Determining Cleanup Goals at Radioactively Contaminated Sites: Case Studies

Prepared by The Interstate Technology and Regulatory Cooperation Work Group Radionuclides Team

> Brookhaven National Laboratory, N.Y. Enewetak Atoll, Marshall Islands Fernald Environmental Management Project, Ohio Fort Dix, N.J. Hanford Site, Wash. Johnston Atoll Linde Site, N.Y. Nevada Test Site and Associated Ranges, Nev. Rocky Flats, Colo. Oak Ridge, Tenn. Savannah River Site, S.C. Weldon Spring Site, Mo.

Contact name: Carl Spreng (303)692-3358

Copus naturaliste

ST. Louis FUSRAP Long Term Stewardship Committee DRAFT REPORT on Criteria Research: New Jersey

STATEWIDE CLEANUP EXPECTATIONS

Cleanup Criteria: State regulations require residual concentrations to be equivalent to a 15mrem/yr total dose for the appropriate land use.

WAYNE INTERIM STORAGE SITE

Cleanup Criteria Residential Usc:

5 pCi/g Th-232 and Ra-226 combined (above background of 2.1 pCi/g) 50 pCi/g U-238 and 100 pCi/g Total U above background.

Cleanup Criteria Recreational Use:

15 pCi/g Th-232 and Ra-226 combined (above background of 2.1 pCi/g) 50 pCi/g U-238 and 100 pCi/g Total U (above background of 4.2 pCi/g for total U .. U-234 and U-238).

Note: There is no differentiation between criteria based on depth. This conclusion was drawn while using 10 CFR 20 Subpart E as an ARAR.

New Jersey's position: The state did not concur with the ROD because the dose associated with the specified cleanup concentrations exceeded their expectations. HOWEVER, the cleanup was conducted using ALARA principles therefore the final status survey results met New Jersey requirements.

MIDDLESEX SAMPLING PLANT

Cleanup Criteria: 5 pCi/g Ra-226 (including background) to an infinite depth.

I don't have a reference that shows if a criteria was derived for other radionuclides. The remedial action decision document (an MOU between US DOE, NJ DEP, and the City of Middlesex) dates back to 1980 and was not readily located in the NJ files. The criteria of 5pCi/g was referenced within a memo, from Jan Geiselman, Director of the Air and Hazardous Materials Division, dated 6 October 1980.

MAYWOOD INTERIM STORAGE SITE No Record of Decision

Proposed Cleanup Criteria Residential Use:

Proposed

5 pCi/g Th-232 and Ra-226 combined (above background) 50 pCi/g U-238 and 100 pCi/g Total U above background.

Cleanup Criteria Recreational Use: Industrial

15 pCi/g Th-232 and Ra-226 combined (above background)

50 pCi/g U-238 and 100 pCi/g Total U (above background). $P^{o_5 \times 1}$ New Jersey's position: The state did not concur with the ROD because the risk and dose associated with the specified cleanup concentrations exceeded their expectations.

DUPONT & COMPANY

No Record of Decision or Proposed Plan

CONTACTS

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New Jersey Department of Environmental Protection Radiation Protection Program Jenny Goodman (609)984-5498

SUPPORT DOCUMENTATION

- Excerpts from the Wayne Interim Storage Site Record of Decision, March 2000
- July 20 and September 5, 2000 letters from NJ DEP to the USACoE stating New Jersey does NOT concur with the Wayne Interim Storage Site Record of Decision.
 - Oct. 5, 2000 USACoE response to NJ DEP stating their regret for New Jersey's not concurring.
- Feb. 5, 2001 Letter from US EPA to NJ DEP regarding previous comments.
 - March 12, 2001 NJ DEP response to US EPA.
 - April 23, 2001 US EPA response to NJ DEP.
- Oct. 6, 1980 Memo from Jan Geiselman (NJ DEP) regarding the Middlesex site.
 - Dec. 8, 1980 Comment Letter for Joe Deal (US EPA) supporting the Middlesex cleanup criteria but commenting on the use of ALARA, concentration computations, and misc references.
 - August 9, 2000 Draft Final Proposed Plan for Soils and Buildings at the Maywood Chemical Superfund Site.
 - Research Notes

- Excerpts from NJ DEP regulations.

