

Appendix H

Detailed Cost Estimates for Remedial Alternatives for the Upper Vadose Soil and Perched Groundwater Remediation Zone (3 to 35 Feet bgs)

TABLE H1 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP2a
HIGH-VACUUM DUAL-PHASE EXTRACTION/ULTRAVIOLET OXIDATION/FLAMELESS THERMAL OXIDATION/GRANULAR ACTIVATED CARBON
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE

Treatment System Equipment and Installation						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>HVDPE Equipment, Materials, and Subcontractors</u>						
1	Treatment Compound - Concrete Pad, Fencing, Lights	1	lump sum	\$10,864.00	\$10,864	RS Means
2	Utility Connections (electric, gas, sewer)	1	lump sum	\$29,220.00	\$29,220	RS Means (Incl. GW and vapor Trmt. Sys.)
3	Mobilization/Demobilization	2	each	\$5,200.00	\$10,400	EnviroSupply
4	1000 SCFM Duel Phase Extraction System	1	lump sum	\$122,869.44	\$122,869	EnviroSupply Purchase
5	Well Installation, 4" dia.	32	each	\$3,500.00	\$112,000	Gregg Drilling
6	Piping Network, Manifold, Valves	1	lump sum	\$34,861.80	\$34,862	Harrington Ind. Plastics and RS Means
7	Trenching and Backfill, 8" wide trench, 24" deep	4,500	linear feet	\$2.18	\$9,810	RS Means
8	Installation and Start-Up	50	hour	\$65.00	\$3,250	EnviroSupply
9	Site Restoration	1	lump sum	\$10,500.00	\$10,500	TN& Associates
10	Confirmation Soil Boring and Analytical Services	1	lump sum	\$34,574	\$34,574	Gregg Drilling and Calscience
<u>UV Ox. Equipment, Materials, & Subcontractors</u>						
11	Mobilization/Installation/Start-Up/Demob.	1	lump sum	\$16,650.00	\$16,650	Calgon Carbon
12	Rayox Reactor System w/PreTrmt. Flow rated to 50 gpm.	1	lump sum	\$111,000.00	\$111,000	Calgon Carbon
13	Discharge Conveyance System	1	lump sum	\$9,810.00	\$9,810	McMaster-Carr and RS Means
<u>Flameless Thermal Oxidizer (1st Year Costs)</u>						
14	Electrical Consumption	170,820	kWH	\$0.18	\$30,748	Alzeta and S.C. Edison
15	Water Consumption	6,535	100 c.f.	\$1.67	\$10,913	Alzeta and Maywood Mutual Water Co.
16	Gas Consumption	152,424	therm	\$0.69	\$105,173	Alzeta and S. Cal Gas Company
17	Sodium Hydroxide (25%)	19,272	gal	\$1.10	\$21,199	Alzeta
18	Alzeta 1000 scfm FTO - Lease	12	month	\$18,750.00	\$225,000	Alzeta
19	Alzeta Service Plan/Start Up Testing/Mob/Demob.	1	lump sum	\$31,068.00	\$31,068	Alzeta
20	Laboratory Analysis of Vapor Discharge	12	month	\$6,587.00	\$79,044	Air Toxics
21	Laboratory Analysis of Water Discharge	12	month	\$500	\$6,000	Calscience Env. Labs.
<u>Vapor Phase GAC (Yr 2 to 5) Equipment, Materials, & Subcontractors</u>						
22	Mobilization/Installation/Start-Up/Demob.	1	each	\$14,744.33	\$14,744	TN& Associates
23	1000 lb Vapor Phase GAC Vessels (full)	2	lump sum	\$5,250.00	\$10,500	Slaby Sales Inc.
24	Handling Fees (3%)	1	lump sum	\$31,505.96	\$31,506	TN& Associates
25	Contingency (10%)	1	lump sum	\$105,019.86	\$105,020	RS Means
Subtotal (Equipment, Materials, and Subs)					\$1,186,724	
<u>Equipment Installation Labor</u>						
26	Construction Management	1,240	hour	\$85.00	\$105,400	TN& Associates
27	Mechanical Assembly and Installation	360	hour	\$85.00	\$30,600	T N & Associates
28	Engineering, Design, and Inspection	720	hour	\$100.00	\$72,000	TN& Associates
29	Project Management	330	hour	\$110.00	\$36,300	TN& Associates
Subtotal (Installation Labor)					\$ 244,300	
TOTAL TREATMENT SYSTEM EQUIPMENT AND INSTALLATION:					\$1,431,024	
Assumptions:						
1. Refer to the conceptual design for Alternative SP2a (Section 3.4.2.2) for additional design information and assumptions.						
2. The estimated 5 year project duration was calculated based on anticipated contaminant extraction rates.						
3. Concentrations of 1,4 dioxane in perched groundwater would not adsorb efficiently to carbon and is therefore best treated using UV oxidation.						
4. This alternative assumes that that initial high mass loading of VOCs extracted in vapor during the first year of operation would be more effectively and efficiently treated using FTO. After one year of remediation, the vapor treatment system would be switched to GAC - a more cost effective option for lower contaminant loading.						
5. Confirmation soil sampling is included above, confirmation groundwater sampling is included under O&M.						
6. The confirmation soil borings would be spaced one boring per 100' x 100' foot grid for 16 boring locations for the perched zone. Seven samples would be collected per boring at approximate five-foot intervals to a depth of 35 feet bgs (5' to 35' bgs).						

