



# THE HANFORD SITE

## Hanford Tank Farms

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Objective of the briefing:

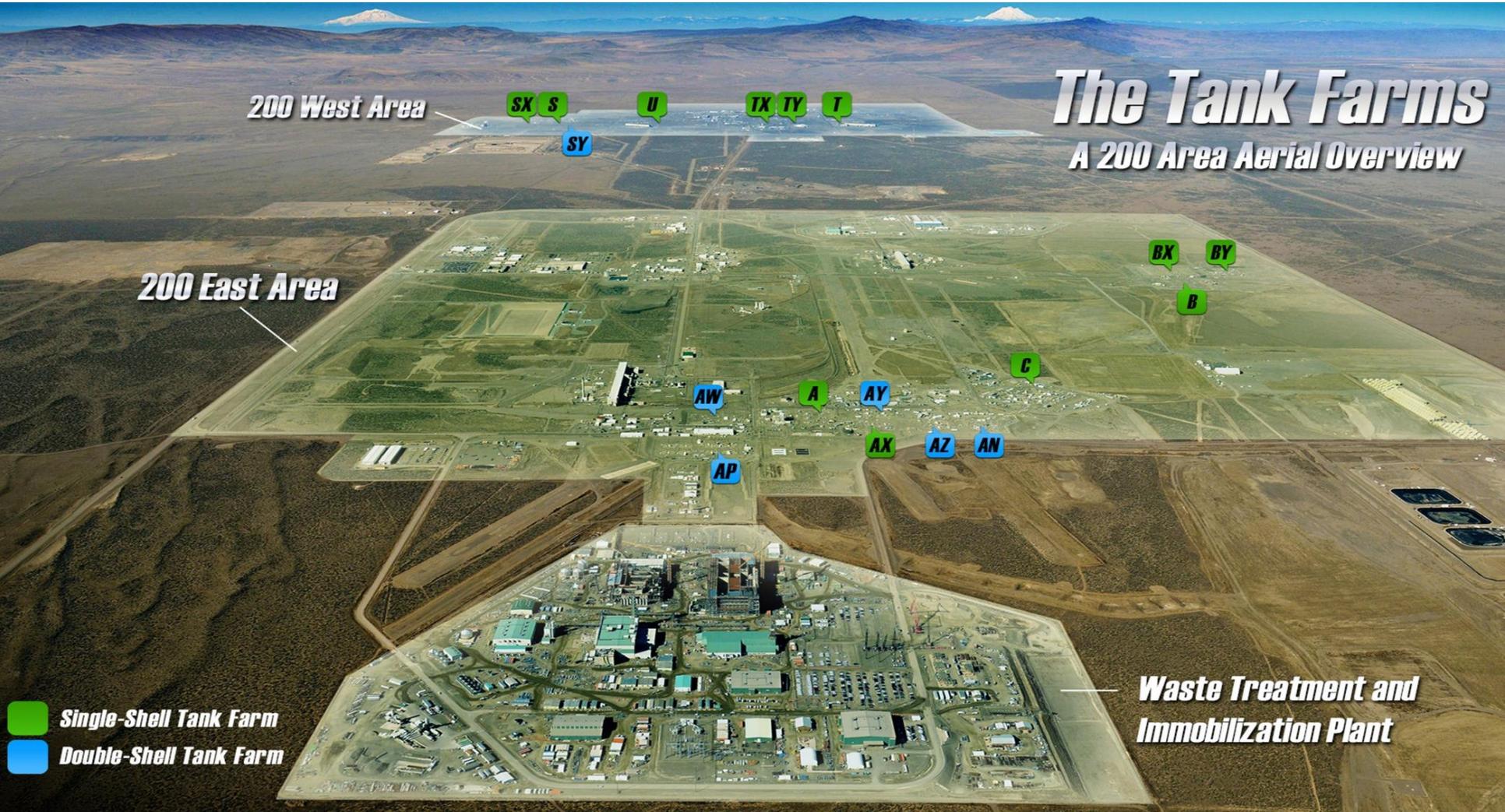
- Provide overview of the Tank Farm program to provide HAB members an understanding of the history, current efforts and future plans to support the Direct-Feed Low-Activity Waste program

What is being briefed?

