

## **NRC, DOE, and TVA Presentation Slides**

# **Production of Tritium in Tennessee Valley Authority Reactors**



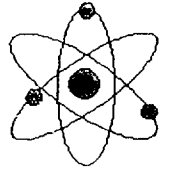
**James S. Chardos**

Tritium Program Manager  
Tennessee Valley Authority

October 2, 2001



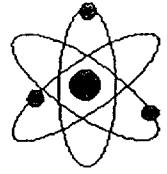
# Tritium Program



- **TVA PROGRAM OVERVIEW**
  - LEAD TEST ASSEMBLY PROGRAM
    - 32 TPBARS - ONE FUEL CYCLE
    - PLANT OPERATION UNAFFECTED
    - EXAMINATIONS HAVE BEEN ESSENTIALLY COMPLETED
      - RESULTS INDICATE PERFORMANCE AS DESIGNED
  - PRODUCTION PROGRAM
    - TVA LICENSE AMENDMENT REQUESTS UTILIZED AS REFERENCES
      - ENVIRONMENTAL IMPACT STATEMENT (EIS)
      - DOE TRITIUM PRODUCTION CORE (TPC) TOPICAL REPORT
        - EFFECT ON PLANT SYSTEMS AND PROGRAMS
      - NRC SAFETY EVALUATION REPORT (SER)
        - PLANT SPECIFIC INTERFACE ITEMS
    - WBN SUBMITTAL - 8/20/01
    - SQN SUBMITTAL - 9/21/01
    - REQUESTED 1 YEAR REVIEW



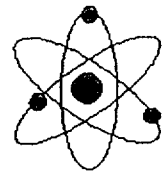
# Tritium Program



- **LICENSE AMENDMENT REQUESTS ADDRESS**
  - TECHNICAL SPECIFICATION CHANGES
    - ALLOW IRRADIATION OF TPBARS
  - FUEL VENDOR REPORTS
    - NRC SER INTERFACE ITEMS
    - EFFECT ON PLANT SYSTEMS
    - OTHER ITEMS (TPBAR CONSOLIDATION)
  - ANALYSIS PERFORMED BY
    - TVA
    - FUEL VENDORS ( WESTINGHOUSE AND FRAMATOME-ANP )
    - PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL)



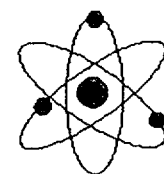
# Tritium Program



- ANALYSIS RESULTS
  - FUEL DESIGN/MANAGEMENT
    - NO DESIGN CHANGES NEEDED
    - NO FUEL STORAGE CHANGES NEEDED
    - REACTOR POWER AND CYCLE LENGTH ARE UNAFFECTED
    - DETERMINED MAXIMUM NUMBER OF TPBARs THAT CAN BE IRRADIATED (~2300)
    - ALL SAFETY LIMITS CONTINUE TO BE MET
  - PLANT SYSTEMS AND PROGRAMS
    - MINOR CHANGES TO SELECT SYSTEMS
      - LIQUID RADWASTE FLOW CONTROL
      - CONTINUOUS AIR SAMPLING
      - RELOCATION OF FOUR CONTROL RODS
    - MINOR CHANGES TO SELECT PLANT PROGRAMS
      - CHEMISTRY
      - RADIOLOGICAL CONTROLS
      - ENVIRONMENTAL MONITORING
      - RADIOLOGICAL EMERGENCY PLANNING



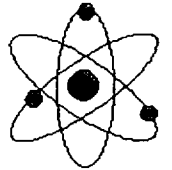
# Tritium Program



- **PLANT PROGRAMS**
  - CHEMISTRY
    - MORE FREQUENT WATER SAMPLING
      - REACTOR COOLANT
      - SPENT FUEL POOL
  - RADIOLOGICAL CONTROLS
    - ADDITIONAL TRITIUM MONITORING INSTRUMENTS
  - RADIOLOGICAL EMERGENCY PREPAREDNESS
    - EMERGENCY PROGRAMS TO INCLUDE ADDITIONAL TRITIUM MONITORING CAPABILITY
  - ENVIRONMENTAL
    - GROUND WATER, WELL WATER, AND DRINKING WATER - MORE FREQUENT SAMPLING
    - ADD TRITIUM AIR SAMPLING CAPABILITIES



