UNITED STATES DEPARTMENT OF ENERGY

OFFICE OF RIVER PROTECTION

Protecting the Columbia River:

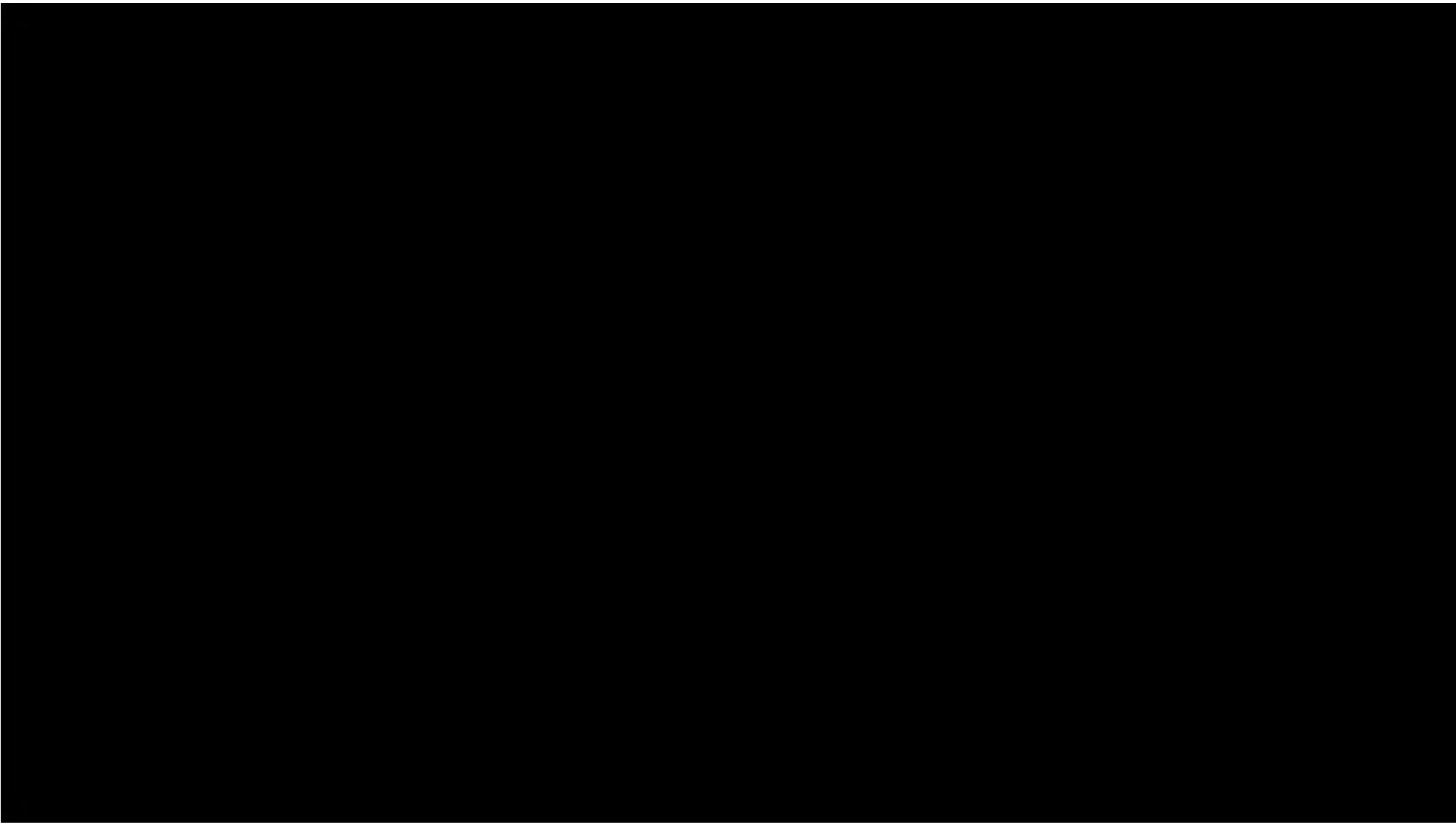
The Office of River Protection Mission

2014 Waste Management Symposia

Panel 49: US DOE Feature Site - Hanford

Presented by: **Kevin Smith, ORP Manager**

March 4, 2014

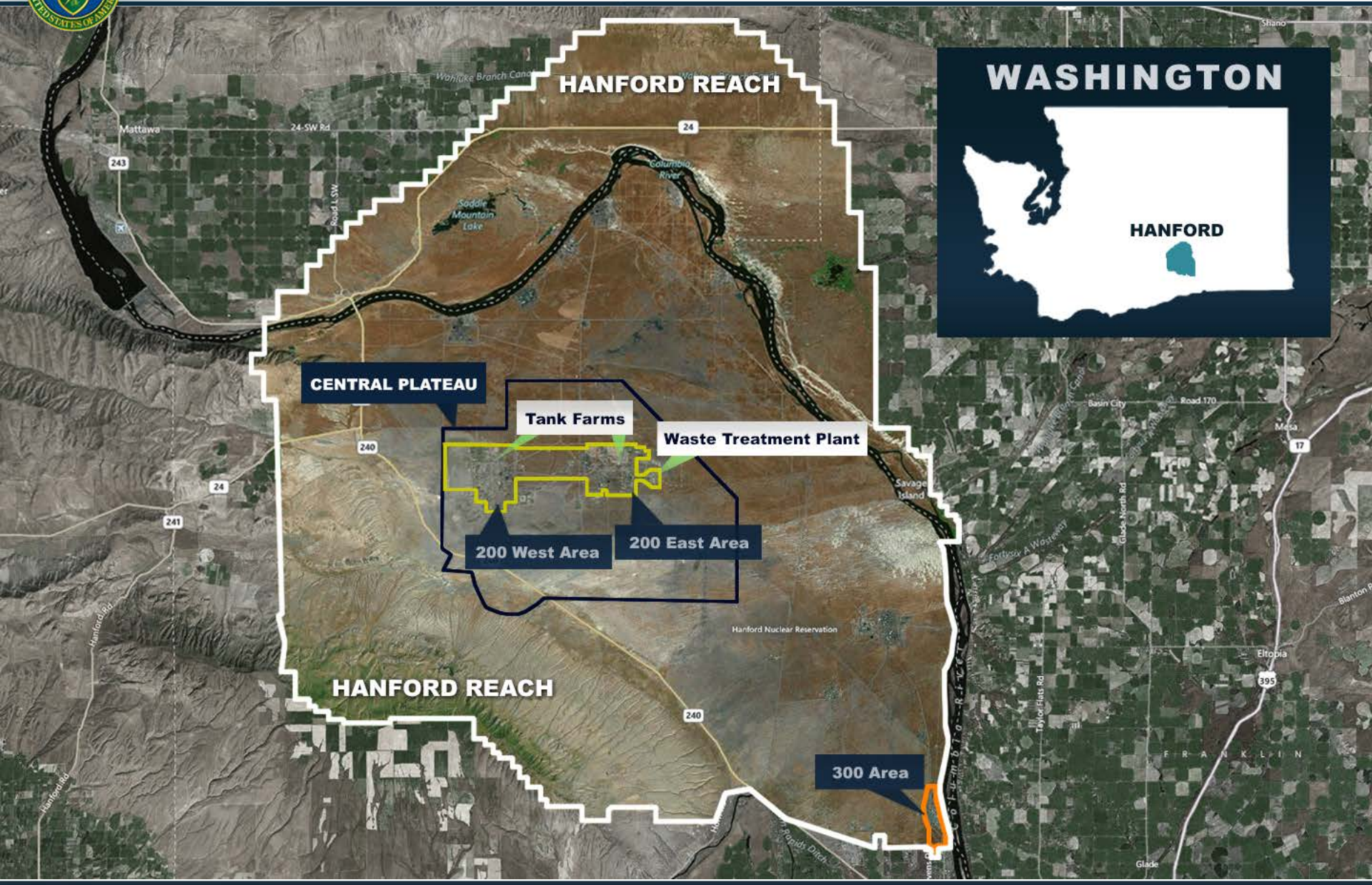


Our Mission

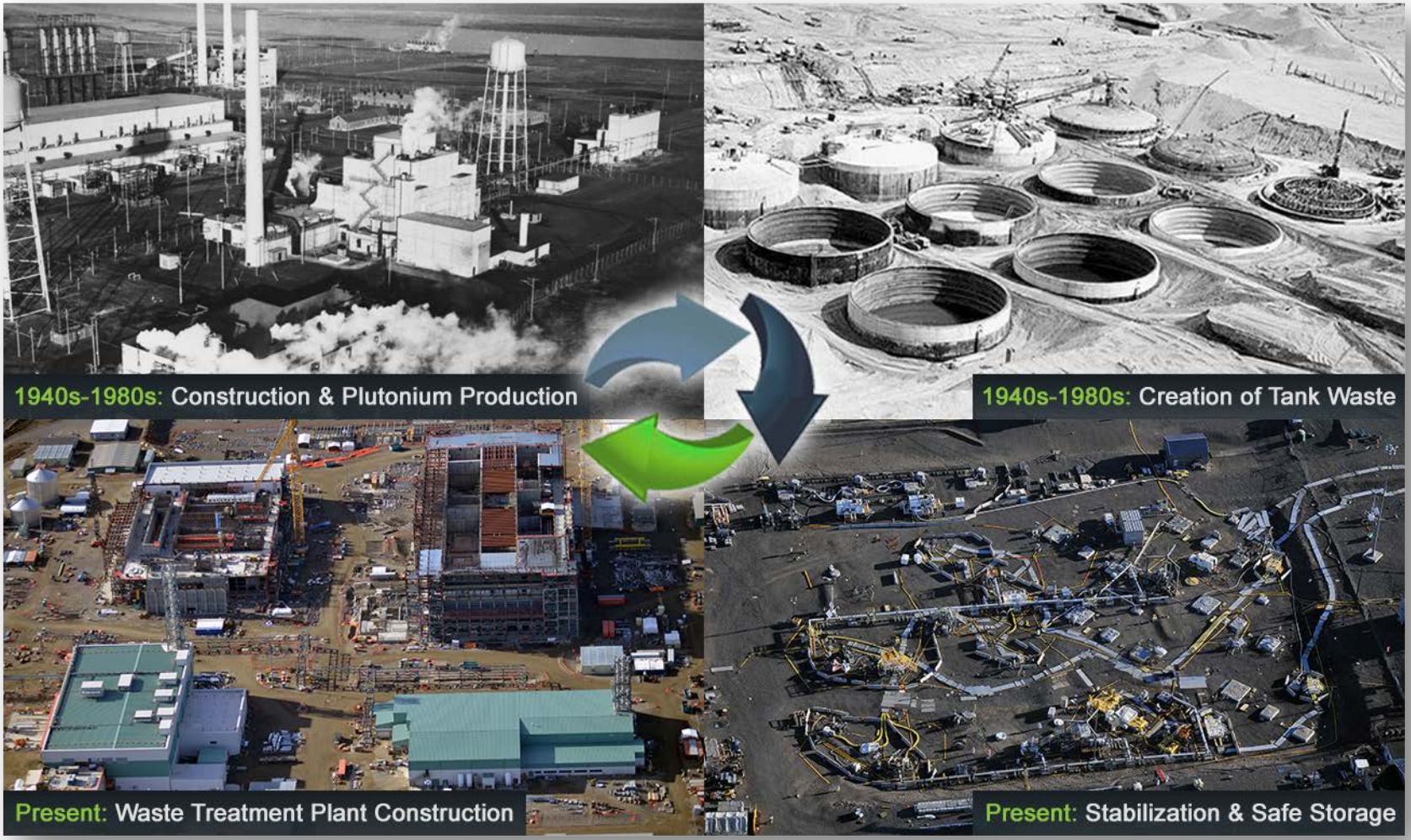
To safeguard the nuclear waste stored in Hanford's 177 underground tanks, and to manage the waste safely and responsibly until it can be treated in the Waste Treatment and Immobilization Plant for final disposition.

Our Goal

To be a high performing organization that is the best in the Department of Energy's nuclear defense complex.


