

NRC Perspective on Science and Technology for the Department of Energy's Defense Environmental Cleanup Program

December 5, 2017

Dr. Christianne Ridge
Sr. Risk Analyst

Division of Decommissioning, Uranium Recovery and
Waste Programs

U.S. Nuclear Regulatory Commission

Overview

- NRC role in DOE Environmental Management (DOE-EM) activities
- Observations: Science and Technology program for DOE-EM
 - Technology selection
 - Performance assessment maintenance
- Role of NRC independent research

NRC Role in DOE-EM Activities

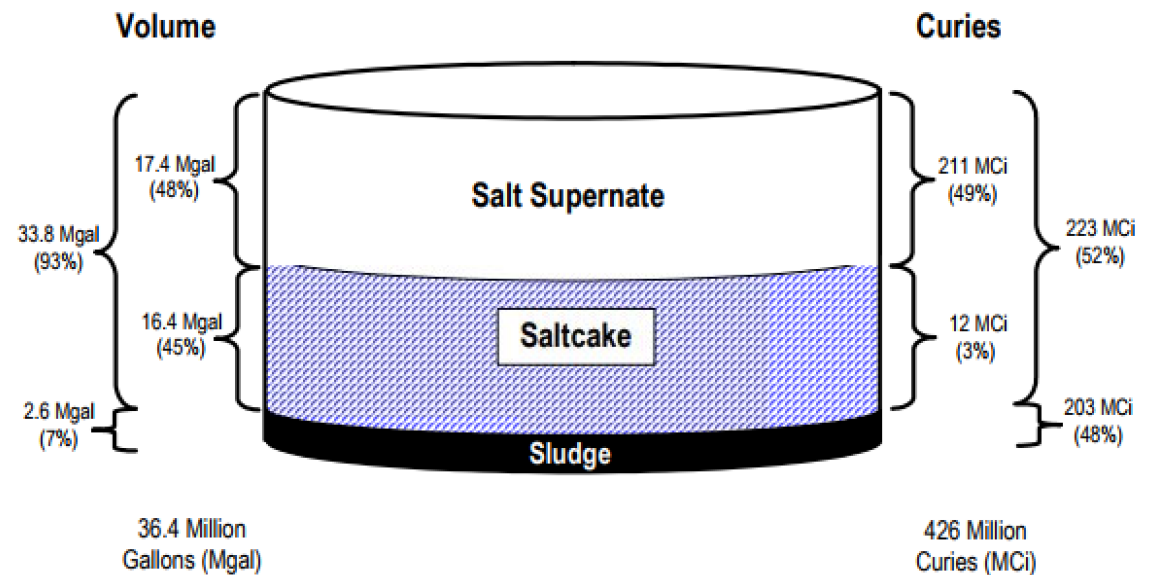
Waste Incidental to Reprocessing (WIR)

- Interagency agreement at Hanford and West Valley (consultation only)
- Congressionally mandated role at the Savannah River Site (SRS) and Idaho National Laboratory (INL)
 - DOE consults with NRC on whether waste is WIR (waste determinations)
 - If DOE determines waste is WIR, NRC monitors disposal activities and reports concerns to Congress

What is WIR? (theory)

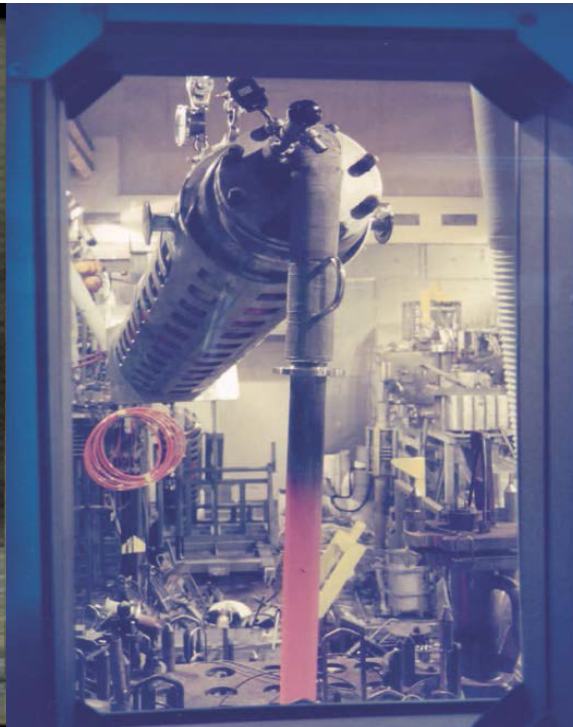
WIR is waste that would be high-level waste (HLW) based on its reprocessing origin, but can be managed as low-level waste because of the lower level of risk it poses. Lower risk can result from:

