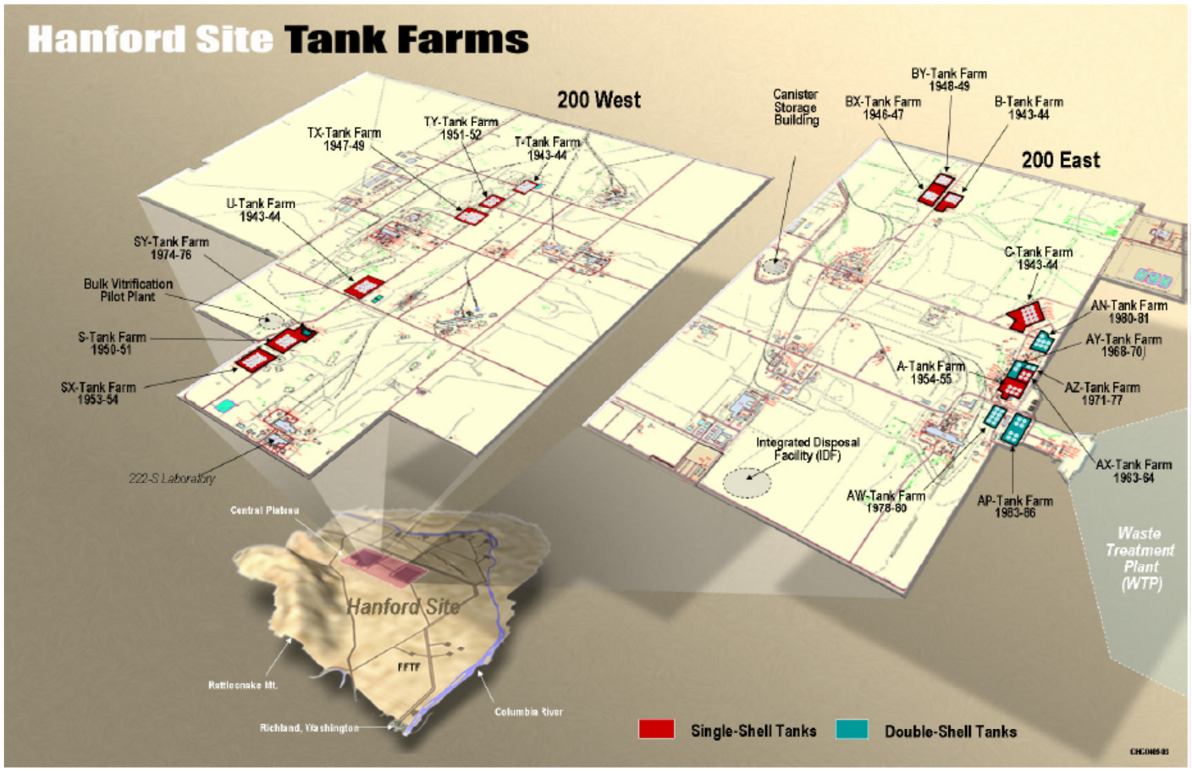
Hanford Tank Waste Residuals

DOE HLW Corporate Board
November 6, 2008



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Hanford Tanks & Tank Waste

- Single-Shell Tanks (SSTs) – ~27 million gallons of waste*
  - 149 SSTs located in 12 SST Farms
  - Grouped into 7 Waste Management Areas (WMAs) for RCRA closure purposes:

200 West Area	**S/SX**	**T**	**TX/TY**	**U**
200 East Area	**A/AX**	**B/BX/BY**	**C**	

- Double-Shell Tanks (DSTs) – ~26 million gallons of waste*
  - 28 DSTs located in 6 DST Farms (1 West/5 East)
- 17 Misc Underground Storage Tanks (MUST)
- 43 Inactive MUST (IMUST)

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* Volumes fluctuate as SST retrievals and 242-A Evaporator runs occur.

Major Regulatory Drivers

- **Radioactive Tank Waste Materials**
  - Atomic Energy Act
  - DOE M 435.1-1, Ch II, HLW
  - Other DOE Orders
- **Hazardous/Dangerous Tank Wastes**
  - Hanford Federal Facility Agreement and Consent Order (TPA)
  - Retrieval/Closure under State's implementation of RCRA (WAC Chapter 173-303 Dangerous Waste Regulations)
- **NEPA/SEPA**
  - TC&WM EIS
- **CERCLA**
  - Final Site Remediation

Inspecting T Farm Barrier

Major Regulatory Drivers (Continued)

- RCRA Permit/TPA address waste storage, retrieval, treatment, and closure.
  - TPA establishes milestones for each of the above.
  - TPA establishes volumetric metrics for maximum residual volumes following retrieval.
  - TPA also establishes a process (Appendix H) to be used to obtain an exception from Ecology/EPA if retrieval metrics cannot be met (tank by tank application).
    - DOE analyses showing why more waste cannot be retrieved.
    - NRC review
  - Appendix I establishes a three-tiered process for Waste Management Area (WMA) closures.