HANFORD REACH
WASHINGTON
HANFORD
CENTRAL PLATEAU
Tank Farms
Waste Treatment Plant
200 West Area
200 East Area
Hanford Nuclear Reservation
HANFORD REACH
300 Area
Mattawa
24-SW Rd
Columbia River
Saddle Mountain Lake
Basin City
Road 170
Mesa
Savage Island
Eltopia
Glade
FRANKLIN

Hanford Site History – World War II to Cleanup



ORP's Hanford Cleanup Projects

Our Team

Office of River Protection (ORP)

ORP is responsible for planning, integrating, and managing the River Protection Program executed by contractors performing work under ORP overall management.

Washington River Protection Solutions (WRPS)

WRPS is the prime contractor responsible for safely managing and operating the Tank Farms.

Bechtel National, Inc. (BNI)

BNI is responsible for the engineering and construction of the Waste Treatment Plant.

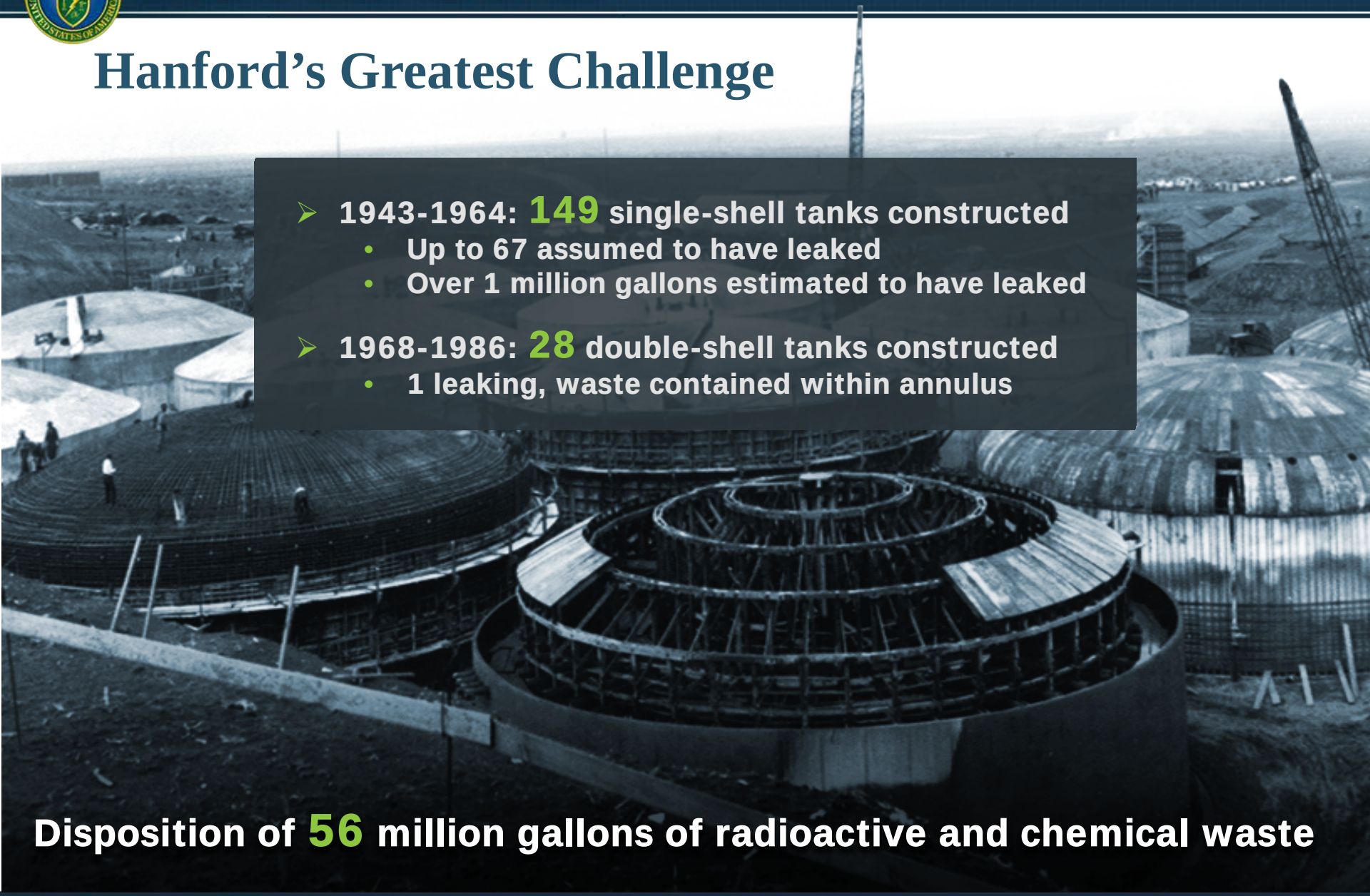
Advanced Technology and Laboratories International (ATL)

ATL is the prime contractor responsible for managing the 222-S Laboratory.

Tank Farms Project

Tom Fletcher
Assistant Manager & Federal Project Director

Hanford's Greatest Challenge

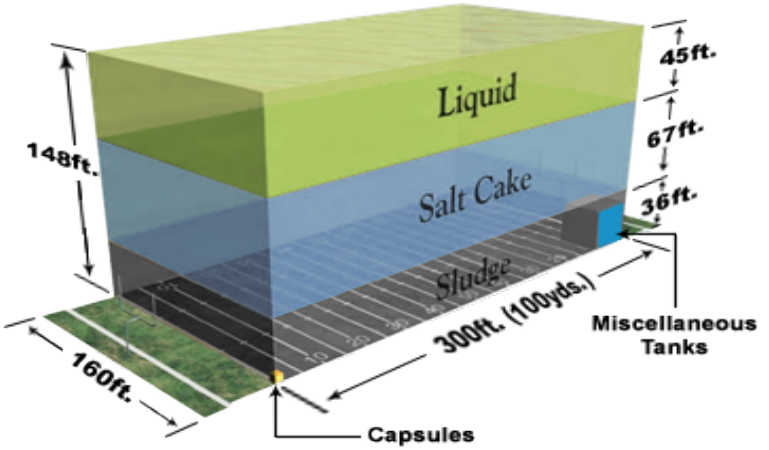


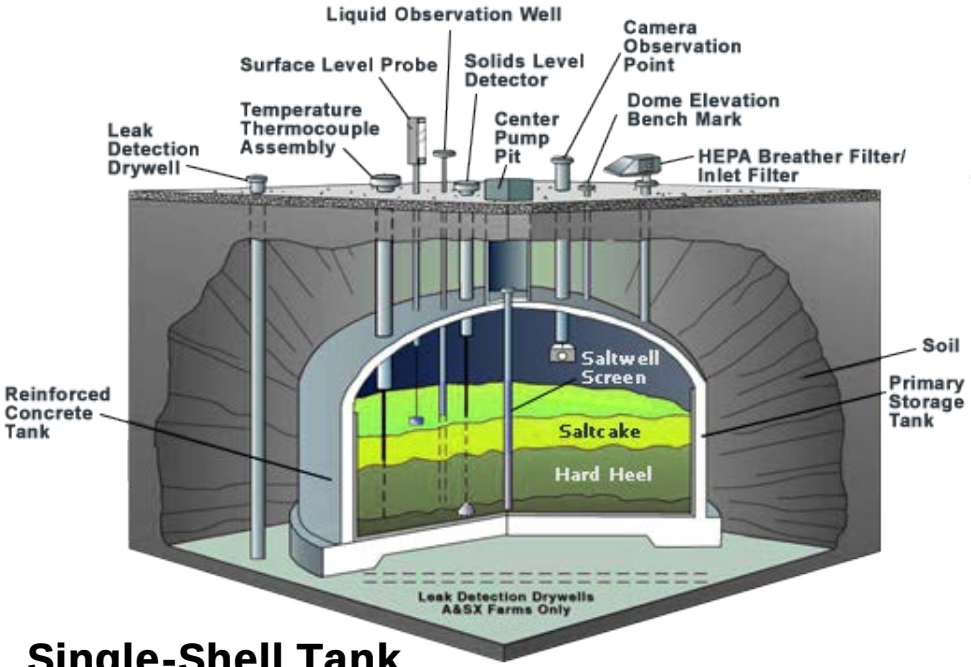
- 1943-1964: **149** single-shell tanks constructed
  - Up to 67 assumed to have leaked
  - Over 1 million gallons estimated to have leaked
- 1968-1986: **28** double-shell tanks constructed
  - 1 leaking, waste contained within annulus

Disposition of 56 million gallons of radioactive and chemical waste

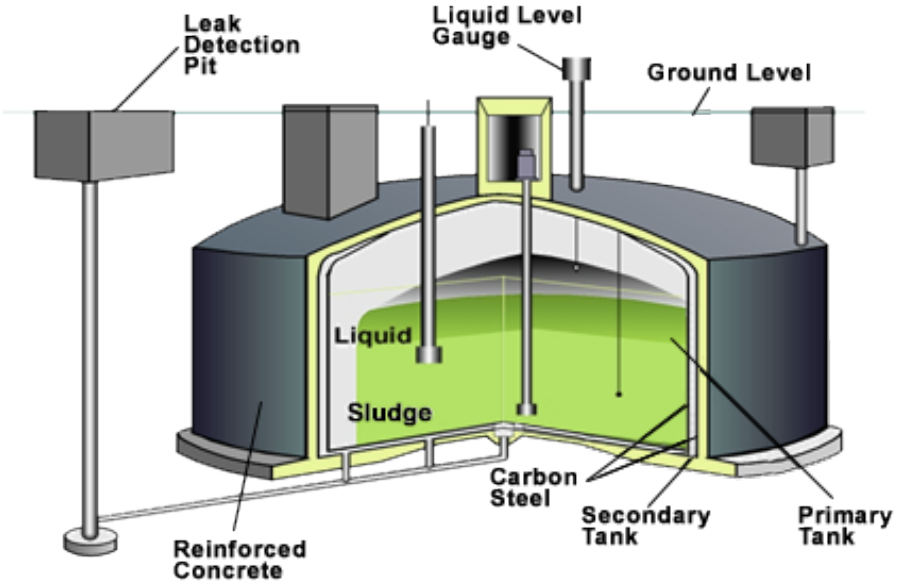
No Two Tanks are the Same

- Waste temperatures range from 60°F to 160°F
- Highly caustic
- Moderate-to-high radioactivity
- No two tanks have the same waste contents
- Most waste produces some hydrogen





Single-Shell Tank



Double-Shell Tank

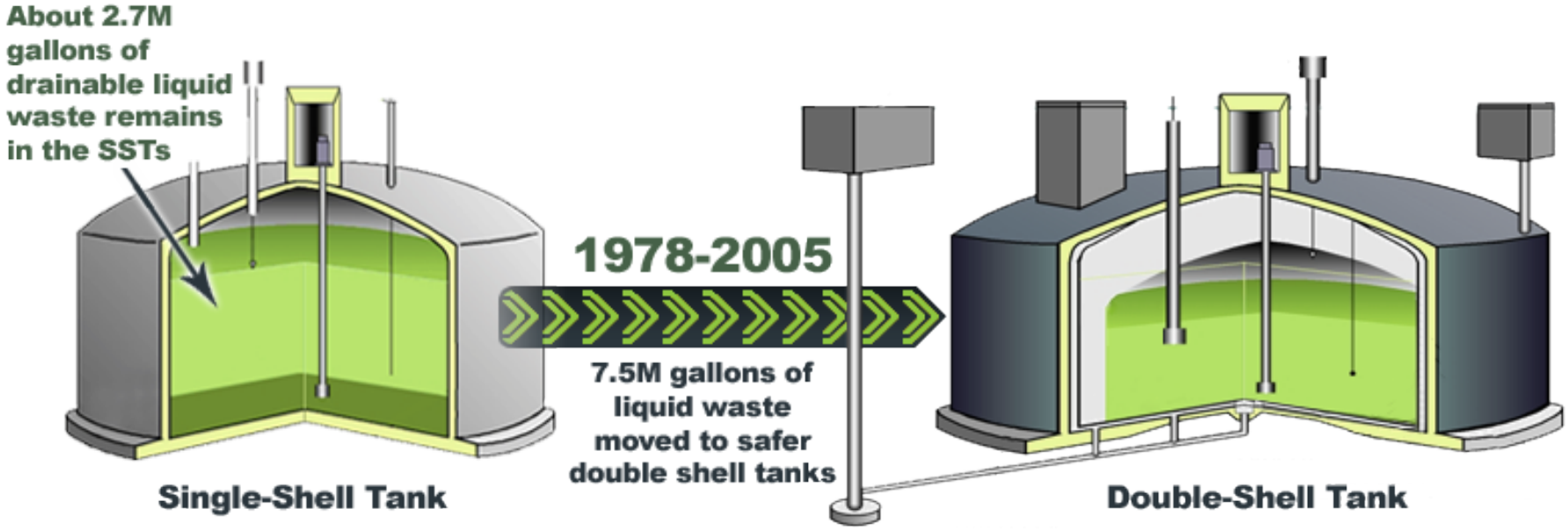
Tank Farms – Complex, Accessible Only from the Surface

