ELECTRIC POWER RESEARCH INSTITUTE

Performance Assessment and LLW Disposal – EPRI Perspective

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EPRI LLW Management Program

Objective:

- Address the Loss of Class B/C Disposal
- Provide Positive Public & Regulatory Assurance

Description:

- R&D Program Elements:
  - Improve LLW Management (B/C Waste Minimization)
  - Assure Safe Storage of LLRW
  - Develop New Disposal Options

R&D Disposal Approach

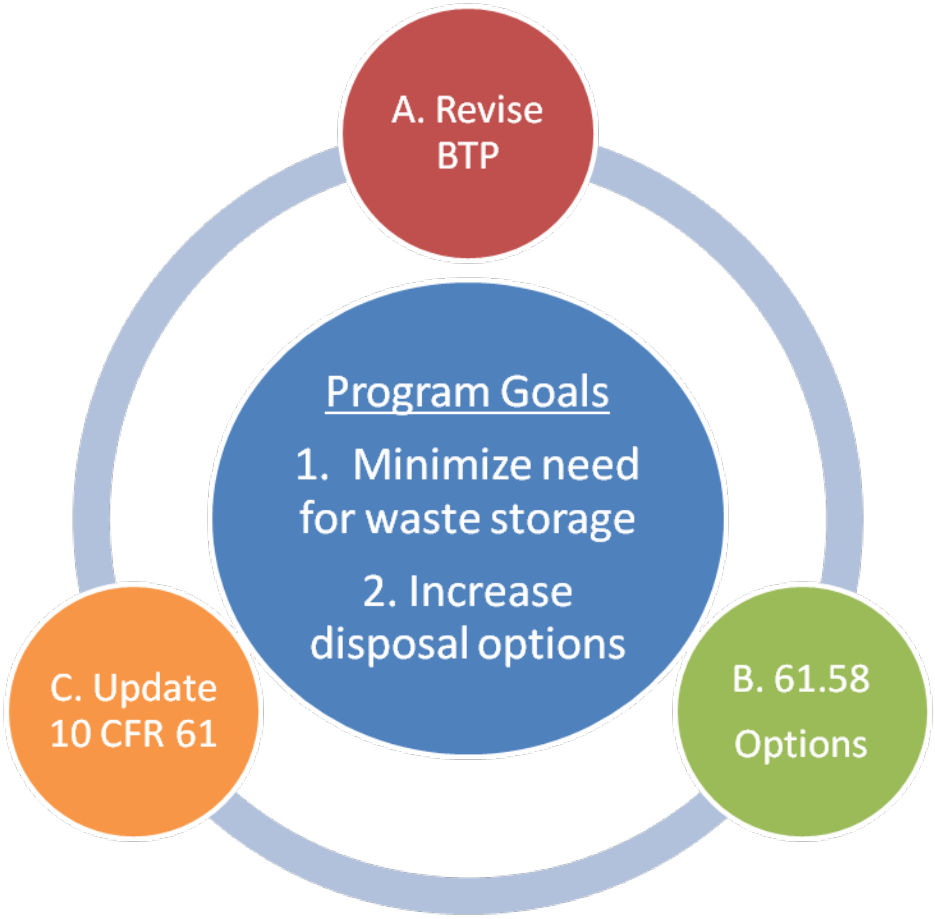
- Expand utility of Branch Technical Position (BTP) on Concentration Averaging [2006-2008]
- Develop alternative, conceptual disposal models to accommodate most/all utility waste
  - Use updated ICRP & disposal practices (via 61.58) [2009-2010]
  - Update 10 CFR 61 (redefine LLW) [2011+]

Benefits:

- Minimize orphaning of waste (provide waste assurance)
- Minimize waste storage requirements

EPRI LLW Disposal R&D

- **Proposed Technical Basis for BTP Modifications**
- **10 CFR 61.58 is the NRC Mechanism for Review of Alternative Disposal Criteria**
- **Work Performed via 61.58 Leads Directly to Risk-Informing Part 61**
- **Update of 10 CFR 61 Provide Technical Basis for Risk Informed Regulations**



