

Cost Estimates

This appendix presents the cost estimates and associated costing assumptions used to develop feasibility-study-level cost estimates for the four remedial alternatives evaluated in the *Focused Feasibility Study, North Hollywood Operable Unit, San Fernando Valley Area 1 Superfund Site, Los Angeles County, California*. The cost estimates for the alternatives are summarized in Table D-1, with more details provided in Table D-2. Detailed cost estimates for each of the components included in the remedial alternatives are provided in Tables D-3A through D-17B. Preliminary cost estimates for screening chromium treatment technologies are provided in Tables D-18A through D-19B).

The scope of the remedial alternatives was developed using assumptions regarding the extent of contamination, future regulatory requirements, and escalation of costs for remedial equipment and services. The cost estimates associated with each alternative are based on representative remedial actions comprised of example technologies. These are presented to make comparative evaluations regarding cost and are not necessarily the specific technologies or methods that will be a part of the final design. After selection of a preferred alternative, the associated technologies and design features may be modified during the final remedial design effort to enhance overall effectiveness, meet new regulatory requirements, or improve efficiency. Such modifications, or significant delays in remedial design and construction, can have a significant impact on actual costs.

Summary of Costs for NHOU Remedial Alternatives

Alternative	Description	Cost Type	Common Elements (monitoring, 97-005, & interim wellhead treatment at NHE-2)	Hydraulic Containment (extraction wells)	VOC Treatment	Chromium Treatment	1,4-Dioxane Treatment	Reinjection (includes add'l monitoring)	TOTAL
1	Existing System - 7 existing extraction wells - VOC treatment by existing air stripper (refurbished) - Wellhead CrVI & dioxane treatment at NHE-2	Capital	\$12,034,070	\$0	\$174,070	\$4,130,000	\$0	\$0	\$16,338,140
		Annual O&M	\$2,265,000	\$352,000	\$365,000	\$790,000	\$0	\$0	\$3,772,000
		30- year NPV (assumed 7% discount rate)	\$17,129,200	\$4,364,800	\$4,700,070	\$13,926,000	\$0	\$0	\$40,120,070
2a	Add Extraction Wells and LPGAC - Deepen/expand 8 original extraction wells - Add 3 new extraction wells in NW area - Add second air-stripper and LPGAC treatment for VOCs - Wellhead CrVI treatment at NHE-1 & 2 - Wellhead dioxane treatment at NHE-2	Capital	\$23,148,140	\$6,510,000	\$4,778,140	\$11,430,000	\$640,000	\$0	\$46,506,280
		O&M	\$3,463,000	\$740,000	\$1,175,000	\$2,512,000	\$428,000	\$0	\$8,318,000
		30- year NPV (assumed 7% discount rate)	\$17,129,200	\$15,686,000	\$19,348,140	\$34,852,600	\$4,708,080	\$0	\$91,724,020
2b	Reinjection Option--modifications from Alternative 2a: - Reinject treated effluent at 6 injection wells - 97-005 process not required - Double-barrier VOC treatment (LPGAC) not required - Assume existing 8 extraction wells, pipeline, and air stripper must be replaced or purchased from LADWP (including the land required for the entire treatment system)	Capital	\$35,948,140	\$17,240,000	\$7,598,140	\$11,430,000	\$640,000	\$16,420,000	\$89,276,280
		O&M	\$3,463,000	\$740,000	\$599,000	\$2,512,000	\$428,000	\$349,000	\$8,091,000
		30- year NPV (assumed 7% discount rate)	\$16,379,200	\$26,416,000	\$15,025,740	\$34,852,600	\$4,708,080	\$20,747,600	\$118,129,220
3a	Add Extraction Wells and LPGAC - Deepen/expand 8 original extraction wells - Add 3 new extraction wells in NW area - Add second air-stripper and LPGAC treatment for VOCs - CrVI treatment for NHE-1 & 2 in single unit - Wellhead dioxane treatment at NHE-2	Capital	\$23,148,140	\$6,510,000	\$4,778,140	\$10,220,000	\$640,000	\$0	\$45,296,280
		Annual O&M	\$3,463,000	\$740,000	\$1,175,000	\$1,873,000	\$428,000	\$0	\$7,679,000
		30- year NPV (assumed 7% discount rate)	\$17,129,200	\$15,686,000	\$19,348,140	\$25,719,000	\$4,708,080	\$0	\$82,590,420
3b	Reinjection Option--modifications from Alternative 3a: - Reinject treated effluent at 6 injection wells - 97-005 process not required - Double-barrier VOC treatment (LPGAC) not required - Assume existing 8 extraction wells, pipeline, air stripper, and land must be replaced or purchased from LADWP	Capital	\$35,948,140	\$17,240,000	\$7,598,140	\$10,220,000	\$640,000	\$16,420,000	\$88,066,280
		Annual O&M	\$2,887,000	\$740,000	\$599,000	\$1,873,000	\$428,000	\$349,000	\$6,876,000
		30- year NPV (assumed 7% discount rate)	\$16,379,200	\$26,416,000	\$15,025,740	\$25,719,000	\$4,708,080	\$20,747,600	\$108,995,620
4a	Add Extraction Wells, LPGAC, Limited CrVI Treatment - Deepen/expand 8 original extraction wells - Add 3 new extraction wells in NW area - Add second air-stripper and LPGAC treatment for VOCs - Wellhead CrVI treatment for NHE-2 - Combined CrVI treatment for NHE-1 and 2 new ext. wells - Wellhead dioxane treatment at NHE-2	Capital	\$23,148,140	\$6,510,000	\$4,778,140	\$17,190,000	\$640,000	\$0	\$52,266,280
		Annual O&M	\$3,463,000	\$740,000	\$1,175,000	\$3,342,000	\$428,000	\$0	\$9,148,000
		30- year NPV (assumed 7% discount rate)	\$17,129,200	\$15,686,000	\$19,348,140	\$50,904,600	\$4,708,080	\$0	\$107,776,020
4b	Reinjection Option--modifications from Alternative 4a: - Reinject treated effluent at 6 injection wells - 97-005 process not required - Double-barrier VOC treatment (LPGAC) not required - Assume existing 8 extraction wells, pipeline, air stripper, and land must be replaced or purchased from LADWP	Capital	\$35,948,140	\$17,240,000	\$7,598,140	\$17,190,000	\$640,000	\$16,420,000	\$95,036,280
		Annual O&M	\$2,887,000	\$740,000	\$599,000	\$3,342,000	\$428,000	\$349,000	\$8,345,000
		30- year NPV (assumed 7% discount rate)	\$16,379,200	\$26,416,000	\$15,025,740	\$50,904,600	\$4,708,080	\$20,747,600	\$134,181,220
5a	Add Extraction Wells, LPGAC, CrVI Treatment for All Extraction Wells - Deepen/expand 8 original extraction wells - Add 3 new extraction wells in NW area - Add second air-stripper and LPGAC treatment for VOCs - CrVI treatment for all wells - Wellhead dioxane treatment at NHE-2	Capital	\$23,148,140	\$6,510,000	\$4,778,140	\$26,590,000	\$640,000	\$0	\$61,666,280
		Annual O&M	\$3,463,000	\$740,000	\$1,175,000	\$3,564,000	\$428,000	\$0	\$9,370,000
		30- year NPV (assumed 7% discount rate)	\$17,129,200	\$15,686,000	\$19,348,140	\$63,057,400	\$4,708,080	\$0	\$119,928,820
5b	Reinjection Option to Contingency--modifications from Alternative 5a: - Reinject treated effluent at 6 injection wells - 97-005 process not required - Double-barrier VOC treatment (LPGAC) not required - Assume existing 8 extraction wells, pipeline, air stripper, and land must be replaced or purchased from LADWP	Capital	\$35,948,140	\$17,240,000	\$7,598,140	\$26,590,000	\$640,000	\$16,420,000	\$104,436,280
		Annual O&M	\$2,887,000	\$740,000	\$599,000	\$3,564,000	\$428,000	\$349,000	\$8,567,000
		30- year NPV (assumed 7% discount rate)	\$16,379,200	\$26,416,000	\$15,025,740	\$63,057,400	\$4,708,080	\$20,747,600	\$146,334,020

Table D-3A

Capital Cost – Construct New Monitoring Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Installation of 16 New Monitoring Wells in Depth Region 1								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	LS	\$10,000	\$10,000	1	\$10,000	WDC, Santa Clarita project 2006
	Setup and move between boring locations / Decon Rig	1	EA	\$3,000	\$3,000	15	\$45,000	WDC, Santa Clarita project 2006
	Noise Control	1	EA	\$32,500	\$32,500	8	\$260,000	WDC, Santa Clarita project 2006
	Furnish and install 14" diameter steel conductor casing in 18" diameter boring	20	LF	\$300	\$6,000	16	\$96,000	WDC, Santa Clarita project 2006
	Drill 10-12" diameter boring by mud rotary (direct, dual tube reverse) methods	300	LF	\$68	\$20,400	16	\$326,400	WDC, Santa Clarita project 2006
	Complete geophysical suite, including caliper	1	EA	\$4,500	\$4,500	16	\$72,000	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC blank casing	270	LF	\$15	\$4,050	16	\$64,800	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC screen	30	LF	\$17	\$510	16	\$8,160	WDC, Santa Clarita project 2006
	Sand filter pack	50	LF	\$6	\$300	16	\$4,800	WDC, Santa Clarita project 2006
	Bentonite-cement grout, installed	250	LF	\$6	\$1,500	16	\$24,000	WDC, Santa Clarita project 2006
	Surface completion	1	EA	\$1,750	\$1,750	16	\$28,000	WDC, Santa Clarita project 2006
	Completely develop monitoring wells, each screen	12	HR	\$145	\$1,740	16	\$27,840	WDC, Santa Clarita project 2006
	Pumps	1	LS	\$5,500	\$5,500	16	\$88,000	WDC, Santa Clarita project 2006
	Standby time for drill rig and associated equipment	8	HR	\$100	\$800	16	\$12,800	WDC, Santa Clarita project 2006

Table D-3A

Capital Cost – Construct New Monitoring Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Installation of 18 New Monitoring Wells in Depth Region 2								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	LS	\$10,000	\$10,000	1	\$10,000	WDC, Santa Clarita project 2006
	Setup and move between boring locations / Decon Rig	1	EA	\$3,000	\$3,000	17	\$51,000	WDC, Santa Clarita project 2006
	Noise Control	1	EA	\$32,500	\$32,500	9	\$292,500	WDC, Santa Clarita project 2006
	Furnish and install 14" diameter steel conductor casing in 18" diameter boring	20	LF	\$300	\$6,000	18	\$108,000	WDC, Santa Clarita project 2006
	Drill 10-12" diameter boring by mud rotary (direct, dual tube reverse) methods	425	LF	\$68	\$28,900	18	\$520,200	WDC, Santa Clarita project 2006
	Complete geophysical suite, including caliper	1	EA	\$4,500	\$4,500	18	\$81,000	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC blank casing	395	LF	\$15	\$5,925	18	\$106,650	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC screen	30	LF	\$17	\$510	18	\$9,180	WDC, Santa Clarita project 2006
	Sand filter pack	50	LF	\$6	\$300	18	\$5,400	WDC, Santa Clarita project 2006
	Bentonite-cement grout, installed	375	LF	\$6	\$2,250	18	\$40,500	WDC, Santa Clarita project 2006
	Surface completion	1	EA	\$1,750	\$1,750	18	\$31,500	WDC, Santa Clarita project 2006
	Completely develop monitoring wells, each screen	12	HR	\$145	\$1,740	18	\$31,320	WDC, Santa Clarita project 2006
	Pumps	1	LS	\$5,500	\$5,500	18	\$99,000	WDC, Santa Clarita project 2006
	Standby time for drill rig and associated equipment	8	HR	\$100	\$800	18	\$14,400	WDC, Santa Clarita project 2006

Table D-3A

Capital Cost – Construct New Monitoring Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Installation of 3 New Monitoring Wells in Depth Region 3								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	LS	\$10,000	\$10,000	1	\$10,000	WDC, Santa Clarita project 2006
	Setup and move between boring locations / Decon Rig	1	EA	\$3,000	\$3,000	2	\$6,000	WDC, Santa Clarita project 2006
	Noise Control	1	EA	\$32,500	\$32,500	2	\$65,000	WDC, Santa Clarita project 2006
	Furnish and install 14" diameter steel conductor casing in 18" diameter boring	20	LF	\$300	\$6,000	3	\$18,000	WDC, Santa Clarita project 2006
	Drill 10-12" diameter boring by mud rotary (direct, dual tube reverse) methods	650	LF	\$68	\$44,200	3	\$132,600	WDC, Santa Clarita project 2006
	Complete geophysical suite, including caliper	1	EA	\$4,500	\$4,500	3	\$13,500	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC blank casing	620	LF	\$15	\$9,300	3	\$27,900	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC screen	30	LF	\$17	\$510	3	\$1,530	WDC, Santa Clarita project 2006
	Sand filter pack	50	LF	\$6	\$300	3	\$900	WDC, Santa Clarita project 2006
	Bentonite-cement grout, installed	600	LF	\$6	\$3,600	3	\$10,800	WDC, Santa Clarita project 2006
	Surface completion	1	EA	\$1,750	\$1,750	3	\$5,250	WDC, Santa Clarita project 2006
	Completely develop monitoring wells, each screen	12	HR	\$145	\$1,740	3	\$5,220	WDC, Santa Clarita project 2006
	Pumps	1	LS	\$5,500	\$5,500	3	\$16,500	WDC, Santa Clarita project 2006
	Standby time for drill rig and associated equipment	8	HR	\$100	\$800	3	\$2,400	WDC, Santa Clarita project 2006
Waste Handling for Depth Region 1 Monitoring Wells								
	Mobilization/demobilization of roll off bins (10 CY bins)	3	EA	\$600	\$1,800	16	\$28,800	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	270	DAY	\$18	\$4,860	16	\$77,760	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	1	EA	\$1,000	\$1,000	16	\$16,000	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	90	DAY	\$35	\$3,150	16	\$50,400	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	30	TON	\$58	\$1,740	16	\$27,840	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	10,000	GAL	\$0.30	\$3,000	16	\$48,000	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.30	\$450	16	\$7,200	WDC, Santa Clarita project 2006

Table D-3A

Capital Cost – Construct New Monitoring Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Waste Handling for Depth Region 2 Monitoring Wells								
	Mobilization/demobilization of roll off bins (10 CY bins)	4	EA	\$600	\$2,400	18	\$43,200	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	360	DAY	\$18	\$6,480	18	\$116,640	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	1	EA	\$1,000	\$1,000	18	\$18,000	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	90	DAY	\$35	\$3,150	18	\$56,700	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	37	TON	\$58	\$2,146	18	\$38,628	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	10,000	GAL	\$0.30	\$3,000	18	\$54,000	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.30	\$450	18	\$8,100	WDC, Santa Clarita project 2006
Waste Handling for Depth Region 3 Monitoring Wells								
	Mobilization/demobilization of roll off bins (10 CY bins)	6	EA	\$600	\$3,600	3	\$10,800	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	540	DAY	\$18	\$9,720	3	\$29,160	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	2	EA	\$1,000	\$2,000	3	\$6,000	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	180	DAY	\$35	\$6,300	3	\$18,900	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	49	TON	\$58	\$2,842	3	\$8,526	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	20,000	GAL	\$0.30	\$6,000	3	\$18,000	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.30	\$450	3	\$1,350	WDC, Santa Clarita project 2006
	Subtotal "A"						\$ 3,468,054	
	Inflation Adjustment 2006 to 2009 (6% per year average)			19.1%		of Subtotal "A"	\$ 662,454	
	Subtotal "B"						\$ 4,130,508	
	Engineering			20.4%		of Subtotal "B"	\$ 841,796	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			20.4%		of Subtotal "B"	\$ 841,796	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 5,814,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 581,400	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 581,400	
	GRAND TOTAL						\$ 6,980,000	

NOTES:

1. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-3B

Operations and Maintenance Cost – Groundwater Monitoring

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes	
		Extraction	Monitoring	Production	QA/QC Samples								
11 Monthly Sampling Events (extraction wells only)	<u>Analytical Costs</u>												
	VOCs	7	0	0	3	10	samples	\$ 95	\$ 950	11	\$ 10,450		
	Hexavalent Chromium	7	0	0	3	10	samples	\$ 95	\$ 950	11	\$ 10,450		
	Dissolved Metals	0	0	0	0	0	samples	\$ 175	\$ -	11	\$ -	Analyze annually	
	Common Anions, TDS, Alkalinity	0	0	0	0	0	samples	\$ 120	\$ -	11	\$ -	Analyze annually	
	Nitrate	0	0	0	0	0	samples	\$ 35	\$ -	11	\$ -	Analyze annually	
	1,4-Dioxane and TCP	7	0	0	3	10	samples	\$ 275	\$ 2,750	11	\$ 30,250		
	NDMA and Perchlorate	0	0	0	0	0	samples	\$ 300	\$ -	11	\$ -	Analyze annually	
	<u>Labor</u>												
	Planning and Mobilization					3	hours	\$ 100	\$ 300	11	\$ 3,300	One staff, includes lab coordination and travel time	
	Sampling					8	hours	\$ 100	\$ 800	11	\$ 8,800	One staff, no purge necessary	
	Demobilization from Field					2	hours	\$ 100	\$ 200	11	\$ 2,200	Ship samples, return equipment, travel time home	
	Data Validation					2	hours	\$ 125	\$ 250	11	\$ 2,750	Review of lab data by chemist, corrections, reporting	
	<u>Reporting/Data Submittal</u>					4	hours	\$ 125	\$ 500	11	\$ 5,500	Database submittal, brief monthly summary report	
	<u>Other Subcontractors</u>												
Well Maintenance					0	hours	\$ 150	\$ -	11	\$ -	Costs included in extraction well O&M		
IDW Disposal					0	hours	\$ 150	\$ -	11	\$ -	No purging necessary for active extraction wells		
<u>Other Costs</u>													
Travel Expenses					1	days	\$ 200	\$ 200	11	\$ 2,200	Vehicle rental and fuel, meals		
Sampling Equipment Rental					1	days	\$ 125	\$ 125	11	\$ 1,375	Water levels, parameters, peristaltic pump, etc.		
Shipping Costs					1	lump sum	\$ 200	\$ 200	11	\$ 2,200	Field equipment, samples, reports		
Perishable Supplies					1	lump sum	\$ 50	\$ 50	11	\$ 550	Ice for samples, decontamination supplies, etc.		
Subtotal Monthly Sampling Events (extraction wells only)										\$ 80,000			