Interim Stabilization Completed

- Hanford's single-shell tanks first began leaking in 1959
- 28 double-shell tanks were constructed to address this problem
- Liquid waste was transferred to safer double-shell tanks from 1978-2005
- 2.7 million gallons of drainable liquid waste remains in Hanford's single-shell tanks

CRITERIA IS:

- < 50,000 gallons interstitial liquid
- < 5,000 gallons free liquid
- < 0.05 gallons/minute pump rate



Single-Shell Tank Waste Retrieval in C Farm

RETRIEVAL TECHNOLOGIES


Mobile Arm Retrieval System Sluicing (MARS-S)

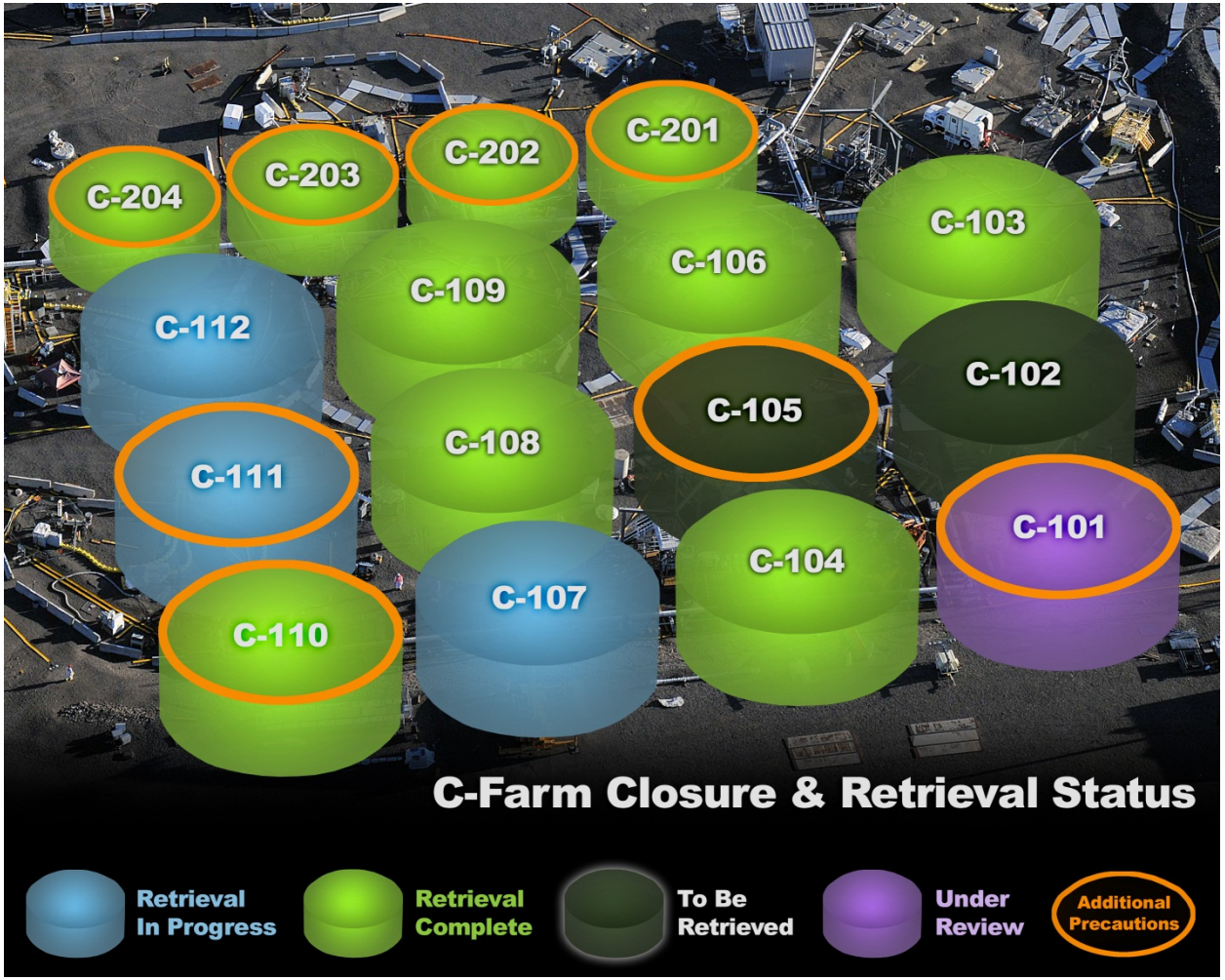

Chemical Dissolution


Enhanced Reach Sluicing System (ERSS)


Modified Sluicing

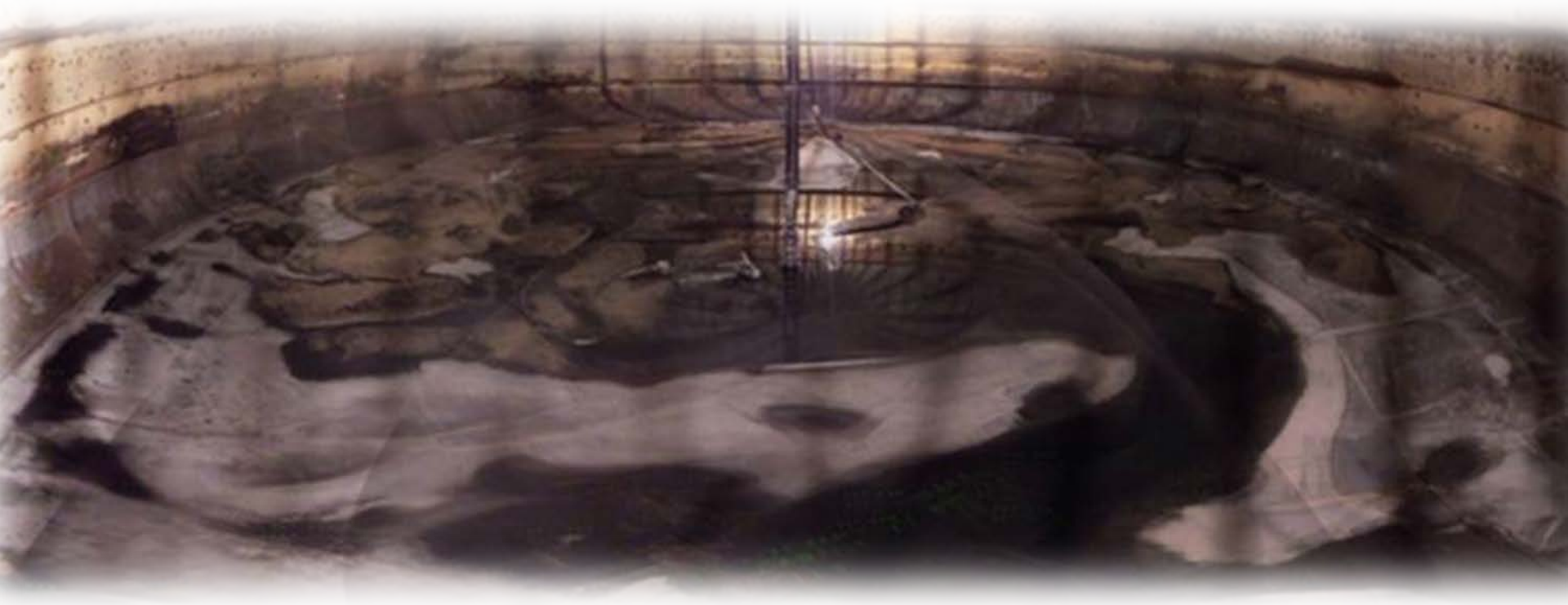

In-Tank Vehicle (Foldtrack)


Mobile Arm Retrieval System Vacuum (MARS-V)



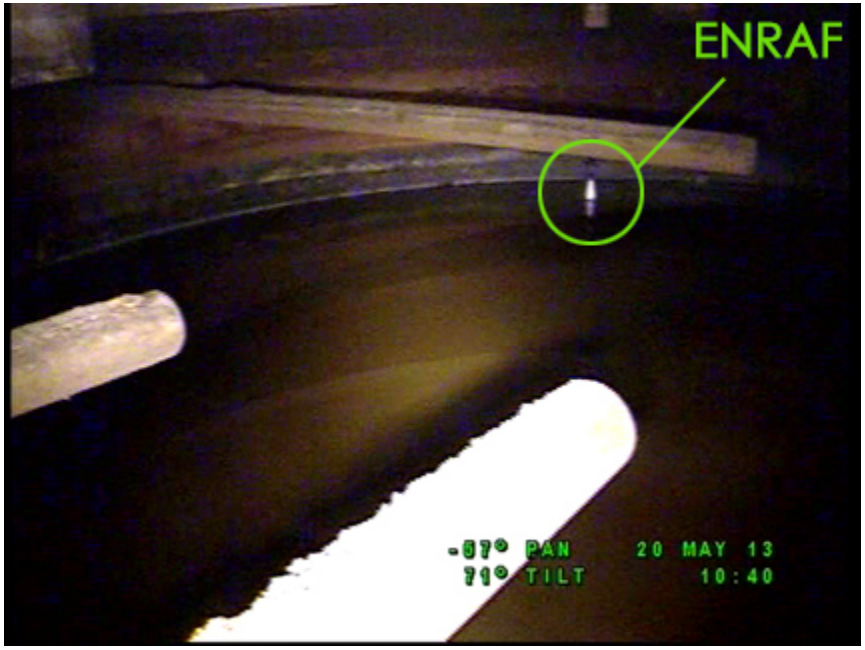
Aerial photograph of C-Farm with graphical overlay that depicts current status of each single-shell tank

Tank Farms Retrieval Progress – Inside Tank C-110

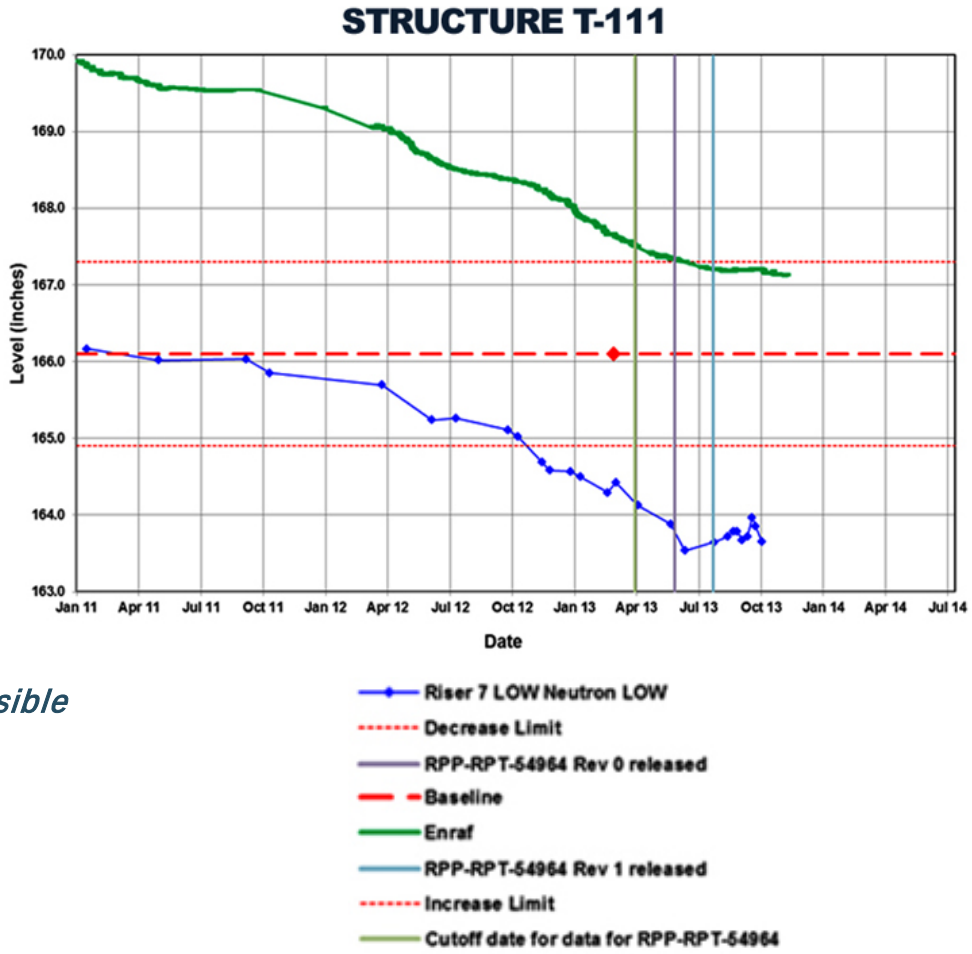


This composite image of dozens of individual-frame photos taken inside Tank C-110 provides a rare panoramic view of the tank interior