TABLE H1 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP2a
HIGH-VACUUM DUAL-PHASE EXTRACTION/ULTRAVIOLET OXIDATION/FLAMELESS THERMAL OXIDATION/GRANULAR ACTIVATED CARBON
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE

Annual Operation and Maintenance						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
HVDPE System						
1	Electrical Consumption	411,993	kWH	\$0.18	\$74,159	EnviroSupply, Calgon, S.C. Edison
2	Maintenance and Service (Average for 5 yrs.)	1	lump sum	\$3,700.00	\$3,700	EnviroSupply
3	Mechanical, Pipe, Valves, Parts (Average for 5 yrs.)	1	lump sum	\$1,743.09	\$1,743	Assume 5% of Network Cost
UV Oxidation System						
6	Electrical Consumption	245,280	kWH	\$0.18	\$44,150	Calgon and S.C. Edison
7	Peroxide, Delivered as 50% Solution (in lbs)	13,870	lbs	\$0.65	\$9,016	Calgon Carbon
8	Maintenance, Parts, Lamp Replacement (Avg. for 5 year)	1	lump sum	\$9,007.00	\$9,007	Calgon Carbon
9	Laboratory Analysis of Water Discharge	12	month	\$500.00	\$6,000	Calscience Environmental Labs.
Vapor Phase GAC System						
10	Replacement Carbon (average yearly, over 4 years)	3,000	lbs	1.15	\$3,450	EnviroSupply and S.C. Gas Company
11	Carbon Analytical Profiling	3	per vessel	350.00	\$1,050	EnviroSupply Service Inc.
12	Carbon Disposal (average yearly, over 4 years)	3,000	lbs	0.60	\$1,800	EnviroSupply Service Inc.
14	Laboratory Analysis of Vapor Discharge	12	month	1,867.14	\$22,406	Air Toxics
Groundwater Monitoring						
4	(2) Semiannual GW Sampling Events, Incl. Some soil	85	each	\$227.20	\$19,312	Calscience Labs
15	Handling Fees (3%)	1	lump sum	\$5,294.41	\$5,294	TN& Associates
16	Contingency (10%)	1	lump sum	\$17,648.04	\$17,648	RS Means
Subtotal (Annual Operation and Maintenance)					\$218,735	
O&M Labor						
17	Weekly Inspection and Monitoring	1,560	hours	85.00	\$132,600	T N & Associates
18	Data Processing and Reporting	840	hours	100.00	\$84,000	T N & Associates
19	Management of O&M	480	hours	110.00	\$52,800	T N & Associates
Subtotal (O&M Labor)					\$269,400	
TOTAL ANNUAL OPERATION AND MAINTENANCE					\$488,135	
Present Worth of Annual Operation and Maintenance						
		Cost	Interest Rate	Years	Present Worth	
Present Worth of Annual O&M		\$488,135	4.25%	5	\$2,158,044	Calculated using uniform series present worth factor.
Present Worth of 5 Years of Additional GW Monitoring (years 5 to 10)		\$89,647	5.00%	5	\$70,241	Calculated from present worth of single payment in 5 years time. The single payment in 5 years time was calculated from a uniform series present worth factor for 5 years of monitoring (5% is a reasonable future interest rate).
Total Present Worth of Annual O&M					\$2,228,285	

