Tritium Readiness Campaign

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National Nuclear Security Administration

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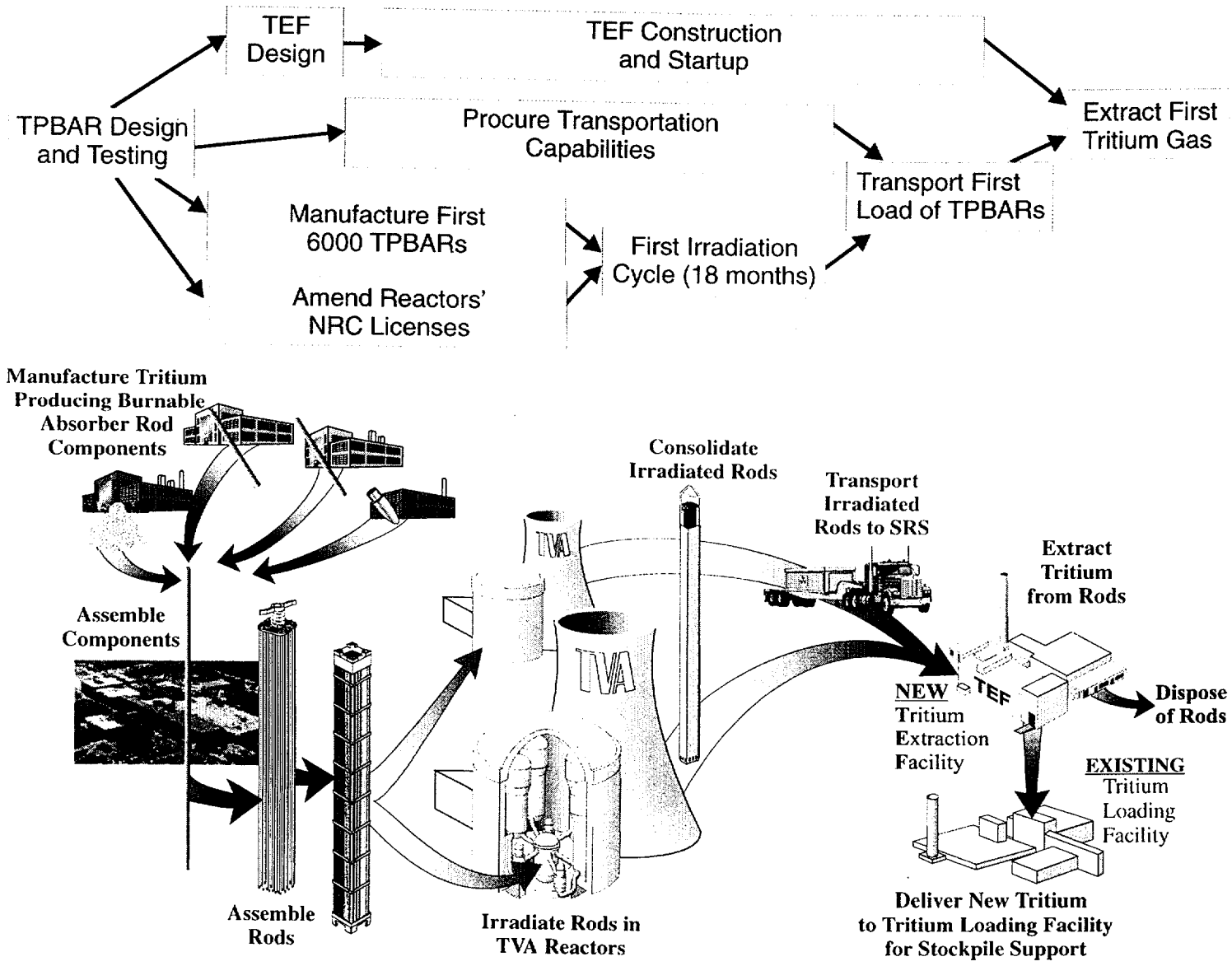
Enclosure 2

National Nuclear Security Administration

The Tritium Campaign is Driven by External Requirements

- All nuclear warheads in the U.S. stockpile need tritium to function as designed.
- No tritium produced since 1988 when SRS reactors were shut down.
- Tritium decays 5.5% per year (12.3 year half life).
- The weapons stockpile is currently being supported with tritium recycled from dismantled warheads.
- The date when tritium production must start and the amount of tritium to be made will be based on stockpile requirements.

