and at the local public document room located at the Chattanooga-Hamilton County Library, 1001 Broad Street, Chattanooga, Tennessee.

Dated at Rockville, Maryland, this 8th day of September 1997.

FOR THE NUCLEAR REGULATORY COMMISSION

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