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Concentration Averaging in the Here and Now

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Concentration averaging defined

- Concentration averaging is the mathematical averaging of radionuclide concentrations in waste
- Its purpose is to determine waste classification (A, B, or C).
- The hazard (class) of the waste determines the controls for safe disposal.

Radionuclide	Concentration, Ci/m³		
	Class A limit	Class B limit	Class C limit
Total of all radionuclides with <5-year half-life	700	n/a	n/a
H-3	40	n/a	n/a
Co-60	700	n/a	n/a
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

Source: "Waste classification," in the NRC's disposal regulations.

Why it matters

- Safety—an inadvertent intruder into a disposal site hundreds of years from now will be protected by limiting concentrations, especially those from "hot spots" such as highly radioactive sealed sources or pieces of activated metal
- Compliance—generators, processors, and disposal facilities must comply with the waste classifications cited above
- Sampling and surveying must be conducted to characterize waste. The number of samples or measurements needed depends on averaging constraints in the BTP.
- Workers receive radiation exposures from sampling and surveying

Some examples

- Activated metals are mixed in a disposal container, with some much more radioactive than others
- Reactor vessel and internals are disposed together with averaging of the hot internals over the entire volume (Trojan reactor vessel

* John Cochran, Sandia Labs, was the NRC contractor for revisions to the Concentration Averaging BTP and a key contributor to this work.

The NRC is revising its guidance for averaging concentrations of radionuclides in classifying low-level waste to address today's challenges.

Existing NRC Guidance (1995)

- The current guidance is in the BTP on Concentration Averaging and Encapsulation.

Users of the Guidance

- Users include generators and processers that ship waste to disposal facilities, regulators, and licensed disposal sites

What's changed since 1995

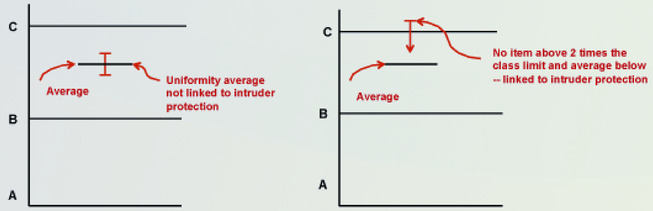
- The Barnwell, SC, disposal facility closed to most U.S. generators in 2008, leaving them with no disposal option for their Class B and C waste. As a result, here has been increased interest in finding alternative disposal paths for certain Class B/C wastes.
- The NRC adopted a risk-informed, performance-based regulatory approach in late 1990s.
- Industry proposed large scale blending for Class B/C waste ion exchange resins
- A post-9/11 dirty bomb threat from sealed radioactive sources increased the need for disposal options

Proposed revisions to NRC guidance to address today's challenges

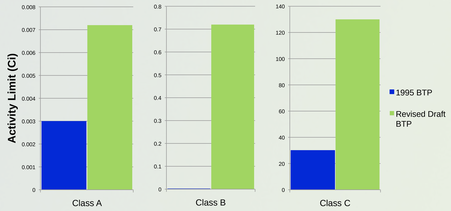
Factor of 2 vs. Factor of 1.5

1995 BTP—concentrations of individual nuclides, in individual items <1.5 times the respective average of each nuclide in mixture

Revised Draft BTP--concentration in individual items <2 times the class limit for that nuclide



Revisions in recommended source and small items activity limits—Cs-137



Guidance for blending LLW is now performance-based. Previously, *inputs* to a mixture were limited. Now, guidance is tied to *output*.

Revised guidance allows for many different alternative approaches to protect an intruder.

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