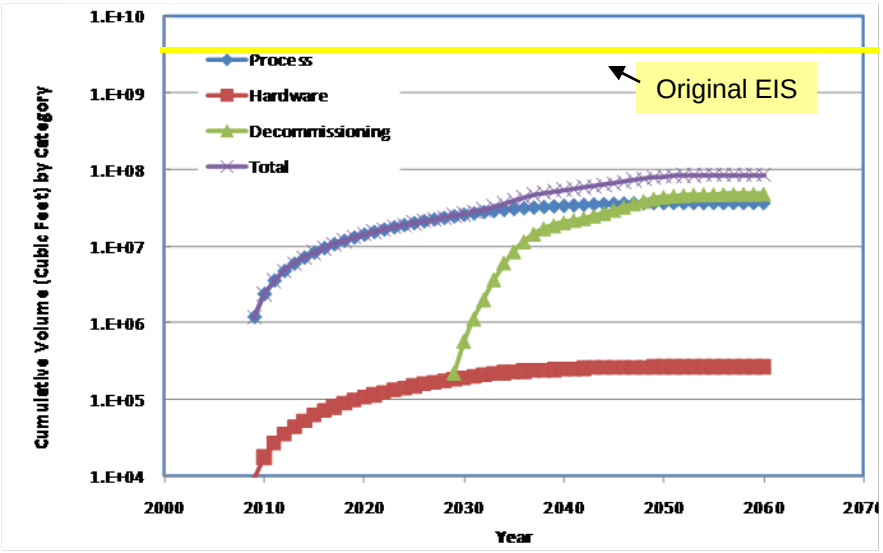
EPRI Approach for Using 61.58

§ 61.58 Alternative requirements for waste classification and characteristics.

The Commission may, upon request or on its own initiative, authorize other provisions for the classification and characteristics of waste on a specific basis, if, after evaluation, of the specific characteristics of the waste, disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives in subpart C of this part. (1)

EPRI Objective: Determine if more appropriate disposal limits could be developed based on 1) radiological risk of the current and projected waste inventory, 2) current ICRP recommendations, and 3) modern disposal practices

Updated Low Level Waste Source Term

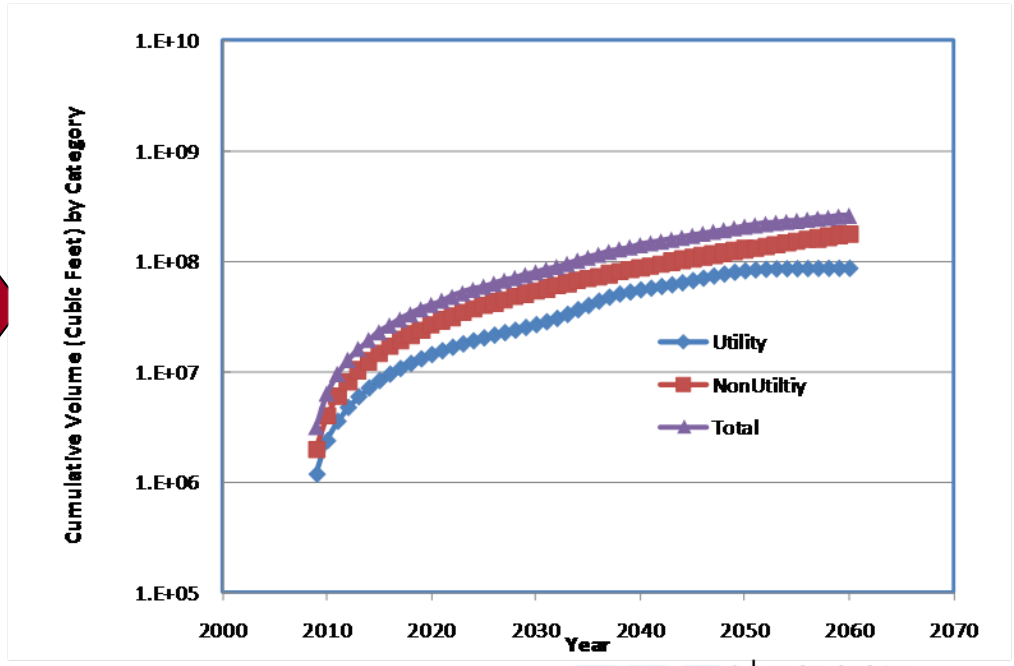


Cumulative LLW Volumes – Commercial Nuclear Power Plants, All Sources

Total volumes are much lower than what was assumed in the original EIS for 10 CFR 61 (~3.53 x 10^9 ft^3)