Hanford Single-Shell Tank Waste Status

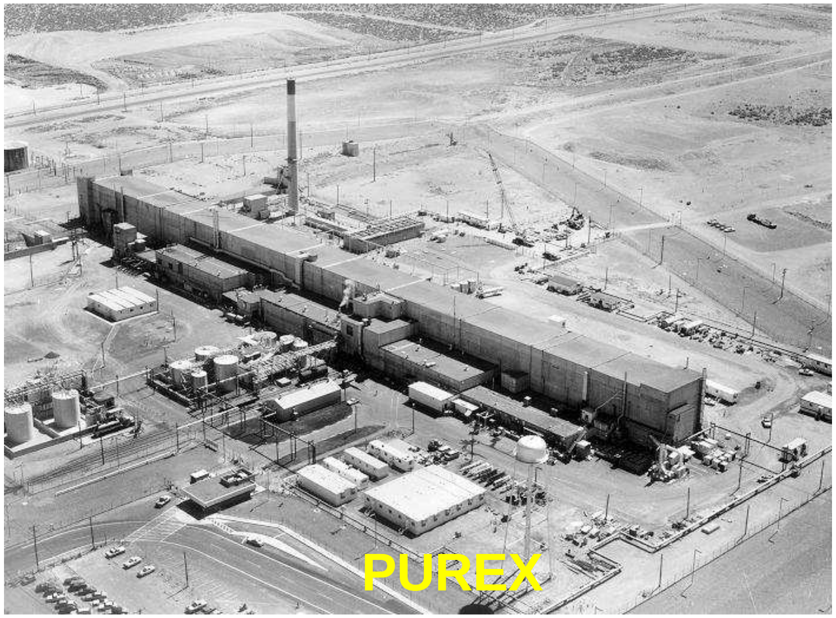
WMA	Number SSTs	Sludge (kgal)	Saltcake (kgal)	Curies (millions)	Complete Retrievals
200 EAST AREA					
A/AX	10	144	1260	27.2	0
B/BX/BY	40	2860	4820	17	0
C	16	1380	0	18	6
200 WEST AREA					
S/SX	27	1650	6240	30.1	1
T	16	1690	136	1.1	0
TX/TY	24	1240	5690	8.2	0
U	16	568	2340	7.8	0

Tank Waste Origins

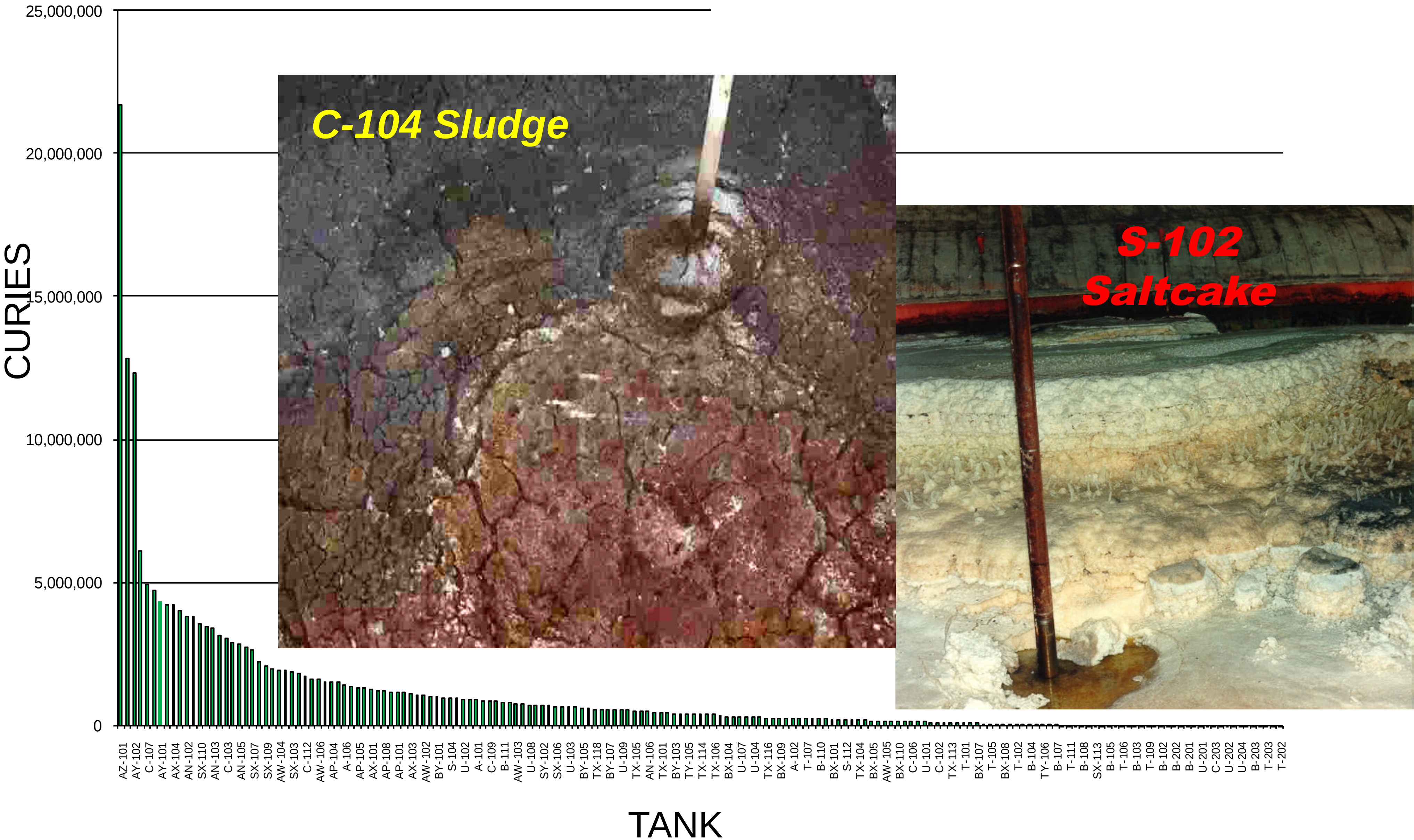
- Hanford tank waste originated from a number of sources such as:
  - Bismuth Phosphate Process
  - REDOX Process
  - PUREX Process
  - Uranium Recovery (Ferro-Cyanide)
  - Cesium Separations (Cs Capsules)
  - Strontium Separation (Sr Capsules)
  - Miscellaneous such as Hot Semi Works, Plutonium Finishing Plant, 222-S Lab,...

