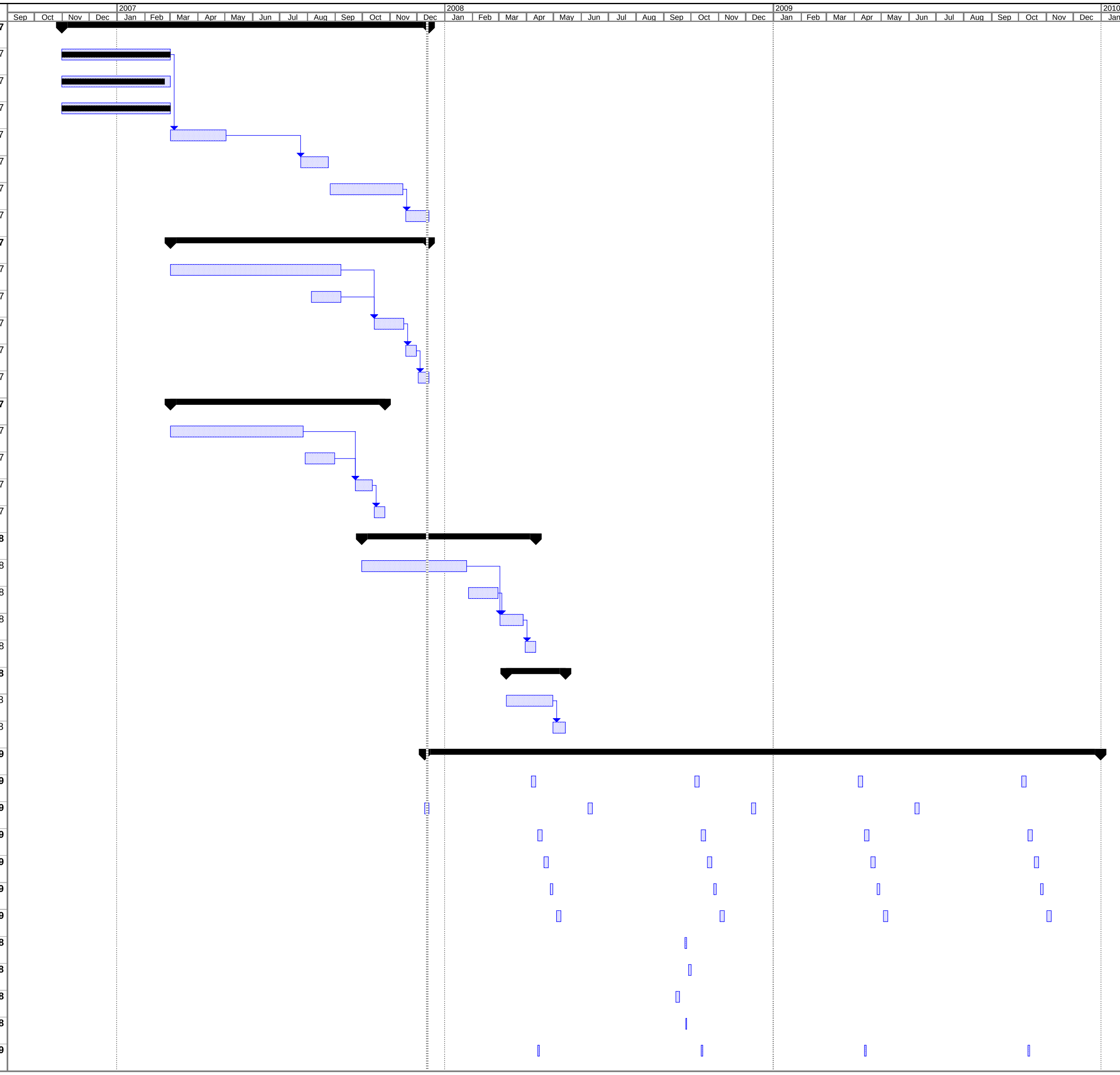
Final Groundwater Remedy Schedule

Chevron Cincinnati Facility, Hooven, Ohio

ID	Task Name	Start	Finish
1	**Workplans and Logistics**	**Wed 11/1/06**	**Fri 12/14/07**
2	Prepare RIP and OMM Plan	Wed 11/1/06	Thu 3/1/07
3	Pursue Remaining Offsite Access Agreements	Wed 11/1/06	Thu 3/1/07
4	Arrange Design/Oversight Contractors	Wed 11/1/06	Thu 3/1/07
5	EPA Review of Workplans	Fri 3/2/07	Wed 5/2/07
6	Address EPA Comments to Workplan	Wed 7/25/07	Fri 8/24/07
7	EPA Review of Revised Workplans	Mon 8/27/07	Thu 11/15/07
8	Address EPA Approval Comments and Finalize Workplans	Mon 11/19/07	Fri 12/14/07
9	**PROD_24 High-Grade Infrastructure Construction**	**Fri 3/2/07**	**Fri 12/14/07**
10	Health and Safety Planning	Fri 3/2/07	Fri 9/7/07
11	Arrange Drilling Contractor	Mon 8/6/07	Fri 9/7/07
12	Drill Additional High-Grade Well	Mon 10/15/07	Fri 11/16/07
13	Install Headers, Piping as Needed	Mon 11/19/07	Fri 11/30/07
14	Systems Startup and Operation, Conditions Permitting	Mon 12/3/07	Fri 12/14/07
15	**Additional Down-Gradient Monitoring Wells Construction**	**Fri 3/2/07**	**Fri 10/26/07**
16	Health and Safety Planning	Fri 3/2/07	Fri 7/27/07
17	Arrange Drilling Contractor	Mon 7/30/07	Fri 8/31/07
18	Drill Sentinel, POC and ROST Wells	Mon 9/24/07	Fri 10/12/07
19	Develop Wells	Mon 10/15/07	Fri 10/26/07
20	**Nested Vapor & Groundwater Monitoring Well Construction**	**Mon 10/1/07**	**Fri 4/11/08**
21	Health and Safety Planning	Mon 10/1/07	Fri 1/25/08
22	Arrange Drilling Contractor	Mon 1/28/08	Fri 2/29/08
23	Drill Nested Vapor Monitoring Wells	Mon 3/3/08	Fri 3/28/08
24	Develop Wells	Mon 3/31/08	Fri 4/11/08
25	**Lysimeter Construction**	**Mon 3/10/08**	**Wed 5/14/08**
26	Health and Safety Planning	Mon 3/10/08	Wed 4/30/08
27	Construct Lysimeters	Thu 5/1/08	Wed 5/14/08
28	**Remedy Sampling/Monitoring/Gauging**	**Mon 12/10/07**	**Thu 12/31/09**
29	**Perimeter Plume Groundwater COC Sampling**	**Mon 4/7/08**	**Fri 10/9/09**
34	**ROST Transect Pushes**	**Mon 12/10/07**	**Fri 6/12/09**
39	**Sentinel and POC Groundwater COC Sampling**	**Mon 4/14/08**	**Fri 10/16/09**
44	**Interior Plume Groundwater COC Sampling**	**Mon 4/21/08**	**Fri 10/23/09**
49	**Supplemental Groundwater COC Sampling**	**Mon 4/28/08**	**Wed 10/28/09**
54	**MNA Geochemical Parameters**	**Mon 5/5/08**	**Fri 11/6/09**
59	**MNA Soil Core & Vapor Diff. Coef. Sampling**	**Thu 9/25/08**	**Fri 9/26/08**
60	**MNA LNAPL Fingerprint Sampling**	**Mon 9/29/08**	**Wed 10/1/08**
61	**MNA Vapor Profiling**	**Mon 9/15/08**	**Thu 9/18/08**
62	**MNA Nested Groundwater Sampling**	**Fri 9/26/08**	**Fri 9/26/08**
63	**MNA Lysimeter Sampling**	**Mon 4/14/08**	**Tue 10/13/09**



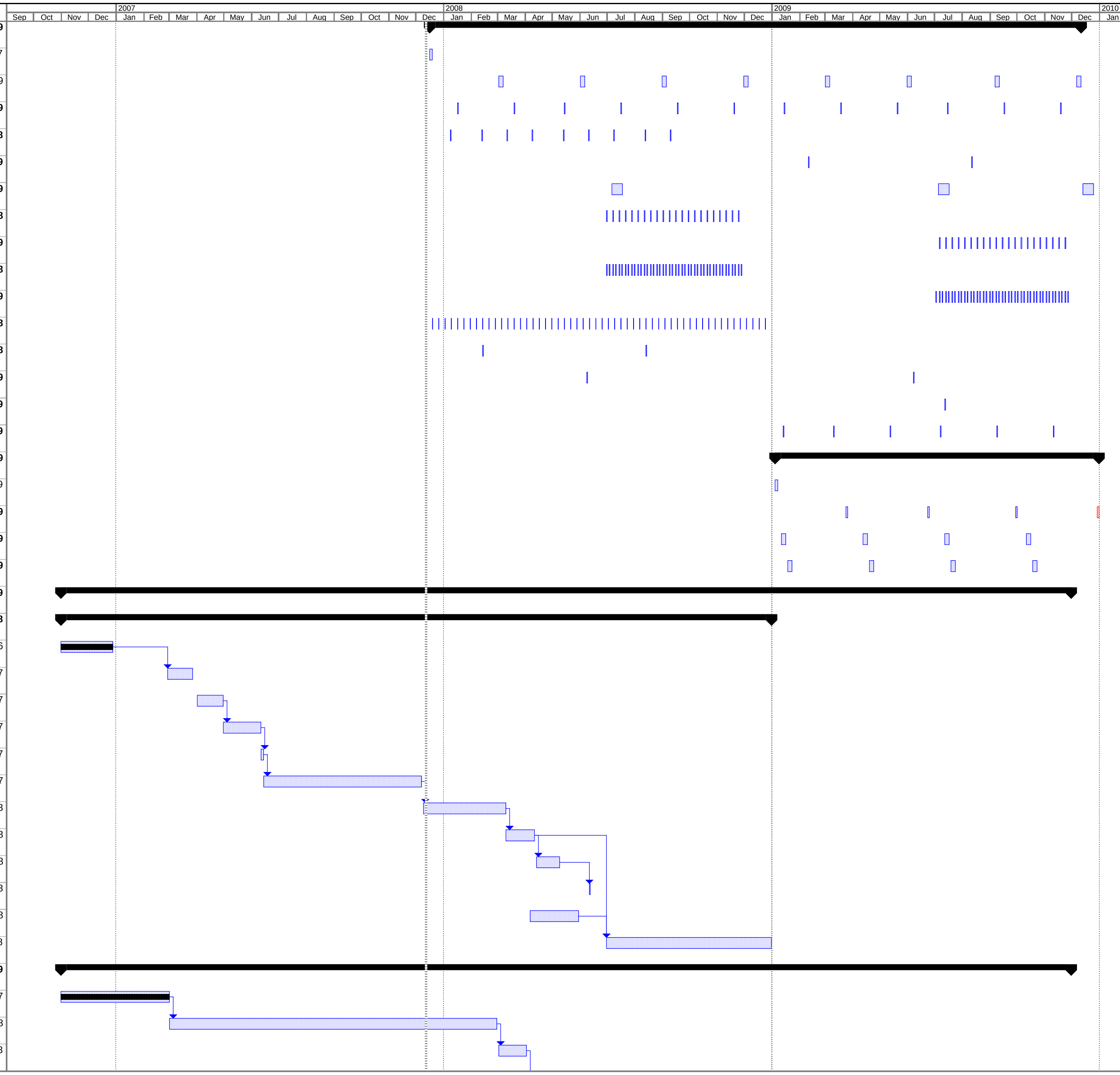
Project: Wastewater Plant
Date: Wed 12/12/07

Task		Progress		Summary		Rolled Up Critical Task		Rolled Up Progress		External Tasks		Group By Summary	
Critical Task		Milestone		Rolled Up Task		Rolled Up Milestone		Split		Project Summary		Deadline	

Final Groundwater Remedy Schedule

Chevron Cincinnati Facility, Hooven, Ohio

ID	Task Name	Start	Finish
68	**Transducer Plume Monitoring**	**Mon 12/17/07**	**Fri 12/11/09**
69	Plume Monitoring Transducer Deployment	Mon 12/17/07	Wed 12/19/07
70	Plume Monitoring Transducer Download	Mon 3/3/08	Fri 12/11/09
79	**Bi-Monthly Fluid Gauging for Plume Monitoring**	**Thu 1/17/08**	**Thu 11/19/09**
92	**Interim River Fluid Level Gauging**	**Wed 1/9/08**	**Wed 9/10/08**
102	**Long-Term River Fluid Level Gauging**	**Wed 2/11/09**	**Wed 8/12/09**
105	**Vapor Pathway/COC Sampling (HG dependant)**	**Mon 7/7/08**	**Fri 12/25/09**
110	**Gulf Park Vapor COC Screening 2008**	**Tue 7/1/08**	**Tue 11/25/08**
133	**Gulf Park Vapor COC Screening 2009**	**Tue 7/7/09**	**Tue 11/24/09**
155	**High-Grade Fluid Level Gauging 2008**	**Tue 7/1/08**	**Fri 11/28/08**
200	**High-Grade Fluid Level Gauging 2009**	**Fri 7/3/09**	**Fri 11/27/09**
244	**Interim River Sheen Observations**	**Thu 12/20/07**	**Thu 12/25/08**
299	**Interim River Surface Water Sampling**	**Thu 2/14/08**	**Thu 8/14/08**
302	**Gulf Park Groundwater COC Sampling**	**Mon 6/9/08**	**Mon 6/8/09**
305	**Barrier and Bank Inspections**	**Mon 7/13/09**	**Mon 7/13/09**
307	**Barrier Manual Fluid Gauging**	**Wed 1/14/09**	**Wed 11/11/09**
314	**Barrier Transducer Monitoring**	**Mon 1/5/09**	**Thu 12/31/09**
315	Barrier Transducer Deployment	Mon 1/5/09	Wed 1/7/09
316	Barrier Transducer Download	**Wed 3/25/09**	**Thu 12/31/09**
321	**Barrier Groundwater COC Sampling**	**Mon 1/12/09**	**Fri 10/16/09**
326	**Barrier MNA Indicator Sampling**	**Mon 1/19/09**	**Fri 10/23/09**
331	**River Controls**	**Wed 11/1/06**	**Mon 11/30/09**
332	**West Bank at Former Refinery**	**Wed 11/1/06**	**Wed 12/31/08**
333	Prepare Engineering Analysis	Wed 11/1/06	Thu 12/28/06
334	EPA Review of Workplans	Wed 2/28/07	Tue 3/27/07
335	Address EPA Comments to Workplan	Mon 4/2/07	Mon 4/30/07
336	EPA Review of Revised Workplan	Tue 5/1/07	Mon 6/11/07
337	Finalize EA per EPA Approval Letter	Tue 6/12/07	Thu 6/14/07
338	Design Engineering Controls and River Monitoring Syste	Fri 6/15/07	Fri 12/7/07
339	EPA Review of Designs	Mon 12/10/07	Mon 3/10/08
340	Address EPA Comments to Designs	Tue 3/11/08	Fri 4/11/08
341	EPA Review of Revised Designs	Mon 4/14/08	Fri 5/9/08
342	Finalize Designs per EPA Approval Letter	Thu 6/12/08	Thu 6/12/08
343	Submit NOI to USACE for NWP 38	Mon 4/7/08	Fri 5/30/08
344	Construct Engineered Control and River Monitoring Syst	Tue 7/1/08	Wed 12/31/08
345	**Gulf Park**	**Wed 11/1/06**	**Mon 11/30/09**
346	Prepare Engineering Analysis	Wed 11/1/06	Thu 3/1/07
347	EPA Review of Gulf Park EA	Fri 3/2/07	Fri 2/29/08
348	Address EPA Comments to Workplan	Mon 3/3/08	Wed 4/2/08



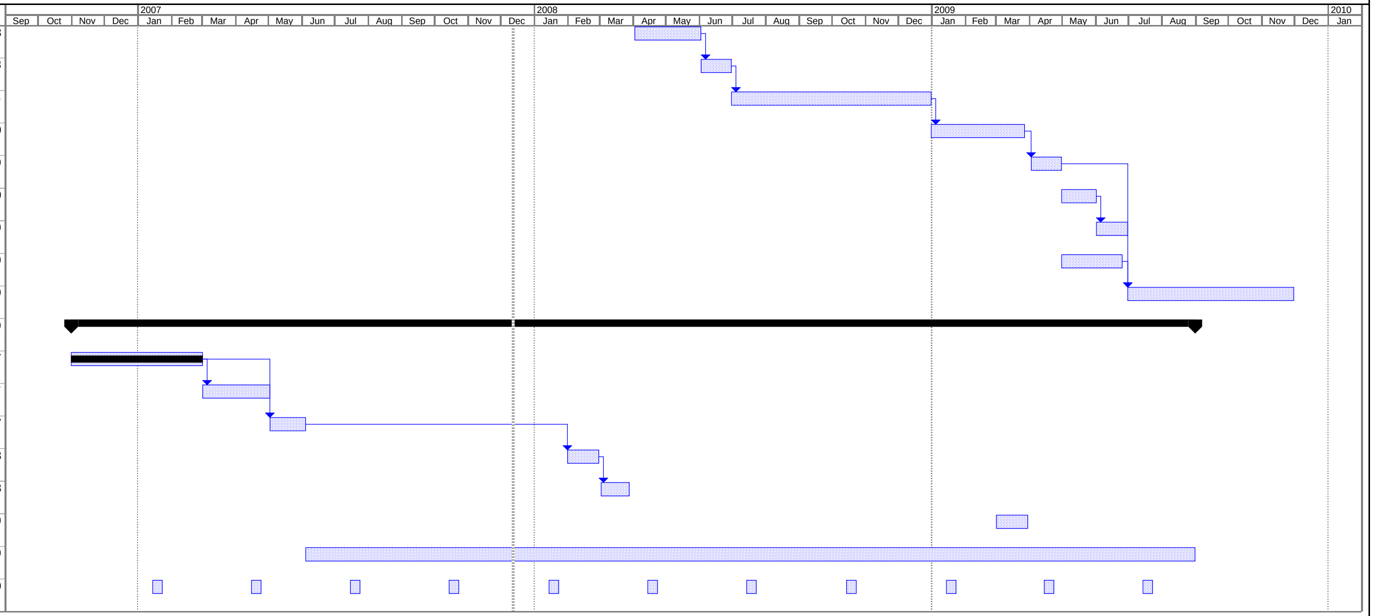
Project: Wastewater Plant
Date: Wed 12/12/07

