

# HANFORD TANK WASTE TREATMENT ALTERNATIVES ESTIMATED TO SIGNIFICANTLY REDUCE LIFE CYCLE COST

Presentation for the National Academy of Sciences, Engineering, and Medicine  
Richland, Washington

March 1, 2018

*D.H. Alexander, PhD*  
*Chemical Processing*

*J. J. Davis*  
*Mechanical Engineering*

# RESULTS OF THIS ALTERNATIVES EVALUATION SHOW THAT:

- Classification of tank waste based on constituency vs source
  - Over 90% of total tank waste could be disposed of as Class C:  
121 SSTs and 17 DSTs (277,400 kgals)
  - 22 Tanks (26,000 kgals) remain as TRU-Like waste and all but 8 can be readily blended to Class C
- Tank waste processed as Engineered Macro-Encapsulation Package(EMP)
  - Substantial Cost Savings estimated to be >>\$100B
  - Significantly reduces mission duration
  - Significantly reduces operational risk and substantially improves on worker and public health and safety
  - Allows disposal of a substantial fraction of waste product onsite
    - Portable EMP
    - Large volume vault
    - Supports disposal of low volume, low inventory SST's without retrieval based on performance assessments (Grand Challenge Winner)
  - Vitrification of tank wastes is not required based on the Performance Assessment (PA) which shows that EMP performs comparably to glass
    - Alternatively, vitrification of the 8 "TRU-like" tank wastes could be achieved by use of the LAW facility after Cs-137 removal

# GAO Cost Comparison of Grout Vs. Vitrification




**Table 2: Comparisons of Total Estimated Costs for Grouting Low -Activity Waste (LAW) at the Savannah River Site and Vitrifying LAW at the Hanford Site, Based on Best Available Information**

	Savannah River Site	Hanford Site	Hanford Site	Hanford Site	
	Existing and new salt waste processing facilities	LAW Treatment facility	Vitrification facility for supplemental LAW <sup>a</sup>		Total
Estimated cost to construct treatment facilities (millions of dollars)	\$2,700	\$6,500 <sup>b</sup>	\$6,500		\$13,000
Estimated cost to treat LAW (millions of dollars)	\$2,800	\$20,000 <sup>c</sup>	\$20,000		\$40,000
<b>Total estimated cost (millions of dollars)</b>	<b>\$5,500</b>		na	na	<b>\$53,000</b>
<b>Total LAW (gallons)<sup>d</sup></b>	<b>36 million</b>		na	na	<b>49 million</b>
<b>Estimated average cost per gallon of LAW treated (dollars)</b>	<b>\$153/gallon</b>		na	na	<b>\$1,081/gallon</b>

Source: GAO analysis of Department of Energy (DOE) data and interviews. | GAO-17-306

Capital and Operating cost in the WRPS Life-Cycle Cost and Schedule Model (LCM) estimate, are the basis for the System Plan 8 values, which are lower than the costs estimated in the GAO report

