APPENDIX T

Groundwater O&M Costing

APPENDIX T
POST REMEDY INVESTIGATION, VAPOR CONTROL SYSTEMS AND GROUNDWATER REMEDIATION COST ESTIMATES

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Table T-1
Estimate of Post-Remedy Surveys of Vapor Intrusion Risk
Ascon Landfill Site

Baseline Evaluation

- Soil vapor survey of upper 3' of soil. Collect sample vapor samples over 1 acre
- Quantity is based on 6 residential lots per acre, and 1 monitoring point per lot

Assumptions Number of soil vapor samples 16

Item	Units	Unit Price	Quantity	Total Cost	Assumptions
Mob/Demob	day	$200	1	$200	
Geoprobe Soil Vapor Survey	day	$2,000	1	$2,000	
Geologist/Engineer	hour	$100	10	$1,000	assume 10 hour work days
Surveying	day	$1,500	1	$1,500	
Equipment and Supplies	day	$150	1	$150	includes truck rental, health and safety equipment and miscellaneous
Laboratory Analyses	each	$280	6	$1,680	includes Suma Cans and VOC analyses by TO-15
Data Analysis Reporting	LS	$2,000	1	$2,000	
CM/CQA	*%*		*15%*	*$1,280*	
Contingency	*%*		*10%*	*$853*	
	Sub-Total Capital Cost			**$10,663**	

Groundwater verification testing (if required based on results of vapor survey)

-Groundwater/soil geoprobe sampling of upper aquifer zone. Collect samples over 1 acre, 1 per residential lot.

Item	Units	Unit Price	Quantity	Total Cost	Assumptions
Mob/Demob	day	$200	1	$200	
Geoprobe soil/gw sampling	day	$2,000	1	$2,000	
Geologist/Engineer	hour	$100	10	$1,000	assume 10 hour work days
Surveying	day	$1,500	1	$1,500	
Equipment and Supplies	day	$150	1	$150	includes truck rental, health and safety equipment and miscellaneous
Laboratory Analyses	each	$125	6	$750	VOC analyses by EPA 8260
Data Analysis Reporting	LS	$2,500	1	$2,500	
CM/CQA	*%*		*15%*	*$1,215*	
Contingency	*%*		*10%*	*$810*	
	Sub-Total Capital Cost			**$10,125**	

Table T-2
Estimated Costs
Building Vapor Control Systems
Ascon Landfill Site

Engineered Controls:

- Costs are for one acre
- Engineering controls include a sub-slab vapor control system.
- Square footage for engineering controls based on six lots per acre and 1500 square feet coverage per lot.

ITEM	Units	Unit ($)	Qnty	Extended ($)	Notes/Assumptions
Engineered Controls					
Cushion Geotextile[2]	SF	$ 0.30	9,000	$ 2,700	
Spray Applied Geomembrane Gas Barrier[2]	SF	$ 2.00	9,000	$ 18,000	
Heat Bonded Nonwoven Carrier Geotextile[2]	SF	$ 0.20	9,000	$ 1,800	
Double Sided Geocomposite[2]	SF	$ 0.45	9,000	$ 4,050	
Pipe, Fittings, Gravel, Trenching, Blower, Vaults[2]	SF	$ 1.25	9,000	$ 11,250	
Contractor & Misc. Overhead[3]			10%	$ 3,780	
Permitting[3]			20%	$ 7,560	
Engineering Design[3]			20%	$ 7,560	
Construction CQA[3]			15%	$ 5,670	
Contingency[3]			20%	$ 7,560	
Total Capital Costs				**$ 69,930**	
Operation and Maintenance Costs					
Operation and Maintenance[2]	Yr	$ 2,900	1	$ 2,900	Assume $0.33 per sq. ft per yr
Annual Reporting[2]	Yr	$ 6,000	1	$ 6,000	
Total Annual Operation and Maintenance Costs				**$ 8,900**	

[1] Cost based on Means guide
[2] Cost based on professional experience
[3] Cost factor based on "A guide to developing and documenting cost estimates during the feasibility study", USEPA, July 2000
[4] Cost based on personal communication with vendor
[5] Cost based on estimate from vendor

Table T-3
Estimated Costs
Bioremediation/MNA
Ascon Landfill Site

Bioremediation and Monitored Natural Attenuation:

- Treatment area is one acre.
- Single injection of Regenesis ORC to 20' bgs using direct push drill rig.
- Installation of 6 additional groundwater monitoring wells for performance monitoring.