Table D-3B

Operations and Maintenance Cost – Groundwater Monitoring

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
3 Quarterly Sampling Events (4th quarterly event will coincide with the annual sampling event, below)	Analytical Costs											
	VOCs	0	50	10	18	78	samples	\$ 95	\$ 7,410	3	\$ 22,230	Assume half of monitoring and production wells described in Section 4.2.5 of FFS will require quarterly monitoring, remainder sampled annually
	Hexavalent Chromium	0	50	10	18	78	samples	\$ 95	\$ 7,410	3	\$ 22,230	See note for VOCs
	Dissolved Metals	0	0	0	0	0	samples	\$ 175	\$ -	3	\$ -	Analyzed annually
	Common Anions, TDS, Alkalinity	0	0	0	0	0	samples	\$ 120	\$ -	3	\$ -	Analyzed annually
	Nitrate	0	0	0	0	0	samples	\$ 35	\$ -	3	\$ -	Analyzed annually
	1,4-Dioxane and TCP	0	50	10	18	78	samples	\$ 275	\$ 21,450	3	\$ 64,350	See note for VOCs
NDMA and Perchlorate	0	0	0	0	0	samples	\$ 300	\$ -	3	\$ -	Analyzed annually	
	Labor											
	Planning and Mobilization		20	4		24	hours	\$ 100	\$ 2,400	3	\$ 7,200	Two staff, includes lab and subcontractor coordination, and travel time
	Sampling		252	20		272	hours	\$ 100	\$ 27,200	3	\$ 81,600	Based on current SFV quarterly sampling program
	Demobilization from Field		8			8	hours	\$ 100	\$ 800	3	\$ 2,400	Ship samples, return equipment, travel time home
	Data Validation					24	hours	\$ 125	\$ 3,000	3	\$ 9,000	Review of lab data by chemist, corrections, reporting
	Reporting/Data Submittal					40	hours	\$ 125	\$ 5,000	3	\$ 15,000	Database submittal, brief summary report
	Other Subcontractors											
	Well Maintenance					12	hours	\$ 150	\$ 1,800	3	\$ 5,400	One day well subcontractor support assumed
	IDW Disposal					60	hours	\$ 100	\$ 6,000	3	\$ 18,000	Tanker truck to collect purged water from wells, dispose at NHOU or BOU treatment systems
	Other Costs											
	Travel Expenses					9	days	\$ 350	\$ 3,150	3	\$ 9,450	Vehicle rental and fuel, meals, hotel for two staff
	Sampling Equipment Rental					9	days	\$ 125	\$ 1,125	3	\$ 3,375	Water levels, parameters, peristaltic pump, etc.
	Shipping Costs					1	lump sum	\$ 2,200	\$ 2,200	3	\$ 6,600	Field equipment, samples, reports
	Perishable Supplies					1	lump sum	\$ 200	\$ 200	3	\$ 600	Ice for samples, decontamination supplies, etc.
Subtotal Quarterly Sampling Events										\$ 267,000		

Table D-3B

Operations and Maintenance Cost – Groundwater Monitoring

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
1 Annual Sampling Event	<u>Analytical Costs</u>											
	VOCs	7	100	20	39	166	samples	\$ 95	\$ 15,770	1	\$ 15,770	
	Hexavalent Chromium	7	100	20	39	166	samples	\$ 95	\$ 15,770	1	\$ 15,770	
	Dissolved Metals	7	100	20	39	166	samples	\$ 175	\$ 29,050	1	\$ 29,050	
	Common Anions, TDS, Alkalinity	7	100	20	39	166	samples	\$ 120	\$ 19,920	1	\$ 19,920	
	Nitrate	7	100	20	39	166	samples	\$ 35	\$ 5,810	1	\$ 5,810	
	1,4-Dioxane and TCP	7	100	20	39	166	samples	\$ 275	\$ 45,650	1	\$ 45,650	
	NDMA and Perchlorate	7	100	20	39	166	samples	\$ 300	\$ 49,800	1	\$ 49,800	
	<u>Labor</u>											
	Planning and Mobilization	4	20	4		28	hours	\$ 100	\$ 2,800	1	\$ 2,800	Two staff, includes lab and subcontractor coordination, and travel time
	Sampling	4	500	40		544	hours	\$ 100	\$ 54,400	1	\$ 54,400	Based on current SFV quarterly sampling program
	Demobilization from Field		16			16	hours	\$ 100	\$ 1,600	1	\$ 1,600	Ship samples, return equipment, travel time home
	Data Validation					48	hours	\$ 125	\$ 6,000	1	\$ 6,000	Review of lab data by chemist, corrections, reporting
	<u>Reporting/Data Submittal</u>					240	hours	\$ 125	\$ 30,000	1	\$ 30,000	Database submittal, extensive annual summary report
	<u>Other Subcontractors</u>											
	Well Maintenance					24	hours	\$ 150	\$ 3,600	1	\$ 3,600	Two days well subcontractor support assumed
	IDW Disposal					120	hours	\$ 100	\$ 12,000	1	\$ 12,000	Tanker truck to collect purged water from wells, dispose at NHOU or BOU treatment systems
	<u>Other Costs</u>											
	Travel Expenses					20	days	\$ 350	\$ 7,000	1	\$ 7,000	Vehicle rental and fuel, meals, hotel for two staff
	Sampling Equipment Rental					20	days	\$ 60	\$ 1,200	1	\$ 1,200	Water levels, parameters, peristaltic pump, etc.
	Shipping Costs					1	lump sum	\$ 12,000	\$ 12,000	1	\$ 12,000	Field equipment, samples, reports
	Perishable Supplies					1	lump sum	\$ 1,000	\$ 1,000	1	\$ 1,000	Ice for samples, decontamination supplies, etc.
Subtotal Annual Sampling Event											\$ 313,000	

Table D-3B

Operations and Maintenance Cost – Groundwater Monitoring

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
Other Annual Costs	<u>Labor</u>											
	Project Management				80	hours	\$ 150	\$ 12,000	1	\$ 12,000	Coordination with EPA and field teams, monthly status reporting	
	Subcontracting				24	hours	\$ 100	\$ 2,400	1	\$ 2,400	Develop subcontracts	
	Sampling program review and optimization				60	hours	\$ 125	\$ 7,500	1	\$ 7,500		
	QA/QC and Safety Audits				40	hours	\$ 125	\$ 5,000	1	\$ 5,000	Laboratory and field team audits	
	<u>Other Costs</u>											
	Travel Expenses				6	days	\$ 350	\$ 2,100	1	\$ 2,100	Annual coordination meeting with EPA, other well owners, field and laboratory audits	
Subtotal Other Annual Costs										\$ 29,000		
Contingency on Materials/Services								10%		\$ 69,000		
										\$ 758,000		
												GRAND TOTAL

Table D-4

Operations and Maintenance Cost – Operate Existing NHOU Extraction Wells at Current Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power	Well Pumps to Treatment Sys	800 gpm @ 350'	579,618	1	579,618	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				596,084	kW-hr	\$ 0.12	\$ 71,530
Analytical	Water Samples - Monthly Tests (see groundwater monitoring table)			0		ea.	\$ 500	\$ -
	Water Samples - Additional Annual Tests (see groundwater monitoring table)			0		ea.	\$ 750	\$ -
Labor	Operating			500		hrs	\$ 40	\$ 20,000
	Maintenance			500		hrs	\$ 48	\$ 24,000
	Supervisory			0		hrs	\$ 80	\$ -
	Clerical			0		hrs	\$ 26	\$ -
	Laboratory			0		hrs	\$ 48	\$ -
	Yardwork			0		hrs	\$ 40	\$ -
Subcontracts	Regulatory Monitoring reports (RWCQB, EPA)			1		lot	\$ 25,000	\$ 25,000
	Heavy Maintenance			1		lot	\$ 50,000	\$ 50,000
Parts	(2% of Capital)				2%		\$ 6,450,000	\$ 129,000
								\$ 320,000
Contingency on Materials/Services					10%			\$ 32,000
	GRAND TOTAL							\$ 352,000

Table D-5A

Capital Cost – Modify and Rehabilitate Existing NHOU Extraction Wells

Item	Description	Estimated Depth/Quantity	Number of Locations	Estimated Total Quantity	Unit	Unit Cost	Total Cost	Cost Estimate Source
Installation of Replacement Extraction Wells - NHE-1, NHE-2, NHE-4, and NHE-5								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	1	1	Lump Sum	\$113,623	\$113,623	Layne - Palmdale 2005
	Setup and move between boring locations / Decon Rig	1	3	3	Each	\$9,469	\$28,406	Layne - Palmdale 2005
	Sound Control	1	2	2	Each	\$38,708	\$77,416	Assume Half Wells - Santa Clarita (Lang, 2006)
	Conductor Casing and Sanitary Seal - drill 30-inch (minimum) hole and furnish and install 24-inch conductor casing	50	4	200	Linear foot	\$566	\$113,131	GSWC - Ojai, 2004
	Drilling Reverse Mud Rotary/Ream (20-inch)	400	4	1,600	Linear foot	\$130	\$208,056	GSWC - Ojai, 2004
	Geophysical	1	4	4	Each	\$5,852	\$23,406	GSWC - Ojai, 2004
	Steel Well Casing - 10-inch	300	4	1,200	Linear foot	\$120	\$143,559	PVOU - 2004
	Stainless Steel Screen - 10-inch	100	4	400	Linear foot	\$202	\$80,622	PVOU - 2004
	Dissimilar Metals Connector	1	4	4	Each	\$3,251	\$13,004	PVOU - 2004
	Gravel Tube	275	4	1,100	Linear foot	\$26	\$28,608	GSWC - Ojai, 2004
	Sound Tube	400	4	1,600	Linear foot	\$20	\$31,208	GSWC - Ojai, 2004
	Filter Pack	150	4	600	Linear foot	\$20	\$11,703	PVOU - 2004
	Annular Grout or Neat Cement	250	4	1,000	Linear foot	\$33	\$32,509	PVOU - 2004
	Well Development - Primary & Secondary	20	4	80	Hours	\$265	\$21,210	Layne - Palmdale 2005
	Development Rig	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Mobilization/Demobilization/Cleanup	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Step-Rate Aquifer Test	8	4	32	Hours	\$265	\$8,484	Layne - Palmdale 2005
	Constant-Rate Aquifer Test	72	4	288	Hours	\$265	\$76,355	Layne - Palmdale 2005
	Video Camera Survey	1	4	4	Each	\$1,262	\$5,050	Layne - Palmdale 2005
	Disinfect Well	1	4	4	Each	\$1,951	\$7,802	GSWC - Ojai, 2004
Pump and Power Service Connection								
	Well Head	1	4	4	Each	\$5,050	\$20,200	Layne - Palmdale 2005
	Submersible Pump - 6 inch	1	4	4	Each	\$9,102	\$36,410	PVOU - 2004
	Pump Installation Cost	1	4	4	Each	\$2,209	\$8,837	Layne - Palmdale 2005
	Pump Riser Pipe (stainless steel)	350	4	1,400	LF	\$40	\$56,071	PVOU - 2004
	Check Valve	1	4	4	Each	\$520	\$2,081	PVOU - 2004
	Flow Meter	1	4	4	Each	\$5,592	\$22,366	PVOU - 2004
	Gate Valve	1	4	4	Each	\$780	\$3,121	PVOU - 2004
	Power service connection and panel	1	4	4	Each	\$25,000	\$100,000	

Table D-5A

Capital Cost – Modify and Rehabilitate Existing NHOU Extraction Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Task - Replacement Extraction Wells - NHE-1, NHE-2, NHE-4, and NHE-5								
	Mobilization/demobilization of roll off bins (10 CY bins)	11	EA	\$715	\$7,861	4	\$31,443	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	990	DAY	\$21	\$21,224	4	\$84,896	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	3	EA	\$1,191	\$3,573	4	\$14,292	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	270	DAY	\$42	\$11,255	4	\$45,020	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	36	TON	\$69	\$2,487	4	\$9,947	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	40,000	GAL	\$0.36	\$14,292	4	\$57,169	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.36	\$536	4	\$2,144	WDC, Santa Clarita project 2006
Task - Clean Existing Wells								
	Planning				\$1,500	4	\$6,000	
	Contractor Costs				\$5,800	4	\$23,200	
	Subtotal "A"						\$ 1,551,765	
	Inflation Adjustment 2006 to 2009			0.0%		of Subtotal "A"	\$ -	Calculated within line items
	Subtotal "B"						\$ 1,551,765	
	Engineering			23.6%		of Subtotal "B"	\$ 365,732	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			23.6%		of Subtotal "B"	\$ 365,732	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 2,283,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 228,300	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 228,300	
	GRAND TOTAL						\$ 2,740,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-5B

Operations and Maintenance Cost – Existing NHOU Extraction Wells

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps to Treatment Sys	2000 gpm @ 350'	1,449,045	1	1,449,045	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				1,465,511	kW-hr	\$ 0.12	\$ 175,861
Analytical								
	Water Samples - Monthly Tests (see groundwater monitoring table)			0		ea.	\$ 500.00	\$ -
	Water Samples - Additional Annual Tests (see groundwater monitoring table)			0		ea.	\$ 750.00	\$ -
Labor								
	Operating			500		hrs	\$ 40.00	\$ 20,000
	Maintenance			500		hrs	\$ 48.00	\$ 24,000
	Supervisory			0		hrs	\$ 80.00	\$ -
	Clerical			0		hrs	\$ 26.00	\$ -
	Laboratory			0		hrs	\$ 48.00	\$ -
	Yardwork			0		hrs	\$ 40.00	\$ -
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA)			1		lot	\$ 25,000.00	\$ 25,000
	Heavy Maintenance			1		lot	\$ 30,000.00	\$ 30,000
Parts	(2% of Capital)				2%		\$ 6,450,000	\$ 129,000
								\$ 404,000
Contingency on Materials/Services					10%			\$ 41,000
								\$ 445,000

Table D-5C

Operations and Maintenance Cost – Operate Pipeline from Eight Extraction Wells to NHOU Treatment Plant

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			0		hrs	\$ 40.00	\$ -
	Maintenance			48		hrs	\$ 48.00	\$ 2,304
	Supervisory			0		hrs	\$ 80.00	\$ -
	Clerical			0		hrs	\$ 26.00	\$ -
	Laboratory			0		hrs	\$ 48.00	\$ -
	Yardwork			0		hrs	\$ 40.00	\$ -
Equipment								
	Pickup			96		hrs	\$ 12.00	\$ 1,152
Misc Repairs, Annual	(1% of Capital)				1%		\$ 7,020,000	\$ 70,200
								\$ 74,000
Contingency on Materials/Services					10%			\$ 8,000
								\$ 82,000
								GRAND TOTAL

Table D-5D

Capital Cost – Replace Eight Existing NHOU Extraction Wells

Item	Description	Estimated Depth/Quantity	Number of Locations	Estimated Total Quantity	Unit	Unit Cost	Total Cost	Cost Estimate Source
Installation of Replacement Extraction Wells - NHE-1 through NHE-8								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	1	1	Lump Sum	\$113,623	\$113,623	Layne - Palmdale 2005
	Setup and move between boring locations / Decon Rig	1	7	7	Each	\$9,469	\$66,280	Layne - Palmdale 2005
	Sound Control	1	4	4	Each	\$38,708	\$154,832	Assume Half Wells - Santa Clarita (Lang)
	Conductor Casing and Sanitary Seal - drill 30-inch (minimum) hole and furnish and install 24-inch conductor casing	50	4	200	Linear foot	\$566	\$113,131	GSWC - Ojai, 2004
	Drilling Reverse Mud Rotary/Ream (20-inch)	400	8	3,200	Linear foot	\$130	\$416,112	GSWC - Ojai, 2004
	Geophysical	1	8	8	Each	\$5,852	\$46,813	GSWC - Ojai, 2004
	Steel Well Casing - 10-inch	300	8	2,400	Linear foot	\$120	\$287,118	PVOU - 2004
	Stainless Steel Screen - 10-inch	100	8	800	Linear foot	\$202	\$161,244	PVOU - 2004
	Dissimilar Metals Connector	1	8	8	Each	\$3,251	\$26,007	PVOU - 2004
	Gravel Tube	275	8	2,200	Linear foot	\$26	\$57,215	GSWC - Ojai, 2004
	Sound Tube	400	8	3,200	Linear foot	\$20	\$62,417	GSWC - Ojai, 2004
	Filter Pack	150	8	1,200	Linear foot	\$20	\$23,406	PVOU - 2004
	Annular Grout or Neat Cement	250	8	2,000	Linear foot	\$33	\$65,018	PVOU - 2004
	Well Development - Primary & Secondary	20	8	160	Hours	\$265	\$42,419	Layne - Palmdale 2005
	Development Rig	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Mobilization/Demobilization/Cleanup	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Step-Rate Aquifer Test	8	8	64	Hours	\$265	\$16,968	Layne - Palmdale 2005
	Constant-Rate Aquifer Test	72	8	576	Hours	\$265	\$152,709	Layne - Palmdale 2005
	Video Camera Survey	1	8	8	Each	\$1,262	\$10,100	Layne - Palmdale 2005
	Disinfect Well	1	8	8	Each	\$1,951	\$15,604	GSWC - Ojai, 2004
Pump and Power Service Connection								
	Well Head	1	8	8	Each	\$5,050	\$40,399	Layne - Palmdale 2005
	Submersible Pump - 6 inch	1	8	8	Each	\$9,102	\$72,820	PVOU - 2004
	Pump Installation Cost	1	8	8	Each	\$2,209	\$17,675	Layne - Palmdale 2005
	Pump Riser Pipe (stainless steel)	350	8	2,800	LF	\$40	\$112,142	PVOU - 2004
	Check Valve	1	8	8	Each	\$520	\$4,161	PVOU - 2004
	Flow Meter	1	8	8	Each	\$5,592	\$44,732	PVOU - 2004
	Gate Valve	1	8	8	Each	\$780	\$6,242	PVOU - 2004
	Power service connection and panel	1	8	8	Each	\$25,000	\$200,000	

Table D-5D

Capital Cost – Replace Eight Existing NHOU Extraction Wells

<u>Scope Item</u>	<u>Description</u>	<u>Estimated Quantity per Well</u>	<u>Units</u>	<u>Unit Costs</u>	<u>Single Well Costs</u>	<u>No. of Wells</u>	<u>Total Costs</u>	<u>Cost Estimate Source</u>
Waste Handling/Disposal								
	Mobilization/demobilization of roll off bins (10 CY bins)	11	EA	\$715	\$7,861	8	\$62,886	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	990	DAY	\$21	\$21,224	8	\$169,791	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	3	EA	\$1,191	\$3,573	8	\$28,584	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	270	DAY	\$42	\$11,255	8	\$90,041	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	36	TON	\$69	\$2,487	8	\$19,895	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	40,000	GAL	\$0.36	\$14,292	8	\$114,338	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.36	\$536	8	\$4,288	WDC, Santa Clarita project 2006
	Subtotal "A"						\$ 2,823,427	
	Inflation Adjustment 2005 to 2009 (6% per year average)			0.0%		of Subtotal "A"	\$ -	Calculated within line items
	Subtotal "B"						\$ 2,823,427	
	Engineering			21.6%		of Subtotal "B"	\$ 610,402	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			21.6%		of Subtotal "B"	\$ 610,402	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 4,044,000	
	Land Purchase for Well Sites	0.1	ACRE	\$ 2,000,000	\$200,000	8	\$ 1,600,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 404,400	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 404,400	
	GRAND TOTAL						\$ 6,450,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-5E

Capital Cost – Construct Pipeline from Eight Replacement Extraction Wells to NHOU Treatment Plant

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Pipeline	8-inch, buried	Ductile iron, cement-lined	10,000	\$ 107	\$ 1,066,276	CH2M HILL Files, 1998
	Relief Valves/Pits		Brass	7	\$ 7,903	\$ 55,322	Means 1999
	Flow indicating totalizer	8-inch		8	\$ 8,000	\$ 64,000	CH2M HILL Eng. Estimate
	Installation ancillary costs (traffic, road repair, thrust blocks, valves)			10.0%	\$ 1,066,276	\$ 106,628	CH2M HILL Eng. Estimate
	Subtotal "A"					\$ 1,292,226	
	Site Piping			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.4%	of Subtotal "A"	\$ 69,274	1992 EPRI Document, Figure 7-2
	Site Electrical			0.6%	of Subtotal "A"	\$ 7,466	1992 EPRI Document, Figure 7-3
	Common Facilities			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document, Figure 7-4
	Building/Site Improvements			0.0%	of Subtotal "A"	\$ -	
	Subtotal "B"					\$ 1,368,966	
	"Pass through" materials	None				\$ -	
	Subtotal "C"					\$ 1,368,966	
	Engineering			24.0%	of Subtotal "C"	\$ 328,238	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			24.0%	of Subtotal "C"	\$ 328,238	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 2,025,000	
	Right of Way Purchase for Pipeline (units in acres)			22.96	\$ 200,000	\$ 4,591,368	Land at \$2,000,000/Acre, Use 10% for a 100' Wide Easement
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 202,500	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 202,500	
	GRAND TOTAL					\$ 7,020,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-6A