Cumulative Volume Generation - All Waste Sources

Non-utility waste is just as important a contributor as Utility waste



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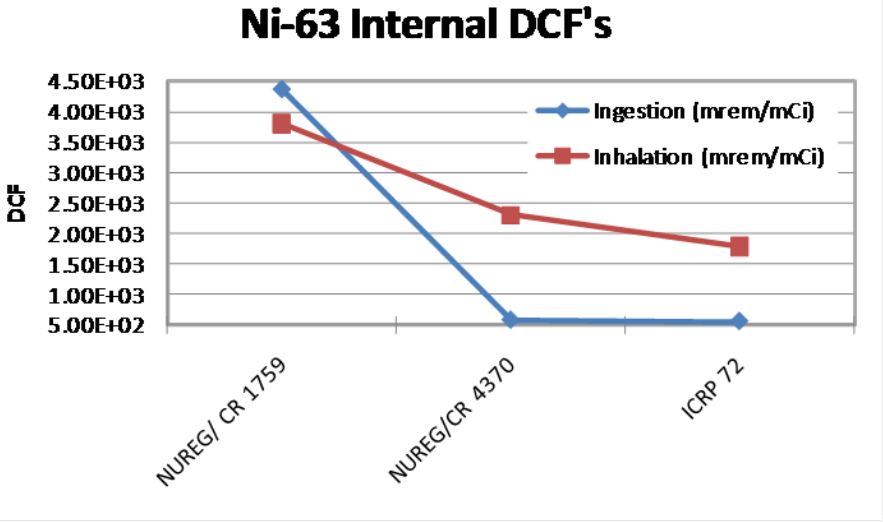
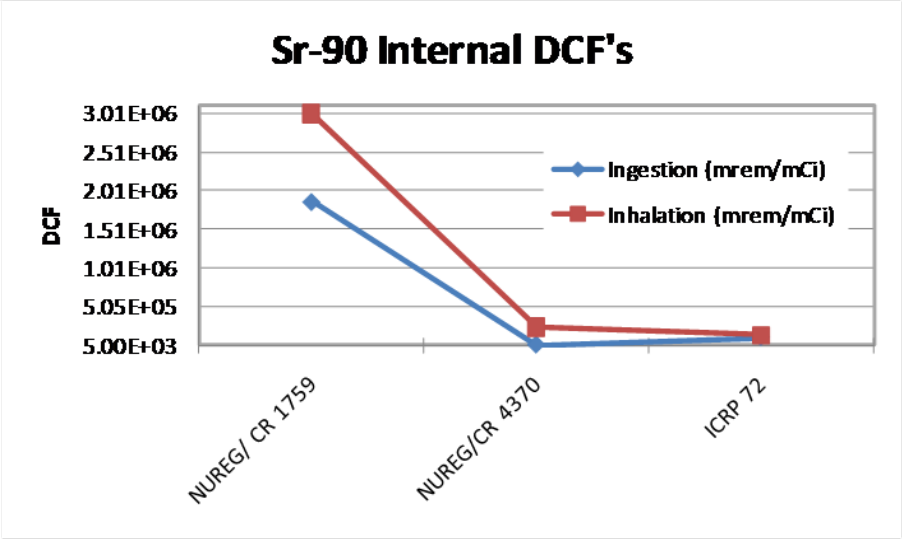
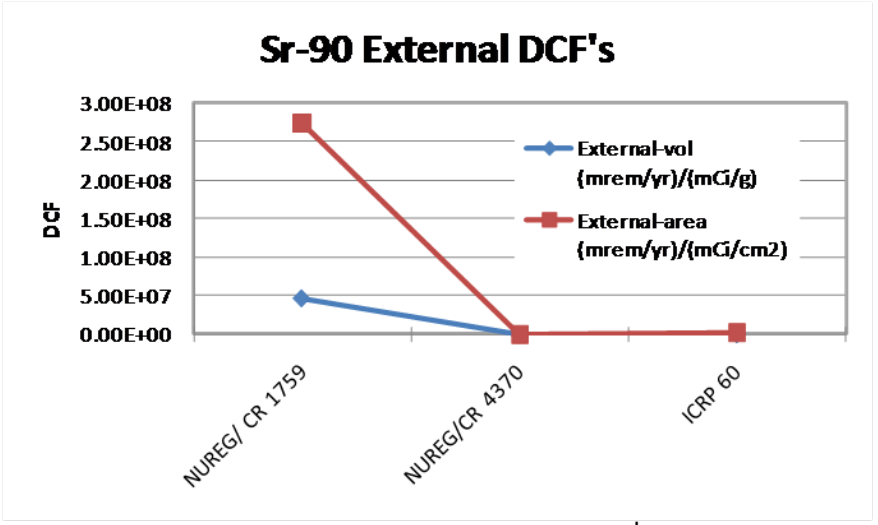
Impact from Using Updated Science (More Recent ICRP Recommendations)