- Separation and, in some cases, further decontamination of low-level fraction of waste
- Residuals of a higher-activity fraction, left in place and further stabilized

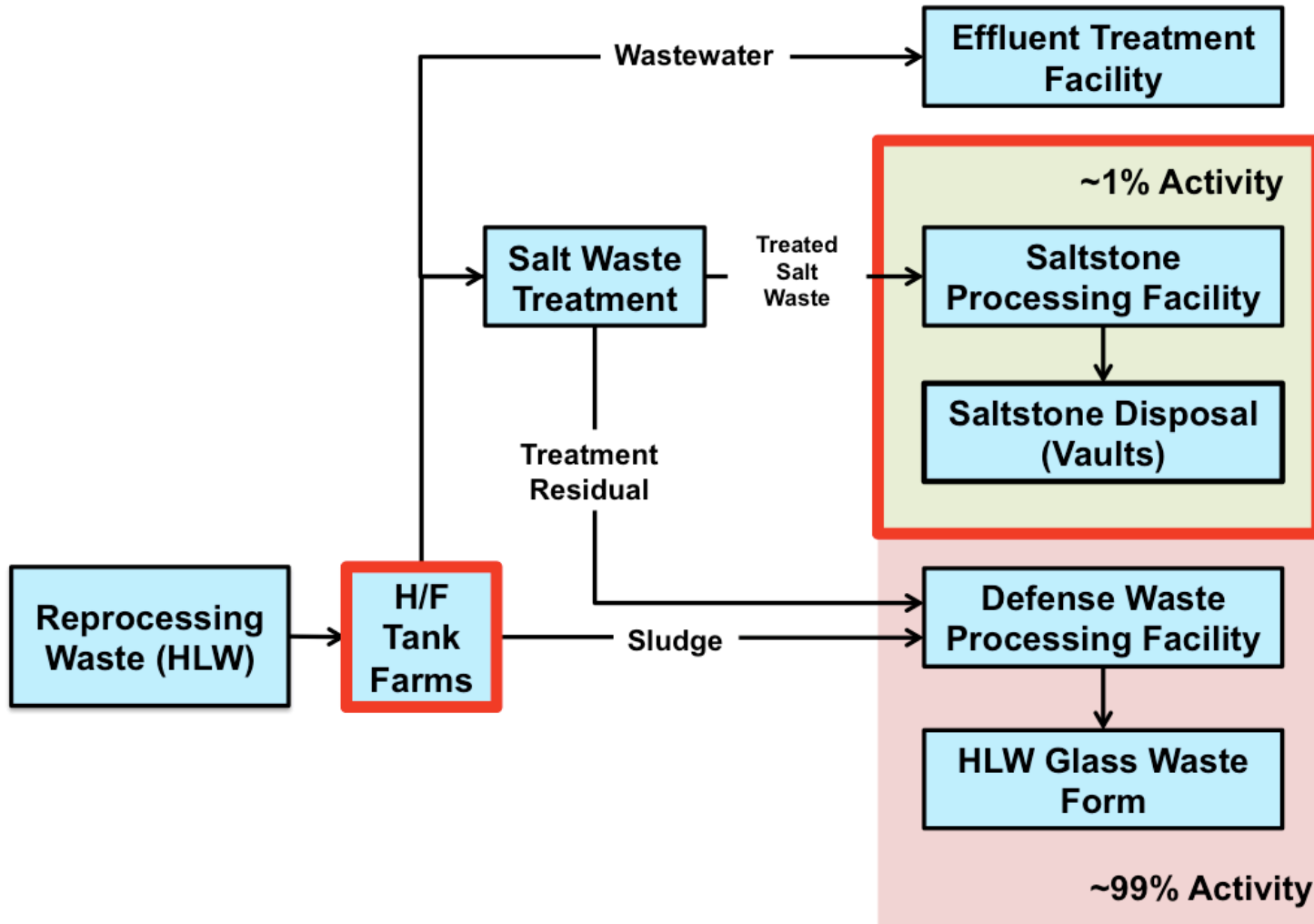


What is WIR? (practice)