Task | Progress | Summary | Rolled Up Critical Task | Rolled Up Progress | External Tasks | Group By Summary
Critical Task | Milestone | Rolled Up Task | Rolled Up Milestone | Split | Project Summary | Deadline

Final Groundwater Remedy Schedule

Chevron Cincinnati Facility, Hooven, Ohio

ID	Task Name	Start	Finish
349	EPA Review of Revised EA	Thu 4/3/08	Mon 6/2/08
350	Finalize EA per EPA Approval Letter	Tue 6/3/08	Mon 6/30/08
351	Design Engineering Controls and Monitoring System	Tue 7/1/08	Wed 12/31/08
352	EPA Review of Gulf Park River Bank Design	Thu 1/1/09	Fri 3/27/09
353	Address EPA Comments to Design	Fri 4/3/09	Thu 4/30/09
354	EPA Review of Revised Design	Fri 5/1/09	Mon 6/1/09
355	Finalize Design per EPA Approval Letter	Tue 6/2/09	Tue 6/30/09
356	Submit NOI to USACE for NWP 38	Fri 5/1/09	Thu 6/25/09
357	Construct Engineered Control and River Monitoring Syst	Wed 7/1/09	Mon 11/30/09
358	**Financial Assurance**	**Wed 11/1/06**	**Mon 8/31/09**
359	Submit Cost Estimates with RIP/OMM Plan	Wed 11/1/06	Thu 3/1/07
360	EPA Review of Cost Estimates	Fri 3/2/07	Wed 5/2/07
361	Address EPA Comments to Cost Estimates	Thu 5/3/07	Mon 6/4/07
362	If Instruments a.1 through a.5, draft to EPA	Fri 2/1/08	Fri 2/29/08
363	Implement Financial Assurance within 90 days Fiscal Close	Mon 3/3/08	Fri 3/28/08
364	Annual Inflation Update to FA Amount	Mon 3/2/09	Mon 3/30/09
365	Updates to Cost Estimates and FA if Become Inadequate	Tue 6/5/07	Mon 8/31/09
366	**Quarterly Summary Progress Reports**	**Mon 1/15/07**	**Thu 7/23/09**



Project: Wastewater Plant
Date: Wed 12/12/07

Task		Progress		Summary		Rolled Up Critical Task		Rolled Up Progress		External Tasks		Group By Summary	
Critical Task		Milestone		Rolled Up Task		Rolled Up Milestone		Split		Project Summary		Deadline	

APPENDIX B
REMEDY COST ESTIMATE

Summary of Final Groundwater Remedy Costs, Chevron Cincinnati Facility, Hooven, Ohio

	Table	Remedial Component	42-Year Current Dollar Cost	Assumptions/Basis
Capital Construction	1	Monitoring Wells Installation	$172,000	Install sentinel and point-of-compliance groundwater monitoring wells, and ROST LNAPL monitoring stations in Southwest Quadrant. See Table 1 for details.
	2	High-grade Infrastructure Installation	$1,092,000	Install additional high-grade wells and piping. See Table 2 for additional details.
	3	Great Miami River Controls at Main Site	$5,609,000	Install natural floodplain/sheetpile bank stabilization measures at main site. Maintenance and upkeep of wall is included with capital construction cost. Cost subject to revision pending detailed design of measures, and USEPA approval of selected remedy. See Great Miami River Engineering Analysis Report and Table 3 for additional details.
	4	Great Miami River Controls at Gulf Park	$1,329,300	Install bank stabilization measures at Gulf Park. Maintenance and upkeep of wall is included with capital construction cost. Cost subject to revision pending detailed design of measures, and USEPA approval of selected remedy. See Gulf Park Engineering Analysis Report and Table 4 for additional details.
Operations, Maintenance and Monitoring	5	High-grade operation	$3,299,000	High-grade system operation, assuming operation for 5 months/year, for 12 years. See Table 5 for additional details.
	6	HSVE System Operation	$689,000	HSVE system operation, assuming operation at same time as high-grade, for 4 months/year, for 12 years. See Table 6 for additional details.
	7	Gulf Park System Operation	$147,000	Gulf Park biovent system operation for 5 more years. See Table 7 for additional details.
	8	Hooven Soil Vapor Monitoring	$547,000	Vapor monitoring in Hooven. See Table 8 for additional details.
	9	ROST and Compliance Groundwater Monitoring	$1,369,000	ROST and perimeter and interior plume groundwater monitoring per OM&M Plan. See Table 9 for additional details.
	10	River Monitoring	$581,000	Routine river monitoring, including nearby groundwater and hyporheic zone sampling. See Table 10 for additional details.
	11	Fluid Level Monitoring	$294,000	Pressure transducers measure levels weekly at 11 locations around site, total fluids measured semiannually at 24 wells, changing to monthly during high-grade operation. See Table 12 for additional details.
	12	Quarterly Summary Letters, and Semiannual Technical Reporting	$902,000	Quarterly activity reports, and semiannual technical detail reports preparation and submittal to USEPA. See Table 12 for additional details.
	13	MNA Monitoring and 5-year reviews	$1,229,000	Monitoring necessary to document and track monitored natural attenuation (MNA) activity and effectiveness, and preparation of evaluations leading into 5-year reviews. See OM&M Plan and Table 13 for additional details.
	14	Gulf Park Monitoring and Reporting	$68,000	Annual groundwater monitoring and reporting. See Table 14 for details.
	15	Project Management	$674,000	Consultant Project Management to oversee and direct above programs, and to coordinate routine correspondence and communications with Chevron and USEPA. See Table 15 for details.
	16	Institutional and Engineering Controls	$3,231,000	Implementation of deed restrictions across Chevron property overlying plume including all of Main Site and LTU, notification of future down-gradient property owners regarding groundwater use restrictions, and construction of vapor barriers in future buildings constructed over the plume. See Table 16 for details.
Grand Total			**$21,232,300**	Comprehensive 42-year lifecycle cost for all activities associated with the Final Groundwater Remedy implementation.

TABLE 1. COST ESTIMATE FOR ROST, POINT OF COMPLIANCE MONITORING WELLS, AND CENTRAL PLUME VAPOR WELLS INSTALLATION, FINAL GROUNDWATER REMEDY CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity		Hourly or Daily Rate or Charge		Hours or Unit Estimate	Subtotal
1.	Installation of New Monitoring Wells	Personnel				
	- Installation of nine ROST monitoring wells	Senior Project Manager	$	85	40	$3,400
	- Installation of four new POC groundwater monitoring wells	Project Engineer/Scientist	$	72	340	$24,480
	- Installation of four new vertical nested groundwater wells					
	- Installation of four new soil moisture lysimeters	Field Expenses and Equipment				
	- Develop groundwater monitoring wells	Field Instruments/Equipment	Lump Sum		1	$6,000
	- Installation of three new vertical nested vapor monitoring wells	Consumable Field Supplies and PPE	$	50	25	$1,250
	- Access agreements already in place with property owners in Southwest Quadrant	Office/Incidental Expenses	$	50	9	$450
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	4-wheel drive vehicle	$	55	25	$1,375
	- Drilling costs include mobe charges, and are based on Jersey West Drilling Company estimate					
	- Design/oversight personnel are based in Cincinnati, so no travel or per diem expenses incurred	Subcontractors				
	- Assumes 9 days office work for design/contracting/followup documentation, 25 days field work	Driller	Lump Sum		1	$135,000
	- One-time purchase of project-dedicated field equipment	Other	Lump Sum		0	$0
	Activity 1. Subtotal					$172,000

TABLE 2. COST ESTIMATE DETAILS FOR HIGH-GRADE WELLS AND ASSOCIATED PIPING INSTALLATION, FINAL GROUNDWATER REMEDY
CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Item	Description	Units	Qty	Unit Rate	Total Cost	Cost Reference/Notes
1.0	**Land Acquisition**				N/A	
	- Construction activities and well installation conducted on facility property; additional planning costs not incurred.					
	Subtotal				$0	
2.0	**Land Development**					
2.1	Storage shed	EA	1	$2,100	$2,100	Per McMaster Carr
2.2	Bollards (42" X 5-1/2")	EA	6	$243	$1,458	Per McMaster Carr
	Subtotal				$3,558	
3.0	**Drilling**					
3.1	Labor and drilling equipment	LS	1	$25,000	$25,000	
	- Includes cost for both Production Well (4.0) and Recovery Well					
3.2	Materials (pipe, shaft, pack)	LS	1	$35,000	$35,000	Per Jackson and Sons Drilling
	- Includes cost for both Production Well (4.0) and Recovery Well (5.0)					
3.3	Pump bowl	EA	1	$6,000	$6,000	Per Jackson and Sons Drilling
3.4	Discharge head with access port	EA	1	$10,000	$10,000	Per Jackson and Sons Drilling
	- 8" steel discharge head with 4" access opening and NPT plug					
3.5	Motor	EA	1	$10,000	$10,000	Per Jackson and Sons Drilling
	- 150 HP from US Motors					
3.6	Well Screen	EA	1	$10,000	$10,000	Per Jackson and Sons Drilling
	- 20" gravel pack					
3.7	Well development and testing	LS	1	$6,000	$6,000	Per Jackson and Sons Drilling
3.8	Video survey	LS	1	$1,200	$1,200	Per Jackson and Sons Drilling
	Subtotal				$103,200	
4.0	**Production Well**					
4.1	10" flanged 90D elbow	EA	2	$153	$305	Based on most recent well installation, per various local part vendors
4.2	10" flanged pipe	EA	1	$100	$100	
4.3	10" to 12" pre-fab run of 150" for pressure gage and flow meter	EA	1	$500	$500	
4.4	12" spacers (1") for valve opening	EA	2	$29	$57	
4.5	12" duo-check valve (lugged)	EA	1	$250	$250	
4.6	12" butterfly valve (lugged) w/ wheel operator	EA	1	$300	$300	
4.7	12" SDR 11 WD fab flanged 90D elbow	EA	1	$199	$199	
4.8	12" SDR 11 90D elbow	EA	2	$150	$300	
4.9	12" electrofusion coupling	EA	3	$300	$900	
4.10	12" IPS SDR 11 flange adapter PE3408 black 12 OAL AWWA	EA	1	$88	$88	
4.11	12" C bupp back up ring	EA	1	$46	$46	
4.12	12" SDR 11 40' Jt Blk I 61	EA	25	$23	$575	
4.13	10" IPS SDR 11 flange adapter PE3408 black 12 OAL AWWA	EA	1	$56	$56	
4.14	10" C bupp back up ring	EA	1	$29	$29	
4.15	10" SDR 11 40' Jt Blk I 61	EA	25	$16	$400	
4.16	12" electrofusion machine rental	EA	1	$500	$500	
4.17	Nuts & bolts	EA	1	$120	$120	
4.18	Signet 8550 flow meter	EA	1	$395	$395	
4.19	Signet flow sensor	EA	1	$473	$473	
4.20	Mount kit	EA	1	$48	$48	
4.21	Power supply for flowmeter	EA	1	$90	$90	
4.22	Labor	EA	1	$9,000	$9,000	Based on 1 foreman and 2 fitters for 1-1/2 week
	Subtotal				$14,731	
5.0	**Recovery Well**					
5.1	Material	EA	1	$3,220	$3,220	140 ft at $23/ft
5.2	Labor	EA	1	$1,200	$1,200	Based on 1 foreman and 2 fitters for 1 day
	Subtotal				$4,420	
6.0	**Electrical**					
6.1	Material	EA	1	$18,345	$18,345	
6.2	VFD for 150 HP motor	EA	1	$16,300	$16,300	
6.3	1 PH transformers w/ pole bracket and hanging equipment	EA	3	$3,258	$9,774	
6.4	Equipment	EA	1	$2,500	$2,500	
6.5	Misc. pole line equipment	EA	1	$994	$994	
6.6	Wiring	EA	1	$2,592	$2,592	
6.7	Electrical labor	EA	1	$18,000	$18,000	1 foreman and 2 journeymen for 3 weeks
	Subtotal				$68,505	
7.0	**Supervisory Control and Data Acquisition (SCADA) System**					
7.1	SCADA system for well	EA	1	$7,029	$7,029	
7.2	SCADA labor	EA	1	$707	$707	4 hours tech. @ $90/hr + $347 travel expenses
	Subtotal				$7,736	
8	**Piping**					
8.1	Contractor	EA	1	$50,000	$50,000	
8.2	Engineering and Oversight	EA	1	$15,000	$15,000	
	Subtotal				$65,000	
9	**Soil Cuttings Disposal**					
9.1	Analytical and Characterization	EA	1	$2,000	$2,000	
9.2	Disposal, assuming maximum 60 yards per well	EA	60	$65	$3,900	Per agreement with WMI for non-haz, petroleum impacted soil transportation and disposal to Stoney Hollow, OH landfill
	Subtotal				$5,900	
Total Per Well					**$273,050**	
Total for 4 new high-grade wells over 12 years					**$1,092,000**	

Notes:

- LS - lump sum
- LF - linear foot
- EA - each
- CY - cubic yard
- SF - square foot
- LB - pound
- SY - square yard

TABLE 3. COST ESTIMATE DETAILS FOR NATURAL FLOODPLAIN RESTORATION AT MAIN SITE ALONG GREAT MIAMI RIVER, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Construction Costs

Item #	Description	Units	Quantity	Unit Price	Total
1	Prepare Bank for Extension/Construction Activities (Clear & Grub Upper Bank Surface)	LS	1	$ 20,450.00	$ 20,450
2	Furnish and Install Sediment Fence	LF	1,600	$ 0.99	$ 1,584
3	Excavate Gravel Bar Material to Create Work Platform/Liner Subgrade	CY	10,400	$ 13.70	$ 142,480
4	Transfer Gravel Bar Material to Create Work Platform/Liner Subgrade	CY	10,400	$ 5.50	$ 57,200
5	Compact Gravel Bar Material to Create/Stabilize Work Platform/Liner Subgrade	CY	10,400	$ 0.33	$ 3,432
5	Furnish 30' Conventional Steel Sheetpiles (PZC18)	SF	54,000	$ 12.00	$ 648,000
6	Install 30' Conventional Steel Sheetpiles (PZC18)	SF	54,000	$ 18.00	$ 972,000
7	Excavate Upper Bank Material	CY	15,000	$ 1.84	$ 27,600
8	Transfer Upper Bank Material to Lower Bank to Create More Natural Floodplain	CY	15,000	$ 5.50	$ 82,500
9	Place Protective Rip-Rap on Riverside of Sheetpile Wall	TON	2,300	$ 22.50	$ 51,750
10	Plant Flood Tolerant Vegetation (Willow Stakes)	SY	20,780	$ 30.00	$ 623,400
11	Install Rock Vane	EA	1	$ 30,000.00	$ 30,000
12	Install Rock Groins	EA	2	$ 10,000.00	$ 20,000
13	Excavate and Load Gravel Bar Materials Near Jordan Creek Confluence	CY	37,500	$ 14.73	$ 552,281
14	Haul Gravel Bar Material to Site	CY	37,500	$ 7.45	$ 279,375
15	Place Gravel Bar Material On Site (Use as Clean Fill)	CY	37,500	$ 0.69	$ 25,875
16	Excavate SWMU-10 Berm Material	CY	32,000	$ 1.84	$ 58,880
17	Place Berm Material in SWMU-10 (Use as Clean Fill)	CY	32,000	$ 0.69	$ 22,080
18	Excavate and Load Target East Bank and Island Channel River Bed Material	CY	20,700	$ 14.73	$ 304,859
19	Haul River Bed Material to Site	CY	20,700	$ 7.45	$ 154,215
20	Place River Bed Material On Site (Use as Clean Fill)	CY	20,700	$ 0.69	$ 14,283
21	Design and Construction Oversight			30%	$ 804,119
	Total				$ 4,896,000

Operation & Maintenance Costs

Item #	Description	Units	Quantity	Unit Price	Total
1	Annual Labor for Sheetpile Barrier Integrity and Flood Tolerant Vegetation Inspections	HOURS	32	$ 60.00	$ 1,920
2	Annual Repair/Replacement of 5% of Rip-Rap	TON	115	$ 22.50	$ 2,588
3	Annual Repair/Replacement of 2% of Flood Tolerant Vegetation	SY	416	$ 30.00	$ 12,468
	42 Year Maintenance Cost				$713,000

Note - see Table 3b for cost basis information.

Total Life Cycle Cost (Installation plus Maintenance) **$5,609,000**

TABLE 3b. COST ESTIMATE SOURCE INFORMATION FOR NATURAL FLOODPLAIN RESTORATION AT MAIN SITE ALONG GREAT MIAMI RIVER, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Construction

Item #	CostWorks ID	Alternate Source / Additional Info
1	NA	Assume 300 HP dozer @ $86.56/hr and Equipment Operator III @ $27.05/hr, clearing 10 LF/hr, 1800 LF Total. Equipment and labor rates based on Entact equipment and rate schedule.
2	31251 310 1100	Erosion control, silt fence, polypropylene, adverse conditions, 3' high
3	31231 642 0550	Excavating, bulk bank measure, 1 CY capacity = 35 CY/hour, clamshell (Adjusted by 312316424200 +100% for wet excavation). Volumes based on platform extending to ~20' east of smear zone lateral extent, then 1:1 to river bed. Volume calculated using SurvCAD
4	31231 646 4400	Excavating, bulk, open site, bank measure, sand and gravel, 200 H.P. dozer, 300' haul
5	31232 323 5080	Compaction, riding, vibrating roller, 3 passes, 12" lifts
5	NA	Per Mike Hauser (Goettle, Inc.) correspondence. Assume 30' long sheetpiles
6	NA	Per Mike Hauser (Goettle, Inc.) correspondence. Assume 30' long sheetpiles
7	31231 642 0260	Excavating, bulk bank measure, 2 C.Y. capacity = 130 C.Y./hour, backhoe, hydraulic, crawler mounted. 15,013 CY cut estimate and 14,780 CY fill estimate from Survcad; excess material placed on river side beneath rip rap
8	31231 646 4400	Excavating, bulk, open site, bank measure, sand and gravel, 200 H.P. dozer, 300' haul
9	31371 310 0370	Rip-rap, random, broken stone, 300 lb. average, dumped. 1,708 CY of rip rap per Survcad calcs; assume 100 lb/cf for rip rap density.
10	NA	Per FMSM cost information - $10 per willow stake, 3 stakes per SY; area per Survcad calc.
11	NA	Per FMSM cost information
12	NA	Per FMSM cost information
13	31231 642 0550	Quantity per Survcad calc. assuming excavation depth of 468 ft-amsl. Excavating, bulk bank measure, 1 C.Y. capacity = 35 C.Y./hour, clamshell (Adjusted by 312316424200 +100% for wet excavation and 31231 642 0020 +15% for loading).
14	31232 318 0100	Quantity per Survcad calc. assuming excavation depth of 468 ft-amsl. Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 2.6 loads/hour, 6 C.Y. dump truck, highway haulers, excludes loading
15	31232 314 4000	Quantity per Survcad calc. assuming excavation depth of 468 ft-amsl. Backfill, structural, sand and gravel, 200 H.P. dozer, 50' haul.
16	31231 642 0260	Quantity per Survcad calc. assuming excavation depth of 481 ft-amsl. Excavating, bulk bank measure, 2 C.Y. capacity = 130 C.Y./hour, backhoe, hydraulic, crawler mounted
17	31232 314 4000	Quantity per Survcad calc. assuming excavation depth of 481 ft-amsl. Backfill, structural, sand and gravel, 200 H.P. dozer, 50' haul
18	31231 642 0550	Quantity per Survcad calc. assuming 1-yard excavation depth at areas indicated by FMSM. Excavating, bulk bank measure, 1 C.Y. capacity = 35 C.Y./hour, clamshell (Adjusted by 312316424200 +100% for wet excavation and 31231 642 0020 +15% for loading).
19	31232 318 0100	Quantity per Survcad calc. assuming 1-yard excavation depth at areas indicated by FMSM. Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 2.6 loads/hour, 6 C.Y. dump truck, highway haulers, excludes loadin
20	31232 314 4000	Quantity per Survcad calc. assuming 1-yard excavation depth at areas indicated by FMSM. Backfill, structural, sand and gravel, 200 H.P. dozer, 50' haul

Operation & Maintenance

Item #	CostWorks ID	Alternate Source / Additional Info
1	NA	Assume quarterly, 8-hr day inspections, 2 laborers @ $30/hr each.
2	NA	Unit Price equivalent to Construction Item #9. Quantity based on percentage of Construction Item #9.
3	NA	Unit Price equivalent to Construction Item #10. Quantity based on percentage of Construction Item #10.

