Hanford Waste Treatment and Immobilization Plant Project

Presented at the

National Spent Nuclear Fuel Program

Washington, DC

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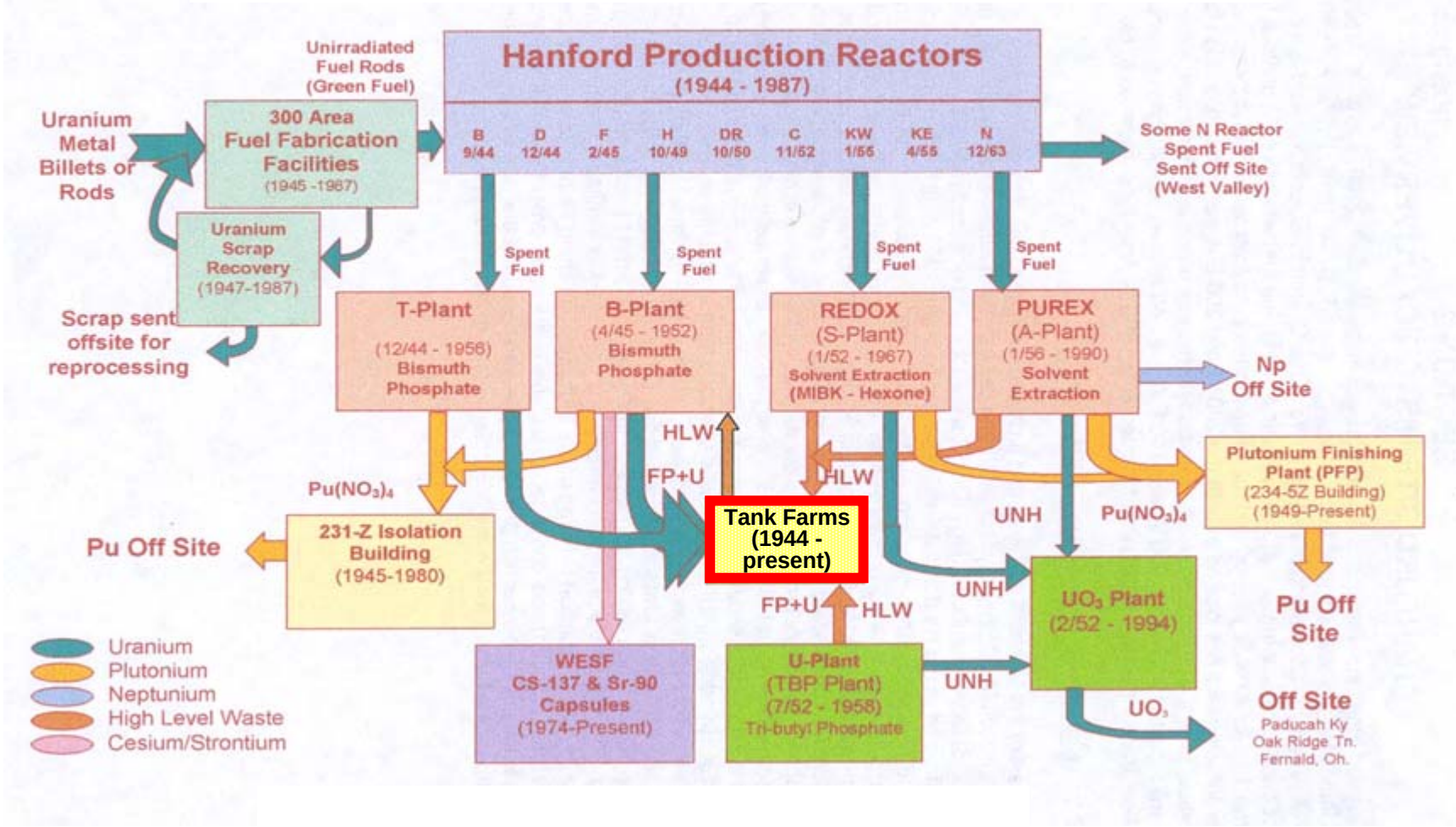
Outline