ITEM	Units	Unit ($)	Qty	Extended ($)	Notes /Assumptions
ORC Injection					
ORC Injection[2]	each	15000	1	$ 15,000	1,000 lbs ORC, 3 days geoprobe injection.
Contractor & Misc. Overhead[3]			10%	$ 1,500	
Permitting[3]			5%	$ 750	
Engineering Design[3]			20%	$ 3,000	
Construction CQA[3]			15%	$ 2,250	
Contingency			20%	$ 3,000	
Subtotal				**$ 25,500**	
Monitoring Well Installation					
Mob/Demob[2]	day	300	3	$ 900	
Drill and Install Well[2]	each	1300	6	$ 7,800	
Well Development[2]	each	480	6	$ 2,880	4 hrs/well at $120/hr.
Well Vaults[1]	each	720	6	$ 4,320	Locking vaults.
Soil Bin[5]	each	1500	1	$ 1,500	
Soil Recycling Facility Transportation and Disposal[5]	ton	40	5	$ 200	1.4 tons per CY in place.
Development Water Storage Tank[5]	each	1000	1	$ 1,000	
Facility Transportation and Disposal[1]	gal	1.25	300	$ 375	50 gallons per well.
Laboratory - Water[2]	sample	150	6	$ 900	VOCs.
Equipment[2]	day	200	3	$ 600	
Sampling Supplies[2]	per well	100	6	$ 600	
Contractor & Misc. Overhead[3]			10%	$ 2,108	
Permitting[3]			10%	$ 2,108	
Engineering Design[3]			20%	$ 4,215	
Construction CQA[3]			15%	$ 3,161	
Contingency[3]			20%	$ 4,215	
Subtotal				**$ 36,881**	
Total Capital Costs				**$ 62,381**	
Operation and Maintenance Costs					
Groundwater Monitoring[2]	Yr	$ 12,000	1	$12,000	Assumes semiannual monitoring of 6 wells.
Reporting[2]	Yr	$ 6,000	2	$12,000	Assumes semiannual reporting.
Total Annual O&M Costs				**$ 24,000**	

[1] Cost based on Means guide
[2] Cost based on professional experience
[3] Cost factor based on "A guide to developing and documenting cost estimates during the feasibility study", USEPA, July 2000
[4] Cost based on personal communication with vendor
[5] Cost based on estimate from vendor

Table T-4
Estimated Costs
In Situ Chemical Oxidation Treatment - Oxidant Injection
Ascon Landfill Site

***In Situ* Chemical Oxidant Injection:**
- Assumes treatment of one acre area.
- Installation of 3 injection wells to 20' bgs.
- Injection of 1,000 gallons of potassium permanganate solution into each well three times.
- Inject potassium permanganate at a concentration of 10 g/L.
- Installation of 4 groundwater monitoring wells for performance monitoring.

ITEM	Units	Unit ($)	Qty		Extended ($)	Notes /Assumptions
Injection Well Installation						
Mob/Demob[2]	day	300	2	$	600	
Drill and Install Well[2]	each	1300	3	$	3,900	
Well Development[2]	each	480	3	$	1,440	4 hrs/well at $120/hr.
Well Vaults[1]	each	720	3	$	2,160	Locking vaults.
Soil Bin[5]	each	1500	1	$	1,500	
Soil Recycling Facility Transportation and Disposal[5]	ton	85	3	$	255	1.4 tons per CY in place.
Development Water Storage Tank[5]	each	1000	1	$	1,000	
Facility Transportation and Disposal[1]	gal	1.25	150	$	188	50 gallons each
Laboratory - Water[2]	sample	150	3	$	450	Initial testing for VOCs.
Equipment[2]	day	200	2	$	400	
Sampling Supplies[2]	per well	100	3	$	300	
Contractor & Misc. Overhead[3]			10%	$	1,219	
Permitting[3]			20%	$	2,439	
Engineering Design[3]			20%	$	2,439	
Construction CQA[3]			15%	$	1,829	
Contingency			20%	$	2,439	
Subtotal				**$**	**22,556**	
Bench Testing						
Bench Test[5]	Each	15,000	1	$	15,000	
Subtotal				**$**	**15,000**	
Monitoring Well Installation						
Mob/Demob[2]	day	300	2	$	600	
Drill and Install Well[2]	each	1300	4	$	5,200	
Well Development[2]	each	480	4	$	1,920	4 hrs/well at $120/hr.

Table T-4
Estimated Costs
In Situ Chemical Oxidation Treatment - Oxidant Injection
Ascon Landfill Site

ITEM	Units	Unit ($)	Qty	Extended ($)	Notes /Assumptions
Well Vaults[1]	each	720	4	$ 2,880	Locking vaults.
Soil Bin[5]	each	1500	1	$ 1,500	
Soil Recycling Facility Transportation and Disposal[5]	ton	85	4	$ 340	1.4 tons per CY in place.
Development Water Storage Tank[5]	each	1000	1	$ 1,000	
Facility Transportation and Disposal[1]	gal	1.25	200	$ 250	50 gallons each.
Laboratory - Water[2]	sample	150	4	$ 600	Initial testing for VOCs.
Equipment[2]	day	200	2	$ 400	
Sampling Supplies[2]	per well	100	4	$ 400	
Contractor & Misc. Overhead[3]			10%	$ 1,509	
Permitting[3]			10%	$ 1,509	
Engineering Design[3]			20%	$ 3,018	
Construction CQA[3]			15%	$ 2,264	
Contingency[3]			20%	$ 3,018	
Subtotal				**$ 26,408**	
Total Capital Costs				**$ 63,964**	
Operation and Maintenance Costs					
Treatment System O&M[2]	Yr	$ 15,000	1	$15,000	Labor & equipment.
Treatment System Rehabilitation[2]	Yr	$ 10,000	1	$10,000	Address precipitate, etc.
Chemical Dosing[2]	Yr	$ 9,500	1	$9,500	Assumes potassium permanganate refill/delivery to wells.
Groundwater Monitoring[2]	Yr	$ 8,000	1	$8,000	Assumes semiannual monitoring of 4 wells.
Reporting[2]	Ea	$ 6,000	2	$12,000	Assumes semiannual reporting.
Total Annual O&M Costs				**$ 54,500**	

[1] Cost based on Means guide
[2] Cost based on professional experience
[3] Cost factor based on "A guide to developing and documenting cost estimates during the feasibility study", USEPA, July 2000
[4] Cost based on personal communication with vendor
[5] Cost based on estimate from vendor