

































FS – Detailed Analysis of Alternatives Balancing criteria – 5. Short-term effectiveness 9. Protection of the community during remedial action 9. Protection of workers 9. Potential adverse environmental impacts during construction and implementation 7. Time until remedial response objectives are achieved 6. Implementability 9. Technical feasibility (construction, operation, reliability, ease of undertaking) 9. Administrative feasibility (permits, access agreements) 9. Availability of services and materials (contractors, equipment, disposal facilities)

18



Jurisdiction	USEPA	NH	NY	VT
Reference	CERCLA	Env-Or 606.12	DER-10	IRCP Sec 35-503
	Protection of human health & environment	\checkmark	\checkmark	\checkmark
	Compliance with ARARs		\checkmark	N
	Long-term effectiveness and permanence	Effectiveness and reliability	\checkmark	\checkmark
	Reduction of toxicity, mobility, or volume	Risk reduction	\checkmark	\checkmark
Evaluation		Time to achieve no further	2	2
Criteria for	Short-term effectiveness	action criteria	v	v
Remedial	Implementability	\checkmark	\checkmark	N
Alternatives	Cost	\checkmark	\checkmark	\checkmark
	State acceptance		Future land use	Environmental impact and sustainability
	Community acceptance		\checkmark	

FS Last Step - Comparative Analysis of Alternatives	
Identifies the advantages/disadvantages of each alternative relative to one another	
Narrative discussion of strengths/weaknesses relative to one another for each criterion	
Caution using scoring/ranking systems – can lead to controversy	
Identifies the preferred alternative based on the comparative analysis	
SANBORN I HEAD	21

After the FS

For CERCLA sites and State sites subject to public notice

- The EPA or State agency prepares a Proposed Plan or Proposed Remedial Action Plan
- Proposed Plan is the subject of a public meeting and public comment period (typically 30 days)
- EPA or State Agency then issues a Record of Decision (ROD) or approval of the remedial action plan
- Once the ROD is issued, remedial design can begin, followed by remedial action

For State sites not subject to public notice

- The FS leads to a proposed Remedial Action Plan, or the FS can be combined with Remedial Action Plan
- · Once the State approves the Remedial Action Plan, remedial design can begin, followed by remedial action

SANBORN HEAD

22





Presumptive Remedies

Site/Contaminants	EPA Presumptive Remedies
Volatile organic compounds in soils (and groundwater)	 Soil vapor extraction (Multi-phase extraction) Thermal desorption Incineration
Metals in soils	 Reclamation/recovery Immobilization (solidification, stabilization) Containment (vertical and horizontal barriers
Wood treaters	 For organics: Incineration, bioremediation, dechlorination For Inorganics: immobilization
Municipal Landfills	Containment (capping, leachate collection, LF gas treatment, institutional controls)
BORN HEAD	



	Environmental Protection Solid Waste Agency Emergency	and EPA 540/F-96/008 Response PB 96-963308 July 1996	Unitio same 3 Chick of EVA SAV-3405A Environmental Protection Agency Solid Valate and SAVRA-8485.03/73/S Environmental Protection Agency Response PB98-965001 Solphenter 1999	
\$£PA	User's Guide to the VOCs in Soils		SEPA Presumptive Remedy for Metals-in-Soil Sites	
ffice of Emergency and	Presumptive Re	User's Guide	DDE Diffee of Environmentia and Policy Assistance (EH-H1) EPA Office of Emergency and Remodal Response (Mail Code 5004-G) Quick Reference Guide	
	United States Office of Environmental Protection Solid Waste and Agency Emergency Resp.	Directive No. 9355.0-49FS EPA 540-F-93-035 PB 93-963339 onse September 1993	United States Office of Solid Waste Publication 9360.0.46F Environmental and Emergency EPA540.F-93.020 Protection Agency Response April 1993	
\$®A	Presumptive Rem	edy for al Landfill	Presumptive Remedies	
	Sitoe		Technology Selection Guide fo	
\$EPA	Presumptive Rem CERCLA Municipa	edy for al Landfill	Presumptive Remedie Technology Selection Guide 1 Wood Treater Sites	

		N.J.A.C. 7:2	6E 5.3 Table 5.1	
	Presumptive I Cł	Remedies for S nild Care Cent	Soil Contamination at Schools, ers, and Residences	
Contamination type	Subcategories/Scenarios	Presumptive Remedy/ Remediation Goal	Remedial Action-Schools, Child Care Centers, and Type II Residential	Remedial Action - Type I Residential
Historic Fill and/or all other discharged contaminants not otherwise excluded in N.J.A.C.7:26E-5.3	1) Play Areas Loose Fill Surface (e.g., mulch, sand, etc.)	Restricted Use	Option #1. Barrier - Minimum of one foot clean loose fill material; Buffer - Minimum of one foot clean loose fill material; Demarcation - Geotextile fabric; and Inspection - Quarterly Option #2. Barrier - Minimum of two feet clean loose fill material; Buffer - Minimum of two feet clean loose fill material; Demarcation - Visible contamination boundary marker or geotextile fabric; and Inspection - Semi-annual	Same engineering control requirement as schools, child care centers and Type II Residential





Key Components of FS Cost Estimates	
 Capital Costs – costs to construct the remedial action Contractor costs Professional/technical services, including design, construction management, PM 	
 Annual Operations & Maintenance (O&M) Costs – post-construction costs Remedial system operations Groundwater monitoring Reporting 	
 Periodic Costs – costs incurred every few years Equipment replacement 5-year reviews Site closeout 	
SANBORN HEAD	31