- Requirements of the Tank Farm program, what is being done now to meet those requirements and future plans for the storage, retrieval, integrity and treatment missions

What do we want the HAB to do with this information?

- Information is relevant in continued high-level discussions regarding potential increases in safety and efficiency in tank waste storage and retrieval as well as protections for the workforce and environment



## 1943: Hanford

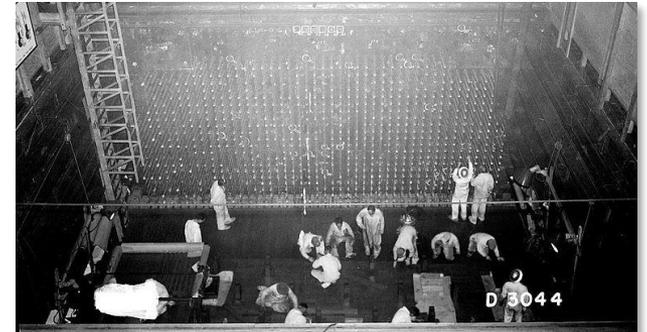
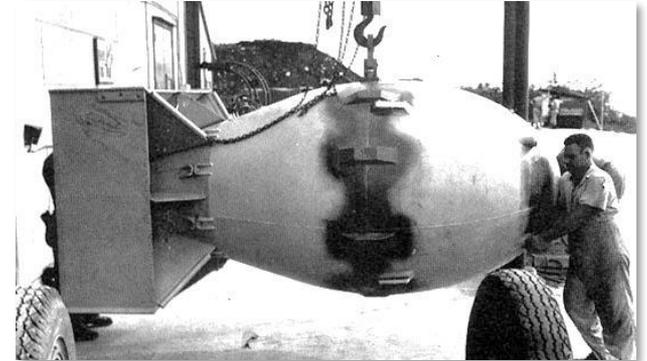
Manhattan project site chosen to produce plutonium

