



OFFICE OF
RIVER PROTECTION
United States Department of Energy

Analysis of Approaches for Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation

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Our Mission

To safeguard the nuclear waste stored in Hanford's 177 underground tanks, and to manage the waste safely and responsibly until it can be treated in the Waste Treatment and Immobilization Plant for final disposition.

Vision

To be a high-performing, innovative organization that is safety-conscious and employee-focused, and committed to achieving our mission with environmental and fiscal responsibility.





Office of River Protection (ORP)

ORP is responsible for planning, integrating, and managing the River Protection Program executed by contractors performing work under ORP management. ORP has ~225 employees, both federal and contractor.

Washington River Protection Solutions (WRPS)

WRPS is the prime contractor responsible for safely managing and operating the Tank Farms. WRPS has 2,094 employees*.

Bechtel National, Inc. (BNI)

BNI is responsible for the engineering, construction, startup and commissioning of the Waste Treatment and Immobilization Plant. BNI has 3,044 employees*.

Wastren Advantage, Inc. (WAI)

WAI is the prime contractor responsible for managing the 222-S Laboratory. WAI has 56 employees.*



*As of September 30, 2016





The Tank Farms

A 200 Area Aerial Overview

200 West Area

200 East Area

*Retrieval efforts
at double-shell
tank AY-102*

Tank Farm update

*Future location of
Low-Activity Waste
Pretreatment System*

*Waste Treatment and
Immobilization Plant*

Single-Shell Tank Farm
Double-Shell Tank Farm





Safely maintain **56** million gallons of radioactive and chemical waste



- 1943-1964: **149** single-shell tanks (SST)
- 1968-1986: **28** double-shell tanks (DST)





➤ **Analyze Treatment Approaches**

- Further removal of long lived constituents
- Vitrification, grouting, steam reforming and other identified alternatives

➤ **Further Analysis**

- Risks of approaches
- Benefits and costs of approaches
- Anticipated schedules of approaches
- Regulatory compliance of approaches
- Obstacles to approaches





- Review of FFRDC Analysis: Conducted concurrent and parallel to FFRDC analysis
- Public Review: Provide an opportunity for public comment with sufficient notice to inform and improve the review quality
- FFRDC and NASEM will provide to the state of Washington:
 - Analysis and review in draft form
 - At least 60 days to review and comment
- Submission to Congress: Every 180 days DOE will provide a progress briefing to the Congressional defense committees on both the analysis and review
- Completed Analysis and Review: DOE will submit to the Congressional defense committees the completed analysis, review and any comments from the state of Washington