How to Develop the Cost Estimate

- 1. Describe the alternative.
- 2. Identify major cost items, including quantities and unit costs, for capital, annual O&M, and periodic components
- 3. Apply contingency
- 4. Add professional/technical services costs
- 5. Calculate present value

SANBORN || HEAD

Example Cost Presentation		
Capital Costs:		
Mobilization / Demobilization Monitoring, Sampling, Testing, and Analysis Site Work Air Sparging / Soil Vapor Extraction Passive Treatment Wall Off-Site Treatment / Disposal CONSTRUCTION SUBTOTAL Contingency (10% scope + 15% bid) SUBTOTAL Project Management (5%) Remedial Design (8%)	\$106,723 \$60,838 \$12,940 \$252,851 \$2,028,564 \$1,550 \$2,463,465 615,866 \$3,079,331 153,967 246,346	
Construction Management (6%) TOTAL	184,760 \$3,664,404	
and the second sec		33

Total Continge	ency = Scope continge Bid contingency Exhibit 5-6 Example FS-Level Scope Contingency	ency (see table y (10 to 20%) y Percentages	e) +	
	Remedial Technology	Scope Contingency (%)		
	Soil Excavation	15-55		
	Groundwater Treatment (Multiple)	15-35		
	On-Site Incineration	15-35		
	Extraction Wells	10-30		
	Vertical Barriers	10-30		
	Synthetic Cap	10-20		
	Sludge Stabilization	10-20		
	Off-Site Disposal	5-15		
	Off-Site Incineration	5-15		
	Drum Processing	5-15		
	Bulk Liquid Processing	5-15		
	Groundwater Treatment (Single)	5-10		
	Clay Cap	5-10		
	Surface Grading/Diking	5-10		
	Revegetation	5-10		

Capital Cost Element	< \$100K (%)	\$100K-\$500K (%)	\$500K-\$2M (%)	\$2M-\$10M (%)	>\$10M (%)
Project Management	10	8	6	5	5
Remedial Design	20	15	12	8	6
Construction Management	15	10	8	6	6

SANBORN II HEAD

https://semspub.epa.gov/work/HQ/174890.pdf 35

Year	Capital Costs (\$)	Annual O&M Costs (\$)	Periodic Costs (\$)	Total Cost (\$)	Discount Factor at 7%	Total Presen Value Cost a 7% (\$)
0	1,800,000	0	0	1,800,000	1.000	1,800,000
1	0	50,000	0	50,000	0.935	46,800
2	0	50,000	0	50,000	0.873	43,700
3	0	50,000	0	50,000	0.816	40,800
4	0	50,000	0	50,000	0.763	38,200
5	0	50,000	10,000	60,000	0.713	42,800
6	0	50,000	0	50,000	0.666	33,300
7	0	50,000	0	50,000	0.623	31,200
8	0	50,000	0	50,000	0.582	29,100
9	0	50,000	0	50,000	0.544	27,200
10	0	50,000	50,000	100,000	0.508	50,800

COMPARISON OF TOTAL COST OF REMEDIAL ALTERNATIVES						
Site: Location: Phase:	Former Industrial Site Any City, Any State Feasibility Study (-30% to +50%)		Base Y Date:	ear: 2000 April 12, 200	0	
	DESCRIPTION	<u>Alternative 1</u> No Action	<u>Alternative 2</u> Limited Action/ Natural Attenuation	<u>Alternative 3</u> In Situ Treatment	<u>Alternative 4</u> Ex Situ Treatment	
Total Pr	oject Duration (Years)	0	30	15	15	
Capital	Cost	\$0	\$147,000	\$3,677,000	\$5,300,000	
Annual	O&M Cost	\$0	\$41,000	\$306,000	\$146,000	
Total Pe	riodic Cost	\$0	\$68,000	\$72,000	\$43,000	
T () D	vosont Value of Alternative	\$0	\$690.000	\$6 501 000	\$6 649 000	

Г





Public Perception – requires effective communication

- Meet/speak with the regulator to present and discuss potential remedial alternatives before launching the FS (or CMS, RAP, RAA, etc.)
- Establish whether the project requires public notice and set a schedule
- Establish a Community Relations Plan for the project (either formal or informal)
 - Mail/Email list
 - Project website and/or Facebook page
 - Fact sheets
 - ➢ FAQs
 - > Provide update flyers after key milestones
 - > Informational meetings w/local government officials
 - > Informational meetings w/abutters
 - Informational meetings w/the public (one-on-one or group)
 - Caution with "town hall" style Q&A sessions break up into small groups and use "science fair" style presentations/discussions
 - > Refer to EPA and State guidance documents on Community Relations Plans

SANBORN || HEAD

40

FS Lessons Learned

- Engage the regulator early regarding potential alternatives to be presented in the FS.
- Use tables, charts, and figures to streamline presentation of remedial technology screening and alternatives evaluation avoid long narrative text.
- Keep the number of alternatives to a minimum, particularly for small sites (e.g. 2 or 3 at most)
- Use presumptive remedies where they fit with site conditions.
- Flesh out the remedial alternative (i.e. conceptual design) to a sufficient degree to support cost estimating.
- Use the EPA's Cost Estimating guidance for consistent format
- · Engage with the community early in the process with the regulator as a partner

SANBORN | HEAD