- Residuals in HLW tanks or associated with equipment (e.g., melters)
- On-site disposal of treated low-level fraction (e.g., Low Activity Waste (LAW) at Hanford, saltstone at SRS)



Example: NRC Role at SRS



Criteria for Determining Reprocessing Waste is WIR (i.e., not HLW)

- Three sets of similar criteria:
 - Hanford – DOE Manual 453.1-1
 - West Valley – NRC West Valley Policy Statement
 - SRS and INL – National Defense Authorization Act for 2005 (NDAA), Section 3116
- Minor differences between the sets of criteria; however
 - All require removing key radionuclides to the maximum extent practical (or “technically and economically practical”)
 - All require disposal to meet the performance objectives of (or comparable to) 10 CFR Part 61 (DOE Manual 435.1-1 also has alternative requirements for waste identified as TRU)

Performance Objectives of 10 CFR Part 61, Subpart C

- §61.41 Protection of the general population from releases of radioactivity (dose limit & ALARA)
- § 61.42 Protection of individuals from inadvertent intrusion
- § 61.43 Protection of individuals during operations
- § 61.44 Stability of the disposal site after closure

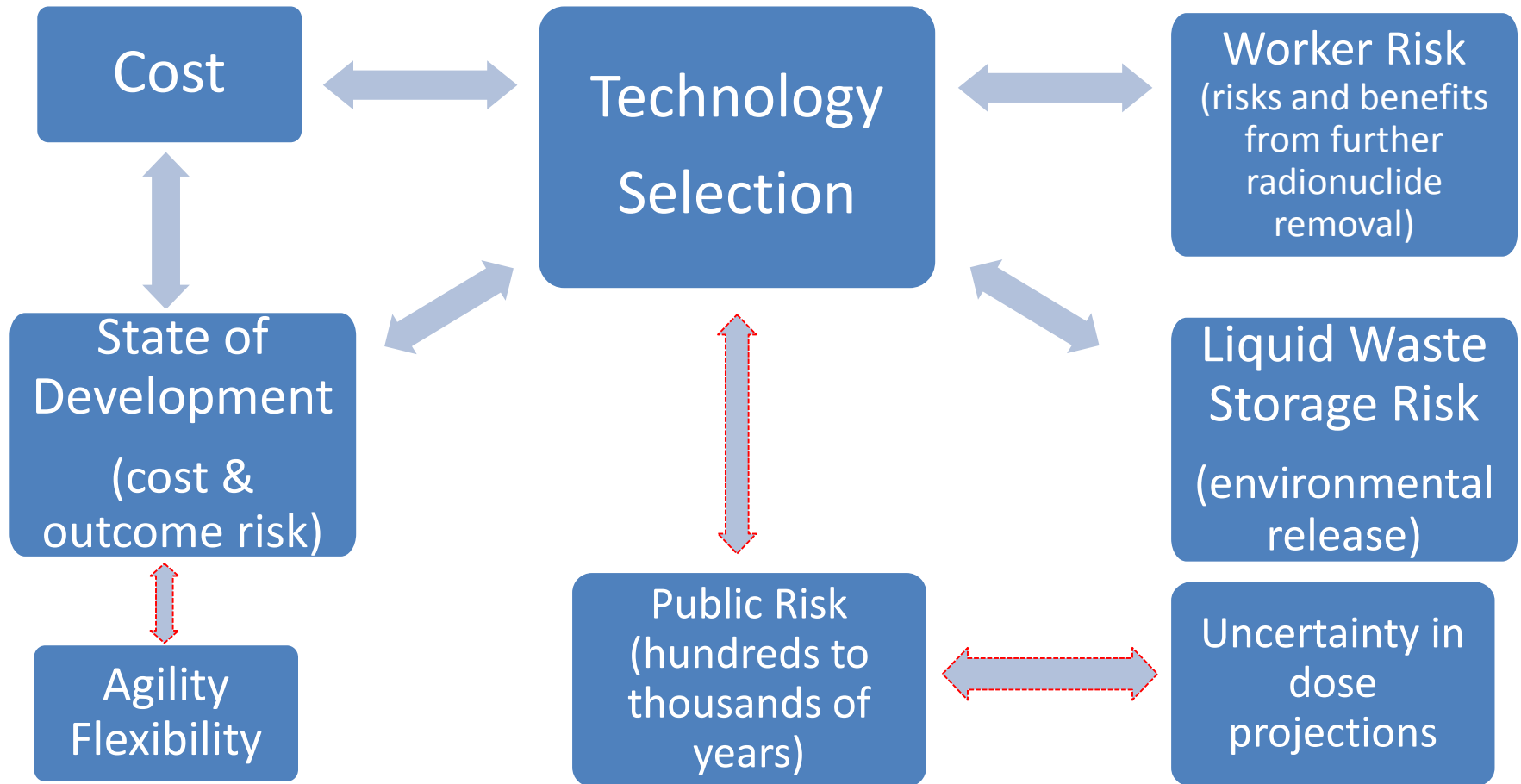
NRC Role in DOE Technology Selection

- NRC does not make specific technology recommendations to DOE
- NRC does review DOE technology selection processes
 - Prior to DOE waste determination, DOE consults with NRC on removal of key radionuclides to the maximum extent practical
 - During monitoring (when applicable) two of the performance objectives of 10 CFR Part 61 include “As Low as Reasonably Achievable” (ALARA) requirements (protection of the general population and protection of individuals during operations)

Technology Selection: Tank Cleaning

- DOE does not consult with NRC about bulk tank waste removal