## 1944: B Reactor

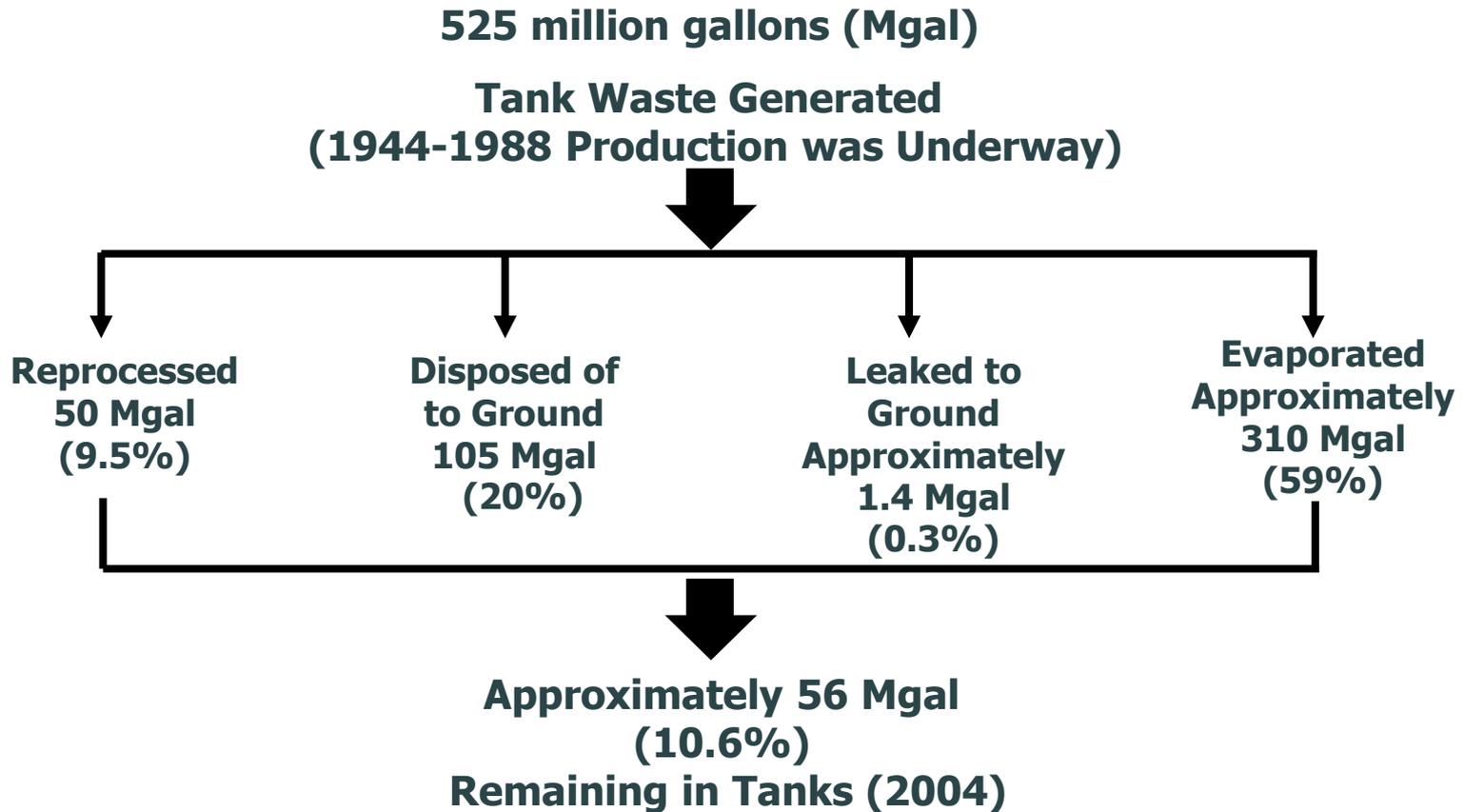
- World's first full-scale nuclear reactor
- Produced plutonium for nuclear weapons used in World War II

## Cold War Era

Over next 45 years, Hanford supplied two-thirds of our nation's plutonium for national defense