- Decreasing DCFs → decrease in dose → higher waste concentration limits
  - Ni-63 decrease by 15
  - Sr-90 decrease by 7





Risk Assessment of Key Radionuclides

	Why is it a concern?	Impact on Disposal Site Performance	Regulatory Consideration
Cs-137	Most dominant	• Generally controls classification of LLW in the short term	• Defines institutional control period
Ni-63	Classification limiting 10 CFR 61	• Impact due to averaging restriction (BTP) on mechanical filters and ion exchange resins	• Use current ICRP DCFs (limits will increase by factor of 15) • Activity should be averaged across disposal cell since activity is contained in a stable waste form
Sr-90	10 CFR 61	• No significant impact on intruder scenarios or long term risk • Over-reported generation rate	• Use current ICRP DCFs should be used (limits will increase by factor of 7)
Nb-94	long half-life, Relative abundance 10 CFR 61	• Subordinate to Co-60 and Cs-137 in leading exposure scenarios •Becomes a prominent source of exposure following control periods	•Disposal limits should assume Nb-94 is dispersed due to disintegration (will no longer be discrete).
Ni-59	Relative abundance 10 CFR 61	• weak emission, never classification limiting •Not a significant long term risk	• Disposal limits should assume Ni-59 is dispersed due to disintegration (will no longer be discrete).

Risk Assessment of Key Radionuclides: "Phantom Four"

	Why is it a concern?	Impact on Disposal Site Performance	Regulatory Consideration
H-3	Mobility 10 CFR 20	• No significant impact on intruder scenarios or long term risk • Min. dose • Not a classification determinant	Potential exist for non-utility tritium rich waste so maintain reporting requirements
C-14	Mobility Long half-life 10 CFR 20	• No significant impact on intruder scenarios or long term risk • Over-reported generation rate	• Actual generation <1% of Class A limits; thus should be considered "insignificant" • Consider removing reporting requirement (costly & unnecessary)
Tc-99	Mobility Long half-life 10 CFR 20	• No significant impact on intruder scenarios or long term risk •Over-reported generation rate of 100 to 1000 times	•Actual generation <1% of Class A limits; thus should be considered "insignificant" • Consider removing reporting requirement (costly & unnecessary)
I-129	Mobility Long half-life 10 CFR 20	• Low dose contribution to intruder scenario (dose over-estimated by factor of 3 because used whole body instead of organ) • Over-reported generation rate of ~1000 times	•Actual generation <1% of Class A limits; thus should be considered "insignificant" • Consider removing reporting requirement (costly & unnecessary)

Site Specific Characteristics- “Natural Barriers”

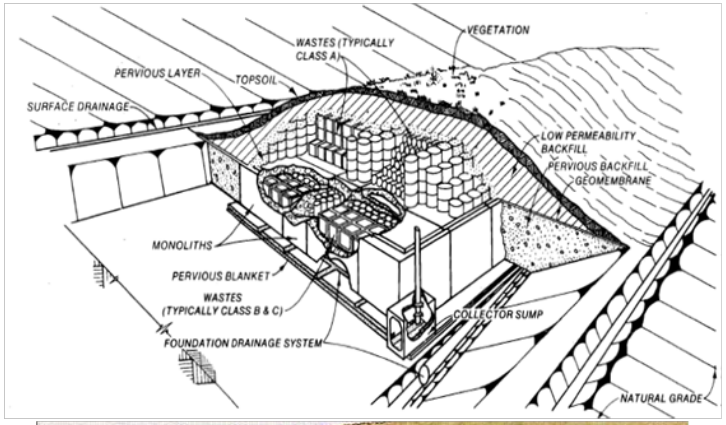
- Four Regional Areas
- Most Constraining Parameters Used for 10 CFR 61 Basis
- Not Reflective of Characteristics of Any Actual Site

