

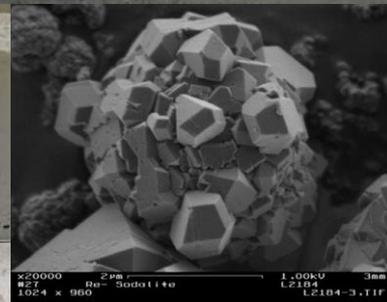


# Department of Energy Office of River Protection

## Supplemental Low Activity Waste Immobilization and the one-time Hanford Tank Waste Supplemental Treatment Technologies Report

**Steve Pfaff, DOE**  
Office of River Protection  
Federal Project Director

**November 7, 2012**



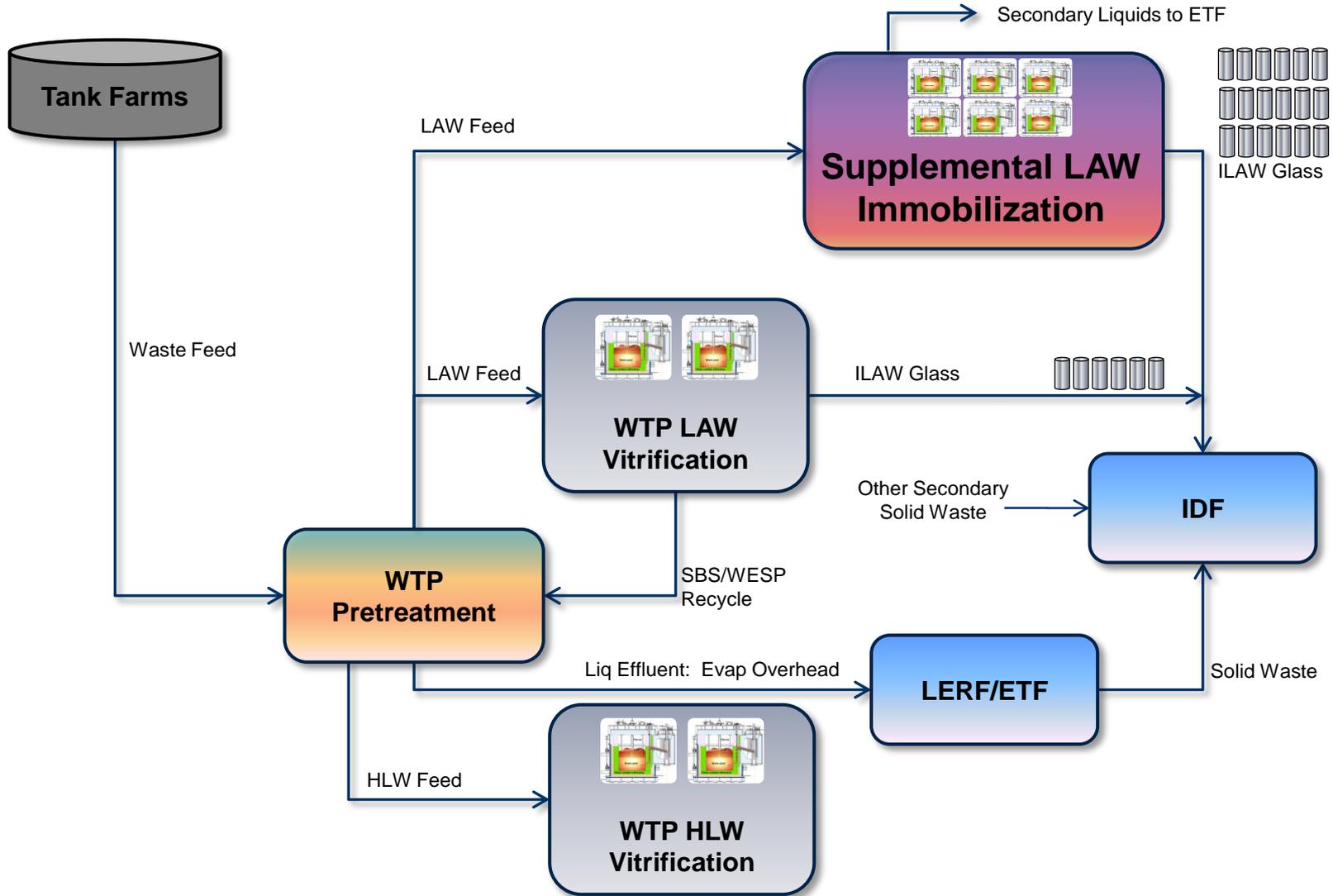


# Supplemental Low Activity Waste Immobilization

- The WTP Low Activity Waste (LAW) vitrification plant will only treat ~35% of the total LAW (as reflected in System Plan 6)
- Supplemental LAW Immobilization is needed to treat the remainder of the LAW to complete the River Protection Project in a reasonable timescale
- TPA Milestone M-062-40zz requires ORP to submit to Ecology by October 31, 2014 a “one time report” if a Supplemental Immobilization technology is proposed other than 2<sup>nd</sup> LAW vitrification facility
- TPA milestone M-062-45 describes the process for Ecology and DOE to complete a negotiated LAW immobilization technology selection (along with defining implementing milestones) by April 30, 2015