The CLWR Project Will Establish the CLWR System in a Time Phased Manner



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CLWR Project Description

- ***Purpose of CLWR Project***

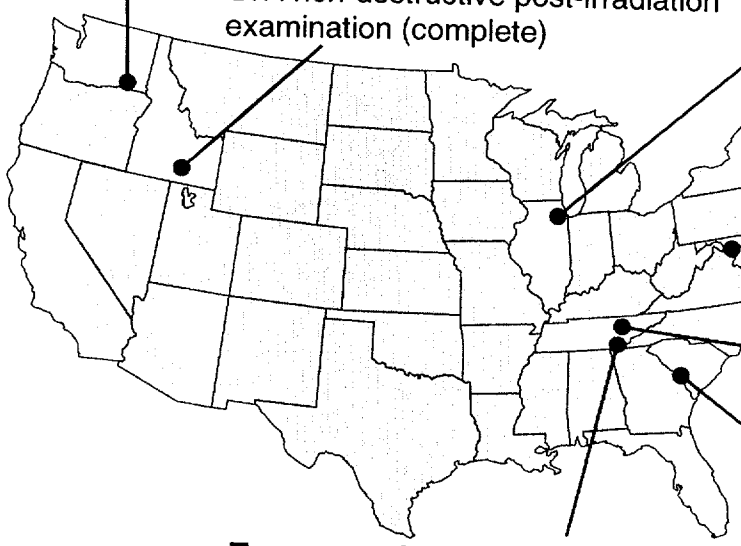
The CLWR Project will establish, by FY 2003, the production capability and operations systems to produce tritium in commercial reactors so that tritium can be delivered to the nuclear weapons stockpile by FY 2006.

- ***Scope of the CLWR Project***

When the CLWR Project is completed in FY 2006, the CLWR Tritium Production System will include:

- Full-scale commercial capabilities for manufacturing tritium-producing rods
- TVA reactors available, prepared, and licensed for operation with tritium-producing rods
- Certified services available to transport radioactive, irradiated rods
- Tritium Extraction Facility in operation at the Savannah River Site
- New tritium being delivered to the SRS Tritium Loading Facility

CLWR Project Participants



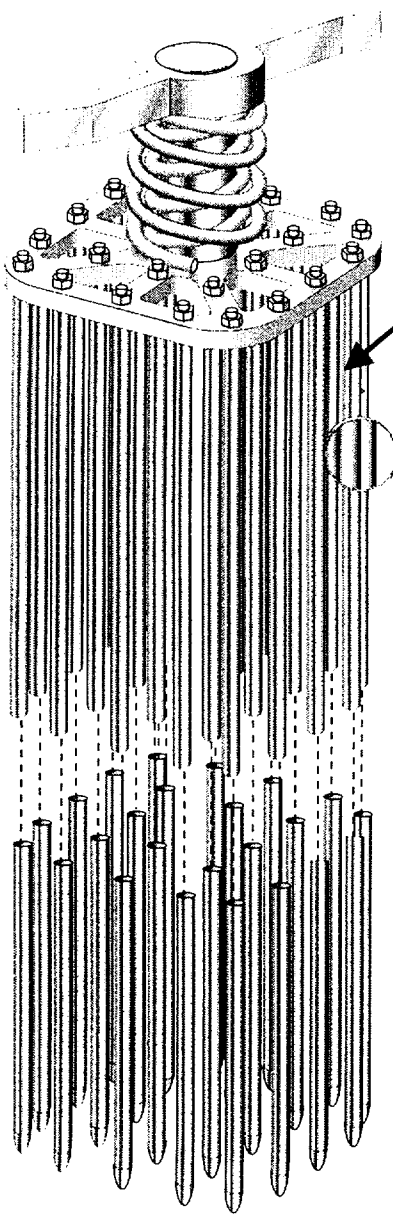
Major Vendors

Wesdyne, Columbia Fuel Facility - *TPBAR Assembly & Fabrication*
Superior Tube Co - *Cladding tubes*
Hitemco - *Cladding coating*
Carpenter Specialty Products - *Steel*
Hohman Plating - *Plating services*
Carpenter Advanced Ceramics - *Pellets*
DOE Y-12 - *Enriched Lithium-6*