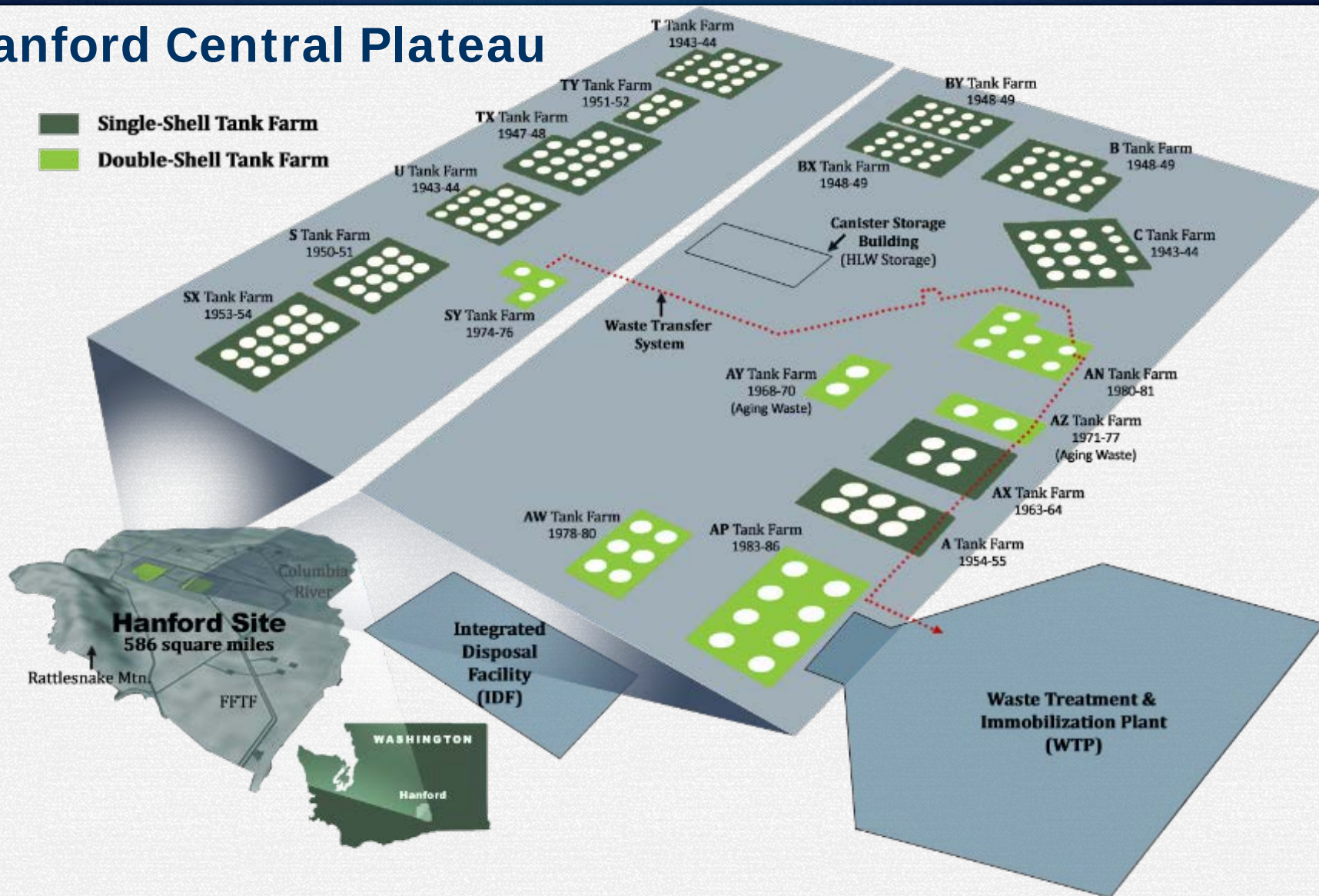


- Beneficiary of the analysis and review
- Established multi-year funding
- Facilitates exchange of information
- Coordinates field visits: First on-site team meeting was May 23-24





Hanford Central Plateau



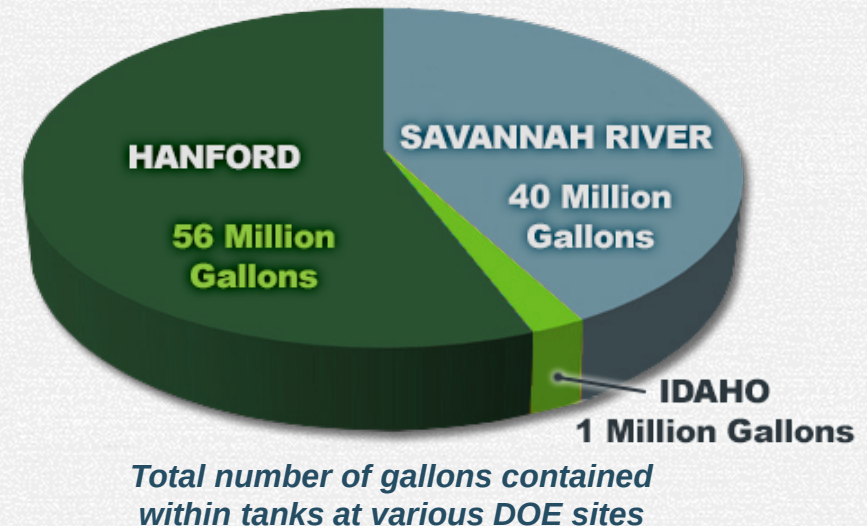


Hanford's Tank Farms Compared to Other Sites



Hanford Tank Farms

- **177 underground carbon steel storage tanks**
 - 149 single-shell tanks
 - 28 double-shell tanks
 - 56 million gallons of radioactive and chemical waste
- **176 million curies of radioactivity**
 - 106 million curies of previously removed strontium and cesium – stored in capsules
- **240,000 tons of complex chemical waste**
- **Five major facilities were used for Hanford waste generation**



