

# Savannah River Site Defense Waste Processing Facility Recycle Wastewater

*A Waste Stream to be Disposed Under DOE's High-Level  
Radioactive Waste Interpretation*

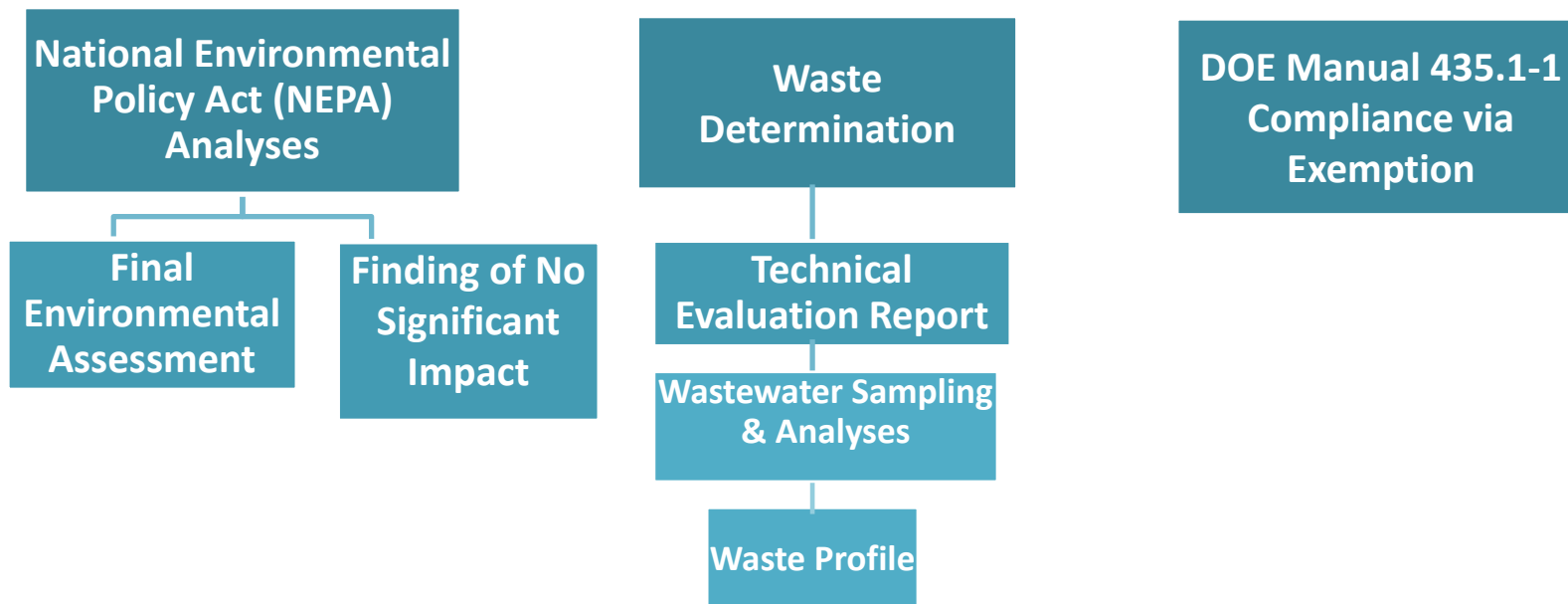
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Department of Energy  
September 2020

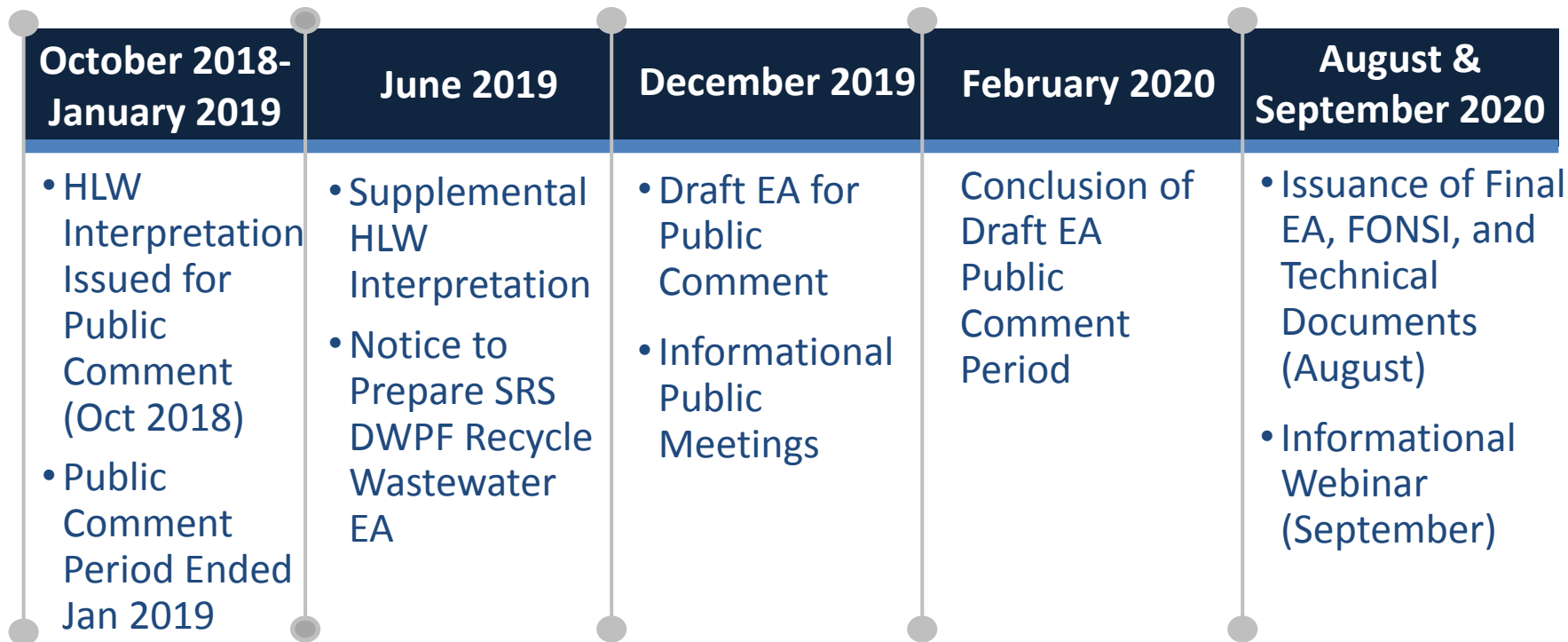
1. Introduction
2. Overview of Savannah River Site (SRS) Defense Waste Processing Facility (DWPF) Recycle Wastewater
3. National Environmental Policy Act (NEPA) *Final Environmental Assessment for the Commercial Disposal Of Defense Waste Processing Facility Recycle Wastewater From The Savannah River Site* (Final EA) and *Finding of No Significant Impact for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site* (FONSI)
4. Waste Determination/*Technical Evaluation for Non-High-Level Radioactive Waste (Non-HLW) Determination under the HLW Interpretation: Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site* (Technical Evaluation)
5. Technical Justification for an Exemption from Application of Waste Incidental to Reprocessing (WIR) Criteria in DOE Manual 435.1-1, *Radioactive Waste Management Manual* (Technical Justification for an Exemption)
6. Conclusion