Notes:
CostWorks IDs, if available, refer to Means CostWorks 2006 Cost Data for the Heavy Construction Title. Values were adjusted for Cincinnati, OH (451 zip code) and union wage rates.

TABLE 4. COST ESTIMATE DETAILS FOR TARGET AREA SHEET PILE WALL INSTALLATION AT GULF PARK, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Construction Costs

Item No.	Description	Units	Quantity	Unit Price	Total
1	Prepare Bank for Construction Activities (Clear & Grub Upper Bank Surface)	SF	16,420	$1.00	$16,420
2	Prepare Construction Roads	LS	1	$7,500	$7,500
3	Furnish and Install Sediment Fence & Oil-Absorbent Booms	LF	650	$2.00	$1,300
4	Furnish and Install 40-foot Steel Sheet Piles	SF	21,520	$40.00	$860,800
5	Furnish and Install Joint Sealant	LF	10,760	$2.13	$22,919
6	Furnish and Place Clean Fill Material between Sheet Pile Wall and Existing Bank	CY	8,568	$10.00	$85,681
7	Furnish and Place Riprap Protection at Toe of Sheet Pile Wall	CY	333	$42.00	$14,000
8	Design and Construction Oversight	%	30	$9,946	$298,386
	Total Construction Cost				$1,307,006

Operation & Maintenance Costs

Item No.	Description	Units	Quantity	Unit Price	Total
1	Annual Wall Inspection, Vegetation & Debris Removal	LS	1	$5,000	$5,000
	Total 5-Year Maintenance Cost				$22,259

Total Life-Cycle Cost **$1,329,300**

Notes:
See table 4b for cost basis information
CY - cubic yard
LF - linear foot
LS - lump sum
SF - square foot
% - percent

TABLE 4b. COST ESTIMATE INFORMATION FOR TARGET AREA SHEET PILE WALL INSTALLATION AT GULF PARK, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Construction Costs

Item #	CostWorks ID	Alternate Source / Additional Info
1	NA	Areas to be cleared as indicated on Figure 12 providing 20FT cleared area at top of bank. 7,278 SF for southern portion, 9,142 SF for northern portion. Unit Price per Entact representative upon site inspection and discussion of proposed activities.
2	NA	Per Entact representative upon site inspection and discussion of proposed activities.
3	NA	Sediment fence installation location indicated in Figure 12. 298 LF (south) + 352 LF (north). Unit Price per Entact representative upon site inspection and discussion of proposed activities.
4	NA	Sheet pile wall alignments as indicated in Figure 12. Square footage based on 244 LF (south), 294 LF (north), 40 ft-bgs. Unit Price per Geottle Representative Mike Hauser for barge-mounted driving.
5	NA	Linear footage based on 2-foot joint spacing at 40-foot depth. Unit Price per Adeka Representative Jim Miller - assumes $97/gallon A-30 sealant, 1 gallon covers 70 LF, application production rate of 650 ft/8-hr shift, 2-man crew @ $30/hr each.
6	NA	Backfill cross sectional area as shown on Figure 13. Volume based on 430 SF cross section area extruded over 244 LF (south) and 294 LF (north) wall alignments. Unit Price per Entact representative upon site inspection and discussion of proposed activities
7	31371 310 0100	Riprap, random, broken stone, machine placed for slope protection. Volume based on 20SF of riprap placed at toe extruded over southern (200LF) and northern (250LF) lengths.

Operation & Maintenance Costs

Item #	CostWorks ID	Alternate Source / Additional Info
1	NA	Assume quarterly, 2 x 10-hr day inspections and debris removal, 2 laborers @ $30/hr each.

Notes:
CostWorks ID\s, if available, refer to Means CostWorks 2007 Cost Data for the Heavy Construction Title.
Values were adjusted for Cincinnati, OH (451 zip code) and union wage rates.

TABLE 5. COST ESTIMATE FOR HIGH GRADE PUMPING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

GAC Shutdown and Restart each season

Item #	Description	Units	Quantity		Unit Price		Total
1	Take GAC Offline						
2	Labor (4 men x 5 days x 8-hour days)	HR	160	$	37.00	$	5,920
3	Supervisor	HR	8	$	49.00	$	392
7	Strainer	DAY	4	$	100.00	$	400
8	Restart GAC	HR	10	$	30.00	$	300
9	Labor (3 men x 3 days x 8-hour days)	HR	72	$	37.00	$	2,664
10	Supervisor	HR	4	$	49.00	$	196
12	Re-seed GAC units with Sewage	LS	1	$	500.00	$	500
	Total Shutdown and Restart Fixed Costs **for one** GAC Reactor						$10,372
	Total Shutdown and Restart Fixed Costs **for both** GAC Reactors				100%		$20,744

Operation Labor Costs

Item #	Description	Units	Quantity	Unit Price		Total
1	Operations[1]	YR	0.42	$29,393	$	12,345
2	Maintenance[1]	YR	0.42	$29,393	$	12,345
3	Monitoring[1,2]	YR	0.42	$54,676	$	22,964
4	Admin.[1,3]	YR	0.42	$29,394	$	12,345
	Annual P&T Labor Cost					$59,999

Operation Costs

Item #	Description	Units	Quantity		Unit Price		Total
1	Analytical[4]	YR	1	$	17,748	$	17,748
2	Effluent Treatment[1]	YR	0.42	$	107,036	$	44,955
3	Utilities[1]	YR	0.42	$	142,856	$	60,000
4	Well Rehabilitation[5]	YR	1	$	38,256	$	38,256
5	Annually dispose of 30,000 gallons recovered free product[6]	GAL	30,000	$	0.78	$	23,301
	Annual P&T Operation Cost						$184,260

GAC maintenance when not operating

Item #	Description	Units	Quantity		Unit Price		Total
1	GAC Electrical Demand (Peak) - Space Heating	kW	40	$	9.76	$	390
2	GAC Electrical Energy (Usage) - Space Heating	kWh	4,800	$	0.05	$	240
3	PROD_12 Non-Operational Maintenance	HR	8	$	49.00	$	392
4	GAC Non-Operational Maintenance	HR	8	$	49.00	$	392
	Monthly Offline Maintenance Cost						$1,414
	Annual Offline Maintenance Cost (assuming offline 7 months/year)						$9,900

Total Annual Cost	$274,904
Total Lifecycle Operations Cost, 12 years	**$3,299,000**

Notes:

[1] Table C-5b, Needs Assessment, SAIC, June 2005 (Optimize GAC Operations), adjusted for inflation and for 5 months operation per year.
[2] Actual annual costs, pro-rated to projected maximum 5 months per year of system operation
[3] Double reported GAC administrative costs to account for non-GAC system components
[4] Use entire historic annual analytical costs as conservatively high basis to account for non-GAC system components
[5] Assumes two wells/year rehab, per average Jackson & Sons cost.
[6] Unit price per August 2007 quote from Heritage Environmental, for reuse of recovered fuel at Indianapolis, IN Facility.

TABLE 6. COST ESTIMATE FOR HSVE SYSTEM OPERATION, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

Labor Costs

Item #	Description	Units	Quantity	Unit Price		Total
1	Operations[1]	YR	1	$10,025	$	10,025
2	Maintenance[1]	YR	1	$10,025	$	10,025
3	Monitoring[1]	YR	1	$6,290	$	6,290
4	Admin.[1]	YR	1	$1,250	$	1,250
5	Misc.[1]	YR	1	$10,400	$	10,400
	Annual HSVE System Labor Cost					$37,990

Operation Costs

Item #	Description	Units	Quantity		Unit Price		Total
1	Analytical[1]	YR	1	$	2,140	$	2,140
2	Subcontractor[1]	YR	1	$	1,920	$	1,920
3	Utilities[1]	YR	1	$	12,740	$	12,740
4	50 HP Blower[2]	MO	3	$	884.00	$	2,652
	Annual HSVE System Operation Cost						$19,452

Notes:

[1] Table C-1b, Needs Assessment, SAIC, June 2005, and per actual average annual costs.

[2] Blower costs based on electrical rates reported in Cost Evaluation for GAC Shutdown and Restart.

Totals

Annual Cost (Labor and Operations)	$57,442
Grand Total if system operated for 12 years	**$689,000**

TABLE 7. COST ESTIMATE FOR GULF PARK REMEDIAL SYSTEMS OPERATION, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	Biovent System Operation and Maintenance	Personnel			
	- Activate and de-activate Biovent System annually based on GW elevation relative to trigger levels	Senior Project Manager	$ 85	15	$1,275
	- System operational for 6 months per year; routine field operation/system monitoring requires 2 hrs/wk	Project Engineer/Scientist	$ 72	52	$3,744
	- Balance biovent system lines each week of operation and record operation performance parameters	Technician	$ 47	20	$940
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	CAD	$ 55	0	$0
	- Field equipment cost assumes one-time lump sum purchase	Field Expenses and Equipment			
	- All personnel based locally, so no per-diem or travel charges will be incurred	Field Instruments/Equipment	Lump Sum	1	$1,000
		Consumable Field Supplies and PPE	$ 50	26	$1,300
		4-wheel drive	$ 55	5	$275
		Subcontractors			
		Other	Cost +5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 1. Subtotal				$8,534
2.	Fluid Level Monitoring	Personnel			
	- Monitor fluid level elevations at 2 MWs weekly and compare with System trigger levels	Senior Project Manager	$ 85	5	$425
	- All measurements incorporated into fluid level database	Project Engineer/Scientist	$ 72	52	$3,744
	- Hour estimates encompass all measurements conducted over a full year	Technician	$ 47	0	$0
	- Field instrument expenses shared with other monitoring programs at main site	CAD	$ 55	0	$0
	- Field equipment cost assumes one-time lump sum purchase	Field Expenses and Equipment			
	- All personnel based locally, so no per-diem or travel charges will be incurred	Field Instruments/Equipment	Lump Sum	1	$2,000
		Consumable Field Supplies and PPE	$ 50	52	$2,600
		4-wheel drive	$ 55	0	$0
		Subcontractors			
		Other	Cost + 5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 2. Subtotal				$8,769
3.	Respirometry Testing, per event	Personnel			
	- Collect 22 soil vapor samples and field screen for fixed gases and TOV	Senior Project Manager	$ 85	10	$850
	- Perform series of 7 soil gas measurements at all 22 vapor wells over 2-week period	Project Engineer/Scientist	$ 72	60	$4,320
	- Obtain and calibrate Landtec and PID, prepare lung box and sampling equipment	Technician	$ 47	0	$0
	- Personnel rates per Trihydro Corporation 2007 contract rates	CAD	$ 55	0	$0
	- Lung box and PID one-time purchase	Field Expenses and Equipment			
	- Analysis and Reporting Costs contained within Table 14. Gulf Park Monitoring & Reporting	Field Instruments/Equipment	Lump Sum	1	$6,000
	- Purchase 25 dedicated Tedlar bags for field screening samples	Consumable Field Supplies and PPE	50.00/day	7	$350
	- All personnel based locally, so no per-diem or travel charges will be incurred	25 Tedlar bags	250.00/event	1	$250
		4-wheel drive	55.00	7	$385
		Subcontractors			
		Other	Cost + 5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 3. Subtotal				$12,155

Totals Years	Sampling Frequency	Total Cost Event	Events in Period	Total Cost for Period
1-5	Biovent System Operation, Fluid Level Monitoring and 1 Respirometry Event per Year	$29,458	5	$147,290
Grand Total				**$147,000**

TABLE 8. COST ESTIMATE FOR VAPOR MONITORING, FINAL GROUNDWATER REMEDY,
CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	Vapor Monitoring Conducted in Five Nested Vapor Monitoring Wells in Hooven, per event	Personnel			
	- Coordinate with laboratory; order summa canisters	Senior Project Manager	$ 85	20	$1,700
	- Obtain and calibrate Landtec and PID, prepare lung box and sampling equipment	Project Engineer/Scientist	$ 72	80	$5,760
	- Complete seal testing on nested vapor monitoring wells VW-93, VW-96, VW-99, VW-127, and VW-128	Technician	$ 47	0	$0
	- Collect 35 soil vapor samples from the above listed wells, at 5, 10, 20, 30, 40, 50 and 60 ft-bgs	CAD	$ 55	0	$0
	- Prepare duplicate and trip blanks				
	- Collect ambient air sample during each day of soil vapor sampling				
	- Complete chain of custody and submit samples to lab for analysis of VOCs via TO-15 and	Field Expenses and Equipment			
	fixed gases (i.e., O2, CO2, CH4) by ASTM-1946.	Field Instruments/Equipment	Lump Sum	1	$4,000
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Consumable Field Supplies and PPE	50.00/day	7	$350
	- Assumes one-time purchase of Lung box and PID	Office Expenses	100.00	7	$700
	- Standard turn around time for analytical results	4-wheel drive	55.00	7	$385
		Subcontractors			
		Lab	Cost + 5%	38	$15,900
		Other	Cost + 5%	0	$0
	Activity 1. Subtotal				$28,795

Totals Years	Cost Estimate ActivitiesBasis	Total Cost for Period
1-2	Semiannual Sampling - 4 events over 2 years	$115,180
3-5	Annual Sampling - 3 events over 3 years	$86,385
6-42	Sampling once every 3 years - 12 events over 36 years	$345,540
Grand Total		**$547,000**

TABLE 9. COST ESTIMATE FOR ROST AND COMPLIANCE GROUNDWATER MONITORING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges		Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	ROST Monitoring (per event)	Personnel				
	- Complete CPT/ROST logging at 12 ROST monitoring wells (three per transect, up to 4 transects)	Senior Project Manager	$	85	8	$680
	- ROST drilling contractor rate per quote from Fugro Geosciences	Project Engineer/Scientist	$	72	50	$3,600
	- Environmental consultant labor rates per Trihydro Corporation 2007 Chevron contract	Technician	$	47	0	$0
	- Drilling contractor mobilization costs included in lump sum amount; all other services provided by	CAD	$	55	0	$0
	local based personnel, so no travel or per diem expenses are incurred	Field Expenses and Equipment				
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Field Instruments/Equipment		N/A	0	$0
		Consumable Field Supplies and PPE	$	50	5	$250
		4-wheel drive	$	55	5	$275
		Subcontractors				
		ROST Rig Contractor		Cost + 5%	1	$33,125
		Other		Cost + 5%	0	$0
	Activity 1. Subtotal					$37,930
2.	Groundwater Sampling (per event)	Personnel				
	- Prepare 35 groundwater monitoring wells for sampling via low-flow sampling method	Senior Project Manager	$	85	8	$680
	- Measure field parameters (pH, temp, conductivity) during well preparation and prep QC samples	Project Engineer/Scientist	$	72	20	$1,440
	- Collect 39 total groundwater samples, including QC, for laboratory analysis of Table 1 COCs	Technician	$	47	60	$2,820
	- Also submit 8 supplemental samples for NAPL fingerprinting analysis	CAD	$	55	0	$0
	- Decontaminate equipment prior to use at each well using detergent wash, tap rinse, and	Field Expenses and Equipment				
	distilled water final rinse, if sample pumps are not dedicated to each well	Field Instruments/Equipment		Lump Sum	1	$6,000
	- Complete chain of custody and submit samples to certified laboratory for analysis of Table 1 COCs	Consumable Field Supplies and PPE	$	50	12	$600
	- Standard turn around time for analytical results	2-wheel drive	$	45	0	$0
	- One-time, lump-sum purchase of sampling equipment and water quality meters, dedicated to project	4-wheel drive	$	55	6	$330
	- Sample purge and decontamination water are managed through GAC system in years 1-12, with costs	Subcontractors				
	for system operation accounted for in Table 5; wastewater management costs in years after GAC	Laboratory		Direct Bill Cost	39	$5,200
	shut-down accounted for below, under activity 3.	Other		Cost + 5%	0	$0
	Activity 2. Subtotal					$17,070
3	Wastewater Management, after GAC System is Shut Down, per event	Contractors				
	- Using low-flow sample methods, purge water volumes are 1 gallon or less/sample, plus decon water	Heritage, Indianapolis, IN	$	2.91	500	$1,455
	- Waste water is accumulated in on-site storage tank with water from all other sampling, and	Annual Storage Tank Inspection/Maint.	$	4,000	1	$4,000
	shipped one time per year to Heritage in Indianapolis, IN, via bulk tank truck for disposal					
	- Wastewater disposal costs included only in later year event estimates below, after GAC shut down					
	Activity 3. Subtotal					$5,455

Total Years	Sampling Frequency	Total Cost Event	Events in Period	Total Cost for Period
1-2	4 Extra Events in First 2 Years for 4 New Wells	$2,200	4	$8,800
1-5	Semiannual	$55,000	10	$550,000
6-10	Annual	$55,000	5	$275,000
11-20	Biennial	$60,455	5	$302,275
21-42	Every five years	$60,455	4	$241,820
Grand Total				**$1,369,000**