SNF Reprocessing

Non-SNF Reprocessing



The tank waste is heterogeneous. Even within a single tank, several waste layers can exist. Radionuclide concentrations and inventories can vary widely from tank to tank.



Source: Best Basis Inventory in TWINS Database

Determining Retrieval End Points

- TPA (M-045-00)

  "Closure will follow retrieval of as much tank waste as technically possible, with tank waste residues not to exceed 360 cubic feet (cu. ft.) in each of the 100 series tanks, 30 cu. ft. in each of the 200 series tanks, or the limit of waste retrieval technology capability, whichever is less." [emphasis added]

  "If the DOE believes that waste retrieval to these levels is not possible for a tank, then DOE will submit a detailed explanation to EPA and Ecology explaining why these levels cannot be achieved, and specifying the quantities of waste that the DOE proposes to leave in the tank…. the criteria are outlined in Appendix H to this agreement."

- DOE M 435.1-1

  "…remove key radionuclides to the maximum extent that is technically and economically practical…" [emphasis added]

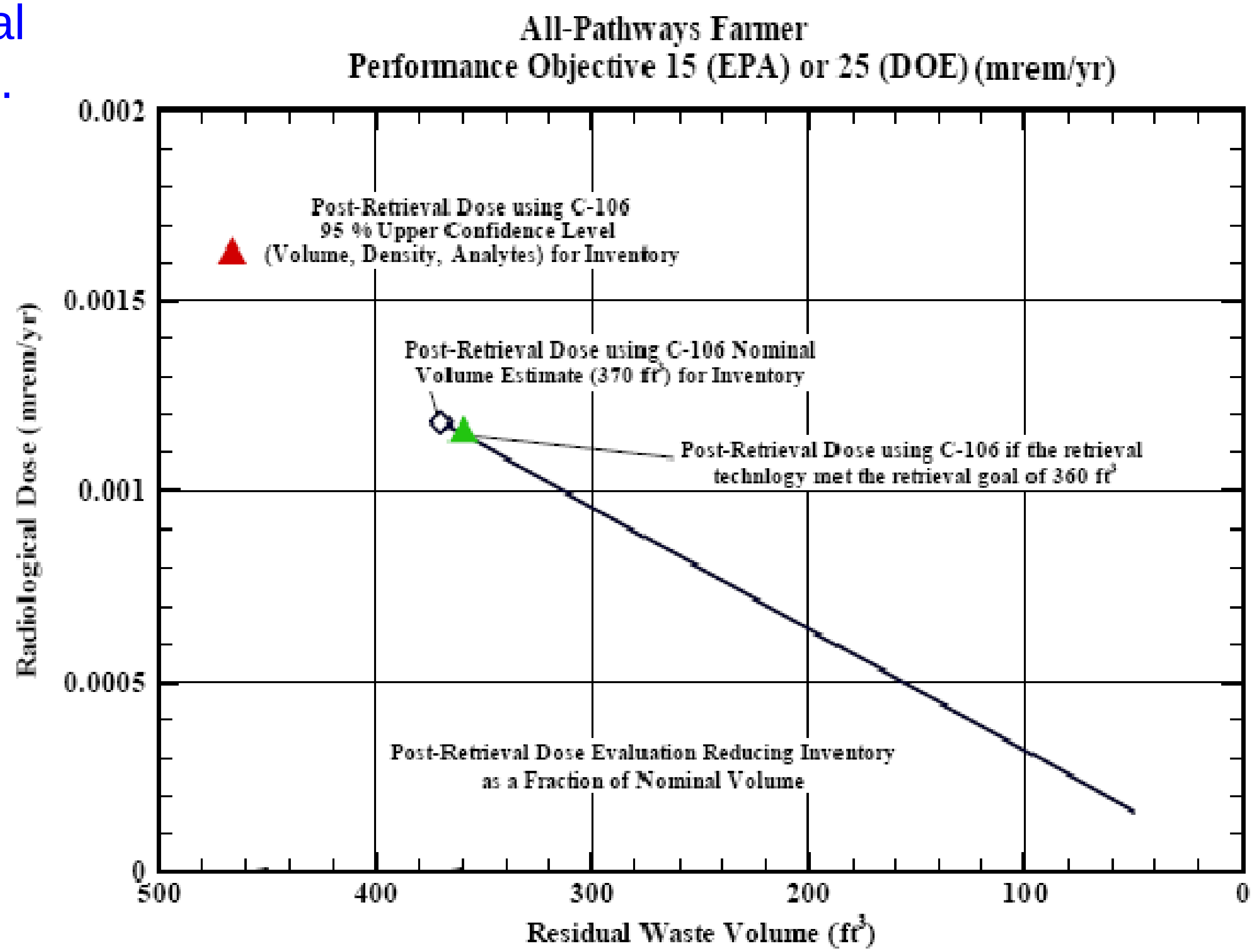
Note: Cost is not a TPA retrieval factor unless Appendix H must be used.