- SRS DWPF recycle wastewater is first waste stream evaluated under DOE's interpretation of the Atomic Energy Act (AEA)/Nuclear Waste Policy Act (NWPA) definition of high-level radioactive waste (HLW).
- This process is part of DOE's science-based approach to managing radioactive waste and to identify potential disposal options for reprocessing waste that are fully protective of human health and the environment.

## *Completed Analyses for DWPF Recycle Wastewater*



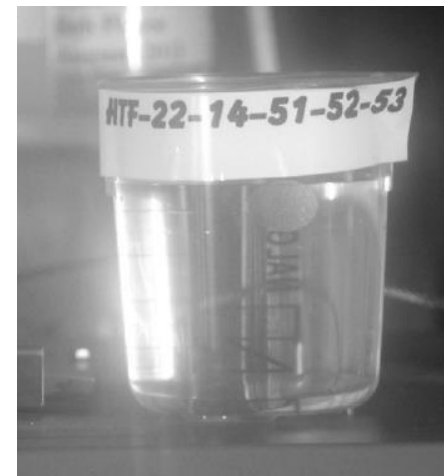
## Key Milestones



## 2. Overview of DWPF Recycle Wastewater

### What is DWPF Recycle Wastewater?

- Combination of several liquid waste streams consisting primarily of condensates (liquid waste formed from the cooling of off-gas vapors in the DWPF melter) from vitrification of tank waste at DWPF.
- Waste streams are consolidated on batch basis in Tank 22 at H Tank Farm.
- Key radionuclide is cesium-137.