TABLE 10. COST ESTIMATE FOR GREAT MIAMI RIVER MONITORING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Unit Charge	Hours or Unit Estimate	Subtotal
1.	River inspection until engineered controls installed	Personnel			
	- Inspect surface water each week until engineered controls and final monitoring system is in place	Senior Project Manager	$ 85	20	$1,700
	- Measure fluid levels in ten groundwater monitoring wells and five surface water monitoring locations	Project Engineer/Scientist	$ 72	40	$2,880
	- Maintaining pressure transducers in monitoring network	Technician	$ 47	100	$4,700
	- Incorporate data into fluid level database	CAD	$ 55	0	$0
	- Evaluate relative stage of the river and hydraulic gradients along river bank				
	- Cost for one-time purchase of monitoring equipment included in Table 9	Field Expenses and Equipment			
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Field Instruments/Equipment	N/A	0	$0
	- Inspection and gauging completed in 1.5 hours each week	Consumable Field Supplies and PPE	$ 50	52	$2,600
	- Expected to continue for first year	4-wheel drive	$ 55	52	$2,860
		Subcontractors			
		Laboratory	Cost	0	$0
		Other	Cost + 5%	0	$0
	Activity 1. Subtotal				$14,740
2.	Groundwater/Hyporheic/Surface Water Sampling (Per Event, COCs only)	Personnel			
	- Prepare 3 paired groundwater/hyporheic/surface water monitoring stations for sampling	Senior Project Manager	$ 85	10	$850
	- Measure field parameters (pH, temp, conductivity, O2, ORP, turbidity) during preparation	Project Engineer/Scientist	$ 72	30	$2,160
	- Collect 24 water samples for laboratory analysis of Order Table 1 COCs	Technician	$ 47	40	$1,880
	- Prepare duplicate samples, MS/MSDs, equipment blanks and submit for above listed analyses	CAD	$ 55	0	$0
	- Decontaminate equipment prior to use at each well using detergent wash, tap rinse, and distilled water final rinse, if sample pumps are not dedicated to each well	Field Expenses and Equipment			
	- Purchase of project-dedicated field water quality monitoring equipment addressed in Table 9	Field Instruments/Equipment	N/A	0	$0
	- Sample purge and decontamination water are managed through GAC system in years 1-12, with costs for system operation accounted for in Table 5; wastewater management costs in years after GAC shut-down accounted for below, under activity 3.	Consumable Field Supplies and PPE	$ 50	6	$300
		4-wheel drive	$ 55	3	$165
	- Maximum 3 days to complete field work, plus one day prep and followup	Subcontractors			
		Laboratory	Cost	15	$2,592
		Other	Cost + 5%	0	$0
	Activity 2. Subtotal				$7,947
3.	Groundwater/Hyporheic/Surface Water Sampling (Per Event, COCs plus MNA parameters)	Personnel			
	- Prepare 3 paired groundwater/hyporheic/surface water monitoring stations for sampling	Senior Project Manager	$ 85	10	$850
	- Measure field parameters (pH, temp, conductivity, O2, ORP, turbidity) during preparation	Project Engineer/Scientist	$ 72	34	$2,448
	- Collect 24 water samples for laboratory analysis of Order Table 1 COCs plus MNA parameters	Technician	$ 47	44	$2,068
	- Prepare duplicate samples, MS/MSDs, equipment blanks and submit for above listed analyses	CAD	$ 55	0	$0
	- Decontaminate equipment prior to use at each well using detergent wash, tap rinse, and distilled water final rinse, if sample pumps are not dedicated to each well	Field Expenses and Equipment			
	- Purchase of project-dedicated field water quality monitoring equipment addressed in Table 9	Field Instruments/Equipment	N/A	0	$0
	- Sample purge and decontamination water are managed through GAC system in years 1-12, with costs for system operation accounted for in Table 5; wastewater management costs in years after GAC shut-down accounted for below, under activity 3.	Consumable Field Supplies and PPE	$ 50	6	$300
		4-wheel drive	$ 55	3	$165
	- Maximum 3 days to complete field work, plus one day prep and followup	Subcontractors			
		Laboratory	Cost	15	$14,232
		Other	Cost + 5%	0	$0
	Activity 3. Subtotal				$20,063
4	Wastewater Management, after GAC System is Shut Down, per event	Contractors			
	- Using low-flow methods, purge water volumes are 1 gallon or less/sample, plus decon water	Heritage, Indianapolis, IN	$ 2.91	500	$1,455
	- Waste water is accumulated in on-site storage tank with water from all other sampling, and shipped one time per year to Heritage in Indianapolis, IN, via bulk tank truck for disposal	Annual Storage Tank Inspection/Maint.	$ 4,000	1	$4,000
	- Wastewater disposal costs included only in later year event estimates below, after GAC shut down				
	Activity 4. Subtotal				$5,455

Total Years	Sampling Frequency	Total Cost per Year	Years in Period	Total Cost for Period
1	Interim Inspections	$14,740	1	$14,740
2-3	Quarterly	$56,020	2	$112,040
4-5	Semiannual	$40,126	2	$94,992
6-15	Annual	$20,063	10	$200,630
16-42	Biennial	$10,032	27	$270,851
Grand Total				**$581,000**

TABLE 11. COST ESTIMATE FOR FLUID LEVEL MONITORING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	Fluid Level Monitoring	Personnel			
	- Pressure transducers measure levels weekly at 12 locations around site	Senior Project Manager	$ 85	24	$2,040
	- Total fluid levels measured at 24 wells semiannually, during groundwater monitoring event	Project Engineer/Scientist	$ 72	0	$0
	- All measurements incorporated into fluid level database	Technician	$ 47	96	$4,512
	- Purchase of project-dedicated water level probe addressed in Table 9	CAD	$ 55	0	$0
	- When high-grade operational, increase total fluid measurement frequency to monthly	Field Expenses and Equipment			
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Field Instruments/Equipment	N/A	0	$0
	- Hour estimates encompass all measurements conducted over a full year	Consumable Field Supplies and PPE	$ 50	0	$0
		4-wheel drive	$ 55	8	$440
		Subcontractors			
		Other	Cost + 5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 1. Subtotal				$6,992

Totals Years	Sampling Frequency	Total Annual Cost	Number of Years	Grand Total
1-42	Annual	$6,992	42	$293,664
Grand Total				**$294,000**

TABLE 12. COST ESTIMATE FOR ROUTINE REPORTING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1	Quarterly Status Letter Report	Personnel			
	- Summarize field activity, correspondence submitted or received, and upcoming notable events	Senior Project Manager	$ 85	6	$510
	- Submitted for each calendar quarter, by 15th of month following end of quarter	Project Engineer/Scientist	$ 72	0	$0
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Drafter	$ 55	0	$0
		Clerical	$ 35	2	$70
		Expenses			
		Office		1	$25
		Report Reproduction		1	$25
		Subcontractors			
		Other	Cost + 5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 1 Subtotal				$630
2.	Semiannual Technical Reports	Personnel			
	- Summarize and evaluate all data collected during previous 6-month period	Senior Project Manager	$ 85	20	$1,700
	- Validate data from lab and enter to database	Project Engineer/Scientist	$ 72	80	$5,760
	- Prepare tables and maps summarizing analytical results	Drafter	$ 55	20	$1,100
	- Compare groundwater, vapor, river water and ROST data as available to standards, as applicable	Clerical	$ 35	12	$420
	- Prepare report containing the following information: introduction, site background,	Expenses			
	scope of the field techniques, summary of analytical results, and recommendations for future monitorin(	Office		1	$200
	and/or remedial activities (including upcoming high-grade event trigger levels, if applicable)	Report Reproduction		1	$300
		Subcontractors			
		Other	Cost + 5%	0	$0
		Other	Cost + 5%	0	$0
	Activity 2. Subtotal				$9,480

Task	Activity	Cost/Year	Total Cost/42 Years
1	Quarterly Letter Status Summaries	$2,520	$105,840
2	Semiannual Technical Reports	$18,960	$796,320
Grand Total			**$902,000**

TABLE 13. COST ESTIMATE FOR MONITORED NATURAL ATTENUATION MONITORING AND 5-YEAR REVIEWS, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	MNA Monitoring (per event)	Personnel			
	- Prepare 22 groundwater wells for sampling via low-flow methods	Senior Project Manager	$ 85	16	$1,360
	- Measure MNA field parameters during well preparation	Project Engineer/Scientist	$ 72	60	$4,320
	- Collect 22 groundwater samples for lab analysis of MNA list	Technician	$ 47	50	$2,350
	- Prepare duplicate samples, MS/MSDs, equipment blanks and submit for above listed analyses	CAD	$ 55	0	$0
	- Collect four soil moisture lysimeter samples for OMM Plan Table 3-3 (MNA) constituent analysis				
	- Decontaminate equipment prior to use at each well using detergent wash, tap rinse, and	Field Expenses and Equipment			
	distilled water final rinse, if sample pumps are not dedicated to each well	Field Instruments/Equipment	N/A	0	$0
	- Complete chain of custody and submit samples to certified laboratory for analysis of MNA lab list	Consumable Field Supplies and PPE	$ 50	10	$500
	- Standard turn around time for analytical results, and lab direct bills Chevron	2-wheel drive	$ 45	0	$0
	- Purchase of project-dedicated water level probe addressed in Table 9	4-wheel drive	$ 55	5	$275
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services				
		Subcontractors			
		Laboratory	Cost	1	$15,420
		Other	Cost + 5%	0	$0
	Activity 1. Subtotal				$24,225
2.	5-Year MNA Review Reports and Related Data Collection	Personnel			
	- Collect 12 LNAPL/smear zone soil samples (3 depths at 4 locations) for LNAPL analysis	Senior Project Manager	$ 85	60	$5,100
	- Collect 12 soil vapor samples for OMM Plan Table 2-1 (COCs) constituent analysis	Project Engineer/Scientist	$ 72	280	$20,160
	- Purge 4 vertically nested groundwater wells via low-flow, and measure MNA field parameters	Technician	$ 47	80	$3,760
	- Collect 12 nested groundwater samples for lab analysis of MNA list	CAD	$ 55	16	$880
	- Summarize and evaluate MNA activity and trends	Field Expenses and Equipment			
	- Provide updates regarding progress toward end goals and recommend changes to remedial	Field Instruments/Equipment	N/A	0	$0
	approach, if warranted	Consumable Field Supplies and PPE	$ 50	10	$500
		2-wheel drive	$ 45	0	$0
		4-wheel drive	$ 55	10	$550
		Subcontractors			
		Laboratory	Cost	0	$20,600
		Driller	Cost + 5%	0	$12,000
	Activity 2. Subtotal				$63,550
3	Wastewater Management, after GAC System is Shut Down, per event	Contractors			
	- Using low-flow sample methods, purge volumes are 1 gallon or less/sample, plus decon water	Heritage, Indianapolis, IN	$ 2.91	500	$1,455
	- Waste water is accumulated in existing on-site storage tank with water from all other sampling,	Annual Storage Tank Inspection/Maint.	$ 4,000	1	$4,000
	and shipped one time per year to Heritage in Indianapolis, IN, via bulk tank truck for disposal				
	- Wastewater disposal costs included only in later year event estimates below, after GAC shut down				
	Activity 3. Subtotal				$5,455

Totals

Years	Activity	Total Cost Event	Events in Period	Total Cost for Period
1-2	Semi-Annual MNA Monitoring	$24,225	4	$96,900
3-12	MNA Monitoring Annually	$24,225	10	$242,250
13-42	MNA Monitoring Biennially (wastewater disposal cost included, after GAC system is shut down)	$29,680	15	$445,200
5 - 42	5-Year Review Report and Related Data Collection	$63,550	7	$444,850
Grand Total				**$1,229,000**

TABLE 14. COST ESTIMATE FOR GULF PARK ROUTINE MONITORING AND REPORTING, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges		Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1.	Groundwater Sampling (per event)	Personnel				
	- Prepare 12 groundwater monitoring wells for sampling via low-flow sampling method	Senior Project Manager	$	85	8	$680
	- Measure field parameters (pH, temp, conductivity) during well preparation	Project Engineer/Scientist	$	72	50	$3,600
	- Collect twelve groundwater samples for laboratory analysis of Table 1 COCs	Technician	$	47	50	$2,350
	- Prepare duplicate samples, MS/MSDs, equipment blanks and submit for above listed analyses	Clerical	$	35	0	$0
	- Decontaminate equipment prior to use at each well using detergent wash, tap rinse, and	Field Expenses and Equipment				
	distilled water final rinse, if sample pumps are not dedicated to each well	Field Instruments/Equipment		N/A	0	$0
	- Complete chain of custody and submit samples to certified laboratory	Consumable Field Supplies and PPE	$	50	4	$200
	- Standard turn around time for analytical results	Office		Lump	0	$0
	- Purchase of project-dedicated water level probe addressed in Table 9	4-wheel drive	$	55	4	$220
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Subcontractors				
	- All purge and decontamination waste water management costs accounted for in Table 5	Laboratory		Cost	0	$1,296
		Other		Cost + 5%	0	$0
	Activity 1. Subtotal					$8,346
2.	Annual Technical Report	Personnel				
	- Summarize and evaluate groundwater quality, biovent system performance, and	Senior Project Manager	$	85	10	$850
	respirometry data collected during previous year	Project Engineer/Scientist	$	72	50	$3,600
	- Validate data from lab and enter into database	CAD	$	47	10	$470
	- Prepare tables, charts, and maps summarizing analytical, biovent system performance,	Clerical	$	35	6	$210
	and respirometry results	Field Expenses and Equipment				
	- Determine hydrocarbon aerobic degradation rates using respirometry data to evaluate	Field Instruments/Equipment		N/A	0	$0
	continued system operation	Consumable Field Supplies and PPE	$	50	0	$0
	- Prepare report containing the following information: introduction, site background,	Office	Lump		1	$200
	scope of field techniques, and summary of analytical results, biovent system performance,	4-wheel drive	$	55	0	$0
	& respirometry results	Subcontractors				
		Laboratory		Cost	0	$0
		Other		Cost + 5%	0	$0
	Activity 2. Subtotal					$5,330

Totals

Years	Activity	Total Cost Event	Events in Period	Total Cost for Period
1-5	Annual Groundwater Sampling with Annual Technical Report	$13,676	5	$68,380
Grand Total				**$68,000**

TABLE 15. COST ESTIMATE FOR PROJECT MANAGEMENT, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges		Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1	Coordination and oversight program, annual basis	Personnel				
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Senior Project Manager	$	85	20	$1,700
		Project Engineer/Scientist	$	72	0	$0
		CAD	$	55	0	$0
		Clerical	$	35	2	$70
		Expenses				
		Office			1	$25
		Report Reproduction			1	$25
		Subcontractors				
		Other		Cost + 5%	0	$0
		Other		Cost + 5%	0	$0
	Activity 1 Subtotal					$1,820
2.	Coordination with Chevron and USEPA	Personnel				
	- Weekly status calls with Chevron Project Manager	Senior Project Manager	$	85	80	$6,800
	- Quarterly progress meetings with USEPA, 2 by phone and 2 in person at USEPA office in Chicago	Project Engineer/Scientist	$	72	60	$4,320
	- Preparation of PowerPoint summary presentations for semiannual in-person meetings	CAD	$	55	16	$880
		Clerical	$	35	12	$420
		Expenses				
		Office			1	$200
		Travel			2	$1,600
		Subcontractors				
		Other		Cost + 5%	0	$0
		Other		Cost + 5%	0	$0
	Activity 2. Subtotal					$14,220

Task	Activity	Cost/Year	Total Cost/42 Years
1	Coordination and oversight program, annual basis	$1,820	$76,440
2	Coordination with Chevron and USEPA	$14,220	$597,240
Grand Total			**$674,000**

TABLE 16. COST ESTIMATE FOR IMPLEMENTATION OF INSTITUTIONAL AND ENGINEERING CONTROLS, FINAL GROUNDWATER REMEDY, CHEVRON CINCINNATI FACILITY, HOOVEN, OHIO

	Activity	Schedule of Charges	Hourly Rate or Charge	Hours or Unit Estimate	Subtotal
1	Institutional Controls for Chevron Owned Property	Personnel			
	- Once USEPA provides approved model environmental covenant language, place use restrictions into deeds for all Chevron owned land overlying the plume, and at the LTU, and provide proof of deed recordation to USEPA	Senior Project Manager	$ 85	120	$10,200
		Project Engineer/Scientist	$ 72	0	$0
		CAD	$ 55	20	$1,100
	- Labor rates per 2007 Chevron Contract rates for environmental consulting services	Clerical	$ 35	20	$700
		Expenses			
		Office		1	$500
		Recordation Fees		1	$1,000
		Subcontractors			
		Outside Legal	Cost + 5%	0	$30,000
		Other	Cost + 5%	0	$0
	Activity 1 Subtotal				$43,500
2	Annual Updates as Needed with Down-Gradient Property Ownership Change	Personnel			
	- Perform annual review of down gradient property ownership changes and provide notice to new owners regarding groundwater use restrictions	Senior Project Manager	$ 85	20	$1,700
		Project Engineer/Scientist	$ 72	0	$0
		CAD	$ 55	0	$0
		Clerical	$ 35	2	$70
		Expenses			
		Office		1	$100
		Report Reproduction		1	$100
		Subcontractors			
		Outside Legal	Cost + 5%	0	$5,000
		Other	Cost + 5%	0	$0
	Activity 2 Subtotal				$6,970
3	Engineering Controls	Personnel			
	- Chevron has purchased remaining land in Southwest Quadrant overlying plume, where future construction is feasible, and will apply deed restrictions requiring barriers for future construction	Senior Project Manager	$ 85	200	$17,000
		Project Engineer/Scientist	$ 72	60	$4,320
	- Based on most recent installation costs, average vapor barrier installation costs have been $7.52/ft2	CAD	$ 47	16	$752
	- Based on preliminary redevelopment options analysis study, developable area on Chevron owned land is approximately 375,000 square feet (in comparison, 117,000 ft2 have been built between nine buildings in the Southwest Quadrant over the past 10 years)	Clerical	$ 38	12	$456
		Expenses			
		Office		1	$200
	- Total cost to install vapor barrier shown as lump sum, but will be incurred as individual building construction occurs	Travel		2	$1,600
		Subcontractors			
		Outside Legal	Cost + 5%	0	$40,000
		Vapor Barrier Installation	Cost + 5%	0	$2,830,000
	Activity 3 Subtotal				$2,894,328

Task	Activity	Cost/Year	Total Cost/42 Years
1	Institutional Controls for Chevron Owned Property	One Time	$43,500
2	Annual Updates as Needed with Down-Gradient Property Ownership Change	$6,970	$292,740
3	Engineering Controls	One Time	$2,894,328
Grand Total			**$3,231,000**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

July 17, 2007

DE-9J
REPLY TO THE ATTENTION OF:

Received
7-25-07

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Mr. Randy Jewett
Chevron U.S.A. Inc.
5000 State Route 128
Cleves, OH 45002

Re: Comments on the Operation, Maintenance, and Monitoring Plan & the Remedy Implementation Plan for the Final Groundwater Remedy, Chevron Cincinnati Facility
OHD 004 254 132

Dear Mr. Jewett:

On February 28, 2007, Chevron submitted the Operation, Maintenance, and Monitoring Plan for the Groundwater Remedy, Cincinnati Facility Hooven, Ohio and an additional report the Remedy Implementation Plan for the Final Groundwater Remedy, Cincinnati Facility Hooven, Ohio to the U.S. Environmental Protection Agency (U.S. EPA). The submittal was required under paragraph 11 and 12 of the RCRA Section 3008(h) Administrative Order on Consent between Chevron U.S.A. Inc. and U.S. EPA signed November 1, 2006, Docket No. RCRA-05-2007-0001. U.S. EPA has reviewed these documents and currently cannot approve these documents in their current form. The enclosure contains general and specific comments on various aspects of these reports. Chevron shall respond to the comments through written correspondence. Once U.S. EPA and Chevron have reached resolution on the comments, Chevron shall submit the final modified document to U.S. EPA. If you have any questions, please contact me at (312) 886-1451.