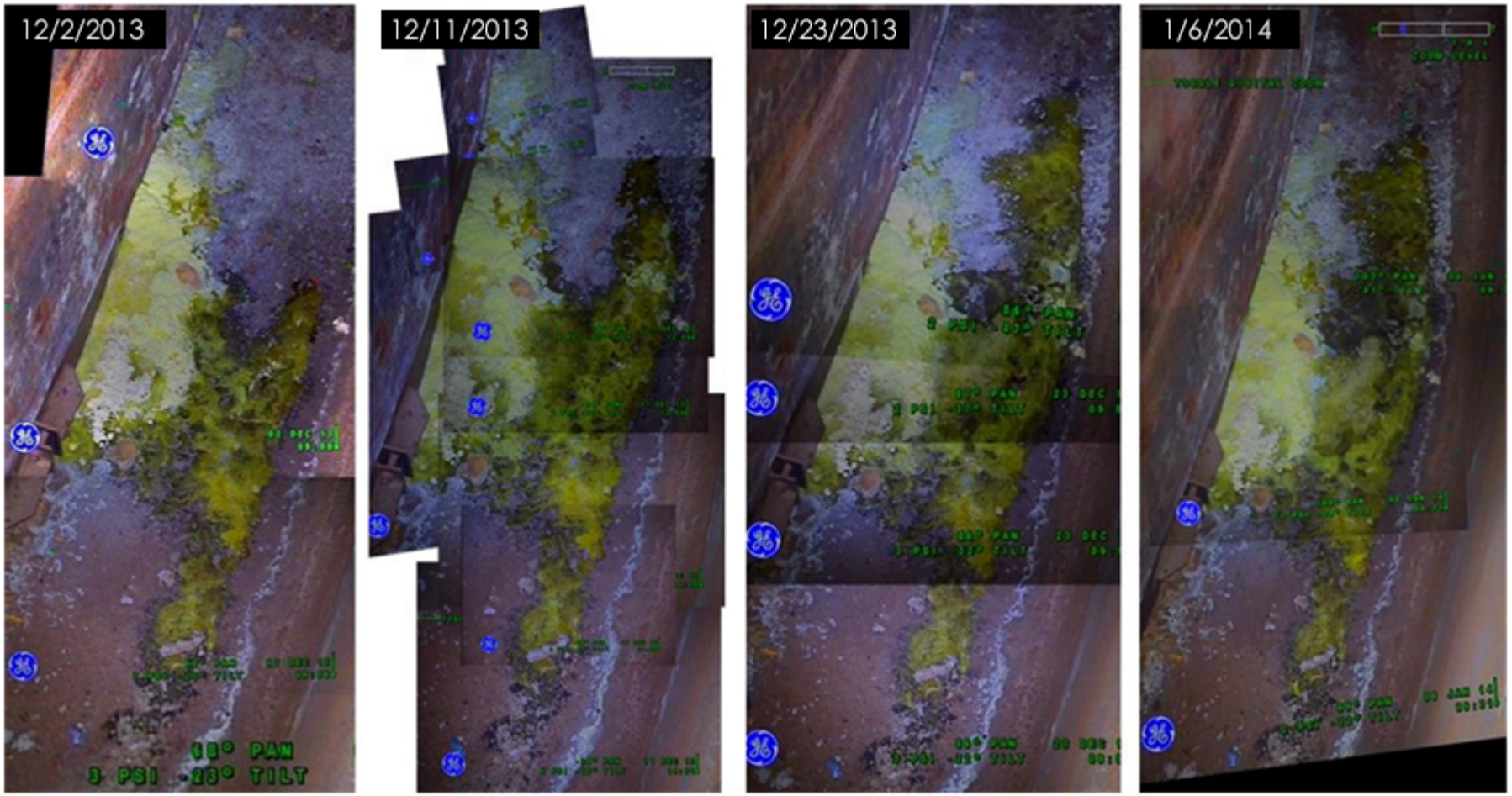
Single-Shell Tank Liquid Level Monitoring



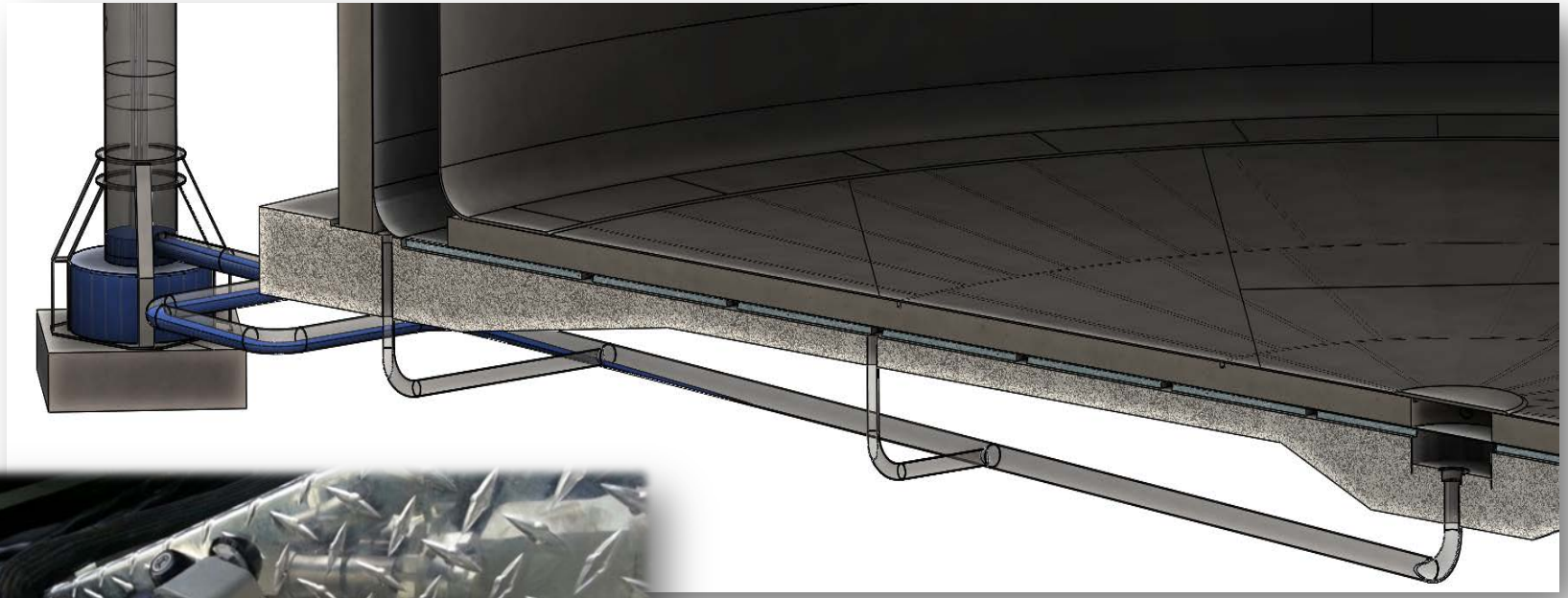
View inside tank T-111 with ENRAF tank level gauge visible



Tank AY-102 Changes Over Time



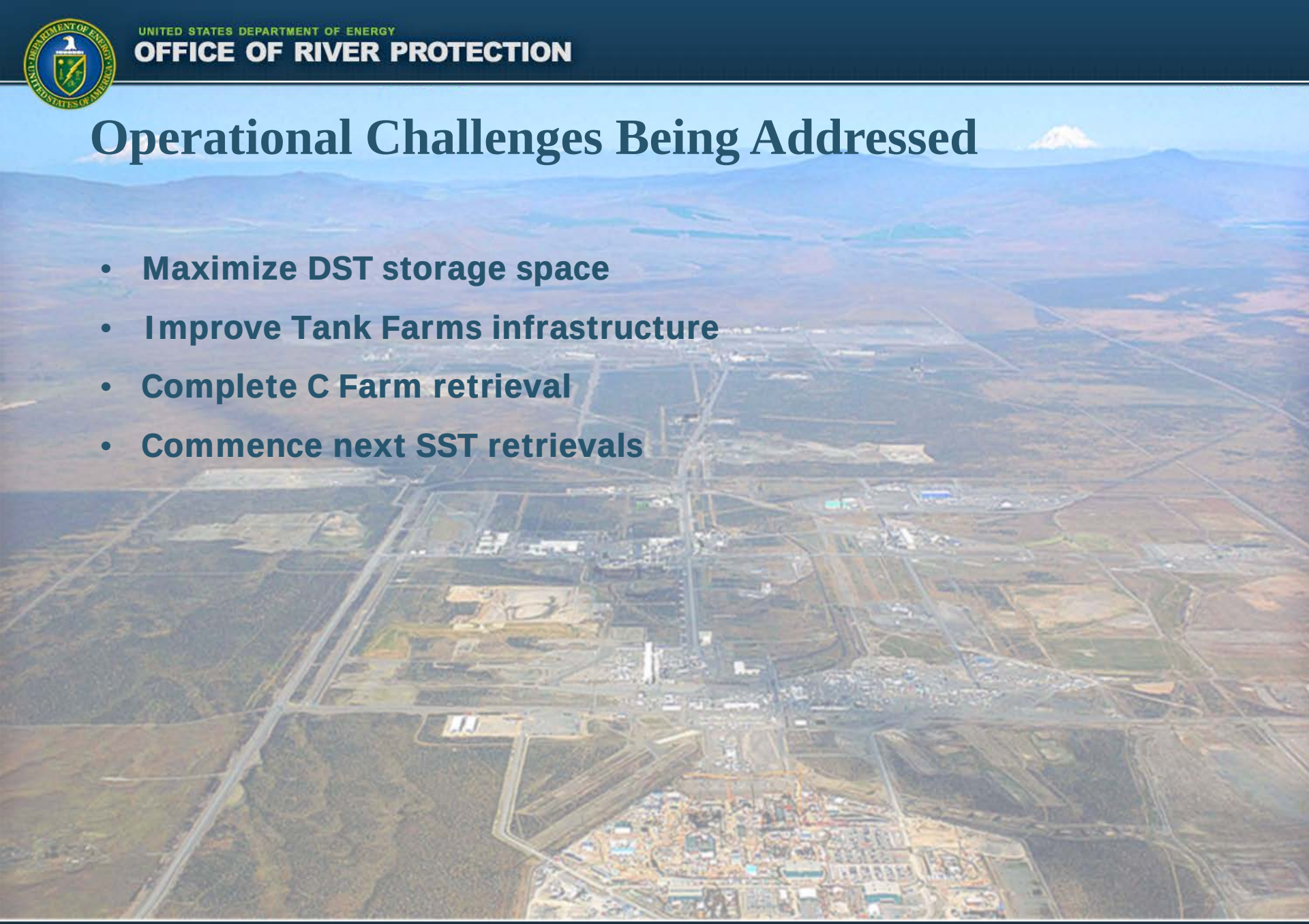
Tank AY-102 – Robotic Crawler



Robotic crawler was navigated through 60 feet of six-inch drain line underneath Tank AY-102

Operational Challenges Being Addressed

- Maximize DST storage space
- Improve Tank Farms infrastructure
- Complete C Farm retrieval
- Commence next SST retrievals



Hanford Tank Operations Contract

washingtonriver protectionsolutions
Dave Olson
President & Project Manager

Tank Operations team

- Washington River Protection Solutions (WRPS) is a prime contractor to DOE's Office of River Protection
- WRPS is a joint venture between URS Corporation and Energy Solutions, with integrated subcontractor AREVA
- ~1,500 employees; just wrapped up fifth year of operations; contract extended through FY-2016; FY-14 budget of $520 million