Recycle wastewater lab sample



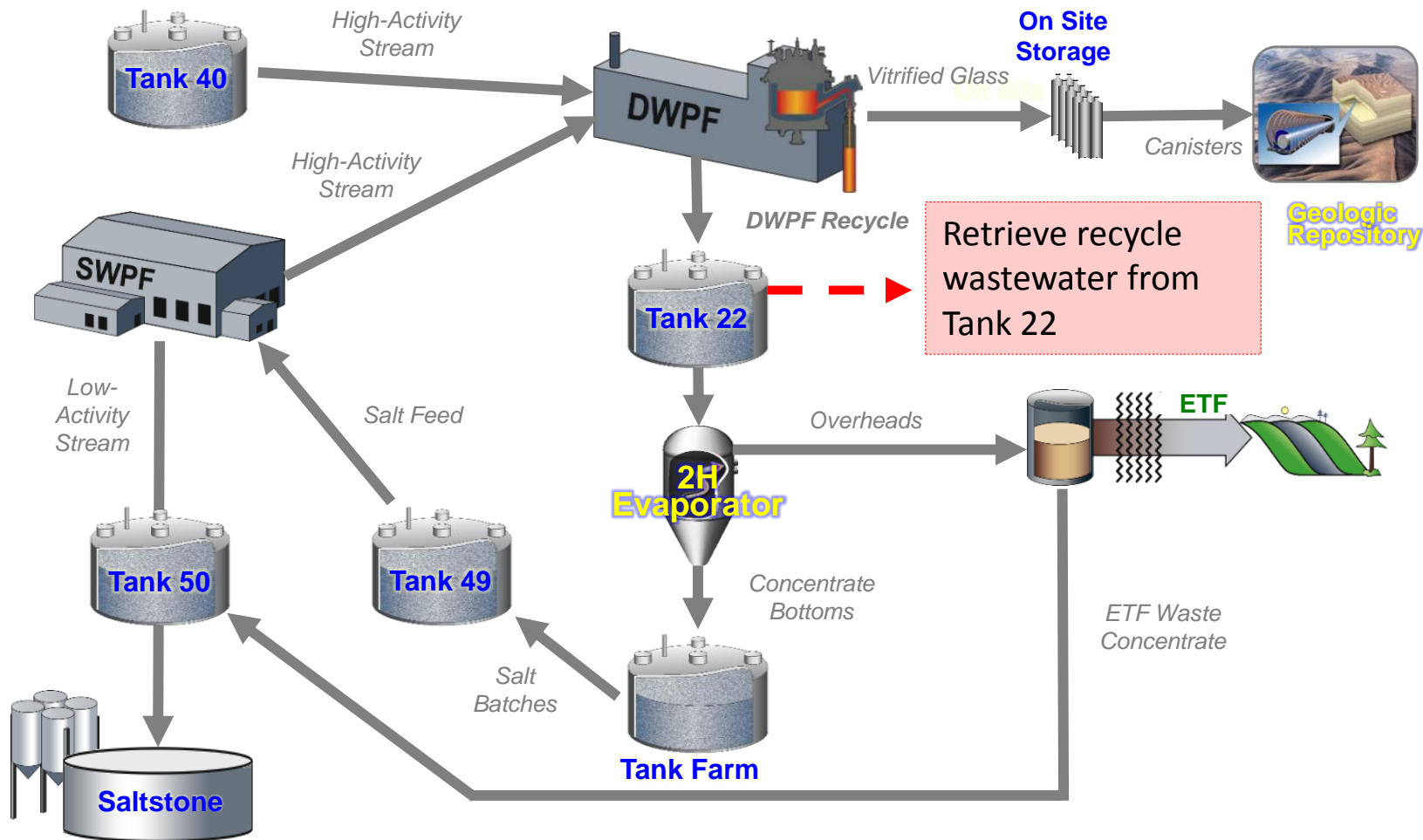
DWPF



Aerial view of Tank 22 and H Tank Farm

# 2. Overview of DWPF Recycle Wastewater Cont'd

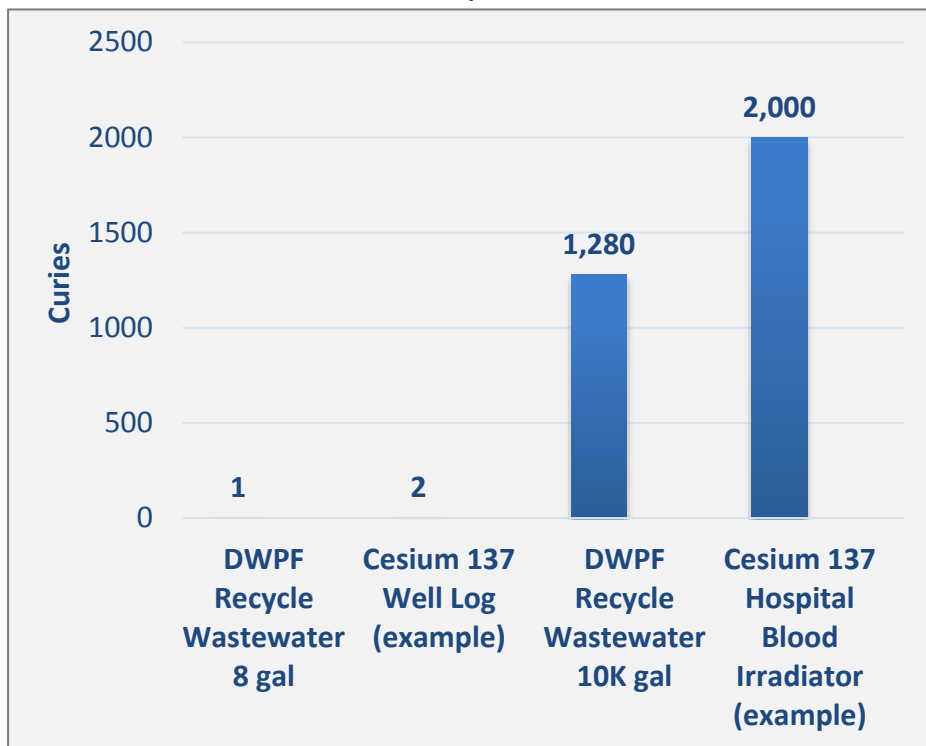
## Current Practice



# 2. Overview of DWPF Recycle Wastewater Cont'd

## How Radioactive is DWPF Recycle Wastewater?

- Up to 8 gallons (gal) of DWPF recycle wastewater as described in the FONSI contains less radioactivity than typical petroleum industry well logging device.
- DWPF recycle wastewater 10,000-gals as described in the Final EA contains less radioactivity than typical blood irradiators used at hospitals.



Sources: <https://www.osti.gov/servlets/purl/1148424> & <https://hps.org/meetings/50annual/50annual19.html>

## Comparison



Cesium-137 Blood irradiator (1,000 to 12,000 curies)



Petroleum industry well logging devices (typical activity 0.027 – 23 curies)

**Final EA Proposed Action:** Disposal of up to 10,000 gallons of stabilized (grouted) DWPF recycle wastewater from the SRS H-Area Tank Farm at a commercial low-level radioactive waste (LLW) disposal facility located outside of South Carolina and licensed by either the NRC or an Agreement State under 10 CFR Part 61.