Sincerely yours,

Christopher J. Black
Corrective Action Section
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
enclosure
cc: Harold O'Connell, OEPA-SWDO
cc: Jerome Kujawa, ORC

GENERAL COMMENTS

REMEDIAL IMPLEMENTATION PLAN FOR
FINAL GROUNDWATER REMEDY
CHEVRON CINCINNATI FACILITY
HOOVEN, OHIO

1. Two overarching comments pertain to the cost estimate, which should be addressed prior to implementing the RIP. The first concern is that the cost estimate should be revised in light of any additional components or monitoring suggested or required in the general and specific comments made on the RIP and Operation, Maintenance, and Monitoring (OMM) Plan. For example, more production wells may be used as high-grade pumping wells and will need modifications and upgrading. Once the comments on the RIP and OMM are addressed and both Chevron and EPA agree on the final number of monitoring wells, and number of production wells that may require upgrading, the cost estimate should be revised to address these changes.

   Secondly, the cost estimate does not fulfill the AOC conditions outlined under Section VII 24.a, Estimated Cost of the Work. Section VII 24.a of the AOC requires the cost estimate to be presented and detailed on the worksheets for each remedy assuming that a third party would perform the work. The 40 Code of Federal Register (CFR) Part 264.142 defines a third party as a party who is neither a parent nor a subsidiary of the owner or operator. Clearly, some of the actual costs included on the tables are reflected as negligible or as a zero cost. For example, the assumptions for Tables 10, 11, and/or 14 indicate that personnel and equipment are located at the Chevron facility; the interface probe, sampling equipment, and water quality meters are maintained at the Chevron facility; and purge water is discharged to the granular activated carbon (GAC) system. The costs associated with acquiring and maintaining equipment, and non-Chevron (i.e., third party) personnel conducting the monitoring (i.e., travel and per diem) have not been considered or included in the cost estimate. The contractor/consultant profit and overhead costs are also not included in the cost estimates. Chevron should review and revise all sections of the cost estimate to reflect the third-party costs associated with each remediation system.

2. We anticipate that Chevron will continue to maintain the GAC system since it is a critical treatment train component for many of the remedies in place or planned at the facility. One of the assumptions for Table 10, entitled Cost Estimate for Great Miami River Monitoring Intermediate Groundwater Remedy, has two activities. The second activity, Groundwater/Surface Water Sampling, assumes that purge water may be discharged to the on-site waste water treatment plant. The costs for maintaining the GAC system as it pertains to treating the purge water from the groundwater purging should be included. In addition, this is the only table where this assumption is made and it is not clear if there are other instances where contaminated purge water, decontamination wash water, or other wastewater associated with a remedy component has been accounted for in the cost estimate. Chevron should review all remedies and associated cost estimate tables and

ensure that disposal costs of non-hazardous and hazardous waste costs have been taken into accounted. These costs are often overlooked and may be substantial, if waste disposal is an active component of any remedy.

SPECIFIC COMMENTS

Section 2.2, Conceptual Site Model

1. The discussion of the groundwater conceptual site model (CSM) includes a statement that "both LNAPL and dissolved phase plumes have been shown to be stable and no longer migrating." While short-term tests have suggested that the light non-aqueous phase liquid (LNAPL) and dissolved-phase plumes are stable under natural groundwater gradients, the long-term stability of both plumes under natural groundwater gradient conditions has not been clearly demonstrated. The discussion of the CSM should be revised accordingly.

2. The discussion of the CSM states that "the primary driver for dissolved phase plume stability is active biodegradation of dissolved contaminants in the oxygenated groundwater at the periphery of the plume." Based on the generally observed patterns of natural attenuation of dissolved petroleum contaminants in groundwater, it appears clear that active biodegradation should be the primary driver for the stability of the dissolved-phase plume. However, it has not been established that this is primarily an aerobic process. Based on the size and nature of the plume, it is more likely that active anaerobic biodegradation will be the primary driver for natural attenuation of the plume. The program for monitoring and evaluation of natural attenuation established in the OMM Plan should clearly identify the mechanisms responsible for the natural attenuation of contaminants in groundwater at the facility. The discussion of the CSM included in the RIP should be revised accordingly.

Section 3.0, Groundwater Remedy Approach

3. The RIP (page 3-2) states that "if the LNAPL and dissolved contaminant plumes do not remain stable under natural gradient conditions, additional corrective actions will evaluated and implemented, as appropriate and agreed to with the USEPA." To assure consistency with the Final Decision Document and the AOC, the above-referenced statement should be revised to read "if the LNAPL and dissolved contaminant plumes do not remain stable under natural gradient conditions, the site-wide recovery system will be reactivated to contain the plumes and additional corrective actions will evaluated and implemented, as appropriate and agreed to with the USEPA."

4. The RIP provides a list of remedy components requiring new systems, infrastructure, or modification of existing systems. The list includes only upgrades to production well PROD_12. However, the OMM Plan (page 4-2) identifies a number of additional

production wells that may be used in the high-grade pumping program. These include production wells PROD_19, PROD_20, PROD_21, and PROD_22. Based on previous discussion with EPA, it appears that it will be necessary to use other production wells in addition to PROD_12 as part of the high-grade pumping program, even if only to address the second area of LNAPL accumulation in the center of the facility. The RIP should be revised to include a more complete list of production wells that will likely be required for the high-grade pumping program and that will require modifications or upgrades.

Section 4.0, Down-Gradient Monitoring Systems

5. The RIP indicates that "as described in the Order, a confirmed detection of a COC at levels above the MCL in a POC well will be cause for immediate resumption of groundwater containment pumping and evaluation of additional corrective measures." The RIP should be revised to also indicate that "as described in the Order, a confirmed detection of a COC at levels above the MCL in a sentinel well will be cause for immediate resumption of groundwater containment pumping."

Section 4.2, ROST Transects

6. When discussing the installation of the three Rapid Optical Screen Tool (ROST) transects, the RIP (page 4-2) states that "once the edge of the smear zone has been estimated, one ROST boring for each transect will be installed in the LNAPL smear zone, with the other two ROST borings installed in 'clean' locations down gradient of the smear zone, each space to 20 feet apart within the transact." However, no indication is provided of how the edge of the smear zone will be estimated. Presumably, this will be based on a preliminary ROST survey, but this is not clearly stated. The RIP should provide a detailed description of how the edge of the smear zone was or will be identified. This description should identify the spacings between these initial ROST borings and indicate how the ROST data will be interpreted to identify the absence and presence of LNAPL.

7. The RIP (page 4-2) proposes to install permanent ROST boring locations as shown in Figure 4-3. The text follows by providing a description of the "typical construction methodology." However, this description provides only details of the cone penetrometer testing (CPT) and ROST methodology as typically implemented. Few details are provided regarding the design and installation of the permanent ROST locations; no details are provided in either the RIP or OMM Plan regarding routine use of the CPT and ROST tools at these locations. The RIP should clearly describe the design and installation of the ROST monitoring locations, including the diameter of the well casing, any materials (i.e., sand pack) placed inside of the well casing above the smear zone, and any efforts to seal the annular space between the well casing and the borehole. The RIP should also provide assurances that repeated reentry of the CPT into the same limited space beneath the well casing will not adversely impact the potential migration of the LNAPL into this area or the detection of that LNAPL beneath the well casing.

Section 7.1, Engineering Controls

8. The RIP (page 7-1) states that "in general, basement and other sub-grade structures should not be constructed over the plume where the depth to the top of the smear zone is less than approximately 30 ft-bgs without a location and structure-specific analysis of the protective measure to be employed." This language does not appear consistent with the AOC. The AOC (Section 16) specifically requires that "Chevron shall execute and record an Environmental Covenant imposing activity and use limitations upon the refinery and land farm portions of the facility that include no subgrade development." The RIP should be revised to clearly resolve this inconsistency with the AOC.

   Paragraph 11.e of the AOC states "Respondent shall exercise best efforts to install vapor barriers in buildings in the Southwest Quadrant to prevent human exposure to any soil vapors reaching the ground surface exceeding the risk-based residential standards identified in the RIP/OMM Plan." Please update the RIP to include these risk-based residential standards required by the Order.

Section 7.1, Engineering Controls and Section 7.2 Institutional Controls

9. The RIP (page 7-1) states that Chevron is in a position to control future development (in the Southwest Quadrant located over the plume) since they recently purchased the property and thus owns most of the land that has not already been developed. Thus, Chevron indicates that they will ensure that engineering controls are built into future design and construction plans. The next paragraph states that the need for engineering controls will be addressed during redevelopment planning for the former refinery property. However, because Chevron currently has control of both the on-site and some of the off-site property, no cost estimate is included nor does Chevron indicate that the financial assurance for engineering controls is necessary.

   The RIP (page 7-2) states that Chevron has offered to fund the inclusion of engineering controls in structures built over the plume in the Southwest Quadrant. Regardless of which entity ultimately finances the engineering controls on structures built on the Southwest Quadrant or former refinery property, these costs should be included in the cost estimate.

   The text states that the development and execution of the covenants is not anticipated to result in expenses beyond the time required for tailoring approved language to the site and project management time was added to the cost estimate in Appendix B. Engineering and institutional controls are expected to have both staff and management time associated with the implementation, and operation and maintenance or monitoring of the controls over the life of the remedy or remedies. While the Environmental Covenant with Ohio establishes an activity and use limitation upon the former refinery and land farm portions of the facility, there are no costs or expenses included in Appendix B for the institutional controls. Paragraph 16.a of the AOC states that Chevron assures that the activity and use limitations set forth in the Environmental Covenant are continually maintained so long as Chevron owns the facility. The third-party costs associated with the implementation and operation and maintenance or monitoring of the controls over the life of the remedy or remedies should be detailed in the cost estimate. Finally, page 6 of the RCRA Final Decision and Response to Comments on the Selection of Remedial Alternative for Groundwater, issued August 2006, indicates that most of the institutional controls will be in the form of the restrictive covenants that run with the land. However, Chevron is required to provide notice to existing and future owners of off-site properties that they should not install drinking water wells on their property. This cost has not been included in Appendix B. Revise the cost estimate accordingly.

Appendix B: Table 4

10. Chevron should provide an explanation for the line item "Total 5-year Maintenance Cost at 2% Inflation, 6% discount (present dollars)." The two percent inflation cost is accurate; however, no information is provided to substantiate the six percent discount on present dollars.

11. The construction and other cost estimates provided are poorly supported by the source of the cost data. If the cost data source is referenced, it is included in the notes section. For example, Table 5 references the Unit price for well rehabilitation and free product disposal costs from the 2001 Corrective Measures Study, and this value is adjusted for inflation. However, it appears that the operation costs/unit price is inaccurate. According to the 2006 ECHOS Environmental Remediation Cost Data-Unit Price 12th Edition Database, the unit costs for disposal of either hazardous ($3.01/gallon, adjusted for location) or nonhazardous used oil ($2.38/gallon, adjusted for location) is significantly more than the $0.78/gallon presented on Table 5. As another example, Table 4 assumes a unit price of $42.00/cubic yard for furnishing and placing riprap protection at the toe of the sheet pile wall. The ECHOS database provides a cost of $23.99/cubic yard, adjusted for location. Therefore, the cost estimates provided for these two assemblies or elements are too low in the first case and too high in the second case. In order for EPA to adequately evaluate the cost estimate and ensure that financial assurance is sufficiently funded, revise Appendix B to provide substantiation for each line item associated with each component of each remedy.

GENERAL COMMENTS

OPERATION, MAINTENANCE AND MONITORING PLAN FOR FINAL GROUNDWATER REMEDY

1. The OMM Plan as written lacks the detail and rationale necessary to carry out this remedy. Paragraph 11 of the AOC states "Specifications for conducting the performance monitoring components of the selected remedy shall be included in the OMM Plan.", these components as specified in subparagraphs 11.a – 11.i and this document does not sufficiently flush out the technical details to enable a clear map of what will take place in the following 42 years. The sampling schedule and frequency as established in the Final Decision/Response to Comments should be incorporated in the OMM Plan per paragraph 12.b of the 11/1/06 AOC. In places in the OMM Plan sampling schedules and frequency are not consistent with the Final Decision/Response to Comments.

2. Restarting the current site-wide groundwater recovery system is identified as a contingency in the OMM Plan. To avoid any confusion should the site-wide pumping system have to be restarted, the OMM Plan should provide a detailed summary of the program, including the specification of which production wells are used in the program and the pumping rates for each of these wells.

II. SPECIFIC COMMENTS

Section 3.3.1, LNAPL and Dissolved Phase Perimeter Plume Monitoring

1. The OMM Plan (page 3-3) indicates that downgradient plume monitoring will be performed at the point-of-compliance (POC) and sentinel wells, as well as the Rapid Optical Screen Tool (ROST) transects, on a semi-annual basis for the first five years, annually for the next five years (staggered for seasonality), biennially for the next ten years, and every five years thereafter. While this is consistent with the monitoring frequency established in the Final Decision Document for existing wells, this frequency is not consistent with that established for newly installed wells. The Final Decision Document (page 4) states that "whenever new wells are installed, Chevron will develop an initial data set for the new wells by sampling quarterly for the first two years." As shown in Table 3-1, two additional sentinel monitoring wells (MW-131 and MW-132) and two additional POC monitoring wells (MW-133 and MW-134) are proposed for installation to complete the sentinel and POC monitoring networks. These new monitoring wells should be sampled quarterly for the first two years in accordance with the Final Decision Document.

2. The OMM Plan (page 3-3) indicates that during ROST monitoring, "the tool will be advanced from approximately 5 feet above the water to approximately 5 feet below the water table." However, the text does not indicate how any changes in water table elevation will be accounted for. Chevron should provide a discussion of the potential

impacts of seasonal and other fluctuations in the water table on the detection and monitoring of the leading edge of the light non-aqueous phase liquid (LNAPL) plume using ROST measurements.

3. When discussing the use of the ROST technology to monitor the stability of the LNAPL plume, the OMM Plan states that "the ROST screen results will provide an indication of the presence/absence of LNAPL at each location." A detailed description of the procedure for ROST monitoring should be provided. This procedure should include the following types of information: requirements for calibration of the instrument prior to measurement, the wavelengths/frequencies that will be monitored for fluorescence, evaluation of background fluorescence, and procedures for comparisons between ROST readings at specific locations. The procedure should clearly detail how the final determination will be made that LNAPL has been detected at a location where it has not previously been detected. The procedure should be included, as appropriate, as a standard operating procedure (SOP) in the facility's Quality Assurance Project Plan (QAPP).

4. The OMM Plan discusses the "sporadic" and "multiple" detection of contaminants in the sentinel wells. The OMM Plan indicates that "sporadic" detection of contaminants in the sentinel wells does not necessarily confirm the indication of plume migration. The OMM Plan further states "however, confirmed detection over multiple events, or an increasing concentration trend over time in a given sentinel well will likely provide an indication of dissolved-phase plume down-gradient migration." This approach to evaluating the monitoring results from the sentinel well is not consistent with the requirements of the AOC. The AOC (Section 11.b.1) specifically requires that "if monitoring shows that groundwater in a sentinel well contains concentration of a Contaminant of Concern (COC) listed in Table 1 exceeding the Safe Drinking Water Act Maximum Contaminant Level (MCL), which exceedance is not due to low water table conditions, the sentinel well shall be sampled again in two months." The AOC further states that "if resampling confirms and exceedance of the MCL, respondent shall resume operation of the site-wide ground water recovery system." Based on this language, the AOC does not use the mere detection of a COC, but rather the exceedance of the MCL, as an indication of plume movement. Additionally, there is no provision for trend monitoring to identify plume movement.

   The OMM Plan should be revised to include an approach for evaluating monitoring data from sentinel wells that is consistent with the AOC. Chevron may wish to consider specifying a statistical approach for identifying significant increases of COC concentrations above MCLs. The approach to evaluating monitoring data from sentinel wells should also provide a detailed discussion, with appropriate justification, of how it will be determined that low water table elevations are responsible for the observed increase in a COC's concentration in groundwater.

Section 3.3.2, Interior Plume Monitoring

5. A group of monitoring wells have been identified in Table 3-2 for interior plume monitoring. The stated purpose of this interior plume monitoring program is to track degradation trends in dissolved-phase groundwater COCs. Section 3.4.3 of the OMM Plan (page 3-7) further indicates that the results from interior plume monitoring "will be used to track progress toward the overall plume natural attenuation goals discussion in subsection 3.4.3."

   The OMM Plan provides no discussion or rationale for the selection of the specific wells included in the Interior Plume Monitoring Network. However, if data from the interior plume monitoring wells are to be used to track progress toward the natural attenuation goals established for the facility, the selection of these interior plume monitoring wells must be justified based on a full analysis of natural attenuation in the plume and a carefully developed program of monitoring and data analysis designed to demonstrate that natural attenuation goals established for the facility are being achieved (see Specific Comment Nos. 7 and 17). The OMM Plan should be revised to provide adequate justification for the selection of interior monitoring wells intended to evaluate natural attenuation in the groundwater plume.