Safety Oversight

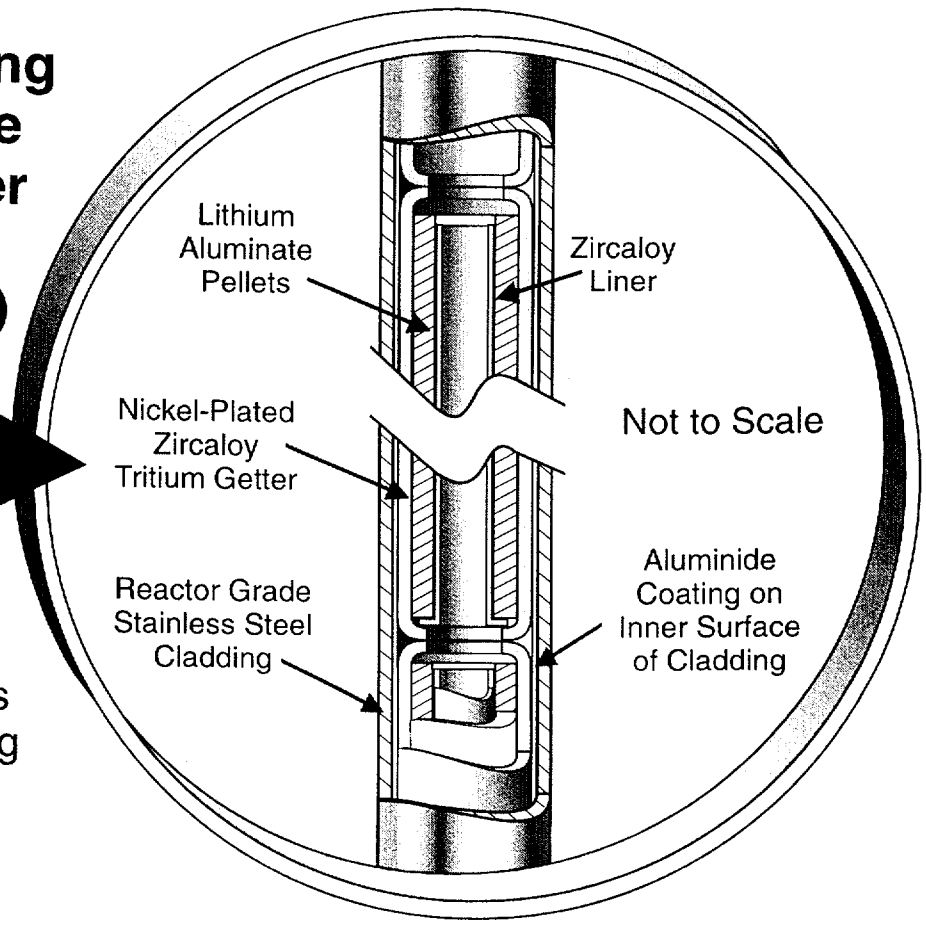
Nuclear Regulatory Commission:
TVA Reactors
TPBAR Assembly
Component Fabrication
Defense Nuclear Facilities Safety Board
TEF Design, Construction & Operation
DOE Office of Environmental Restoration
Transportation Operations

Tritium Producing Burnable Absorber Rod (TPBAR)



Assemblies consist of 24 rods suspended from a base plate.

Each rod is 12 feet long ~ 3/8 inch diameter



Functions of TPBAR Components

Stainless Steel Cladding - Similar to reactor fuel elements. Contains all TPBAR components

Aluminum Coating - Prevents diffusion of tritium through the stainless steel cladding into the reactor coolant. Also prevents hydrogen in the coolant from entering the TPBAR.