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Contominant	On-Property FRL ^a	Off-Property FRL^b
Contaminant	(pCi/g)	(pCi/g)
Cesium-137 + 1D	1.4	0.82
Neptunium + 1D	3.2	0.49
Lead-210	38	2.2
Plutonium-238	78	9.3
Plutonium-239/240	77	9.0
Radium-226 + 8D	1.7	1.5
Radium-228 + 1D	1.8	1.4
Strontium-90	14	0.61
Technetium-99	30	1.0
Thorium-228 + 7D	1.7	1.5
Thorium-230	280	80
Thorium-232 + 10D	1.5	1.4
Uranium, total (K _l =325 L/kg) (ppm)	82	50
Uranium, total (K _l =15 L/kg) (ppm)	20	NA

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT Fernald Site Final Remediation Levels (FRLs)

^a Undeveloped park user scenario at 10⁻⁶ excess cancer risk.

^b Resident farmer scenario at 10⁻⁵ excess cancer risk.

From ITRC draft document "Determining Cleanup Goals at Radioactively Contaminated Sites: Case Studies". A copy of pages from the Fernald Site-Wide Excavation Plan matching this information is provided in the Support Documentation. NOTE: These are TOTAL VALUES (background is to be included).

MIAMISBURG MOUND

Cleanup Objectives (pCi/g)

Contaminant	Background	10-5 Risk(2)	Cleanup Objective
Actinium-227 +	0.11	4.5	4.7
decay products in			
secular equilibrium			
to Lead-207			
Americium-241		63	63
Cesium-137 +	0.42	3.4	3.8
daughter products			
Cobalt-60		0.7	0.7
Lead-210 + decay	1.2 (1)	6.2	7.4
procucts in secular			
equilibrium to Lead-			
206			
Protactinium-231 +	0.11(1)	3.9	. 4

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decay products in secular equilibrium			
to Lead-207			
Plutonium-238	0.13	61	55
Radium-226 +	2.0	0.9	2.9
decay products in			
secular equilibrium			
to Lead-210			
Thorium-230 +	1.9	0.9	2.8
decay products in		·	
secular equilibrium			
to Lead-206			
Thorium-232 +	1.4	0.7	2.1
decay products in			
secular equilibrium			
to Lead-208			

Cleanup objective is the sum of 10-5 Risk Based Guideline and background (With the exception of Plutonium-238. 55pCi/g was a previously discussed value that was kept the same despite the risk assessment.)

- (1) These radionuclides have comparatively short half-lives and are deduced to be in secular equilibrium with the parent nuclide. Thus the background value measure for the parent is considered to be the appropriate value for these as well. The validity of this method for background determination for other radionuclides will be assessed on a case by case basis if not available
- (2) More conservative scenario of a construction or office worker.

This information came from Table 5.1 of the Public Review Draft of the Contingent Removal Action Memorandum for the Miamisburg Mound Site.

LUCKEY FUSRAP SITE

No Record of Decision

USACE Proposed Cleanup Criteria for Unrestricted Use (subsistence farmer):

-	•
Radium-226	2.0 pCi/g
Thorium-230	5.8 pCi/g
Uranium-234	26 pCi/g
Uranium-238	26 pCi/g
Beryllium	131 mg/kg

This information was provided via E-Mail by the US EPA. I need to contact the site project manager to obtain a copy of the Proposed Plan.

Note: I suspect these are average values ABOVE background but I must confirm it. Afterall, Fernald standards are TOTAL values. These were computed from RESRAD using a CERCLA risk range. I need to confirm the CERCLA risk associated but I suspect it to be 1x10-6.

Note: No differentiation made for surface/subsurface criteria.

PAINESVILLE FUSRAP SITE

No Record of Decision or Proposed Plan.

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However criteria is expected to be similar to that proposed for the Luckey Site.

DOE PORTSMOUTH GASEOUS DIFFUSION PLANT

Contamination is being investigated under RCRA corrective action. No cleanup criteria has been established. The plant is on "cold-standby" mode but is unlikely to be restarted.

ASHTABULA & BATTELLE

I need to contact NRC or Ohio Department of Health to get information.