6. OMM has identified a set of interior plume monitoring wells that will be used to collect data to track degradation trends in dissolved-phase groundwater COCs (see Specific Comment No. 5). The OMM Plan indicates that these wells will be sampled on a semi-annual basis for the first four sampling events, in order to establish COC baseline data. Thereafter, these wells will be sampled only on a five year-year interval, six months prior to each five-year review. No justification for this sampling frequency has been provided.

   As previously indicated in Specific Comment No. 5, the details of the interior plume monitoring program should only be specified in the context of a carefully developed program of monitoring and data analysis designed to demonstrate that natural attenuation goals established for the facility are being achieved. Such a program is not currently provided in the OMM Plan (see Specific Comment Nos. 7 and 17). It is important to note, however, that the monitoring frequency currently specified for the interior monitoring wells does not appear to meet the requirements of the Region 5 Framework for Monitored Natural Attenuation Decisions for Groundwater (Region 5 MNA Framework). The Region 5 MNA Framework requires that historical groundwater data used to demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration should be based on at least two years of quarterly sampling to evaluate seasonal effects on the contaminant concentrations. After this initial period of quarterly monitoring, it may be appropriate to reduce the sampling frequency somewhat. However, it does not appear that monitoring once every five years will provide an adequate basis for a meaningful trend analysis. The OMM Plan should be revised to include a suitable frequency for monitoring wells intended to identify trends in decreasing contaminant mass and/or groundwater concentrations.

Section 3.3.3, Monitored Natural Attenuation (MNA) Monitoring

7. The OMM Plan has not provided a clear and well-developed conceptual site model (CSM) of the natural attenuation processes that are expected to control and reduce contaminant mass and groundwater concentrations at the facility. Such a CSM is required by the Region 5 MNA Framework and typically includes the identification and description of all physical and biological processes that are expected to impact contaminant concentrations. The CSM also clearly identifies which constituents will be impacted by natural attenuation and describes the geochemical conditions that are necessary for the required biotic or abiotic reactions to occur, thereby providing a basis for the subsequent evaluation of MNA data. The CSM should also clearly identify source areas, groundwater flow directions, and anticipated contaminant migration pathways, both vertical and horizontal.

   The OMM Plan has provided an extensive list of MNA parameters that will be routinely monitored (Table 3-3). Preliminary review of these parameters indicates that these are appropriate and sufficient for MNA monitoring of contaminant plumes comprised of petroleum hydrocarbons. The general purpose for each constituent has been identified in Table 3-4. However, no discussion has been provided regarding the conditions (concentrations or values) expected for each of these parameters in order to demonstrate effective natural attenuation of contaminants, additionally discussion of the Data Quality Objectives (DQOs) for these parameters. Similarly, no discussion has been provided of how these values are expected to vary throughout the plume and with time as remediation progresses via natural attenuation. The monitoring wells that will undergo routine monitoring for MNA parameters are shown in Figure 3-4. Only a limited set of wells has been identified for MNA monitoring, and these well are primarily located along the downgradient edge of the plume and beneath Hoover. The rationale for this distribution of wells is unclear. Additional wells in a more centrally located area of the plume appear to be necessary to evaluate natural attenuation throughout the plume.

   The OMM Plan should provide a well-developed and detailed CSM for natural attenuation processes at the site. All aspects of the MNA monitoring program, including well locations, sampling parameters, and sampling frequencies, should be developed and justified based on this model.

8. The sampling frequency for monitoring MNA parameters is specified as semi-annual for the first two years. Thereafter, these wells will be sampled only on a five year-year interval, six months prior to each five-year review. No justification for this sampling frequency has been provided. The sampling frequency for MNA parameters should be based on the CSM for natural attenuation established for the site (see Specific Comment No. 7). The frequency should be sufficient to verify expected trends in parameter values.

9. The OMM Plan provides for no routine monitoring of the LNAPL within the LNAPL plume. Since reduction in contaminant mass via natural attenuation mechanisms within the LNAPL plume is expected to play an important role in site remediation, a program of

routine sampling and analysis of LNAPL throughout the LNAPL plume should be developed and included in the OMM Plan. This routine LNAPL sampling and analysis plan should be based on a thorough analysis of the changes expected in LNAPL composition over time and should include sampling throughout the vertical extent of the LNAPL smear zone to verify that the expected changes in LNAPL composition are, in fact, occurring.

Section 3.3.4, River Monitoring

10. The OMM Plan provides no schedule for monitoring three hyporheic zone wells during long-term monitoring. Revise the OMM Plan to include the monitoring schedule of these hyporheic zone wells.

Section, 3.3.5, Fluid Level Monitoring

11. The OMM Plan indicates that fluid levels will be monitored both manually and using data logging probes. The network of wells that will be subject to manual fluid level monitoring is shown on Figure 3-6 and appears extensive. The network of monitoring wells in which data logging probes will be installed are shown on Figure 3-5. These wells are limited in number and appear to be concentrated in downgradient areas of the plume, particularly at the leading edge of the plume and beneath Hooven. No explanation has been provided for the selection of the location of the wells in which data logging probes will be installed. The OMM Plan should be revised to provide a rationale and justification for selecting the monitoring wells in which data logging probes will be installed.

12. The OMM Plan indicates that transducers will be used to monitor fluid levels. The OMM Plan indicates that the data will be downloaded from the transducers as driven by the data needs and the memory capacity of the transducer. The data needs and the memory capacity are not included in this section. Revise the OMM Plan accordingly.

13. The OMM Plan indicates that water level gauging will be performed on a bi-monthly basis, with the frequency increasing to monthly when groundwater is below the trigger level established at monitoring well MW-20S. A bi-monthly frequency for monitoring water levels does not appear adequate for first identifying the low groundwater elevations that may result in initiation of high-grade pumping. A much more frequent groundwater elevation monitoring program, particularly in those wells that are used to assess the viability of high grade pumping, appears appropriate during the season when drought or low water-level conditions are likely to occur. The frequency for the fluid-level monitoring should be increased to provide an adequate notification so that conditions potentially favorable for the high-grade pumping may be developing. Consideration should be given to a weekly schedule in select wells during the summer and fall.

Section 3.4.1, LNAPL and Dissolved Phase Perimeter Plume Monitoring

14. The OMM Plan indicates that once the site-wide groundwater recovery system is restarted in response to the confirmed detection of LNAPL or COCs above MCLs in a sentinel or POC well, "operation of the groundwater recovery system will cease should future monitoring confirm the absence of LNAPL and that the concentrations of all COCs listed in Table 2-1 are less than MCLs." However, operation of the site-wide groundwater recovery system may itself become responsible for the improvement in COC concentrations in groundwater and potentially, though not as likely, for movement of LNAPL in the LNAPL plume. Thus, it would not be appropriate to stop the site-wide groundwater recovery unless it was clearly demonstrated that, once the operation of the recovery system was stopped, exceedance(s) in COCs concentrations or further movement of LNAPL was not likely to occur. Such a demonstration would require EPA's review and approval. The OMM Plan should be revised accordingly.

15. The OMM Plan (Section 3.3.1) establishes a set of general plume monitoring wells in addition to the sentinel and POC monitoring wells. These wells are identified in Table 3-1 and their locations are shown on Figure 3-2. The OMM Plan (page 3-4) indicates that these wells will be sampled at the same frequency as the sentinel and POC wells and further states that the samples will be "analyzed for groundwater COCs listed in Table 2-1 for comparison against MCL standards." Performance metrics or contingencies have not been provided for these general plume monitoring wells in Section 3.4.1 of the OMM Plan. The OMM Plan should be revised to more clearly indicate how the groundwater quality data from the general plume monitoring wells will be evaluated and if these data will be used to trigger any contingent actions.

16. The OMM Plan (page 3-7) states that "if ROST or fluid level monitoring detects LNAPL in an inner ROST boring located outside the current smear zone boundary, then operation of the site-wide groundwater recovery system will be resumed." Based on the design details provided in Figure 4-3 of the RIP, it does not appear that it will be possible to monitor fluid levels at the ROST locations. This apparent discrepancy between the OMM Plan and the RIP should be reconciled, as appropriate.

Section 3.4.3, Monitored Natural Attenuation Monitoring

17. The AOC (Section 11.f) requires that "periodic long term monitoring of the plumes and five-year review of the progress of natural attenuation, *as specified in the RIP/OMM Plan*, shall be conducted by the Respondent [emphasis added]." However, the OMM Plan provides no program of data analysis to evaluate the progress of natural attenuation. The OMM Plan should be revised to provide a detailed program of data analysis and evaluation that is capable of demonstrating that reductions in contaminant mass and concentrations via natural attenuation are sufficient to meet remedial goals for the site. This data analysis program should be based on the detailed CSM for natural attenuation processes at the site that was used to establish the MNA monitoring program (see Specific Comment No. 7).

The data analysis program should address contaminant mass reductions in the LNAPL plume as well as in the dissolved-phase plume.

Section 3.4.4, River Monitoring

18. The paragraph entitled "Short-Term Monitoring" indicates that the results of the dissolved-phase groundwater and river monitoring will be compared to the Ohio EPA surface water standards. However, the Ohio EPA surface water standards have not been provided in the OMM Plan. Revise the OMM Plan to include the Ohio EPA surface water standards.

Section 3.4.5, Fluid Level Monitoring

19. The OMM Plan (page 3-9) indicates that "additional details regarding proposed progress metrics related to LNAPL thickness monitoring results and the long-term plan for high-grade operations will be included in the plan that Chevron will submit to the USEPA by October 31, 2008." It is presumed that the referenced plan is the "criteria for determining that High Grade Pumping is no longer contributing to reducing the timeframe for reaching the groundwater cleanup standards" that the AOC (Section 11.a) requires to be submitted within two years of the effective data of the AOC. To avoid confusion, the OMM Plan should be revised to clearly indicate the context in which the referenced plan will be submitted.

Section 4.1, Component Description

20. The OMM Plan states that "although the remaining LNAPL has been shown to be stable, additional recovery will further increase certainty regarding LNAPL stability at the lowest natural water table conditions." While a short-term test suggests that the LNAPL plume is stable, the long-term stability of the LNAPL plume under natural groundwater flow conditions has not, as yet, been clearly demonstrated. The long-term stability of the LNAPL plume will be demonstrated by the long-term monitoring program established in the OMM Plan. The above-referenced statement should be revised accordingly.

21. Groundwater elevation trigger levels will be used to initiate and terminate seasonal high-grade pumping. Trigger levels have been identified for five monitoring wells in the southwestern portion of the plume. However, the basis used for establishing these trigger levels has not been provided. Since it is expected that these trigger levels will have to be adjusted over time as the removal of LNAPL progresses, it is important that the criteria or basis for identifying and adjusting trigger levels be firmly established. The OMM Plan should be revised to provide a detailed discussion of the factors that influence the establishment of groundwater elevation trigger levels. This discussion should provide the criteria that have been and will be used in the future to establish these trigger levels.

    When discussing trigger levels, the OMM Plan indicates that the seasonal high-grade pumping will only partly rely on groundwater elevation trigger levels to initiate and cease high-grade pumping. The OMM Plan indicates that the decision to initiate or cease high-grade operations will also be based in part on whether LNAPL is recoverable. This implies that trigger levels will not be set based on whether LNAPL is recoverable (i.e., at groundwater levels where LNAPL begin to collect in monitoring wells). The discussion in the OMM Plan should be expanded to clarify how the recoverability of LNAPL is to be determined and to explain why such considerations are not implicit in the establishment of trigger levels.

22. Table 4-1 provides groundwater elevation trigger levels for five monitoring wells in the southwestern portion of the plume. However, based on the discussion provided in the OMM Plan, it is not clear if each of these trigger levels or only one must be reached before initiation of high-grade pumping will be considered. The OMM Plan should be revised to clearly indicate how these initial trigger levels will be evaluated when considering the initiation of seasonal high-grade pumping.

23. The AOC (Section 12.b) requires that pumping rates be specified in the OMM Plan. Pumping rates during high-grade pumping have not been discussed in the OMM Plan. The OMM Plan should be revised to specify pumping rates during high-grade pumping. If it is not possible to specify precise pumping rates, the OMM Plan should provide anticipated pumping rates for prospective production wells and a discussion of the factors that may influence actual pumping rates during high-grade pumping.

Section 4.3.1, Preparatory Monitoring

24. The discussion of actual preparatory monitoring provided in the OMM Plan (page 4-3) is limited to stating that "manual fluid level gauging will be conducted as needed in preparation of each high-grade event in order to collect operational baseline data and to measure against established trigger elevation in surrounding monitoring wells." The OMM Plan should be revised to clearly state the goals and objectives of the preparatory monitoring program (e.g., identification of background trends in groundwater levels). The OMM Plan should similarly provide the details of a preparatory monitoring program that will clearly meet the established objectives for the program.

Section 5.1, Component Description

25. The OMM Plan indicates that the granulated activated carbon (GAC) is designed to treat benzene, ethylbenzene, toluene, and xylenes. The COCs specified in the AOC include additional contaminants (arsenic, chlorobenzene, and lead). The OMM Plan should verify that National Pollutant Discharge Elimination System (NPDES) requirements for these contaminants are met at the point of discharge to surface water.

Section 6.2, Component Installation/Operation

26. The OMM Plan (page 6-2) states that "in addition to high grade pumping events, the HSVE system will be operated when fluid level gauging shows the groundwater elevation at monitoring well MW-20S to be 464.8 feet above mean sea level or lower, and regional weather conditions are such that the groundwater elevation is expected to stay at or below this level." The OMM Plan further states "the trigger for operation of the HSVE system is expected to declining over time, as continued mass removal and natural degradation reduces the remaining LNAPL that is amenable to removal through vapor recovery." No rationale or basis is provided for selecting water levels in MW-20S for use as a trigger for operating the horizontal soil vapor extraction (HSVE) system. Similarly, no rationale or basis is provided for identifying 464.8 feet above mean sea level as the water level in MW-20S to use as the actual trigger level.

The trigger cited to initiate operation of the HSVE is the same as the trigger used to initiate high-grade pumping. Since the same triggers have been established for the operation of both systems, it would appear that the HSVE would only be operated during periods of high-grade pumping. However, the Final Decision Document clearly envisions that there may be times when the HSVE should be operated due to low water table conditions and an exposed LNAPL smear zone beneath Hooven, although high-grade pumping is not operating. This would seem to require that water level triggers be located more centrally beneath Hooven and be developed based on water elevations beneath Hooven that result in exposure of the smear zone in this area.

The OMM Plan should be revised to provide an adequate rationale for selecting trigger levels to initiate the operation of the HSVE system beneath Hooven independent of the operation of the high-grade pumping system. Based on this rationale and an evaluation of the existing observations of groundwater and LNAPL levels, the OMM should propose monitoring well(s) and associated trigger level(s) for current use to initiate the HSVE system independent of high-grade pumping program.

Paragraph 11.c of the AOC states "At any time, Respondent may submit to U.S. EPA for approval for approval criteria for permanent shutdown of the HSVE system. The approved criteria shall be incorporated into the RIP/OMM Plan." Chevron does not list specific criteria for permanent shutdown and state they will propose shutdown when "… likely once high-grade operations have been completed, and when a period of two or more years have passed when conditions have not been amenable to the system accomplishing significant additional LNAPL mass removal." Please quantify these terms "amenable" and "significant" to satisfy the need for approved criteria.

Section 7.3, Sampling/Monitoring

27. Chevron has proposed that vapor monitoring well VW-128 be included in the long-term vapor monitoring program instead of VW-93, as specified in the Final Decision

Document. The stated reasons for the proposed substitution are to collect additional data near the school and to ensure that one of the wells monitored over the long term is located over the dissolved phase. The additional data from VW-128 would be useful and provide added confidence to long-term vapor monitoring. However, all of the vapor monitoring wells originally specified in the Final Decision Document should be included in the long-term vapor monitoring program. Vapor monitoring well VW-128 should be added to the program rather than substituted for one of the specified wells.

28. The Final Decision Document (page 7) specifies that the "vapor wells will be tested twice annually during the Spring and Fall or to account for the high and low water table conditions for the first two years of sampling, once per year during years three to five, and then every three years thereafter." However, the OMM Plan (page 7-1) states that the vapor monitoring wells "will be sampled semiannually for the first two years, annually for the next three years, biennially for the next five years, and every five years thereafter." The proposed vapor monitoring schedule after the first five years is not consistent with that specified in the Final Decision Document. While Chevron may sample biennially between year five and year ten, the three-year schedule specified in the Final Decision Document must be followed for subsequent years. The OMM Plan should also clearly specify the schedule for the first two years of sampling contained in the Final Decision Document.

29. The OMM Plan indicates that the wells will be sampled utilizing the suggested soil vapor sampling operating procedure provided in Appendix A. While not clearly stated, it is assumed that the suggested procedure in Appendix A is different than that used in the past to sample soil vapor in Hooven. Chevron should provide a detailed comparison between the two procedures, clearly indicating how the suggested procedure differs from the current sampling procedure. An analysis of how the differences between the two procedures are likely to impact soil vapor measurements should also be provided. The impact on the comparability of data previously collected and collected in the future using the new procedure should be evaluated. If available, peer-reviewed articles supporting the suggested procedures should be provided.

30. The Final Decision Document (page 7) states that "the vapor monitoring wells will be sampled at 5 and 10 feet below ground surface and at 10 foot intervals to the groundwater table." While it indicates that "soil vapor probes are positioned at 5- and/or 10-foot intervals extending from the ground surface to between 50 and 60 feet below groundwater surface (ft-bgs)," the OMM Plan does not clearly indicate from which probe samples will be taken or that these probes extend to the water table. The OMM Plan should be revised to include specifications for soil vapor sampling that are clearly consistent with the requirement established in the Final Decision Document.

Section 7.4, Performance Metrics and Contingencies

31. The OMM Plan (page 7-2) states that "additional corrective measures will be evaluated to

prevent vapors from migrating upward from the LNAPL plume into occupied buildings in Hooven at concentrations exceeding the VI Guidance residential screening standards." While not clearly identified, it is presumed that the VI Guidance refers to the U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 2002 Draft Vapor Intrusion (VI) Guidance. To avoid confusion, the OMM Plan should clearly identify the VI Guidance as the above document.

Section 8.3, Sampling/Monitoring

32. When specifying the monitoring program for the Gulf Park bioventing system, the OMM Plan identifies a series of components that *may be included* in the system performance monitoring program. These monitoring program components are also frequently only described generally, without any specific details (e.g., groundwater elevation in selected wells). The OMM Plan never actually identifies the specific monitoring program that will be followed at Gulf Park. The OMM Plan should be revised to clearly specify the details of the performance monitoring program that will be conducted at Gulf Park.