Assumptions:

- Costs associated with treatment of water and vapor discharge are included with the treatment scenarios.
- Electrical rate for small business were provided by Southern California Edison (Los Angeles) and range from \$.14 - \$.21/kWH.
- Semiannual groundwater sampling would be performed on 32 wells and the analysis would be for VOCs via EPA Methods 8260B.
- Carbon useage is based on Table 3.4 of Appendix B (GROUNDWATER EXTRACTION DESIGN SUMMARY FOR THE UPPER VADOSE AND PERCHED GROUNDWATER ZONE).
- Weekly inspections will be performed and reported in conjunction with the remediation system monitoring and compliance sampling.
- The interest rate used in the present worth calculation (4.25%) is the reported Prime Rate (Nov. 2002).

TABLE H2 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP2b
HIGH-VACUUM DUAL-PHASE EXTRACTION/ULTRAVIOLET OXIDATION/ GRANULAR ACTIVATED CARBON
 UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE

Treatment System Equipment and Installation						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>HVDPE Equipment, Materials, and Subcontractors</u>						
1	Treatment Compound - Concrete Pad, Fencing, Lights	1	lump sum	\$10,864.00	\$10,864	RS Means
2	Utility Connections (electric, gas, sewer)	1	lump sum	\$29,220.00	\$29,220	RS Means (Incl. GW and vapor Trmt. Sys.)
3	Mobilization/Demobilization	2	each	\$5,200.00	\$10,400	EnviroSupply
4	1000 SCFM Dual Phase Extraction System	1	lump sum	\$122,869.44	\$122,869	EnviroSupply Purchase
5	Well Installation, 4" dia.	32	each	\$3,500.00	\$112,000	Gregg Drilling
6	Piping Network, Manifold, Valves	1	lump sum	\$34,861.80	\$34,862	Harrington Ind. Plastics and RS Means
7	Trenching and Backfill, 8" wide trench, 24" deep	4,500	linear feet	\$2.18	\$9,810	RS Means
8	Installation and Start-Up	50	hour	\$65.00	\$3,250	EnviroSupply
9	Site Restoration	1	lump sum	\$10,500.00	\$10,500	TN& Associates
10	Confirmation Soil Boring and Analytical Services	1	lump sum	\$34,574	\$34,574	Gregg Drilling and Calscience
<u>UV Ox. Equipment, Materials, & Subcontractors</u>						
11	Mobilization/Installation/Start-Up/Demob.	1	lump sum	\$16,650.00	\$16,650	Calgon Carbon
12	Rayox Reactor System w/PreTrmt. Flow rated to 50 gpm.	1	lump sum	\$111,000.00	\$111,000	Calgon Carbon
13	Discharge Conveyance System	1	lump sum	\$9,810.00	\$9,810	McMaster-Carr and RS Means
<u>Vapor Phase GAC Equipment, Materials, & Subcontractors</u>						
14	Mobilization/Installation/Start-Up/Demob.	1	each	\$14,744.33	\$14,744	TN& Associates
15	2000 lb Vapor Phase GAC Vessels (full)	2	lump sum	\$10,400.00	\$20,800	EnviroSupply Service, Inc.
16	Laboratory Analysis of Vapor Discharge	12	month	\$6,587.00	\$79,044	Air Toxics
17	Handling Fees (3%)	1	lump sum	\$18,911.93	\$18,912	TN& Associates
18	Contingency (10%)	1	lump sum	\$63,039.76	\$63,040	RS Means
	Subtotal (Equipment, Materials, and Subs)				\$712,349	
<u>Equipment Installation Labor</u>						
19	Construction Management	1,085	hour	\$85.00	\$92,225	TN& Associates
20	Mechanical Assembly and Installation	240	hour	\$85.00	\$20,400	T N & Associates
21	Engineering, Design, and Inspection	480	hour	\$100.00	\$48,000	TN& Associates
22	Project Management	303	hour	\$110.00	\$33,275	TN& Associates
	Subtotal (Installation Labor)				\$ 193,900	
TOTAL TREATMENT SYSTEM EQUIPMENT AND INSTALLATION:					\$906,249	