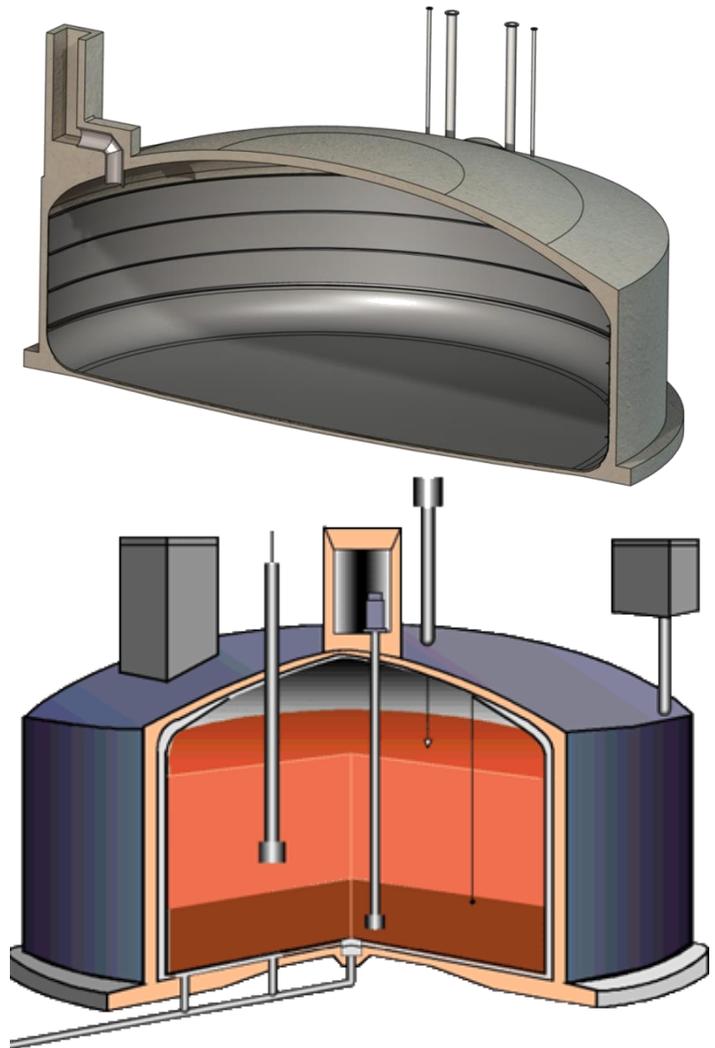
# Hanford Tank Waste Legacy



Waste stored in tanks is awaiting retrieval, treatment and disposal.

Two types of tanks:

- **Single-shell tanks (SST)**
  - 149 tanks
  - Constructed 1943–1964
  - 55,000 to 1 million gallons
  - 58 of the 149 SSTs are suspected “leakers”
- **Double-shell tanks (DST)**
  - 28 tanks
  - Constructed 1968–1986
  - 1 to 1.26 million gallons