Example of grouted waste simulant



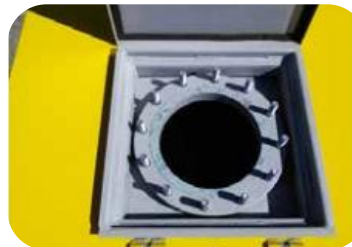
Example of grouted LLW in disposal container



Example of grouted LLW shipment



Example of Liquid LLW transport package



Example of Liquid LLW transport package

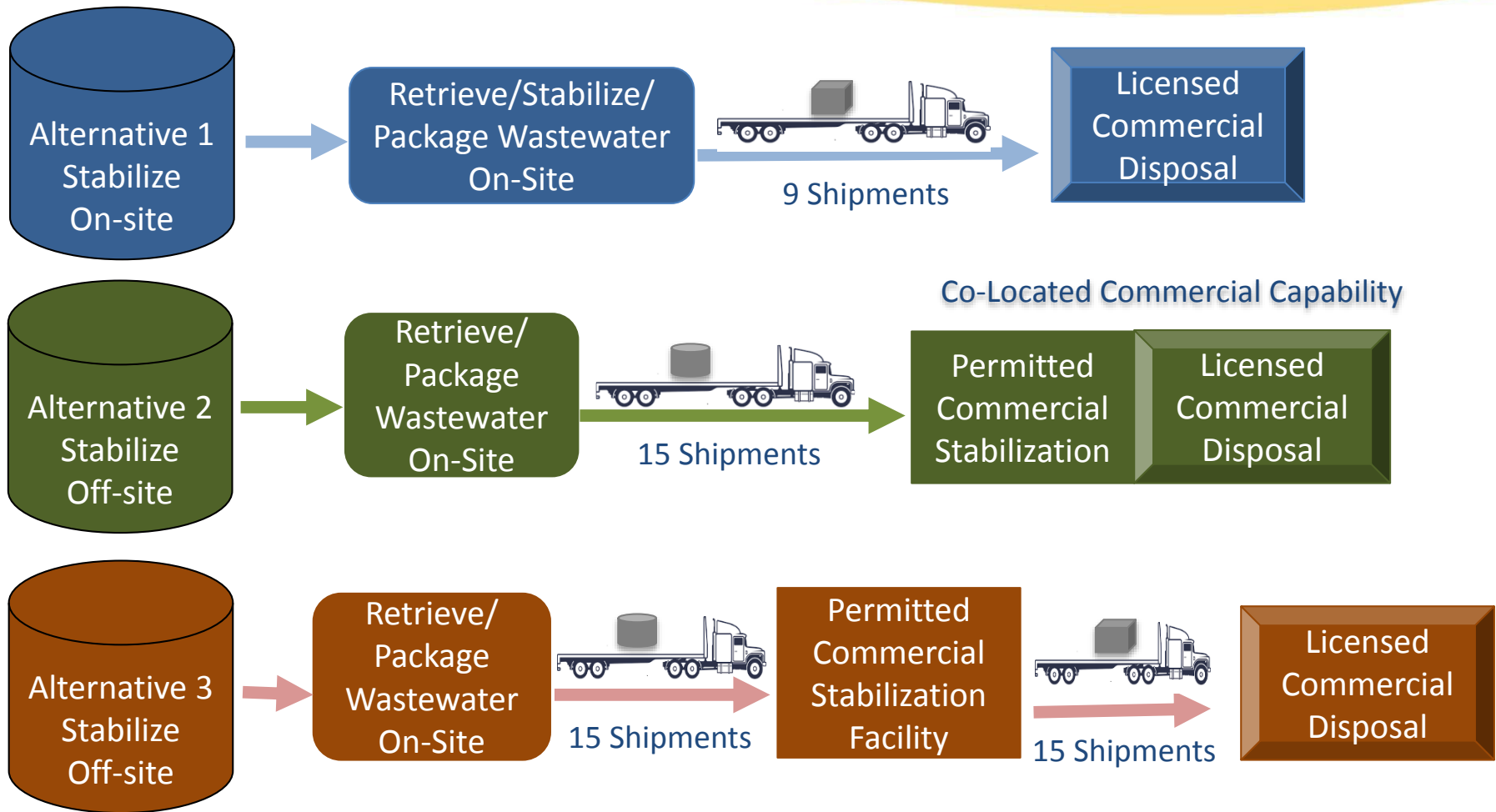


Commercial LLW disposal facility

All pictures are for illustrative purposes only. Actual DWPF recycle wastewater stabilization, packaging, transport, and disposal methods will comply with all applicable requirements.



# 3. NEPA: Final EA–Alternatives



No-Action Alternative also evaluated as required by 10 CFR 1021.321(c), *Requirements for Environmental Assessments*. Please note that the above shipments account for the up to 10,000 gallons analyzed in the Final EA. Shipments of the up to 8 gallons determined to be the path forward in the FONSI would be less.

- Potential environmental impacts for all three alternatives would be minor (Chapter 3 of Final EA).
- **No substantial** ground disturbance or routine releases of radiological or hazardous materials.
- **Minor impacts** to air quality, human health (under the following scenarios: normal operations, accidents, and intentional destructive acts), and waste management.
  - Transportation (assumes 9 to 30 truck shipments).
    - **Low probability** for non-radiological fatalities during a truck accident.
    - For Alternatives 2 and 3 (liquid waste shipments), extremely small probability for radiological exposure during a potential severe accident conditions and conservative assumptions.
- Sensitivity Analysis added to Final EA
  - Assessed potential small quantity shipments; radionuclide concentration variations; and package sizes and types.

### 3. NEPA: Final EA-Public Comments on Draft EA

- DOE received 19 comment documents: 3 requests for extension of public comment period (granted) and 16 comment documents on the Draft EA.
- DOE considered all comments in development of the Final EA.
- Comment documents and DOE responses are included in the Final EA.