# Tritium Program



- **OVERALL EFFECT**
  - DOES NOT AFFECT REACTOR OPERATION
  - DOES NOT AFFECT PLANT SAFETY (SAFETY ANALYSIS)
  - MINIMAL EFFECT ON ONSITE AND OFFSITE PERSONNEL EXPOSURE
  - EFFECT ON ENVIRONMENT BOUNDED BY EIS

# **Production of Tritium in Tennessee Valley Authority Reactors**



**Stephen M. Sohinki**

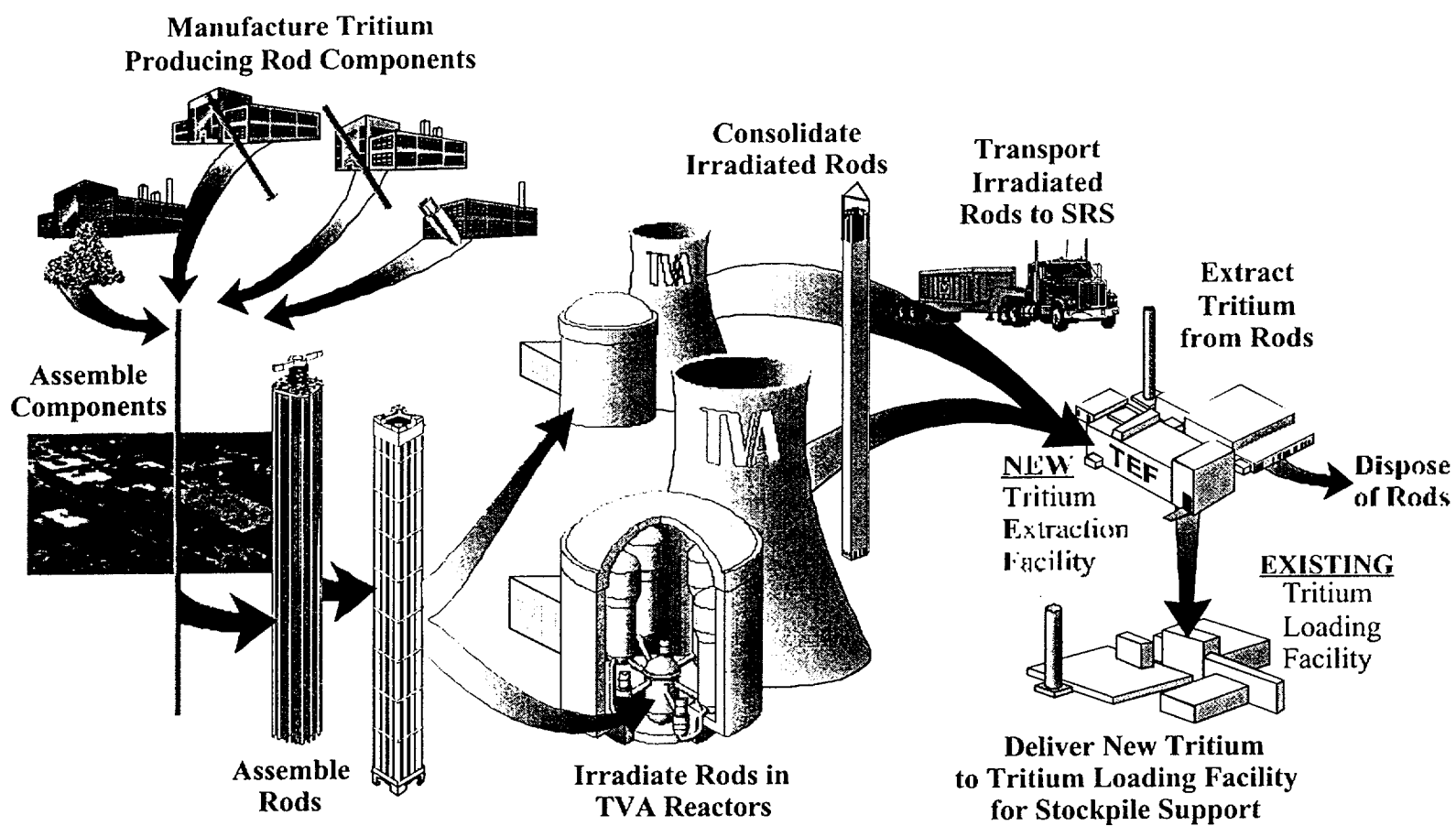
Director, Office of Tritium Production  
National Nuclear Security Administration