Mission Statement

WRPS is committed to the safe and efficient management, retrieval and treatment of radioactive and hazardous tank waste to protect the Columbia River

Challenge: Maximize DST storage space

242-A Evaporator

Challenge: Improve tank farm infrastructure

242-A Evaporator control room

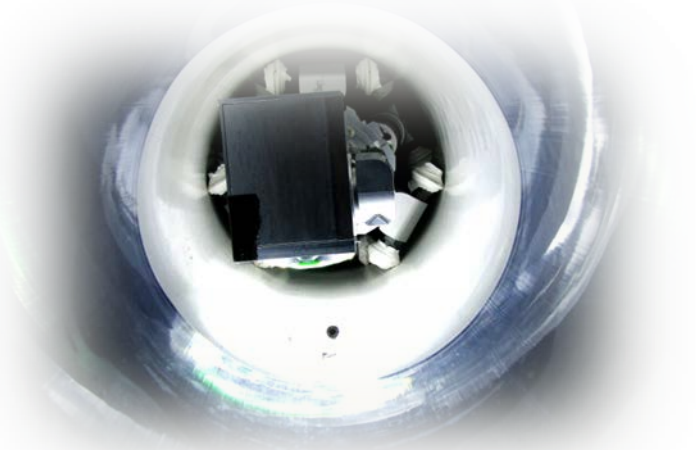
Core Sampling Platform

High Resolution Resistivity system

Tank farm infrastructure improvements

DST ventilation

Tank integrity



Weatherization

Control systems

Challenge: Complete C Farm retrieval

Hanford tank retrieval progress

Tank C-110

Tank C-101

Tank C-112

Tank C-107

Waste retrieval technologies

C-105 dome cut

MARS vacuum

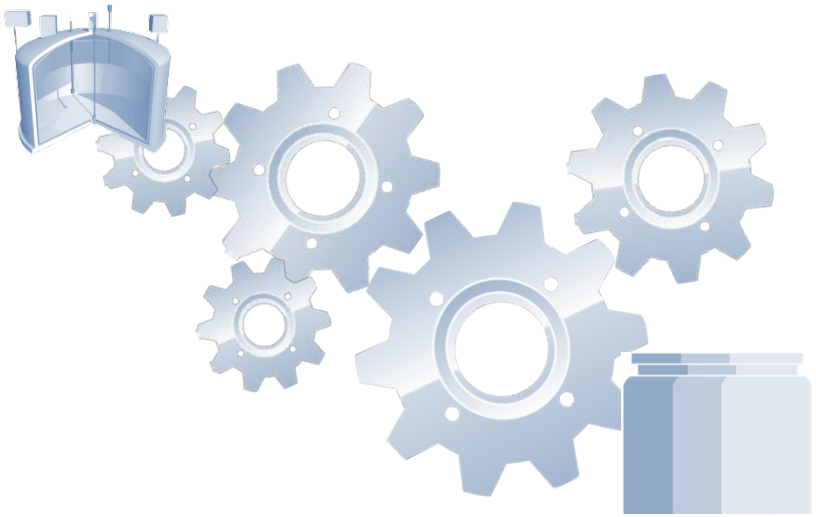
Enhanced reach sluicer

MARS install

Fold Track

Challenge: Commence next SST retrievals

Challenge: Integrate through One System with WTP

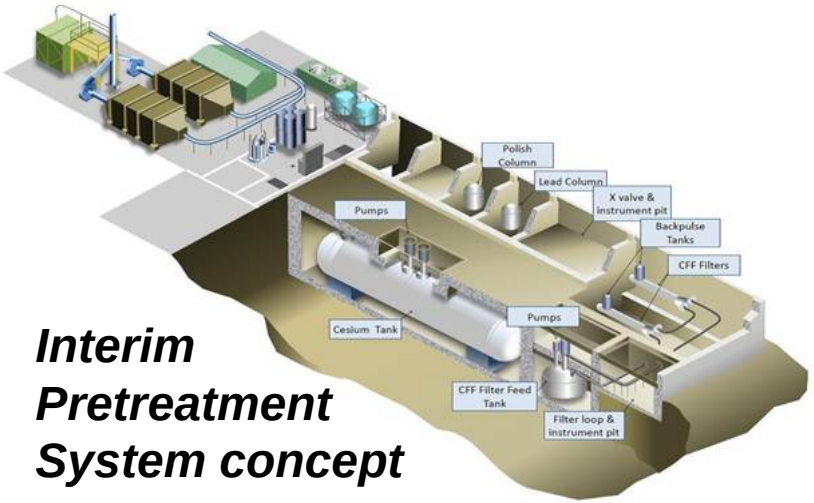


Flow sheet management

Waste mixing demo

National lab outreach

SRNL
SAVANNAH RIVER NATIONAL LABORATORY
TM



Interim Pretreatment System concept

Summary

- Improving tank farm stewardship
- Maintaining focus on retrievals
- Increasing outreach to national laboratories
- Transitioning to potential line item project management
- Expanding integration with the Waste Treatment Plant

Potential gas release event testing

UNITED STATES DEPARTMENT OF ENERGY

OFFICE OF RIVER PROTECTION

Waste Treatment and Immobilization Plant Project

Bill Hamel
Assistant Manager & Federal Project Director

WTP Leadership Changes in 2013

Kevin Smith
ORP Manager
January 2013

JD Dowell
ORP Deputy Manager
October 2013

Bill Hamel
WTP Assistant Manager
February 2013

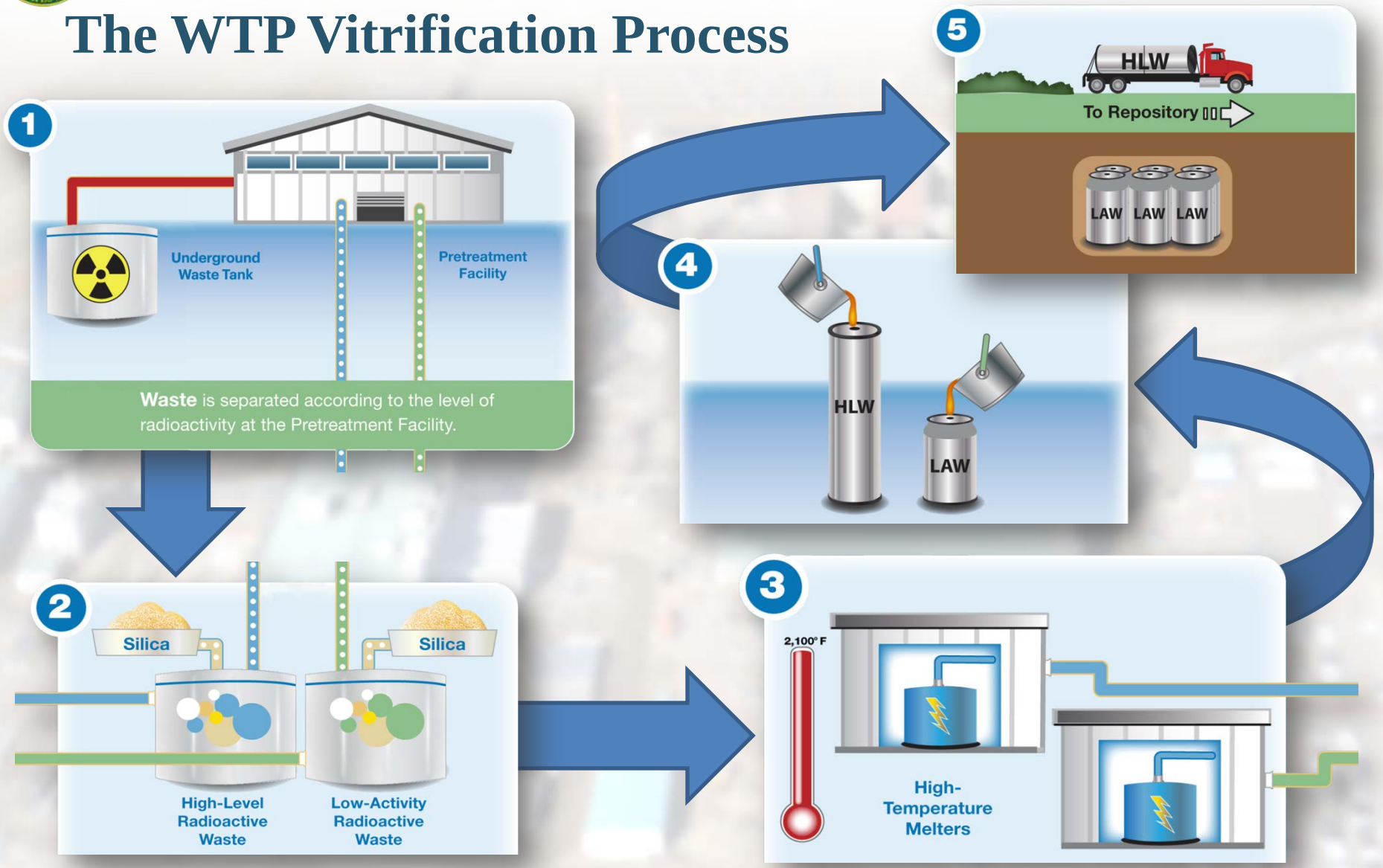
Peggy McCullough
WTP Project Director
July2013

Waste Treatment Plant Project Details

The WTP Mission: Immobilize the Waste in Glass

Vitrification offers the best solution for immobilizing Hanford's high-level radioactive waste for reducing the risk

