Applying Today's Release Criteria to Yesterday's Releases

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Revisit of Past & Current Practices

- Topic was originally prepared and presented at the 1998 RETS-REMP Workshop in Durham, NH
- Although an “old” topic, still relevant today
- Provides a historical perspective behind current practices for material free-release

Outline -- Where We'll Go

- Past Practice for Free-Release
- Past History
- Current Guidance for Free-Release
- Implications
  - Dose Rate vs. Concentration Release Limits
  - Dose Implications of Releases
- What's Next?

Past *Release* Criteria

- Adopted from approach used to release equipment
- Surface: Less than 100 corrected counts/minute via “pancake probe” frisk
- ***Volume: Less than 0.1 mR/hour via frisk with a “hot dog” GM probe***
- Used until late 1980’s (and beyond!)

Past History

- 1974: Regulatory Guide 1.86, “Termination of Operating Licenses for Nuclear Reactors”

- 5,000 dpm/100 cm^2 -- equates to about 750 dpm/probe area (~15 cm^2)

- Basis for <100 cpm “free release” frisking criterion

- Nearest we came to a “release limit”

Past History (continued)

- 1981: I&E Circular 81-07

- provided acceptable limits of detection for portable survey equipment (intended for surface contamination)

- 1981: Draft Interim Position -- Follow-up to IEC-81-07

-for volume contamination, recommended LLD of 5E-7 μCi/g (tied to effluent LLD)

- <u>NOT A RELEASE LIMIT!!</u> – shift in philosophy

Past History (continued)

- 1985: Internal NRC Memo

- Recommended LLD for potentially contaminated oil: 1.5E-8 μCi/g (tied to environmental LLD)

- 1988: Information Notice 88-22, "Disposal of Sludge from Onsite Sewage Treatment Facilities"

- "….provide….LLD appropriate to measurements of environmental samples."

- "Birth" of the environmental LLD as screening criterion for free-release of bulk material

Current Requirements

- "Required" by NRC since IN-88-22.... "accepted(??) by industry in early 1990s
- Environmental LLDs as "adequate survey"
- Specified for gamma emitters identified via spectroscopy
- ~1.5E-7 μCi/g for solid/granular material
- <u>NOT A RELEASE LIMIT!!</u> -- release "limit" is no detectable activity when counted to "operational state-of-the-art" sensitivity; if you detect activity, material ***<u>cannot</u>*** be free-released

The $64,000 Question: ($64E+???)

WHAT HAPPENS WHEN YOU APPLY CURRENT SURVEY CRITERIA TO MATERIAL RELEASED UNDER THE "OLD" RELEASE CRITERIA?

Approach

- Formulate comparison between “old” and “new” release criteria...

- “Old” criterion dose rate based: <0.1 mR/hr (***WAS*** used as a release limit)

- “New” criterion concentration based: <1.5E-7 μCi/g (***NOT*** *to be used as a release limit, but as an adequate survey criterion*)

- Base comparison on NRC-accepted external dose conversion factors (DCFs) for soil... Mn-54, Co-60, Cs-137

External DCFs for 15cm Soil Slab
Units: mR/hr per pCi/g

Reference	Mn-54	Co-60	Cs-137
EPA/FGR-12	5.1E-4	1.5E-3	3.6E-4
NUREG/CR-5512	7.9E-4	2.4E-3	5.7E-4
RESRAD	5.1E-4	1.6E-3	3.4E-4
MicroShield	9.8E-4	2.7E-3	6.8E-4

Concentration Derived From 0.1 mR/hr Release Criterion

Value	Mn-54	Co-60	Cs-137
DCF: mR/hr/pCi/g	5.1E-4	1.5E-3	3.6E-4
Concentration yielding 0.1 mR/hr			
μCi/g:	2.0E-4	6.5E-5	2.7E-4
pCi/kg:	2.0E+5	6.5E+4	2.7E+5

0.1 mR/hr Concentrations vs. Decay Time

Units: μCi/g

Time Since Placement	Mn-54	Co-60	Cs-137
0 years	2.0E-4	6.5E-5	2.7E-4
5 years	3.4E-6	3.3E-5	2.4E-4
10 years	6.0E-8	1.7E-5	2.2E-4
20 years	1.8E-11	4.7E-6	1.7E-4
30 years	5.5E-15	1.3E-6	1.4E-4
40 years	1.7E-18	3.4E-7	1.1E-4

0.1 mR/hr Concentrations vs. Decay Time
Units: pCi/kg

Time Since Placement	Mn-54	Co-60	Cs-137
0 years	2.0E+5	6.5E+4	2.7E+5
5 years	3.4E+3	3.3E+4	2.4E+5
10 years	6.0E+1	1.7E+4	2.2E+5
20 years	1.8E-2	4.7E+3	1.7E+5
30 years	5.5E-6	1.3E+3	1.4E+5
40 years	1.7E-9	3.4E+2	1.1E+5

Dose Impact from 0.1 mR/hr Concentrations -- mrem/yr

Based on RESRAD 5.61 Calculation: T = 0 yr

Nuclide	No Cover	15 cm Soil Cap
Mn-54	530	61
Co-60	530	78
Cs-137	550	67

Dose Impact from 1.5E-7 μCi/g Concentrations -- mrem/yr

Based on RESRAD 5.61 Calculation: T = 0 yr

Nuclide	No Cover	15 cm Soil Cap
Mn-54	0.41	0.047
Co-60	1.2	0.18
Cs-137	0.29	0.035

Summary

- “Old” release limit of 0.1 mR/hr was used into the early 1990s.
- “New” adequate survey criterion of 1.5E-7μCi/g is several orders of magnitude more sensitive, especially if done in a laboratory environment
- Material released 30-40 years ago under “old” criterion could still contain activity at levels 10 to 1000+ times above modern detection sensitivity

Summary (continued)

- Are licensees obligated to resurvey materials released under the “old” criterion, using detection sensitivities corresponding to today’s “adequate survey” criterion?
- What do you do if you find something released 40 years ago which doesn’t meet today’s release criterion of “no detectable activity”? Is “Do Nothing” an option? Do you have to “remediate”?
- Does application of today’s criterion to yesterday’s releases constitute double jeopardy?

Questions?