Capital Cost – Construct New Northwestern Extraction Wells

Item	Description	Estimated Depth/Quantity	Number of Locations	Estimated Total Quantity	Unit	Unit Cost	Total Cost	Cost Estimate Source
Installation of New Extraction Wells								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	1	1	Lump Sum	\$113,623	\$113,623	Layne - Palmdale 2005
	Setup and move between boring locations / Decon Rig	1	2	2	Each	\$9,469	\$18,937	Layne - Palmdale 2005
	Sound Control	1	1.5	2	Each	\$38,708	\$58,062	Assume Half Wells - Santa Clarita (Lang)
	Conductor Casing and Sanitary Seal - drill 30-inch (minimum) hole and furnish and install 24-inch conductor casing	50	3	150	Linear foot	\$566	\$84,848	GSWC - Ojai, 2004
	Drilling Reverse Mud Rotary/Ream (20-inch)	400	3	1,200	Linear foot	\$130	\$156,042	GSWC - Ojai, 2004
	Geophysical	1	3	3	Each	\$5,852	\$17,555	GSWC - Ojai, 2004
	Steel Well Casing - 10-inch	300	3	900	Linear foot	\$120	\$107,669	PVOU - 2004
	Stainless Steel Screen - 10-inch	100	3	300	Linear foot	\$202	\$60,466	PVOU - 2004
	Dissimilar Metals Connector	1	3	3	Each	\$3,251	\$9,753	PVOU - 2004
	Gravel Tube	275	3	825	Linear foot	\$26	\$21,456	GSWC - Ojai, 2004
	Sound Tube	400	3	1,200	Linear foot	\$20	\$23,406	GSWC - Ojai, 2004
	Filter Pack	150	3	450	Linear foot	\$20	\$8,777	PVOU - 2004
	Annular Grout or Neat Cement	250	3	750	Linear foot	\$33	\$24,382	PVOU - 2004
	Well Development - Primary & Secondary	20	3	60	Hours	\$265	\$15,907	Layne - Palmdale 2005
	Development Rig	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Mobilization/Demobilization/Cleanup	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Step-Rate Aquifer Test	8	3	24	Hours	\$265	\$6,363	Layne - Palmdale 2005
	Constant-Rate Aquifer Test	72	3	216	Hours	\$265	\$57,266	Layne - Palmdale 2005
	Video Camera Survey	1	3	3	Each	\$1,262	\$3,787	Layne - Palmdale 2005
	Disinfect Well	1	3	3	Each	\$1,951	\$5,852	GSWC - Ojai, 2004
Pump and Power Service Connection								
	Well Head	1	3	3	Each	\$5,050	\$15,150	Layne - Palmdale 2005
	Submersible Pump - 6 inch	1	3	3	Each	\$9,102	\$27,307	PVOU - 2004
	Pump Installation Cost	1	3	3	Each	\$2,209	\$6,628	Layne - Palmdale 2005
	Pump Riser Pipe (stainless steel)	350	3	1,050	LF	\$40	\$42,053	PVOU - 2004
	Check Valve	1	3	3	Each	\$520	\$1,560	PVOU - 2004
	Flow Meter	1	3	3	Each	\$5,592	\$16,775	PVOU - 2004
	Gate Valve	1	3	3	Each	\$780	\$2,341	PVOU - 2004
	Power service connection and panel	1	3	3	Each	\$25,000	\$75,000	

Table D-6A

Capital Cost – Construct New Northwestern Extraction Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Waste Handling/Disposal								
	Mobilization/demobilization of roll off bins (10 CY bins)	11	EA	\$715	\$7,861	3	\$23,582	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	990	DAY	\$21	\$21,224	3	\$63,672	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	3	EA	\$1,191	\$3,573	3	\$10,719	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	270	DAY	\$42	\$11,255	3	\$33,765	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	36	TON	\$69	\$2,487	3	\$7,461	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	40,000	GAL	\$0.36	\$14,292	3	\$42,877	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.36	\$536	3	\$1,608	WDC, Santa Clarita project 2006
	Subtotal "A"						\$ 1,169,067	
	Inflation Adjustment 2005 to 2009 (6% per year average)			0.0%		of Subtotal "A"	\$ -	Calculated within line items
	Subtotal "B"						\$ 1,169,067	
	Engineering			24.5%		of Subtotal "B"	\$ 286,319	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			24.5%		of Subtotal "B"	\$ 286,319	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 1,742,000	
	Land Purchase for Well Sites	0.1	ACRE	\$ 2,000,000	\$ 200,000	3	\$ 600,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 174,200	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 174,200	
	GRAND TOTAL						\$ 2,690,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-6B

Operations and Maintenance Cost – Operate New Northwestern Extraction Wells

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps to Treatment Sys	1050 gpm @ 350'	760,748	1	760,748	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				777,215	kW-hr	\$ 0.12	\$ 93,266
Analytical (included with groundwater monitoring)								
	Water Samples - Monthly Tests			0		ea.	\$ 500	\$ -
	Water Samples - Additional Annual Tests			0		ea.	\$ 750	\$ -
Labor								
	Operating			200		hrs	\$ 40	\$ 8,000
	Maintenance			200		hrs	\$ 48	\$ 9,600
	Supervisory			0		hrs	\$ 80	\$ -
	Clerical			0		hrs	\$ 26	\$ -
	Laboratory			0		hrs	\$ 48	\$ -
	Yardwork			0		hrs	\$ 40	\$ -
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA)			0		lot	\$ 25,000	\$ -
	Heavy Maintenance			1		lot	\$ 15,000	\$ 15,000
Parts	(2% of Capital)				2%		\$ 2,690,000	\$ 53,800
								\$ 180,000
Contingency on Materials/Services					10%			\$ 18,000
								\$ 198,000
								GRAND TOTAL

Table D-6C

Capital Cost – Construct Pipeline from New Northwest Extraction Wells to NHOU Treatment Plant

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Northern Plume Extracted Water Transmission Pipeline							
	Pipeline	8-inch, buried	Ductile iron, cement-lined	1,500	\$ 107	\$ 159,941	CH2M HILL Files, 1998
	Relief Valves/Pits		Brass	1	\$ 7,903	\$ 7,903	Means 1999
	Flow indicating totalizer	8-inch		1	\$ 8,000	\$ 8,000	CH2M HILL Eng. Estimate
	Installation ancillary costs (traffic, road repair, thrust blocks, valves)			10.0%	\$ 159,941	\$ 15,994	CH2M HILL Eng. Estimate
	Subtotal "A"					\$ 191,839	
	Site Piping			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			6.4%	of Subtotal "A"	\$ 12,271	1992 EPRI Document, Figure 7-2
	Site Electrical			0.7%	of Subtotal "A"	\$ 1,426	1992 EPRI Document, Figure 7-3
	Common Facilities			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document, Figure 7-4
	Building/Site Improvements			0.0%	of Subtotal "A"	\$ -	
	Subtotal "B"					\$ 205,536	
	"Pass through" materials	None				\$ -	
	Subtotal "C"					\$ 205,536	
	Engineering			30.2%	of Subtotal "C"	\$ 61,976	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			30.2%	of Subtotal "C"	\$ 61,976	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 329,000	
	Right of Way Purchase for Pipeline (units in acres)			3.44	\$ 200,000	\$ 688,705	Land at \$2,000,000/Acre, Use 10% for a 100' Wide Easement
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 32,900	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 32,900	
	GRAND TOTAL					\$ 1,080,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-6D

Operations and Maintenance Cost – Operate Pipeline from New Northwest Extraction Wells to NHOU Treatment Plant

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			0		hrs	\$ 40	\$ -
	Maintenance			12		hrs	\$ 48	\$ 576
	Supervisory			0		hrs	\$ 80	\$ -
	Clerical			0		hrs	\$ 26	\$ -
	Laboratory			0		hrs	\$ 48	\$ -
	Yardwork			0		hrs	\$ 40	\$ -
Equipment								
	Pickup			96		hrs	\$ 12	\$ 1,152
Misc Repairs, Annual	(1% of Capital)				1%		\$ 1,080,000	\$ 10,800
								\$ 13,000
Contingency on Materials/Services					10%			\$ 2,000
								\$ 15,000
		GRAND TOTAL						\$ 15,000

Table D-7A

Capital Cost – Refurbish Existing Air Stripper

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Refurbish Existing Stripper							
Replace Rotating Equipment							
	First stage blower	6000 scfm @ 6 in H2O		1	\$ 5,000	\$ 5,000	Assumed
	Booster fan	6000 scfm @ 4 in H2O		1	\$ 5,000	\$ 5,000	Assumed
Refurbish Existing Equipment (refurbished in 2008; assume refurbish again in 15 years)							
	Rebuild all valves	Misc.		1	\$ 20,000	\$ 20,000	Assumed
	Clean and Repaint Wellhead (Outside surfaces)			1	\$ 25,000	\$ 25,000	Assumed - Service
Replace VPGAC Carbon							
	VPGAC	4 x 8	Coconut-base	1	\$ 29,299	\$ 29,299	US Filter, 2006
	SubTotal "A"					\$ 84,299	
	Engineering, Overhead, Fees					\$ 20,000	Assumed
	SubTotal "B"					\$ 104,299	
	Cost Basis Contingency			10.0%	of SubTotal "C"	\$ 10,430	
	Concept Scope Contingency			10.0%	of SubTotal "C"	\$ 10,430	
	GRAND TOTAL					\$ 130,000	

NOTES:
 1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
 2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
 3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-7B

Operations & Maintenance Cost – Groundwater Treatment for VOCs via Air Stripping at Current Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	900 gpm @ 50'	93,153	1	93,153	kW-hr		
	First stage blower	6000 scfm @ 6 in H2O	73,807	1	73,807	kW-hr		
	Booster fan	6000 scfm @ 4 in H2O	49,290	4	197,161	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	1	2,047	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				382,634	kW-hr	\$ 0.12	\$ 45,916
Natural Gas								
	Stripper Offgas Heater	6000 scfm @ 20F	1,120	1	1,120	MM BTU	\$ 7.00	\$ 7,841
Carbon Make-up								
	VGAC	26 lbs/day	9,490	1	9,490	lbs VGAC	\$ 1.60	\$ 15,184
Chemicals								
	Polyphosphate	2 ppm dosage	7,890	1	7,890	lbs dry	\$ 1.00	\$ 7,890
Materials								
	None							
Residuals Disposal								
	VGAC	Included in above						
Analytical								
	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			8		ea.	\$ 250	\$ 2,000
Labor								
	Operating			645		hrs	\$ 40	\$ 25,800
	Maintenance			62		hrs	\$ 48	\$ 2,976
	Supervisory			915		hrs	\$ 80	\$ 73,200
	Clerical			116		hrs	\$ 26	\$ 3,016
	Laboratory			559		hrs	\$ 48	\$ 26,832
	Yardwork			693		hrs	\$ 40	\$ 27,720

Table D-7B

Operations & Maintenance Cost – Groundwater Treatment for VOCs via Air Stripping at Current Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 25,000	\$ 25,000
	Heavy Maintenance			1		lot	\$ 15,000	\$ 15,000
Parts	(2% of Capital)				2%		\$ 1,690,000	\$ 33,800
								\$ 331,000
Contingency on Materials/Services					10%			\$ 34,000
								\$ 365,000
		GRAND TOTAL						\$ 365,000

Table D-8A
Capital Cost – New Air Stripper

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Install Second Parallel Air Stripper							
Basket Strainer System							
	Basket strainer vessels (1 pair)	3,300 gpm	CS, Epoxy coated	1	\$ 11,764	\$ 11,764	McMaster-Carr (P.1397)(+100% Allowance)
	Differential pressure switch	0 - 30 psig	Brass	1	\$ 444	\$ 444	McMaster-Carr (P.1459)(+20% Allowance)
Air Stripper System							
	Air stripper tower	12' Dia. x 20' bed + 6' sump	FRP	1	\$ 321,109	\$ 321,109	Vendor Estimate (HydroGroup, 1997)
	Analog level controller			1		\$ -	Included above
	Internals (Demister, packing, supports)			1		\$ -	Included above
	Blower	12,000 scfm @ 6" H2O		1		\$ -	Included above
	Differential pressure switch	0 - 10 in H2O	Brass	1	\$ 444	\$ 444	McMaster-Carr (P.1459)(+20% Allowance)
Acid Cleaning System							
	Acid Recirculation Pumps	3000 gpm @ 50'	FRP	2	\$ 40,704	\$ 81,408	CH2M Filles - Escalate from 1993
	Acid Batch Tank	15,000 gal, slope bottom	FRP	1	\$ 38,137	\$ 38,137	CH2M Filles - Escalate from 1993
	Backwash tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Off-Gas Handling System							
	Booster blower	12,000 scfm @ 6" H2O	CS, Epoxy coated	1	\$ 7,968	\$ 7,968	ECHOS Database - Escalate from 1996
	Flow indicating transmitter			1	\$ 1,500	\$ 1,500	Engineer's estimate
	Temperature indicating transmitter			2	\$ 1,500	\$ 3,000	Engineer's estimate
	Preheater heat exchanger	CS		1	\$ 5,683	\$ 5,683	CH2M Filles - Escalate from 1993

Table D-8A
Capital Cost – New Air Stripper

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
VGAC Adsorber System							
	VGAC adsorbers	12,000 lbs, Horiz. 6' Deep x 20' L	CS, Epoxy coated	2	\$ 82,292	\$ 164,585	Vendor Quote (NW Carbon, 1997)
	Discharge stack	CS, Epoxy coated	CS, Epoxy coated	1	\$ 4,000	\$ 4,000	Engineer's estimate
							Engineer's estimate
	SubTotal "A"					\$ 641,542	
	Site Piping			12.3%	of SubTotal "A"	\$ 79,033	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.7%	of SubTotal "A"	\$ 36,831	1992 EPRI Document, Figure 7-2
	Site Electrical			6.4%	of SubTotal "A"	\$ 40,966	1992 EPRI Document, Figure 7-3
	Common Facilities			21.4%	of SubTotal "A"	\$ 137,584	1992 EPRI Document, Figure 7-4
	SubTotal "B"					\$ 935,956	
	Engineering, Overhead, Fees			50.4%	of SubTotal "B"	\$ 472,014	1992 EPRI Document, Figure 7-5
	SubTotal "C"					\$ 1,408,000	
	Cost Basis Contingency			10.0%	of SubTotal "C"	\$ 140,800	
	Concept Scope Contingency			10.0%	of SubTotal "C"	\$ 140,800	
	GRAND TOTAL					\$ 1,690,000	
	Additional Cost for Land Purchase for Treatment Facility (units are acres):			2	\$ 2,000,000	\$ 4,000,000	
	Assume existing facility must be replaced or purchased from LADWP						
	GRAND TOTAL W/LAND INCLUDED					\$ 5,690,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-8B

Operations & Maintenance Cost – Groundwater Treatment for VOCs via Air Stripping at Planned Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power	Pump discharge to LADWP	3050 gpm @ 50'	315,685	1	315,685	kW-hr		
	First stage blower	6000 scfm @ 6 in H2O	73,807	2	147,614	kW-hr		
	Booster fan	6000 scfm @ 4 in H2O	49,290	2	98,580	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	1	2,047	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				580,393	kW-hr	\$ 0.12	\$ 69,647
Natural Gas	Stripper Offgas Heater	4100 scfm @ 20F	765	2	1,531	MM BTU	\$ 5.00	\$ 7,654
Carbon Make-up	VGAC	38 lbs/day	13,870	2	27,740	lbs VGAC	\$ 1.23	\$ 34,120
Chemicals	Polyphosphate	2 ppm dosage	26,739	1	26,739	lbs dry	\$ 1.00	\$ 26,739
Materials	None							
Residuals Disposal	VGAC	Included in above						
Analytical	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			8		ea.	\$ 250	\$ 2,000
Labor	Operating			1,559		hrs	\$ 35	\$ 54,565
	Maintenance			158		hrs	\$ 42	\$ 6,636
	Supvisory			1,983		hrs	\$ 70	\$ 138,810
	Clerical			532		hrs	\$ 23	\$ 12,103
	Laboratory			957		hrs	\$ 42	\$ 40,194
	Yardwork			1,664		hrs	\$ 35	\$ 58,240
Subcontracts	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 25,000	\$ 25,000
	Heavy Maintenance			1		lot	\$ 15,000	\$ 15,000
Parts	(2% of Capital)				2%		\$ 1,690,000	\$ 33,800
								\$ 544,000
Contingency on Materials/Services					10%			\$ 55,000
	GRAND TOTAL							\$ 599,000

Table D-9A

Capital Cost – Construct New LPGAC Adsorber Pairs

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
LPGAC Adsorber Columns (4,800 gpm total capacity)							
	LPGAC Adsorber Pair (1200 gpm/pair)	20,000 lbs each vessel	Lined CS	4	\$ 186,080	\$ 744,321	Vendor Quote (Calgon), 2003 included
	Valve set	8 inch	Lined CS	4	\$ -	\$ -	
	Flow indicating totalizer	6-inch		4	\$ 1,500	\$ 6,000	CH2M HILL Eng. Estimate
Backwash and Rinse Recovery System							
	-- Cone bottom holding tank	30,000 gal	FRP	2	\$ 58,426	\$ 116,852	Ershigs Quote, 1993
	-- VGAC Drum			2	\$ 300	\$ 600	CH2M HILL Eng. Estimate
	-- Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M HILL Eng. Estimate
	-- Polymer tank with mixer	150 gal	SS	1	\$ 8,845	\$ 8,845	McMaster-Carr (P.1248, 1257) 2005
	-- Polymer feed pump	10 gph	316 SS	2	\$ 10,251	\$ 20,502	CH2M HILL Files - Escalate from 1994
	-- Backwash recirculation pump	1000 gpm @ 40'	CS, SS Impeller	2	\$ 9,019	\$ 18,038	CH2M HILL Files - Escalate from 1993
	-- Plate and frame filter press	25 cu.ft.	PVC	1	\$ 149,217	\$ 149,217	Vendor Quote (US Filter, 2005) - Adjusted for size
	-- Tank level switch			2	\$ 1,500	\$ 3,000	Assumed
	-- Slant bottom holding tank	30,000 gal	FRP	1	\$ 49,662	\$ 49,662	Ershigs Quote, 1993
	-- VGAC Drum			1	\$ 300	\$ 300	CH2M HILL Eng. Estimate
	-- Tank level switch			2	\$ 1,500	\$ 3,000	Assumed
Bag Filters							
	Bag Filters	600 gpm	Coated Steel	2	\$ 11,027	\$ 22,054	CH2M HILL Files - Escalate from 2004
	Diff Pressure Switch			1	\$ 300	\$ 300	CH2M HILL Est.
	Subtotal "A"					\$ 1,146,692	
	Site Piping			11.2%	of Subtotal "A"	\$ 128,972	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.4%	of Subtotal "A"	\$ 62,216	1992 EPRI Document, Figure 7-2
	Site Electrical			5.9%	of Subtotal "A"	\$ 67,438	1992 EPRI Document, Figure 7-3
	Common Facilities			19.6%	of Subtotal "A"	\$ 224,226	1992 EPRI Document, Figure 7-4
	Subtotal "B"					\$ 1,629,544	
	Engineering			23.4%	of Subtotal "B"	\$ 381,468	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			23.4%	of Subtotal "B"	\$ 381,468	1992 EPRI Document, Figure 7-5