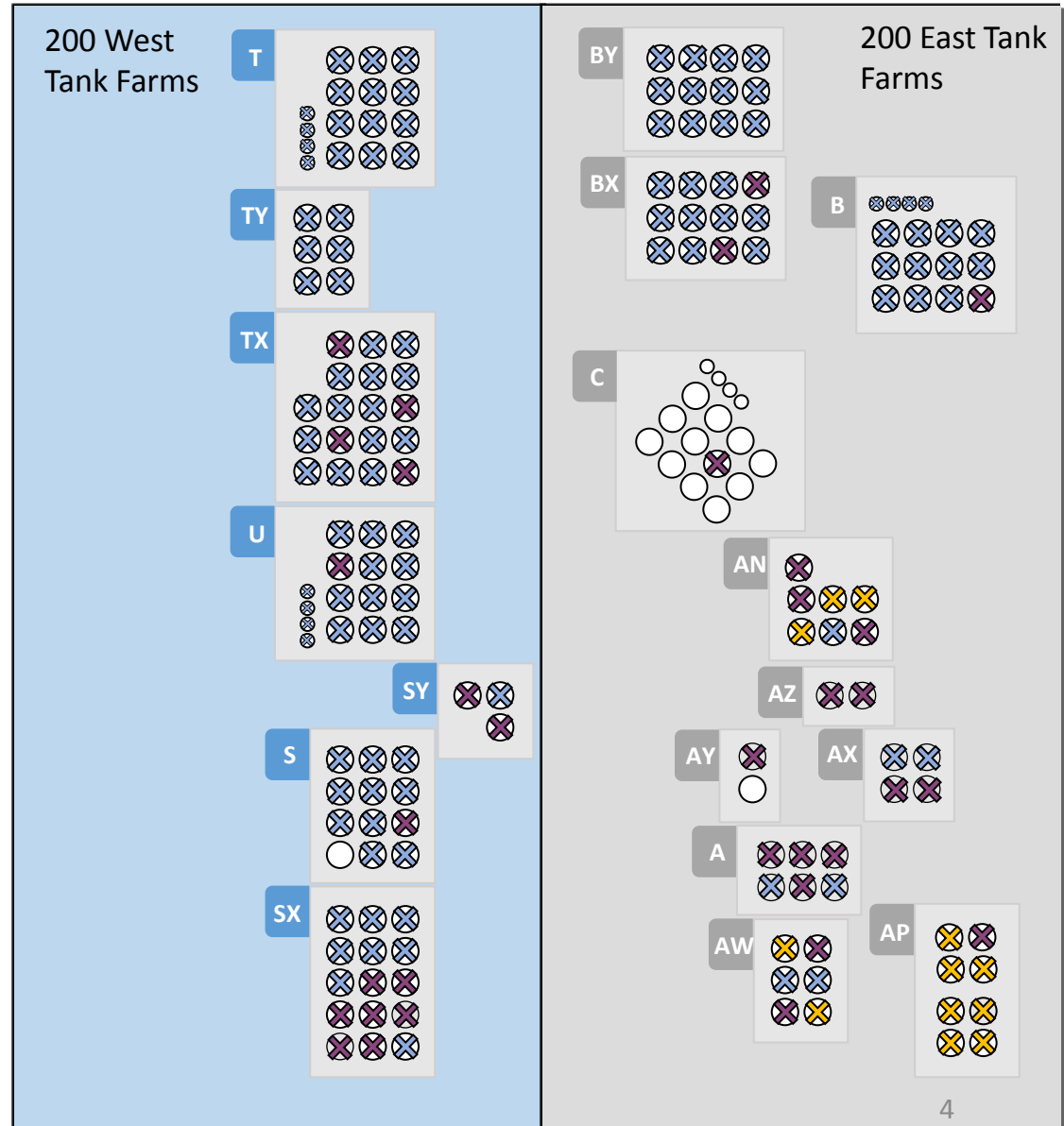
# EMP Product Classification

- Class C 
  - 110 SSTs (213,500 kgal)
  - 16 DSTs (38,000 kgal)
- TRU-like 
  - 34 tanks (35,900 kgal)
- Retrieved 
  - 17 tanks (100 kgal)