56 million gallons of waste

## Saltcake

23 Mgal



Mostly water-soluble salts; small amount of interstitial liquid

## Supernate

21 Mgal



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

## Sludge

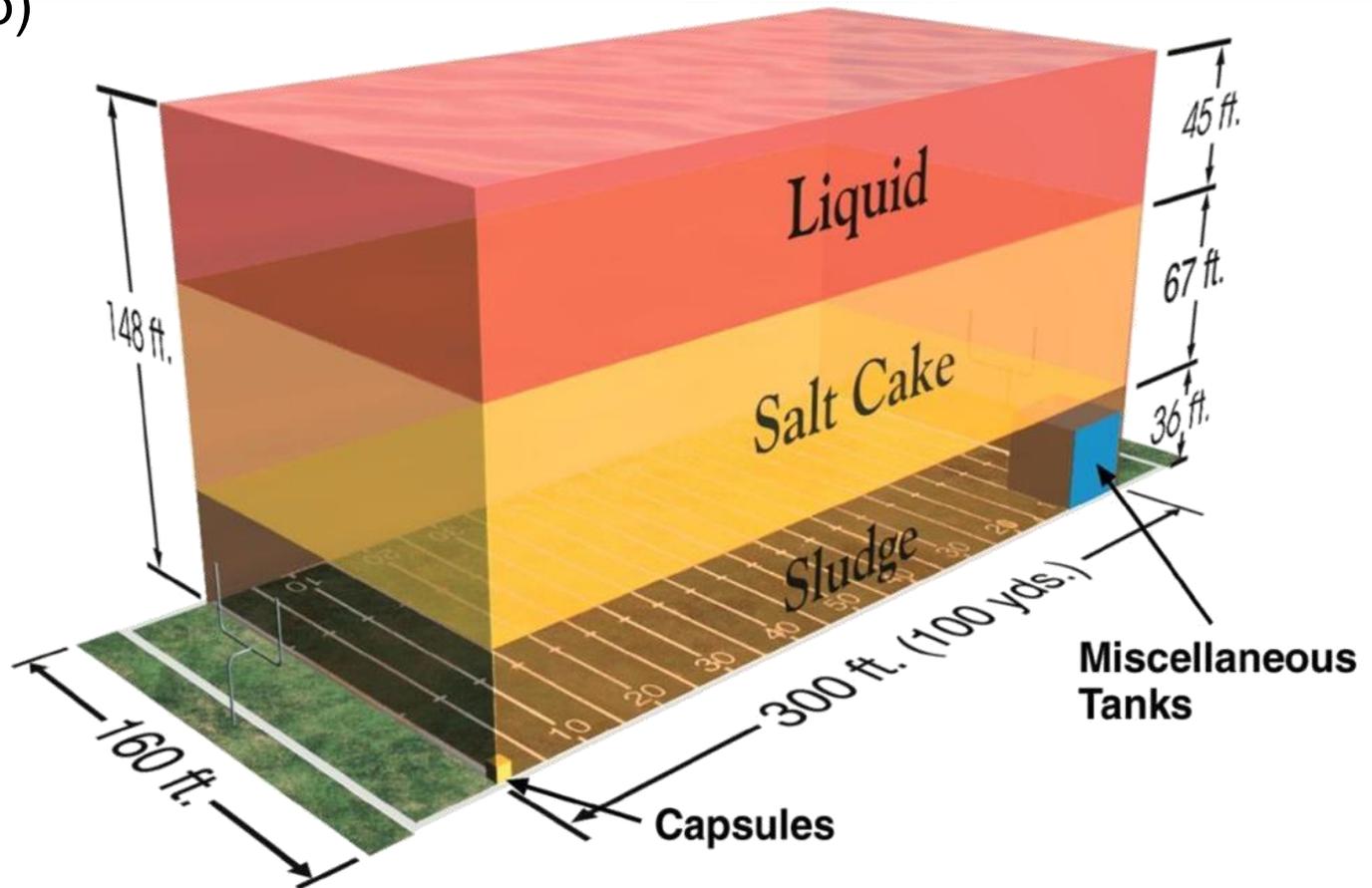
12 Mgal



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

# How to Quantify Tank Waste

Approximately 56 million gallons of waste contained in 177 underground storage tanks (enough to cover a football field 148 feet deep)



# Tank Farm Vapors



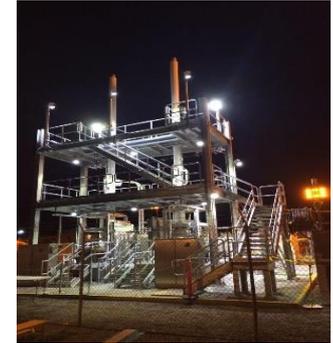
Cartridge testing



Full-face air-purifying respirator



Ammonia monitoring



AP Tank Farm Exhauster



Tank headspace sampling

Implement Hanford Vapors Integrated Safety Management Strategy and complete Comprehensive Vapor Action Plan activities

Memorandum of Agreement signed in 2016

Supplied air required until chemical cartridges are proven effective and concurred with by StoneTurn Consultants (STC)

Interim mandatory respiratory protection required until engineering controls or other approaches are proven effective

Demonstrate that full-face air-purifying respirators and powered air-purifying respirators chemical cartridges are effective with tank farm mixture

Implement full-face respirators in actively ventilated farms

- Received concurrence from STC
- Cartridges implemented in SY, AN, AX, AY, and AZ Tank Farms
- Completed implementation in AP and AW Tank Farms in March 2019
- Implemented ammonia monitoring in actively ventilated farms