Table D-9A

Capital Cost – Construct New LPGAC Adsorber Pairs

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Subtotal "C"					\$ 2,392,000	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 239,200	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 239,200	
	GRAND TOTAL					\$ 2,870,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-9B

Operations and Maintenance Cost – New LPGAC Biologically Active Reactors and Adsorber Pairs

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	3050 gpm @ 154' (70 psi)	972,309	1	972,309	kW-hr		
	Chemical metering pumps	0.5 hp each, 10% time	409	1	409	kW-hr		
	Backwash Waste Pump (to NPDES)	500 gpm @ 70' (10%)	7,245	1	7,245	kW-hr		
	Backwash Recirc Pump	1000 gpm @ 40' (10%)	8,280	1	8,280	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				1,004,710	kW-hr	\$ 0.12	\$ 120,565
Carbon Make-up								
	LPGAC (VOC Adsorption)	365 day service @ 600 gpm	12,708	8	101,667	lbs	\$ 1.00	\$ 101,667
Chemicals								
	Dewatering polymer	20 lbs/ton dosage	51	1	51	lbs dry	\$ 5.00	\$ 254
Materials								
	Filter Bags	20 micron	50	1	50	bags	\$ 5.00	\$ 250
Residuals Disposal								
	VPGAC	Included in above						
	LPGAC	Included in above						
Analytical								
	Water Samples			120		ea.	\$ 400	\$ 48,000
	Air Samples			0		ea.	\$ 250	\$ -
Labor								
	Operating			779		hrs	\$ 40	\$ 31,160
	Maintenance			79		hrs	\$ 48	\$ 3,792
	Supervisory			991		hrs	\$ 80	\$ 79,280
	Clerical			266		hrs	\$ 26	\$ 6,916
	Laboratory			0		hrs	\$ 48	\$ -
	Yardwork			832		hrs	\$ 40	\$ 33,280
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 25,000	\$ 25,000
	Heavy Maintenance			1		lot	\$ 15,000	\$ 15,000
Parts								
	(2% of Capital)				2%		\$ 2,870,000	\$ 57,400
								\$ 523,000
Contingency on Materials/Services								
					10%			\$ 53,000
								\$ 576,000
	GRAND TOTAL							\$ 576,000

Table D-10A

Capital Cost – Interim Wellhead Chromium and 1,4-Dioxane Treatment for NHE-2 at Current Pumping Rate

Major System	Component	Details	Cost	Cost Estimate Source
Construction costs (for 190 gpm Design rate)				
Purchased Equipment				
	Tanks & Vessels	6 IE vessels; 2 GAC vessels; 3 pipe racks; AOP system by APT; 2,000 gallon break tank. Includes initial GAC & IE media. 190 gpm flow rate.	\$ 447,360	Estimate provided by MWH (for Honeywell)
	Pumps	Booster pump & sump pump and controls	\$ 6,500	Estimate provided by MWH (for Honeywell)
	Signage, H & S		\$ 2,500	Estimate provided by MWH (for Honeywell)
	Inlet Filters	300 gpm inlet duplex particle filters.	\$ 5,000	Estimate provided by MWH (for Honeywell)
	Miscellaneous Equipment		\$ 2,000	Estimate provided by MWH (for Honeywell)
	Spart Parts Allowance		\$ 23,170	Estimate provided by MWH (for Honeywell)
	Equipment Off-loading & Setting Allowance		\$ 27,800	Estimate provided by MWH (for Honeywell)
	Freight Allowance		\$ 23,170	Estimate provided by MWH (for Honeywell)
	Subtotal 1		\$ 537,500	
Installation Costs				
	Site Preparation	Selective site demo; grading & drainage; 190 lf of fencing; 4 double 8 ft swing gates; 2 pedestrian gates.	\$ 35,000	Estimate provided by MWH (for Honeywell)
	Site Improvements	Entrance gates & security lighting. 2,100 sf concrete; 8"-12" thick #4 rebar 12" OC access ramps; containment; 20 4" protective bollards.	\$ 30,300	Estimate provided by MWH (for Honeywell)
	Concrete		\$ 58,000	Estimate provided by MWH (for Honeywell)
	Structural Steel		\$ -	
	Buildings & Roofed Structures		\$ -	
	Aboveground Piping	Tie-ins to NPDES discharge & LADWP main; steel, PVC & HDPE piping; valves, hoses, fittings, etc.	\$ 14,500	Estimate provided by MWH (for Honeywell)
	Underground Piping (outside process)	500 ft HDPE pipe.	\$ 50,000	Estimate provided by MWH (for Honeywell)
	Aboveground Electrical	Existing panel tie; transformer.	\$ 26,850	Estimate provided by MWH (for Honeywell)
	Underground Electrical		\$ 5,370	Estimate provided by MWH (for Honeywell)
	Instrumentation & Controls	Sump level sensor; flow/pressure switches; pH sensors; break tank level sensor.	\$ 25,250	Estimate provided by MWH (for Honeywell)
	Insulation		\$ 5,370	Estimate provided by MWH (for Honeywell)
	Painting		\$ 10,740	Estimate provided by MWH (for Honeywell)
	Paving along Dehougne Street	Street resurfacing after pipeline installation.	\$ 5,370	Estimate provided by MWH (for Honeywell)
	Proratables		\$ 10,740	Estimate provided by MWH (for Honeywell)
	Subtotal 2		\$ 277,490	
Contractor Indirect Costs				
	Construction Equipment		\$ 33,200	Estimate provided by MWH (for Honeywell)
	Overheads & Indirects		\$ 55,400	Estimate provided by MWH (for Honeywell)
	Sales Tax		\$ 44,300	Estimate provided by MWH (for Honeywell)
	Fees & Profits		\$ 65,100	Estimate provided by MWH (for Honeywell)
	Other Unidentified Contractor Costs		\$ 50,600	Estimate provided by MWH (for Honeywell)
	Subtotal 3		\$ 248,600	

Table D-10A

Capital Cost – Interim Wellhead Chromium and 1,4-Dioxane Treatment for NHE-2 at Current Pumping Rate

Major System	Component	Details			Cost	Cost Estimate Source
Construction Management Costs						
	MWH Constructors CM	Burdened labor, profit, mark-up, travel, & ODCs not included elsewhere in this spreadsheet.			\$ 237,680	Estimate provided by MWH (for Honeywell)
	Other Unidentified CM Costs				\$ -	
	Subtotal 4				\$ 237,680	
Home Office Costs						
	Engineering & Procurement				\$ 10,000	Estimate provided by MWH (for Honeywell)
	60% & 90% Wellhead Treatment Design				\$ 100,000	Estimate provided by MWH (for Honeywell)
	Construction Management/Coordination				\$ 15,000	Estimate provided by MWH (for Honeywell)
	NPDES/LABOS Permitting				\$ 25,000	Estimate provided by MWH (for Honeywell)
	Flood Control Permitting				\$ 4,500	Estimate provided by MWH (for Honeywell)
	Overall Permit Fees				\$ 5,000	Estimate provided by MWH (for Honeywell)
	Subtotal 5				\$ 159,500	
Surface Water Treatment System						
Major System	Component	Size	Material	Quantity	Cost	Cost Estimate Source
LPGAC Biologically Active Reactors (300 gpm total capacity) - Before RCF Chromium Treatment						
	LPGAC Adsorber Pair	10,000 lbs each vessel (8 ft Dia)	Lined CS	1	\$ 134,308	Vendor Quote (Calgon), 2003 included
	Valve set	4 inch	Lined CS	1	\$ -	
	Flow indicating totalizer	2.5-inch		2	\$ 1,500	
Backwash and Rinse Recovery System						
	-- Cone bottom holding tank	15,000 gal	FRP	1	\$ 36,365	Ershigs Quote, 1993
	-- VGAC Drum			1	\$ 300	CH2M HILL Eng. Estimate
	-- Diaphragm-type sludge pump			2	\$ 2,000	CH2M HILL Eng. Estimate
	-- Polymer tank with mixer	50 gal	SS	1	\$ 4,316	McMaster-Carr (P-1248, 1257) 2005
	-- Polymer feed pump	10 gph	316 SS	1	\$ 9,671	CH2M HILL Files - Escalate from 1994
	-- Backwash recirculation pump	1000 gpm @ 40'	CS, SS Impeller	1	\$ 8,509	CH2M HILL Files - Escalate from 1993
	-- Plate and frame filter press	5 cu.ft.	PVC	1	\$ 53,596	Vendor Quote (US Filter, 2005) - Adjusted for size
	-- Tank level switch			1	\$ 1,500	Assumed
	-- Slant bottom holding tank	15,000 gal	FRP	1	\$ 30,910	Ershigs Quote, 1993
	-- VGAC Drum			1	\$ 300	CH2M HILL Eng. Estimate
	-- Tank level switch			1	\$ 1,500	Assumed
Coagulation and Media Filtration (Can be removed for alternatives also treating chromium via RCF process at same wellhead)						
	Multi-media filter skid	66" Dia. X 60" SS, Set of 4	CS, Epoxy coated	1	\$ 167,517	Vendor Quote (Yardney, 1997)
	Coagulant Feed System					Vendor supplied
	-- Tote Bin	250 gal	Poly	1	\$ -	CH2M Files, escalate from 1996
	-- Metering Pumps		Caustic Spec	2	\$ 9,663	CH2M Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	1	\$ 700	Assumed
	-- Static mixer	4-inch		1	\$ 3,000	Assumed
Disinfection (300 gpm) - After RCF Chromium Treatment						
	Disinfection Vessel (ASME Code)	CT = 4 mg/l - min (4-log virus) Use T10/T=0.5, Vol = 2500 gal	CS, coated	1	\$ 41,202	Ershigs Quote, 1993
	Bleach Feed System					Vendor supplied
	-- Tote Bin	250 gal	Poly	1	\$ -	CH2M Files, escalate from 1996

Table D-10A

Capital Cost – Interim Wellhead Chromium and 1,4-Dioxane Treatment for NHE-2 at Current Pumping Rate

Major System	Component	Details				Cost	Cost Estimate Source
	-- Metering Pumps		Caustic Spec	2	\$	9,663	\$ 19,326 CH2M Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	1	\$	700	\$ 700 Assumed
	-- Cl2 Probe			1	\$	1,500	\$ 1,500 Assumed
	-- Static mixer	4-inch		1	\$	3,000	\$ 3,000 Assumed
	SubTotal "A"						\$ 544,545
	Site Piping			12.6%	of SubTotal "A"	\$ 68,732	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.8%	of SubTotal "A"	\$ 31,747	1992 EPRI Document, Figure 7-2
	Site Electrical			14.1%	of SubTotal "A"	\$ 76,580	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			50.2%	of SubTotal "A"	\$ 273,560	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of SubTotal "A"	\$ 136,136	
	SubTotal "B"						\$ 1,131,300
	SubTotal "C"	Subtotals 1, 2, 3, 4, 5, and B					\$ 2,592,070
	Engineering (Simplified)			10.9%	of SubTotal "C"	\$ 283,801	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			21.9%	of SubTotal "C"	\$ 567,602	1992 EPRI Document, Figure 7-5
	SubTotal "D"						\$ 3,443,000
	Cost Basis Contingency			10.0%	of SubTotal "D"	\$ 344,300	
	Concept Scope Contingency			10.0%	of SubTotal "D"	\$ 344,300	
	GRAND TOTAL						\$ 4,130,000

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.
4. Site Electrical factor is escalated by 20 percent to account for use of 220 and 440 VAC service.

Table D-10B

Operations and Maintenance Cost – Interim Wellhead Chromium and 1,4-Dioxane Treatment for NHE-2 at Current Pumping Rate

Major System	Component	Details			Cost	Cost Estimate Source			
Operations & Maintenance Costs									
	Treatment Media & Chemical Costs	GAC & IE media; AOP chemicals. Includes delivery.			\$ 495,221	Estimate provided by MWH (for Honeywell), Scaled up from 190 gpm to 300 gpm			
	PLC & Electrical Costs				\$ 51,158	Estimate provided by MWH (for Honeywell), Scaled up from 190 gpm to 300 gpm			
	Equipment Allowance	Miscellaneous equipment costs estimated at \$5,000 per month.			\$ 78,917	Estimate provided by MWH (for Honeywell), Scaled up from 190 gpm to 300 gpm			
	Analytical	Lab costs for NPDES permit monitoring & reporting program			\$ 60,000	Estimate provided by MWH (for Honeywell)			
	Engineering Support	Field labor, data management & review, reporting			\$ 97,520	Estimate provided by MWH (for Honeywell)			
Surface Water Disinfection O&M Cost									
O&M Category	Equipment Name	Equipment Description	O&M Requirement per Unit	Number of Units	Total Requirements	Units	Unit Cost	Cost	
Electrical Power	Chemical metering pumps	0.5 hp each, 100% time	4,095	1	4,095	kW-hr			
	System headloss	190 gpm @ 60'	23,599	1	23,599	kW-hr			
	Misc. Controls/Lights	500 W	5,489	1	5,489	kW-hr			
	Total				33,182	kW-hr	\$ 0.12	\$ 3,982	Estimate by CH2M HILL
Natural Gas	None								
Carbon Make-up	Bioactive GAC	Replace every 8 years	2,500	1	2,500	lbs	\$ 1.50	\$ 3,750	
Chemicals	Bleach	5 ppm dosage	4,164	1	4,164	lbs dry	\$ 1.00	\$ 4,164	Estimate by CH2M HILL
	Sodium metabisulfate	10 ppm as CaCO3	13,151	1	13,151	lbs-dry	\$ 0.10	\$ 1,315	Estimate by CH2M HILL
Materials	No Additional								Estimate by CH2M HILL
Residuals Disposal	Biomass	Assume 1 mg/l average, 1% solids	9,986	1	9,986	gal	\$ 0.30	\$ 2,996	
Analytical	No Additional								Estimate by CH2M HILL
Labor	Operating			1522		hrs	\$ 35	\$ 53,270	Estimate by CH2M HILL
	Maintenance			1011		hrs	\$ 42	\$ 42,462	Estimate by CH2M HILL
	Supvisory			686		hrs	\$ 70	\$ 48,020	Estimate by CH2M HILL
	Clerical			83		hrs	\$ 23	\$ 1,888	Estimate by CH2M HILL
	Laboratory			478		hrs	\$ 42	\$ 20,076	Estimate by CH2M HILL
	Yardwork			555		hrs	\$ 35	\$ 19,425	Estimate by CH2M HILL
Subcontracts	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			0		lot	\$ 30,000	\$ -	Estimate by CH2M HILL
	Heavy Maintenance			1		lot	\$ 10,000	\$ 10,000	Estimate by CH2M HILL
Parts	(2% of Capital)				2%		\$ 4,130,000	\$ 82,600	Estimate by CH2M HILL
SubTotal "A"								\$ 721,432	Scaled for only IE Equipment
Contingency on Materials/Services				10.0%	of SubTotal "A"			\$ 73,000	
GRAND TOTAL								\$ 790,000	

Table D-11A

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates (Replace existing Wellhead System)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Extracted Water Transmission Pipeline							
	Pipeline	6-inch, Below grade	Poly	500	\$ 104	\$ 52,049	CH2M HILL Files, Escalate from 2000
	Flow indicating totalizer	10-inch		1	\$ 3,000	\$ 3,000	CH2M HILL Eng. Estimate
Chromium Treatment System:							
Inline Cr(VI) Reduction Reactor System							
	Recirculation pumps	300 gpm @ 30'	FRP	2	\$ 8,269	\$ 16,539	CH2M HILL Files - Escalate from 1993
	ASME Code vessels	1,500 gal	Lined CS	1	\$ 30,794	\$ 30,794	Ershigs Quote, 1993
	Valve set	4 inch	Lined CI	1	\$ 4,000	\$ 4,000	Assumed
	Flow indicating totalizer	4-inch		1	\$ 2,000	\$ 2,000	CH2M HILL Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M HILL Eng. Estimate
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	7,500 gal	FRP	1	\$ 33,396	\$ 33,396	Ershigs Quote, 1993
	Axial mixer	5 hp	Rubber coated CS	1	\$ 10,000	\$ 10,000	Assumed
	ORP Probe		Acid Spec	1	\$ 2,000	\$ 2,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	7,500 gal	FRP	3	\$ 33,396	\$ 100,189	Ershigs Quote, 1993
	Axial mixer	2 hp	Rubber coated CS	3	\$ 6,000	\$ 18,000	Assumed
	Blower	40 scfm @ 10 psig		3	\$ 2,500	\$ 7,500	Assumed
	Valve set	4 inch	Lined CI	3	\$ 5,000	\$ 15,000	Assumed
	Flow indicating totalizer	4-inch		1	\$ 2,000	\$ 2,000	CH2M HILL Eng. Estimate
	pH Probe		Acid Spec	6	\$ 2,000	\$ 12,000	Assumed
	VPGAC Adsorber	1,000 lbs.		1	\$ -	\$ -	Vendor provided rented vessel
	Caustic Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Caustic Spec	4	\$ 9,663	\$ 38,651	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	2	\$ 700	\$ 1,400	CH2M HILL Files, escalate from 1996
Pump Station							
	Holding tank	3,000 gal	FRP	1	\$ 19,809	\$ 19,809	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	300 gpm @ 20 ft H2O	CI/SS trim	2	\$ 9,525	\$ 19,050	Gierlich-Mitchell Quote, escalate from 1998

Table D-11A

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates (Replace existing Wellhead System)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Microfilter System							
	Microfilter system	300 gpm (No spare)	plastic	1	\$ 579,496	\$ 579,496	Pall Est 2004
	Backwash source tank		FRP	1		included above	Assumed
	Backwash pump and controls			1		included above	Assumed
	Air Scour System			1		included above	Assumed
	Cleaning system			1		included above	Assumed
Pump Station							
	Holding tank	3,000 gal	FRP	1	\$ 19,809	\$ 19,809	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	300 gpm @ 30 ft H2O	Cl/SS trim	2	\$ 10,889	\$ 21,777	Gierlich-Mitchell Quote, escalate from 1998
Backwash and Rinse Recovery							
	Cone bottom holding tank	10,000 gal	FRP	1	\$ 39,290	\$ 39,290	Ershigs Quote, 1993
	VGAC Drum			1	\$ -	\$ -	Vendor provided
	Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M HILL Eng. Estimate
	Polymer tank with mixer	500 gal	SS	1	\$ 7,248	\$ 7,248	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gph	316 SS	2	\$ 10,251	\$ 20,502	CH2M HILL Files - Escalate from 1994
	Backwash recirculation pump	300 gpm @ 50'	CS, SS Impeller	1	\$ 6,525	\$ 6,525	CH2M HILL Files - Escalate from 1993
	Plate and frame filter press	10 cu.ft.	Coated Steel	1	\$ 86,253	\$ 86,253	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	Assumed
	pH Probe			2	\$ 1,500	\$ 3,000	Assumed
	Static mixer	10-inch		1	\$ 7,000	\$ 7,000	Assumed
	Subtotal "A"					\$ 1,258,938	
	Site Piping			11.1%	of Subtotal "A"	\$ 139,427	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.4%	of Subtotal "A"	\$ 67,668	1992 EPRI Document, Figure 7-2
	Site Electrical			5.8%	of Subtotal "A"	\$ 73,018	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			19.2%	of Subtotal "A"	\$ 242,345	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 314,734	
	Subtotal "B"					\$ 2,096,130	

Table D-11A

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates (Replace existing Wellhead System)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	"Pass through" materials						
	None					\$ -	
	Subtotal "C"					\$ 2,096,130	
	Engineering			22.6%	of Subtotal "C"	\$ 473,502	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			22.6%	of Subtotal "C"	\$ 473,502	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 3,043,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 304,300	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 304,300	
	GRAND TOTAL					\$ 3,650,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year..
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-11B