---

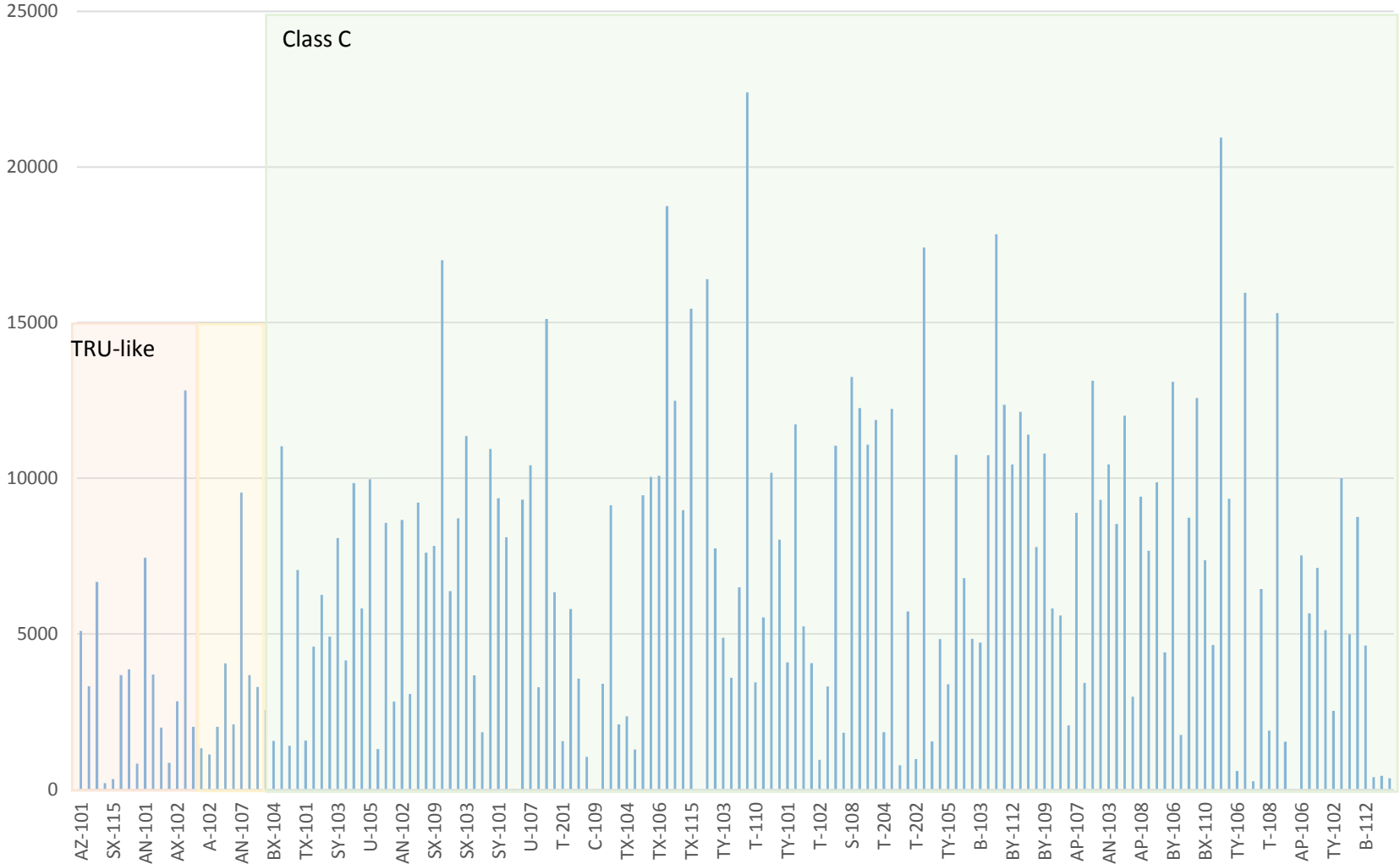
## TRU Volume Reduction Option

- Class C
  - 121 SSTs (234,400 kgal)
  - 17 DSTs (43,000 kgal)
- TRU-like
  - 22 tanks (26,600 kgal)