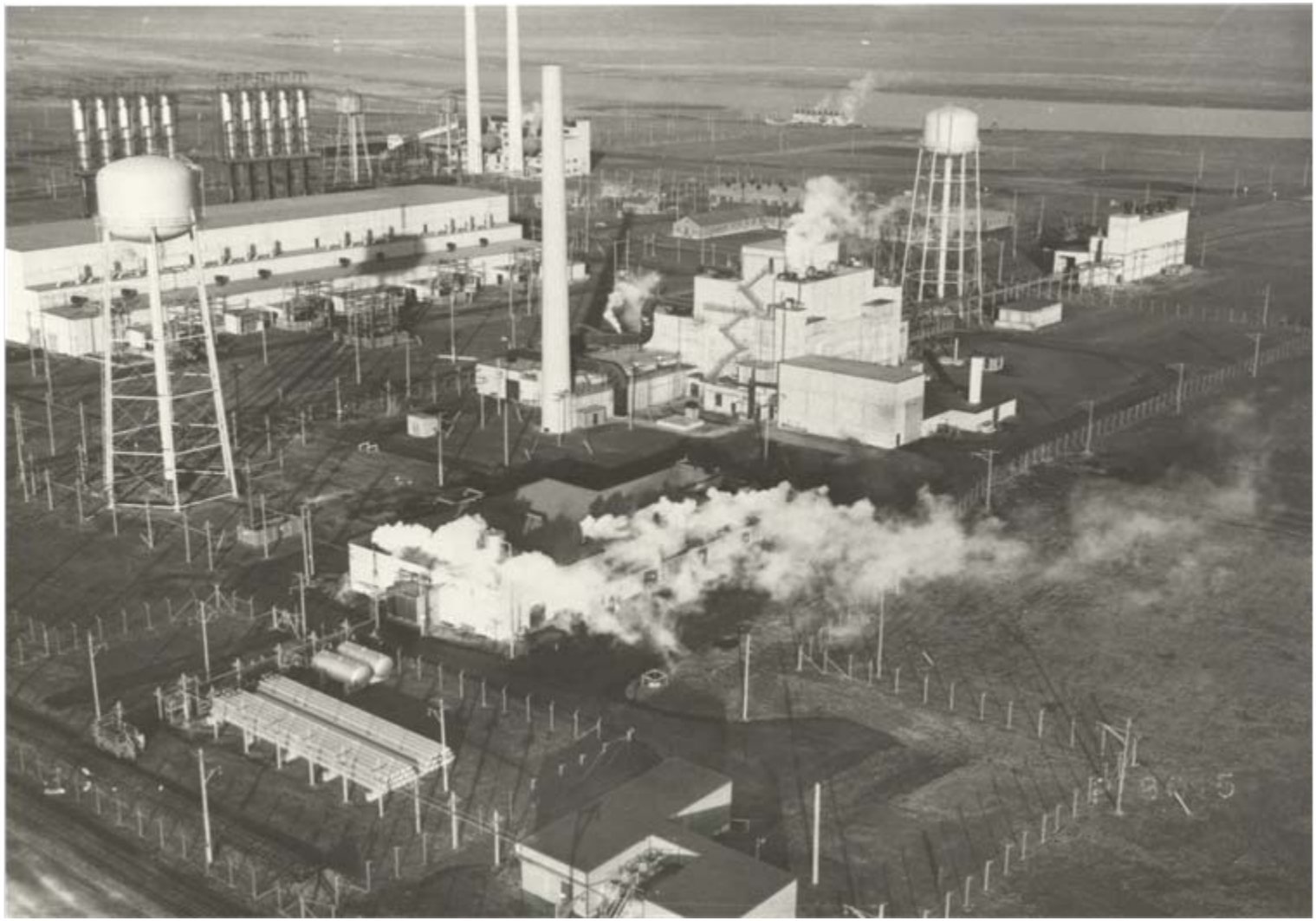
- Background
  - Waste Generation at Hanford
  - Waste Treatment and Immobilization Plant (WTP) Project
- Update
- Next Steps