SST Retrieval Results

Tank	Retrieval Complete	Initial Volume (k gal)	Final Volume (k gal)	Final Volume (ft^3) 95% CL	Final Curies	Final Tc-99 (Ci)
C-103	8/23/06	78	2.6	351	19,700	0.045
C-106	12/31/03	192	3	401	132,000	0.16
C-201	3/23/06	0.86	0.15	20.5	539	.0026
C-202	8/11/05	1.4	0.16	20.9	960	0.0025
C-203	3/24/05	2.6	0.15	19.9	463	0.0023
C-204	12/13/06	1.5	0.15	19.6	307	0.0032
S-112	3/2/07	614	2.4	319	130	0.14
S-102	*In Process*	438	*In Process*	*In Process*	*In Process*	*In Process*
C-108	*In Process*	66	*In Process*	*In Process*	*In Process*	*In Process*
C-109	*In Process*	64	*In Process*	*In Process*	*In Process*	*In Process*

Appendix H – DOE request for alternative retrieval endpoint

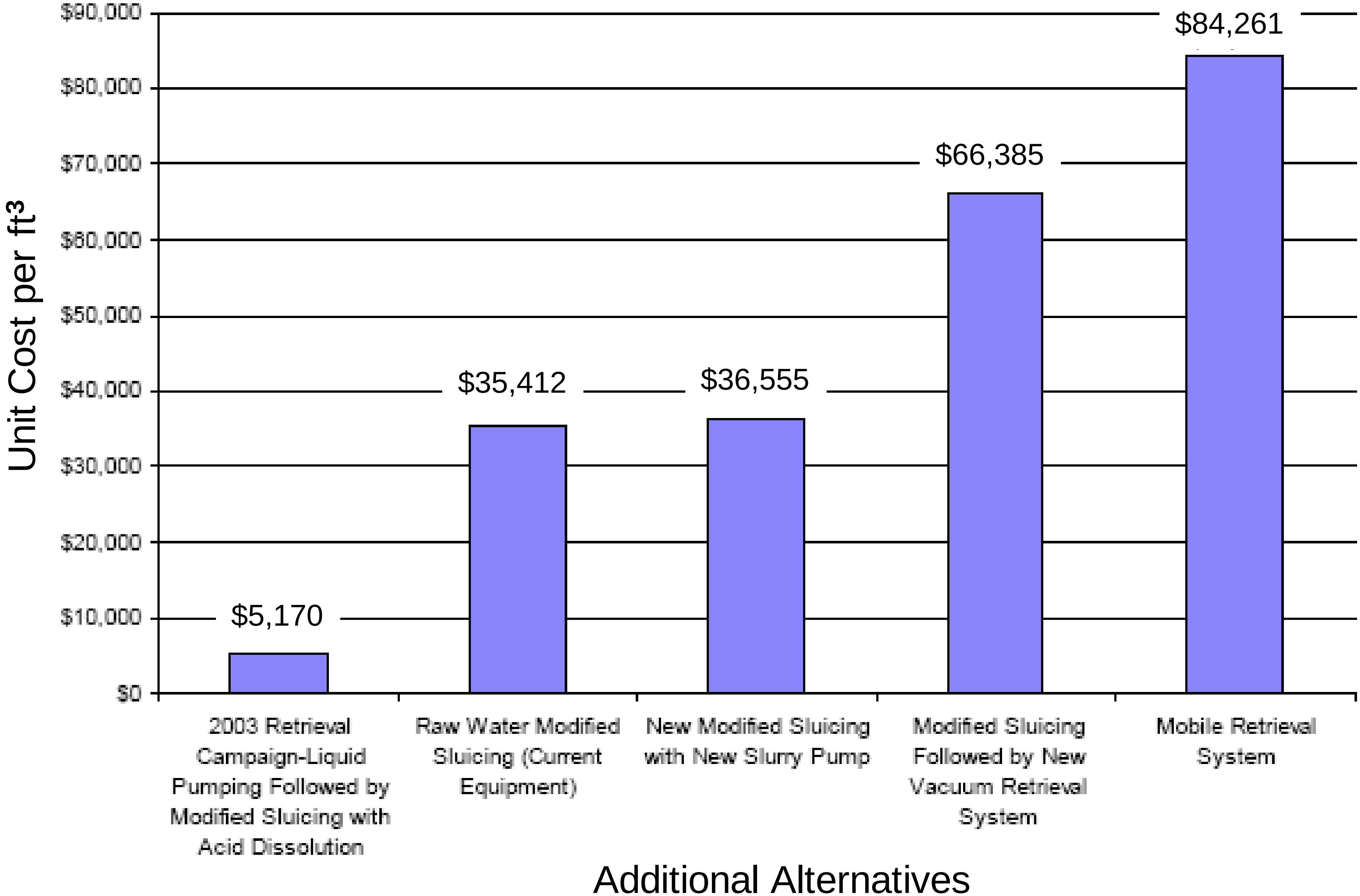
1. Reason DOE does not believe retrieval criteria can be met.
2. The schedule, with existing technology, to complete retrieval to the criteria if possible.
3. The potential for future retrieval technology developments that could achieve the criteria, including estimated schedules and costs for development and deployment.
4. The volume of waste proposed to be left in place, and its chemical and radiological characteristics.
5. Expected impacts to human health and the environment if residual waste is left in place.
6. Additional information as required by EPA/Ecology.



Source: RPP-RPT-35112, Rev 0, Retrieval Data Report for Single-Shell Tank 241-S-112, December 2007, CH2MHILL Hanford Group.