CONTACTS

Fernald Environmental Management Project

J.D. Chiou (513)648-3000

Ohio Environmental Protection Agency

Zack Clayton (614)644-2924 [Zack works on power plant decommissionings, however he coordinated the collection of information for us]

Graham Mitchell (937) 285-6468

Brian Nickel (937)285-6357 [contact regarding the Miamisburg Mound Site] Steve Snyder (419)373-3040 [contact regarding the Luckey FUSRAP Site] Kurt Kollar (330)963-1208 [contact regarding the Painesville FUSRAP Site] Tom Schneider (937)285-6466 [contact regarding the Fernald Environmental Management Project]

ITRC

Carl Spreng (303)692-3358

SUPPORT DOCUMENTATION

 Table 5.1 from the Public Review Draft Contingent Removal Action

 Memorandum for the Miamisburg Mound Site

- Table 1.4 from the Fernald Environmental Management Project Sitewide

 Excavation Plan
- ITRC draft document "Determining Cleanup Goals at Radioactively Contaminated Sites: Case Studies".
 - E-Mails from Ohio EPA
 - Research Notes

ST. Louis FUSRAP Long Term Stewardship Committee DRAFT REPORT on Criteria Research: California

STATEWIDE CLEANUP EXPECTATIONS

Future land use goals: unrestricted at all properties.

Standards: California is a NRC agreement state. Therefore a 25mrem/year dose is used to compute cleanup criteria. MARSSIMS is used to confirm the cleanup standard is met. **Exceptions:** Expectations for land use and cleanup standards differ at the DOE managed properties.

Tasks: I need to research the computed soil concentrations that correspond to this dose at various California sites.

EXCEPTIONS

LEHR at University of California-Davis.

Contaminates of Concern

The primary C.O.C's are Radium-226 and Strontium-90. However other contaminates such as Thorium and Uranium are being addressed.

Cleanup Criteria

Cleanup is based upon 10-6 risk based action standards for an on-site researcher. However, whenever background concentrations for a particular contaminate exceed the risk range then the background value becomes the action level.

The cleanup values shown appear very small. I need to contact Steve Ross and confirm the document I received is up-to-date.

Radium-226 + daughter products: 0.75 pCi/g Uranium 234 (U238 + daughter products): 3.2 pCi/g Thorium 228 + daughter products: 0.74 pCi/g Thorium 232: 0.75 pCi/g

The criteria shown is from excerpts of the "Draft Work Plan for Removal Actions in the SW Trenches, Ra/Sr Treatment System, Domestic Tanks".

NO RECORD OF DECISION has been drafted. The site is currently being addressed through interim action under an Engineering Evaluation and Cost Analysis document. The goal for the Record of Decision is a No Further Action Statement.

Cleanup Criteria

Livermore Laboratories

The criteria can be found in the Main Facility Record of Decision (signed in the mid 90s) and the Interim Record of Decision for Site 300. Note, a final ROD was issued for the General Operations operable unit of Site 300.

All of these documents can be obtained from <u>www.erd.llnl.gov/indes.html</u>. I was unable to download these files because of either the size or software. This will be attempted again later. If that doesn't work, I'll contact Mark Piros for assistance.

Contaminates of Concern at Site 300

Depleted Uranium and Tritium from explosives testing.

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Future land Use at Site 300

DOE cleanup is based upon a future land continued as a laboratory and wildlife refuge. A big debate regarding potential uses over the next 1,000 years in on-going.

CONTACTS

California Department of Health Services Environmental Management Branch (916)323-3023 [reviews dose and risk computations] Steven Pay (916)445-4772 [reviews dose and risk computations] California Environmental Protection Agency, Department of Toxic Substance Control, Site Mitigation Section Stan Phillippe (916)255-3750 Barbara Cook (510)540-3843 Steve Ross (916)255-3694 [contact for LEHR at the University of California/Davis] Mark Piros (510)540-3832 [contact for Livermoore Labs] United States Environmental Protection Agency Kathy Setian (415)972-3180 Central Valley Regional Water Quality Initiative Susan Timm (916)255-3057 San Francisco Bay Regional Water Quality Initiative Naomi Feger (510)622-2328

SUPPORT DOCUMENTATION

Excerpts of the "Draft Work Plan for Removal Actions in the SW Trenches, Ra/Sr Treatment System, Domestic Tanks". Research Notes Upcoming: excerpts from the Livermooe RODs.

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UMTRA Sites

Colorado has 18 UMTRA sites. Seven are designated as disposal facilities having unique qualities worth further study.

Cleanup Criteria

Radium 5pCi/g (top six inches) 15pCi/g (at all other depths) above background. **Thorium Site Specific Values** (I need to provide a list of the related decisions)

Land Use and Restrictions

The State of Colorado obtained titles for all the sites except a couple. Most were donated, after remediation, to local governments but restrictions were placed on the deeds. The restrictions required State review of construction plans, radon vents for dwellings, and no groundwater access for some areas.

A Colorado law passed in July 2001 gives the State the means of establishing covenants with the owners of these properties. The enforceability does not apply to some of the older sites for which the State had not been in the title chain. However, the State is contacting the owners of these properties and requesting VOLUNTARY covenants.