- As part of evaluating radionuclide removal to the maximum extent practical, NRC consults with DOE on technologies selected for heel removal
- Different tank wastes and designs pose different challenges
- Many tanks require individualized technologies

Technology Selection and Risk Mitigation



GAO Report: Hanford Low Activity Waste (LAW)

GAO evaluated technical and non-technical challenges related to treatment of LAW at Hanford. Recommendations (subset):

- Technology selection should be based on the most current information about the state of technology development and expected performance
- DOE should consider using more than one approach to suit different waste chemistries

Example: Technology Selection for Salt Waste Treatment at SRS

- In 2005, DOE consulted with NRC on salt waste treatment at SRS. Proposed treatment did not target Tc-99 or I-129
- DOE basis
 - Projected low dose from Tc-99 and I-129
 - Lack of time to develop a suitable technology
- NRC questioned
 - Consideration of uncertainties in long-term dose projections
 - Use of current information to assess available technologies
 - Decision not to use interim processing time to develop Tc-99, I-129 removal technology for salt waste treatment at SRS

Example: Technology Selection for Salt Waste Treatment at SRS (continued)

Forward to 2017

- DOE continues wasteform research
- Greater DOE consideration of uncertainties in dose projections
- Tc-99, I-129 dominate projected dose from saltstone within 10,000 years
- DOE Salt Waste Processing Facility (SWPF) to begin operations in 2018 without significant removal of Tc-99 or I-129

Current Examples of Flexibility

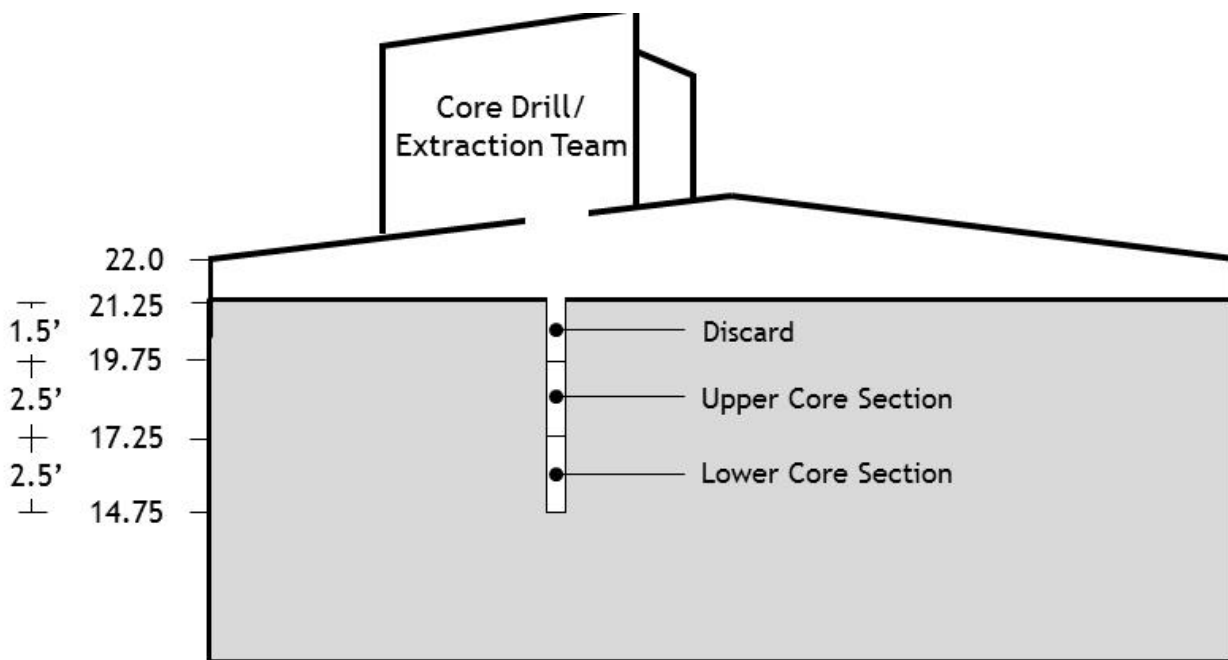
- SRS 2016 Liquid Waste System Plan demonstrates flexibility with a new technology introduced for Tank Closure Cesium Removal (TCCR)
- DOE-wide Technetium Management Program Plan describes forward-looking research areas integrated across sites

