Hanford Low Activity Waste Historical Overview

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Outline

This session will cover:

- Hanford Low Activity Waste (LAW) - origin and definition
- Seminal decisions and factors that led to selecting glass for immobilization of LAW

Origin of the Waste

- 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)

Waste Classification

- High Level Waste first defined by AEC in 1970 (10 CFR App F)

  …irradiated reactor fuel, liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and solids into which such liquid wastes have been converted.

- Nuclear Waste Policy Act of 1982 modified definition

  the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly and any solid material derived from such liquid waste that contains fission products in sufficient concentrations and other highly radioactive material that…requires permanent isolation

- Waste Incidental to Reprocessing

  wastes that are the result of spent fuel reprocessing plant operations such as contaminated job wastes including laboratory items such as clothing, tools and equipment, and liquid residuals resulting from reprocessing once key radionuclides have been removed in order to permit downgrading the classification to either low-level waste or transuranic waste

- Low Level Waste

  Not HLW, spent fuel, TRU waste, or byproduct material

  Meets LLW disposal criteria per DOE O 435.1

Early Plans for Disposition of Waste

- Waste Management EIS (ERDA-1538, December 1975)
  - Alternatives for treatment & disposal – no formal ROD
- Hanford Waste Vitrification Plant – High Level Waste
  - Project initiated circa 1985 projected start date 1994, 1.1 MTG/day
- Hanford Grout Disposal Program – Low Level Waste
  - Mid-1980s constructed 5 x 1.3 Mgal vaults, grouted 1 Mgal reactor decon waste
- Hanford Defense Waste EIS (DOE/EIS-0113 December 1987)
  - Preferred alternative and ROD included vitrification of HLW from DSTs, grouting of low activity waste fraction from processing tank waste, and disposition of Cs and Sr capsules
  - No decision on disposition of waste from SSTs

Hanford Grout Treatment Facility

- 1.3 Mgal vaults designed for disposal of grouted LLW from DSTs
  - Lined vaults equipped with leachate collection systems

- One vault filled with 1 Mgal of grouted reactor decontamination waste

Tank Waste Disposition Analyses

- Tri-Party Agreement – 1989
  - Result of negotiations between DOE, EPA, and Washington State Dept. of Ecology to comply with RCRA and CERCLA requirements
- Expanded scope to treat waste in all 177 Hanford Tanks (DSTs and SSTs) plus Cs and Sr capsules
  - Systems Analysis of Alternatives for Final Disposition of the Single-Shell Tank System on the Hanford Site, PNL-7426, 1991
  - Systems Engineering Study for the Closure of Single Shell Tanks, WHC-EP-0405, August 1991
  - Tank Waste Technical Options Report, WHC-EP-0616, March 1993
- Bottom line results
  - HWVP capacity too low to vitrify all HLW
  - 200+ grout vaults needed to treat all LAW (260 Mgal, 1 Mm^3)

Decision Analysis

- Tank Waste Decision Analysis Report, WHC-EP-0617, March 1993
  - DOE-EM Secretary and Director of Ecology agreed on need to re-baseline plans for tank waste treatment[1]
  - Evaluated new approaches for remediating tank waste
  - Recommended a new technical strategy
  - To facilitate DOE formed the Tank Waste Remediation System
- New Technical Strategy Evaluated two options
  - Extensive Separations - low volume of HLW glass and LLW grout with low radioactivity (Class A) and reduced chemical toxicity
  - High capacity vitrification – use available separations technology and vitrify both HLW and LAW fractions

[1]Duffy, L. P., 1991, "Secretary Decision Concerning the Tank Waste Remediation System, Hanford Site," (Memorandum to John D. Wagoner, Manager, DOE Field Office, Richland, December 20, 1991), U.S. Department of Energy-Headquarters, Washington, D.C.