Zircaloy (zirconium alloy) Tritium Getter - Absorbs free tritium gas.

Nickel Plating - Protects the tritium getter from oxidation.

Lithium Aluminate Pellets - High-temperature ceramic material containing Lithium-6, the material that transmutes to tritium when a neutron is absorbed.

Zircaloy Liner - Removes oxygen to improve getter performance.

During and after irradiation, nearly all the tritium is held tightly in the ceramic, the tritium getter, and the zircaloy liner until it is released by the extraction process. There is little or no free tritium gas.

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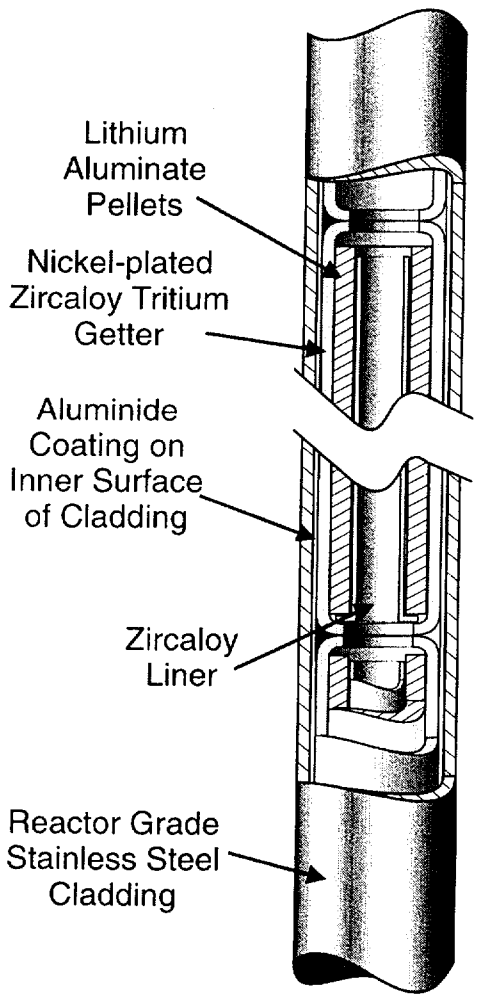
CLWR Project Status
TPBAR Technology

- **Production TPBAR design is complete**
  - Certified by TVA for use in Watts Bar and Sequoyah reactors.
  - TPBARs were designed by PNNL.
  - WesDyne Int'l, the fabricator, will become the designer of record.
  - Improvements to the TPBAR design are being explored.
    - Full-length plated getter tubes
- **TPBARs have undergone extensive tests**
  - 32 TPBARs irradiated in TVA's Watts Bar reactor
  - Nondestructive examinations of irradiated TPBARs are complete. All results were as expected.
  - Four irradiated TPBARs are currently undergoing destructive examinations at PNNL. No surprises thus far.
  - Results of the post-irradiation examinations will be forwarded to the Nuclear Regulatory Commission as supplemental proof that TPBARs pose no safety hazards to commercial reactors.



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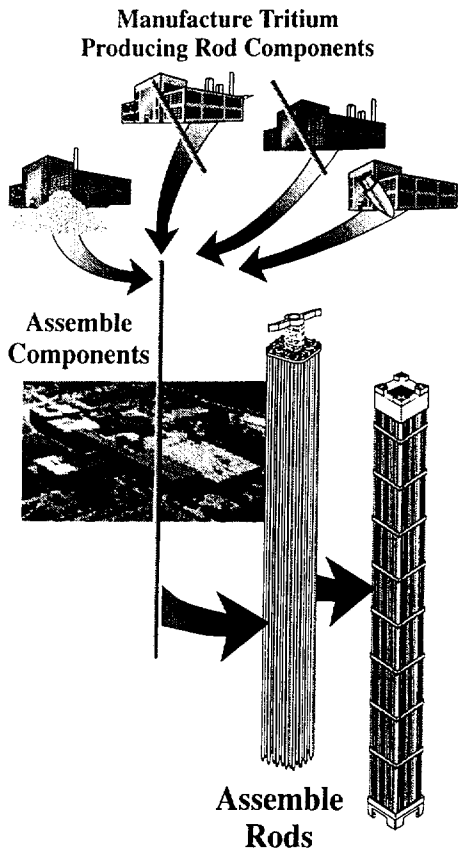
CLWR Project Status
TPBAR Fabrication