Operations and Maintenance Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	300 gpm @ 50'	31,051	1	31,051	kW-hr		
	Recirc Pump for Fe(II) Loop	300 gpm @ 30'	18,631	1	18,631	kW-hr		
	Tank Mixers	2 hp, 100% time	16,378	4	65,513	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	24	49,135	kW-hr		
	Polymer Tank Mixer	1 hp, 10% time	819	1	819	kW-hr		
	Pump Stn Pump	300 gpm @ 20'	12,420	1	12,420	kW-hr		
	Transfer Pumps to UV/Ox	300 gpm @ 140'	86,943	1	86,943	kW-hr		
	Air Compressor	5 hp	40,946	4	163,783	kW-hr		
	Misc. Controls/Lights	2,500 W	27,444	4	109,774	kW-hr		
	Total				538,070	kW-hr	\$ 0.12	\$ 64,568
Natural Gas								
	None							\$ -
Carbon Make-up								
	VGAC Drums		1	2	2	drums	\$ 500.00	\$ 1,000
	VPGAC Adsorber Vessel	1,000 lbs.	1	1	1	vessel	\$ 3,000.00	\$ 3,000
Chemicals								
	Ferrous Sulfate	10 ppm dosage as Fe	35,694	1	35,694	lbs dry	\$ 0.45	\$ 16,067
	NaOH	40 ppm as CaCO3	52,602	1	52,602	lbs-dry	\$ 0.29	\$ 15,079
	Acid	15 ppm as CaCO3	19,726	1	19,726	lbs-dry	\$ 0.11	\$ 2,093
	Polymer	0.1 ppm	132	1	132	lbs-dry	\$ 5.00	\$ 658
Materials								
	None							
Residuals Disposal								
	VGAC	2 drums per year	2.0	1	2.0	drums	\$ 200	\$ 400
	Ferric sludge waste	20 ppm @ 600 gpm	37.57	1	37.57	tons	\$ 200	\$ 7,515
Analytical								
	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			4		ea.	\$ 250	\$ 1,000
	Monitoring Wells			0		ea.	\$ 1,740	\$ -

Table D-11B

Operations and Maintenance Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			3,652		hrs	\$ 40	\$ 146,080
	Maintenance			2,426		hrs	\$ 48	\$ 116,448
	Supervisory			1,030		hrs	\$ 80	\$ 82,400
	Clerical			166		hrs	\$ 26	\$ 4,316
	Laboratory			957		hrs	\$ 48	\$ 45,936
	Yardwork			1,331		hrs	\$ 40	\$ 53,240
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 30,000	\$ 30,000
	Heavy Maintenance			1		lot	\$ 100,000	\$ 100,000
Parts	(2% of Capital)				2%		\$ 3,650,000	\$ 73,000
								\$ 782,000
Contingency on Materials/Services					10%			\$ 79,000
								\$ 861,000
								GRAND TOTAL

Table D-11C

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Extracted Water Transmission Pipeline							
	Pipeline	6-inch, Below grade	Poly	500	\$ 104	\$ 52,049	CH2M HILL Files, Escalate from 2000
	Flow indicating totalizer	10-inch		1	\$ 3,000	\$ 3,000	CH2M HILL Eng. Estimate
Chromium Treatment System:							
Inline Cr(VI) Reduction Reactor System							
	Recirculation pumps	300 gpm @ 30'	FRP	2	\$ 8,269	\$ 16,539	CH2M HILL Files - Escalate from 1993
	ASME Code vessels	1,500 gal	Lined CS	1	\$ 30,794	\$ 30,794	Ershigs Quote, 1993
	Valve set	4 inch	Lined CI	1	\$ 4,000	\$ 4,000	Assumed
	Flow indicating totalizer	4-inch		1	\$ 2,000	\$ 2,000	CH2M HILL Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M HILL Eng. Estimate
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	7,500 gal	FRP	1	\$ 33,396	\$ 33,396	Ershigs Quote, 1993
	Axial mixer	5 hp	Rubber coated CS	1	\$ 10,000	\$ 10,000	Assumed
	ORP Probe		Acid Spec	1	\$ 2,000	\$ 2,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	7,500 gal	FRP	3	\$ 33,396	\$ 100,189	Ershigs Quote, 1993
	Axial mixer	2 hp	Rubber coated CS	3	\$ 6,000	\$ 18,000	Assumed
	Blower	40 scfm @ 10 psig		3	\$ 2,500	\$ 7,500	Assumed
	Valve set	4 inch	Lined CI	3	\$ 5,000	\$ 15,000	Assumed
	Flow indicating totalizer	4-inch		1	\$ 2,000	\$ 2,000	CH2M HILL Eng. Estimate
	pH Probe		Acid Spec	6	\$ 2,000	\$ 12,000	Assumed
	VPGAC Adsorber	1,000 lbs.		1	\$ -	\$ -	Vendor provided rented vessel
	Caustic Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Caustic Spec	4	\$ 9,663	\$ 38,651	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	2	\$ 700	\$ 1,400	CH2M HILL Files, escalate from 1996
Pump Station							
	Holding tank	3,000 gal	FRP	1	\$ 19,809	\$ 19,809	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	300 gpm @ 20 ft H2O	CI/SS trim	2	\$ 9,525	\$ 19,050	Gierlich-Mitchell Quote, escalate from 1998

Table D-11C

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Microfilter System							
	Microfilter system	300 gpm (No spare)	plastic	1	\$ 579,496	\$ 579,496	Pall Est 2004
	Backwash source tank		FRP	1		included above	Assumed
	Backwash pump and controls			1		included above	Assumed
	Air Scour System			1		included above	Assumed
	Cleaning system			1		included above	Assumed
Pump Station							
	Holding tank	3,000 gal	FRP	1	\$ 19,809	\$ 19,809	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	300 gpm @ 30 ft H2O	Cl/SS trim	2	\$ 10,889	\$ 21,777	Gierlich-Mitchell Quote, escalate from 1998
Backwash and Rinse Recovery							
	Cone bottom holding tank	10,000 gal	FRP	1	\$ 39,290	\$ 39,290	Ershigs Quote, 1993
	VGAC Drum			1	\$ -	\$ -	Vendor provided
	Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M HILL Eng. Estimate
	Polymer tank with mixer	500 gal	SS	1	\$ 7,248	\$ 7,248	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gph	316 SS	2	\$ 10,251	\$ 20,502	CH2M HILL Files - Escalate from 1994
	Backwash recirculation pump	300 gpm @ 50'	CS, SS Impeller	1	\$ 6,525	\$ 6,525	CH2M HILL Files - Escalate from 1993
	Plate and frame filter press	10 cu.ft.	Coated Steel	1	\$ 86,253	\$ 86,253	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	Assumed
	pH Probe			2	\$ 1,500	\$ 3,000	Assumed
	Static mixer	10-inch		1	\$ 7,000	\$ 7,000	Assumed
	Subtotal "A"					\$ 1,258,938	
	Site Piping			11.1%	of Subtotal "A"	\$ 139,427	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.4%	of Subtotal "A"	\$ 67,668	1992 EPRI Document, Figure 7-2
	Site Electrical			5.8%	of Subtotal "A"	\$ 73,018	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			19.2%	of Subtotal "A"	\$ 242,345	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 314,734	
	Subtotal "B"					\$ 2,096,130	

Table D-11C

Capital Cost – Wellhead Chromium Treatment (per well) at Design Pumping Rates

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	"Pass through" materials					\$ -	
	None					\$ -	
	Subtotal "C"					\$ 2,096,130	
	Engineering			22.6%	of Subtotal "C"	\$ 473,502	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			22.6%	of Subtotal "C"	\$ 473,502	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 3,043,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 304,300	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 304,300	
	GRAND TOTAL					\$ 3,650,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year..
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-12A

Capital Cost – Ex Situ Chromium Treatment and Pipeline for Extraction Wells NHE-1 and NHE-2 (combined flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Extracted Water Transmission Pipeline							
	Pipeline	6-inch, Below grade	Poly	500	\$ 107	\$ 53,611	CH2M HILL Files, Escalate from 2000
	Flow indicating totalizer	10-inch		1	\$ 3,000	\$ 3,000	CH2M HILL Eng. Estimate
Chromium Treatment System:							
Inline Cr(VI) Reduction Reactor System							
	Recirculation pumps	600 gpm @ 30'	FRP	2	\$ 10,395	\$ 20,790	CH2M HILL Files - Escalate from 1993
	ASME Code vessels	3,000 gal	Lined CS	1	\$ 45,714	\$ 45,714	Ershigs Quote, 1993
	Valve set	6 inch	Lined CI	1	\$ 6,000	\$ 6,000	Assumed
	Flow indicating totalizer	6-inch		1	\$ 2,500	\$ 2,500	CH2M HILL Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M HILL Eng. Estimate
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	15,000 gal	FRP	1	\$ 49,578	\$ 49,578	Ershigs Quote, 1993
	Axial mixer	5 hp	Rubber coated CS	1	\$ 10,000	\$ 10,000	Assumed
	ORP Probe		Acid Spec	1	\$ 2,000	\$ 2,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	15,000 gal	FRP	3	\$ 49,578	\$ 148,733	Ershigs Quote, 1993
	Axial mixer	5 hp	Rubber coated CS	3	\$ 10,000	\$ 30,000	Assumed
	Blower	80 scfm @ 10 psig		3	\$ 3,000	\$ 9,000	Assumed
	Valve set	10 inch	Lined CI	3	\$ 10,000	\$ 30,000	Assumed
	Flow indicating totalizer	8-inch		1	\$ 3,000	\$ 3,000	CH2M HILL Eng. Estimate
	pH Probe		Acid Spec	6	\$ 2,000	\$ 12,000	Assumed
	VPGAC Adsorber	1,000 lbs.		1	\$ -	\$ -	Vendor provided rented vessel
	Caustic Feed System						
	-- Holding Tank	250 Gal Tote	Poly	1	\$ -	\$ -	Vendor supply
	-- Metering Pumps		Caustic Spec	4	\$ 9,663	\$ 38,651	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	2	\$ 1,187	\$ 2,373	CH2M HILL Files, escalate from 1996
Pump Station							
	Holding tank	5,000 gal	FRP	1	\$ 26,505	\$ 26,505	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	600 gpm @ 20 ft H2O	CI/SS trim	2	\$ 11,973	\$ 23,946	Gierlich-Mitchell Quote, escalate from 1998

Table D-12A

Capital Cost – Ex Situ Chromium Treatment and Pipeline for Extraction Wells NHE-1 and NHE-2 (combined flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Microfilter System							
	Microfilter system	400 gpm (No spare)	plastic	2	\$ 688,673	\$ 1,377,347	Pall Est 2004
	Backwash source tank		FRP	2		included above	Assumed
	Backwash pump and controls			2		included above	Assumed
	Air Scour System			2		included above	Assumed
	Cleaning system			1		included above	Assumed
Pump Station							
	Holding tank	5,000 gal	FRP	1	\$ 26,505	\$ 26,505	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	600 gpm @ 30 ft H2O	Cl/SS trim	2	\$ 13,687	\$ 27,374	Gierlich-Mitchell Quote, escalate from 1998
Backwash and Rinse Recovery							
	Cone bottom holding tank	10,000 gal	FRP	1	\$ 39,290	\$ 39,290	Ershigs Quote, 1993
	VGAC Drum			1	\$ -	\$ -	Vendor provided
	Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M HILL Eng. Estimate
	Polymer tank with mixer	500 gal	SS	1	\$ 7,248	\$ 7,248	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gph	316 SS	2	\$ 10,251	\$ 20,502	CH2M HILL Files - Escalate from 1994
	Backwash recirculation pump	300 gpm @ 50'	CS, SS Impeller	1	\$ 6,525	\$ 6,525	CH2M HILL Files - Escalate from 1993
	Plate and frame filter press	10 cu.ft.	Coated Steel	1	\$ 86,253	\$ 86,253	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	Assumed
	pH Probe			2	\$ 1,500	\$ 3,000	Assumed
	Static mixer	10-inch		1	\$ 7,000	\$ 7,000	Assumed
	Subtotal "A"					\$ 2,199,104	
	Site Piping			10.0%	of Subtotal "A"	\$ 220,910	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.1%	of Subtotal "A"	\$ 111,543	1992 EPRI Document, Figure 7-2
	Site Electrical			5.3%	of Subtotal "A"	\$ 116,894	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			17.4%	of Subtotal "A"	\$ 383,373	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 549,776	
	Subtotal "B"					\$ 3,581,600	

Table D-12A

Capital Cost – Ex Situ Chromium Treatment and Pipeline for Extraction Wells NHE-1 and NHE-2 (combined flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	"Pass through" materials					\$ -	
	None						
	Subtotal "C"					\$ 3,581,600	
	Engineering			20.8%	of Subtotal "C"	\$ 746,564	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			20.8%	of Subtotal "C"	\$ 746,564	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 5,075,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "D"	\$ 507,500	
	Concept Scope Contingency			10.0%	of Subtotal "D"	\$ 507,500	
	GRAND TOTAL					\$ 6,090,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-12B

Operations and Maintenance Cost – Ex Situ Chromium Treatment for Extraction Wells NHE-1 and NHE-2 (combined flow)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	600 gpm @ 50'	62,102	1	62,102	kW-hr		
	Recirc Pump for Fe(II) Loop	600 gpm @ 30'	37,261	1	37,261	kW-hr		
	Tank Mixers	5 hp, 100% time	40,946	4	163,783	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	24	49,135	kW-hr		
	Polymer Tank Mixer	1 hp, 10% time	819	1	819	kW-hr		
	Pump Stn Pump	600 gpm @ 20'	24,841	1	24,841	kW-hr		
	Transfer Pumps to UV/Ox	600 gpm @ 30'	37,261	1	37,261	kW-hr		
	Air Compressor	10 hp	81,892	4	327,567	kW-hr		
	Misc. Controls/Lights	2,500 W	27,444	4	109,774	kW-hr		
	Total				812,544	kW-hr	\$ 0.12	\$ 97,505
Natural Gas								
	None							\$ -
Carbon Make-up								
	VGAC Drum		1	2	2	drums	\$ 500.00	\$ 1,000
	VPGAC Adsorber Vessel	1,000 lbs.	1	1	1	vessel	\$ 3,000.00	\$ 3,000
Chemicals								
	Ferrous Sulfate	10 ppm dosage as Fe	71,388	1	71,388	lbs dry	\$ 0.45	\$ 32,134
	NaOH	40 ppm as CaCO3	105,204	1	105,204	lbs-dry	\$ 0.29	\$ 30,158
	Acid	15 ppm as CaCO3	39,452	1	39,452	lbs-dry	\$ 0.11	\$ 4,185
	Polymer	0.1 ppm	263	1	263	lbs-dry	\$ 5.00	\$ 1,315
Materials								
	None							
Residuals Disposal								
	VGAC	2 drums per year	2.0	1	2.0	drums	\$ 200	\$ 400
	Ferric sludge waste	20 ppm @ 600 gpm	75.15	1	75.15	tons	\$ 200	\$ 15,029
Analytical								
	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			4		ea.	\$ 250	\$ 1,000
	Monitoring Wells			0		ea.	\$ 1,740	\$ -

Table D-13A

Capital Cost – Ex Situ Chromium Treatment (NHE-1 and Two New Extraction Wells, 1,100 gpm Peak Flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Inline Cr(VI) Reduction Reactor System							
	Recirculation pumps	1500 gpm @ 30'	CI, SS Impeller	2	\$ 13,066	\$ 26,133	CH2M HILL Files - Escalate from 1993
	ASME Code vessels	8,000 gal	Lined CS	1	\$ 79,956	\$ 79,956	CH2M HILL Files
	Valve set	10 inch	Lined CI	1	\$ 10,000	\$ 10,000	Assumed
	Flow indicating totalizer	8-inch		1	\$ 3,000	\$ 3,000	CH2M HILL Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	-- Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	2	\$ 700	\$ 1,400	CH2M HILL Eng. Estimate
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	20,000 gal	FRP	2	\$ 58,412	\$ 116,824	Ershigs Quote, 1993
	Axial mixer	10 hp	Rubber coated CS	2	\$ 15,000	\$ 30,000	Assumed
	ORP Probe		Acid Spec	2	\$ 2,000	\$ 4,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	20,000 gal	FRP	6	\$ 58,412	\$ 350,471	Ershigs Quote, 1993
	Axial mixer	10 hp	Rubber coated CS	6	\$ 15,000	\$ 90,000	Assumed
	Blower	160 scfm @ 10 psig		6	\$ 3,000	\$ 18,000	Assumed
	Valve set	10 inch	Lined CI	6	\$ 10,000	\$ 60,000	Assumed
	Flow indicating totalizer	8-inch		2	\$ 3,000	\$ 6,000	CH2M HILL Eng. Estimate
	pH Probe		Acid Spec	6	\$ 2,000	\$ 12,000	Assumed
	VPGAC Adsorber	2,000 lbs.		2	\$ -	\$ -	Vendor provided rented vessel
	Caustic Feed System						
	-- Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	-- Metering Pumps		Caustic Spec	3	\$ 10,251	\$ 30,754	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	3	\$ 700	\$ 2,100	CH2M HILL Eng. Estimate
Pump Station							
	Holding tank	20,000 gal	FRP	1	\$ 58,412	\$ 58,412	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	750 gpm @ 20 ft H2O	CI/SS trim	3	\$ 12,888	\$ 38,664	Gierlich-Mitchell Quote, escalate from 1998
Microfilter System							
	Microfilter system	800 gpm (6 operating, No spare)	plastic	2	\$ 1,043,834	\$ 2,087,668	Pall Est 2004
	Backwash source tank		FRP	1		included above	Assumed
	Backwash pump and controls			2		included above	Assumed
	Air Scour System			2		included above	Assumed
	Cleaning system			1		included above	Assumed

Table D-13A

Capital Cost – Ex Situ Chromium Treatment (NHE-1 and Two New Extraction Wells, 1,100 gpm Peak Flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Pump Station							
	Holding tank	20,000 gal	FRP	1	\$ 58,412	\$ 58,412	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	750 gpm @ 80 ft H2O	Cl/SS trim	3	\$ 20,364	\$ 61,092	Gierlich-Mitchell Quote, escalate from 1998
Backwash and Rinse Recovery							
	Cone bottom holding tank	20,000 gal	FRP	1	\$ 59,552	\$ 59,552	Ershigs Quote, 1993
	VGAC Drum			1	\$ -	\$ -	Vendor provided
	Diaphragm-type sludge pump			1	\$ 2,000	\$ 2,000	CH2M HILL Eng. Estimate
	Polymer tank with mixer	500 gal	SS	1	\$ 7,248	\$ 7,248	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gpm	316 SS	1	\$ 10,251	\$ 10,251	CH2M HILL Files - Escalate from 1994
	Backwash recirculation pump	700 gpm @ 50'	CS, SS Impeller	1	\$ 8,630	\$ 8,630	CH2M HILL Files - Escalate from 1993
	Plate and frame filter press	30 cu.ft.	Coated Steel	1	\$ 166,742	\$ 166,742	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	Metering Pumps		Acid Spec	1	\$ 9,663	\$ 9,663	CH2M HILL Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	Assumed
	pH Probe			1	\$ 1,500	\$ 1,500	Assumed
	Static mixer	10-inch		1	\$ 7,000	\$ 7,000	Assumed
	Subtotal "A"					\$ 3,538,322	
	Site Piping			9.2%	of Subtotal "A"	\$ 324,380	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			4.8%	of Subtotal "A"	\$ 170,335	1992 EPRI Document, Figure 7-2
	Site Electrical			4.9%	of Subtotal "A"	\$ 173,463	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			15.9%	of Subtotal "A"	\$ 562,028	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 884,580	
	Subtotal "B"					\$ 5,653,107	
	"Pass through" materials						
	None					\$ -	