# Current River Protection Project Baseline – Summarized by System Plan 6 Flowsheet





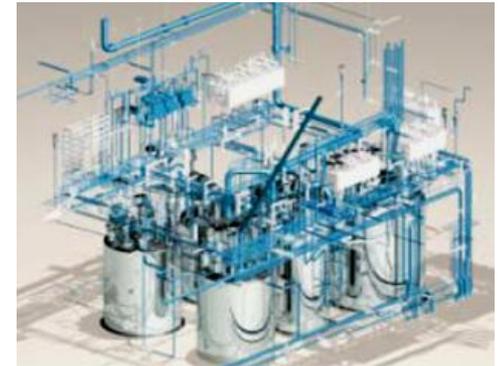
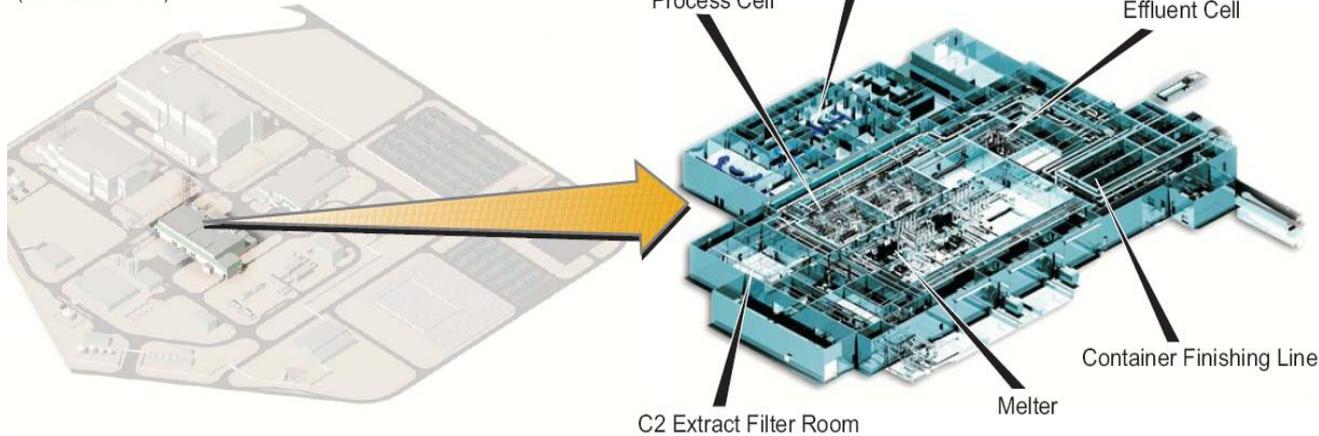
# Project Progress in Fiscal Year 2011

- Supplemental Immobilization project established at beginning of FY-11
- Justification of Mission Need approved in January 2011
- Four immobilization technologies identified for evaluation:
  - Second LAW Vitrification Facility
  - Fluidized Bed Steam Reforming
  - Bulk Vitrification
  - Cast Stone
- Developed underpinning documents covering the four technologies (specifications, calculations, draft data package, etc.)
- Continued to collect data on steam reforming (related technology development project)
- Funding limitations curtailed further progress by the end of FY-11



# 2<sup>nd</sup> Low Activity Waste Vitrification

Low-Activity Waste Vitrification Facility  
(Elevation 3'-0")