Generation of Hanford Tank Wastes



9 Reactors; 4 Fuel Reprocessing Flowsheets; 100,000 MT Fuel Processed

Hanford's B Reactor, as it stood in 1945

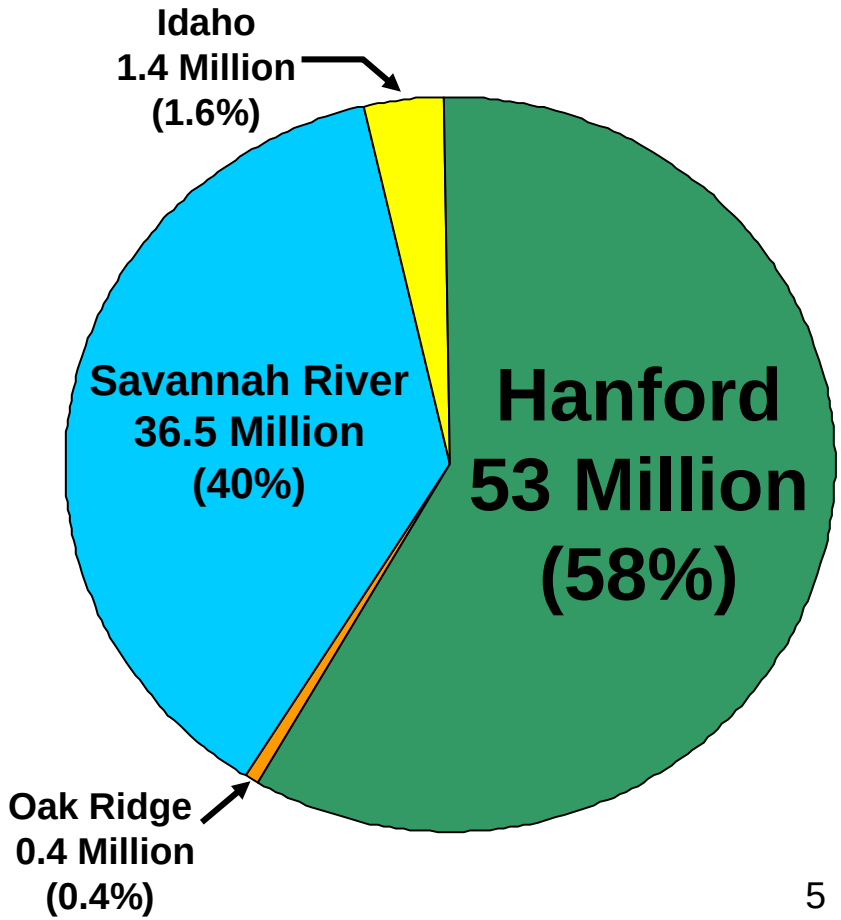


Hanford Tank Waste Cleanup Challenge

Hanford has:

- 63% of DOE tanks; 80% of DOE single-shell tanks
- 58% of DOE total tank waste
- ~194 million curies of radioactivity
- ~190,000 tons of chemicals

Total Number of Gallons in Waste Tanks at DOE Sites:



Single Shell Tanks (SSTs) under Construction

149 SSTs
Capacity up to 1 Mgal

Double-Shell Tanks (DSTs) under Construction

28 DSTs
Capacity 1 Mgal
Diameter 80 ft
Height 49 ft

Waste Treatment Plant (WTP)

Hanford's WTP will be the world's largest radioactive waste treatment plant to treat Hanford's underground tank waste