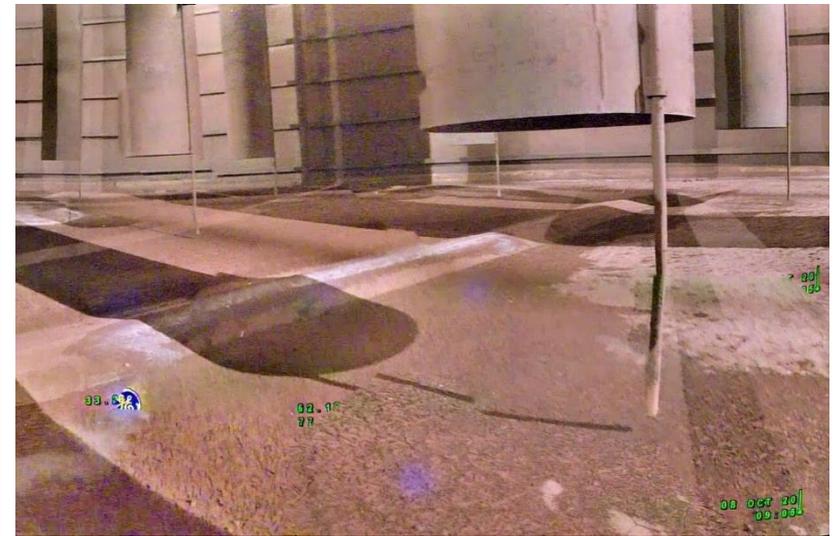
Work with STC to transition to risk-based controls

- Demonstrate effective implementation of the industrial hygiene exposure assessment
- Establish guidelines for determining when no respiratory protection is required
- Recognize ammonia as the sentinel chemical for monitoring the source and the worker breathing zone for change conditions
- Implement and maintain vapor rounds and routines
- Timely evaluation and communication of monitoring results
- Communication and training to support risk-based decision-making

- Waste has been retrieved from the tanks for decades
- Transferring waste from SSTs to DSTs reduces risk of leaks
- Currently preparing systems to send waste to the Waste Treatment and Immobilization Plant



C Farm



Top: Retrieval Camera Operator | Bottom: AX-102

- **Risk**

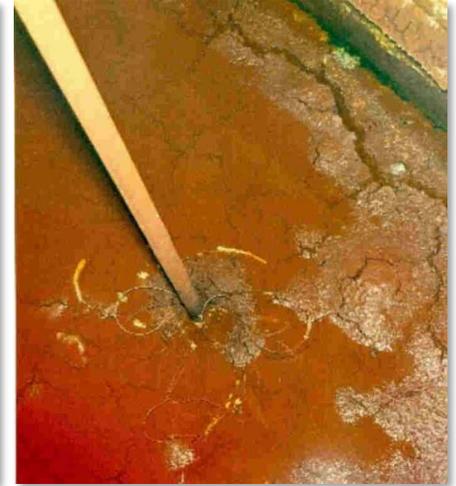
Waste is highly radioactive and must be handled remotely

- **Variation**

Tanks contain multiple forms of waste: liquid, sludge, solids

- **Accessibility**

Tanks are buried underground and have a limited number of small access pipes



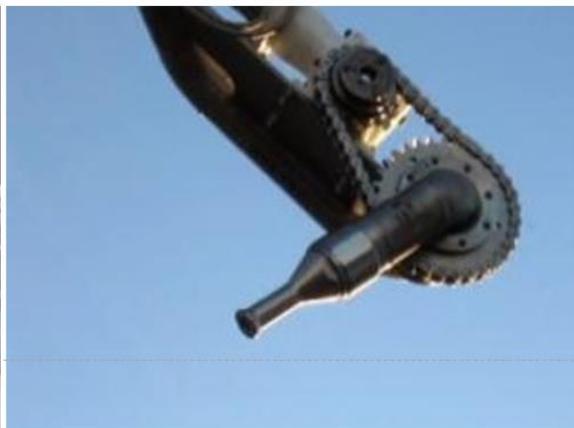
# Retrieval Tools



Modified sluicing



Mobile-arm retrieval system



Enhanced-reach sluicing



Chemical dissolution



Foldtrack



Mobile Arm Retrieval System vacuum



C Farm in 2000



C Farm – Post-retrieval

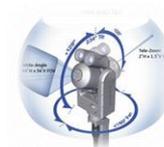
# Double-shell Tank Integrity Program

- Maintain DST structural integrity to support waste processing operations while maintaining safe storage
- Meet regulatory requirements
- Program elements
  - Corrosion Control
    - Waste chemistry envelope
    - Waste chemistry sampling and adjustment
  - Inspections
    - Visual and volumetric
    - Primary tank wall
    - Secondary tank
    - Under-tank Inspection
  - Structural analyses and studies
  - Repair technology development