#### Commenters

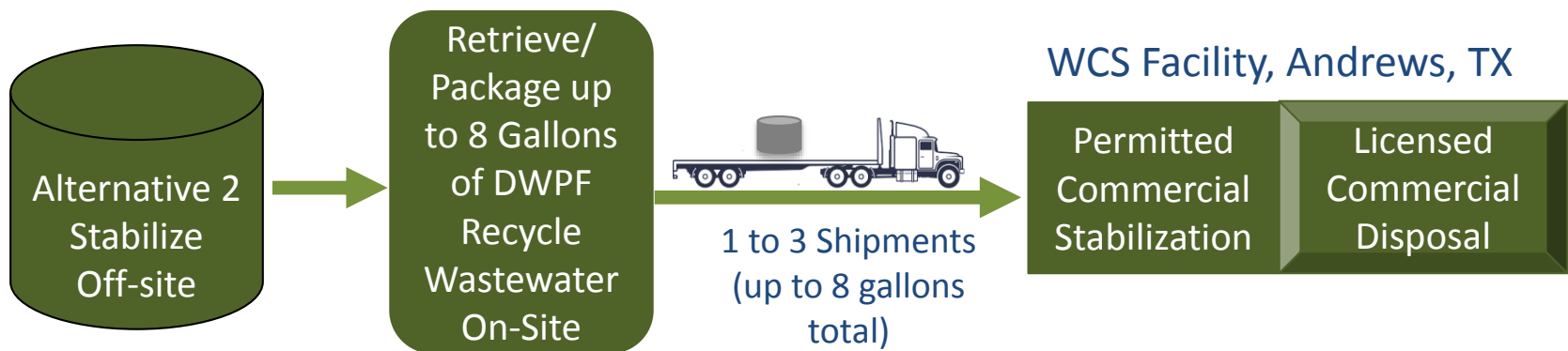
- State regulatory agencies (5):  
MO, OR, SC\*, TX\*, WA
- EPA Region IV
- Natural Resources Defense Council\*
- SRS Watch
- Energy Communities Alliance
- SRS Community Reuse Organization
- Citizens for Nuclear Technology Awareness
- Commercial vendors (2)
- General public (3)

\*Submitted two comment documents, including a request for extension of public comment period

#### Overview of Comment Topics

- Supportive and non-supportive statements
- Timeline for proposed action
- NEPA
- NRC oversight
- Questions on recycle wastewater generation
- Waste handling and transportation
- Need for deep geologic repository
- Technical suggestions

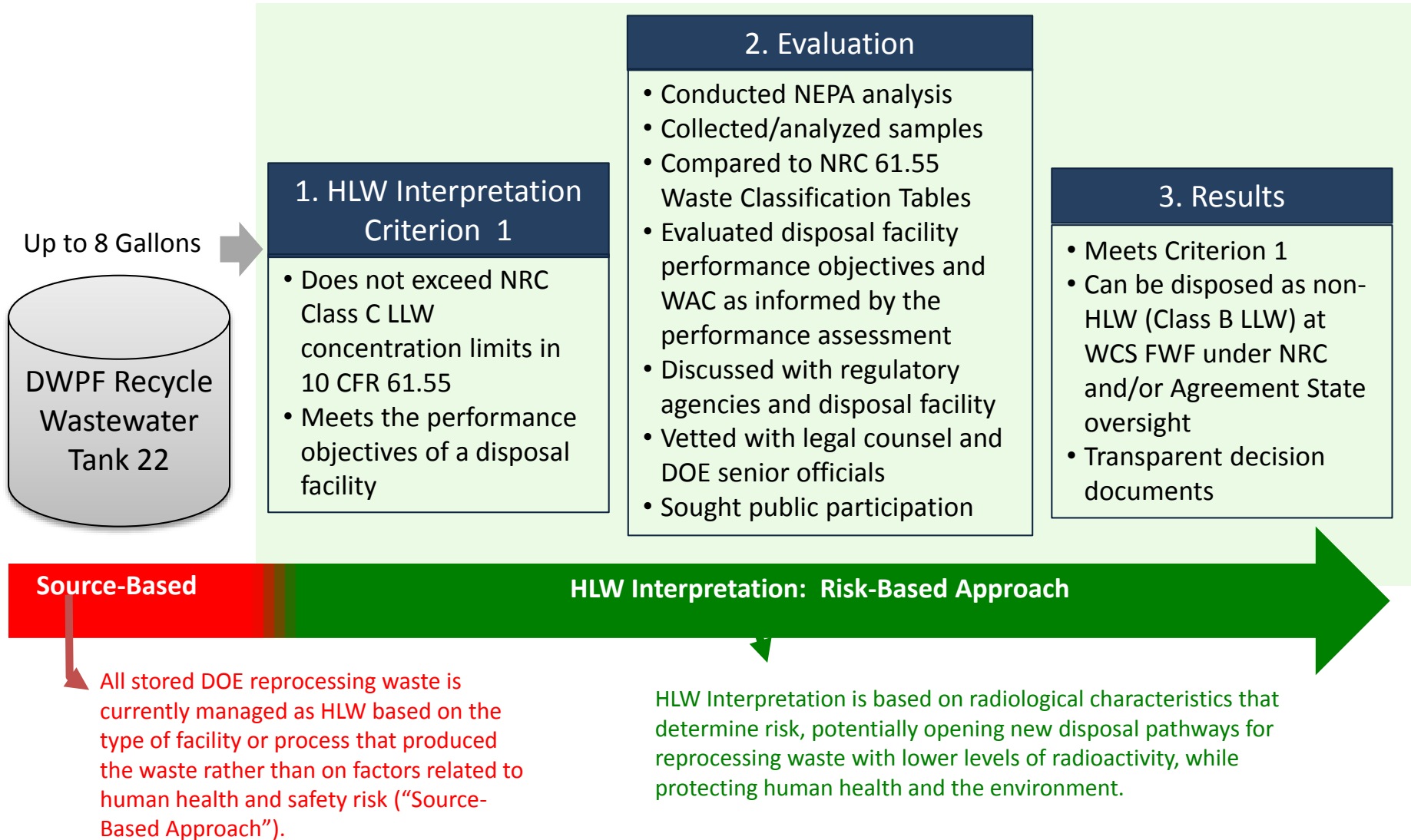
- The FONSI concludes that the Final EA analysis shows low environmental and human health impacts.
- As soon as August 26, 2020, DOE intends to initiate removal of DWPF wastewater from Tank 22 at SRS to begin the disposition process and within the next 12 months, DOE intends to initiate the shipment of a small quantity (up to 8 gallons) from the up to 10,000 gallons of DWPF recycle wastewater to the Waste Control Specialists, LLC (WCS) Federal Waste Facility (FWF) for treatment and disposal in accordance with the facility's waste acceptance criteria, license conditions, environmental permits, and all other applicable requirements.