Science and Technology in DOE Performance Assessment (PA) Maintenance

- DOE Manual 435.1-1 directs DOE to perform PAs for its low-level waste facilities (including WIR sites)
- DOE performs laboratory and field research as part of its PA maintenance program
- In our monitoring role (when applicable), NRC reviews DOE PA maintenance research and evaluates effects on meeting the 10 CFR Part 61 performance objectives, including projections of long-term site performance

Example: DOE PA Maintenance Research on Saltstone Cores

In 2015, DOE collected cores of field-emplaced saltstone for wasteform validation and testing

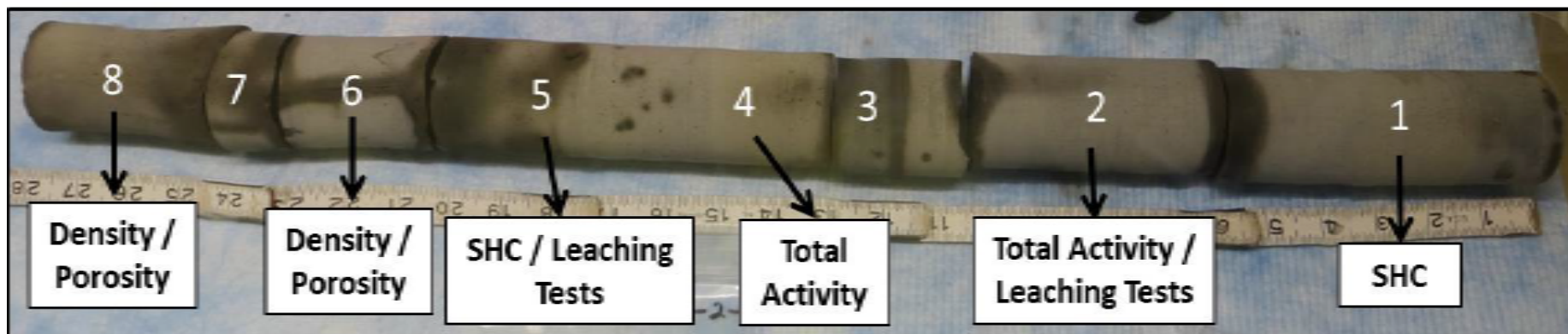


Example: DOE PA Maintenance

Research on Saltstone Cores (continued)

High-quality studies of cores of field-emplaced grout

- Reduce uncertainty in SRS dose projections
- Enable NRC to close certain technical questions in monitoring role at SRS
- Allow comparison of laboratory and field samples
- Enhance understanding of the system
- Have the potential to inform future DOE-wide decisions



NRC-directed Research at the Center for Nuclear Waste Regulatory Analyses (CNWRA)

Studies designed to supplement DOE work in some cases, independently verify DOE results in others

- Grout Test Bed informed NRC about
 - Grout structure and formation of fast pathways
 - Feasibility of acoustic monitoring of grout fracturing
- Column Studies informed NRC about
 - Groundwater conditioning by tank grout
 - Saltstone hydraulic properties and Tc-99 release

Concluding Observations

- NRC role limited to certain DOE-EM activities
- DOE balances many risks during technology selection
 - Uncertainties in long-term performance projections must be understood to support good decisions
 - Technology selection process must include avenue to revisit decisions in response to new information, within practical limits
 - Forward-looking research will enable future flexibility
- DOE PA maintenance research also can inform future technology selection
- NRC independence supported by NRC-directed research