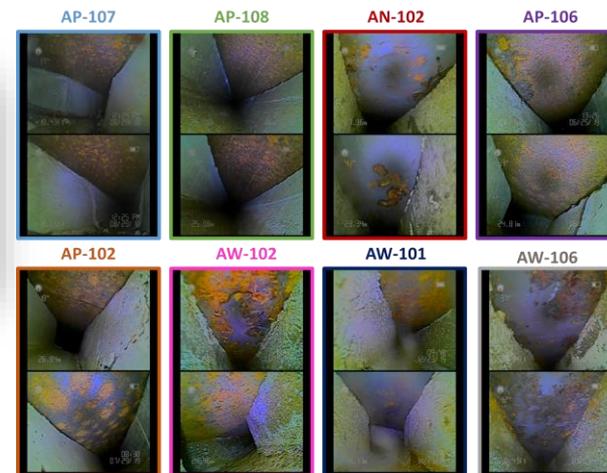
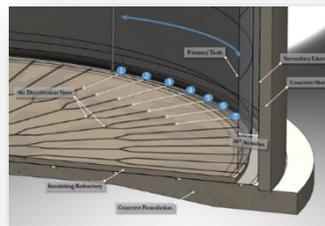
Visual inspection crawler

- Tank annulus visual inspection
  - Prior to 2014, inspected every 5-7 years through four risers
  - Since 2014, enhanced inspection every three years with >95% coverage of annulus floor
  - Document any visual anomalies between inspections
- Primary tank wall volumetric inspection
  - 8-10 year frequency
  - Inspect portions of the primary tank wall and secondary liner
- Current development
  - Deployed first-time under-tank visual inspections
  - Under-tank volumetric inspections

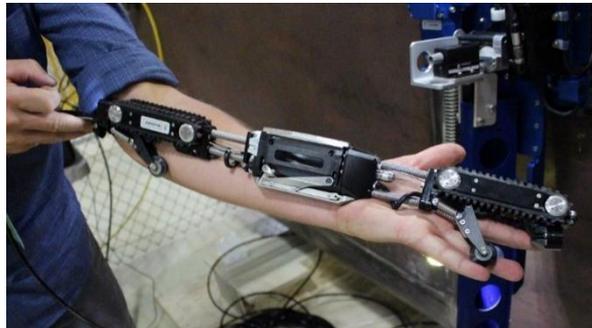
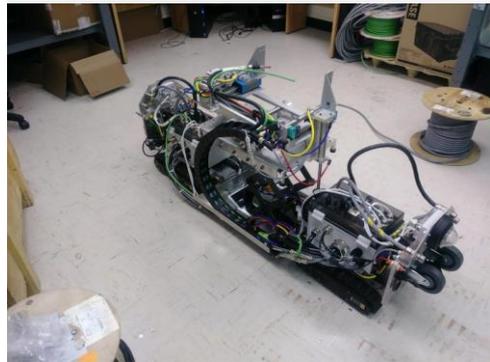
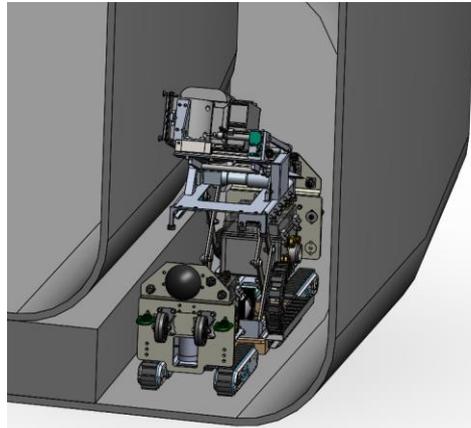