Table D-13A

Capital Cost – Ex Situ Chromium Treatment (NHE-1 and Two New Extraction Wells, 1,100 gpm Peak Flow)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Subtotal "C"					\$ 5,653,107	
	Engineering			19.4%	of Subtotal "C"	\$ 1,094,320	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			19.4%	of Subtotal "C"	\$ 1,094,320	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 7,842,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 784,200	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 784,200	
	GRAND TOTAL					\$ 9,410,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-13B

Operations and Maintenance Cost – Ex Situ Chromium Treatment (NHE-1 and Two New Extraction Wells, 950 gpm Average Flow)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	950 gpm @ 50'	98,328	1	98,328	kW-hr		
	Recirc Pump for Fe(II) Loop	950 gpm @ 30'	58,997	1	58,997	kW-hr		
	Tank Mixers	10 hp, 100% time	81,892	8	655,134	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	12	24,568	kW-hr		
	Polymer Tank Mixer	1 hp, 10% time	819	1	819	kW-hr		
	Pump Stn Pump	950 gpm @ 20'	39,331	1	39,331	kW-hr		
	Pump Stn Pump	950 gpm @ 80'	157,325	1	157,325	kW-hr		
	Air Compressor	30 hp	245,675	2	491,350	kW-hr		
	Misc. Controls/Lights	2,500 W	27,444	2	54,887	kW-hr		
	Total				1,580,739	kW-hr	\$ 0.12	\$ 189,689
Natural Gas								
	None							\$ -
Carbon Make-up								
	VGAC Drum		1	2	2	drums	\$ 500.00	\$ 1,000
	VPGAC Adsorber Vessel	2,000 lbs.	1	2	2	vessel	\$ 5,000.00	\$ 10,000
Chemicals								
	Ferrous Sulfate	10 ppm dosage as Fe	113,032	1	113,032	lbs dry	\$ 0.45	\$ 50,878
	NaOH	40 ppm as CaCO3	166,573	1	166,573	lbs-dry	\$ 0.29	\$ 47,751
	Acid	15 ppm as CaCO3	62,465	1	62,465	lbs-dry	\$ 0.11	\$ 6,627
	Polymer	.1 ppm	416	1	416	lbs-dry	\$ 5.00	\$ 2,082
Materials								
	None							
Residuals Disposal								
	VGAC Drums		1.0	1	1.0	drums	\$ 200	\$ 200
	Ferric sludge waste	20 ppm @ 950 gpm	118.98	1	118.98	tons	\$ 200	\$ 23,796
Analytical								
	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			4		ea.	\$ 250	\$ 1,000
	Monitoring Wells			0		ea.	\$ 1,740	\$ -

Table D-13B

Operations and Maintenance Cost – Ex Situ Chromium Treatment (NHE-1 and Two New Extraction Wells, 950 gpm Average Flow)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			7,762		hrs	\$ 40	\$ 310,480
	Maintenance			5,155		hrs	\$ 48	\$ 247,440
	Supervisory			1,373		hrs	\$ 80	\$ 109,840
	Clerical			283		hrs	\$ 26	\$ 7,358
	Laboratory			1,627		hrs	\$ 48	\$ 78,096
	Yardwork			2,829		hrs	\$ 40	\$ 113,160
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 30,000	\$ 30,000
	Heavy Maintenance			1		lot	\$ 100,000	\$ 100,000
Parts	(2% of Capital)				2%		\$ 9,410,000	\$ 188,200
								\$ 1,537,000
Contingency on Materials/Services					10%			\$ 154,000
								\$ 1,691,000
		GRAND TOTAL						\$ 1,691,000

Table D-14A

Capital Cost – Ex Situ Chromium Treatment (All Extraction Wells)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Inline Cr(VI) Reduction Reactor System							
	Recirculation pumps	1200 gpm @ 30'	CI, SS Impeller	6	\$ 13,066	\$ 78,398	CH2M HILL Files - Escalate from 1993
	ASME Code vessels	6,000 gal	Lined CS	4	\$ 67,864	\$ 271,455	Ershigs Quote, 1993
	Valve set	10 inch	Lined CI	4	\$ 10,000	\$ 40,000	Assumed
	Flow indicating totalizer	8-inch		4	\$ 3,000	\$ 12,000	CH2M HILL Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	-- Metering Pumps		Acid Spec	6	\$ 9,663	\$ 57,977	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	4	\$ 700	\$ 2,800	CH2M HILL Eng. Estimate
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	27,000 gal	FRP	4	\$ 69,309	\$ 277,237	Ershigs Quote, 1993
	Axial mixer	10 hp	Rubber coated CS	4	\$ 15,000	\$ 60,000	Assumed
	ORP Probe		Acid Spec	4	\$ 2,000	\$ 8,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	27,000 gal	FRP	12	\$ 69,309	\$ 831,710	Ershigs Quote, 1993
	Axial mixer	10 hp	Rubber coated CS	12	\$ 15,000	\$ 180,000	Assumed
	Blower	160 scfm @ 10 psig		12	\$ 3,000	\$ 36,000	Assumed
	Valve set	10 inch	Lined CI	12	\$ 10,000	\$ 120,000	Assumed
	Flow indicating totalizer	8-inch		4	\$ 3,000	\$ 12,000	CH2M HILL Eng. Estimate
	pH Probe		Acid Spec	12	\$ 2,000	\$ 24,000	Assumed
	VPGAC Adsorber	5,000 lbs.		4	\$ -	\$ -	Vendor provided rented vessel
	Caustic Feed System						
	-- Holding Tank	7,000 gal	FRP	1	\$ 34,064	\$ 34,064	Ershigs Quote, 1993
	-- Metering Pumps		Caustic Spec	10	\$ 10,251	\$ 102,512	CH2M HILL Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	10	\$ 700	\$ 7,000	CH2M HILL Eng. Estimate
Pump Station							
	Holding tank	30,000 gal	FRP	1	\$ 73,599	\$ 73,599	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	800 gpm @ 20 ft H2O	CI/SS trim	6	\$ 13,165	\$ 78,992	Gierlich-Mitchell Quote, escalate from 1998
Microfilter System							
	Microfilter system	800 gpm (6 operating, No spare)	plastic	6	\$ 1,043,834	\$ 6,263,003	Pall Est 2004
	Backwash source tank		FRP	1		included above	Assumed
	Backwash pump and controls			2		included above	Assumed
	Air Scour System			2		included above	Assumed
	Cleaning system			1		included above	Assumed

Table D-14A

Capital Cost – Ex Situ Chromium Treatment (All Extraction Wells)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Pump Station							
	Holding tank	30,000 gal	FRP	1	\$ 73,599	\$ 73,599	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	900 gpm @ 80 ft H2O	Cl/SS trim	5	\$ 21,627	\$ 108,134	Gierlich-Mitchell Quote, escalate from 1998
Backwash and Rinse Recovery							
	Cone bottom holding tank	20,000 gal	FRP	2	\$ 59,552	\$ 119,104	Ershigs Quote, 1993
	VGAC Drum			2	\$ -	\$ -	Vendor provided
	Diaphragm-type sludge pump			3	\$ 2,000	\$ 6,000	CH2M HILL Eng. Estimate
	Polymer tank with mixer	500 gal	SS	1	\$ 7,248	\$ 7,248	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gph	316 SS	2	\$ 10,251	\$ 20,502	CH2M HILL Files - Escalate from 1994
	Backwash recirculation pump	700 gpm @ 50'	CS, SS Impeller	1	\$ 8,630	\$ 8,630	CH2M HILL Files - Escalate from 1993
	Plate and frame filter press	30 cu.ft.	Coated Steel	1	\$ 166,742	\$ 166,742	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,000 gal	FRP	1	\$ 32,108	\$ 32,108	Ershigs Quote, 1993
	Metering Pumps		Acid Spec	2	\$ 9,663	\$ 19,326	CH2M HILL Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	Assumed
	pH Probe			2	\$ 1,500	\$ 3,000	Assumed
	Static mixer	10-inch		1	\$ 7,000	\$ 7,000	Assumed
	Subtotal "A"					\$ 9,179,450	
	Site Piping			7.4%	of Subtotal "A"	\$ 680,016	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			4.3%	of Subtotal "A"	\$ 394,393	1992 EPRI Document, Figure 7-2
	Site Electrical			4.1%	of Subtotal "A"	\$ 374,004	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			12.8%	of Subtotal "A"	\$ 1,173,030	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 2,294,862	
	Subtotal "B"					\$ 14,095,757	
	"Pass through" materials					\$ -	
	None					\$ -	

Table D-14A

Capital Cost – Ex Situ Chromium Treatment (All Extraction Wells)

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Subtotal "C"					\$ 14,095,757	
	Engineering			16.4%	of Subtotal "C"	\$ 2,309,144	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			16.4%	of Subtotal "C"	\$ 2,309,144	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 18,714,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 1,871,400	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 1,871,400	
	GRAND TOTAL					\$ 22,460,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-14B

Operations and Maintenance Cost – Ex Situ Chromium Treatment (All Extraction Wells)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	3050 gpm @ 50'	315,685	1	315,685	kW-hr		
	Recirc Pump for Fe(II) Loop	3050 gpm @ 30'	189,411	1	189,411	kW-hr		
	Tank Mixers	10 hp, 100% time	81,892	16	1,310,268	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	24	49,135	kW-hr		
	Polymer Tank Mixer	1 hp, 10% time	819	1	819	kW-hr		
	Pump Stn Pump	3050 gpm @ 20'	126,274	1	126,274	kW-hr		
	Pump Stn Pump	3050 gpm @ 80'	505,096	1	505,096	kW-hr		
	Air Compressor	30 hp	204,729	4	818,917	kW-hr		
	Misc. Controls/Lights	2,500 W	27,444	4	109,774	kW-hr		
	Total				3,425,378	kW-hr	\$ 0.12	\$ 411,045
Natural Gas								
	None							\$ -
Carbon Make-up								
	VGAC	2 drums/yr	1	4	4	drums	\$ 500.00	\$ 2,000
	VPGAC Adsorber Vessel	5,000 lbs.	1	4	4	vessel	\$ 8,000.00	\$ 32,000
Chemicals								
	Ferrous Sulfate	10 ppm dosage as Fe	362,892	1	362,892	lbs dry	\$ 0.45	\$ 163,346
	NaOH	40 ppm as CaCO3	534,787	1	534,787	lbs-dry	\$ 0.29	\$ 153,305
	Acid	15 ppm as CaCO3	200,545	1	200,545	lbs-dry	\$ 0.11	\$ 21,276
	Polymer	.1 ppm	1,337	1	1,337	lbs-dry	\$ 5.00	\$ 6,685
Materials								
	None							
Residuals Disposal								
	VGAC	2 drums per year	2.0	1	2.0	drums	\$ 200	\$ 400
	Ferric sludge waste	20 ppm @ 3050 gpm	381.99	1	381.99	tons	\$ 200	\$ 76,398
Analytical								
	Water Samples			48		ea.	\$ 400	\$ 19,200
	Air Samples			4		ea.	\$ 250	\$ 1,000
	Monitoring Wells			0		ea.	\$ 1,740	\$ -

Table D-14B

Operations and Maintenance Cost – Ex Situ Chromium Treatment (All Extraction Wells)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			9,131		hrs	\$ 40	\$ 365,240
	Maintenance			6,065		hrs	\$ 48	\$ 291,120
	Supervisory			2,059		hrs	\$ 80	\$ 164,720
	Clerical			333		hrs	\$ 26	\$ 8,658
	Laboratory			1,914		hrs	\$ 48	\$ 91,872
	Yardwork			3,328		hrs	\$ 40	\$ 133,120
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 30,000	\$ 30,000
	Heavy Maintenance			1		lot	\$ 100,000	\$ 100,000
Parts	(2% of Capital)				2%		\$ 22,460,000	\$ 449,200
								\$ 2,521,000
Contingency on Materials/Services					10%			\$ 253,000
		GRAND TOTAL						\$ 2,774,000

Table D-15A

Capital Cost – Augment Interim 190 gpm Dioxane Treatment System at NHE-2 to Achieve 300 gpm

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Advanced Oxidation Reactor							
	Advanced oxidation System	110 gpm		1	\$ 147,814	\$ 147,814	Trojan Quote, 2004
	- Reactor vessel		Wetted: 316SS	1		included above	
	- UV lights and power supply			1		included above	
	- Valve set	8 inch	Lined CI	1		included above	
	- Flow indicating totalizer	6-inch		1		included above	
	Peroxide Feed System					included above	
	-- Holding Tank	1,000 gal	FRP	1		included above	
	-- Metering Pumps		H2O2 Spec	3		included above	
	-- Pulsation dampener		H2O2 Spec	2		included above	
	-- ORP Probe			2	\$ 2,000	\$ 4,000	CH2M HILL Eng. Estimate
Reducing Agent Feed System (Use existing)							
Pump Station							
	Holding tank	1,000 gal	FRP	1	\$ 9,991	\$ 9,991	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	200 gpm @ 100 ft H2O	CI/SS trim	2	\$ 13,369	\$ 26,739	Gierlich-Mitchell Quote, escalate from 1998
	Subtotal "A"					\$ 190,044	
	Site Piping			14.6%	of Subtotal "A"	\$ 27,680	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			6.4%	of Subtotal "A"	\$ 12,166	1992 EPRI Document, Figure 7-2
	Site Electrical			7.4%	of Subtotal "A"	\$ 14,144	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			25.4%	of Subtotal "A"	\$ 48,287	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of Subtotal "A"	\$ 47,511	

Table D-15A

Capital Cost – Augment Interim 190 gpm Dioxane Treatment System at NHE-2 to Achieve 300 gpm

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Subtotal "B"					\$ 339,831	
	"Pass through" materials						
	None					\$ -	
	Subtotal "C"					\$ 339,831	
	Engineering			28.5%	of Subtotal "C"	\$ 96,904	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			28.5%	of Subtotal "C"	\$ 96,904	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 534,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 53,400	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 53,400	
	GRAND TOTAL					\$ 640,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-15B

Operations and Maintenance Cost – NHE-2 Wellhead AOP Treatment (300 gpm total pumping rate)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	AOP Reactor lights	15 kW each	164,662	1	164,662	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	2	4,095	kW-hr		
	Transfer Pumps	300 gpm @ 160'	99,363	1	99,363	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	2	32,932	kW-hr		
	Total				301,052	kW-hr	\$ 0.12	\$ 36,126
Natural Gas								
	None							\$ -
Carbon Make-up								
	Bioactive GAC	Replace every 5 years	4,000	1	4,000	lbs	\$ 1.50	\$ 6,000
Chemicals								
	Hydrogen peroxide	25 ppm dosage	32,876	1	32,876	lbs dry	\$ 0.80	\$ 26,301
	Sodium metabisulfate	17 ppm	22,356	1	22,356	lbs-dry	\$ 0.10	\$ 2,236
	Bleach	5 ppm dosage	6,575	1	6,575	lbs dry	\$ 1.00	\$ 6,575
Materials								
	Lamp Replacement		300.0	1	300.0	lamps	\$ 145.00	\$ 43,500
Residuals Disposal								
	Biomass	Assume 1 mg/l average, 1% solid:	15,768	1	15,768	gal	\$ 0.30	\$ 4,730
Analytical								
	Water Samples			24		ea.	\$ 400	\$ 9,600
	Air Samples			0		ea.	\$ 250	\$ -
	Monitoring Wells			0		ea.	\$ 1,740	\$ -
Labor								
	Operating			1522		hrs	\$ 40	\$ 60,880
	Maintenance			1011		hrs	\$ 48	\$ 48,528
	Supervisory			686		hrs	\$ 80	\$ 54,880
	Clerical			83		hrs	\$ 26	\$ 2,158
	Laboratory			478		hrs	\$ 48	\$ 22,944
	Yardwork			555		hrs	\$ 40	\$ 22,200

Table D-15B

Operations and Maintenance Cost – NHE-2 Wellhead AOP Treatment (300 gpm total pumping rate)

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Subcontracts								
		Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)		0		lot	\$ 30,000	\$ -
		Heavy Maintenance		1		lot	\$ 30,000	\$ 30,000
Parts	(2% of Capital)				2%		\$ 640,000	\$ 12,800
								\$ 389,000
Contingency on Materials/Services					10%			\$ 39,000
								\$ 428,000
		GRAND TOTAL						\$ 428,000

Table D-16A
Capital Cost – Construct New Injection Wells

Item	Description	Estimated Depth/Quantity	Number of Locations	Estimated Total Quantity	Unit	Unit Cost	Total Cost	Cost Estimate Source
Installation of New Injection Wells								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	1	0	Lump Sum	\$113,623	\$0.00	Assume included with cost of mobilization for new extraction wells
	Setup and move between boring locations / Decon Rig	1	5	5	Each	\$9,469	\$47,343	Layne - Palmdale 2005
	Sound Control	1	3	3	Each	\$38,708	\$116,124	Assume Half Wells - Santa Clarita (Lang)
	Conductor Casing and Sanitary Seal - drill 30-inch (minimum) hole and furnish and install 24-inch conductor casing	50	6	300	Linear foot	\$566	\$169,696	GSWC - Ojai, 2004
	Drilling Reverse Mud Rotary/Ream (20-inch)	400	6	2,400	Linear foot	\$130	\$312,084	GSWC - Ojai, 2004
	Geophysical	1	6	6	Each	\$5,852	\$35,109	GSWC - Ojai, 2004
	Steel Well Casing - 10-inch	300	6	1,800	Linear foot	\$120	\$215,338	PVOU - 2004
	Stainless Steel Screen - 10-inch	100	6	600	Linear foot	\$202	\$120,933	PVOU - 2004
	Dissimilar Metals Connector	1	6	6	Each	\$3,251	\$19,505	PVOU - 2004
	Gravel Tube	275	6	1,650	Linear foot	\$26	\$42,912	GSWC - Ojai, 2004
	Sound Tube	400	6	2,400	Linear foot	\$20	\$46,813	GSWC - Ojai, 2004
	Filter Pack	150	6	900	Linear foot	\$20	\$17,555	PVOU - 2004
	Annular Grout or Neat Cement	250	6	1,500	Linear foot	\$33	\$48,763	PVOU - 2004
	Well Development - Primary & Secondary	20	6	120	Hours	\$265	\$31,814	Layne - Palmdale 2005
	Development Rig	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Mobilization/Demobilization/Cleanup	1	1	1	Lump Sum	\$4,419	\$4,419	Layne - Palmdale 2005
	Step-Rate Aquifer Test	8	6	48	Hours	\$265	\$12,726	Layne - Palmdale 2005
	Constant-Rate Aquifer Test	72	6	432	Hours	\$265	\$114,532	Layne - Palmdale 2005
	Video Camera Survey	1	6	6	Each	\$1,262	\$7,575	Layne - Palmdale 2005
	Disinfect Well	1	6	6	Each	\$1,951	\$11,703	GSWC - Ojai, 2004
Pump and Power Service Connection								
	Well Head	1	6	6	Each	\$5,050	\$30,299	Layne - Palmdale 2005
	Submersible Pump - 6 inch	0	0	0	Each	\$9,102	\$0	Not needed for injection well
	Pump Installation Cost	0	0	0	Each	\$2,209	\$0	Layne - Palmdale 2005
	Injection Riser Pipe (stainless steel)	350	6	2,100	LF	\$40	\$84,107	PVOU - 2004
	Check Valve	1	6	6	Each	\$520	\$3,121	PVOU - 2004
	Flow Meter	1	6	6	Each	\$5,592	\$33,549	PVOU - 2004
	Gate Valve	1	6	6	Each	\$780	\$4,681	PVOU - 2004
	Power service connection and panel	0	0	0	Each	\$25,000	\$0	Not needed for injection well