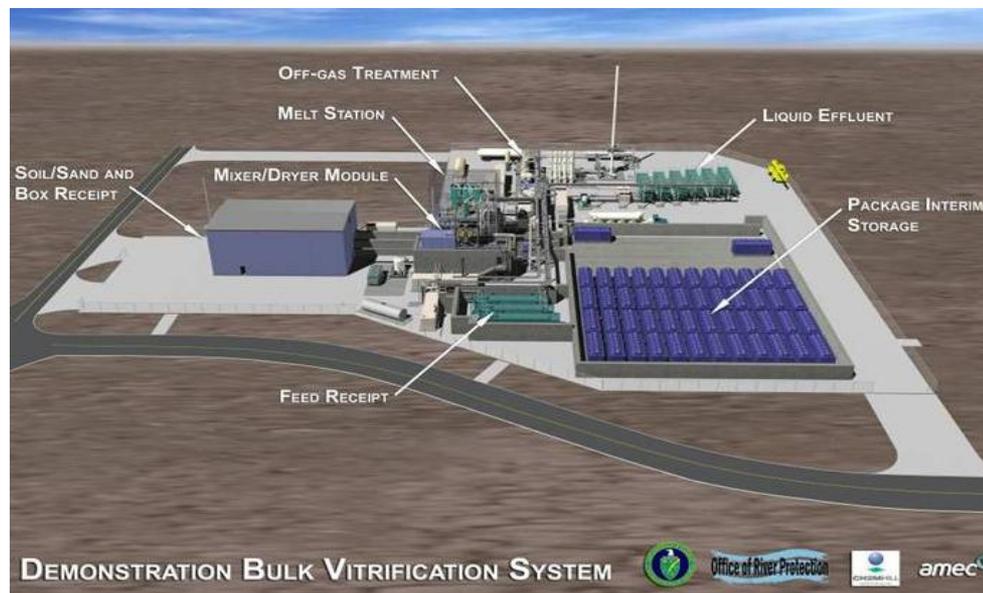
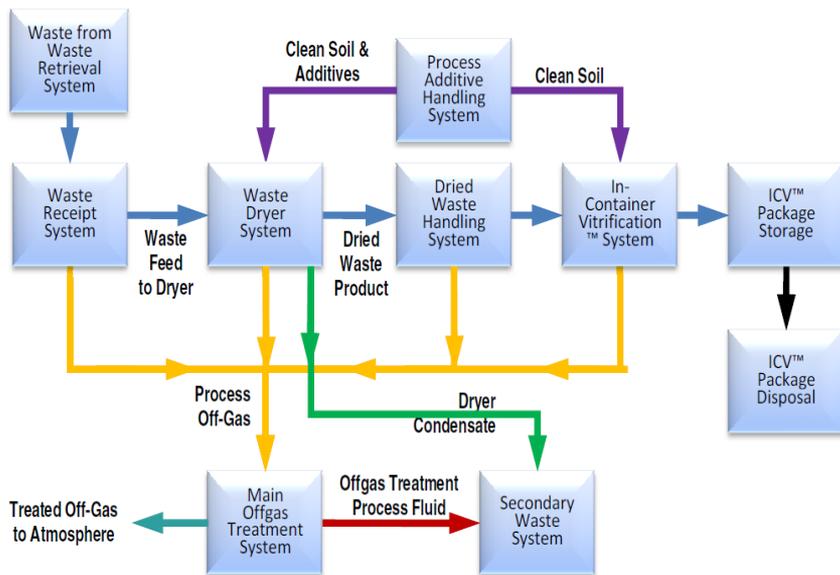
- Joule heated ceramic melter facility
- Current facility has 2 melters
- 2<sup>nd</sup> LAW facility needs ~3x capacity of current facility
- Glass poured into stainless containers 4 ft dia. x 7 ft tall
- Glass performance excellent
- However, work underway to evaluate liquid secondary waste impacts and options
- May evaluate certain design enhancements as part of the work for the one-time report



LAW Facility in June 2009



# Bulk Vitrification



- Joule heated melting in a refractory lined steel box
- Box used once, serves as disposal container
- Soil (with additives) used as glass former
- LAW feed mixed with soil and additives, dried then fed into box and melted
- Extensive testing and design work from 2003-2007
- Demonstration facility designed through CD-3

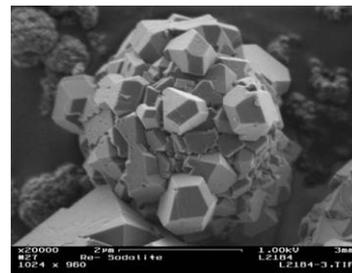
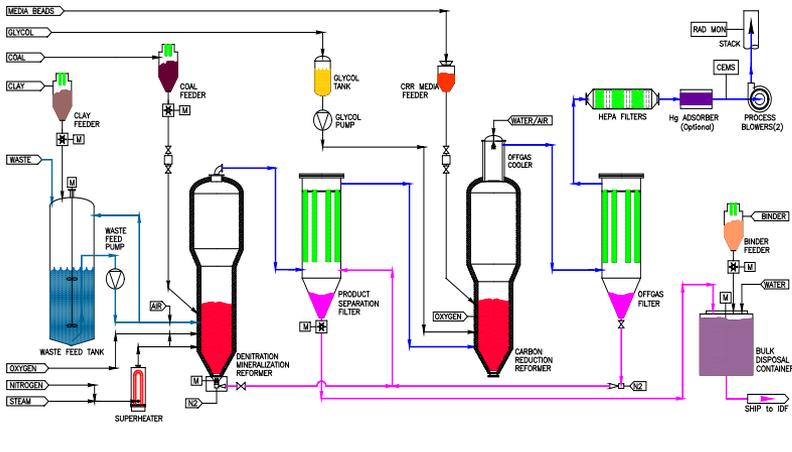