Assumptions:

1. Refer to the conceptual design for Alternative SP2a (Section 3.4.2.3) for additional design information and assumptions.
2. The estimated 5 year project duration was calculated based on anticipated contaminant extraction rates.
3. Concentrations of 1,4 dioxane in perched groundwater would not adsorb efficiently to carbon and is therefore best treated using UV oxidation.
4. This alternative assumes that additional volume and higher quality GAC (vapor phase) will adequately control emissions of vinyl chloride and 1,4 dioxane (if they are found to be at low enough concentrations). Therefore, some uncertainty exists with the ability of vapor phase GAC treatment to meet discharge requirements.
5. Confirmation soil sampling is included above, confirmation groundwater sampling is included under O&M.
6. The confirmation soil borings would be spaced one boring per 100' x 100' foot grid for 16 boring locations for the perched zone. Seven samples would be collected per boring at approximate five-foot intervals to a depth of 35 feet bgs (5' to 35' bgs).

TABLE H2 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP2b
HIGH-VACUUM DUAL-PHASE EXTRACTION/ULTRAVIOLET OXIDATION/ GRANULAR ACTIVATED CARBON
 UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE

Annual Operation and Maintenance						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>HVDPE System</u>						
1	Electrical Consumption	411,993	kWH	\$0.18	\$74,159	EnviroSupply, Calgon, S.C. Edison
2	Maintenance and Service (Average for 5 yrs.)	1	lump sum	\$3,700.00	\$3,700	EnviroSupply
3	Mechanical, Pipe, Valves, Parts (Average for 5 yrs.)	1	lump sum	\$1,743.09	\$1,743	Assume 5% of Network Cost
4	(2) Semiannual GW Sampling Events, Incl. Some soil	85	each	\$227.20	\$19,312	Calscience Labs
5	Present Worth of Yr 5 - 10 Semiannual GW Sampling Eve	1	lump sum	\$85,378.00	\$85,378	Calscience Labs
<u>UV Oxidation System</u>						
6	Electrical Consumption	245,280	kWH	\$0.18	\$44,150	Calgon and S.C. Edison
7	Peroxide, Delivered as 50% Solution (in lbs)	13,870	lbs	\$0.65	\$9,016	Calgon Carbon
8	Maintenance, Parts, Lamp Replacement (Avg. for 5 years)	1	lump sum	\$9,007.00	\$9,007	Calgon Carbon
9	Laboratory Analysis of Water Discharge	12	month	\$500.00	\$6,000	Calscience Environmental Labs.
<u>Vapor Phase GAC System</u>						
10	Replacement Carbon (average yearly, over 5 years)	8,000	lbs	1.15	\$7,221	EnviroSupply and S.C. Gas Company
11	Carbon Analytical Profiling	15	per vessel	350.00	\$2,450	EnviroSupply Service Inc.
12	Carbon Disposal (average yearly, over 5 years)	8,000	lbs	0.60	\$3,782	EnviroSupply Service Inc.
13	Laboratory Analysis of Vapor Discharge	12	month	1,867.14	\$22,406	Air Toxics
15	Handling Fees (3%)	1	lump sum	\$8,649.71	\$8,650	TN& Associates
16	Contingency (10%)	1	lump sum	\$28,832.37	\$28,832	RS Means
Subtotal (Annual Operation and Maintenance)					\$325,806	
<u>O&M Labor</u>						
17	Weekly Inspection and Monitoring	1,560	hours	85.00	\$132,600	T N & Associates
18	Data Processing and Reporting	840	hours	100.00	\$84,000	T N & Associates
19	Management of O&M	480	hours	110.00	\$52,800	T N & Associates
Subtotal (O&M Labor)					\$269,400	
TOTAL ANNUAL OPERATION AND MAINTENANCE					\$595,206	
Present Worth of Annual Operation and Maintenance						
		Cost	Interest Rate	Years	Present Worth	
	Present Worth of Annual O&M	\$595,206	4.25%	5	\$2,631,405	Calculated using uniform series present worth factor.
	Present Worth of 5 Years of Additional GW Monitoring (years 5 to 10)	\$89,647	5.00%	5	\$70,241	Calculated from present worth of single payment in 5 years time. The single payment in 5 years time was calculated from a uniform series present worth factor for 5 years of monitoring (5% is a reasonable future interest rate).
Total Present Worth of Annual O&M					\$2,701,646	