October 2, 2001





# System for Producing Tritium in Commercial Reactors





## How We Got Here

- **10 year analysis of alternatives for a new tritium supply source.**
- **May 1999**
  - **Secretary of Energy decided to use TVA reactors to assist in meeting tritium requirements.**
- **October 1999**
  - **Secretary's decision codified by the Congress and the President when Public Law 105-65 was enacted.**



# Tritium Requirements

- All US nuclear weapons need tritium to be capable of performing as designed.
- Tritium is a radioactive isotope of hydrogen.
  - 5.5% decays every year. Half is lost in 12.3 years.
- The U.S. has not made tritium since 1988.
  - Requirements met by recycling tritium from retired weapons.
- To meet current requirements, we need to start making it in late 2003.
  - Extraction operations to begin in 2006.
- Secretary of Defense Rumsfeld's nuclear posture review has been initiated.

# **NRC Public Meeting on TVA's License Amendment Requests to Produce Tritium**

**October 2, 2001**



L. Mark Padovan, Lead Project Manager  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission

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# Topics of Discussion

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- U.S. Nuclear Regulatory Commission
  - Who we are
  - What we do
  
- TVA's Watts Bar and Sequoyah License Amendment Requests to Irradiate Tritium-Producing Burnable Absorber Rods (TPBARs)
  
- Status of NRC's Review of TVA's Amendment Request

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# **U.S. NRC — Who We Are**

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- Independent Federal Agency
- Established by the U.S. Congress Under the Energy Reorganization Act of 1974
- Responsibility is to Ensure Adequate Protection of the Public Health and Safety, and the Environment, in the Use of Nuclear Materials in the United States

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# **NRC's Activities Include:**

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- Licensing and Inspection of Nuclear Reactors and Other Nuclear Facilities Including the Following:
  - ▶ plant operators
  - ▶ nuclear materials
  - ▶ developing and implementing rules and regulations
  - ▶ investigating nuclear incidents and allegations
  - ▶ enforcing NRC regulations and the requirements of NRC licenses

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# **Watts Bar and Sequoyah Operating Licenses**

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- Operating License for the Watts Bar Issued on February 7, 1996
  - ▶ 40-year license
- Operating Licenses for Sequoyah Units 1 & 2 Issued on September 17, 1980 and September 15, 1981
  - ▶ 40-year licenses



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# **NRC's License Amendment Review Process**

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- How Can a Licensee Change its Facility After it is Licensed?
  - ▶ Request license amendment from NRC
  - ▶ NRC must review and approve license amendment

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# **TVA's License Amendment Requests**

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- August 20, 2001 — Install and Irradiate up to 2304 TPBARs in the Watts Bar Reactor
- September 21, 2001 — Install and Irradiate up to 2256 TPBARs in Sequoyah Units 1 & 2 Reactors

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# NRC's Review

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- Experts from Many Technical Disciplines Perform Review
  - ▶ Evaluating proposed changes to assure they meet NRC regulations
- Will Publish Notices of Amendment Applications in the *Federal Register* Giving Procedures for Commenting and Requesting Hearings

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## **NRC Review (cont.)**

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- ▶ Will consider comments received within 30 days
- ▶ NRC's Proposed No Significant Hazards Consideration Determinations are not NRC approvals
- NRC to Prepare and Issue an Environmental Assessment

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# **Status of NRC's Review**

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- Review is Ongoing
- NRC Will Hold a Meeting With the Public Near the Plant Sites Before Making a Final Decision

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# Major NRC Review Milestones

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- TVA License Amendment Requests
  - August 20, 2001 for Watts Bar
  - September 21, 2001 for Sequoyah Units 1 and 2
- *Federal Register* Notices
- Environmental Assessment
- Issue Amendments

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# NRC Contacts

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- Mark Padovan, Watts Bar Project Manager
  - E- mail: [LMP@nrc.gov](mailto:LMP@nrc.gov)
- Ron Hernan, Sequoyah Project Manager
  - E-mail: [RWH@nrc.gov](mailto:RWH@nrc.gov)
- Richard Correia, Section Chief
  - E-mail: [RPC@nrc.gov](mailto:RPC@nrc.gov)
- (301) 415-1485, 415-2024, 1-800-368-5642
- Tritium Website Soon
  - Will take public feedback

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## **NRC Contacts (cont.)**

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- Tritium Documents Located in ADAMS
  - NRC website: <http://www.nrc.gov>
  - 1-800-397-4209 or E-mail at [pdr@nrc.gov](mailto:pdr@nrc.gov)
  
- Tritium Website Soon
  - Will take public feedback



## Questions and Comments Presented by Members of the Public

### Comment:

The public needs better NRC notifications of such meetings.