# Fluidized Bed Steam Reforming



Studsvik's Commercial FBSR Facility for LLW

- Uses steam and clay at approx. 725 deg. C
- Evaporates liquids, destroys organics, converts nitrates/nitrites to nitrogen
- Radionuclides incorporated into a mineral form
- Appears to be efficient at capturing Tc-99, S
- Mineral product monolithed for disposal
- Anticipate no secondary liquid wastes
- Selected at INL for sodium bearing wastes
- Need to complete and evaluate recent test data and watch outcomes at INL

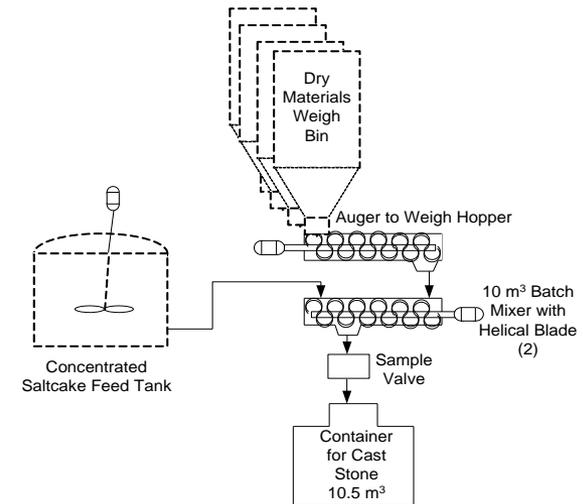


Sodalite Crystal, Granular Product and Monolith Samples



# Cast Stone

- Portland cement, flyash, clay, slag, etc. mixed with concentrated LAW feed and solidified in containers
- Could use other formulations (e.g., duralith)
- Extensive work at Hanford in the '80s – '90s
  - Grouted ~1M gallons of N reactor clean-out solution (high phosphate/sulfate '88-'89)
- Some additional work completed in 2003 as a potential Supplemental Immobilization technology
- Evaluating cast stone in FY-13 and early FY-14 via simulant and real waste tests



One of two mixer trains



# Supplemental Immobilization Refocus in Fiscal Year 2012

- Further evaluation in FY-12 resulted in the decision to defer the technology down select and the start of the CD-1 design process until after the negotiated selection in April 2015
- This alternative approach allows the opportunity to:
  - Finish testing and analysis on fluidized bed steam reforming
  - Complete the Vitrious State Laboratory effort to understand impacts of LAW melter off-gas recycle on glass production and Tc<sup>99</sup> retention in glass
  - Obtain additional data on the cast stone option
  - Obtain additional data on Tc<sup>99</sup> removal options
  - Continue to refine the engineering data package



# Scope in Fiscal Year 2013 and Fiscal Year 2014

- Undertake cast stone waste form work
- Update information on all 4 immobilization options
- Technetium removal technology maturation
- Prepare engineering studies and life cycle cost estimates of the 4 immobilization options and variations
- Support technical reviews by an expert review panel and an independent review of the LCC estimate by the Corps of Engineers
- Translate all of the above into the one-time report by October 2014



## M-062-40zz Milestone (Excerpt from M-062-40)

Not later than the System Plan Report due date of 10/31/2014, DOE will submit a one-time Hanford Tank Waste Supplemental Treatment Technologies Report, which will be required if a tank waste supplemental treatment technology is proposed, other than a 2nd LAW Vitrification Facility. This report will:

- Describe additional treatment facilities and technologies, and cost which in combination with the WTP are needed to vitrify all of Hanford's tank waste by a date that is as quickly as is technically feasible but not later than the date established in milestone M-062-00, with and without consideration of (i) whether such further optimization would be excessively difficult or expensive within the context of such activities and (ii) any impact on the overall cleanup mission.
- Apply the same selection criteria to all options and include a 2nd LAW Vitrification Facility as an option.
- Include all the results from all waste form performance data (compared against the performance of borosilicate glass) for all the treatment technologies being considered.
- Describe the technologies being considered (including size, throughput, sodium loading, quantity of waste to be processed, quantity of final waste forms, secondary waste quantity and nature, technical viability, and life cycle cost and schedule estimates).
- Include data from both cold and hot testing if bulk vitrification is to be retained as an option.