Example: Experience with Citizen Participation in the Selection of In-Situ Decommissioning as a Remediation End Point

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Background

- This presentation was originally given at the International Atomic Energy Agency International Experts' Meeting on Decommissioning and Remediation After a Nuclear Accident, on 28 January – 1 February, in Vienna, Austria. The briefing was titled "Experience with In-Situ Decommissioning as a Remediation End Point"

- At that time I was employed by the United States Department of Energy, at the Savannah River Site, Aiken, SC, USA, as a Senior Advisor to the Site Manager

- I was previously responsible for decommissioning at the Savannah River Site

- Safely completed decommissioning of over 240 facilities

- Worked with local citizens, State and Federal regulators to develop a path forward for decommissioning the site's nuclear reactors, leading to a lower cost, first-of-a-kind closure alternative (in-situ decommissioning)

INTRODUCTION

- In 2011, the United States Department of Energy (USDOE) successfully decommissioned two former nuclear materials production reactors
- A remediation approach, according to United States Environmental Protection Agency (USEPA) regulations, was followed
- Both reactors were entombed, or in-situ decommissioned

Before decommissioning

After decommissioning

KEYS to SUCCESS

- An established regulatory structure within which to work
- Robust and meaningful regulator and stakeholder involvement efforts
- Technically viable, environmentally protective, and defendable end state plan

AN ENVIRONMENTAL REMEDIATION FRAMEWORK PROVIDED STRUCTURE

A joint 1995 policy between the USEPA and the USDOE established the use of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as the framework for decommissioning USDOE defense nuclear facilities

- This framework establishes a risk-based end state in consideration of potential future use of the area, such as
  - Residential
  - Industrial
  - Recreational
- Ensures protection of worker and public health and the environment
- Provides for stakeholder involvement
- Achieves risk reduction without unnecessary delay
- Seeks a permanent, final solution

END STATE SELECTION INCLUDES ANALYSIS AGAINST NINE CRITERIA

Alternatives are analyzed individually against each criterion and then compared against one another to determine respective strengths and weaknesses and to identify key trade-offs that must be balanced

- Threshold Criteria
  - Overall protection of human health and the environment
  - Compliance with other state and federal regulations
- Primary balancing Criteria
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying Criteria
  - Regulatory acceptance (State government and/or USEPA)
  - Community acceptance

3 ALTERNATIVES WERE EVALUATED

- No action, facility would remain in its current condition indefinitely
- In-situ decommissioning with land use controls
  - Stabilize/isolate contamination remaining within facility
  - Limit contamination migration of radioactive or hazardous contaminants to groundwater to prevent radioactive or hazardous contaminant exposure to industrial worker or animal intruder
- Complete removal, which would return reactor footprint to green-field condition

Comparison of Alternatives Against CERCLA Threshold and Primary Balancing Criteria

Criteria \ Alternative	No Action	In-Situ Decommissioning	Complete Removal
Overall Protectiveness of Human Health and Environment	No	Yes	Yes
Compliance with Other State and Federal Regulations	No	Yes	Yes
Reduction of Toxicity, Mobility, or Volume	Poor	Good	Good
Long-Term Effectiveness	Poor	Medium	High
Short-Term Effectiveness	None	High	Low
Implementability	Not Applicable	Easy	Difficult
Cost	$0	$52 to $236M	$366M

INPUT FROM STAKEHOLDERS

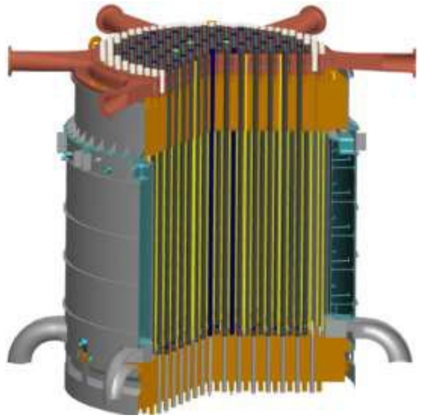
- Savannah River Citizen Advisory Board (CAB)
  - 25 member board provides advice, information, and recommendations on issues:
    - Clean up standards and environmental restoration
    - Waste management and disposition
    - Stabilization and disposition of non-stockpile nuclear materials
    - Excess facilities
    - Future land use and long-term stewardship
    - Risk assessment and management
    - Clean-up science and technology activities
- Workshops conducted in various locations allowed interested stakeholders an opportunity to discuss various elements of the plans for reactors

CONSTRUCTION OF A REACTOR MODEL

- Physical model and a virtual 3D model of reactor was used as important tool for communication and work planning:
  - Provides means to learn about reactor and appreciate it's scale and complexity
  - Used to develop grouting strategy, determine grout quantities, and direct work planning