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Saltcake *23M gallons*



Mostly water-soluble salts; small amount of interstitial liquid

Supernate *21M gallons*



Any non-interstitial liquid in the tanks – similar to saltcake in composition

Sludge *12M gallons*



Water-insoluble metal oxides, significant amount of interstitial liquid – texture similar to peanut butter





- Hanford tank waste was generated from chemical processing of irradiated uranium metal fuel rods to recover plutonium for defense and uranium for recycle
- Five major processes were employed that generated the waste
 - Bismuth Phosphate precipitation (T & B Plants)
 - Redox solvent extraction (S Plant)
 - Uranium Recovery (U Plant)
 - PUREX (A Plant)
 - Isotope Separation and Recovery (B Plant)





From Storage to Making Glass – Providing Feed to WTP



Mast of the MARS-V installed at tank C-105

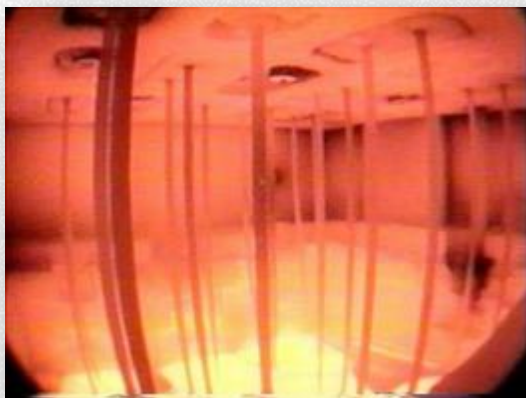


High-level waste canister (tall) and low-activity waste container





Vitrification and Storage



Molten glass and waste in a melter



Simulated vitrified waste



High-level waste (tall) and
low-activity waste containers



Simulated vitrified waste
in a container





Tank Farms – Complex, Accessible Only from the Surface





Mobile Arm Retrieval System



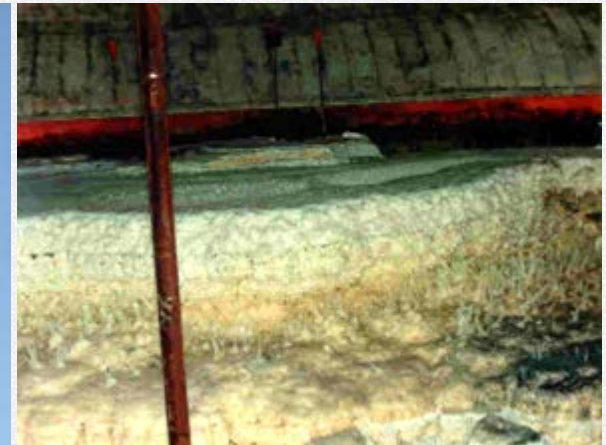
- Articulated arm on vertical mast can reach everywhere within tank
- Effective & efficient

Enhanced Reach Sluicing



- Telescoping arm brings sluicer closer to waste vs. traditional sluicing methods
- Successfully broke through hardpan-like top layer to expose sludge below

Caustic Dissolution



- Gained state approval to pre-soak hard-heel waste
- Process improvement speeds retrieval schedule, improves efficiency