Table D-16A
Capital Cost – Construct New Injection Wells

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Waste Handling/Disposal								
	Mobilization/demobilization of roll off bins (10 CY bins)	22	EA	\$715	\$15,721	6	\$94,328	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	1,980	DAY	\$21	\$42,448	6	\$254,687	WDC, Santa Clarita project 2006
	Mobilization/demobilization of tanks for liquid waste	6	EA	\$1,191	\$7,146	6	\$42,877	WDC, Santa Clarita project 2006
	Rental of tanks for liquids (90 day average)	540	DAY	\$42	\$22,510	6	\$135,061	WDC, Santa Clarita project 2006
	Offsite disposal of soil cuttings as non-hazardous waste	72	TON	\$69	\$4,974	6	\$29,842	WDC, Santa Clarita project 2006
	Disposal of drilling mud and high solids water as non-hazardous waste	80,000	GAL	\$0.36	\$28,584	6	\$171,506	WDC, Santa Clarita project 2006
	Disposal of clear (development) water as non-hazardous waste	3,000	GAL	\$0.36	\$1,072	6	\$6,431	WDC, Santa Clarita project 2006
	Subtotal "A"						\$ 2,265,434	
	Inflation Adjustment 2005 to 2009 (6% per year average)			0.0%		of Subtotal "A"	\$ -	Calculated within line items
	Subtotal "B"						\$ 2,265,434	
	Engineering			22.3%		of Subtotal "B"	\$ 506,016	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			22.3%		of Subtotal "B"	\$ 506,016	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 3,277,000	
	Land Purchase for Well Sites	0.1	ACRE	\$ 2,000,000	\$ 200,000	6	\$ 1,200,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 327,700	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 327,700	
	GRAND TOTAL						\$ 5,130,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-16B

Operations and Maintenance Cost – Operate New Injection Wells

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power	NHOU to injection wells	(included in treatment O&M, Table 8B)	-	1	-	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	<u>16,466</u>	kW-hr		
	Total				16,466	kW-hr	\$ 0.12	\$ 1,976
Analytical (included with groundwater monitoring)	Water Samples - Monthly Tests			0		ea.	\$ 500	\$ -
	Water Samples - Additional Annual Tests			0		ea.	\$ 750	\$ -
Labor	Operating			200		hrs	\$ 40	\$ 8,000
	Maintenance			200		hrs	\$ 48	\$ 9,600
	Supervisory			0		hrs	\$ 80	\$ -
	Clerical			0		hrs	\$ 26	\$ -
	Laboratory			0		hrs	\$ 48	\$ -
	Yardwork			0		hrs	\$ 40	\$ -
Subcontracts	Regulatory Monitoring reports (RWCQB, EPA)			0		lot	\$ 25,000	\$ -
	Heavy Maintenance			1		lot	\$ 15,000	\$ 15,000
Parts	(2% of Capital)				2%		\$ 5,130,000	<u>\$ 102,600</u>
								\$ 137,000
Contingency on Materials/Services					10%			<u>\$ 14,000</u>
	GRAND TOTAL							\$ 151,000

Table D-16C

Capital Cost – Construct Pipeline from NHOU Treatment Plant to New Injection Wells

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
	Pipeline	18-inch, buried	Ductile Iron or PVC	9,000	\$ 310	\$ 2,790,000	CH2M HILL Eng. Estimate
	Relief Valves/Pits			4	\$ 12,000	\$ 48,000	CH2M HILL Eng. Estimate
	Flow indicating totalizer	18-inch		1	\$ 30,000	\$ 30,000	CH2M HILL Eng. Estimate
	Miscellaneous Appurtenances			5.0%	\$ 2,790,000	\$ 139,500	CH2M HILL Eng. Estimate
	Subtotal "A"					\$ 3,007,500	
	Site Piping			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			4.9%	of Subtotal "A"	\$ 147,435	1992 EPRI Document, Figure 7-2
	Site Electrical			0.5%	of Subtotal "A"	\$ 15,169	1992 EPRI Document, Figure 7-3
	Common Facilities			0.0%	of Subtotal "A"	\$ -	1992 EPRI Document, Figure 7-4
	Building/Site Improvements			0.0%	of Subtotal "A"	\$ -	
	Subtotal "B"					\$ 3,170,104	
	"Pass through" materials	None				\$ -	
	Subtotal "C"					\$ 3,170,104	
	Engineering			21.2%	of Subtotal "C"	\$ 673,392	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			21.2%	of Subtotal "C"	\$ 673,392	1992 EPRI Document, Figure 7-5
	Subtotal "D"					\$ 4,517,000	
	Right of Way Purchase for Pipeline (units in acres)			20.66	\$ 200,000	\$ 4,132,231	Land at \$2,000,000/Acre, Use 10% for a 100' Wide Easement
	Cost Basis Contingency			10.0%	of Subtotal "C"	\$ 451,700	
	Concept Scope Contingency			10.0%	of Subtotal "C"	\$ 451,700	
	GRAND TOTAL					\$ 9,550,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year to 2004, then 6% per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-16D

Operations and Maintenance Cost – Operate Pipeline from New Northwest Extraction Wells to NHOU Treatment Plant

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Labor								
	Operating			0		hrs	\$ 40.00	\$ -
	Maintenance			96		hrs	\$ 48.00	\$ 4,608
	Supervisory			0		hrs	\$ 80.00	\$ -
	Clerical			0		hrs	\$ 26.00	\$ -
	Laboratory			0		hrs	\$ 48.00	\$ -
	Yardwork			0		hrs	\$ 40.00	\$ -
Equipment								
	Pickup			96		hrs	\$ 12.00	\$ 1,152
Misc Repairs, Annual	(1% of Capital)				1%		\$ 9,550,000	\$ 95,500
								\$ 101,000
Contingency on Materials/Services					10%			\$ 11,000
								\$ 112,000
		GRAND TOTAL						\$ 112,000

Table D-17A

Capital Cost – Construct Additional New Monitoring Wells to Monitor Injection

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Installation of 6 x 300 ft Monitoring Wells								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	LS	\$10,000	\$10,000	1	\$10,000	WDC, Santa Clarita project 2006
	Setup and move between boring locations / Decon Rig	1	EA	\$3,000	\$3,000	5	\$15,000	WDC, Santa Clarita project 2006
	Noise Control	1	EA	\$32,500	\$32,500	3	\$97,500	WDC, Santa Clarita project 2006
	Furnish and install 14" diameter steel conductor casing in 18" diameter boring	20	LF	\$300	\$6,000	6	\$36,000	WDC, Santa Clarita project 2006
	Drill 10-12" diameter boring by mud rotary (direct, dual tube reverse) methods	300	LF	\$68	\$20,400	6	\$122,400	WDC, Santa Clarita project 2006
	Complete geophysical suite, including caliper	1	EA	\$4,500	\$4,500	6	\$27,000	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC blank casing	270	LF	\$15	\$4,050	6	\$24,300	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC screen	30	LF	\$17	\$510	6	\$3,060	WDC, Santa Clarita project 2006
	Sand filter pack	50	LF	\$6	\$300	6	\$1,800	WDC, Santa Clarita project 2006
	Bentonite-cement grout, installed	250	LF	\$6	\$1,500	6	\$9,000	WDC, Santa Clarita project 2006
	Surface completion	1	EA	\$1,750	\$1,750	6	\$10,500	WDC, Santa Clarita project 2006
	Completely develop monitoring wells, each screen	12	HR	\$145	\$1,740	6	\$10,440	WDC, Santa Clarita project 2006
	Pumps	1	LS	\$5,500	\$5,500	6	\$33,000	WDC, Santa Clarita project 2006
	Standby time for drill rig and associated equipment	8	HR	\$100	\$800	6	\$4,800	WDC, Santa Clarita project 2006

Table D-17A

Capital Cost – Construct Additional New Monitoring Wells to Monitor Injection

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Installation of 3 x 425 ft Monitoring Wells								
	Mobilization/Demobilization/Cleanup (one-time charge)	1	LS	\$10,000	\$10,000	1	\$10,000	WDC, Santa Clarita project 2006
	Setup and move between boring locations / Decon Rig	1	EA	\$3,000	\$3,000	2	\$6,000	WDC, Santa Clarita project 2006
	Noise Control	1	EA	\$32,500	\$32,500	2	\$65,000	WDC, Santa Clarita project 2006
	Furnish and install 14" diameter steel conductor casing in 18" diameter boring	20	LF	\$300	\$6,000	3	\$18,000	WDC, Santa Clarita project 2006
	Drill 10-12" diameter boring by mud rotary (direct, dual tube reverse) methods	425	LF	\$68	\$28,900	3	\$86,700	WDC, Santa Clarita project 2006
	Complete geophysical suite, including caliper	1	EA	\$4,500	\$4,500	3	\$13,500	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC blank casing	395	LF	\$15	\$5,925	3	\$17,775	WDC, Santa Clarita project 2006
	Furnish and Install 4" diameter, Sch. 80 PVC screen	30	LF	\$17	\$510	3	\$1,530	WDC, Santa Clarita project 2006
	Sand filter pack	50	LF	\$6	\$300	3	\$900	WDC, Santa Clarita project 2006
	Bentonite-cement grout, installed	375	LF	\$6	\$2,250	3	\$6,750	WDC, Santa Clarita project 2006
	Surface completion	1	EA	\$1,750	\$1,750	3	\$5,250	WDC, Santa Clarita project 2006
	Completely develop monitoring wells, each screen	12	HR	\$145	\$1,740	3	\$5,220	WDC, Santa Clarita project 2006
	Pumps	1	LS	\$5,500	\$5,500	3	\$16,500	WDC, Santa Clarita project 2006
	Standby time for drill rig and associated equipment	8	HR	\$100	\$800	3	\$2,400	WDC, Santa Clarita project 2006

Table D-17A

Capital Cost – Construct Additional New Monitoring Wells to Monitor Injection

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Waste Handling for 6 x 300 ft Monitoring Wells								
	Mobilization/demobilization of roll off bins (10 CY bins)	3	EA	\$600	\$1,800	6	\$10,800	WDC, Santa Clarita project 2006
	Rental of roll off bins (90 day average)	270	DAY	\$18	\$4,860	6	\$29,160	
	Mobilization/demobilization of tanks for liquid waste	1	EA	\$1,000	\$1,000	6	\$6,000	
	Rental of tanks for liquids (90 day average)	90	DAY	\$35	\$3,150	6	\$18,900	
	Offsite disposal of soil cuttings as non-hazardous waste	30	TON	\$58	\$1,740	6	\$10,440	
	Disposal of drilling mud and high solids water as non-hazardous waste	10,000	GAL	\$0	\$3,000	6	\$18,000	
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0	\$450	6	\$2,700	

Table D-17A

Capital Cost – Construct Additional New Monitoring Wells to Monitor Injection

Scope Item	Description	Estimated Quantity	Units	Unit Costs	Single Well Costs	No. of Wells	Total Costs	Cost Estimate Source
Waste Handling for 3 x 425 ft Monitoring Wells								
	Mobilization/demobilization of roll off bins (10 CY bins)	4	EA	\$600	\$2,400	3	\$7,200	
	Rental of roll off bins (90 day average)	360	DAY	\$18	\$6,480	3	\$19,440	
	Mobilization/demobilization of tanks for liquid waste	1	EA	\$1,000	\$1,000	3	\$3,000	
	Rental of tanks for liquids (90 day average)	90	DAY	\$35	\$3,150	3	\$9,450	
	Offsite disposal of soil cuttings as non-hazardous waste	37	TON	\$58	\$2,146	3	\$6,438	
	Disposal of drilling mud and high solids water as non-hazardous waste	10,000	GAL	\$0.30	\$3,000.00	3	\$9,000	
	Disposal of clear (development) water as non-hazardous waste	1,500	GAL	\$0.30	\$450.00	3	\$1,350	
	Subtotal "A"						\$ 812,203	
	Inflation Adjustment 2005 to 2009 (6% per year average)			19.1%		of Subtotal "A"	\$ 155,144	
	Subtotal "B"						\$ 967,347	
	Engineering			25.1%		of Subtotal "B"	\$ 242,883	1992 EPRI Document, Figure 7-5
	Contractor Overhead, Fees			25.1%		of Subtotal "B"	\$ 242,883	1992 EPRI Document, Figure 7-5
	Subtotal "C"						\$ 1,453,000	
	Cost Basis Contingency			10.0%		of Subtotal "C"	\$ 145,300	
	Concept Scope Contingency			10.0%		of Subtotal "C"	\$ 145,300	
	GRAND TOTAL						\$ 1,740,000	

NOTES:

- All cost escalation adjustments assumed 3% inflation per year.
- All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
- The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.

Table D-17B

Operations and Maintenance Cost – Groundwater Monitoring to Monitor Injection

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
11 Monthly Sampling Events (extraction wells only)	<u>Analytical Costs</u>											
	VOCs	7	0	0	3	10	samples	\$ 95	\$ 950	0	\$ -	
	Hexavalent Chromium	7	0	0	3	10	samples	\$ 95	\$ 950	0	\$ -	
	Dissolved Metals	0	0	0	0	0	samples	\$ 175	\$ -	0	\$ -	Analyze annually
	Common Anions, TDS, Alkalinity	0	0	0	0	0	samples	\$ 120	\$ -	0	\$ -	Analyze annually
	Nitrate	0	0	0	0	0	samples	\$ 35	\$ -	0	\$ -	Analyze annually
	1,4-Dioxane and TCP	7	0	0	3	10	samples	\$ 275	\$ 2,750	0	\$ -	
	NDMA and Perchlorate	0	0	0	0	0	samples	\$ 300	\$ -	0	\$ -	Analyze annually
	<u>Labor</u>											
	Planning and Mobilization					3	hours	\$ 100	\$ 300	0	\$ -	One staff, includes lab coordination and travel time
	Sampling					8	hours	\$ 100	\$ 800	0	\$ -	One staff, no purge necessary
	Demobilization from Field					2	hours	\$ 100	\$ 200	0	\$ -	Ship samples, return equipment, travel time home
	Data Validation					2	hours	\$ 125	\$ 250	0	\$ -	Review of lab data by chemist, corrections, reporting
	<u>Reporting/Data Submittal</u>					4	hours	\$ 125	\$ 500	0	\$ -	Database submittal, brief monthly summary report
	<u>Other Subcontractors</u>											
	Well Maintenance					0	hours	\$ 150	\$ -	0	\$ -	Costs included in extraction well O&M
	IDW Disposal					0	hours	\$ 150	\$ -	0	\$ -	No purging necessary for active extraction wells
	<u>Other Costs</u>											
	Travel Expenses					1	days	\$ 200	\$ 200	0	\$ -	Vehicle rental and fuel, meals
	Sampling Equipment Rental					1	days	\$ 125	\$ 125	0	\$ -	Water levels, parameters, peristaltic pump, etc.
	Shipping Costs					1	lump sum	\$ 200	\$ 200	0	\$ -	Field equipment, samples, reports
	Perishable Supplies					1	lump sum	\$ 50	\$ 50	0	\$ -	Ice for samples, decontamination supplies, etc.
Subtotal Monthly Sampling Events (extraction wells only)											\$ -	

Table D-17B

Operations and Maintenance Cost – Groundwater Monitoring to Monitor Injection

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes	
		Extraction	Monitoring	Production	QA/QC Samples								
3 Quarterly Sampling Events (4th quarterly event will coincide with the annual sampling event, below)	<u>Analytical Costs</u>												
	VOCs	0	9	0	2	11	samples	\$ 95	\$ 1,045	3	\$ 3,135	Assume this sampling event occurs during primary NHOU sampling event	
	Hexavalent Chromium	0	9	0	2	11	samples	\$ 95	\$ 1,045	3	\$ 3,135	See note for VOCs	
	Dissolved Metals	0	0	0	0	0	samples	\$ 175	\$ -	3	\$ -	Analyzed annually	
	Common Anions, TDS, Alkalinity	0	0	0	0	0	samples	\$ 120	\$ -	3	\$ -	Analyzed annually	
	Nitrate	0	0	0	0	0	samples	\$ 35	\$ -	3	\$ -	Analyzed annually	
	1,4-Dioxane and TCP	0	9	0	2	11	samples	\$ 275	\$ 3,025	3	\$ 9,075	See note for VOCs	
	NDMA and Perchlorate	0	0	0	0	0	samples	\$ 300	\$ -	3	\$ -	Analyzed annually	
	<u>Labor</u>												
	Planning and Mobilization		5			5	hours	\$ 100	\$ 500	3	\$ 1,500	Two staff, includes lab and subcontractor coordination, and travel time	
	Sampling			24		24	hours	\$ 100	\$ 2,400	3	\$ 7,200	Based on current SFV quarterly sampling program	
	Demobilization from Field			4		4	hours	\$ 100	\$ 400	3	\$ 1,200	Ship samples, return equipment, travel time home	
	Data Validation					6	hours	\$ 125	\$ 750	3	\$ 2,250	Review of lab data by chemist, corrections, reporting	
	<u>Reporting/Data Submittal</u>					10	hours	\$ 125	\$ 1,250	3	\$ 3,750	Database submittal, brief summary report	
	<u>Other Subcontractors</u>												
Well Maintenance					4	hours	\$ 150	\$ 600	3	\$ 1,800	One day well subcontractor support assumed		
IDW Disposal					15	hours	\$ 100	\$ 1,500	3	\$ 4,500	Tanker truck to collect purged water from wells, dispose at NHOU or BOU treatment systems		
<u>Other Costs</u>													
Travel Expenses					2	days	\$ 350	\$ 700	3	\$ 2,100	Vehicle rental and fuel, meals, hotel for two staff		
Sampling Equipment Rental					3	days	\$ 125	\$ 375	3	\$ 1,125	Water levels, parameters, peristaltic pump, etc.		
Shipping Costs					1	lump sum	\$ 550	\$ 550	3	\$ 1,650	Field equipment, samples, reports		
Perishable Supplies					1	lump sum	\$ 50	\$ 50	3	\$ 150	Ice for samples, decontamination supplies, etc.		
Subtotal Quarterly Sampling Events										\$ 43,000			

Table D-17B

Operations and Maintenance Cost – Groundwater Monitoring to Monitor Injection

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
1 Annual Sampling Event	<u>Analytical Costs</u>											
	VOCs	0	9	0	2	11	samples	\$ 95	\$ 1,045	1	\$ 1,045	
	Hexavalent Chromium	0	9	0	2	11	samples	\$ 95	\$ 1,045	1	\$ 1,045	
	Dissolved Metals	0	9	0	2	11	samples	\$ 175	\$ 1,925	1	\$ 1,925	
	Common Anions, TDS, Alkalinity	0	9	0	2	11	samples	\$ 120	\$ 1,320	1	\$ 1,320	
	Nitrate	0	9	0	2	11	samples	\$ 35	\$ 385	1	\$ 385	
	1,4-Dioxane and TCP	0	9	0	2	11	samples	\$ 275	\$ 3,025	1	\$ 3,025	
	NDMA and Perchlorate	0	9	0	2	11	samples	\$ 300	\$ 3,300	1	\$ 3,300	
	<u>Labor</u>											
	Planning and Mobilization			5		5	hours	\$ 100	\$ 500	1	\$ 500	Two staff, includes lab and subcontractor coordination, and travel time
	Sampling			24		24	hours	\$ 100	\$ 2,400	1	\$ 2,400	Based on current SFV quarterly sampling program
	Demobilization from Field			4		4	hours	\$ 100	\$ 400	1	\$ 400	Ship samples, return equipment, travel time home
	Data Validation					12	hours	\$ 125	\$ 1,500	1	\$ 1,500	Review of lab data by chemist, corrections, reporting
	<u>Reporting/Data Submittal</u>											
						60	hours	\$ 125	\$ 7,500	1	\$ 7,500	Database submittal, extensive annual summary report
	<u>Other Subcontractors</u>											
	Well Maintenance					6	hours	\$ 150	\$ 900	1	\$ 900	Two days well subcontractor support assumed
	IDW Disposal					15	hours	\$ 100	\$ 1,500	1	\$ 1,500	Tanker truck to collect purged water from wells, dispose at NHOU or BOU treatment systems
	<u>Other Costs</u>											
	Travel Expenses					2	days	\$ 350	\$ 700	1	\$ 700	Vehicle rental and fuel, meals, hotel for two staff
	Sampling Equipment Rental					3	days	\$ 60	\$ 180	1	\$ 180	Water levels, parameters, peristaltic pump, etc.
	Shipping Costs					1	lump sum	\$ 550	\$ 550	1	\$ 550	Field equipment, samples, reports
Perishable Supplies					1	lump sum	\$ 50	\$ 50	1	\$ 50	Ice for samples, decontamination supplies, etc.	
Subtotal Annual Sampling Event										\$ 28,000		