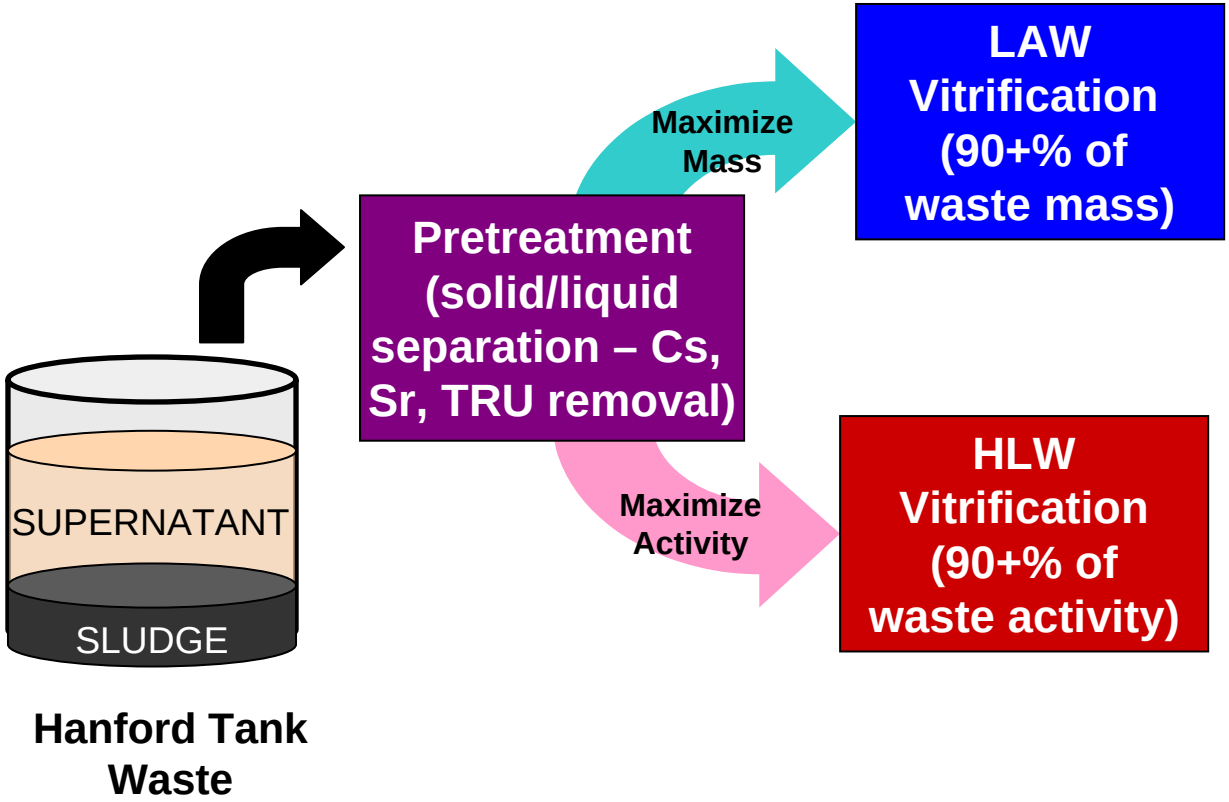
Major Facilities

1. Pretreatment (PT) Facility
2. Low Activity Waste (LAW) Vitrification Facility
3. High Level Waste (HLW) Vitrification Facility
4. Analytical Laboratory
5. Balance of Facilities

Commodities

Concrete	90,000 CY
Structural Steel	10,000 Ton
Pipe	160,000 ft
HVAC	1,200 Ton
Cable Tray	40,000 ft
Conduit	220,000 ft

WTP Flow Sheet – Key Process Flows



How is the Vitrified Waste Dispositioned?

