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Solutions for a  
Safe and Secure  
World

# Washington Safety Management Solutions

## Tritium Extraction Facility ALARA

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## TEF Description

- **Tritium Producing Burnable Absorber Rods (TPBARs) irradiated at TVA**
- **Shipped to SRS**
- **TEF built to extract the tritium**
- **Designed for 14 shipments/yr**
- **TPBARs are highly radioactive**
- **Requires extensive shielding**



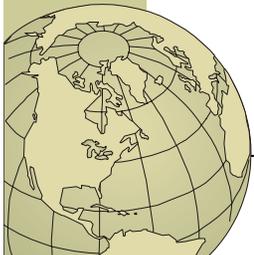
## Source Term

- **Size: approximately 8.4 in. square and 12 ft. tall**
- **Co-60 due to steel activation**
- **Dose Rate: 50,000 R/hr at 1 ft**



# Shielding

- **0.25 mrem/hr**
- **Bulk Shielding**
- **Streaming**



# Bulk Shielding

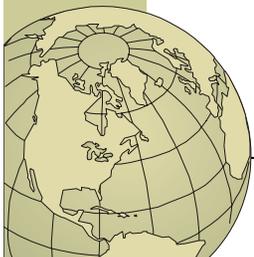
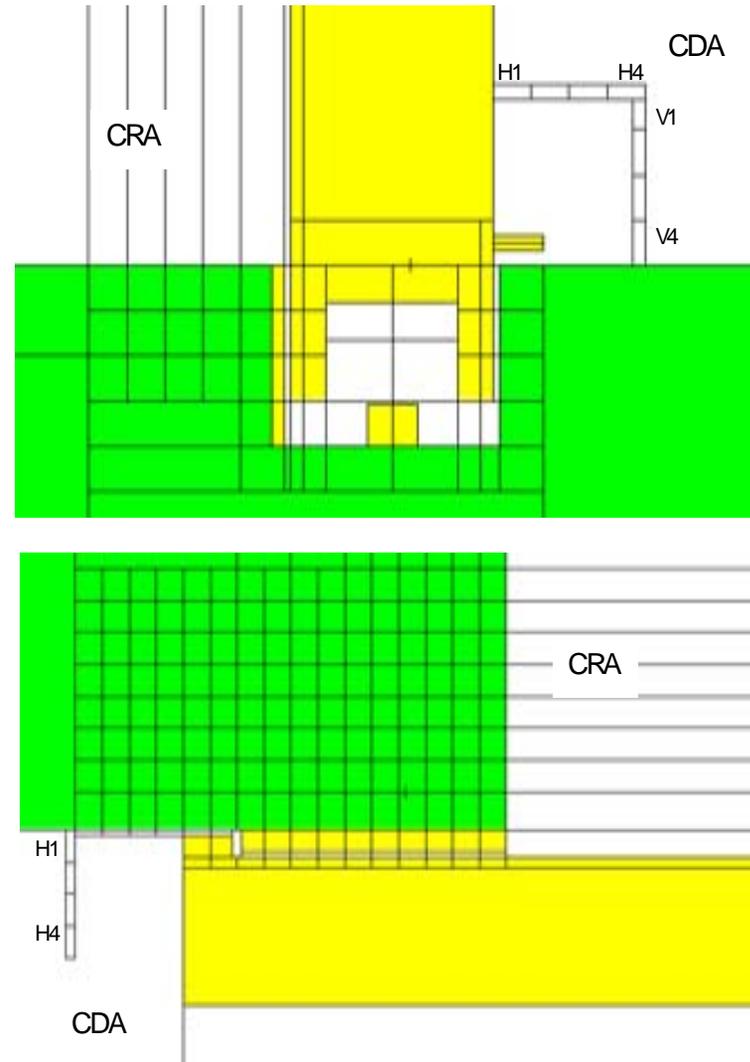
- **Walls**
  - Concrete
  - Several Penetrations (large and small)
- **Doors**
  - Steel
  - Streaming Concerns





# Door Streaming

- 1/2 in. gaps
- Steel in walls
- Steel lip
- Labyrinth



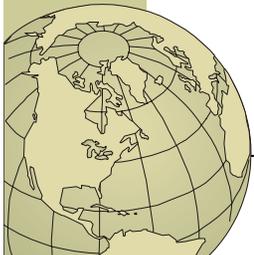
# Dose Assessment

- **Determine dose rate in all areas**
- **Develop Time and Motion Data**
- **Calculate person-rem associated with each operation**
- **Associate person-rem with dollar values**
- **Examine high dollar operations**



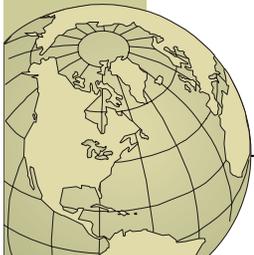
# Shield Verification

- **ANSI/ANS 6.3.1**
- **Not feasible to bring in a source**
- **Use TPBARs for testing**
- **Need confidence personnel safety**
- **3 Steps**
  - **Determine conservatism in design**
  - **Test installation of equipment necessary for personnel radiation protection**
  - **Bring in TPBARs and test shields**



# Conservatism Analysis

- **Small source tests of selected penetrations and concrete**
- **Review construction QA**
- **Concluded no risk to personnel safety**



# Start-Up Testing

- **Verify monitors and alarms working**
- **Verify shield door operation**
- **Verify shield plug installation**



# Testing with TPBAR

- **Segment shield structure in grids for measurement**
- **Determine if TPBAR can test shield**
- **Test verifiable shields**
- **Check each incoming TPBAR**