Randall W. Jewett
Cincinnati Facility
Site Manager

Chevron Environmental Management Company
5000 State Route 128
Cleves, OH 45002
Tel 513-353-1323
Fax 513-353-4664

August 24, 2007

Mr. Christopher Black
U.S. EPA Region 5
Corrective Action Section
Enforcement and Compliance Assurance Branch, DE-9J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: Response to USEPA Comments
Remedial Implementation and Operations, Maintenance and Monitoring Plans
Chevron Cincinnati Facility, Hooven, Ohio

Dear Mr. Black:

On July 25, 2007, Chevron Environmental Management Company (Chevron) received comments from the United States Environmental Protection Agency (USEPA), regarding the above referenced report. Based on your comments, we are hereby responding and submitting the attached proposed revisions to the report. Your comments are summarized below in plain text, and our responses are shown in italics. Proposed revised versions of the Remedial Implementation Plan (RIP) and Operations, Maintenance and Monitoring (OMM) Plan text, and updated versions of the figures and tables and appendices to those reports, are attached.

We have attempted to provide the additional details that you are requesting. One overarching comment though, is that we respectfully note that Chevron is pursuing a remedy that is in some ways novel and innovative both in terms of the use of best available science for assessing and monitoring the nature and extent of contaminants, and the development of a remedial strategy that is tailored to the site conditions. As such, many of the remedy components will need to be continually developed and fine-tuned as the remedy progresses. The USEPA RCRA Cleanup Reform Guidance Documents indicate that it is USEPA's intent to focus on the end goal of protecting human health and the environment, rather than a prescriptive approach which details every step of the remediation process. The presecriptive approach delays the end goal of cleanup as it requires an iterative process of submittals, revisions and approvals before any actual work is performed. These sentiments were emphasized by USEPA management-level personnel during negotiation of the November 2006 Agred Order on Consent (AOC), and the RIP and OMM were prepared in this context. Yet it appears that many of USEPA's comments are focused on providing extensive detail regarding operational aspects of the final remedy throughout its full anticipated 42 years of implementation, rather than looking toward the overall goal of ensuring that receptors are protected and that the plume is naturally attenuating.

Chevron understands the USEPA technical team's desire for additional detail that it can use as a basis to track and monitor progress under the remedy. In respect of and response to that desire, wherever possible, we have added additional detail and specificity to the RIP and OMM Plans. However, we continue to maintain that it is in some cases simply not possible to provide the level of detail that USEPA is requesting, as implementation of the remedy will require flexibility and adjustment as the remedy proceeds. Chevron is committed to pursuing this approach with the end goal in mind, and to continually communicating with USEPA regarding progress and proposed evolution to the program implementation details.

GENERAL COMMENTS - REMEDIAL IMPLEMENTATION PLAN

1. Two overarching comments pertain to the cost estimate, which should be addressed prior to implementing the RIP. The first concern is that the cost estimate should be revised in light of any additional components or monitoring suggested or required in the general and specific comments made on the RIP and Operation, Maintenance, and Monitoring (OMM) Plan. For example, more production wells may be used as high-grade pumping wells and will need modifications and upgrading. Once the comments on the RIP and OMM are addressed and both Chevron and EPA agree on the final number of monitoring wells, and number of production wells that may require upgrading, the cost estimate should be revised to address these changes.

   Secondly, the cost estimate does not fulfill the AOC conditions outlined under Section VII 24.a, Estimated Cost of the Work. Section VII 24.a of the AOC requires the cost estimate to be presented and detailed on the worksheets for each remedy assuming that a third party would perform the work. The 40 Code of Federal Register (CFR) Part 264.142 defines a third party as a party who is neither a parent nor a subsidiary of the owner or operator. Clearly, some of the actual costs included on the tables are reflected as negligible or as a zero cost. For example, the assumptions for Tables 10, 11, and/or 14 indicate that personnel and equipment are located at the Chevron facility; the interface probe, sampling equipment, and water quality meters are maintained at the Chevron facility; and purge water is discharged to the granular activated carbon (GAC) system. The costs associated with acquiring and maintaining equipment, and non-Chevron (i.e., third party) personnel conducting the monitoring (i.e., travel and per diem) have not been considered or included in the cost estimate. The contractor/consultant profit and overhead costs are also not included in the cost estimates. Chevron should review and revise all sections of the cost estimate to reflect the third-party costs associated with each remediation system.

   The cost estimates have been updated commensurate with the revised proposed remedy lifecycle work scope detailed in this submittal. The costs have also been adjusted so they are fully reflective of those incurred for a third-party contractor to perform the work. This has entailed the addition of line items for purchase of equipment, and the updating of contractor labor rates per a contract rate adjustment that has occurred since the cost estimates were originally prepared. However, as discussed further below, we want to assure you that the labor costs already reflected all third-party labor costs including overhead and profit, and the wastewater treatment system operation costs do already capture the treatment of all wastewater generated at the site, including sample purge and decontamination water.

There are not any employees of a Chevron parent or subsidiary company based at the site. All personnel working from offices at the site are employed by third-party contractors. While Chevron does in some instances currently receive a discount from the third-party contractors on hourly rates for employees based at the site, the cost estimate rates reflect the non-discounted rates, and therefore would not change if the personnel were working from the contractors offices instead of from the site office. The vast majority of labor services provided to the site are based in the Cincinnati area, so travel expenses are not incurred regardless of whether personnel work from the site office or the contractor's office. In cases where specialty contractors must be mobilized in (e.g. ROST drilling contractor for southwest quadrant LNAPL monitoring, or sheet-pile driving contractor for river bank engineered control construction), the travel expenses are built into the lump sum or unit rates for these services.

There has been an update to the unit labor rates that Chevron pays for most of its monitoring and operations services since the time when the cost estimates were originally prepared. The unit labor rates in all of the cost estimates have been updated to reflect current costs as of the date of this submittal. The cost estimates have also been updated to include the expense that would be incurred if a third-party contractor furnished the field monitoring instruments that are required for implementation of the remedy.

Costs for operation of the granular activated carbon (GAC) waste water treatment system are driven by utility usage and labor to operate and maintain the system. Thus, they are fixed based on the duration of operation and do not vary with the volume of waste water treatment that is added due to groundwater purging and equipment decontamination. The volume of wastewater generated during groundwater sampling and equipment decontamination is negligible in comparison to the 1,500 – 3,000 gallons per minute that is treated by the system during high-grade pumping. The GAC cost estimates assume that the system is operated for 5 months per year, which is on the upper-end of the timeframe that the system can generally be operated, and therefore is a conservatively high estimate. If wastewater is generated when the system is not in operation, it can be stored in existing tanks until GAC system operation is resumed. Thus, Table 5 captures the costs for managing all wastewater that could potentially be generated at the site, throughout the first 12 years of the remedy. Note that costs for the constructed treatment wetlands maintenance and NPDES Permit monitoring and reporting are also already included in the costs in Appendix B, Table 5.

2. We anticipate that Chevron will continue to maintain the GAC system since it is a critical treatment train component for many of the remedies in place or planned at the facility. One of the assumptions for Table 10, entitled Cost Estimate for Great Miami River Monitoring Intermediate Groundwater Remedy, has two activities. The second activity, Groundwater/Surface Water Sampling, assumes that purge water may be discharged to the on-site waste water treatment plant. The costs for maintaining the GAC system as it pertains to treating the purge water from the groundwater purging should be included. In addition, this is the only table where this assumption is made and it is not clear if there are other instances where contaminated purge water, decontamination wash water, or other wastewater associated with a remedy component has been accounted for in the cost estimate. Chevron should review all remedies and associated cost

estimate tables and ensure that disposal costs of non-hazardous and hazardous waste costs have been taken into account. These costs are often overlooked and may be substantial, if waste disposal is an active component of any remedy.

As discussed above under the response to Comment 1, the GAC system operations costs shown in Appendix B, Table 5 of the RIP, are inclusive of all wastewater treatment costs that will be incurred during the first 12 years of the remedy. Once the high-grade implementation is completed, it was assumed that GAC system operation would be discontinued and that it would be feasible to direct discharge the small volumes of purge and decontamination water that would be generated in the latter years of the remedy, directly to the constructed treatment wetlands, at negligible cost. However, it is acknowledged that this may not be feasible, depending on the characteristics of the purge water at the time. A contingency has been added to the cost summary tables, to accommodate costs for wastewater management in years 13-42 of the remedy, should direct discharge to the constructed treatment wetlands not be feasible based on the characteristics of the wastewater at the time.

SPECIFIC COMMENTS

Section 2.2, Conceptual Site Model

1. The discussion of the groundwater conceptual site model (CSM) includes a statement that "both LNAPL and dissolved phase plumes have been shown to be stable and no longer migrating." While short-term tests have suggested that the light non-aqueous phase liquid (LNAPL) and dissolved-phase plumes are stable under natural groundwater gradients, the long-term stability of both plumes under natural groundwater gradient conditions has not been clearly demonstrated. The discussion of the CSM should be revised accordingly.

   LNAPL and dissolved-phase plume stability are indicated not just by the short-term shut down tests, but also by the extensive LNAPL characterization and groundwater monitoring and modeling that lead up to those tests. As discussed during past meetings between Chevron and USEPA and documented in the June 2005 Document that was submitted to USEPA, titled "Update to Site Conceptual Model and Summary of Remedial Decision Basis, Chevron Cincinnati Facility", LNAPL petrophysical analysis and tracking have shown that residual saturations and other characteristics provide multiple lines of evidence that substantial lateral LNAPL flow is not physically possible.

   The above-referenced RIP text has been revised to clarify that extensive LNAPL characterization and dissolved phase monitoring, as well as short-term shut-down tests, indicate that the LNAPL and dissolved-phase plumes are stable and no longer migrating, and proposed remedies and monitoring programs detailed in the combined RIP/OMM Plan are intended to provide further assurance of long-term plume stability. See also response to USEPA specific OMM Plan comment #20.

2. The discussion of the CSM states that "the primary driver for dissolved phase plume stability is active biodegradation of dissolved contaminants in the oxygenated groundwater at the periphery of the plume." Based on the generally observed patterns of natural attenuation of dissolved petroleum contaminants in groundwater, it appears clear that active biodegradation should be the primary driver for the stability of the dissolved-phase plume. However, it has not been established that this is primarily an aerobic process. Based on the size and nature of the plume, it is more likely that active anaerobic biodegradation will be the primary driver for natural attenuation of the plume. The program for monitoring and evaluation of natural attenuation established in the OMM Plan should clearly identify the mechanisms responsible for the natural attenuation of contaminants in groundwater at the facility. The discussion of the CSM included in the RIP should be revised accordingly.

Taken as a whole, both aerobic and anaerobic biodegradation processes contribute toward LNAPL mass reduction and overall stability of the dissolved phase plume. The above referenced statement though was intended to be specific to the plume periphery, outside of the smear zone, where oxygen is available from adjoining, non-contaminated groundwater. Whenever oxygen is available, aerobic biodegradation processes tend to predominate, since oxygen as the terminal electron acceptor is a more rapid and favorable process for biodegrading microorganisms. There is existing evidence from the site that aerobic degradation processes predominate in the plume periphery, outside of the smear zone, as discussed further below.

We do agree that it has not been definitively established which biodegradative process results in the most overall LNAPL mass removal. But we anticipate that more quantitative estimates of the relative mass loss rates will be feasible over time based on the additional data collection that is proposed in the revised OMM Plan.

To help put these efforts in context, the discussion of the Groundwater Plume Site Conceptual Model in the RIP has been expanded, and a graphical illustration of the SCM has been added as Figures 2-2 and 2-3. In summary the discussion clarifies that, as the groundwater moves from up-gradient of the smear zone to the interior of the plume, and dissolved oxygen is depleted, anaerobic biodegradation processes will tend to dominate. These anaerobic processes are expected to continue within the entire smear zone, given the relatively consistent supply of organic constituents from the smear zone. Immediately down-gradient of the smear zone, anaerobic processes are expected to continue to some extent, as dissolved organic constituents that partitioned to groundwater within the smear zone are consumed. However, immediately down-gradient of the smear zone is considered to be the "transition zone," because the supply of organic constituents for biodegradation processes is consumed in this area, in the absence of the smear zone. Within this transition zone, dissolved oxygen concentrations are expected to "rebound" as the groundwater moves down-gradient. This is an indicator that the supply of organic constituents in groundwater has been depleted, and both anaerobic and aerobic biodegradation is no longer occurring.

A natural attenuation investigation that was conducted in 2002 supports this conceptual model. This investigation is reported in Appendix C of Conceptual Groundwater Remedy Report, *Revision 0 (Chevron Cincinnati Groundwater Task Force, July 2003). For this investigation, a collection of wells was sampled for geochemical indicators and organic compounds. These wells represented groundwater up-gradient of the site on the northern end of the facility, and in West Hooven. Wells were also sampled in the smear zone of the facility and East Hooven, in the "transition zone" immediately down-gradient of the smear zone, and down-gradient near US 50. The findings of this investigation include:*

- *Significant dissolved oxygen was present in shallow groundwater up-gradient of the smear zone (1.3 – 3.6 mg/L). Within the smear zone, the average dissolved oxygen concentration was less than 1 mg/L. This is evidence the groundwater is depleted of dissolved oxygen as it enters the smear zone; aerobic biodegradation processes are occurring at the periphery of the plume.*
- *Sulfate concentrations in groundwater decreased from up-gradient (>50 mg/L) of the smear zone to the interior (non-detect concentrations). This indicates anaerobic biodegradation processes within the interior of the smear zone.*
- *Nitrate concentrations generally decreased from up-gradient to within the plume, and within the transition zone. However, nitrate concentrations in the up-gradient wells at the northern edge of the facility were low, so significant biodegradation with nitrate used as the terminal electron acceptor is not likely in this area. Nitrate concentrations in the up-gradient wells in West Hooven were higher, indicating anaerobic biodegradation processes, possibly in the transition zone.*
- *Dissolved/ferrous iron and methane concentrations were low in the up-gradient wells, high in the smear zone, and intermediate in the transition zone. This indicates anaerobic biodegradation processes in the smear zone, with these processes active but decreasing in the transition zone due to the finite supply of organic constituents.*
- *The "rebound" of oxygen was observed in the transition zone.*
- *BTEX constituents were not detected up-gradient of the site, or in the down-gradient wells near US 50. Within the smear zone, BTEX concentrations were high, and in the transition zone, they were intermediate. This indicates that BTEX partitions from the smear zone to the groundwater and is consumed within the transition zone. In the transition zone, the supply of BTEX is finite and consumed before the groundwater reaches the down-gradient wells near US 50.*

The Monitored Natural Attenuation (MNA) program has been designed to monitor both anaerobic and aerobic biodegradation processes in groundwater. Similar to the investigation conducted in 2002, monitoring wells will include those up-gradient of the facility, within the smear zone, within the transition zone, and down-gradient of the transition zone. Note that additional wells have been added to those proposed in the original draft OMM plan in order to ensure adequate characterization of each zone. All of these wells will be monitored for the geochemical parameters listed in Table 3-3 of the OMM plan. These parameters are indicators of both aerobic and anaerobic biodegradation processes.

Although not explored in the 2002 natural attenuation investigation, it is likely that precipitation that infiltrates into the vadose zone provides significant dissolved oxygen to the surface of the *smear zone, especially following rain events. For this reason, lysimeters will be installed in the vadose zone soils near the following wells: MW-21, MW-18, MW-20, and MW-93. Water samples will be collected from these lysimeters semiannually following rain events in the first two years years, annually during the ensuing ten years, and then biennially following each rain event thereafter. The geochemical parameters listed in Table 3-3 of the OMM plan will be measured in these water samples.*

Section 3.0, Groundwater Remedy Approach

3. The RIP (page 3-2) states that "if the LNAPL and dissolved contaminant plumes do not remain stable under natural gradient conditions, additional corrective actions will be evaluated and implemented, as appropriate and agreed to with the USEPA." To assure consistency with the Final Decision Document and the AOC, the above-referenced statement should be revised to read "if the LNAPL and dissolved contaminant plumes do not remain stable under natural gradient conditions, the site-wide recovery system will be reactivated to contain the plumes and additional corrective actions will evaluated and implemented, as appropriate and agreed to with the USEPA."

   Agreed. The above-referenced text has been revised as stated.

4. The RIP provides a list of remedy components requiring new systems, infrastructure, or modification of existing systems. The list includes only upgrades to production well PROD_12. However, the OMM Plan (page 4-2) identifies a number of additional production wells that may be used in the high-grade pumping program. These include production wells PROD_19, PROD_20, PROD_21, and PROD_22. Based on previous discussion with EPA, it appears that it will be necessary to use other production wells in addition to PROD_12 as part of the high-grade pumping program, even if only to address the second area of LNAPL accumulation in the center of the facility. The RIP should be revised to include a more complete list of production wells that will likely be required for the high-grade pumping program and that will require modifications or upgrades.

   The RIP has been revised to provide a more complete list of production wells that are currently configured to support high-grade pumping, as well as those production wells that may be considered for upgrade or installed to support future high-grade events. The updated list includes a new high-grade well planned for construction within the town of Hooven. Placement of a high-grade well within Hooven had not previously been considered possible due to access limitations and health and safety concerns associated with managing the large volumes of groundwater and hydrocarbon that would be recovered through the well. However, Chevron has been able to arrange the purchase of a parcel where it will be able to construct an enclosed and secured recovery well. The parcel adjoins Highway 128, so it will be possible to transfer groundwater and recovered hydrocarbon back to the site through underground lines directly from the well. Thus, the storage of hydrocarbon or groundwater within the town will not be necessary. Costs for the construction or upgrade of up to four additional high-grade recovery wells is *already accounted for in the cost estimate in the RIP Appendix B, Table 2.*

Section 4.0, Down-Gradient Monitoring Systems

5. The RIP indicates that "as described in the Order, a confirmed detection of a COC at levels above the MCL in a POC well will be cause for immediate resumption of groundwater containment pumping and evaluation of additional corrective measures." The RIP should be revised to also indicate that "as described in the Order, a confirmed detection of a COC at levels above the MCL in a sentinel well will be cause for immediate resumption of groundwater containment pumping."

   The RIP has been revised to clarify that a confirmed detection of a COC at levels above the MCL in a sentinel well during a subsequent re-sampling event, within two months following an initial exceedance, will also be cause for immediate resumption of groundwater containment pumping. If subsequent analysis indicates that the confirmed sentinel well exceedance was due to an anomalous low water table condition, and not to actual plume migration, Chevron will follow up with USEPA to discuss rational and seek approval to discontinue pumping. The OMM Plan has also been revised accordingly. See also response to OMM Specific Comment #4.