CEMENTITIOUS MATERIALS DESIGNED, TESTED, AND PLACED

- Majority of below grade areas – portland cement based fill
- Special below grade areas – portland cement cellular lightweight flowable fill
- Reactor vessel – low pH fill specialty cements designed to avoid reaction with aluminum and generation of hydrogen
  - Calcium sulfoaluminate fill
  - Magnesium sulfoaluminate fill
- Caps – portland cement shrinkage compensating concrete

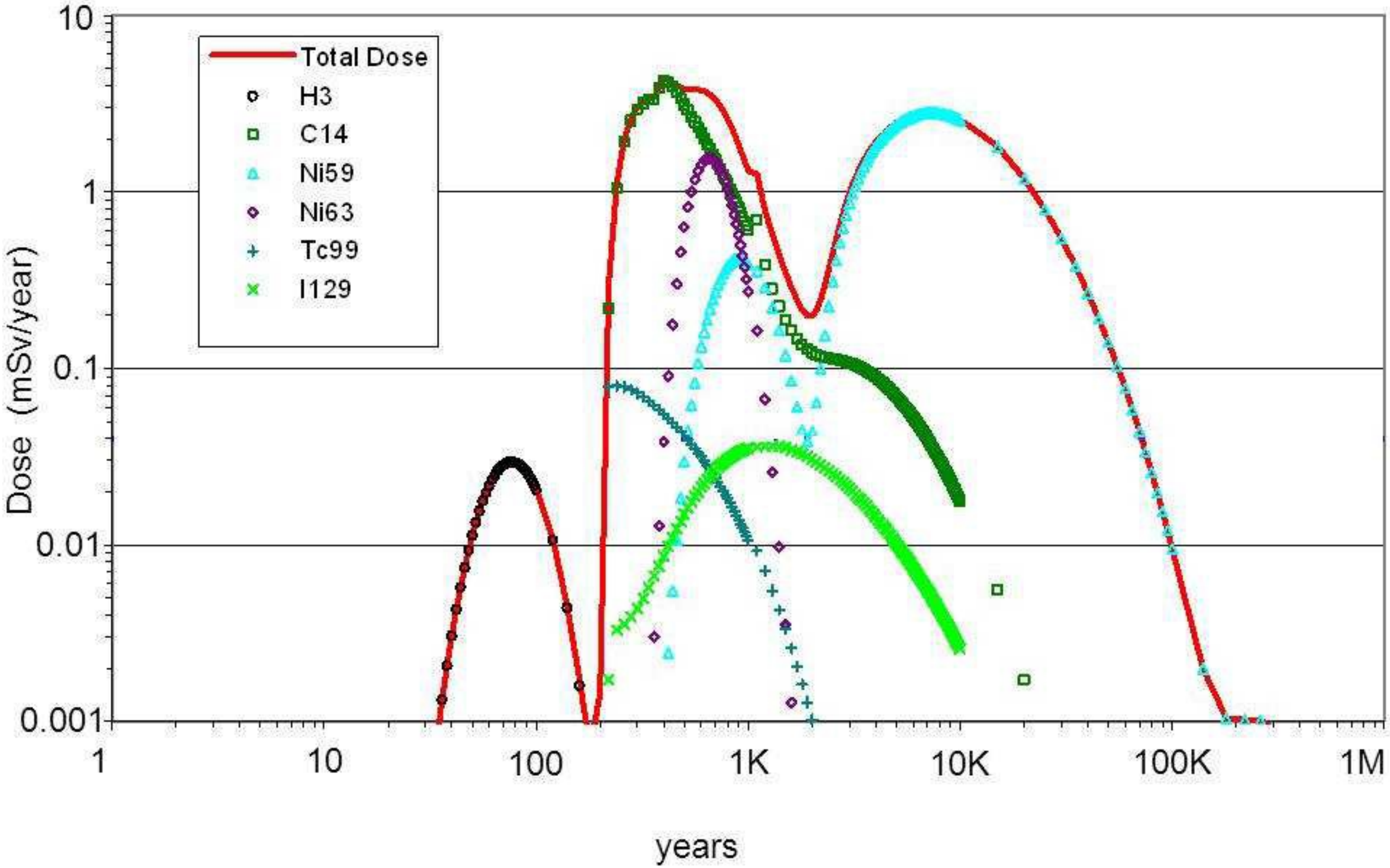


Reactor Vessel Diagram

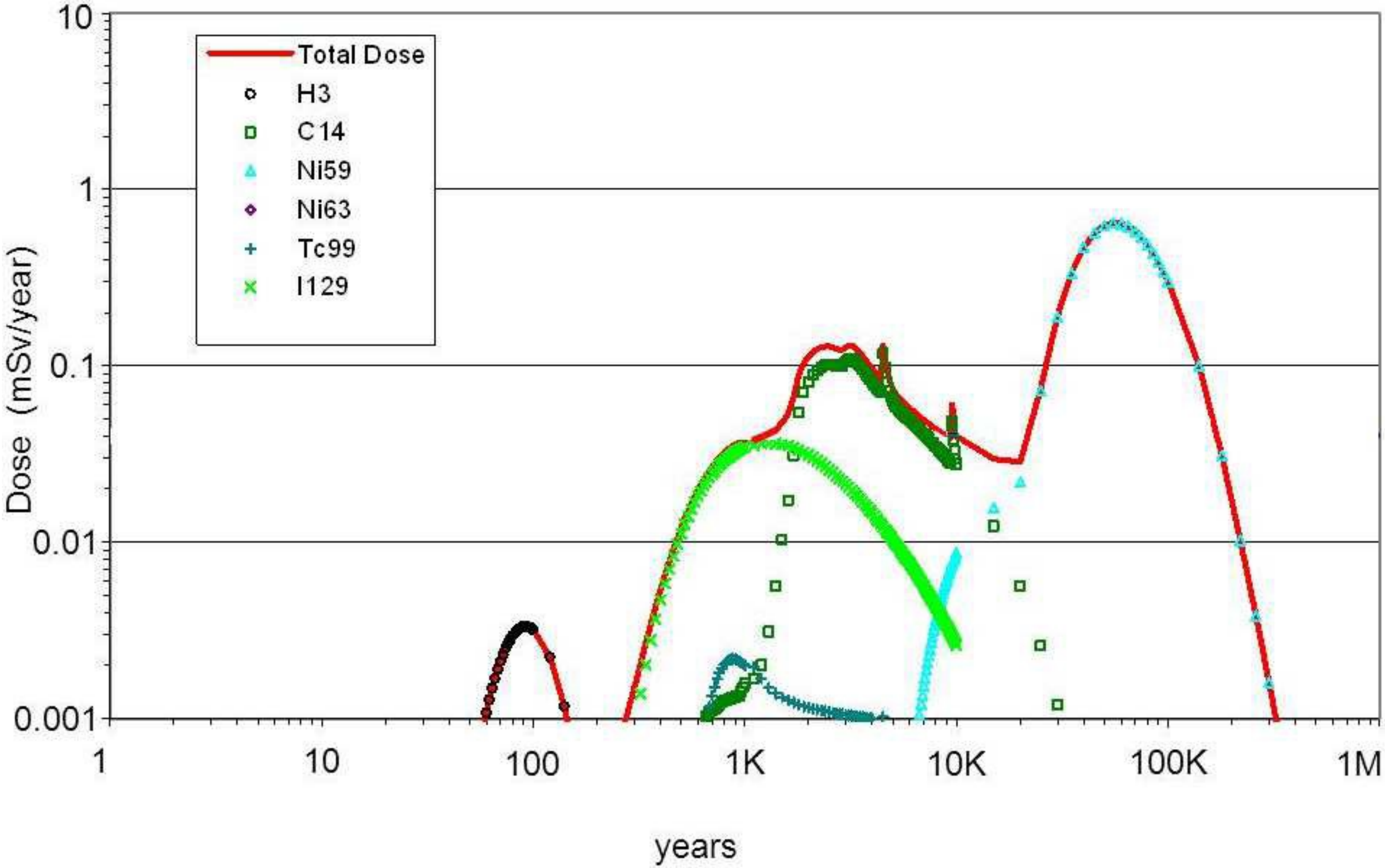
ACCEPTABILITY OF IN-SITU FROM ENGINEERING AND SCIENTIFIC BASIS

- Environmental contaminant modeling was conducted to access:
  - Effectiveness of the end state
  - Provide a transparent technical basis
  - Assure regulators and public of long-tem stability and environmental protectiveness of in-situ decommissioned facilities
- Models of structural stability of reactors
  - Projected stability of major facility elements for greater than 1000 years
    - Structural elements not capable of 1000 year survival were demolished