- Fixed-price contract awarded to WesDyne International for assembly of TPBAR components.
  - WesDyne will assembly government-furnished components for first 6,000 TPBARs.
  - For subsequent batches, WesDyne will make or buy all components.
  - WesDyne has set up a facility in South Carolina for classified TPBAR work.
- PNNL has awarded contracts for production quantities of Lithium-6 pellets, cladding tubes, and getter tubes.
- ~3,000 cladding tubes have been delivered from vendor.
- Contract for production-scale application of aluminide coating of 1,000 cladding tubes awarded to the vendor, Hitemco
  - Alternative coating processes are being developed and assessed.
- Contract for production-scale plating of getter tubes is pending while the vendor completes modifications to its facility.



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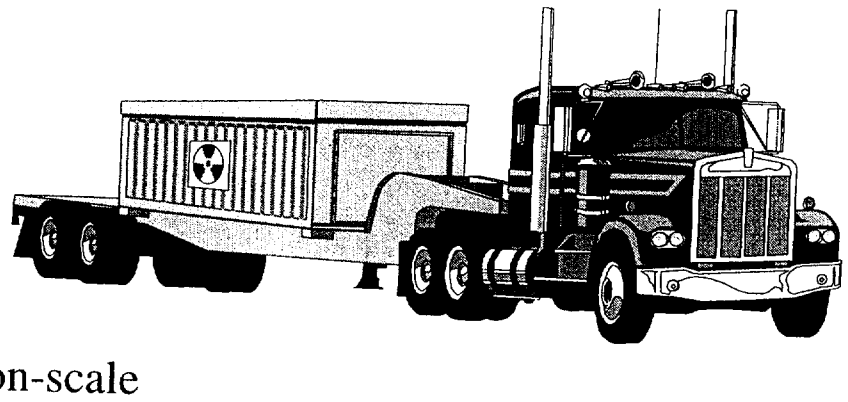
CLWR Project Status
TPBAR Transportation

- 32 Irradiated TPBARs transported from the Watts Bar reactor site to ANL-West for non-destructive exams
- 4 irradiated TPBARs were cut into thirds and shipped to PNNL



- Final request for proposals for production-scale commercial transportation services has been prepared and is under review.
- Issues:
  - Shipment of trisected TPBARs was 7 months late due to process for obtaining EM-5 certificate of compliance. This delayed the start of destructive testing of irradiated TPBARs.
    - To avoid future delays, NNSA is pursuing capability for in-house package certification

