The Oregon Department of Energy has developed an initial response to US DOE’s proposed waste classification determination, published on October 4th.

Limited paper copies are available on the back table.

To read the letter online, visit:

https://tinyurl.com/wmacwir-or
Hanford Radioactive Tank Wastes

Waste Management Area–C
Waste Incidental to Reprocessing

Oregon Public Meeting

Jeff Burright
October 16, 2018
Decision: Can the waste left over in the C-Farm Tanks at Hanford be managed as “low-level waste”?

If it is **high-level**, it must be disposed in a Deep Geologic Repository for high-level radioactive waste, which does not yet exist in the United States.

If it is **low-level**, the tanks and residual waste heels can be closed in place forever at Hanford, assuming long-term safety can be “reasonably expected.”
Hanford’s Single-Shell Tanks
Tank Pipelines and Diversion Boxes
High Level Radioactive Waste and Waste Incidental to Reprocessing (WIR)
Definition of High Level Waste

Nuclear Waste Policy Act of 1982:

The term "high-level radioactive waste" means—

• (A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and

• (B) other highly radioactive material that the (Nuclear Regulatory) Commission, consistent with existing law, determines by rule requires permanent isolation.
Is this high-level waste?

Does it result from reprocessing spent nuclear fuel?
  - **Yes**: Then it is high-level waste.
  - **No**
    - Can it meet criteria, developed by DOE and NRC, to demonstrate that it would not pose an unacceptable risk if managed as low-level or Transuranic waste?
      - **Yes**: Then it’s still High-Level Waste.
      - **No**: Then it is **Waste Incidental to Reprocessing** and does not require deep geologic disposal.

Unless...
Timeline of the Waste Incidental to Reprocessing Determination Process

1990s
- Via written correspondence, DOE and NRC develop 3 criteria for treating tank waste HLW to be WIR.

1999
- DOE sued by NRDC, Oregon, and others, challenging DOE authority to reclassify HLW.
- Congress passes the NDAA Section 3116, which establishes a separate WIR process. Section 3116 does not apply to West Valley or Hanford.

2002
- DOE issues Order 435.1, establishing the WIR determination process.

2003
- Appeals court vacates prior ruling, stating the issue is not yet “ripe”.

2004
- Judicial ruling in favor of NRDC et al.

2005
- DOE issues WIR for tank farm at Savannah River Site using Section 3116.

2006
- DOE issues WIR for treated tank waste at Savannah River Site using Section 3116.

2012
- DOE Order 435.1 used to issue WIR for waste melters at West Valley.

2015
- DOE Order 435.1 used to issue WIR for 3 gallons of grouted Hanford waste shipped to Texas.

2017
- DOE issues WIR for tank farm at Idaho National Lab using Section 3116.

2018
- WMA-C WIR Evaluation at Hanford using Order 435.1.
Waste Incidental to Reprocessing (WIR) Criteria Application
Waste Incidental to Reprocessing (WIR) Criteria

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, Performance Objectives; and

3. Are to be managed, pursuant to DOE’s authority . . . provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55 . . .

Source: DOE M 435.1-1 – Chapter II, Section B (2)
#1: Removal of Key Radionuclides to the Maximum Extent Tech. & Econ. Practical

- Tank retrievals use several technologies
- Simple sluicing with supernatant
- More aggressive jet spraying (e.g. MARS)
Tank Retrievals

- Other technologies (e.g. Foldtrak)
Retrieval in C-Farm: 16 tanks in 19 years
After tank waste retrieval

Tank C-110 – with the Foldtrak near the center
Difficult waste retrieval

Tank C-102 – difficult sludge heel
Figure 5-1. Photographs of As-Received, Post-Final Retrieval Residual Waste Samples from Tanks 241-C-103, 241-C-106, 241-C-202, and 241-C-203.

Source: "Hanford tank residual waste – Contaminant source terms and release models" (Deutsch et al. 2011).
1.7 million gallons of waste retrieved
67,000 gallons of waste remain
473,000 Curies of radioactivity remain
96% retrieval efficiency
C-Farm Retrieval Efficiency

Remaining Waste (gallons)

99% retrieval goal (approximate)
Residual Radionuclides in WMA-C Tanks

Curie values decayed as of 2015
Residual Radionuclides in WMA-C Tanks

Curie values decayed as of 2015
Half Lives (in Years)

- Strontium-90: 29 years
- Cesium-137: 30 years
- Samarium-151: 90 years
- Plutonium-239: 24,100 years
- Technetium-99: 211,000 years
- Iodine-129: 15.7 million years
Residual Constituents by Mass (kg)
Residual Constituents by Mass (kg)
Part 61 sets performance objectives for low-level radioactive waste disposal facilities (which the Hanford tanks would become if closed on site).

1. 25 millirems/year for any member of the public.
2. 500 millirems/year to an inadvertent intruder after active institutional controls are removed (assumed to occur after 100 years).
3. Various groundwater standards (4 mrem/yr beta; alpha; radium; uranium; others)
4. Protective assurance period for 1,000 – 10,000 years.

Conceptual tank closure design (still under development)
How is future risk determined?

Contaminants

People ("representative future person")

Water to drink, soil to inhale, food to eat, etc.
Future Exposure Scenarios in the C-Farm Performance Assessment

- Evaluates a future residential user, living 100 meters away, who grows crops, keeps livestock, and drinks groundwater.
- Evaluates an intruder after 100 years who lives onsite and drills a groundwater well through a buried pipeline.
- Model extends to 10,000 years.
- Assumes cap fails after 500 years.
C Tank Farm closure modeling shows maximum of 30 pCi/L in downgradient water wells, 1,500 years from now

- Drinking water standard = 900 pCi/L

Maximum dose to a future resident estimated at 0.1 millirem/year

- DOE standard = 25 mrem/yr
- Background radiation =
  - ~90 mrem/yr (Hanford area)
  - ~350 mrem/yr (US average)

Oregon: Uncertainty in the modeling
Inadvertent Intruder modeling shows a maximum acute dose to a well driller = **36 millirem**

- Standard = 500 mrem

Maximum chronic dose to an agricultural receptor spreading drill cuttings on crop land = **8.2 mrem/year**

- Standard = 100 mrem/year
#3: Waste to be incorporated in a solid physical form & meet Class C LLW concentrations

- DOE applying NRC guidance to satisfy this criterion.
- What is the definition of “incorporated” vs. “encapsulated”?  
- Do Class C concentrations have to be met everywhere, or just at times and places likely to be encountered by people in the future?
Decision Scope:
Tanks vs. Soils
How do documents affect the ecosystem?

- Performance Assessment
- WIR Evaluation
- DOE Closure Plan
- RCRA Closure Plan

Hanford TPA Appendix I Performance Assessment

Composite Analysis required for DOE Closure plan

Soil remediation under RCRA and CERCLA

Groundwater remediation under CERCLA

Contamination from other sources
Oregon’s Recommendations for the WIR

1. Additional uncertainty analysis is needed for compound effects.

2. Include the full “decision package” in this WIR, including Composite Analysis and Performance Assessment Maintenance Plan.

3. Include Oregon and the public in developing the PA Maintenance Plan. (How will we know later if today’s decision is wrong?)
Oregon’s Recommendations for the WIR

4. Oregon expects to see a WIR evaluation for past tank leaks to soil.

5. DOE should look for more powerful waste retrieval technologies before grouting the tanks.

6. Do not proceed with tank closure actions at least until the Waste Treatment Plant is operational.