Assumptions:

- Costs associated with treatment of water and vapor discharge are included with the treatment scenarios.
- Electrical rate for small business were provided by Southern California Edison (Los Angeles) and range from \$.14 - \$.21/kWH.
- Semiannual groundwater sampling would be performed on 32 wells and the analysis would be for VOCs via EPA Methods 8260B.
- Carbon usage is based on Table 3.4 of Appendix B (GROUNDWATER EXTRACTION DESIGN SUMMARY FOR THE UPPER VADOSE AND PERCHED GROUNDWATER ZONE). Carbon usage has been increased by an approximate factor of 2 based on uncertainty of pilot study results.
- Weekly inspections will be performed and reported in conjunction with the remediation system monitoring and compliance sampling.
- The interest rate used in the present worth calculation (4.25%) is the reported Prime Rate (Nov. 2002).

**TABLE H3 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP3
IN-SITU CHEMICAL OXIDATION
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE**

Treatment System Equipment and Installation						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>Equipment, Materials, and Subcontractors</u>						
1	Bench Test	1	lump sum	\$5,200.00	\$5,200	ISOTEC
2	Mobilization/Demobilization	8	each	\$1,700.00	\$13,600	ISOTEC and Gregg Drilling
3	Pilot Study	1	lump sum	\$93,000.00	\$93,000	ISOTEC
4	Injection wells, 2" PVC	100	lump sum	\$2,100.00	\$210,000	Gregg Drilling
5	ISOTEC Modified Fenton's Reagent Injection	480,000	gallon	\$2.34	\$1,123,200	ISOTEC
6	Site Restoration	100	per well	\$250.00	\$25,000	Miller Brooks Env.
7	Confirmation Soil and GW Sampling	154	per sample	\$463.45	\$71,186	Gregg Drilling and Calscience
8	Handling Fees (3%)	1	lump sum	\$46,235.58	\$46,236	T N & Associates
9	Contingency (10%)	1	lump sum	\$154,118.59	\$154,119	RS Means
Subtotal (Equipment, Materials, and Subs)					\$1,741,540	
<u>Equipment Installation Labor</u>						
10	Construction Management	693	hour	\$85.00	\$58,933	
11	Engineering, Design, and Inspection	260	hour	\$100.00	\$26,000	
12	Project Management	208	hour	\$110.00	\$22,880	
Subtotal (Installation Labor)					\$107,813	
TOTAL TREATMENT SYSTEM EQUIPMENT AND INSTALLATION:					\$1,849,353	

Assumptions:

1. Refer to the conceptual design for Alternative SP4 (Section 3.4.2.4) for additional design information and assumptions.
2. Estimated duration for the pilot scale plus full scale in perched zone is approximately 1 year plus a minimum of 5 years additional monitoring.
3. Due to the difficulty with achieving dispersion in unsaturated soils, a 15 ft. radius of influence was assumed. The ROI for saturated soils is approximately 20 feet.
4. Assumes 100 injection wells, 1600 gal of modified Fenton's Reagent injected per well, and 3 injection events
5. Confirmation sampling is based on 100 ft. by 100 ft. grid, one sample per five foot interval (soil), plus 16 groundwater samples, plus QC.
6. Assume injection wells can be converted to monitoring wells if necessary.