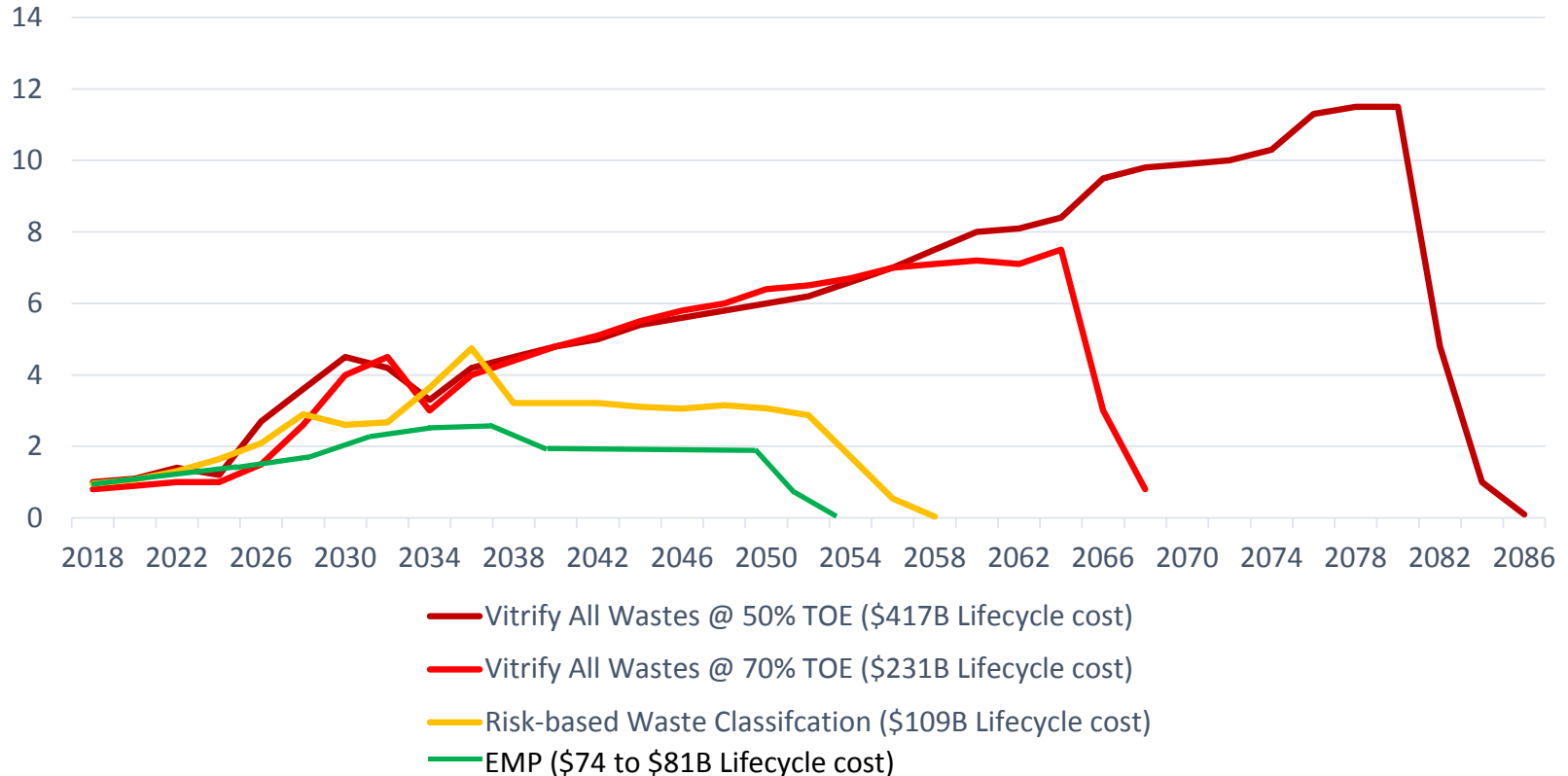
# Volume of Tank Waste per Classification as TRU-like and Class C

Volume (kL)



# Classification versus System Plan 8 Results

## Hanford Tank Waste Treatment Life Cycle Cost Scenarios



System Plan 8 costs for a vitrification baseline have become cost prohibitive. Classification provides alternatives that substantially lower costs <\$109B (escalated).

# HAZARDS CONFRONTING WORKER AND PUBLIC HEALTH AND SAFETY

## VITRIFICATION

WTP vitrification safety systems and their associated design basis accidents that are being analyzed in the Preliminary Documented Safety Analyses.