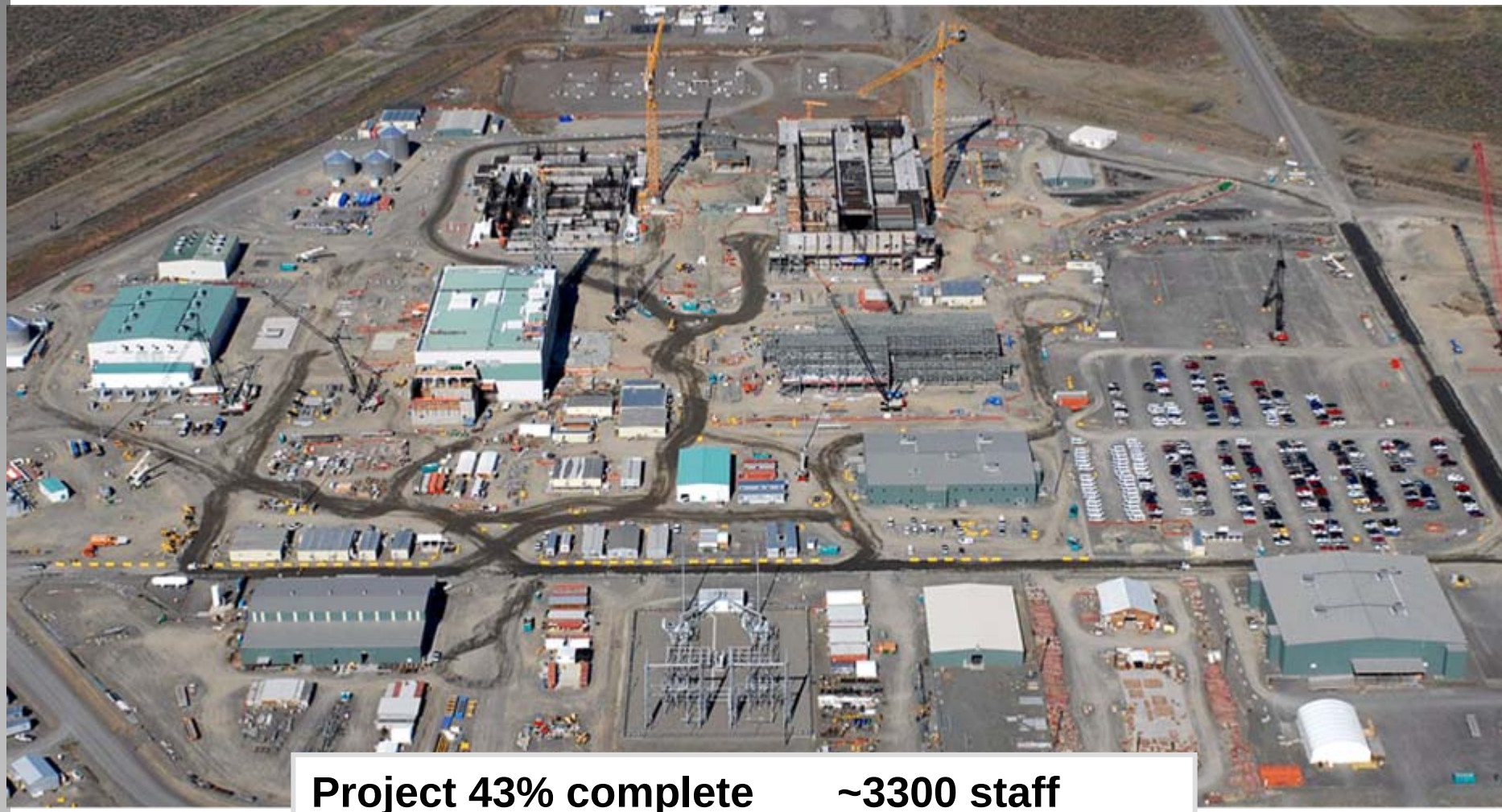
High Level Waste Canisters

- 2’ x 14.5’
- 6,600 pounds of glass
- 600 canisters to be produced/year
- Temporarily stored in Hanford’s Canister Storage Building until National Repository opened

Low Activity Waste Containers

- 4’ x 7.5’
- 13,000 pounds of glass
- 1,300 containers to be produced/year
- Disposed on Hanford Site

Aerial View of the Waste Treatment Plant
$12.2 B 2019 Completion



Project 43% complete **~3300 staff**

38% in Oct ’07 **~2650 staff**

Pretreatment Facility - July 2007

Pretreatment Facility
Design 70% Complete
Construction 25% Complete

5 Stories (0', 28', 56', 77', 98')
250' Wide x 558' Long + 28' wide loading bay/dock
119' Tall (Top of Basemat at Grade to Roof)

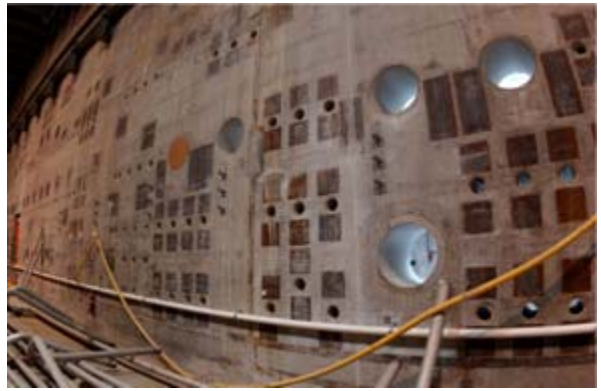
Feed Receipt Vessels in Fabrication-2004

Feed Receipt Vessels (4)

- Largest Vessels in Pretreatment
- Batch Volume 375,000 gal
- Diameter 47 ft, Height 43 feet

Feed Receipt Vessel being lifted into Shielded cell

Pretreatment Black Cell and Hot Cell



- **Permanent equipment installed in Black Cell**
  - 15 Black Cells
- **Equipment requiring maintenance installed in Hot Cell-maintainable/replaceable area**
- **Design concept allows insertion of new/modified technologies at later date**

HLW Vitrification

HLW Vitrification Facility
Design 83% Complete (79%)
Construction 25% Complete (20%)

4 Stories (0', 14', 37', 58')
281' Wide x 448' Long
120' Tall (Bottom of Basemat @ -21' to Roof)

HLW Construction Restart
Aug. 23, 2007
First Concrete Placement
Sept. 20, 2007
HLW

LAW Vitrification

LAW Vitrification Facility
Design 95% Complete (93%)
Construction 52% Complete (48%)

Analytical Laboratory

Analytical Laboratory Oct. 2007
Design 88% Complete
Construction 35% Complete

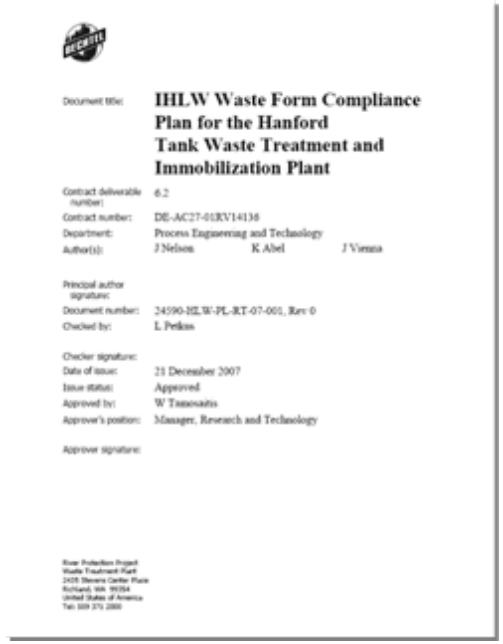
Analytical Laboratory

Analytical Laboratory Dec. 2007
Design 90% Complete (88%)
Construction 47% Complete (35%)