TABLE H3 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP3
IN-SITU CHEMICAL OXIDATION
 UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE

Annual Operation and Maintenance (Monitoring)

Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
O&M - Utilities, Materials, and Subs						
1	(2) Semiannual GW Sampling Events, Incl. QC	72	each	\$463.45	\$33,368	Calscience Labs
2	Handling Fees (3%)	1	lump sum	\$1,001.05	\$1,001	T N & Associates
3	Contingency (10%)	1	lump sum	\$3,336.84	\$3,337	RS Means
Subtotal (Equipment, Materials, and Subs)					\$37,706	
O&M Labor						
4	Sampling/ Monitoring	480	hours	\$85.00	\$40,800	T N & Associates
5	Data Processing and Reporting	280	hours	\$100.00	\$28,000	T N & Associates
6	Management of O&M	240	hours	\$110.00	\$26,400	T N & Associates
Subtotal (O&M Labor)					\$95,200	
TOTAL ANNUAL OPERATION AND MAINTENANCE					\$132,906	

Present Worth of Annual Operation and Maintenance (Monitoring)

	Cost	Interest Rate	Years	Present Worth	
Total Present Worth of Annual O&M	\$132,906	4.25%	6	\$691,113	Calculated using uniform series present worth factor.

Assumptions:

1. Costs associated with treatment of water and vapor discharge are included with the treatment scenarios.
2. Semiannual groundwater sampling at 30 well locations includes analysis for VOCs via EPA Methods 8260B and oxidation specific analyses.
3. The interest rate used in the present worth calculation (4.25%) is the reported Prime Rate (Nov. 2002).

**TABLE H4 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP4
ENHANCED *IN-SITU* BIOREMEDIATION
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE**

Treatment System Equipment and Installation						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>Equipment, Materials, and Subcontractors</u>						
1	Mobilization/Demobilization	4	each	\$2,500.00	\$10,000	Regenesis and Gregg Drilling
2	Pilot Study (Includes Baseline Monitoring)	1	lump sum	\$50,400.00	\$50,400	Regenesis, Gregg Drilling, TN&A
3	Injection Points 0.625-inch I/D	200	lump sum	\$750.00	\$150,000	Gregg Drilling
4	Regenesis HRC, 280 lbs/point	56,000	lbs	\$9.20	\$515,200	Regenesis
5	Monitoring Wells	8	per well	\$3,500.00	\$28,000	Gregg Drilling
6	Confirmation Soil and GW Sampling	1	lump sum	\$43,316.17	\$43,316	Gregg Drilling and Calscience
7	Handling Fees (3%)	1	lump sum	\$23,907.49	\$23,907	T N & Associates
8	Contingency (10%)	1	lump sum	\$79,691.62	\$79,692	RS Means
	Subtotal (Equipment, Materials, and Subs)				\$900,515	
<u>Equipment Installation Labor</u>						
9	Construction Management	693	hour	\$85.00	\$58,933	T N & Associates
10	Engineering, Design, and Inspection	260	hour	\$100.00	\$26,000	T N & Associates
11	Project Management	208	hour	\$110.00	\$22,880	T N & Associates
	Subtotal (Installation Labor)				\$107,813	
TOTAL TREATMENT SYSTEM EQUIPMENT AND INSTALLATION:					\$1,008,329	

Assumptions:

1. Refer to the conceptual design for Alternative SP4 (Section 3.4.2.5) for additional design information and assumptions.
2. Estimated duration for the pilot scale plus full scale in perched zone is approximately 1 year plus a minimum of 5 years additional monitoring.
3. Due to the uncertainty with achieving dispersion in unsaturated soils, the hydrogen release compound (HRC) is not recommended for unsaturated zones.
4. Assumes 200 injection points based on 10-15-foot ROI and 7 lbs of HRC injected per vertical foot.
5. Confirmation sampling is based on 100 ft. by 100 ft. grid, one sample per five foot interval (soil), plus 16 groundwater samples, plus QC.

**TABLE H4 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP4
 ENHANCED *IN-SITU* BIOREMEDIATION
 UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE**

Annual Operation and Maintenance (Monitoring)						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>O&M - Utilities, Materials, and Subs</u>						
1	(2) Semiannual GW Sampling Events, Incl. QC	72	each	\$546.40	\$39,341	Calscience Labs
2	Handling Fees (3%)	1	lump sum	\$1,180.22	\$1,180	T N & Associates
3	Contingency (10%)	1	lump sum	\$3,934.08	\$3,934	RS Means
	Subtotal (Equipment, Materials, and Subs)				\$44,455	
<u>O&M Labor</u>						
4	Sampling/ Monitoring	480	hours	\$85.00	\$40,800	T N & Associates
5	Data Processing and Reporting	280	hours	\$100.00	\$28,000	T N & Associates
6	Management of O&M	240	hours	\$110.00	\$26,400	T N & Associates
	Subtotal (O&M Labor)				\$95,200	
TOTAL ANNUAL OPERATION AND MAINTENANCE					\$139,655	

Present Worth of Annual Operation and Maintenance (Monitoring)					
	Cost	Interest Rate	Years	Present Worth	
Total Present Worth of Annual O&M	\$139,655	4.25%	6	\$726,207	Calculated using uniform series present worth factor.

