

# Transuranic Waste

Presentation to Hanford Advisory Board  
River and Plateau Committee

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High Level Waste		No where to dispose (Yucca Mtn)
Transuranic Waste		Dispose at WIPP
Low Level Waste	Class A	Dispose at ERDF
	Class B	Dispose at ERDF
	Class C	Dispose at ERDF
	> Class C	Not into ERDF

Class A-B-C is NRC classification. Category 1-2-3 is DOE classification.  
 If waste qualifies as high level -- it is high level, even if it also meets the criteria for transuranic or low level.

## High Level Waste

spent nuclear reactor fuel, and waste  
created by reprocessing spent nuclear reactor fuel

Note: This type of waste is defined based on its origin.  
In contrast: Low level waste, and Transuranic waste are based on  
the concentration of certain radionuclides.

Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years,

except for:

- (1) High-level radioactive waste;
- (2) Waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or
- (3) Waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

# Transuranic Waste History

## Before 1970

- \* No Waste category for “TRU”
- \* The Low Level Waste Policy Amendments Act had defined LLW as radioactive waste not classified as high-level waste, spent nuclear fuel, or by-product material specified as uranium or thorium tailings and waste
- \* Wastes containing transuranic radionuclides were managed as LLW, and were disposed of by shallow land burial.

## After 1970

- \* DOE established a transuranic waste category in 1970
- \* Original 1970 threshold concentration was 10 nCi/g, changed to 100 nCi/g in 1984

10 CFR 61.55 (a)(8) Determination of concentrations in wastes. “The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste.”

[https://www.directives.doe.gov/directives/current-directives....](https://www.directives.doe.gov/directives/current-directives...)

Implementation Guide for use with DOE M 435.1-1. Chapter III

**“The mass over which the activity is divided in making the waste determination is the waste matrix. This includes the waste material itself as well as any stabilization media that must be added to meet waste acceptance criteria** for mobility, physical form, structural stability or free liquids. The mass of added shielding, the container, or any rigid liners is not included in the calculation.”

“Given the definition provided in the public law and its application pursuant to DOE M 435.1-1, the **determination of transuranic waste should be made at the time of waste certification**, that is, each time the waste is transferred to another person or facility.”

*“A waste is generated and placed in bags within 55-gallon drums. The waste has been characterized and certified as transuranic waste in accordance with the waste acceptance criteria of the facility receiving the waste. This **same waste, if required to undergo solidification to enable shipment and disposal, could be re-certified** after treatment by the treating facility as low-level waste.”*

<https://www.directives.doe.gov/directives/current-directives...>  
Implementation Guide for use with DOE M 435.1-1. Chapter III

**“Dilution of a transuranic waste stream to reclassify the waste as low-level waste (i.e., reducing the concentration to less than or equal to 100 nCi (3700 Bq) per gram) is not permitted by the Department.** While it is recognized that in the course of stabilizing a waste stream some changes in waste concentration may occur, actions to dilute a waste stream below the concentration limits for transuranic waste are prohibited. It is also recognized that **actions taken to process a waste stream for safety or technological reasons that are justified, may result in the waste being reclassified after processing as low-level waste.**

*Example: Due to the moisture content of a transuranic waste sludge, the waste does not meet the WIPP WAC. The site evaluates several treatment options taking into consideration factors such as worker exposure, waste minimization, cost and complexity of the treatment process and disposal facility waste acceptance requirements. The treatment process selected involves adding grout to the transuranic waste sludge to eliminate free liquids resulting in a solidified waste form that contains transuranic radionuclides in concentrations less than 100 nCi (3700 Bq) per gram and meets the waste acceptance criteria for a low-level waste disposal facility.”*

## Hanford Example #1

Exhausts ducts at 308 building.

Building history suggested about half the ducting would be TRU.

Ducting and glove boxes from 308 building initially designated by the project as TRU are sent to Permafix (off-site north Richland commercial facility).

Size reduction (disassemble, cutting), packaged to meet WIPP WAC, shipped to 200 Area Central Waste Complex (CWC) for non destructive assay (NDA). Most ended up TRU, some didn't.

Note each waste package is certified TRU non-TRU at CWC.

## Hanford Example #2

### Soil Beneath 324 B Cell Leak

Limited data (Cone penetrometer pushes, two soil samples about one teaspoon each)

Conceptual site model:

- \* Leaked around the perimeter of the floor, soaked down thru sandy soil.
- \* Sand in a thin ring immediately beneath the perimeter has about 5x TRU levels.
- \* Sand very nearby is uncontaminated.
- \* TRU isotopes bound more readily with soil, didn't travel as much as Cs & Sr.
- \* Extremely high levels of Cs & Sr. High dose rate.
- \* High dose rate is controlling factor in retrieval, handling, packaging.
- \* Very small volume of soil with TRU levels of radionuclides. This lies within a many fold larger volume of high dose rate soil requiring remote controlled equipment.

Retrieval equipment is not anticipated to have surgical precision to grab just the higher TRU isotope soil without also grabbing adjacent soil.

Grout may be best method to retrieve soil, and pump soil/grout mixture from ground into disposal containers ("containers" likely to be other hot cells that needed to be grout stabilized).

Waste designation will be required for disposal containers.

## Hanford Example #3

### 618-10/11 Vertical Pipe Units

22 inch diameter, five 55 gallon drums welded end-to-end  
48 inch diameter overcasing of VPU and potentially contaminated soil  
immediately adjacent. Provides containment during augering.

Discrete disposal bottles, cans, some lead shielded, waste from hot cells.  
Many discrete items ARE anticipated to have radionuclides > TRU.  
Most of the volume of each VPU is material that IS NOT anticipated > TRU.

Cone penetrometer pushes at each VPU. (50 @ 618-11) (94 @ 618-10)  
No surprises, some parts of some VPU pretty high dose rate, most are low dose rate.

High dose rate discrete items are worker dose & air release challenges out-of-ground.  
Container rupture and mixing high into low/no dose adjacent material:  
dose control, air release control, reactive material control

Sample waste using top to bottom core. Basis for initial TRU or not-TRU.  
If not TRU, end of sampling. Add grout in-ground with auger to treat for lead.  
If initially TRU, retrieve into 55-gallon drums, assay each drum for new TRU decision.

## Low Level Waste. 10 CFR 61.55 Waste classification

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part061/part061-0055.html>

Classified as class A, class B, class C, or greater than class C

Can be classified based on certain **long-lived** radionuclides.

Class A, does not exceed 1/10<sup>th</sup> table values. Class C, does not exceed table values

### Classification into class A, C, >C due to long-lived rads

Radionuclide	[curies per cubic meter]	[nanocuries per gram]
C-14	8	
C-14 in activated metal	80	
Ni-59 in activated metal	220	
Nb-94 in activated metal	0.2	
Tc-99	3	
I-129	0.08	
Alpha emitting transuranic nuclides with half-life greater than 5 years		100
Pu-241		3,500
Cm-242		20,000

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Can be classified based on certain **short-lived** radionuclides.

### Classification into class A, C, >C due to short-lived rads

Radionuclide	Class A limit [curies per cubic meter]	Class B limit [curies per cubic meter]	Class C limit [curies per cubic meter]
Total of all nuclides with less than 5 year half-life	700		
H3	40		
C-60	700		
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600