# 4. Waste Determination/Technical Evaluation: Summary

- Based on the rationale and analysis in the Technical Evaluation, DOE concludes that a small quantity, up to 8 gallons, of DWPF recycle wastewater meets the HLW interpretation for disposal as non-HLW.
- The waste is determined to be Class B LLW.
- The waste may be safely disposed of at the WCS FWF as LLW in accordance with the facility's waste acceptance criteria (WAC), license conditions, environmental permits, and all other applicable requirements.
- Supported by representative sampling and analyses.

# 4. Waste Determination/Technical Evaluation: Summary (cont'd)



## 4. Waste Determination/Technical Evaluation: Waste Approval Process

**Shipment of LLW to a commercial disposal facility is subject to an established, rigorous approval process under the oversight of the NRC and/or an Agreement State.**



1. All generators must be certified by WCS under Quality Assurance program prior to shipping waste; DOE's contractor is certified by WCS\*.
2. Waste profile must be completed by the generator and approved by WCS demonstrating compliance with regulatory and facility requirements; DOE-SRS has completed a waste profile;\* No waste will be shipped until the profile has been approved by WCS.
- 3-5. Each shipment request must be pre-approved by WCS; Waste verification will be performed by WCS on incoming shipments (e.g. paperwork, dose rates); DOE will satisfactorily complete this process with WCS before any DWPF recycle wastewater is shipped.

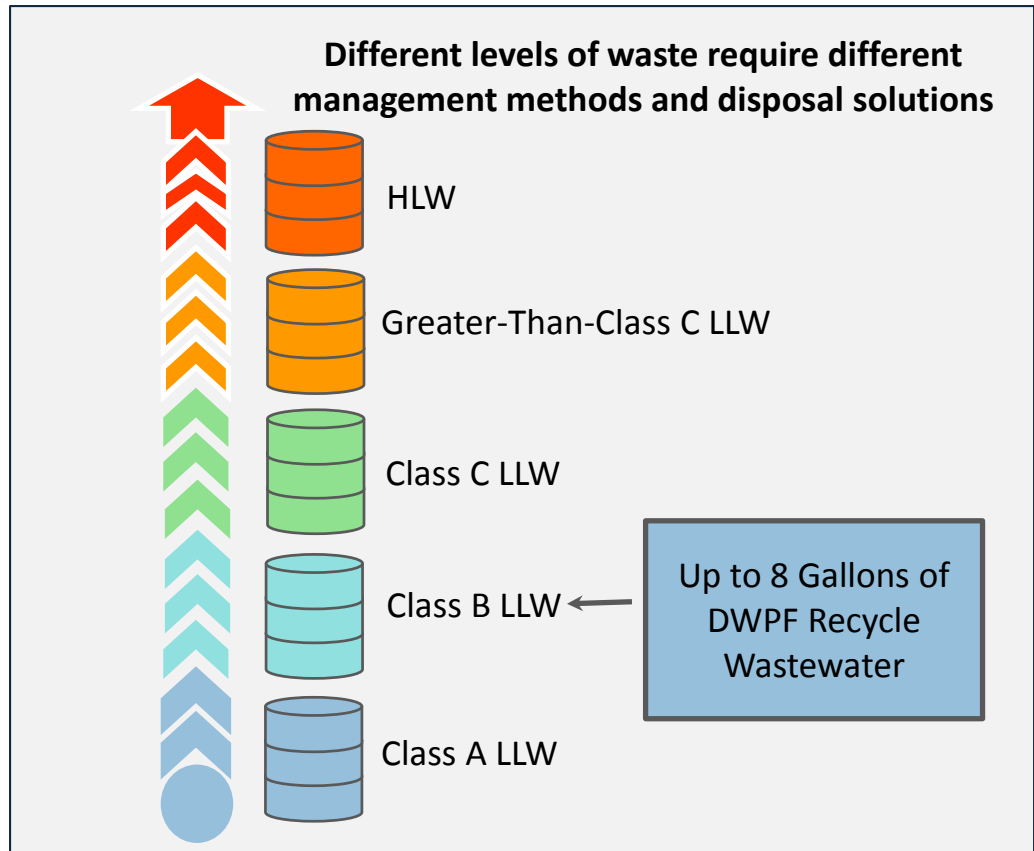
\*Copies of the certification letter and waste profile are included as appendices in *Technical Evaluation for Non-High-Level Radioactive Waste (Non-HLW) Determination under the HLW Interpretation: Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site*.