Radiation-hardened, Pan, Tilt, Zoom Auto-focus Inspection Cameras

AGS-2 Magnetic Wheeled Ultrasonic Testing Crawler



- Once these systems are fully evaluated and tested in a laboratory scale, they will be moved to performance demonstration testing and operator training for field use
- Successful incorporation and periodic deployment within the DST integrity program is the end-state goal for these tools



- Structural Analyses
  - Analysis of Record completed with modern structural analyses to show tanks are sound
- Execution of program
  - Dome-loading program to protect structural analyses
  - Periodic dome-deflection surveys
  - Waste liquid level evaluations
  - Visual inspections
  - Intrusion mitigation
- Leak assessment process

# Waste Feed to Direct-Feed Low-Activity Waste

## DFLAW

DIRECT FEED LOW-ACTIVITY WASTE



**AP FARM TANKS:**  
AP-105 | AP-106 | AP-107 | AP-108  
Feeds untreated tank waste to cesium removal systems and prepares waste for feed to the Low-Activity Waste Facility

**LOW-ACTIVITY WASTE (LAW) FACILITY**  
Mixes LAW feed with glass-forming materials; produces vitrified waste form in stainless steel containers for long-term storage

**EFFLUENT MANAGEMENT FACILITY (EMF)**  
Evaporates liquid effluent from the Low-Activity Waste Facility

**TANK-SIDE CESIUM REMOVAL SYSTEM (TSCR)**  
An at-tank "first feed" pre-treatment technique to remove cesium and prepare LAW waste for immobilization

**INTEGRATED DISPOSAL FACILITY (IDF)\***  
Accepts containers of vitrified low-activity waste for long-term disposal

**EFFLUENT TREATMENT FACILITY (ETF)**  
**LIQUID EFFLUENT RETENTION FACILITY (LERF)\***  
System providing storage and treatment for a variety of aqueous mixed waste

\*NOTE: IDF, ETF and LERF NOT PICTURED ON MAP

**KEY**

- TSCR Campaign
- Cesium Transport - TSCR to IXC Storage Pad
- Untreated Tank Waste
- Pretreated Low-Activity Waste (LAW)
- Liquid Effluent Feed from LAW Facility



UPDATED 5-30-18

# Tank-Side Cesium Removal



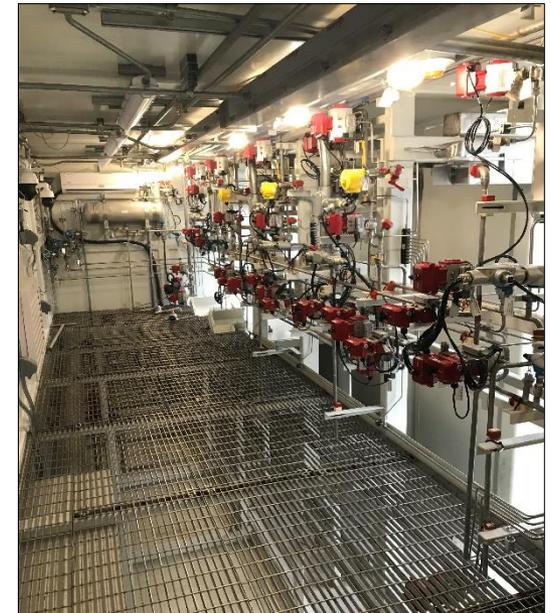
Tank-Side Cesium Removal system  
factory acceptance testing



Modified forklift to safely transport  
27,000-lb ion exchange columns



Loading ion exchange columns



Interior of system process enclosure

- Building world's largest radioactive-waste treatment plant
- Waste will be immobilized in glass using a vitrification process that secures the waste for permanent storage
- The Waste Treatment and Immobilization Plant plays an essential role in reducing the environmental risk posed by Hanford's tank waste



For decades to come, the tank farms will continue performing the following:

- Safely storing waste
- Processing waste for stabilization and disposal
- Closing tanks
- Preparing the area for final closure