### Reply:

The NRC's policy is to announce public meetings at least 10 days before the meeting date. Following this policy, the NRC's Lead Project Manager posted the required details of the meeting on the NRC's external website and noticed the meeting in four local newspapers (Dayton, TN — *The Herald News*; Spring City, TN — *Watts Bar Lake Observer*; Chattanooga, TN — *The Times Free Press*; and Sweetwater, TN — *Monroe County/ Advocate-Democrat*). Furthermore, Francis "Chip" Cameron, the NRC's meeting facilitator, personally talked with some key stake holders before the meeting. During the course of the meeting, the Lead Project Manager requested the meeting participants to leave their names on a list if they wanted to be personally informed about any future meetings on this topic.

### Comment:

An NRC inspection report (IR) stated that 3 times the allowable tritium effluent was released from Watts Bar over a 3-year period.

### Reply:

Our review of NRC IRs did not support this comment. The tritium releases at Watts Bar were a small percentage of the allowable limits specified in Title 10, *Code of Federal Regulations* (CFR) Part 50. The radiation doses and the amounts of activity from tritium released during 1997 at Watts Bar were approximately 3 times larger than those for 1996 due to the normal operational need to process large amounts of reactor coolant system water during the Unit 1 refueling outage. Although the effluent releases for 1998 were even higher than in 1997, the contribution from tritium was less than 3 percent of the 10 CFR 50, Appendix I, limits.

Title 10 CFR Part 50, Section 50.36(a), requires licensees to submit radiological discharge reports to the Commission giving quantities of the principal radionuclides discharged to unprotected areas. Title 10 CFR Part 50, Appendix I, Section IIA, addresses the calculated annual quantity of all radioactive materials that are released from a nuclear power plant to unrestricted areas. Section IIA of that Appendix states that the annual release must not result in an estimated dose from liquid effluents in excess of 3 millirem (mrem) to the total body or 10 mrem to any organ for any individual in an unrestricted area.

DOE's tritium lead test assemblies (LTAs) were irradiated in the Watts Bar core from June 1997 to March 1998. NRC IR 50-390, 391/99-08, stated that Watts Bar had releases and corresponding radiological effluent discharges (which include tritium) as shown in Table 1 on the following page.

**Table 1 — Watts Bar Radioactive Liquid Effluent Releases  
for 1996 Through 1998**

Curies Released				Dose (mrem)	
Year	F&AP Effluent	<sup>3</sup> H Effluent	D&EG Effluent	Total Body (percent of regulatory limit)	Organ (percent of regulatory limit)
1996	0.05	223	3.30E-1	9.76E-4 (0.033%)	1.41E-3 (0.014%)
1997	1.32	639	7.73E-0	2.53E-1 (8.43%)	3.57E-1 (3.568%)
1998	0.23	713	1.14E-2	6.16E-3 (0.205%)	8.20E-3 (0.082%)

Key for Effluents

F&AP= fission and activation products

<sup>3</sup>H = tritium

D&EG = dissolved and entrained gases

The amounts of activity released during 1997 at Watts Bar were approximately 3 times larger than those for 1996. The effluent releases for 1998 were higher than 1997, but the contribution from the tritium isotope was less than 3 percent of the 10 CFR 50, Appendix I, Section IIA, limits.

The NRC's regulatory dose limits are 3 mrem to the total body and 10 mrem to any organ for any individual in an unrestricted area, as previously indicated. Thus, our search and review of NRC IRs did not support the claim that Watts Bar tritium effluent releases to the unprotected areas were three times the allowable. In fact, the releases were a small percentage of the allowable limits specified in the 10 CFR Part 50.

Comment:

There was a 20 percent increase in dose rate at Sequoyah associated with the use of down-blended highly enriched uranium LTAs at the facility.