# 4. Waste Determination/Technical Evaluation: Compliance With HLW Interpretation Criterion #1

## HLW Interpretation

**Criterion 1: “Waste does not Exceed Concentration Limits for Class C LLW as Set Out in Section 61.55 of Title 10, Code of Federal Regulations”.**

- The up to 8 gallons of DWPF recycle wastewater is Class B LLW.
- Supported by representative sampling and laboratory analyses and comparison to 10 CFR 61.55 waste classification tables.
- Transparent, publically available documentation.





# 4. Waste Determination/Technical Evaluation: Compliance With HLW Interpretation Criterion #1 (cont'd)

Table 1. NRC Limits for Long-Lived Radionuclides  
10 CFR 61.55(a)(5)(i)

## Waste Classification Evaluation – Long-Lived Radionuclides

- DWPF recycle wastewater long-lived nuclide fractions and sum of fractions (SOF) for all nuclides do not exceed 0.1.
- Therefore, per 10 CFR 61.55(a)(5), the class of the waste shall be determined by Table 2, NRC limits for short-lived radionuclides.

Radionuclide	DWPF Recycle Wastewater Concentration	NRC Classification Limit	Nuclide Fraction
Carbon-14	0.000052 Ci/m <sup>3</sup>	8 Ci/m <sup>3</sup>	0.0000065
Technetium-99	0.00219 Ci/m <sup>3</sup>	3 Ci/m <sup>3</sup>	0.00073
Iodine-129	0.0000218 Ci/m <sup>3</sup>	0.08 Ci/m <sup>3</sup>	0.0002725
Alpha-emitting TRU nuclides with half-life of >5 years	0.08063 nCi/g	100 nCi/g	0.0008063
Plutonium-241	NA	3,500 nCi/g	0.0
Curium-242	NA	20,000 nCi/g	0.0
SOF for Long-Lived Radionuclides			0.0018

# 4. Waste Determination/Technical Evaluation: Compliance With HLW Interpretation Criterion #1 (cont'd)

## NRC Waste Classification Evaluation – Short-Lived Radionuclides

- SOFs exceeds 1 for Class A but does not exceed 1 for Class B.
- Therefore, the up to 8 gallons of DWPF recycle wastewater is Class B LLW.

Table 2. NRC Limits for Short-Lived Radionuclides 10 CFR 61.55(a)(5)(i)

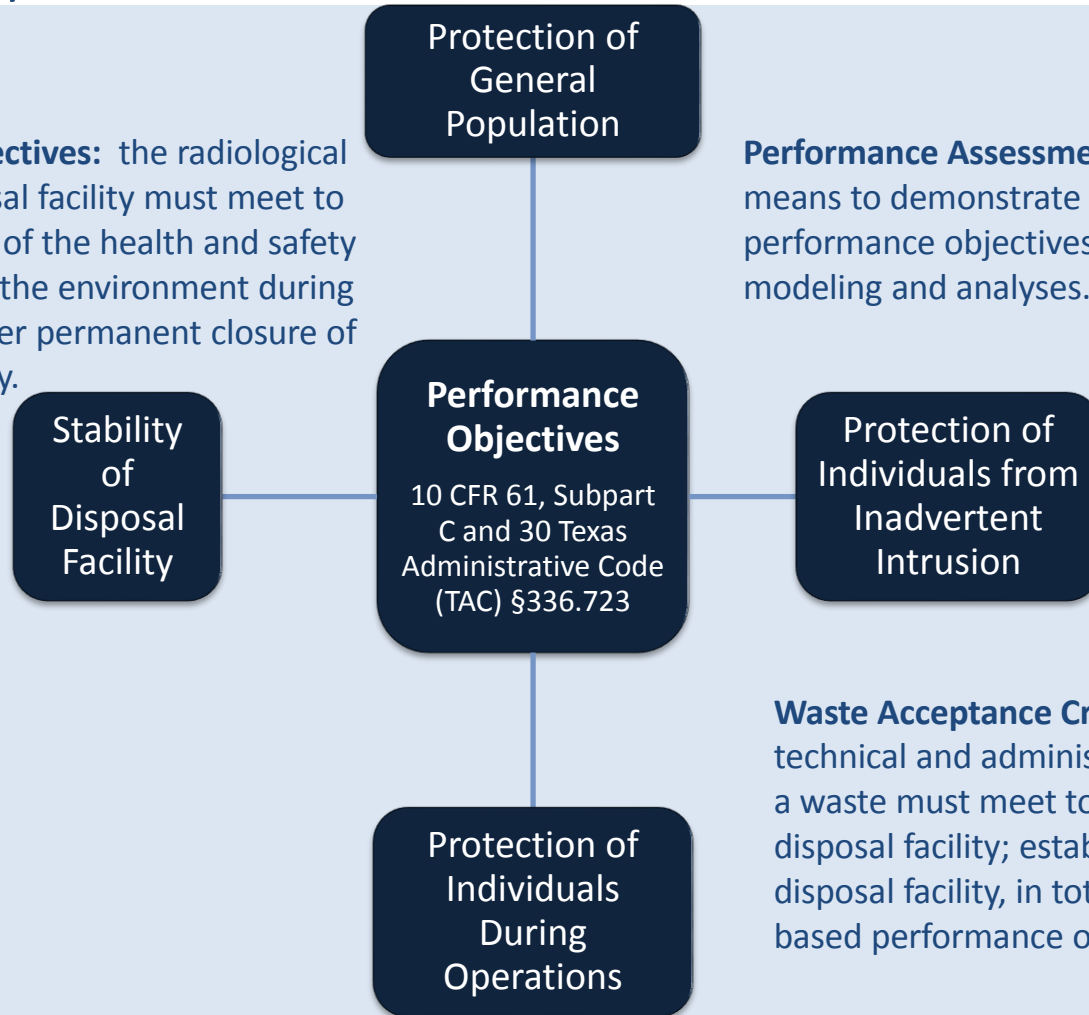
Radionuclide	DWPF Recycle Wastewater Concentration		Class A		Class B		Class C	
	Concentration	Limit	SOF	Limit	SOF	Limit	SOF	
Total of all nuclides with less than 5 year half-life	22.9	700	0.0327	Un-limited	NA	Un-limited	NA	
Tritium	0.0757	40	0.00189	Un-limited	NA	Un-limited	NA	
Cobalt-60	NA	700	0.0	Un-limited	NA	Un-limited	NA	
Nickel-63	NA	3.5	0.0	70	0.0	700	NA	
Strontium-90	0.00791	0.04	0.19775	150	0.00005	7000	NA	
Cesium-137	24.2	1	24.2	44	0.55	4600	NA	
SOF for Short-Lived Radionuclides			<b>24.43</b>		<b>0.55005</b>		NA	