A lesson for other states is the need to secure funding for inspections and enforcement activities. Colorado does have any funds for the UMTRA sites. State officials resort to "drive-by" observations, when in the vicinity of the properties, and sending land owners "self-certification" forms. These forms are completed by the land owner and sent back to state officials.

The State has also developed an UMTRA Soil Management Plan. This plan provided a guidance document for state officials, developers, land owners, and municipalities when dealing with construction activities at the remediated UMTRA sites. Because of the surface versus subsurface criteria, special care is required any time soil is disturbed. The goal is ensuring the surface criteria at the UMTRA property is maintained and that contaminates do not travel elsewhere. Excavated soils are sampled and characterized prior to relocation or backfilling the hole.

Gunneson: Remediation of Thorium has been a troublesome matter. Much debate took place over Thorium criteria. DOE removed soil from the site but opted to use clay radon barriers in some locations when having trouble chasing Thorium contamination. Unfortuneately, the contractors didn't always get the clay barriers in the right locations. The solution to the misplaced barriers was a complex land use map showing locations of remaining contamination. Note: This property is under local government ownership. The municipality previously had plans to use the property but is now NOT seeking development due to the complexity of the land use controls.

Rifle: An overlay district or zone was established to restrict use of groundwater. State officials expressed mixed feelings regarding the use of the district because local

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governments can change it. However, the layering of other mechanisms with this alleviates some of their worries.

Durango: This is one of several Colorado sites where the UMTRA Soil Management Plan is being implemented for soils remediated to the 5/15 above background criteria for Radium. (Reminder: Thorium criteria was computed for each site. This has to be researched.)

Non-UMTRA Sites

Rock Flats

This includes a large expanse or area contaminated by weapons detonations. The primary contaminates of concern are Plutonium and Uranium. Thorium and Radium are not being considered.

Cleanup Criteria UNDECIDED

Rocky Flats is an example of the debates that result from not having a national cleanup standard. Shortly after the Federal Facilities Agreement was signed in 1996, cleanup standards were computed by the State of Colorado officials. A HUGE public controversy over the standards erupted, so DOE funded an oversight committee/task force to develop new numbers. Public controversy did not wane so the State of Colorado is in the midst of yet another attempt to propose standards for public comment. Various research projects were initiated.

- 1) Colorado is computing soil contaminate concentrations to meet EPA's 85/15 proposed rule. The properties would be cleaned up to a 15mrem dose for the intended land use. However the remediation must also meet an 85mrem dose limit for any hypothetical land uses.
- Colorado is computing soil contaminate concentrations to meet NRC's 25mrem dose limit. (Note: this dose limit takes into account ALL radiologic dose contributions.)
- Colorado is computing soil concentrations to meet RESRAD computed risk values to meet CERCLA requirements. Note: all contributions (including background) are included within these computations.
- 4) A report on "New Technology" related to radiological remedial actions is being developed.
- 5) A report on cleanup criteria across the nation is being developed. A draft copy has been presented to ITRC. They are funding the development and release of a final version (due in several weeks).

Reports regarding tasks 2 & 3 were drafted and presented to the public for comments. The CERCLA requirements are more limiting and thus will be most likely implemented.

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Some discussions have taken place on whether or not to use a different criteria for subsurface material. If a different criteria is applied, it will occur at no less than 1 foot in depth.

The future land use is a wildlife refuge. The maximum CERCLA risk to be considered is $1\times10-4$. Another risk criteria of $1\times10-5$ is being proposed for land to be used as a ballpark. (I need to obtain a list of scenarios/assumptions for which these risks were computed.)

Uranium in groundwater is being considered for remediation. The remediation goals relate to surface water concerns because the groundwater impacts ______ River.

LTS Committee note: other sites besides Rock Flats need to be researched.

CONTACTS

Colorado Department of Public Health and the Environment Jeff Deckler (888)569-1831 [Program Manager and contact for land use controls] Wendy Naugle (303)692-3394 [Contact for Thorium risk computations and UMTRA land management plan questions] Steve Gunderson (303)692-3367 [Contact for general info on Rocky Flats] Carl Sprang at Rocky Flats (303)692-3358 [contact for "Cleanup Criteria across the Nation" research and Uranium risk computations.]

SUPPORT DOCUMENTATION

UMTRA Land Management Plan DRAFT copy of "Cleanup Criteria across the Nation" Research Notes