Radioactive spills

Process vessel overflows

Process and cell hydrogen explosions

Ammonia Release

Hydrogen explosions in piping and ancillary vessels

Other Natural phenomena hazards

Facility fires

Spray leaks

Melter off-gas release

NOx release

Canister drops

Molten glass spills

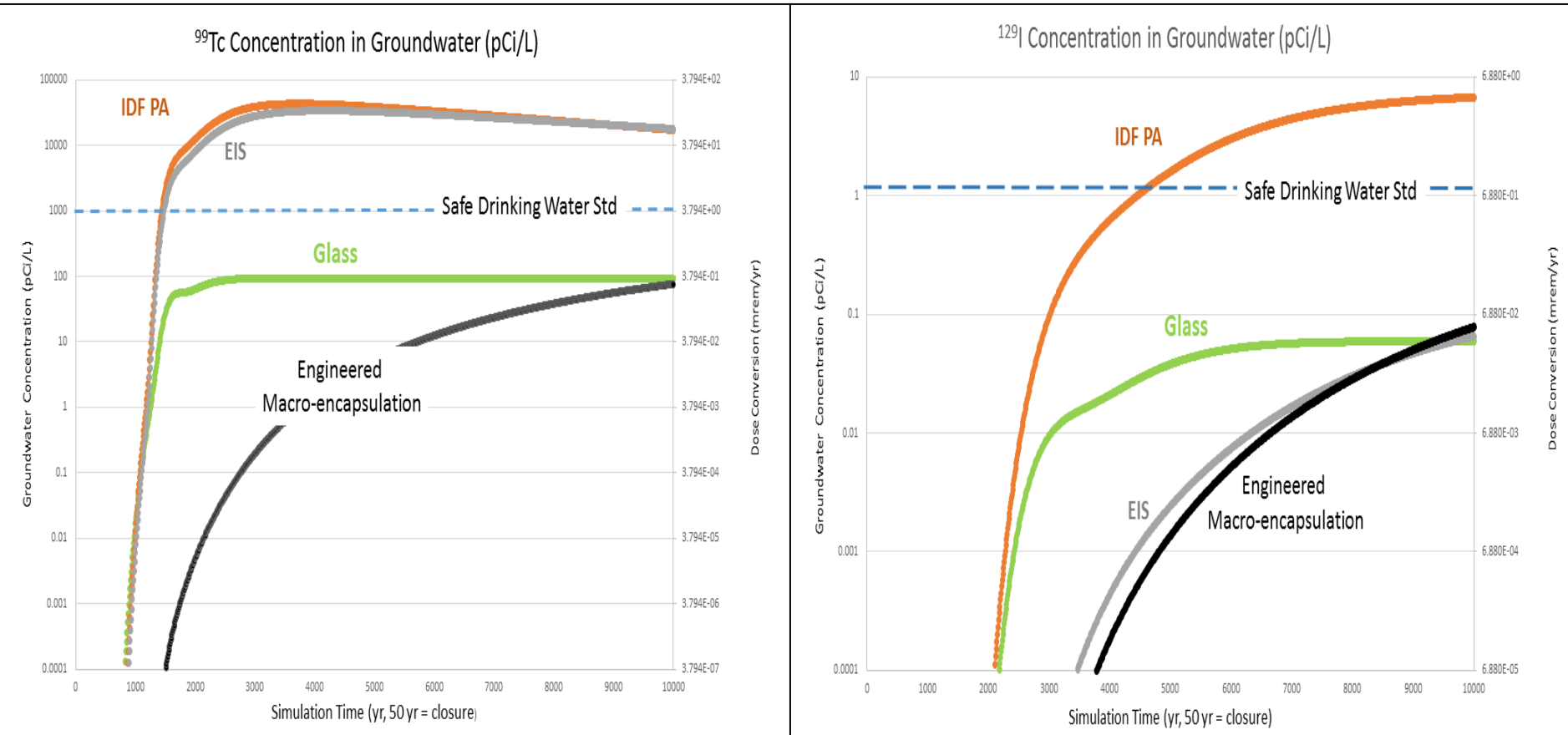
Pressurized releases and overblows

Seismic Event

## ENGINEERED MACRO-ENCAPSULATION

Within a conceptual EMP facility, only a limited number of these accidents scenarios are conceivable. The hazardous operations issues associated with vitrification are substantially reduced by the production of grout based waste product (such as the disposition of salt waste at the SRS Saltstone Disposal Facility).

# EMP Performance Comparable to Glass for 10,000 years



DOE should develop a robust suite of methods for disposal of tank waste commensurate with Performance of the product to 10,000 years. Methods should include vault disposal for a large fraction of the waste (like at SR); closure within tank, and EMP for TRU-Like wastes.