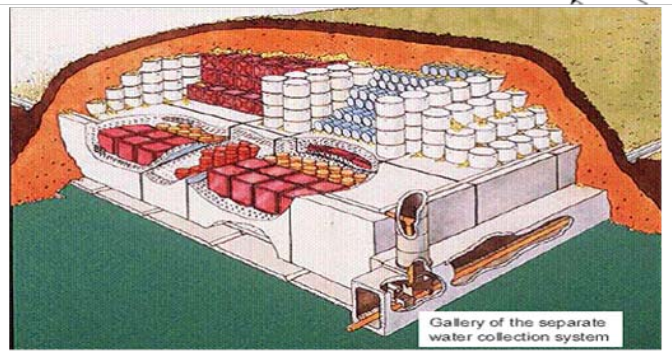
Current Classification Criteria are Marginally Relevant to Today's Disposal Practices

Original Bases for 10 CFR 61

"Kick And Roll" – 2 m Soil Cover

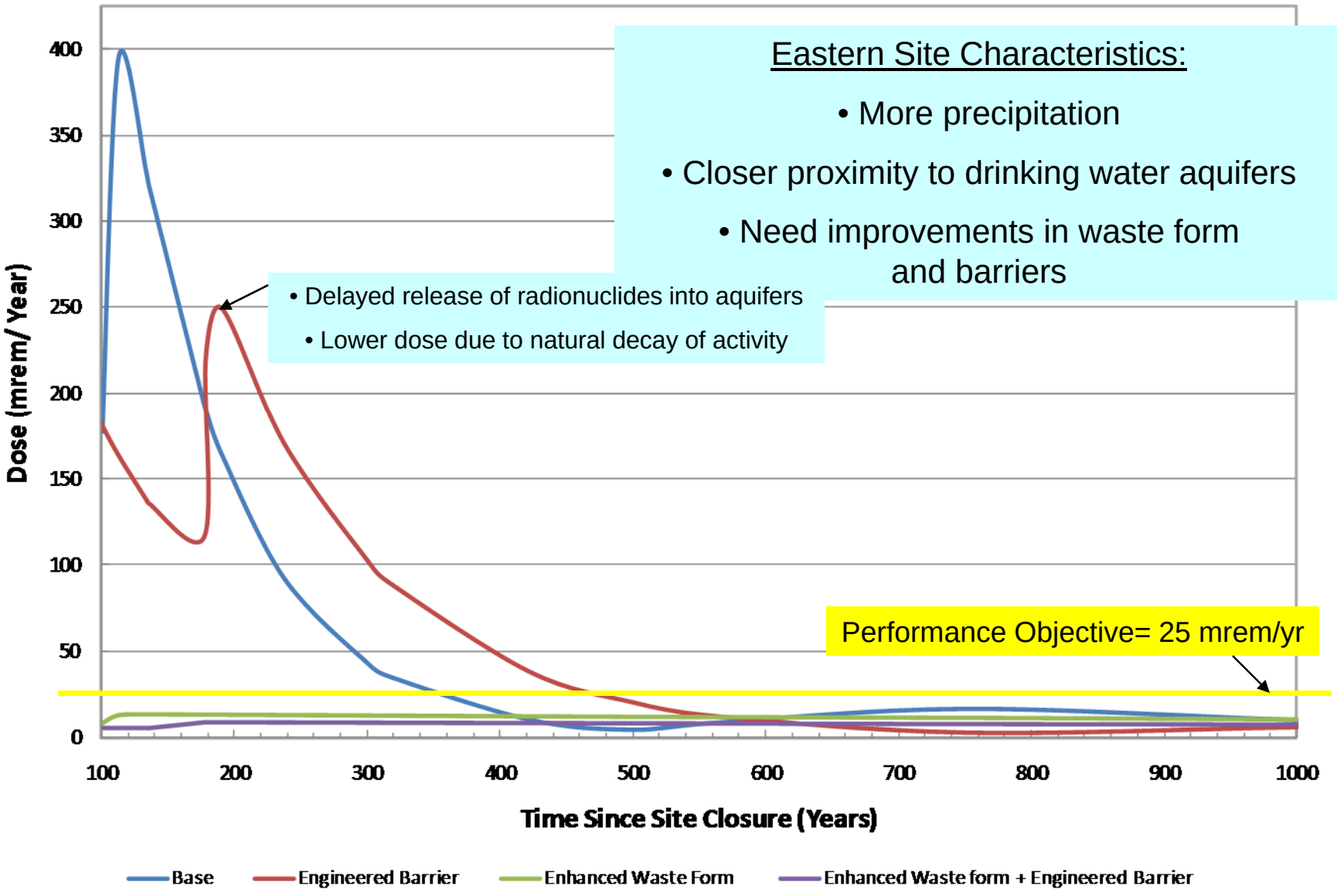
Actual Disposal Designs