The WTP Vitrification Process



WTP's Four Nuclear Facilities


Low-Activity Waste Vitrification


Analytical Laboratory

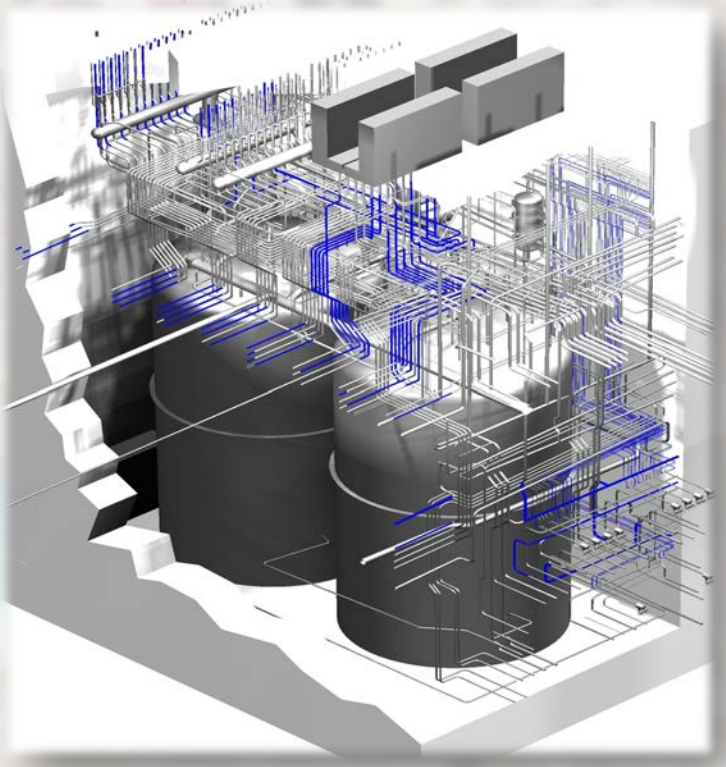

Pretreatment


High-Level Waste Vitrification

Pretreatment Facility – Separates Solids and Liquids

Exterior

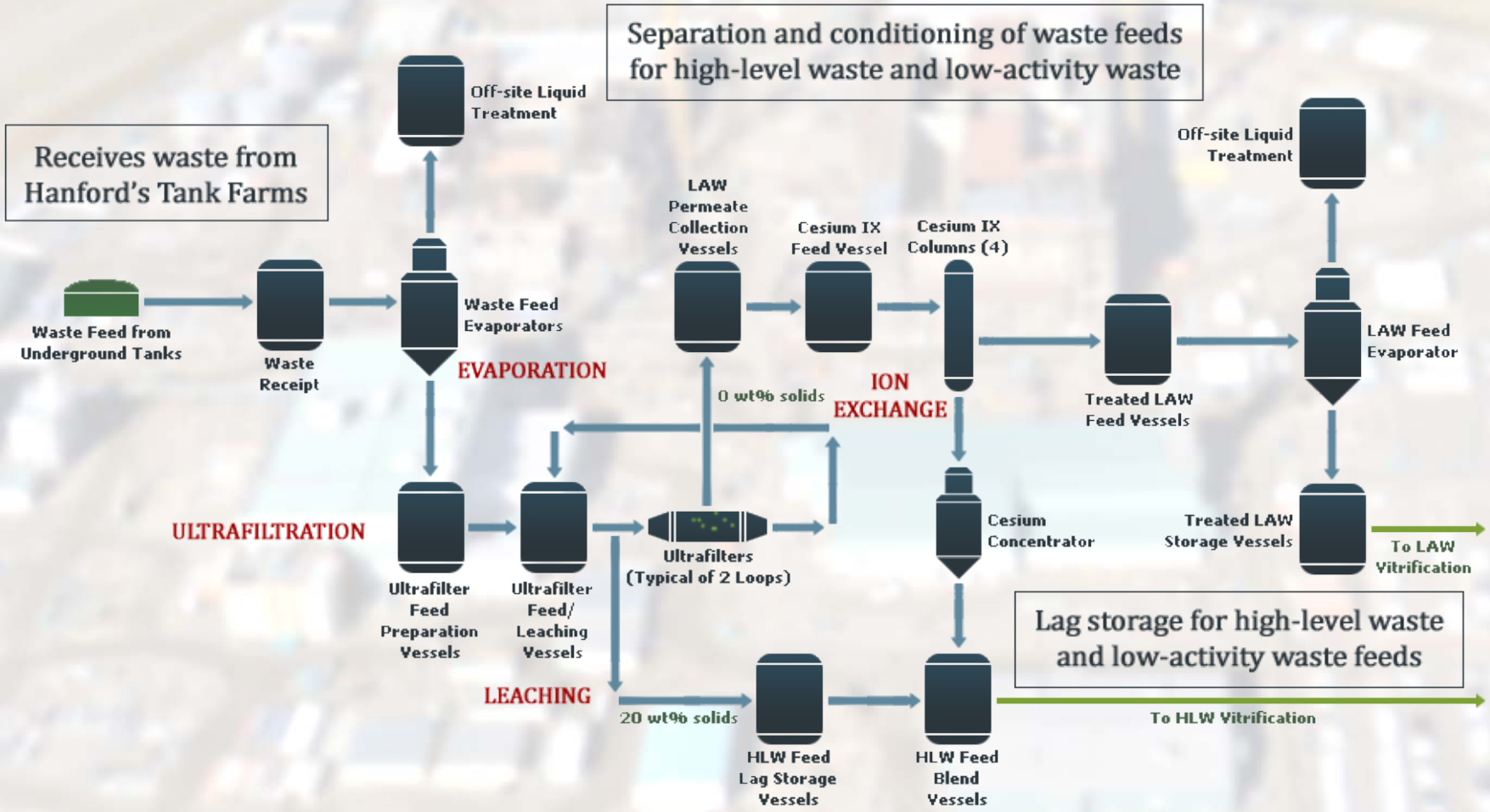
Hot cell



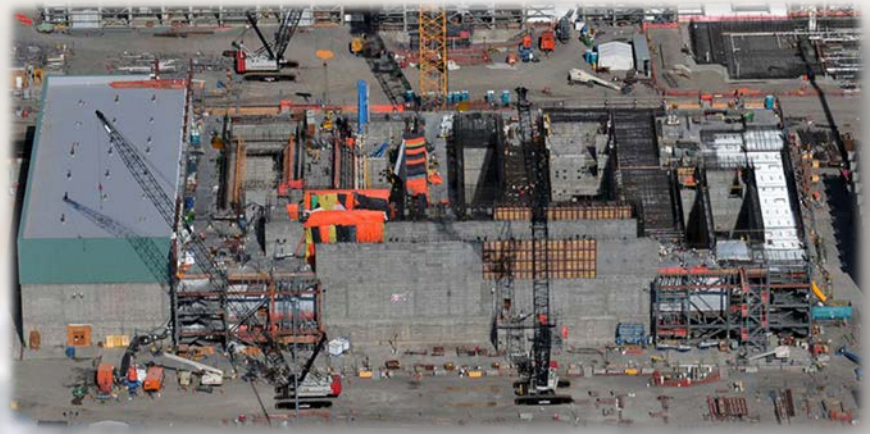
Vessels and pipes in black cell

The Challenge

Pretreatment Facility Functions and Simplified Flow Diagram



High-Level Waste Facility – Makes High-Activity Glass Canisters



Exterior

Truck Bay Walls

Melter Bay

Bridge Crane

Low-Activity Waste Facility – Makes Low-Activity Glass Containers

Exterior

Overhead pipe racks for steam and glass formers

Carbon bed adsorber

Transfer Tunnel

Melter

Analytical Laboratory – Process Samples Testing

Exterior

Fume hoods

Air-handling systems

Balance of Facilities – Supports Operations

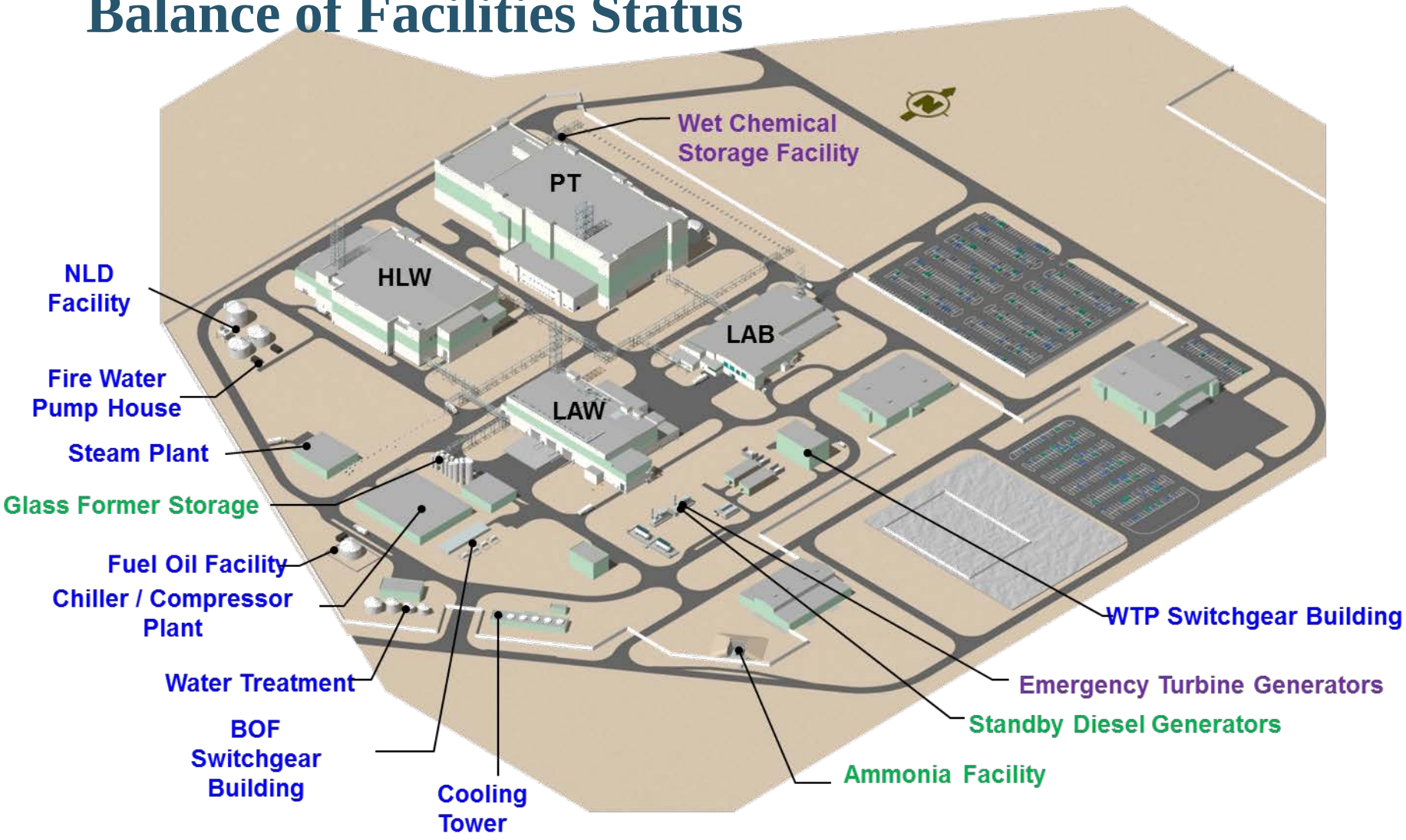
20 support buildings for the Balance of Facilities

Glass former piping

Overhead pipe racks for steam and glass former materials

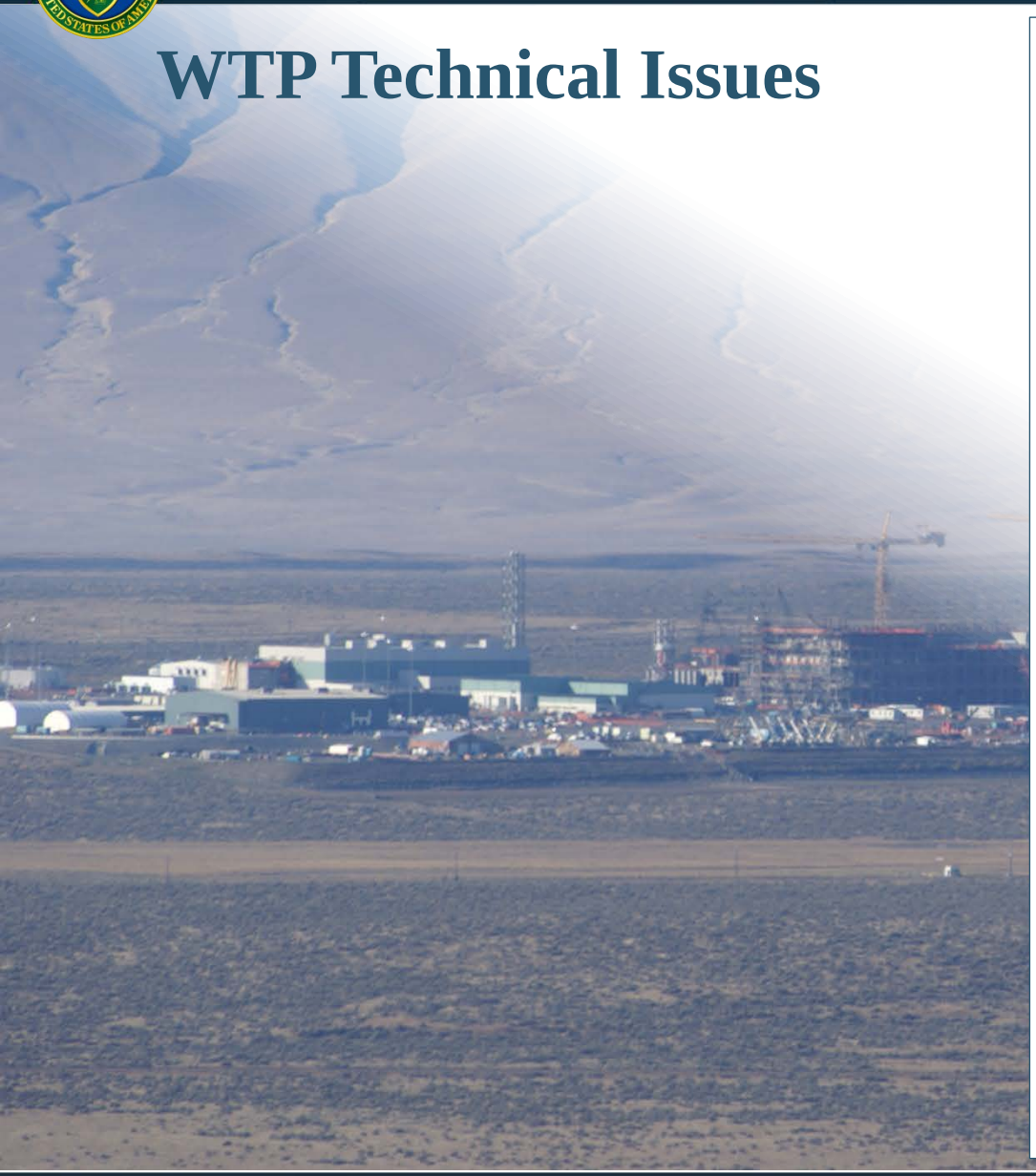
Glass former silos

Balance of Facilities Status



Facility Complete/Construction in Progress/Construction Schedule Aligned with PT/HLW

