

R&D Roadmap for Accelerating Hanford Tank Waste Mission

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*Review of the Continued Analysis of Supplemental Treatment of Low-Activity Waste at the
Hanford Nuclear Reservation (Meeting #2)*

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Needs for Long-Term R&D Investments

- ▶ Life-cycle costs for the Hanford tank waste mission represent the largest fraction of the EM liability. The tank waste mission is expected to extend into the next century under the current approach.
- ▶ EM is taking steps to identify and analyze opportunities and technologies to get waste safely out of tanks, treated and disposed of sooner
- ▶ DOE 2014 SEAB Task Force Report on Technology Development for EM
- ▶ NAS 2019 Independent Assessment of US DOE EM Science and Technology Activities and Program
- ▶ GAO audits of EM research and development program and Hanford tank waste programs
- ▶ Congressional Directions (SASC Proposed FY22 NDAA Language for Incremental and High-Impact Technology Development Programs)

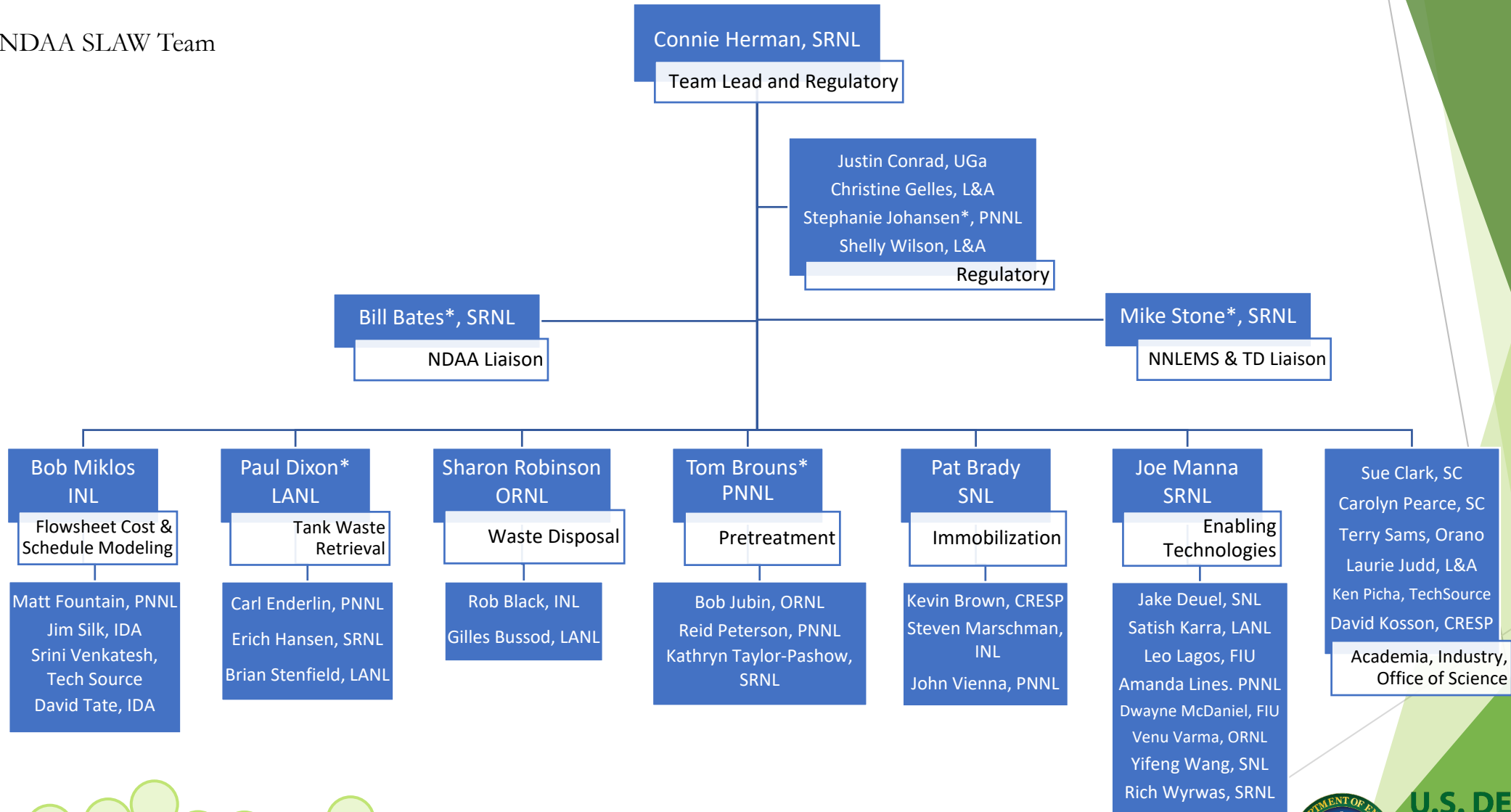


Charter and Federal Steering Committee

- ▶ Charter
 - ▶ Acting Assistant Secretary for Environmental Management (EM-1) commissioned the Network of National Laboratories for Environmental Management and Stewardship (NNLEMS) to conduct an evaluation of the tank waste mission at the Hanford Site and develop a R&D Roadmap for accelerating the mission
 - ▶ Identify R&D opportunities to provide cutting-edge technologies that can be used for improving efficiency, along with cost savings and schedule acceleration for the Hanford tank waste cleanup program