Engineered Barriers Not Credited In 10 CFR 61 Protection Analysis

Eastern Site Total Dose Summed Over All Pathways



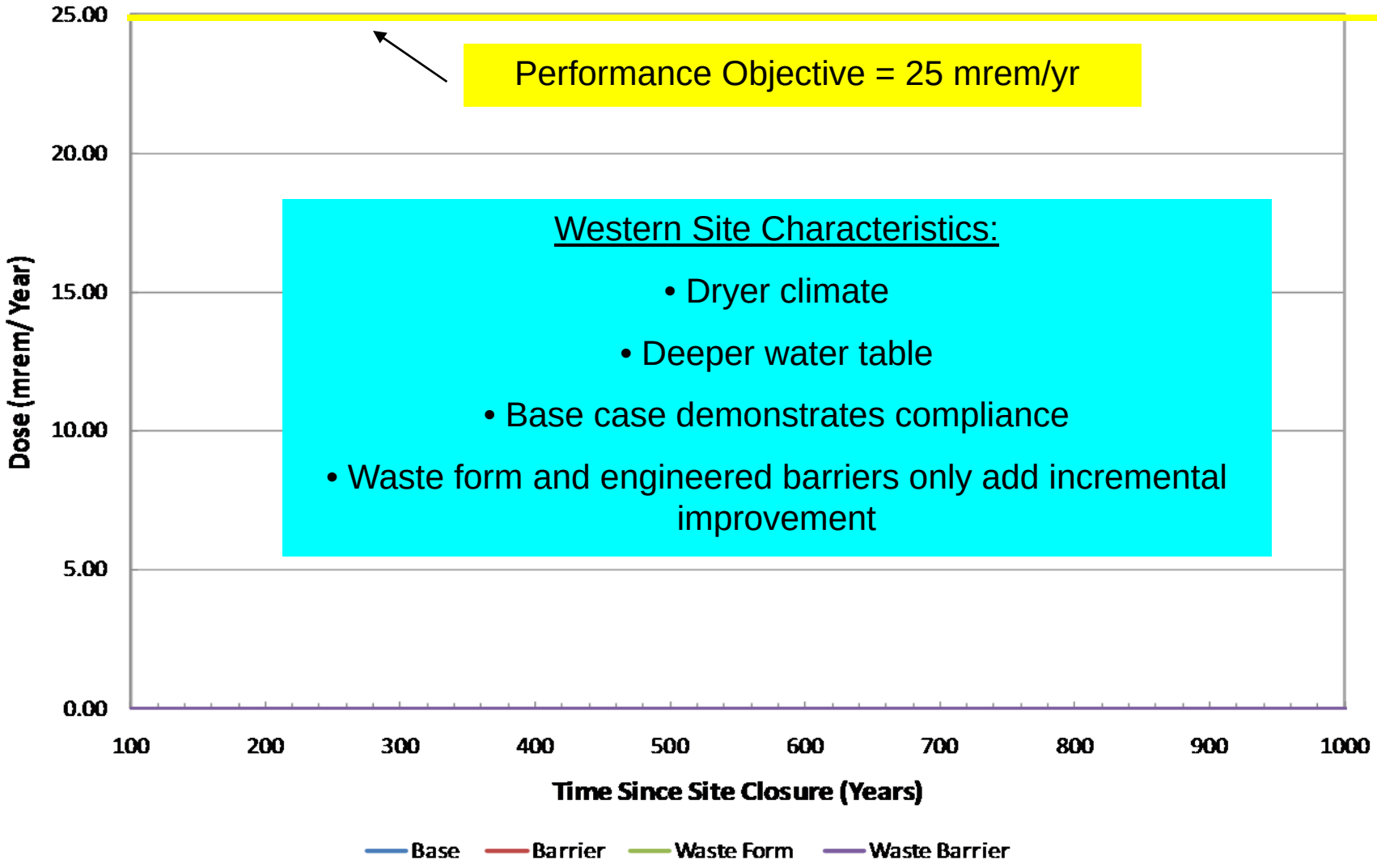
Eastern Site Characteristics:

- More precipitation
- Closer proximity to drinking water aquifers
- Need improvements in waste form and barriers

