CVEN 4474/5474 Haz Waste Outline

- How clean is clean?
- Risk based corrective action (RBCA)

Three Common Approaches to Clean

- Return to background levels
  - –Metals, inorganics -- vary with location!
  - –Anthropogenic cmpds = 0 (can't measure)
- Comply with ARARs
  - –SDWA (MCLs or MCLGs), CWA, CAA,...
- Risk-Based criteria
  - –Site average conc for "acceptable" chronic effects (1x10-6, 1x10-4, ….)
  - –Site max conc for safety from acute effects (<MRL)

Compliance at or Near Measurable Levels

- EPA certified lab analyses
  - –Many detection limits of µg/L are near MCL values (the desired clean-up goal)
  - –Lab certification if matche known concs of 6 of 7 VOC stds at >10 µg/L at ±20%
  - –OR ±40% if <10 µg/L (or ±40% for any vinyl chloride conc)
  - –Example: 2 µg/L MCL for VC; lab reports 2.5 µg/L -- violate! But may really have been 1.8

Compliance with Standards at or near measurable levels….

- How to include values below quantification in computing average concentrations at a site? (example)
  - –Detection limit for VC 0.4 µg/L
  - –Quantification limit 1.3-2.4 µg/L (* = BQL)
  - –What is the average conc?
    - 2.1, 2.7, 1.5*, BDL, BDL
    - Eliminate samples < det limit = 2.1 µg/L
    - Below DL set at DL = 1.4 µg/L
    - Below DL set a 0 = 1.3 µg/L

How Clean is Clean at Rocky Flats?

- 1995 Future Site Use working group:
  - –Soil to average bkg radiation level
  - –(public) 0.04 pCu/g plutonium
- 1996 EPA, DOE, CDPHE interim stds
  - –"radionuclide soil action level" (RSAL) 651 pCu/g soil plutonium
- 1999 "Risk Assessment Corporation" hired
  - –Scenario: family living & ranching on site (future) RSAL 10 pCu/g plutonium
  - – If open space or light industrial use 650 pCu/g ok
- RSAL at other sites, pCu Pu/g
  - – HF 34, Johnston Atoll 15, Nevada Test site 200

BEST GOAL = ??

RBCA = Risk-Based Corrective Action

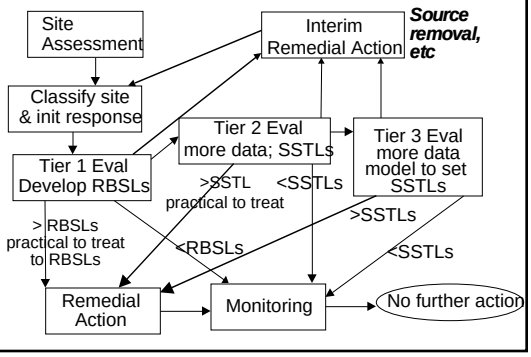
- Used at state and local sites inc. Brownfields and voluntary clean-up
- Possible for use at Superfund & RCRA corrective action sites
- Common for petroleum contaminated sites (LUST cleanup)

Example : BaP RSCL

- Risk-based soil clean-up level (RSCL)
- Assume: living on site, 100 mg/d ingested, and dermal contact
- Acceptable risk level 1 x 10^{-5} for cancer
- 1 x 10^{-5} = Intake * oral slope factor
- 1 x 10^{-5}/7.3 = [(Cs*100 mg/d*1*1) + (Cs* 3160 cm^2/d * 0.5 mg/cm^2 * 0.5 abs)]/70 kg
- RSCL = 1.12E-7 mg/mg = 0.11 mg/kg

Different states select different ARLs, etc.

Common RBCA Approach



Tier 1 Evaluation

- Look-up tables
- Exposure pathways
  - –Air, top soil, soil leach to GW, GW
- Residential vs commercial
- "Target Levels" of specific compounds or cumulative

Tier 2 Evaluation

- More specific to site conditions, inc.
  - –Distance from source to receptors
  - –Soil type on site

Tier 3 Evaluation

- Contaminant fate modeling
- Need LOTS more data

Example of Tier 1 table

	Alaska	Arizona	Dele-ware	Kansas
TPH, mg/kg	150-3000	7000 R 24.5K NR	<1000	100
BTEX, mg/kg	10-100		<10	
Benz, mg/kg	0.1-0.5	47 R 197 NR		1.4

Example Tier 1 Fla - more detail

Clean-up Level of soil in mg/kg

	Direct Contact		Leachability to GW			
	Resid	Work er	Leach a	Leach b	Leach c	Leach d
Benz	1.1	1.5	0.007	0.007	0.05	0.07
BaP	0.1	0.5	7.8	1.2	1.2	78
MTBE	350	6100	0.2	0.2	1.5	1.6
Tol	300	2000	0.4	0.4	0.48	4

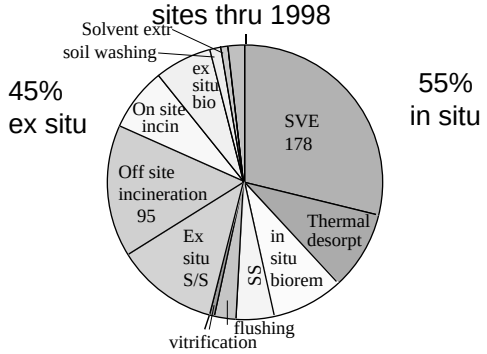
Brownfields - A Rational Approach to Clean-Up of Industrial Sites

- Brownfield = abandoned, idled or underused industrial or commercial facility where expansion or redevelopment is complicated by real or perceived environmental contamination
- EPA "Brownfields Economic Redevelopment Initiative"
  - empowers States, localities, etc. to work together to prevent, assess, safely clean up, and sustainably reuse brownfields
  - benefits are a cleaner environment, new jobs, and an enhanced tax base

REMEDIATION METHODS

- Generally need more than one method per site depending on "media" of interest
  - Soil
  - Groundwater
- "Treatment train" approaches may be used even for the same media
  - Multiple processes in series to target different contaminants (such as ion exchange then biodeg)
- 26% of Superfund sites have had a remedy change from initial ROD to implemented remedial action (RA)

Remedial Designs for Superfund sites thru 1998



Groundwater Contamination at SF sites

- 588 sites with pump & treat only (89%)
  - –Poor for remediation but good for containment
- 39 sites with pump&treat and in situ treatment (6%)
- 26 sites with in situ treatment only (5%)
- In situ treatments: air sparging, natural attenuation, bioremediation

More SF site data

- 34 sites with population relocated (14,341)
- 121 alternate water supply (339,000)
- 330 site security
- 727 institutional controls
- 595 emergency removal actions
- Longterm: 1371 containment technology
  - –1471 treatment technologies

(more than 1 per site with operable units, etc.)

Soil Contamination at SF sites

Treatment	M cubic yds of soil	Ave cubic yds per site
SVE	29.11	237,000
Ex situ S/S	3.66	48,000
Ex situ biorem	2.97	80,000
On site incin	1.74	48,000
In situ biorem	1.35	79,000
In situ S/S	1.29	43,000