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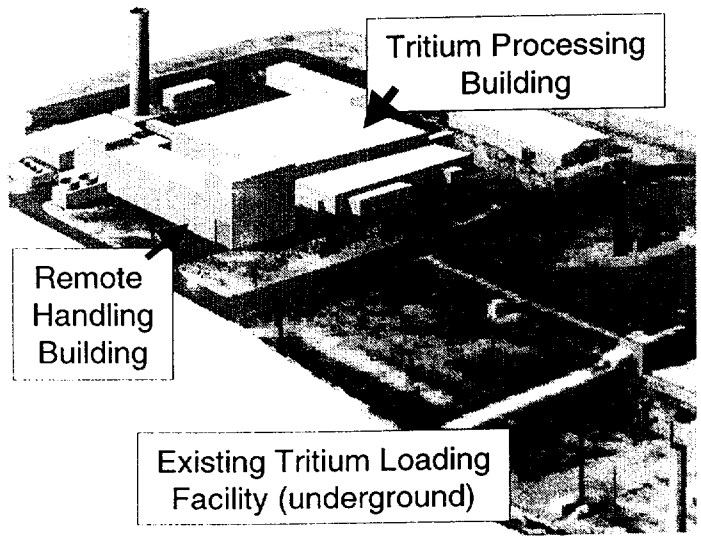
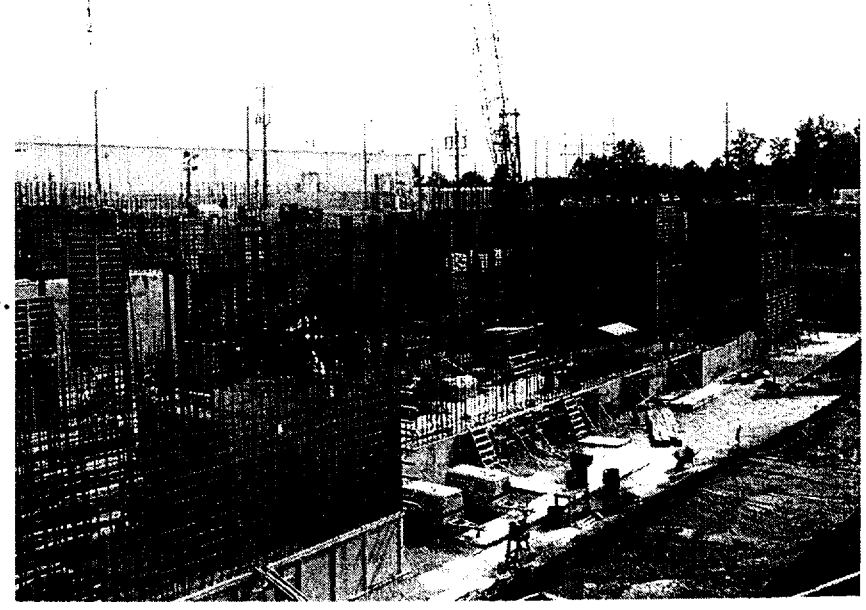
Tritium Extraction Facility (TEF)

Purpose and Function:

- New tritium will be tightly held in a solid state within thousands of TPBARs
- The TEF will use special processes with high temperatures and vacuum to extract gasses that contain tritium from the TPBARs.
- Irradiated TPBARs will be highly radioactive. They must be handled by remote means in a heavily shielded building -- the Remote Handling Building.
- After extraction the tritium will be partially purified in the Tritium Processing Building and sent to the existing Savannah River Site Tritium Loading Facility.
- The Tritium Loading Facility recycles tritium and fills the tritium reservoirs that are installed in nuclear warheads.



- Current Status (August 2001):
  - Site preparation complete.
  - Detailed design is complete.
  - Remote Handling Building construction in progress but a couple of months behind schedule.
  - Procurement of long-lead items on track.
  - RFP to complete construction has been issued.
- Issues:
  - Very little float in the schedule because of prior year constraints.



License Amendment

- Amendment references following documents
  - DOE Tritium Production Core (TPC) Topical Report NDP-98-181, Revision 1
  - NRC SER NUREG-1672
  - DOE CLWR Final Environment Impact Statement (EIS-0288)
- Amendment will address
  - Plant specific interface issues identified in NUREG-1672
  - Plant confirming checks recommended in DOE TPC Topical Report
- Three reactors - WBN-1, SQN-1 and -2
- Reactor power level and cycle length remain as is
  - Fuel enrichment increased to 4.95% U-235
- Maximum number of TPBARs that can be irradiated in a fuel cycle is around 2300
- Minimal increase in exposure to plant personnel and public
- Analysis confirms that irradiating TPBARs will not affect safe plant operation and all regulatory limits continue to be met.

TPBAR Irradiation

- TPBARs will be inserted into fuel just like other burnable absorbers
- TPBARs will be irradiated for one cycle only
- Sample frequency for tritium in Reactor Coolant System will be increased
- Will meet current effluent (ODCM) requirements (liquid and gaseous)
- Following irradiation, TPBARs will be consolidated into shipping containers by TVA and shipped to the Tritium Extraction Facility by DOE
- Expect very little if any effect on plant operations while irradiating TPBARs