New Treatment Strategy

- The New Technical Strategy resulted in selection of high capacity vitrification option for both HLW and LAW
  - Environmentally-safe, retrievable waste forms[2]
- TWRS program surveyed industry for interest in a design-build-operate contracting mechanism for tank waste treatment
  - Privately funded design & construction
  - DOE to pay for glass logs delivered
- Part A competitive procurement awarded 1996
  - Two offerors – feasibility phase
- Part B – Demonstration Phase awarded 1998 to BNFL
  - Treat 10% of the waste containing 25% of radioactivity by 2018

[2]Hanford Tank Waste Task Force Final Report, September 1993

Vitrification Demonstration

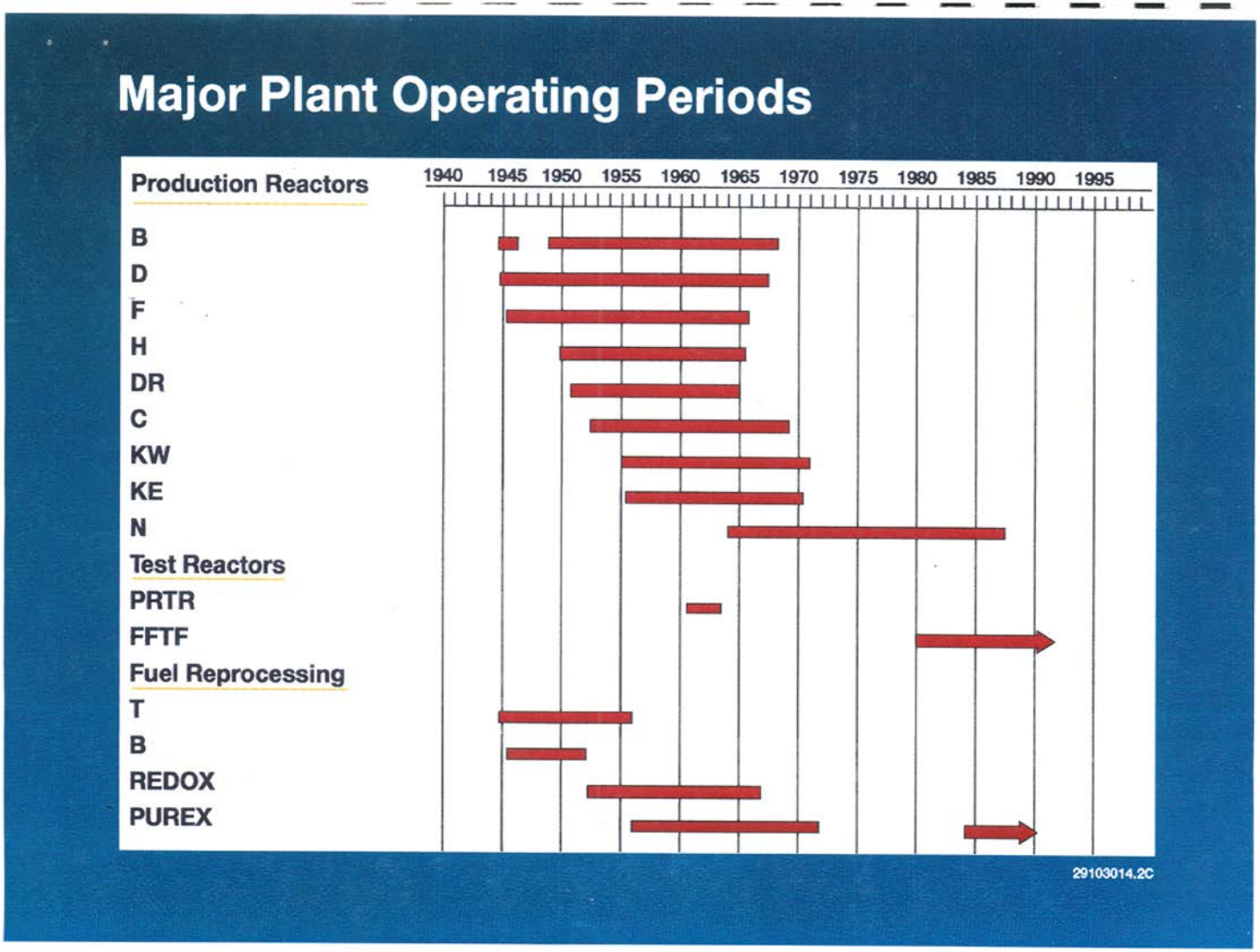
- TWRS EIS ROD (1997)
  - Selected Phased Implementation as preferred alternative
  - Enabled privatized design-build-operate contracting strategy
  - Allowed DOE to continue to evaluate technologies and alternatives for treating all of the tank waste
- Waste Treatment and Immobilization Plant (WTP) Project
  - Originally conceived as a demonstration project
  - World's largest joule-heated nuclear waste melters proposed (10 m^2 melt pool surface area)
  - Utilize VSL/Duratek bubbled melter technology for high throughput
  - Place LAW glass in retrievable storage until disposal performance could be verified (ILAW PA, 2001)
  - ILAW Vitrification to start in 2007 followed by HLW Vit in 2011