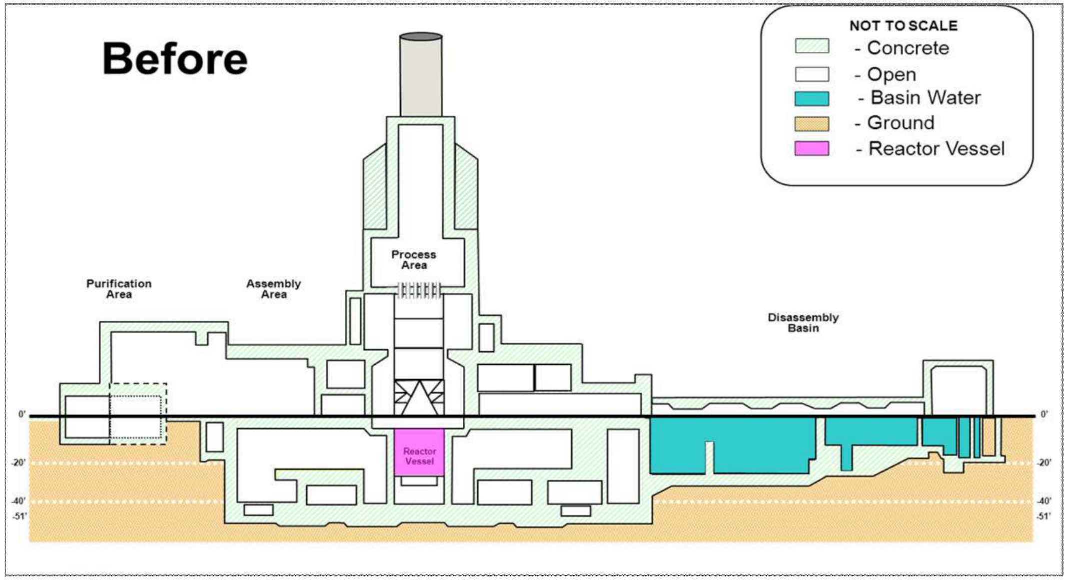
CONTAMINANT MIGRATION - P REACTOR IF NO ACTION

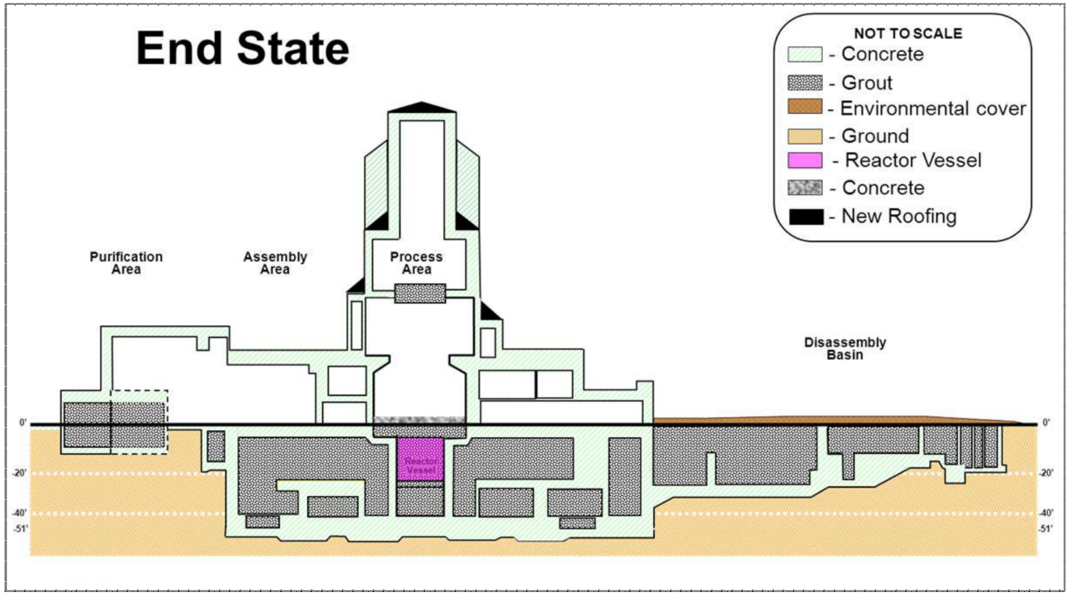


CONTAMINANT MIGRATION - P REACTOR AFTER DECOMMISSIONING



BEFORE AND AFTER PICTURES OF IN-SITU DECOMMISSIONING





SUMMARY

- Two Nuclear Reactors at Savannah River Site were successfully decommissioned in 2011
- In-situ decommissioning was demonstrated as viable alternative to standard demolition and disposal practice
- Actual cost of $70 Million for one reactor compared favorably to a cost estimated greater than $250 Million for demolition of one reactor and transportation of debris to a disposal facility (excluding burial costs)
- In-situ decommissioning provided a permanent solution that is protective of the environment, the worker, and the general population

Contact Information

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