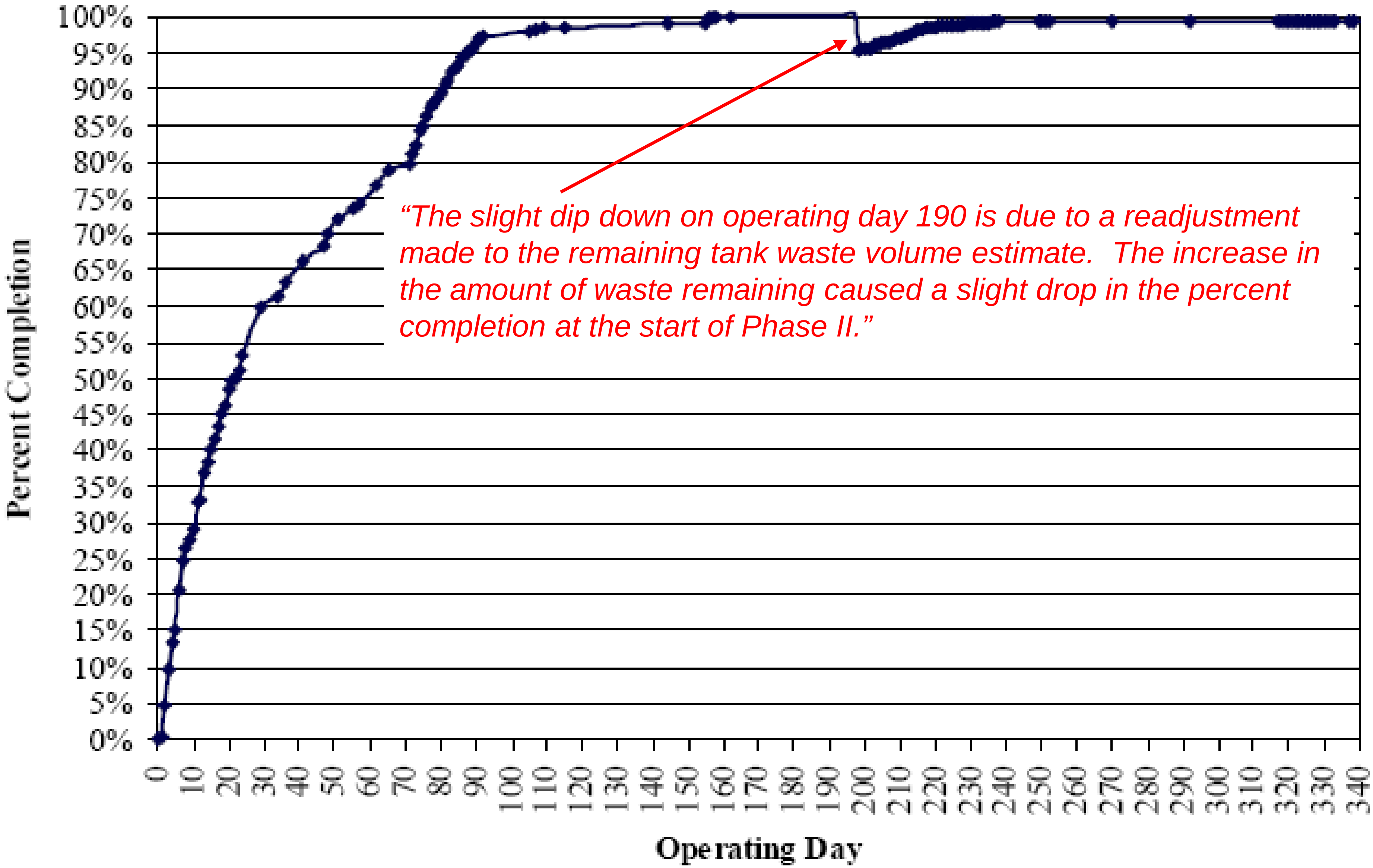
Cost per Cubic Foot of Additional Waste Retrieved.

(Analysis Results for Removing Additional C-106 Waste)