WTP Evolution

- WTP Contract Change
  - April 2000 – DOE rejects WTP contractor's proposal for Phase 2B
  - DOE re-bids WTP contract for design, build, commission and awards to Bechtel/Washington Group team for turnover in March 2001
- Path forward for the tank waste treatment mission
  - Proceed with WTP design and construction
  - Design included space for 2nd HLW melter – sufficient capacity to treat all HLW feed to produce 6 MTG/day
  - LAW Vitrification capacity capped at 30 MTG/day – 2 LAW melters each with 15 MTG/day capacity

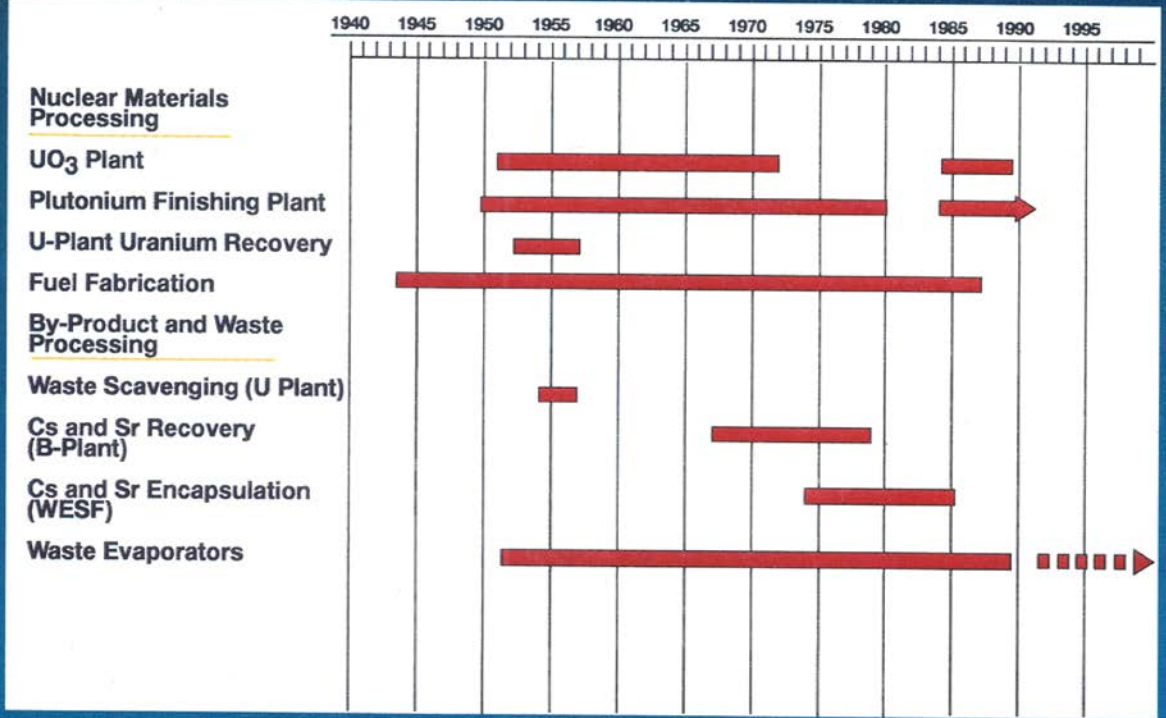
Backup Slides

Operating Periods

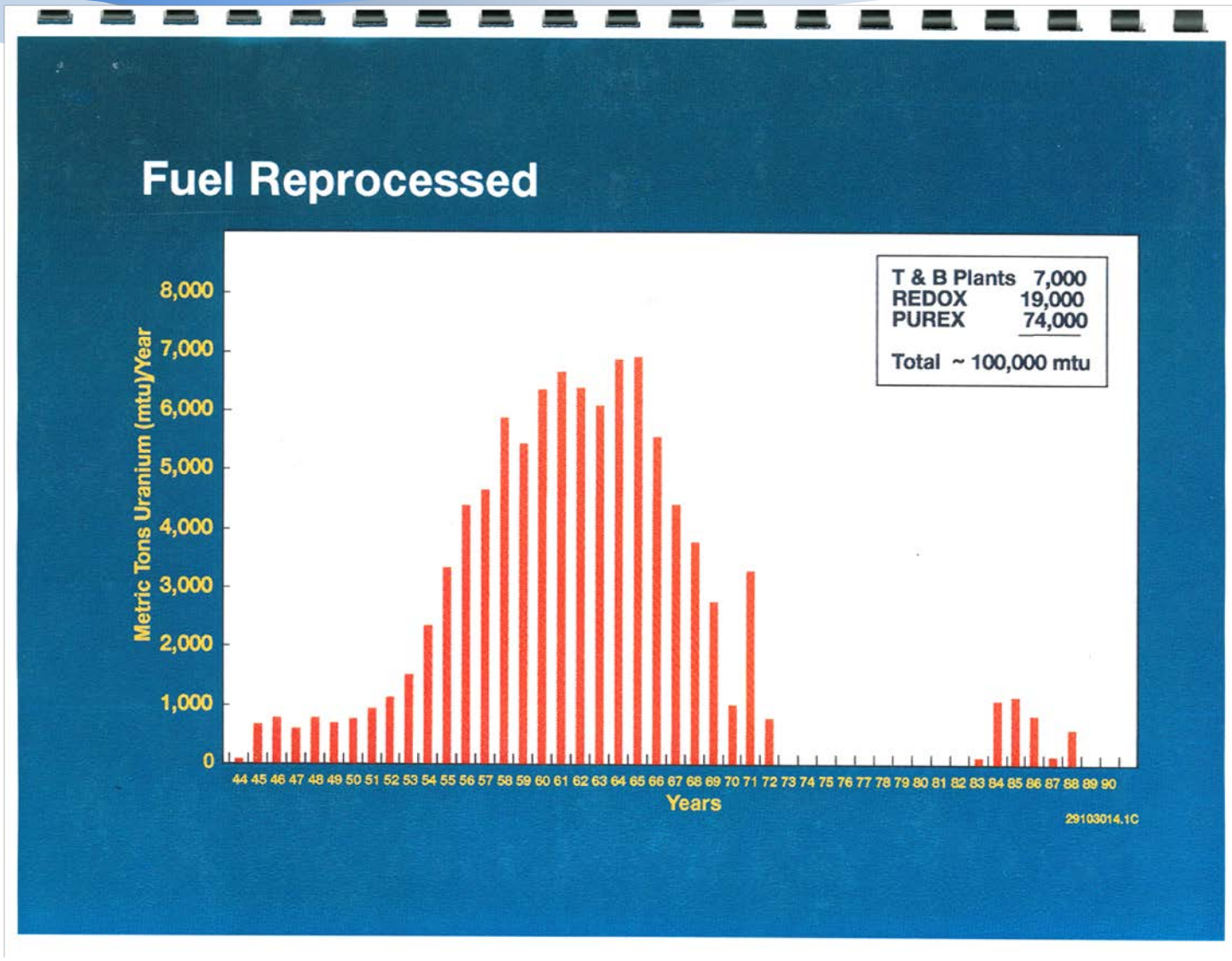


Operational Periods

Major Plant Operating Periods Cont.



Fuel Processed



Waste Generation Rates