 - ▶ Use the roadmap to inform the EM budget request for technology development investments
- ▶ Federal Steering Committee
 - ▶ Reports to EM-1
 - ▶ Led by EM Senior Advisor for Laboratory Policy
 - ▶ Members include Assistant Manager of the Tank Farm Project; the Director of the EM Technology Development Office; the Director of Office of Budget and Planning
 - ▶ Manage, approve, and maintain the R&D Roadmap
 - ▶ Coordinate with other federal agencies, as necessary, during the development and implementation of the Roadmap to ensure that the Roadmap is consistent with current and planned basic research and innovation initiatives
- ▶ NNLEMS will coordinate closely with the NDAA Section 3125 study of supplemental LAW treatment
 - ▶ The R&D Roadmap will look more broadly at the entire Hanford tank waste mission including retrieval, treatment, and disposition of all waste streams, to provide input for long-term R&D investments.

NNLEMS Team

*NDAA SLAW Team



Approach

▶ Three Phases

▶ Phase 1 - Initiation and Information Gathering – Core Team

- ▶ Establish Core Team with relevant expertise in radioactive liquid waste retrieval, treatment, immobilization, disposition, and associated enabling technologies
- ▶ Review prior reports and proposals to gain an understanding of what has been previously proposed, the potential limitations, and understand DOE mission goals and priorities
- ▶ Collect previously identified barriers, suggested technologies and processing strategies, and potential bottlenecks