Reply:

The staff reviewed Framatome Cogema Fuel's Topical Report BAW-2328, "Blended Uranium Lead Test Assembly Design Report, July 1998," which contained the analyses for Tennessee Valley Authority (TVA) to insert a limited number of LTA's into the Sequoyah Unit 2 core. Page 2 of BAW-2328 stated that the increase in radiation exposure rates (not doses) associated with the blended fuel assemblies are estimated to be as much as 20 percent higher

than the exposure rates for the standard uranium fuel assemblies. Potential exposure rates from the blended uranium LTAs do not necessarily equate with dose rate to humans. The LTAs and fuel assemblies were submerged under 20-23 feet of water during irradiation, movement to and from the reactor, and in storage in the spent fuel pool. This water shielded humans from LTA and fuel assembly radiation exposure and there was no evidence they received a 20 percent increase in dose.

The enrichment percentage and hence reactivity of a given LTA assembly may be higher than a similar given standard uranium fuel assembly. However, LTA enrichment never exceeded the maximum NRC-approved enrichment of 5.1 percent.

Comment:

There are serious security problems at Watts Bar.

Reply:

The NRC is treating these issues as potential allegations and will evaluate them following the appropriate agency process.

Comment:

We want to have another public meeting early in the process because many people didn't know about this meeting.

Reply:

NRC will evaluate the need and benefit of holding another public meeting during the amendment review process and will notify interested parties and the public of its decision.

Comment:

A 1991 General Accounting Office (GAO) report says that commercial reactors can't be used for tritium production.

Reply:

NRC staff reviewed several GAO reports issued starting in 1991 pertaining to tritium production. A detailed study of these reports did not substantiate the claim that irradiating TPBARs in a commercial nuclear power plant was prohibited. Additionally, the Defense Authorization Act of 2000, passed in October of 1999, specifies that TVA is to produce tritium at Watts Bar and Sequoyah.

Comment:

We need local access to nuclear plant information, possibly at a local library.

Reply:

Although the NRC no longer supports local Public Document Rooms (PDRs), it does maintain a publicly-available website that contains information on commercial nuclear power plants. Additionally, the public has access to the main PDR by internet, telephone and mail. However, the NRC is actively addressing the issue of how to balance national security interests with public information needs following the September 11, 2001, terrorist attacks. The scope of this evaluation includes having information related to nuclear facilities publicly available. Members of the public are encouraged to visit the NRC website to access information as it is made available during the agency's review. Publicly-available records will be accessible electronically from the Agencywide Documents Access and Management System (ADAMS) Public Electronic Reading Room on the Internet at the NRC Web site, <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC PDR Reference staff by telephone at 1-800-397-4209, 301-415-4737 or by e-mail to [pdrr@nrc.gov](mailto:pdrr@nrc.gov).

Comment:

We need additional time to make comments on the Watts Bar and Sequoyah tritium license amendment requests *Federal Register* notices.

Reply:

Title 10 CFR Part 50, Section 50.91, provides for a public comment period of 30 days after issuance of a *Federal Register* notice.

AGENDA  
U.S. NUCLEAR REGULATORY COMMISSION PUBLIC MEETING  
OCTOBER 2, 2001

NRC RESPONSIBILITIES IN REGARD TO THE POTENTIAL PRODUCTION OF  
TRITIUM AT THE WATTS BAR NUCLEAR REACTOR

The focus of tonight's meeting is on the **U.S. Nuclear Regulatory Commission's** (NRC) responsibilities in regard to the potential production of tritium at the Watts Bar nuclear reactor. However, in order to provide some context for the discussion, the U.S. Department of Energy (DOE) will provide a short status report on the DOE program. In addition, the TVA will discuss some of the site specific aspects of the TVA license amendment application. The NRC, DOE, and TVA presentations will be **brief**, with the objective of providing the maximum amount of time for audience questions and comments.

6:30 P.M.      Welcome, Format, Ground rules

Francis ("Chip") Cameron, Facilitator

6:45 P.M.      Status of the DOE Tritium Production Program

Steve Sohinki  
Director  
Office of Tritium Production  
National Nuclear Security Administration  
U.S. Department of Energy

Discussion

7:15 P.M.      NRC Responsibilities and Procedures in Regard to the Production of Tritium at the Watts Bar and Sequoyah Nuclear Power Plants: The Watts Bar License Amendment Application

Mark Padovan  
Licensing Project Manager for the Watts Bar Nuclear Plant  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission

Discussion

8:15 P.M.      Site Specific Aspects of the Watts Bar License Amendment Application

James Chardos  
TVA

Discussion

9:00 P.M.      Discussion of any remaining issues

9:30 P.M.      Adjourn