Assumptions:

1. Semiannual groundwater sampling at 30 well locations includes analysis for VOCs via EPA Methods 8260B and natural attenuation parameters.
2. The interest rate used in the present worth calculation (4.25%) is the reported Prime Rate (Nov. 2002).

**TABLE H5 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP5
MONITORED NATURAL ATTENUATION
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE**

Treatment System Equipment and Installation

Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
<u>Equipment, Materials, and Subcontractors</u>						
1	Mobilization/Demobilization	2	each	\$1,500.00	\$3,000	Gregg Drilling
2	Monitoring Well Installation	8	per well	\$3,500.00	\$28,000	Gregg Drilling
3	Handling Fees (3%)	1	lump sum	\$930.00	\$930	T N & Associates
4	Contingency (10%)	1	lump sum	\$3,100.00	\$3,100	RS Means
Subtotal (Equipment, Materials, and Subs)					\$35,030	
<u>Equipment Installation Labor</u>						
5	Well Installation/Sampling	440	hour	\$85.00	\$37,400	T N & Associates
6	Engineering, Design, Planning	320	hour	\$100.00	\$32,000	T N & Associates
7	Project Management	240	hour	\$110.00	\$26,400	T N & Associates
Subtotal (Installation Labor)					\$95,800	
TOTAL TREATMENT SYSTEM EQUIPMENT AND INSTALLATION:					\$130,830	

Assumptions:

1. Refer to the conceptual design for Alternative SP5 (Section 3.4.2.6) for additional design information and assumptions.
2. It is assumed that 25 of the existing perched zone wells would be utilized (some would be dry) and 8 new perched zone wells would be required.
3. Monitored natural attenuation does not address vadose zone soil contamination and requires partnering with a source treatment alternative.

**TABLE H5 - DETAILED COST SUMMARY FOR REMEDIAL ALTERNATIVE SP5
MONITORED NATURAL ATTENUATION
UPPER VADOSE SOIL AND PERCHED GROUNDWATER REMEDIATION ZONE**

Annual Operation and Maintenance (Monitoring)						
Item No.	Description	Quantity	Unit	Unit Rate	Total Cost	Source
O&M - Utilities, Materials, and Subs						
1	(2) Semiannual GW Sampling Events, Incl. QC	72	each	\$546.40	\$39,341	Calscience Labs
2	Handling Fees (3%)	1	lump sum	\$1,180.22	\$1,180	T N & Associates
3	Contingency (10%)	1	lump sum	\$3,934.08	\$3,934	RS Means
	Subtotal (Equipment, Materials, and Subs)				\$44,455	
O&M Labor						
4	Sampling/ Monitoring	320	hours	\$85.00	\$27,200	T N & Associates
5	Data Processing and Reporting	280	hours	\$100.00	\$28,000	T N & Associates
6	Management of O&M	110	hours	\$110.00	\$12,100	T N & Associates
	Subtotal (O&M Labor)				\$67,300	
TOTAL ANNUAL OPERATION AND MAINTENANCE					\$111,755	

Present Worth of Annual Operation and Maintenance (Monitoring)					
	Cost	Interest Rate	Years	Present Worth	
Total Present Worth of Annual O&M	\$111,755	4.25%	50	\$2,301,038	Calculated using uniform series present worth factor.

Assumptions:

1. Semiannual groundwater sampling at 30 well locations includes analysis for VOCs and natural attenuation parameters.
2. The interest rate used in the present worth calculation (4.25%) is the reported Prime Rate (Nov. 2002).
3. The assumed project duration for monitored natural attenuation is 50 years.