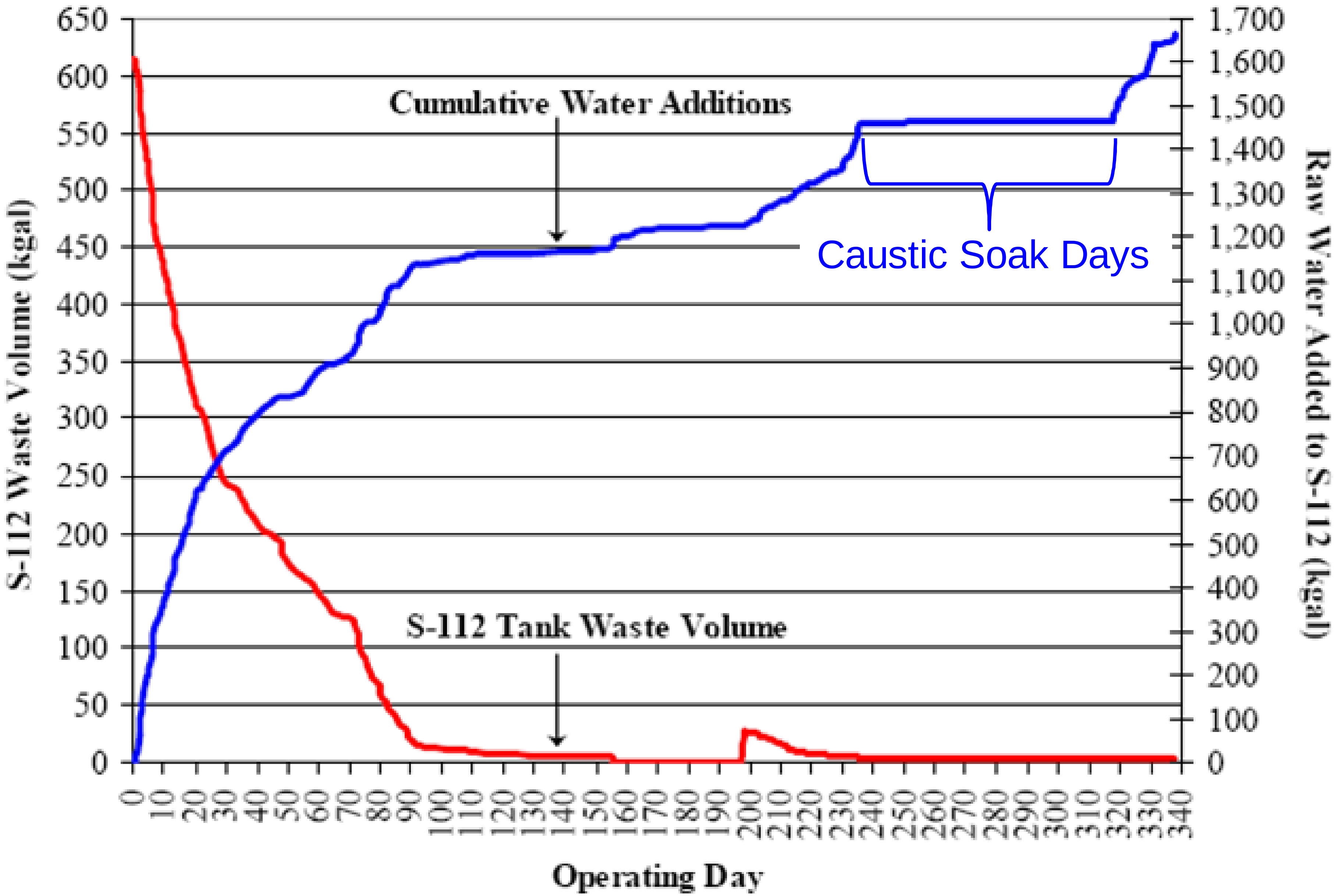


Source: RPP-20577, Stage II Retrieval Data Report for Single-Shell Tank 241-C-106, CH2MHILL Hanford Group, May 2007.

340 Operating Days to Retrieve SST S-112

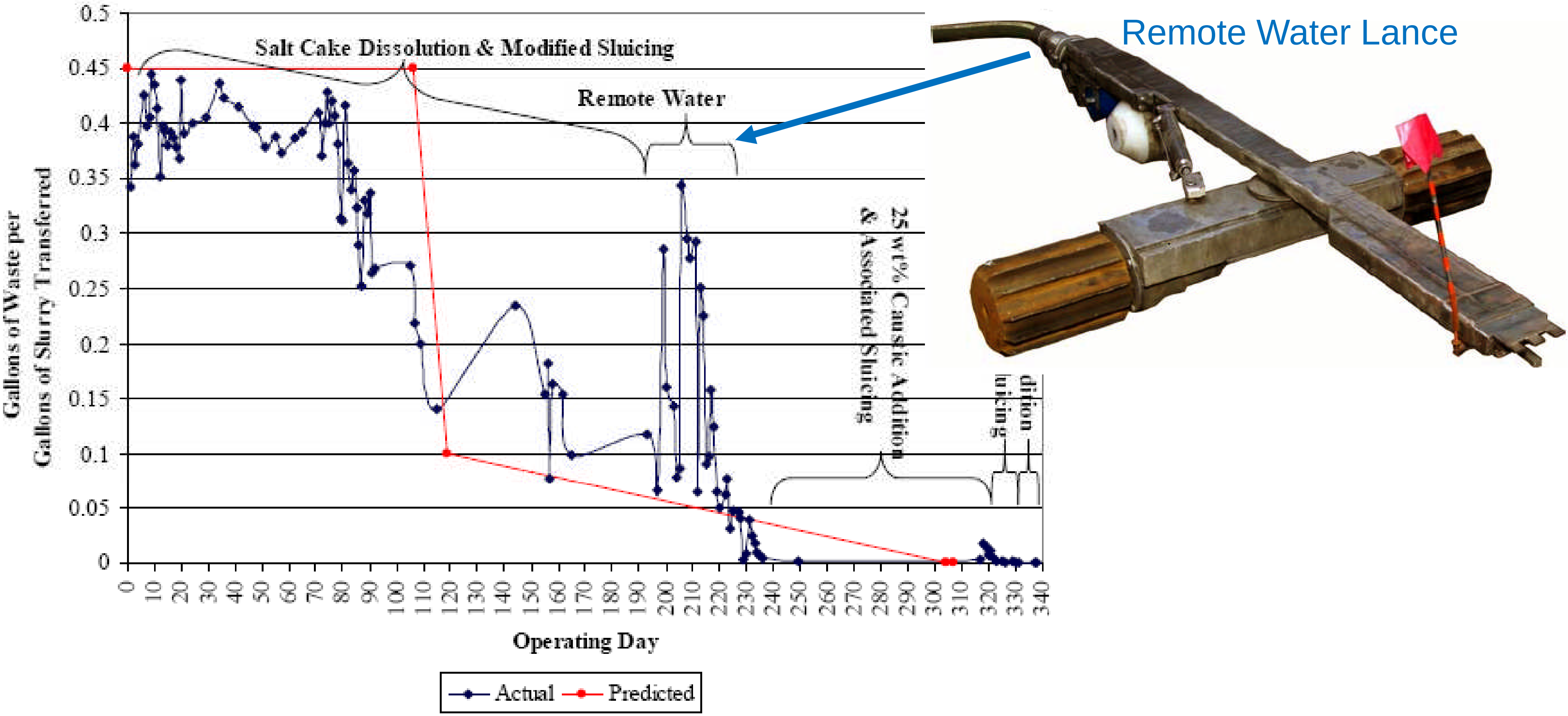


The Tail of the Retrieval Curve is Extensive



Source: RPP-RPT-35112, Rev 0, Retrieval Data Report for Single-Shell Tank 241-S-112, December 2007, CH2MHILL Hanford Group.