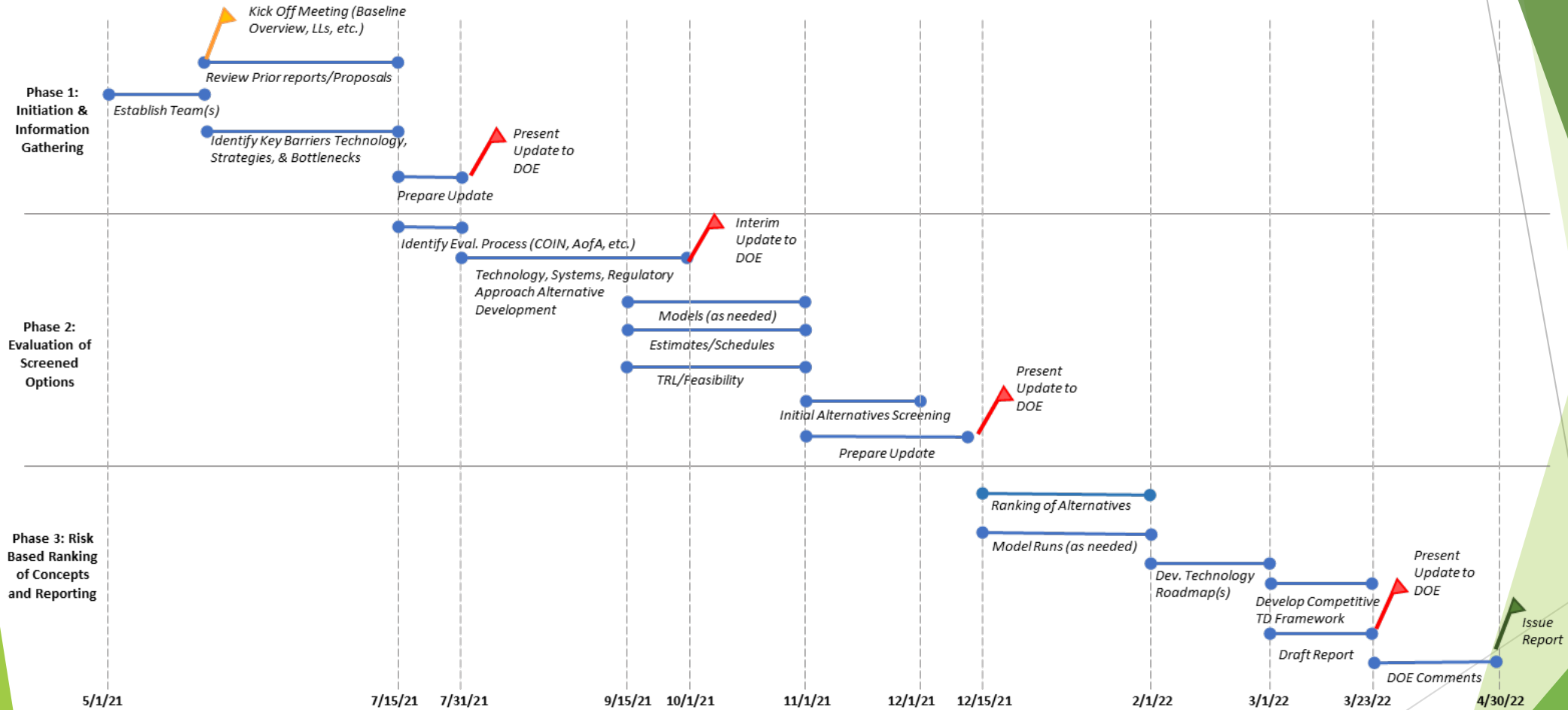
▶ Phase 2 - Evaluation of Screened Options with Expanded Subject Matter Expert Teams

- ▶ Establish contracts with universities and industry and engage other NNLEMS members
- ▶ Brainstorm gaps/pinch points and necessary technologies or fundamental science to eliminate
- ▶ Determine models and criteria for structured evaluation of technology options
- ▶ Perform a systematic review of the steps and unit operations of the mission using a structured flowsheet / technology evaluation process

▶ Phase 3 - Risk-Based Ranking of Concepts and Reporting

- ▶ Ranking of the proposed technologies and strategies in consideration of the gaps /risks and Hanford flowsheet
- ▶ Development of the roadmap with a preliminary cost / benefit analysis and recommendations for implementations

Schedule



Phase 1: Information Gathering

- ▶ Core team review of background documents including previous alternatives analyses, system planning documents, technology innovation documents, Grand Challenges, and six sigma/LEAN events
 - ▶ HLW Analysis of Alternatives
 - ▶ Evaluation of Alternate Tank Waste Disposition Pathways
 - ▶ System Plan (Rev. 2 through 9)
 - ▶ MAI – Supplemental LAW and TRU Waste Disposition
 - ▶ Supplemental LAW NDAA 3134 report
 - ▶ Evaluation of Alternative Strontium and Transuranic Separation Processes
 - ▶ One System River Protection Project Integrated Flowsheet Maturation Plan
 - ▶ Technology and Innovation Roadmap
 - ▶ SST Drainable Liquid
 - ▶ SST Retrieval
 - ▶ NAP The Hanford Tanks: Environmental Impacts and Policy Choices
 - ▶ Hanford Tank Waste to WIPP - Maximizing the Value of our National Repository Asset
 - ▶ Hanford Contact-Handled Transuranic Tank Waste Project
- ▶ Presentations provided by ORP and WRPS on system planning and alternatives evaluations to enable understanding of the current preferred alternatives or baseline Hanford tank waste treatment goals