IHLW Waste Form Compliance Plan for the Hanford Tank Waste Treatment and Immobilization Plant

Currently being reviewed by EM-12 / Technical Review Group

- Denis Koutsandreas, TRG Team Leader, Office of Disposal Operations, EM-12
- Anthony Kluk, Office of Disposal Operations, EM-12
- Mark Senderling, Office of Disposal Operations, EM-12
- Nicholas Machara, Office of Waste Processing, EM-21
- Steven Ross, Office of Waste Processing, EM-21
- Mark Rawlings, Office of Project Management Oversight, EM-53
- Kenneth Picha, Office of Safety Management and Operations, EM-60
- Kriss Grisham, Office of Safety Management, EM-61
- Steven Gomberg, Waste Management Office, RW-9
- Markus Popa, Waste Management Office, RW-9
- Joseph May, Thomas Jefferson Site Office, SC-TJSO
- Jeffrey W. Ray, SRS WSRC



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Contents of the IHLW Waste Form Compliance Plan

History Sheet

1 Introduction

2 Overview of the WTP Process

2.1 Pretreatment Facility

2.2 HLW Vitrification Facility

2.3 LAW Vitrification Facility

2.4 Analytical Laboratory

3 Overview of the WTP Strategy for Compliance with the WAPS and WASRD

3.1 Waste Form Composition Control and Reporting During Production

3.2 Product Consistency Control for Compliance During Production

3.3 Canister and Canistered Waste Form

3.4 Quality Assurance

4 Compliance with WAPS and WASRD Requirements

4.1 Specification 1 – Waste Form Specifications

4.2 Specification 2 – Canister Specifications

4.3 Specification 3 – Canistered Waste Form Specs

4.4 Specification 4 – Quality Assurance Specification

4.5 Specification 5 – Documentation and Other Requirements

5 References

5.1 Project Documents

5.2 Codes and Standards

5.3 Other Documents

Appendices

Appendix A Canister Drawings

Appendix B Grapple Drawings

Appendix C Compliance with WTP Contract Requirements

Appendix D WAPS and WASRD Requirements

Road Map to Support Acceptance of WTP IHLW Product

This series of activities supports the Action Plan for DOE final evaluation of the Waste Treatment Plant (WTP) Integrated Control Network (ICN) waste affecting impact and activities (Inspector General's audit report and recommendations from the, "Quality Assurance Standards for the Integrated Control Network at the Hanford Site's Waste Treatment Plant.")

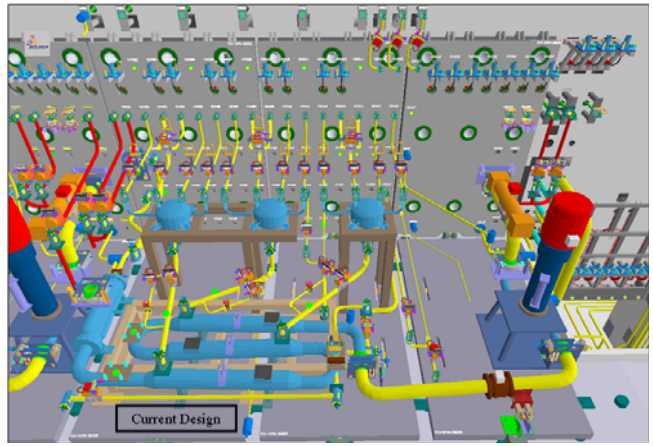
Hanford Tank Waste Treatment and Immobilization Plant (WTP) transmits an IHLW Waste Form Compliance Plan (WCP) to ORP	Complete
ORP review of WCP (comment resolution and incorporation) with contract deliverable transmitted to EM-12	Complete
ORP reviews glass formulation algorithm and WTP data management plan for automated collection and use in IHLW development, commissioning, operations, and production records	Feb 2008
WTP self assessment of IHLW QA	Mar 2008
EM-12 coordinates Radioactive Waste (RW or OCRWM) review (comment resolution and incorporation)	Mar 2008
EM-12/Technical Review Group review (comment resolution and incorporation) of WCP	Mar 2008
EM-12 disseminates a revision to the Waste Acceptance Products Specifications (WAPS)	Mar 2008
Key ORP staff become certified by RW as auditors and technical specialists	Mar 2008
Upon receipt of mandatory comments WTP issues final WCP	Apr 15, '08
WTP re-establishes an OCRWM QA program	May 2008
ORP WED Assessment of IHLW Technical Activities in compliance with QARD	May 2008
WTP issues Waste Acceptance Impacting Items & Activities for IHLW based upon approved WCP	June 2008
ORP qualifies WTP OCRWM QA program with RW/EM involvement	June 2008
ORP re-establishes an OCRWM QA program (EM approval and RW oversight)	June 2008
WTP issues revised Integrated Sampling and Analysis Requirements Document (ISARD) incorporating required accommodations for IHLW activities	Sept 2008
ORP ESQ Assessments on WTP QA Manual, DOE O 414.1C compliance, configuration management, etc.	Dec 2008
END GOAL: WTP issues revised IHLW Waste Form Qualification Report based upon approved WCP	Dec 2008