WTP Technical Issues



Pretreatment and HLW Technical Decisions

Technical Decision #	Item
T1	Hydrogen gas release from vessel solids
T2	Criticality in WTP vessels
T3	Hydrogen in piping and ancillary vessels (HPAV)
T4	Pulse jet mixing vessel performance
T5	Erosion and localized corrosion
T6	Design redundancy in black cells/ in-service inspection (ISI)
T7	Black cell vessel structural integrity
T8	Facility ventilation
T9	Waste preconditioning requirements

WTP Project Accomplishments

Peggy McCullough
Project Director

Achieved Safest Year in Project History

- **Completed 2013 with the lowest number of recordable injuries in project history**
  - No recordable injuries in Lab
  - No lost work days in LAW, BOF and Lab

WTP Construction Site

Analytical Laboratory

10,000 samples per year ensures glass meets regulatory requirements

- 320 feet X 180 feet x 45 feet tall
- 12,000 cubic yards of concrete
- 1,800 tons of structural steel
- 35,000 feet piping
- 172,000 feet electrical cable
- 314,500 pounds heating and ventilation ductwork

2013 LAB Accomplishments

- Completed installing 32 nuclear-quality, stainless steel through-plugs in the hot cell, each of which weigh about 160 pounds and will provide radiation shielding
- Continued installing analysis lab fume hoods and equipment
- Installed more than 32 miles of cable

The Analytical Laboratory exterior

Electricians run cable through high purity gas system control panels outside of the Analytical Laboratory

The Analytical Laboratory hot cell exterior

Low-Activity Waste Vitrification Facility

Turns low-activity waste into glass in two 300-ton melters

- 330 feet X 240 feet x 90 feet tall
- 28,500 cubic yards of concrete
- 6,200 tons of structural steel
- 103,000 feet piping
- 840,000 feet electrical cable
- 945,000 pounds heating and ventilation ductwork

2013 LAW Accomplishments

- Progress made toward LAW completion expected in 2015
- Started placement of LAW melter refractory casting and brick, which comprises 18 cubic feet of casting, more than 200 refractory bricks and more than 30 wall and gas barrier lid placements
- Started installation of LAW melter trough and dam equipment
- Completed LAW lidding equipment installation
- Started installation of power rails for bogie trolley in transfer tunnel

A 25-ton crane is being installed to continue work on the Low-Activity Waste Facility melters

Power rail for the bogey trolley is set in the Low-Activity Waste Facility

Canister drums are set on the melter turntables at the Low-Activity Waste Facility

Balance of Facilities

Vast infrastructure to support operations

Includes:

- Steam plant
- Chiller/compressor facility
- Electrical substation & switchgear
- Water treatment facility
- Glass former storage
- Emergency power facility
- Cooling tower
- Underground waste transfer systems

2013 BOF Accomplishments

- Completed Steam Plant
- Completed turnover of Switchgear building to Startup
- Started foundation for emergency power generators
- Completed six system turnovers to Startup in Switchgear buildings 87 and 91
- Completed more than one mile of pipe installation and testing on overhead pipe racks

Balance of Facilities employees continue building the foundation for the emergency power generators

Piping and equipment installed inside the Balance of Facilities steam plant

An employee covers pipe with insulation in the Balance of Facilities chiller compressor plant

High-Level Waste Vitrification Facility

Turns high-level waste into glass with two 90-ton melters

- 440 feet X 275 feet x 95 feet tall
- 88,000 cubic yards of concrete
- 11,500 tons of structural steel
- 165,000 feet piping
- 1.6 million feet electrical cable
- 1.1 million pounds heating and ventilation ductwork

2013 HLW Accomplishments

- Completed placement of structural steel to the 37-foot elevation of the HLW, meeting a Consent Decree milestone between DOE and Washington state
- Set 30 tons of structural steel to the 77-foot elevation
- Completed installation of structural steel for the import bay
- Completed slab concrete placements for the 37-foot elevation
- Continued concrete placements to the 58-foot elevation

The High-Level Waste Facility

Ironworkers begin rigging a steel beam to be lifted into the High-Level Waste Facility

Employees continue installing structural steel at the 77-foot elevation of the High-Level Waste Facility

Commodities Installed Project-Wide

- **Commodities installed in 2013:**
  - Concrete: 2.860 cubic yards
  - Steel: 581 tons
  - Pipe: 16,126 linear feet
  - HVAC: 37,326 pounds (19 tons)
  - Cable tray: 2,865 linear feet
  - Conduit: 48,219 linear feet
  - Cable and wire: 253,080 linear feet
- **Commodities installed to date:**
  - Concrete: 227,068 cubic yards
  - Steel: 21,074 tons
  - Pipe: 442,592 linear feet
  - HVAC: 1,786,405 pounds (893 tons)
  - Cable tray: 50,345 linear feet
  - Conduit: 418,776 linear feet
  - Cable and wire: 606,645 linear feet

Pretreatment Facility

World's largest radioactive chemical separations facility

- 540 feet X 215 feet x 120 feet tall
- 114,000 cubic yards of concrete
- 17,000 tons of structural steel
- 540,000 feet piping
- 1,491,000 feet electrical cable
- 1,796,000 pounds heating and ventilation ductwork

Pretreatment Facility

Panorama of the Pretreatment Facility

Structural steel frames a corner of the Pretreatment Facility

Pretreatment Facility black cell

Path Forward for WTP Completion

www.hanfordvitplant.com www.twitter.com/HanfordVitPlant www.facebook.com/HanfordVitPlant

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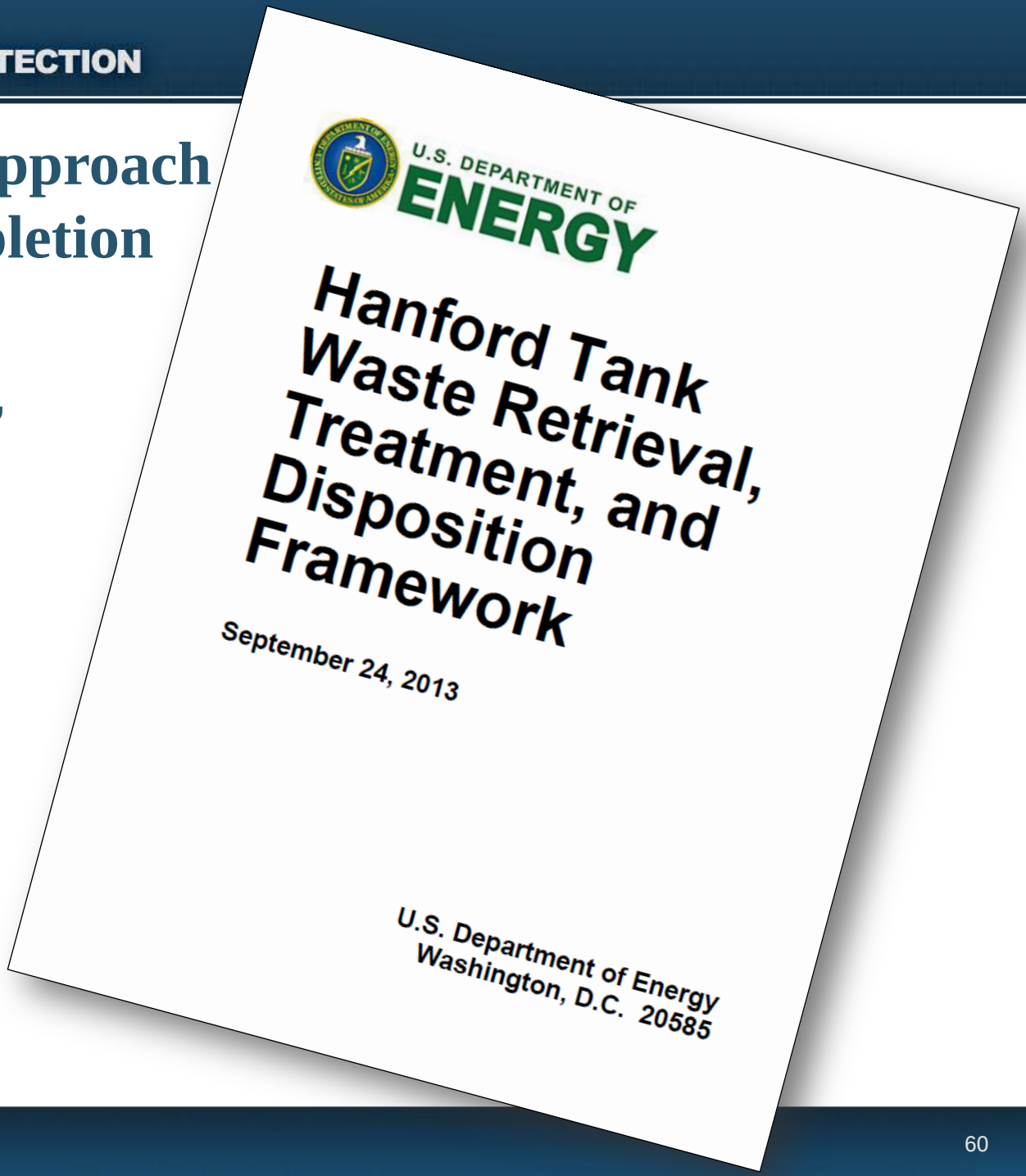
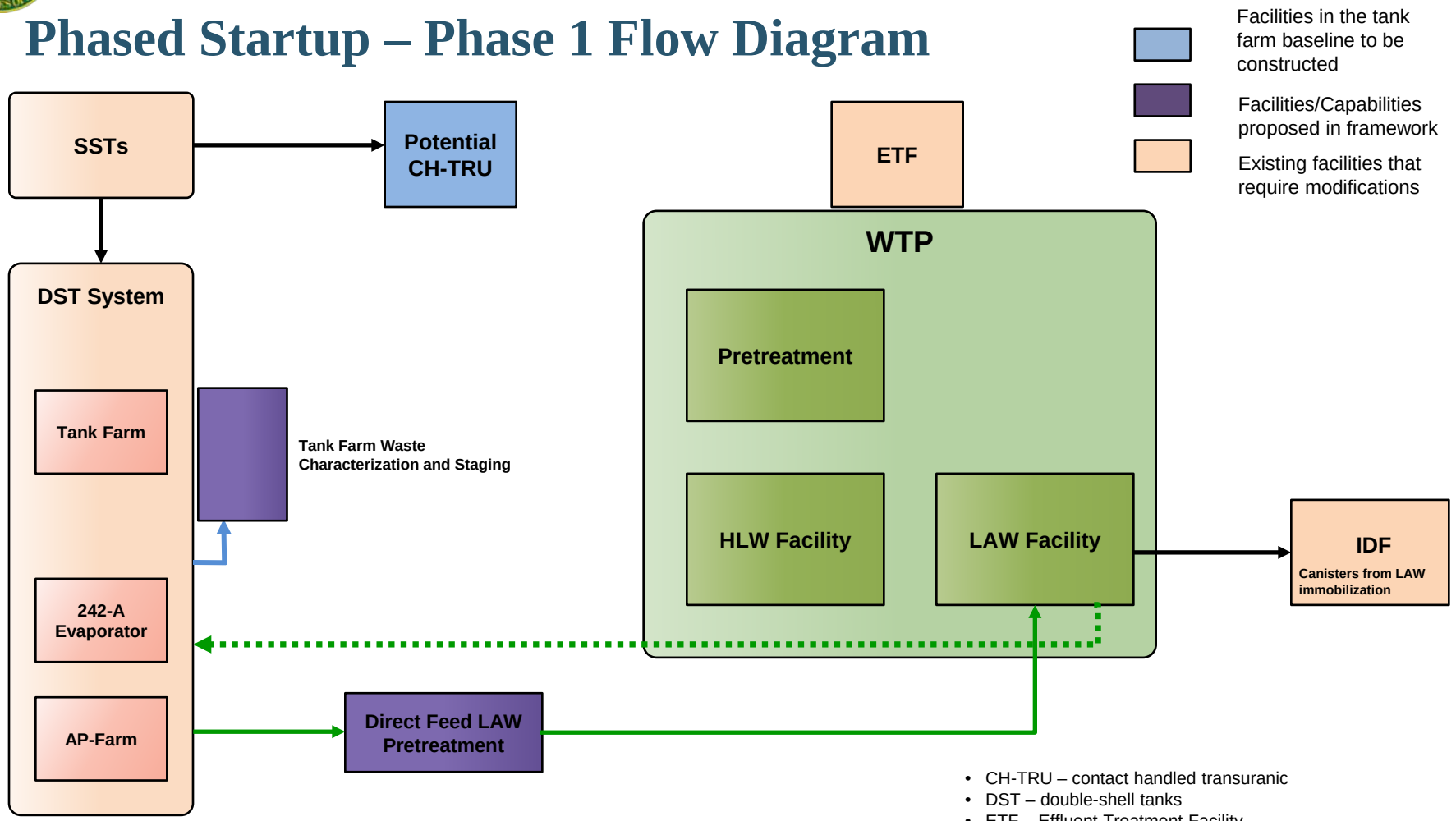
DOE's Phased Approach to Mission Completion

The Secretary of Energy's "Framework" calls for Hanford's cleanup mission to be completed in three phases.