Tank Farms Supporting Facilities



Effluent Treatment Facility



242-A Evaporator



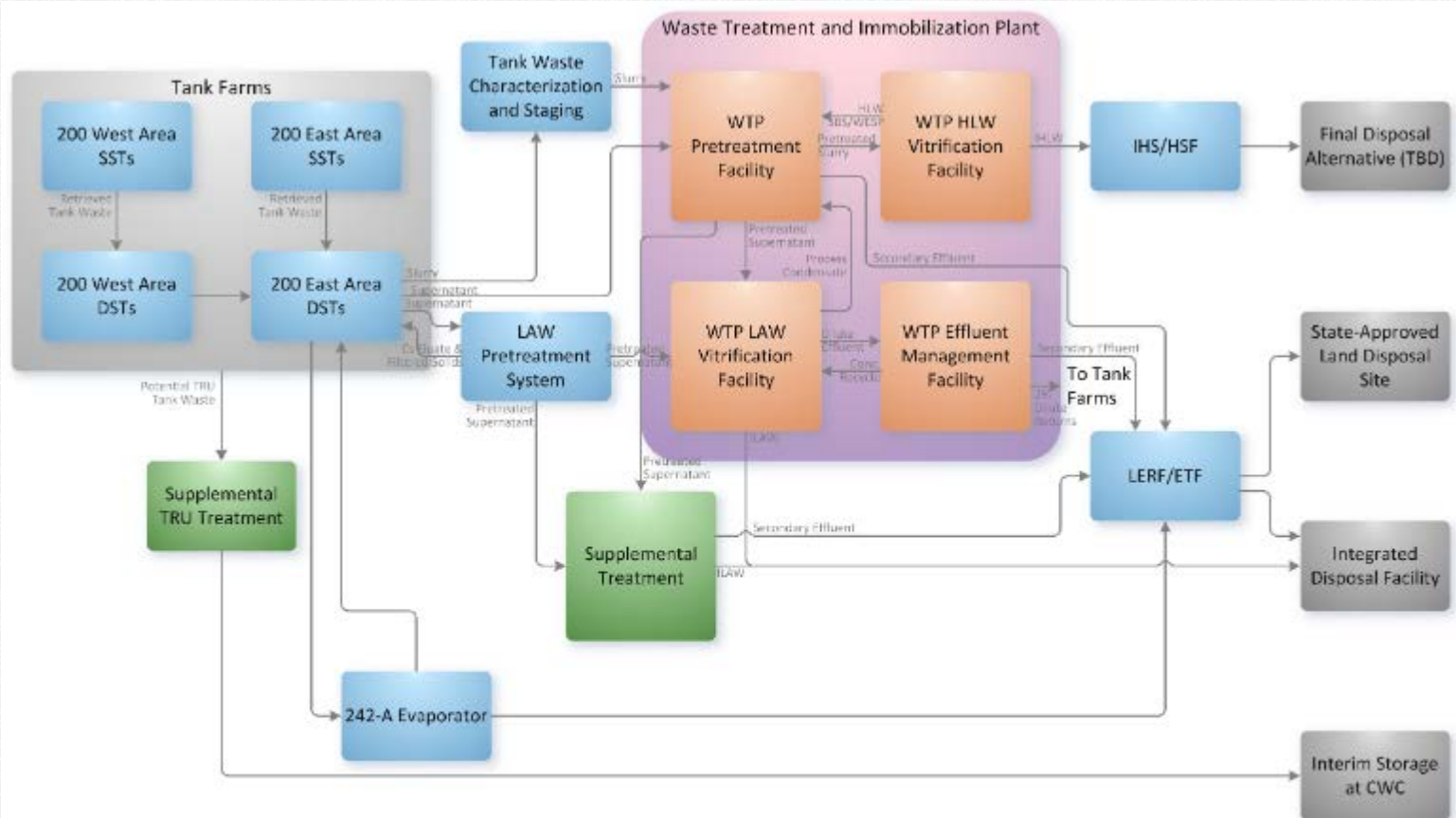
222-S Laboratory





Waste Treatment and Immobilization Plant (WTP)





Legend

Acronyms

CWC	Central Waste Complex
DST	double-shell tank
ETF	Effluent Treatment Facility
HLW	high-level waste
HSH	Hanford Shipping Facility
IHS	Interim Hanford Storage
LAW	low-activity waste

LERF	Liquid Effluent Retention Facility
MT	metric ton
SST	single-shell tank
TBD	to be determined
TRU	transuranic
WTP	Hanford Tank Waste Treatment and Immobilization Plant

For illustrative purposes only: The flowsheet presented here has been simplified for presentation purposes.

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*“Protecting our workers,
the public, and the environment”*

The Hanford Reach
White Bluffs Overlooking the Columbia River





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