Purpose of the WTP TRAs

- Assess the maturity of Critical Technology Elements to:
  - Determine readiness of proceeding/continuing with design and construction
  - Identify immature technologies and components (for tracking of maturity of development)
  - Identify technology development needs for immature technologies
- Apply and refine TRL process for potential use by EM Design/Construct Projects

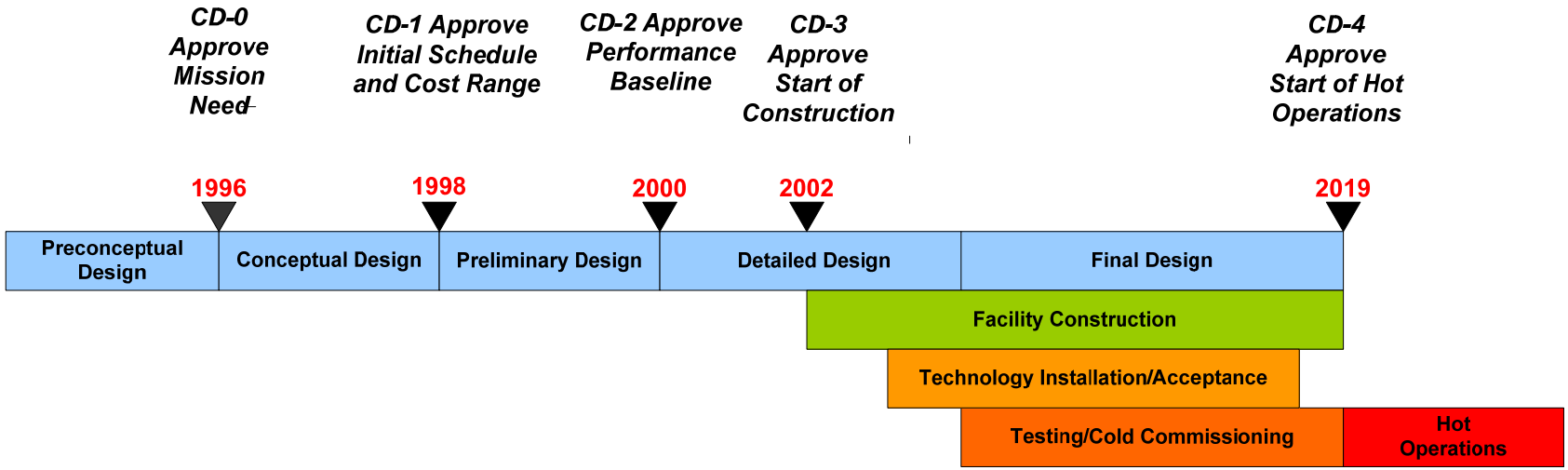
WTP Systems Requiring Maturation

- Pulse Jet Mixing
- Waste Solids Separation
- Radioactive Cesium Removal
- Nitric Acid Recovery and Recycle
- Laser Ablation-Inductivity Coupled Plasma-Atomic Emission Spectrometer
- HLW Melter Offgas Treatment (Electrostatic Precipitator)
- LAW Container Sealing
- LAW Container Decontamination

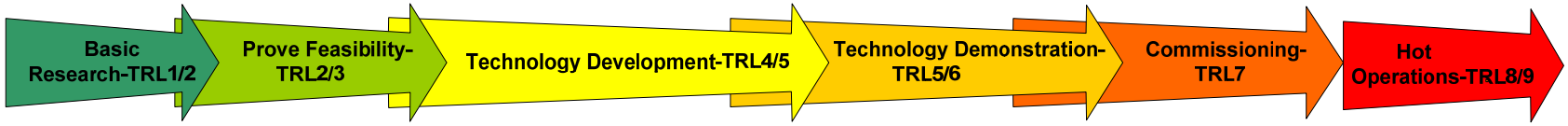


Technology Maturation Sequence and WTP Critical Decisions

DOE's Project Management Process as Applied to WTP



Technology Maturation



Backup

Determination of Critical Technology Elements (CTEs)

- CTE assessment completed for all WTP Process and Process Support Systems for each facility
- CTEs determined by response to two sets of questions
- Must have positive response to at least one question in each question set for determination as CTE
- CTE's to be evaluated with Technology Readiness Levels