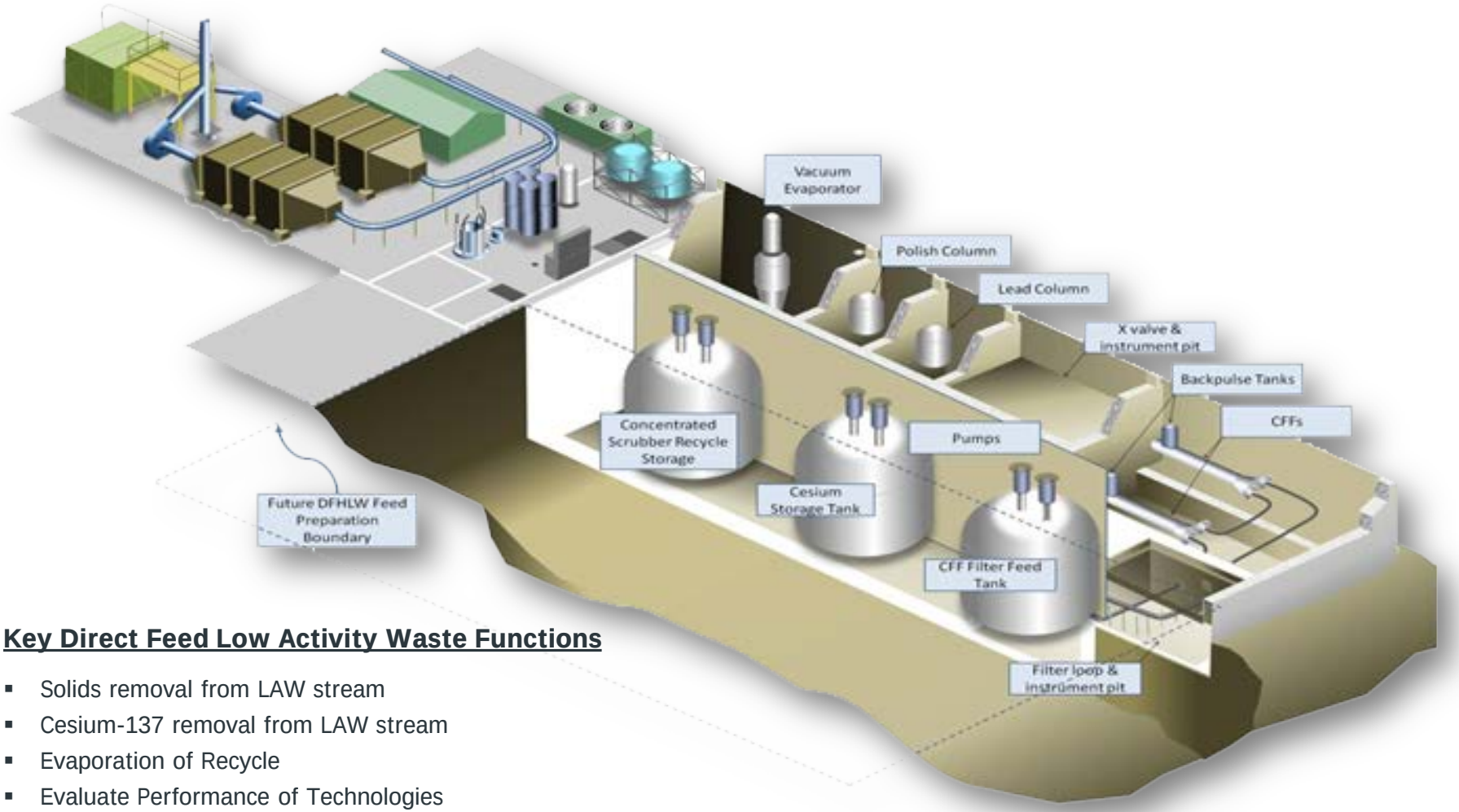


Phased Startup – Phase 1 Flow Diagram



- CH-TRU – contact handled transuranic
- DST – double-shell tanks
- ETF – Effluent Treatment Facility
- HLW – high-level waste
- IDF – Integrated Disposal Facility
- LAW – low-activity waste
- SSTs -- single-shell tanks
- WTP – Waste Treatment and Immobilization Plant

Conceptual Design Direct Feed LAW

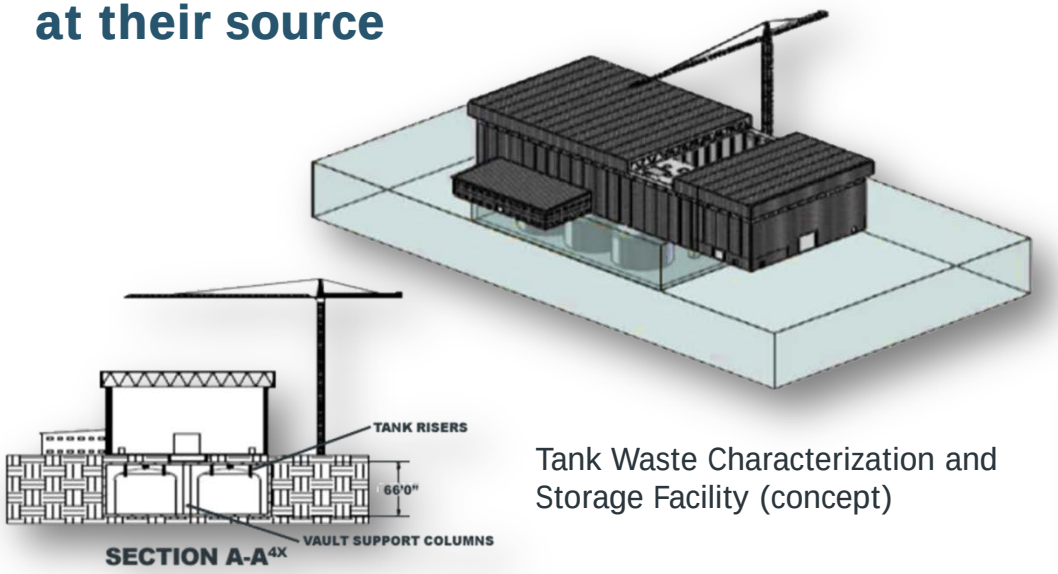


Key Direct Feed Low Activity Waste Functions

- Solids removal from LAW stream
- Cesium-137 removal from LAW stream
- Evaporation of Recycle
- Evaluate Performance of Technologies

Grand Challenge – Utilizing our National Labs

Challenge 1: Treat or optimize wastes at their source



Tank Waste Characterization and Storage Facility (concept)

Challenge 2: Eliminate or substantially reduce LAW off-gas condensate recycle

Create a greater role for the National Labs in flow sheet management and stewardship

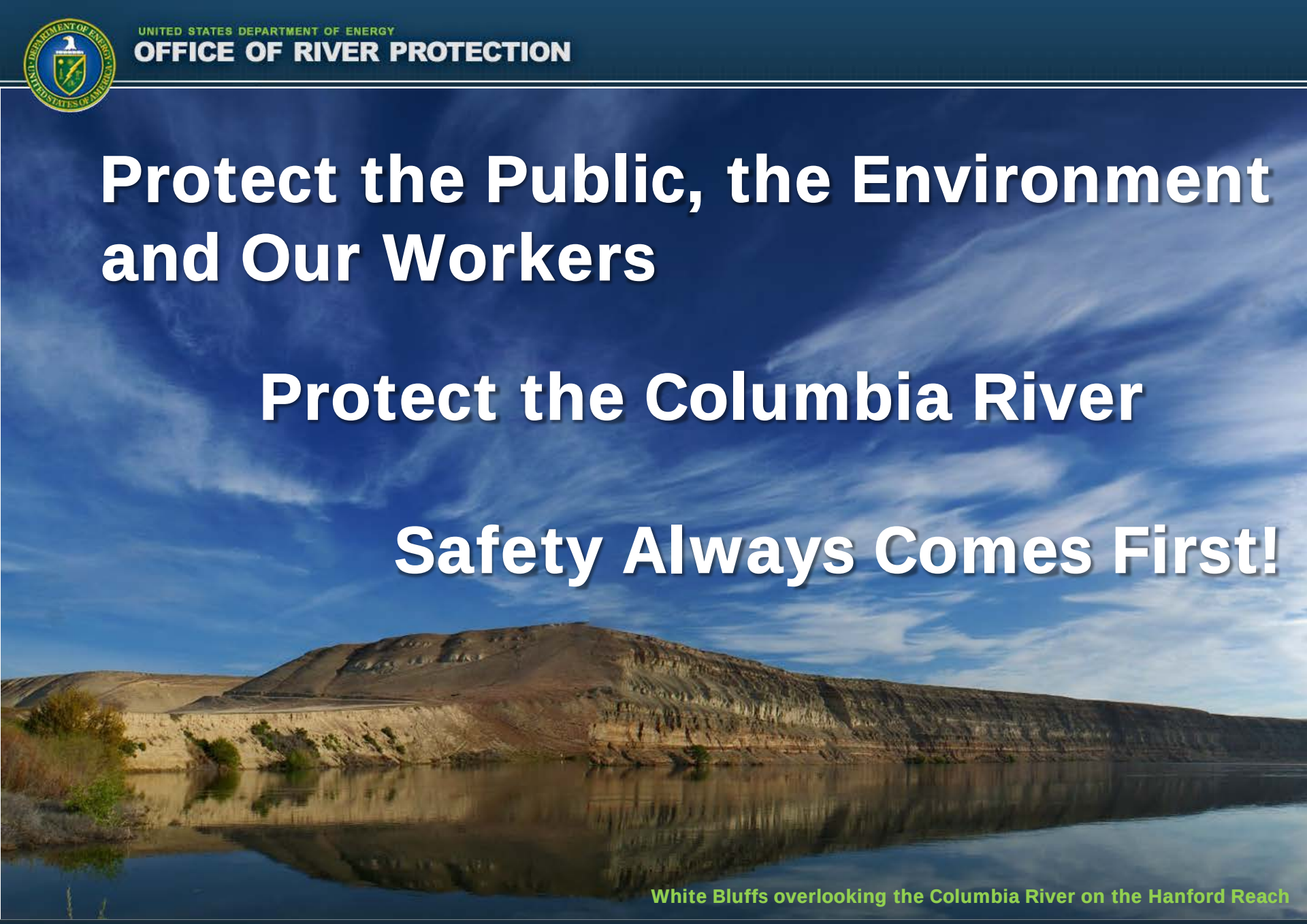
ORP's Top 10 Challenges

- Out-year Funding Profiles
- Aging Tank Farm Infrastructure
- Technical Issues Resolution
- Tri-Party Agreement/Consent Decree Milestones
- Decision to Proceed on HLW – Production Engineering
- Moving Waste from 200 West Tank Farm
- Transition to WTP Operations
- Quality
- Nuclear Safety Basis
- Finding Efficiencies to Shorten Lifecycle

Protect the Public, the Environment and Our Workers

Protect the Columbia River

Safety Always Comes First!



White Bluffs overlooking the Columbia River on the Hanford Reach