# 4. Waste Determination/Technical Evaluation: Compliance With HLW Interpretation Criterion #1-Performance Objectives

## HLW Interpretation Criterion 1: “Meets the performance objectives of the disposal facility.”

**Performance Objectives:** the radiological standards a disposal facility must meet to ensure protection of the health and safety of individuals and the environment during operation, and after permanent closure of the disposal facility.

**Performance Assessment:** the technical means to demonstrate compliance with performance objectives are through modeling and analyses.



**Waste Acceptance Criteria (WAC):** the technical and administrative requirements a waste must meet to be accepted at a disposal facility; established to ensure the disposal facility, in total, meets its safety-based performance objectives.

## 4. Waste Determination/Technical Evaluation: Compliance With HLW Interpretation Criterion #1-Performance Objectives (cont'd)

- Most recent PA for the WCS FWF (approved by the State of Texas in 2019) continues to demonstrate compliance with all applicable performance objectives.
- The up to 8 gallons of DWPF recycle wastewater would constitute negligible inventory contribution to the PA WCS modeled and therefore would not negatively impact continued compliance with performance objectives.
- As long as the up to 8 gallons of stabilized DWPF recycle wastewater meets WCS FWF WAC requirements, it will not affect facility's performance objectives.
- DWPF recycle wastewater would meet WCS FWF WAC.

### **Stabilized DWPF Recycle Wastewater Meets WCS FWF WAC**

- ✓ Negligible contribution to License volume and curie Limits (26 million ft<sup>3</sup>/5.6 million curies)
- ✓ Class A, B, or C LLW
- ✓ No Free Liquids
- ✓ No Prohibited Items (e.g., pyrophoric material)
- ✓ Packaged in accordance to specifications (e.g., meet Dept. of Transportation requirements; contain only one approved waste stream, etc.)
- ✓ See WCS FWF Generator Handbook for complete WAC  
<http://www.wcstexas.com/wpcontent/uploads/2015/08/FWF-Generator-Handbook-Revision-4.pdf>

## 5. Technical Justification for an Exemption

- In accordance with exemption process outlined in DOE Order 251.1D, *Departmental Directives Program*, Appendix E, EM developed the Technical Justification for an Exemption which was approved by the Under Secretary of Science.
- The Exemption request justified the need for DWPF recycle wastewater to be exempted from the WIR requirements contained in DOE Manual 435.1-1, Chapter II, Section B.
  - The Exemption applies to up to 8 gallons of DWPF recycle wastewater.
  - DOE Manual 435.1-1 Chapter II, Section B(2)(b) does not apply as the DWPF recycle wastewater is not transuranic waste.
- DOE's interpretation of the AEA/NWPA definition of HLW:
  - Is fully protective of public health, safety, and the environment.
  - Commensurate with the level of protection required by DOE Manual 435.1-1, Chapter II, Section B.
  - Does not conflict with existing federal laws and regulations.

- DOE has completed detailed NEPA analyses and technical analyses for the DWPF recycle wastewater under an open and transparent process.
- DOE intends to initiate removal of DWPF wastewater from Tank 22 at SRS to begin the disposition process and within the next 12 months, DOE intends to initiate the shipment of a small quantity (up to 8 gallons) from the up to 10,000 gallons of DWPF recycle wastewater to the WCS FWF for treatment and disposal in accordance with the facility's waste acceptance criteria, license conditions, environmental permits, and all other applicable requirements.
  - DOE continues to plan and work towards implementation.
- This science-based approach to manage radioactive waste enables DOE to better address one of its largest environmental risks by potentially allowing the opening of new disposition paths for waste that has been stored for decades at DOE sites with no near-term path for disposal.

**Information on DOE's HLW interpretation and SRS DWPF recycle wastewater including NEPA and technical documents can be found at: <https://www.energy.gov/em/program-scope/high-level-radioactive-waste-hlw-interpretation>**