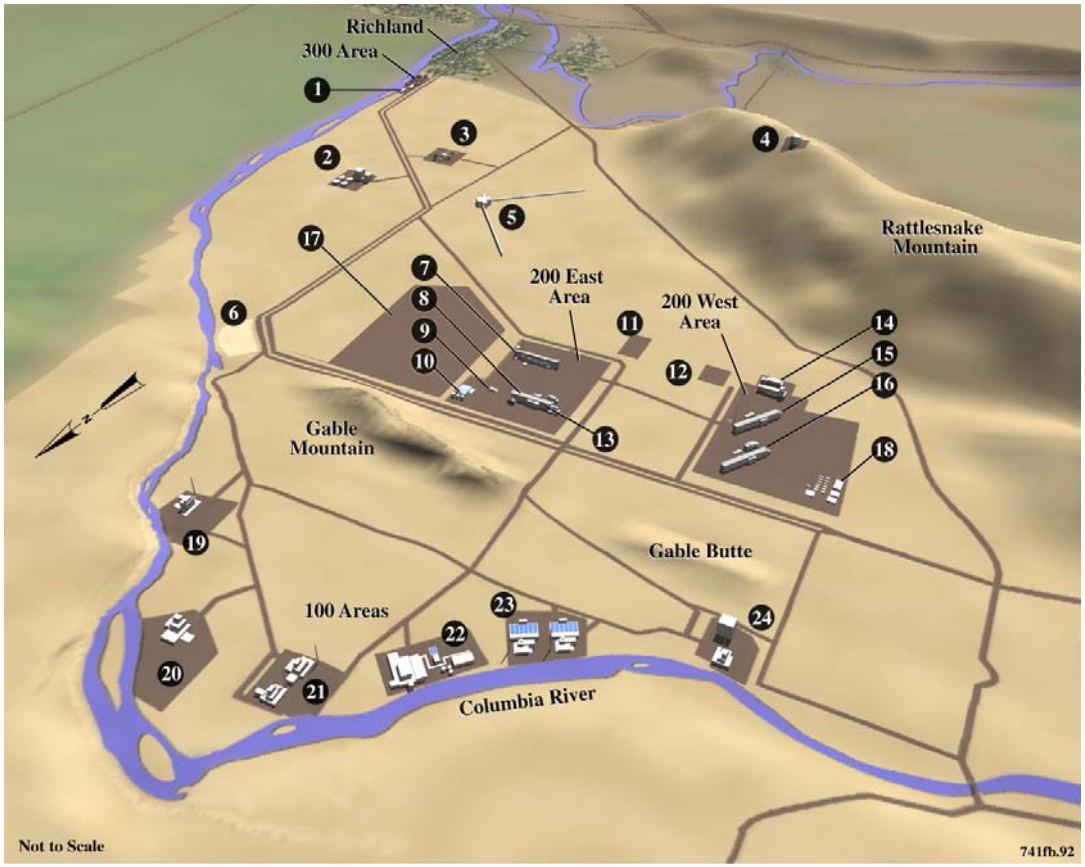
First Question Set

- Does the technology directly impact a functional requirement of the process or facility?
- Do limitations in the understanding of the technology result in a potential schedule risk, i.e., the technology may not be ready for insertion when required?
- Do limitations in the understanding of the technology result in a potential cost risk, i.e., the technology may cause significant cost overuns ?
- Are there uncertainties in the definition of the end state requirements for this technology ?

Second Question Set

- Is the Technology New or Novel?
- Is the Technology modified?
- Has the technology been repackaged so a new relevant environment is realized?
- Is the technology expected to operate in an environment and/or achieve performance beyond its original design intention or demonstrated capability?

Hanford Cleanup Site



1. 300 Area Liquid Effluent Treatment Facility
2. Commercial Operating Nuclear Power Plant
3. Fast Flux Test Facility
4. Observatory
5. Laser Interferometer Gravitational Wave Observatory
6. Old Hanford Town Site
7. Plutonium Uranium Extraction Plant
8. B Plant
9. Prototype Engineered Barrier
10. 200 East Area Effluent Treatment Facility
11. U.S. Ecology Commercial Solid Waste Site
12. Environmental Restoration and Storage Facility
13. Waste Encapsulation and Storage Facility
14. REDOX
15. U Plant
16. T Plant
17. Waste Treatment Plant
18. Waste Receiving and Processing Facility
19. F Reactor
20. H Reactor
21. D and DR Reactors
22. N Reactor
23. KE and KW Reactors
24. B and C Reactors

Balance of Facilities