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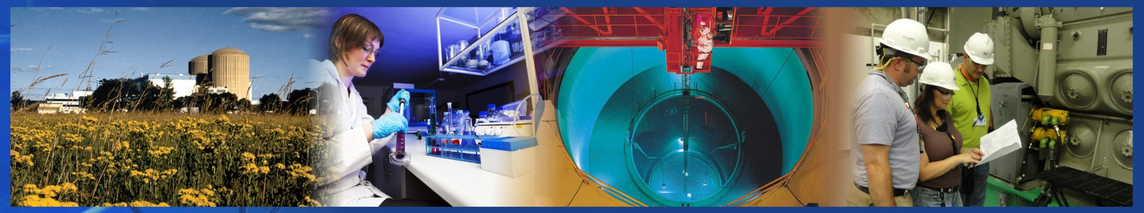


Office of Nuclear Material Safety and Safeguards

Greater-Than-Class C (GTCC) Waste Disposal

What is GTCC Waste?

Title 10 of the *Code of Federal Regulations* (CFR) Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," includes a waste classification system for low-level radioactive waste (LLRW). In 1982, the NRC categorized LLRW as Class A, Class B, or Class C. Waste that exceeded the Class C limit (GTCC waste) was identified as generally not acceptable for near-surface disposal.

Who is responsible for GTCC waste disposal?

The Federal Government is responsible for the disposal of GTCC LLRW under the Low-Level Radioactive Waste Policy Amendment Act (LLRWPAA) of 1985.

The responsibility for disposal of GTCC LLRW has been assumed by DOE.

The LLRWPAA further requires that commercially generated GTCC waste "shall be disposed of in a facility licensed by the Nuclear Regulatory Commission."

No disposal site exists for GTCC waste.

What are the types of GTCC waste?

Three categories for GTCC waste are (1) activated metals, (2) sealed sources, and (3) other waste.

- Activated metals include irradiated components from reactors, as well as some from operations and decommissioning.
- Sealed sources are used in medicine, research, and industry.
- Other Waste consists of contaminated equipment, rubble, scrap metal, filters, soil, and solidified sludges.

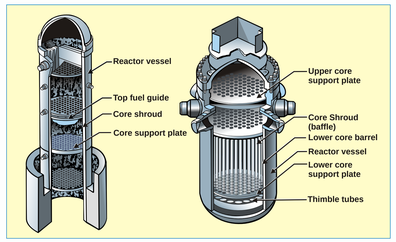


Figure 1: Location of activated metal for Boiling Water Reactor (BWR) (Left) and Pressurized Water Reactor (PWR) (Right)
Source: Sandia National Laboratories, "Basis Inventory for Greater-Than-Class C Low-Level Radioactive Waste Environmental Impact Statement Evaluations Revision 1," 2008.

What is the current and projected volume of GTCC waste?

Table 1: Current Stored and Future Projected Volumes of GTCC LLRW
Source: U.S. Department of Energy, Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste, 2011.

GTCC LLRW	In Storage		Projected		Total Stored and Projected	
Waste Type	Volume (m^3)	Activity (MCi)	Volume (m^3)	Activity (MCi)	Volume (m^3)	Activity (MCi)
Groups 1 and 2						
Activated Metals (RH)	59	1.4	1,900	160	1,959	161.4
Sealed Sources (CH)	a	a	2,900	2	2,900	2
Other Waste (CH)	42	0.00091	1,600	0.024	1,642	0.02491
Other Waste (RH)	33	0.0042	2,300	0.51	2,333	0.5142
Total	134	1.41	8,700	163	8,834	164

CH = contact-handled (waste), RH = remote-handled (waste), 1MCi = 37,000 TBq

[a] NRC licensees currently possess sealed sources that may become GTCC waste when no longer needed by the licensee; the estimated volume and activity of those sources are included in the projected inventory.

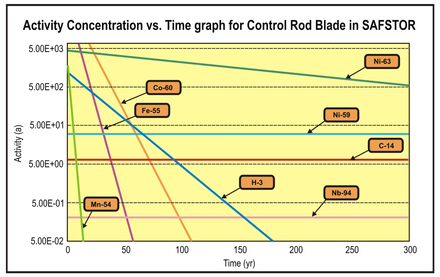
What is NRC Current Activity on GTCC waste?

- A performance-based approach could categorized GTCC waste, which could help determine the level of isolation for disposal needed to protect the health and safety of the public and the environment.
- The application of a site-specific and performance-based approach to GTCC waste stream characterization could assist the NRC in developing specific technical requirements for future disposal of various types of GTCC waste.

Sections 1a,1b and 2 provide examples to demonstrate a performance-based approach that examines and evaluates the radiological characteristics of GTCC waste.

1a) Activated Metals

Figure 2: Decay of radionuclides in BWR control rod blade assembly
Source: Idaho National Engineering Laboratory, "Greater-Than-Class C Low-level Radioactive Waste Characterization-. Estimated Volumes, Radionuclide Activities, and Other Characteristics," 1991, DOE/LLW-114.



The concentration of Ni-63 in activated metals will be the primary radionuclide of concern.

1b) Activated Metals

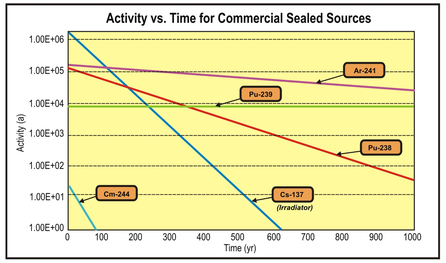
Table 2: Comparison of decay time for internal components in PWR and BWR
Source: Idaho National Engineering Laboratory, "Greater-Than-Class C Low-level Radioactive Waste Characterization-. Estimated Volumes, Radionuclide Activities, and Other Characteristics," 1991, DOE/LLW-114.

Activated Metal Component	Sum of the Fractions Value	10 CFR Part 61 Class C Decay Time (yr)
PWR Thermal Shield	0.6887	500
PWR In-Core Detector	0.8223	500
PWR Thimble Plug	0.9012	500
BWR Control Rod Blade	0.9997	7,850
PWR Instrument Sring	0.9981	8,390
PWR Core Barrel	0.9929	11,700
BWR Local Power Range Monitoring	0.9998	13,320
String	0.9998	24,560
PWR Thimble Tube	0.9991	128,700
BWR Core Shroud	0.9026	150,500
PWR Core Baffle	0.9984	227,820

The majority of the activated metal components in the PWR and BWR will be classified as GTCC waste and may require a higher degree of isolation.

2) Sealed Sources

Figure 3: Decay of commercial sealed sources over time
Source: Sandia National Laboratories, "Basis Inventory for Greater-Than-Class C Low-Level Radioactive Waste Environmental Impact Statement Evaluations Revision 1," 2008.



The GTCC sealed sources can be divided into two groups: industrial cesium sources and commercial plutonium, americium and curium sources.

Conclusion:

- Because some GTCC waste remains potentially dangerous for a few thousand years, it must be safely processed and disposed of in a manner that protects future populations and the environment.
- Based on the characteristics of the various GTCC waste streams, the majority of the activated metal waste will require a higher degree of isolation due to the activity concentrations of C-14, Ni-59, and Nb-94. However the sum of the fraction method indicates that the thermal shield, in-core detectors, and thimble plug assemblies in PWRs may be categorized as Class C waste.
- The projected Cs-137 sealed source activity concentration after 500 years indicates that the Cs-137 irradiators may not require a much higher degree of isolation for disposal.
- It appears that some of the GTCC waste could be managed differently from the majority of the remaining GTCC waste volume.

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