Diminishing Returns for the Final Few Cubic Feet



"The last three technologies, 25 wt% and 50 wt% caustic addition, and modified sluicing, resulted in a short, barely measurable increase in efficiency from 0 to just under 0.02…as the volume retrieved approached the starting waste volume, the efficiency declined and approached zero. For each technology used in Phase II retrieval, the efficiency ended well below the target minimum efficiency established before retrieval of SST S-112 began."

Source: RPP-RPT-35112, Rev 0, Retrieval Data Report for Single-Shell Tank 241-S-112, December 2007, CH2MHILL Hanford Group

Waste Determinations

- Hanford WDs must be based on the DOE M 435.1-1 WIR process, i.e.,
  1. Remove key radionuclides to the maximum extent technically and economically practical,
  2. Manage to meet safety requirements comparable to 10 CFR 61 Subpart C Performance Objectives,
  3. Incorporate into a solid form at concentrations that do not exceed 10 CFR 61.55 Class C concentration limits.
- WD schedule dependent upon TC&WM EIS:
  – Final TC & WM EIS □ROD SST Decision/Date
  – Modeling approach
  – Transport code results

Adequate to support WD or additional work required by WRPS PA analysts?

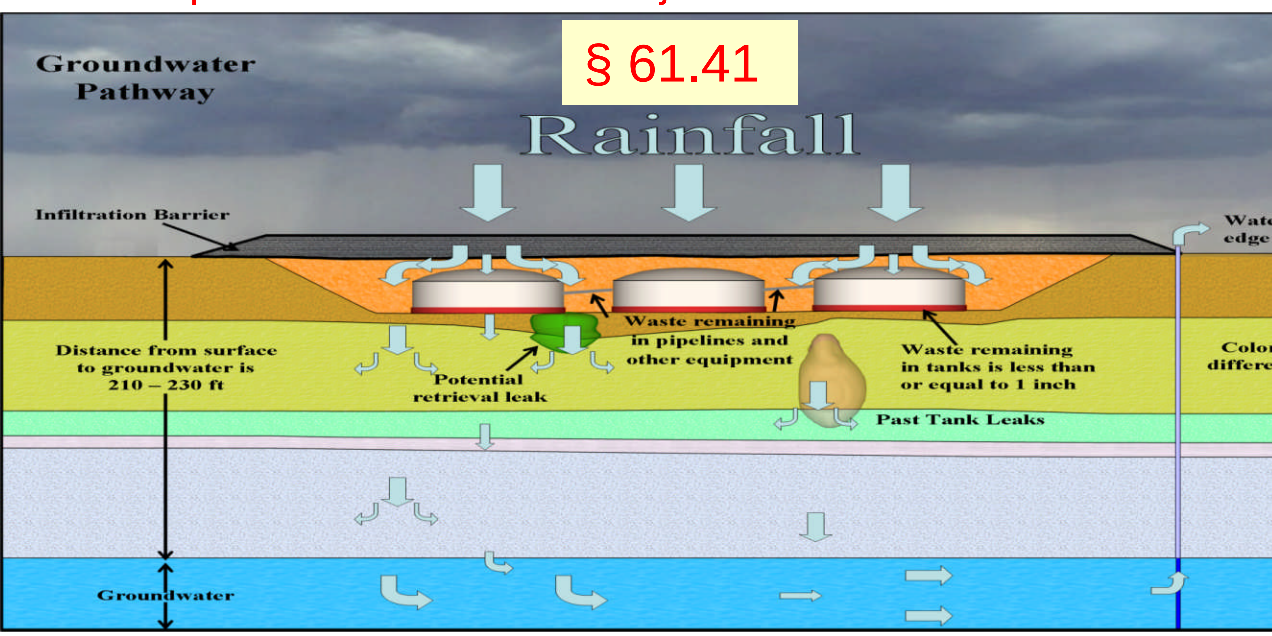
1. Remove key radionuclides to the <u>maximum extent technically and economically practical</u>,

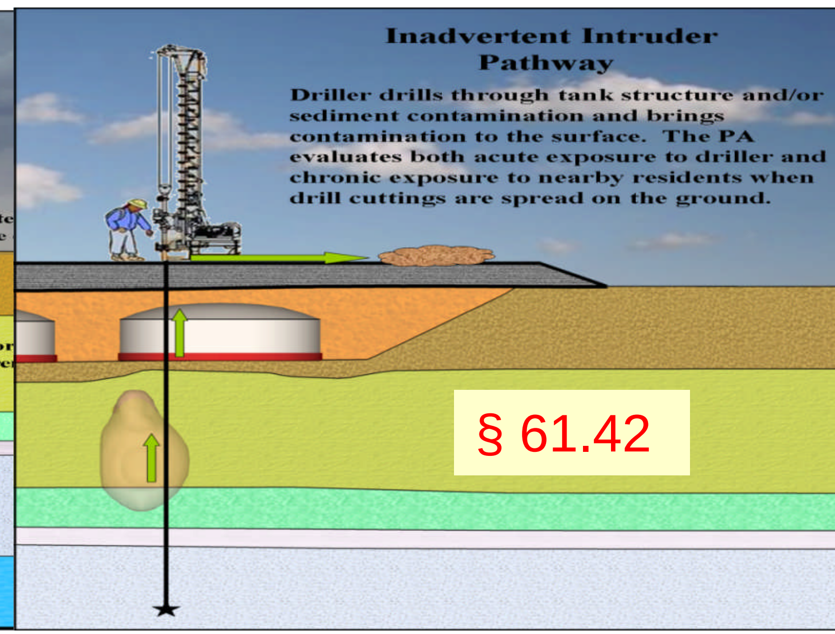
- The 1st WIR criterion is focused on the removal of key radionuclides, not the volume of residual wastes.
- 1st criterion analyses independent of EIS or PA.
- This criterion requires DOE to make the case that it is <u>not</u>:
  - Technically practical to remove more key radionuclides, or
  - Economically practical to remove more key radionuclides.
- Requires technical/cost trade study be developed.