Table D-17B

Operations and Maintenance Cost – Groundwater Monitoring to Monitor Injection

Category	Description	Number of Wells Sampled per Event				Total Number of Units Per Event	Unit of Measure	Unit Cost	Extended Cost Per Event	Number of Events per Year	Total Annual Cost	Notes
		Extraction	Monitoring	Production	QA/QC Samples							
Other Annual Costs	<u>Labor</u>											
	Project Management				20	hours	\$ 150	\$ 3,000	1	\$ 3,000	Coordination with EPA and field teams, monthly status reporting	
	Subcontracting				6	hours	\$ 100	\$ 600	1	\$ 600	Develop subcontracts	
	Sampling program review and optimization				15	hours	\$ 125	\$ 1,875	1	\$ 1,875		
	QA/QC and Safety Audits				10	hours	\$ 125	\$ 1,250	1	\$ 1,250	Laboratory and field team audits	
	<u>Other Costs</u>											
	Travel Expenses				1.5	days	\$ 350	\$ 525	1	\$ 525	Annual coordination meeting with EPA, other well owners, field and laboratory audits	
Subtotal Other Annual Costs										\$ 7,000		
Subtotal										\$ 78,000		
Contingency on Materials/Services								10%		\$ 8,000		
										\$ 86,000		
												GRAND TOTAL

Table D-18A

Capital Cost – Chromium Screening Anion Ion Exchange

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
InLine Booster and pH Reduction System							
	Recirculation pumps	600 gpm @ 70'	Cl, SS Impeller	2	\$ 7,266	\$ 14,532	CH2M Files - Escalate from 1993
	Valve set	8 inch	Lined Cl	1	\$ 6,000	\$ 6,000	Assumed
	Acid Feed System						
	-- Holding Tank	7,500 gal	FRP	1	\$ 20,366	\$ 20,366	Ershigs Quote, 1993
	-- Tank level switch			1	\$ 500	\$ 500	Assumed
	-- Metering Pumps	0.5 gpm	Acid Spec	2	\$ 7,660	\$ 15,321	CH2M Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M Files, escalate from 1996
	-- pH Probe			6	\$ 1,500	\$ 9,000	Assumed
Ion Exchange Columns System							
	Bag Filter System						
	-- Bag filter vessels and bags		CS, Epoxy coated	2	\$ 6,000	\$ 12,000	Filter vendor, 2002
	-- Differential pressure switch	0 - 30 psig	Brass	1	\$ 500	\$ 500	Assumed
	IX adsorber columns (Set of 3)						
	-- ASME Code vessels	120" Dia x 96" SS each	CS, Epoxy coated	1	\$ 297,000	\$ 297,000	Calgon 2003 (Excludes resin)
	-- Vessel internals		Carbon Stell, Coated	1	included		
	-- Piping inside valve nest		PVC	1	included		
	-- Control panel		SS / PVC	1	included		
	Differential Pressure Switch						
	Flow indicating totalizer	0-30 psig	Brass	2	\$ 444	\$ 888	McMaster-Carr
		8-inch		1	\$ 2,000	\$ 2,000	CH2M Eng. Estimate
	BW and Rinse Recovery						
	-- Slant bottom holding tank	25,000 gal	Coated CS	1	\$ 20,759	\$ 20,759	Ershigs Quote, 1993
	-- VGAC Drum			1	\$ 300	\$ 300	CH2M Eng. Estimate
	-- Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M Eng. Estimate
	-- Backwash recirculation pump	200 gpm @ 30'	CS, SS Impeller	1	\$ 2,930	\$ 2,930	CH2M Files - Escalate from 1993
	-- Tank level switch			1	\$ 1,500	\$ 1,500	Assumed

Table D-18A

Capital Cost – Chromium Screening Anion Ion Exchange

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Caustic Feed System	-- Holding Tank	7,500 gal	FRP	1	\$ 20,366	\$ 20,366	Ershigs Quote, 1993
	-- Tank level switch			1	\$ 500	\$ 500	Assumed
	-- Metering Pumps	0.5 gpm	Caustic Spec	2	\$ 7,660	\$ 15,321	CH2M Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	1	\$ 700	\$ 700	CH2M Files, escalate from 1996
	-- pH Probe			2	\$ 1,500	\$ 3,000	Assumed
SubTotal "A"						\$ 448,182	
	Site Piping			13.0%	of SubTotal "A"	\$ 58,180	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.9%	of SubTotal "A"	\$ 26,603	1992 EPRI Document, Figure 7-2
	Site Electrical			8.0%	of SubTotal "A"	\$ 36,018	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			22.6%	of SubTotal "A"	\$ 101,352	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of SubTotal "A"	\$ 112,046	
SubTotal "B"						\$ 782,381	
	"Pass through" materials						
	Resin (First charge)					\$ 631,200	
	None					\$ -	
SubTotal "C"						\$ 1,413,581	
	Engineering, Overhead, Fees			47.7%	of SubTotal "C"	\$ 674,917	1992 EPRI Document, Figure 7-5
SubTotal "D"						\$ 2,088,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			25.0%	of SubTotal "C"	\$ 522,000	
	Concept Scope Contingency			25.0%	of SubTotal "C"	\$ 522,000	
GRAND TOTAL						\$ 3,130,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.
4. Site Electrical factor is escalated by 20 percent to account for use of 220 and 440 VAC service.

Table D-18B
Operations & Maintenance Cost – Chromium Screening Anion Ion Exchange

O&M Category	Equip. Name	Equip. Description	O&M Requirm't per Unit	Number of Units	Total Requirements	Units	Unit Cost	Cost
Electrical Power								
	Inline Booster Pump	600 gpm @ 70'	86,943	1	86,943	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	2	4,095	kW-hr		
	Backwash Tank Pump	1000 gpm @ 30', 10% time	6,210	1	6,210	kW-hr		
	Misc. Controls/Lights	1,000 W	10,977	1	10,977	kW-hr		
	Total				108,225	kW-hr	\$ 0.15	\$ 16,234
Natural Gas	None							\$ -
Carbon Make-up	VGAC	1 drums/yr	1	1	1	drums	\$ 300.00	\$ 300
Chemicals	NaOH	25 ppm as CaCO3	65,753	1	65,753	lbs-dry	\$ 0.29	\$ 18,849
	Acid	50 ppm as CaCO3	131,505	1	131,505	lbs-dry	\$ 0.11	\$ 13,951
Materials	Filter bags	10 micron	4 per week	1	190	ea.	\$ 3.00	\$ 570
	Resin	Service life = 80,000 BV @ 35 ug/	2,010	1	2,010	cu.ft.	\$ 527.00	\$ 1,059,270
Residuals Disposal	IX Resin Sludge	nil						
	VGAC	1 drums per year	1.0	1	1.0	drums	\$ 200.00	\$ 200
Analytical	Water Samples			48		ea.	\$ 400.00	\$ 19,200
	Air Samples			1		ea.	\$ 250.00	\$ 250
	Monitoring Wells			0		ea.	\$ 1,740.00	\$ -
Labor	Operating			1775		hrs	\$ 30.00	\$ 53,250
	Maintenance			257		hrs	\$ 34.50	\$ 8,867
	Supvisory			735		hrs	\$ 40.50	\$ 29,768
	Clerical			83		hrs	\$ 19.50	\$ 1,619
	Laboratory			478		hrs	\$ 30.00	\$ 14,340
	Yardwork			555		hrs	\$ 30.00	\$ 16,650
Subcontracts	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 25,000.00	\$ 25,000
	Heavy Maintenance			1		lot	\$ 10,000.00	\$ 10,000
Parts	(2% of Capital)				2%		\$ 1,413,581	\$ 28,272
								\$ 1,317,000
Contingency on Materials/Services					10%			\$ 131,700
	GRAND TOTAL							\$ 1,448,700

Table D-19A

Capital Cost – Chromium Screening Ferrous Iron Reduction

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
InLine Cr(VI) Reduction Reactor System							
	Recirculation pumps	2,000 gpm @ 30'	Cl, SS Impeller	2	\$ 8,174	\$ 16,347	CH2M Files - Escalate from 1993
	ASME Code vessels	10,000 gal	Lined CS	1	\$ 71,984	\$ 71,984	Ershigs Quote, 1993
	Valve set	10 inch	Lined Cl	1	\$ 10,000	\$ 10,000	Assumed
	Flow indicating totalizer	8-inch		1	\$ 2,000	\$ 2,000	CH2M Eng. Estimate
	Ferrous Chloride Feed System						
	-- Holding Tank	7,500 gal	FRP	1	\$ 20,366	\$ 20,366	Ershigs Quote, 1993
	-- Tank level switch			1	\$ 500	\$ 500	Assumed
	-- Metering Pumps		Acid Spec	2	\$ 7,660	\$ 15,321	CH2M Files, escalate from 1996
	-- Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M Files, escalate from 1996
Back Mixed Cr(VI) Reduction Reactor System							
	Closed Top Tank	40,000 gal	FRP	1	\$ 52,880	\$ 52,880	Ershigs Quote, 1993
	Axial mixer	20 hp	Rubber coated CS	1	\$ 20,000	\$ 20,000	Assumed
Back Mixed Iron Oxidation Reactor System							
	Closed Top Tank	40,000 gal	FRP	3	\$ 52,880	\$ 158,639	Ershigs Quote, 1993
	Axial mixer	20 hp	Rubber coated CS	3	\$ 20,000	\$ 60,000	Assumed
	Blower	400 scfm @ 10 psig		3	\$ 5,000	\$ 15,000	Assumed
	Valve set	10 inch	Lined Cl	3	\$ 10,000	\$ 30,000	Assumed
	Flow indicating totalizer	8-inch		1	\$ 2,000	\$ 2,000	CH2M Eng. Estimate
	Caustic Feed System						
	-- Holding Tank	7,500 gal	CS	1	\$ 12,219	\$ 12,219	Ershigs Quote, 1993
	-- Tank level switch			1	\$ 500	\$ 500	Assumed
	-- Metering Pumps		Caustic Spec	6	\$ 7,660	\$ 45,962	CH2M Files, escalate from 1996
	-- Pulsation dampener		Caustic Spec	3	\$ 700	\$ 2,100	CH2M Files, escalate from 1996
	-- pH Probe			6	\$ 1,500	\$ 9,000	Assumed
Pump Station							
	Holding tank	20,000 gal	FRP	1	\$ 23,045	\$ 23,045	Ershigs Quote, 1993
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
	Transfer pumps	2000 gpm @ 120 ft H2O	Cl/SS trim	2	\$ 25,509	\$ 51,017	Gierlich-Mitchell Quote, escalate from 1998

Table D-19A

Capital Cost – Chromium Screening Ferrous Iron Reduction

Major System	Component	Size	Material	Quantity	Unit Cost	Cost	Cost Estimate Source
Flocculent Feed System							
	Tote Bin Storage	250 gal	Plastic	1	\$ -	\$ -	Vendor supplied
	Tank level switch			1	\$ 500	\$ 500	Assumed
	Metering Pumps			2	\$ 7,660	\$ 15,321	CH2M Files, escalate from 1996
	Pulsation dampener			1	\$ 700	\$ 700	CH2M Files, escalate from 1996
Multimedia Filter System							
	Multimedia filter vessels and media	1000 gpm (3 oper +1 backwashing)	CS, Epoxy coated	2	\$ 217,055	\$ 434,110	NEED TO INCREASE FOR STEEL PRICES Yardney, Escalate from 1997
	Differential pressure switch	0 - 30 psig	Brass			included above	
	Modulating Valve			2	\$ 4,000	\$ 8,000	Assumed
	Backwash Pump and auxillary			2	\$ 10,000	\$ 20,000	Assumed
	Air Scour System			2	\$ 20,000	\$ 40,000	Assumed
Bckwash and Rinse Recovery							
	Cone bottom holding tank	10,000 gal	FRP	1	\$ 23,960	\$ 23,960	Ershigs Quote, 1993
	VGAC Drum			1	\$ 500	\$ 500	CH2M Eng. Estimate
	Diaphragm-type sludge pump			2	\$ 2,000	\$ 4,000	CH2M Eng. Estimate
	Polymer tank with mixer	50 gal	SS	1	\$ 3,624	\$ 3,624	McMaster-Carr (P.1248, 1257)
	Polymer feed pump	10 gph	316 SS	2	\$ 6,229	\$ 12,457	CH2M Files - Escalate from 1994
	Backwash recirculation pump	1500 gpm @ 50'	CS, SS Impeller	1	\$ 6,743	\$ 6,743	CH2M Files - Escalate from 1993
	Plate and frame filter press	30 cu.ft.	Coated Steel	1	\$ 180,000	\$ 180,000	Vendor Quote (Andritz 2006)
	Tank level switch			1	\$ 1,500	\$ 1,500	Assumed
Acid Feed System							
	Holding Tank	7,500 gal	CS	1	\$ 12,219	\$ 12,219	Ershigs Quote, 1993
	Tank level switch			1	\$ 500	\$ 500	Assumed
	Metering Pumps		Acid Spec	2	\$ 7,660	\$ 15,321	CH2M Files, escalate from 1996
	Pulsation dampener		Acid Spec	1	\$ 700	\$ 700	CH2M Files, escalate from 1996
	pH Probe			1	\$ 1,500	\$ 1,500	Assumed
	Static mixer			1	\$ 3,000	\$ 3,000	Assumed
	SubTotal "A"					\$ 1,405,736	
	Site Piping			10.9%	of SubTotal "A"	\$ 152,823	1992 EPRI Document (Note 3), Figure 7-1
	Site I & C			5.3%	of SubTotal "A"	\$ 74,717	1992 EPRI Document, Figure 7-2
	Site Electrical			6.8%	of SubTotal "A"	\$ 96,223	1992 EPRI Document, Figure 7-3 (Note 4)
	Common Facilities			18.9%	of SubTotal "A"	\$ 265,554	1992 EPRI Document, Figure 7-4
	Building/Lab Site Improvements			25.0%	of SubTotal "A"	\$ 351,434	

Table D-19A

Capital Cost – Chromium Screening Ferrous Iron Reduction

<u>Major System</u>	<u>Component</u>	<u>Size</u>	<u>Material</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>	<u>Cost Estimate Source</u>
	SubTotal "B"					\$ 2,346,486	
	"Pass through" materials						
	None					\$ -	
	SubTotal "C"					\$ 2,346,486	
	Engineering, Overhead, Fees			44.4%	of SubTotal "C"	\$ 1,042,866	1992 EPRI Document, Figure 7-5
	SubTotal "D"					\$ 3,389,000	
	Sewer connection fee					\$ -	
	Cost Basis Contingency			25.0%	of SubTotal "C"	\$ 847,250	
	Concept Scope Contingency			25.0%	of SubTotal "C"	\$ 847,250	
	GRAND TOTAL					\$ 5,080,000	

NOTES:

1. All cost escalation adjustments assumed 3% inflation per year.
2. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.
3. The 1992 EPRI document is EPRI document EPRI TR-101788, Dec 1992.
4. Site Electrical factor is escalated by 20 percent to account for use of 220 and 440 VAC service.

Table D-19B

Operations & Maintenance Cost – Chromium Screening Ferrous Iron Reduction

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Electrical Power								
	Well Pumps, Incremental	2000 gpm @ 50'	207,006	1	207,006	kW-hr		
	Recirc Pump for Fe(II) Loop	2000 gpm @ 30'	124,204	1	124,204	kW-hr		
	Tank Mixers	20 hp, 100% time	163,783	4	655,134	kW-hr		
	Chemical metering pumps	0.5 hp each, 50% time	2,047	6	12,284	kW-hr		
	Polymer Tank Mixer	1 hp, 10% time	819	1	819	kW-hr		
	Pump Stn Pump	2000 gpm @ 120'	496,815	1	496,815	kW-hr		
	Backwash Tank Pump	1500 gpm @ 30', 10% time	9,315	1	9,315	kW-hr		
	Misc. Controls/Lights	1,500 W	16,466	1	16,466	kW-hr		
	Total				1,522,044	kW-hr	\$ 0.15	\$ 228,307
Natural Gas								
	None							\$ -
Carbon Make-up								
	VGAC	4 drums/yr	1	4	4	drums	\$ 500.00	\$ 2,000
Chemicals								
	Ferrous Chloride	10 ppm dosage	87,670	1	87,670	lbs dry	\$ 0.45	\$ 39,462
	NaOH	25 ppm as CaCO3	219,175	1	219,175	lbs-dry	\$ 0.29	\$ 62,830
	Acid	15 ppm as CaCO3	131,505	1	131,505	lbs-dry	\$ 0.11	\$ 13,951
	Polymer	1 ppm	8,767	1	8,767	lbs-dry	\$ 5.00	\$ 43,835
Materials								
	None							
Residuals Disposal								
	VGAC	4 drums per year	4.0	1	4.0	drums	\$ 200.00	\$ 800
	Ferric sludge waste	20 ppm @ 2,000 gpm	250.49	1	250.49	tons	\$ 200.00	\$ 50,097
Analytical								
	Water Samples			48		ea.	\$ 400.00	\$ 19,200
	Air Samples			4		ea.	\$ 250.00	\$ 1,000
	Monitoring Wells			0		ea.	\$ 1,740.00	\$ -
Labor								
	Operating			5387		hrs	\$ 35.00	\$ 188,545
	Maintenance			3432		hrs	\$ 42.00	\$ 144,144
	Supvisory			1678		hrs	\$ 70.00	\$ 117,460
	Clerical			222		hrs	\$ 22.75	\$ 5,051
	Laboratory			1754		hrs	\$ 42.00	\$ 73,668
	Yardwork			1387		hrs	\$ 35.00	\$ 48,545

Table D-19B

Operations & Maintenance Cost – Chromium Screening Ferrous Iron Reduction

<u>O&M Category</u>	<u>Equipment Name</u>	<u>Equipment Description</u>	<u>O&M Requirement per Unit</u>	<u>Number of Units</u>	<u>Total Requirements</u>	<u>Units</u>	<u>Unit Cost</u>	<u>Cost</u>
Subcontracts								
	Regulatory Monitoring reports (RWCQB, EPA, Air Emissions Inventory)			1		lot	\$ 25,000.00	\$ 25,000
	Heavy Maintenance			1		lot	\$ 15,000.00	\$ 15,000
Parts	(2% of Capital)				2%		\$ 2,346,486	\$ 46,930
								\$ 1,126,000
Contingency on Materials/Services					10%			\$ 112,600
								\$ 1,238,600
		GRAND TOTAL						\$ 1,238,600