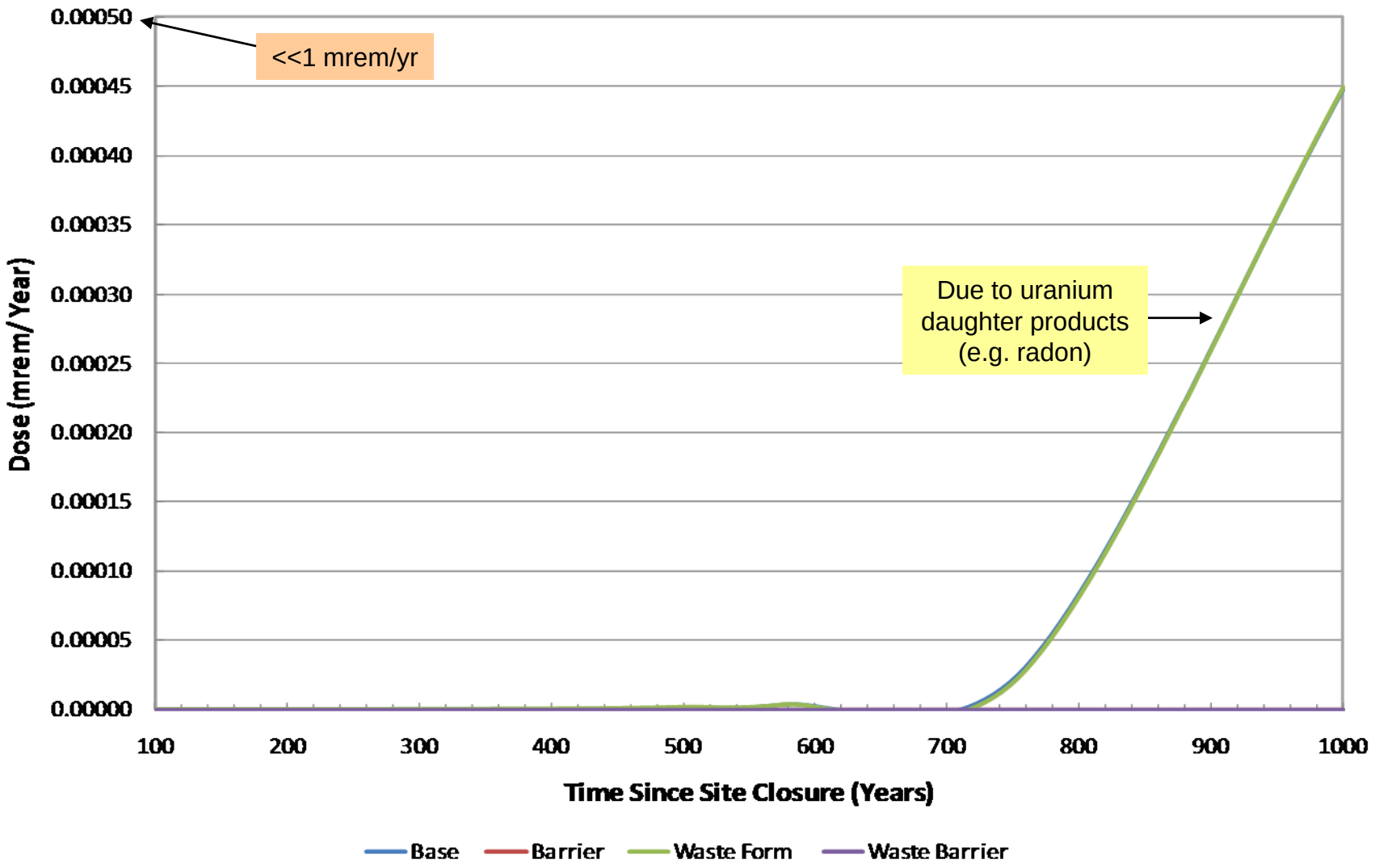
- Delayed release of radionuclides into aquifers
- Lower dose due to natural decay of activity

Performance Objective= 25 mrem/yr

Western Site Total Dose Summed Over All Pathways



Western Site Total Dose Summed Over All Pathways



Conclusions

- Inventory limits should be evaluated on a more site-specific basis than was implemented in 10CFR61.
- Site conditions, waste form and disposal facility design interact to achieve the performance objectives.
- A single LLRW disposal site in a dry climate location could be sufficient to accommodate all LLRW generated in the United States for the time period evaluated in this study.

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