Phase 1: Review of Information

- ▶ July 20 – 22, in-person Core Team meeting held with representatives from CRESP and TechSource, to discuss key observations and barriers from background reviews
 - ▶ Performed review of overall Tank Waste mission flowsheet to determine key decisions driving mission cost and schedule - Critical DOE Mission Level Decisions
 - ▶ Determined that technology evaluation should focus on treatment of the four types of wastes - HLW, LAW, TRU waste, and Secondary Wastes
 - ▶ Key decisions help to identify the roadmap and off-ramps for each waste type with identification of the barriers and technologies needed to address gaps or reduce risks
 - ▶ Identified most viable alternatives, strategies, and/or flowsheets based on expert opinion from this preliminary review
 - ▶ Developed a method for evaluation of each waste pillar using unit operation evaluation from tank retrieval to closure

Phase 1: Key Observations and Assumptions

- ▶ Baseline for System Plan 9 will be used as the baseline Hanford flowsheet to allow comparison for options analyses
- ▶ Given the duration of the mission (~50 yrs), R&D scope must include a long-term, high risk / reward component, which will require facilities that can be retrofitted with new technology (i.e., modular in nature) or new smaller facilities to be built
 - ▶ Flexibility in the treatment options or flowsheet should allow waste removal and treatment to proceed while solutions for more technically challenging wastes are pursued
 - ▶ New right-sized blending / staging tanks could improve throughput and lessen the reliability on existing DST's, which is currently a regulator concern
 - ▶ Alternate technical approaches may appear to be beneficial without increasing the technical risk but will need coordination with stakeholders

Phase 2: Evaluation of Screened Options

- ▶ August 30 – September 1, virtual meeting held with the expanded subject matter expert (SME) team (Core Team members and SMEs from academia, industry, and national laboratories)
 - ▶ Shared Core Team ideas and key findings with the expanded team of SMEs for consideration
 - ▶ Allowed relevant advances and expertise in other technology development programs to be brought forward for Hanford application
 - ▶ SMEs focused on identification of
 - ▶ Game-changing alternatives, technologies and approaches
 - ▶ Gaps/ pinch points in flowsheet for four waste pillars (HLW, LAW, TRU, and Secondary Waste)
 - ▶ Necessary technologies or fundamental science to eliminate gaps and pinch points
 - ▶ Strategies to address regulatory and programmatic concerns

Phase 2 and Phase 3: Path Forward

- ▶ Screening to be performed to consider
 - ▶ The technical maturity of the proposed technology
 - ▶ Anticipated schedules for the implementation of the proposed technology or strategy, including time necessary to fully develop a technology, complete construction and to begin treatment options
 - ▶ Compliance of the approaches with applicable technical standards
- ▶ Perform cursory modeling of the impact of the technology or strategy, and likelihood of technology development success in specific time frames, in the baseline flowsheet to estimate the impact on the proposed treatment timeline
- ▶ Summarize feasibility of proposed concepts and their potential benefits
- ▶ Update DOE on down-selected technologies and strategies with suggested flowsheet modifications that will be further evaluated and those that have been screened out

R&D Roadmap Development

- ▶ Draft R&D Roadmap to be submitted to DOE by April 30, 2022
 - ▶ Provide phased R&D activities to support budget formulation
 - ▶ Identify any challenges or barriers that must be addressed to implement the recommended technologies and strategies
 - ▶ Propose a framework for the competitive proposal process to implement and sustain the R&D Roadmap
- ▶ The roadmap will be used to inform the EM budget request for technology development investments