2. Manage wastes to meet safety requirements comparable to 10 CFR Part 61, Subpart C Performance Objectives,

Performance Objective	Compliance Basis
§ 61.41 All pathways dose whole body/organs.	Performance Assessment (PA)
§ 61.42 Inadvertent Intrusion.	PA/Active & Passive Institutional Controls
§ 61.43 Protection of individuals during operations.	10 CFR 20/10 CFR 835/DOE Orders/ALARA
§ 61.44 Long-term stability of disposal site.	DOE M 435.1-1 Chapter IV, M(1)(a)(c)

PA required for Performance Objectives § 61.41 and § 61.42.





SST Residual Waste Determinations

WD schedule dependent upon TC&WM EIS schedule/content:

- Final TC & WM EIS □ ROD SST Decision/Date □ *[New SST PA?]* □ WD
- Modeling approach
- Transport code results

Adequate to support WD or additional work required by WRPS PA analysts?

Draft TC & WM EIS → Final TC & WM EIS → SST Closure ROD → SST Residual WD

Draft TC & WM EIS

- *Will EIS analyses support WDs?*
- *Yes – Develop stochastic sensitivity/ uncertainty analyses to complement EIS analyses.*
- *No – Adopt/adapt EIS methodology to C-Farm PA.*

Final TC & WM EIS

- *Public comments:*
  - *Affect ability to support WD?*
  - *Necessitate changes in PA methodology?*

SST Closure ROD

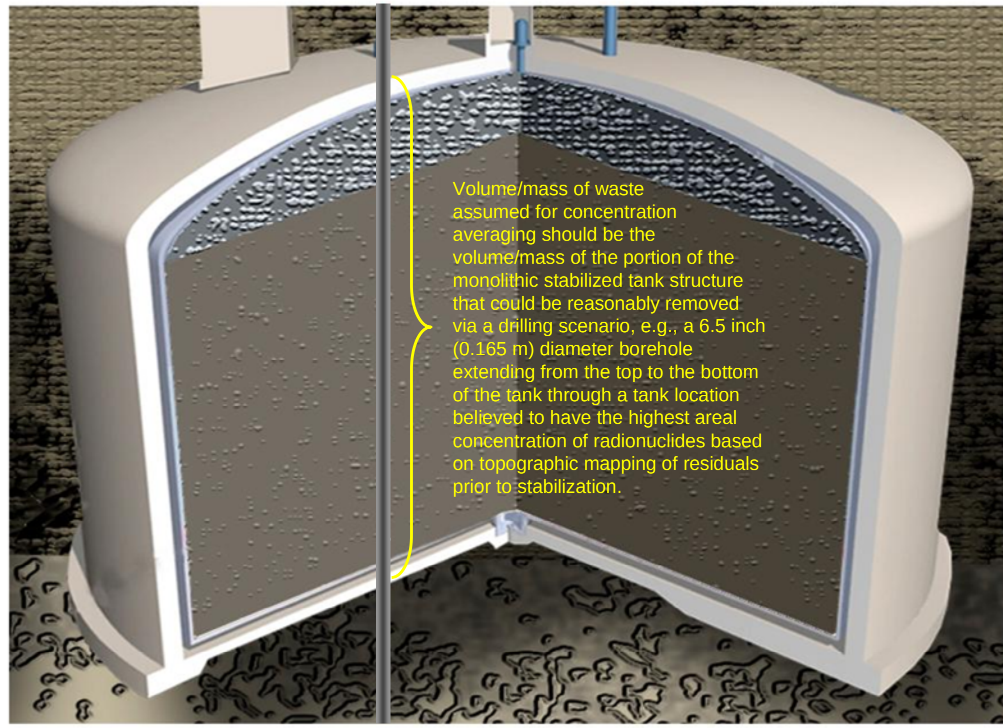
- *Does ROD select landfill closure?*
- *Does ROD affect WD path forward?*

SST Residual WD

- *Still based on DOE M 435.1-1?*
- *First SST?*

3. Incorporate into a solid form at concentrations that do not exceed 10 CFR 61.55 Class C concentration limits …or alternate requirements.

- Stabilize with grout.
- Concentration averaging used to calculate meaningful residual waste concentrations.
  - § 61.55 Class C concentration limits based on dose to inadvertent intruder.
  - Concentration averaging technique:
    - Protective



    - Consistent with radionuclide concentrations an inadvertent intruder and others could be exposed to.
    - NUREG 1854 (Sept 2007) – NRC guidance includes a bore hole-based concentration averaging approach.

SST Residual WD Concept

1st SST WD → **2nd SST WD** → **Remaining SST WDs**

- *Single Retrieved WMA C Tank with Minimal WD Issues*
- *Work Out Any WD Process Issues*
- *Establish Precedents*

- *Remainder of WMA C*
- *Project inventory envelopes for some SSTs*
- *Work Out Process Issues*
- *New Precedents*

- *Remaining 6 WMAs*
  - ***S/SX** (27 SSTs)*
  - ***T** (16 SSTs)*
  - ***TX/TY** (24 SSTs)*
  - ***U** (16 SSTs)*
  - ***A/AX** (10)*
  - ***B/BX/BY** (40)*
- *Apply Precedents & Lessons Learned*

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Aggressive 1st Residual Waste Determination Schedule

Schedule that assumes the TC & WM EIS is issued/finalized as noted and that its analyses provide sufficient PA support for a WIR WD.