Section 4.2, ROST Transects

6. When discussing the installation of the three Rapid Optical Screen Tool (ROST) transects, the RIP (page 4-2) states that "once the edge of the smear zone has been estimated, one ROST boring for each transect will be installed in the LNAPL smear zone, with the other two ROST borings installed in 'clean' locations down gradient of the smear zone, each spaced to 20 feet apart within the transact." However, no indication is provided of how the edge of the smear zone will be estimated. Presumably, this will be based on a preliminary ROST survey, but this is not clearly stated. The RIP should provide a detailed description of how the edge of the smear zone was or will be identified. This description should identify the spacings between these initial ROST borings and indicate how the ROST data will be interpreted to identify the absence and presence of LNAPL.

   The edge of the smear zone has already been determined to within approximately 10 feet during previous ROST investigations in the Southwest Quadrant. The edge of the smear zone and the target ROST well locations will be will be staked at the surface at the ROST well transect locations, and the ROST monitoring wells will be installed based on those surveyed locations. Subsequently, the ROST rig will be mobilized in and utilized to confirm that the first ROST well is inside the plume, and that the second two down-gradient wells are outside the plume. If the ROST readings from the initial well locations indicate that alternate locations are necessary to achieve the target spacing across the edge of the plume, additional ROST wells will be installed. Because the ROST rig is so expensive, and because difficult drilling conditions are anticipated, it will be more economical to proceed in this fashion, than to have the ROST rig on standby throughout the drilling activities required to install the ROST monitoring wells. Section 4.2 of the RIP has been revised to address this procedure for locating the edge of the smear zone using ROST exploratory soundings.

It is important to bear in mind that the majority of the area now known as the Southwest Quadrant, was at one time a gravel pit which was subsequently filled with construction debris prior to construction of the commercial structures present there today. During past attempts to install ROST borings, extreme difficulty and/or refusal has been encountered in advancing the ROST tool down to the groundwater table. Thus, the target spacing will be subject to adjustment in the field based on subsurface conditions.

7. The RIP (page 4-2) proposes to install permanent ROST boring locations as shown in Figure 4-3. The text follows by providing a description of the "typical construction methodology." However, this description provides only details of the cone penetrometer testing (CPT) and ROST methodology as typically implemented. Few details are provided regarding the design and installation of the permanent ROST locations; no details are provided in either the RIP or OMM Plan regarding routine use of the CPT and ROST tools at these locations. The RIP should clearly describe the design and installation of the ROST monitoring locations, including the diameter of the well casing, any materials (i.e., sand pack) placed inside of the well casing above the smear zone, and any efforts to seal the annular space between the well casing and the borehole. The RIP should also provide assurances that repeated reentry of the CPT into the same limited space beneath the well casing will not adversely impact the potential migration of the LNAPL into this area or the detection of that LNAPL beneath the well casing.

Additional details regarding the ROST Well construction plans have been integrated to the RIP and OMM Plans, where feasible. However, it is important to remember that use of the ROST tool is not yet a common practice with regard to monitoring LNAPL plume stability at the leading edge of the plume, through time. Chevron has been proactive in applying best available science to the assessment and remediation of the Cincinnati Facility, and believes that use of the ROST tool will provide additional definition and certainty regarding the plume conditions, beyond those which are available at the vast majority of LNAPL contaminant sites in the country. To our knowledge, there has never been an attempt to establish a permanent ROST monitoring station or network. Thus, it is simply not possible to define with certainty the protocols that should be followed to construct and monitor the network. As discussed in past technical meetings between Chevron and the USEPA, Chevron is committed to continuing to apply best available science to addressing the Cincinnati Facility plume, and asks that some flexibility be afforded in accomplishing the end remedy goals defined in the 2006 Order.

Also, as noted above in the response to Specific Comment No. 6, extreme difficulty has been encountered in the past in advancing the ROST tool through fill material in the Southwest Quadrant. Thus, adjustments to ROST station locations may be necessary based on conditions encountered in the field during installation.

Details regarding the nature of the ROST well casing and annulus fill material were omitted from the initial RIP as they were considered immaterial to performance of the wells, since the ROST tool will only be measuring for the potential presence of LNAPL across the region just above and below the water table, and this depth range will remain native material. Nevertheless, Figure 4-3 has been modified to indicate that the anticipated well casing construction material will be 2-inch *diameter PVC (or larger, if dictated by the size of the ROST tools being used by the ROST drilling contractor at the time of the well installation), surrounded by a bentonite-cement grout which will be installed in the remainder of the boring annulus. The casing will be filled with 10/20 silica or similar sized sand. Placement of sand inside the casing is necessary, because the ROST tool drive-rod is not designed to bear weight in an open hole.*

Section 4.2 of the RIP has also been revised to provide additional specifics regarding the planned ROST Well installation procedure. ROST borings will be constructed by drilling a bore hole 4 to 6 inches in diameter to depth in the same way that a monitoring well boring is advanced. The 2-inch schedule 80 PVC casing will then be installed to the bottom of the bore hole and the casing grouted in place and filled with sand, as described above. A plastic cap will be placed on the casing during grouting and when not in use to ensure that it doesn't become plugged with foreign materials. The construction details and protocol for advancement of the ROST tool across the groundwater table may need to be adjusted based on initial operational results.

When the ROST tool is advanced through the formation, it pushes aside native materials. While push-rod advanced sample collection can result in an open hole in fine-grained material formations, the aquifer material at this site is primarily coarse sand and gravel, which collapses back into the hole as the tool is extracted. While repeated advancement of the tool through the same interval could potentially reduce the amount of gravel that is present in the formation since sand will be more likely than gravel to fall back into the hole as the ROST tool is extracted, it seems unlikely that this phenomenon will significantly alter the overall formation characteristics.

However, because the protocols for ROST monitoring outlined in the RIP and OMM Plans are novel and have not been previously field tested to our knowledge, it is not possible to provide an assurance that repeated entry of the ROST tool across the narrow diameter space beneath the ROST Well will not adversely affect the ability to detect the presence of LNAPL. If over time it appears that results are anomalous, Chevron will evaluate and propose to USEPA alternatives to compensate for the anomaly, including an offset replacement of the ROST Well(s), or reliance instead on measurement for the presence of free-phase LNAPL in a traditional groundwater monitoring well, as is standard practice at most LNAPL sites.

The potential for the ROST measurements to present a means for enhanced LNAPL mobility is negligible, primarily because the pilot hole is so small (about 1-inch in diameter), relative to the size of the plume. Also, the ROST transects are located at the down-gradient toe of the plume, where the smear zone is only a few inches thick, and where residual LNAPL saturations are much lower than what would be necessary for LNAPL flow to occur.

Section 7.1, Engineering Controls

8. The RIP (page 7-1) states that "in general, basement and other sub-grade structures should not be constructed over the plume where the depth to the top of the smear zone is less than approximately 30 ft-bgs without a location and structure-specific analysis of the protective measure to be employed." This language does not appear consistent with the AOC. The AOC

(Section 16) specifically requires that "Chevron shall execute and record an Environmental Covenant imposing activity and use limitations upon the refinery and land farm portions of the facility that include no subgrade development." The RIP should be revised to clearly resolve this inconsistency with the AOC.

Paragraph 11.e of the AOC states "Respondent shall exercise best efforts to install vapor barriers in buildings in the Southwest Quadrant to prevent human exposure to any soil vapors reaching the ground surface exceeding the risk-based residential standards identified in the RIP/OMM Plan." Please update the RIP to include these risk-based residential standards required by the Order.

The referenced RIP text was intended to pertain to controls for construction of basements or other sub-grade structures at locations over the plume, but outside of the refinery and land farm portions of the Facility, where Chevron may not be able to control whether or not a subsurface structure is constructed. The referenced section has been revised to clarify requirements to be imposed by the Environmental Covenant for structures constructed on the refinery and land farm potions of the Facility, versus those for engineering controls for structures located over the plume but outside of these areas of the Facility.

RIP Section 7.1, second paragraph, has been revised to add the following first sentence: "In accordance with the 2006 Order, Chevron will exercise best efforts to convince the owner of any newly constructed buildings in the Southwest Quadrant to install vapor barriers at Chevron's cost to prevent human exposure to soil vapors reaching the ground surface exceeding the risk-based residential standards identified in the OMM Plan."

Section 7.1, Engineering Controls and Section 7.2 Institutional Controls

9. The RIP (page 7-1) states that Chevron is in a position to control future development (in the Southwest Quadrant located over the plume) since they recently purchased the property and thus own most of the land that has not already been developed. Thus, Chevron indicates that they will ensure that engineering controls are built into future design and construction plans. The next paragraph states that the need for engineering controls will be addressed during redevelopment planning for the former refinery property. However, because Chevron currently has control of both the on-site and some of the off-site property, no cost estimate is included nor does Chevron indicate that the financial assurance for engineering controls is necessary.

The RIP (page 7-2) states that Chevron has offered to fund the inclusion of engineering controls in structures built over the plume in the Southwest Quadrant. Regardless of which entity ultimately finances the engineering controls on structures built on the Southwest Quadrant or former refinery property, these costs should be included in the cost estimate.

The text states that the development and execution of the covenants is not anticipated to result in expenses beyond the time required for tailoring approved language to the site and project management time was added to the cost estimate in Appendix B. Engineering and institutional controls are expected to have both staff and management time associated with the implementation, and operation and maintenance or monitoring of the controls over the life of the remedy or remedies. While the Environmental Covenant with Ohio establishes an activity and use limitation upon the former refinery and land farm portions of the facility, there are no costs or expenses included in Appendix B for the institutional controls. Paragraph 16.a of the AOC states that Chevron assures that the activity and use limitations set forth in the Environmental Covenant are continually maintained so long as Chevron owns the facility. The third-party costs associated with the implementation and operation and maintenance or monitoring of the controls over the life of the remedy or remedies should be detailed in the cost estimate. Finally, page 6 of the RCRA Final Decision and Response to Comments on the Selection of Remedial Alternative for Groundwater, issued August 2006, indicates that most of the institutional controls will be in the form of the restrictive covenants that run with the land. However, Chevron is required to provide notice to existing and future owners of off-site properties that they should not install drinking water wells on their property. This cost has not been included in Appendix B. Revise the cost estimate accordingly.

A provision has been added to the costs estimates in the RIP, for potential future costs related to implementing deed restrictions on the former refinery property, for providing notice to down-gradient property owners regarding groundwater use restrictions, and for including engineered controls to prevent vapor migration into buildings that may conceivably be constructed in the Southwest Quadrant and in areas of the former refinery where construction is not precluded by the location of the 100-year flood plain.

Appendix B: Table 4

10. Chevron should provide an explanation for the line item "Total 5-year Maintenance Cost at 2% Inflation, 6% discount (present dollars)." The two percent inflation cost is accurate; however, no information is provided to substantiate the six percent discount on present dollars.

The reference to a 2% inflation and 6% discount rate was a remnant from an earlier version of the costs estimates and has been removed. Per CFR264.142, all cost estimates provided in the original submittal and in the attached update are in current dollars.

11. The construction and other cost estimates provided are poorly supported by the source of the cost data. If the cost data source is referenced, it is included in the notes section. For example, Table 5 references the Unit price for well rehabilitation and free product disposal costs from the 2001 Corrective Measures Study, and this value is adjusted for inflation. However, it appears that the operation costs/unit price is inaccurate. According to the 2006 ECHOS Environmental Remediation Cost Data-Unit Price 12th Edition Database, the unit costs for disposal of either hazardous ($3.01/gallon, adjusted for location) or nonhazardous used oil ($2.38/gallon, adjusted for location) is significantly more than the $0.78/gallon presented on Table 5. As another example, Table 4 assumes a unit price of $42.00/cubic yard for furnishing and placing riprap protection at the toe of the sheet pile wall. The ECHOS database provides a cost of $23.99/cubic yard, adjusted for location. Therefore, the cost estimates provided for these two assemblies or elements are too low in the first case and too high in the second case. In order for EPA to

adequately evaluate the cost estimate and ensure that financial assurance is sufficiently funded, revise Appendix B to provide substantiation for each line item associated with each component of each remedy.

Most costs were based on actual, recurring expenses, or on recent quotes from vendors to provide the materials or services at the Cincinnati Facility. For example, the hydrocarbon disposal unit rate is a conservatively high estimate based on actual disposal rates which Chevron is paying to Heritage Environmental Services, for transport to and disposal at their Indianapolis, IN facility. Rates for recovered hydrocarbon management vary widely depending on the price of oil, the quality of the recovered fuel, and the local market for recycling such materials. A recent quote from Heritage verifying that the unit rate shown in the cost estimates is appropriate for the fuel being recovered from the Cincinnati facility, is available upon request.

Where standard industry costs were utilized, they were generally from the RS Means database. Additional details have been provided in the updated cost estimates, regarding the basis or source for the costs.

GENERAL COMMENTS - OPERATION, MAINTENANCE AND MONITORING PLAN

1. The OMM Plan as written lacks the detail and rationale necessary to carry out this remedy. Paragraph 11 of the AOC states “Specifications for conducting the performance monitoring components of the selected remedy shall be included in the OMM Plan.”, these components as specified in subparagraphs 11.a – 11.i and this document does not sufficiently flush out the technical details to enable a clear map of what will take place in the following 42 years. The sampling schedule and frequency as established in the Final Decision/Response to Comments should be incorporated in the OMM Plan per paragraph 12.b of the 11/1/06 AOC. In places in the OMM Plan sampling schedules and frequency are not consistent with the Final Decision/Response to Comments.

   As noted in Chevron’s introductory response, the RIP and OMM Plans were prepared in context of Order negotiations that this is to be a performance based Order, and the USEPA’s RCRA Cleanup Reforms stated intent to move away from a proscriptive approach to RCRA corrective action. The proposed remedy will require continual adjustment, within the bounds of demonstrating continued protection of receptors and progress toward plume natural attenuation.

   The OMM Plan as originally submitted did provide plans for extensive long-term monitoring, including all monitoring components identified in the Order. There were minor instances where the monitoring frequency proposed in the OMM Plan was not consistent with that described in the Final Decision/Response to Comments, and they have been corrected in the attached version of the OMM Plan. Overall, we disagree that the OMM Plan as submitted, lacked the detail and rationale necessary to carry out the primary goal of the remedy, which is to protect human health and the environment by documenting long-term stability and natural attenuation of the plume.

Nevertheless, additional proposed details have been added to the OMM Plan, which will provide additional information above and beyond that called for in the Order, to assist with tracking plume stability and attenuation. Details regarding the additional proposed monitoring protocols are provided in the attached revised version of the plan, and discussed below with regard to subsequent specific USEPA comments.

2. Restarting the current site-wide groundwater recovery system is identified as a contingency in the OMM Plan. To avoid any confusion should the site-wide pumping system have to be restarted, the OMM Plan should provide a detailed summary of the program, including the specification of which production wells are used in the program and the pumping rates for each of these wells.

   Operation of the site-wide groundwater recovery system currently entails production of 1000 to 1600 gallons per minute, including from one or more production wells in the southwest area of the plume plus a production well located in the northern portion of the refinery for supply of supplemental oxygen-rich water to the GAC. While it may be beneficial to set general pumping rate goals for overall groundwater recovery (supplemental water is a function of recovered groundwater requiring treatment), it would not be practical to specify precise pumping rates for individual wells, as they are routinely impacted by a number of factors that may be beyond the control of operations personnel. While Chevron must maintain flexibility in the selection of production wells to carry out the contingency which has triggered the resumption of site-wide groundwater recovery, Section 1.0 of the OMM Plan has been revised to state proposed recovery pumping ranges as well as summarize those wells available for use should resumption of site-wide groundwater recovery system be necessary.

II. SPECIFIC COMMENTS

Section 3.3.1, LNAPL and Dissolved Phase Perimeter Plume Monitoring

1. The OMM Plan (page 3-3) indicates that downgradient plume monitoring will be performed at the point-of-compliance (POC) and sentinel wells, as well as the Rapid Optical Screen Tool (ROST) transects, on a semi-annual basis for the first five years, annually for the next five years (staggered for seasonality), biennially for the next ten years, and every five years thereafter. While this is consistent with the monitoring frequency established in the Final Decision Document for existing wells, this frequency is not consistent with that established for newly installed wells. The Final Decision Document (page 4) states that "whenever new wells are installed, Chevron will develop an initial data set for the new wells by sampling quarterly for the first two years." As shown in Table 3-1, two additional sentinel monitoring wells (MW-131 and MW-132) and two additional POC monitoring wells (MW-133 and MW-134) are proposed for installation to complete the sentinel and POC monitoring networks. These new monitoring wells should be sampled quarterly for the first two years in accordance with the Final Decision Document.

   OMM Plan Section 3.3.1 has been revised to address the exception to the above-referenced monitoring schedule to address monitoring of newly installed wells on a quarterly basis for the first two years following installation.

2. The OMM Plan (page 3-3) indicates that during ROST monitoring, "the tool will be advanced from approximately 5 feet above the water to approximately 5 feet below the water table." However, the text does not indicate how any changes in water table elevation will be accounted for. Chevron should provide a discussion of the potential impacts of seasonal and other fluctuations in the water table on the detection and monitoring of the leading edge of the light non-aqueous phase liquid (LNAPL) plume using ROST measurements.

   Water table data can be collected from ROST borings through piezocone penetration testing by conducting pore pressure dissipation testing. The cone is stopped at a suitable point while advancing the CPT, and the pore pressure is allowed to dissipate to hydrostatic pressure. A suitable soil would be a sand or silty soil. In sands a typical dissipation test can be completed in a few minutes. While it is possible to do dissipation testing in clays it is not practical as it can take from several hours to several days for the pore pressure to fully dissipate. However, the soil throughout the area of testing in the Southwest Quadrant is primarily sand and gravel, so this method will be attempted to verify the water table elevation during each sampling event. If this method proves ineffective, then water table elevations will be inferred from measurement with a fluid level probe in the nearest groundwater monitoring well. Section 3.3.1 of the OMM Plan has been revised accordingly.

3. When discussing the use of the ROST technology to monitor the stability of the LNAPL plume, the OMM Plan states that "the ROST screen results will provide an indication of the presence/absence of LNAPL at each location." A detailed description of the procedure for ROST monitoring should be provided. This procedure should include the following types of information: requirements for calibration of the instrument prior to measurement, the wavelengths/frequencies that will be monitored for fluorescence, evaluation of background fluorescence, and procedures for comparisons between ROST readings at specific locations. The procedure should clearly detail how the final determination will be made that LNAPL has been detected at a location where it has not previously been detected. The procedure should be included, as appropriate, as a standard operating procedure (SOP) in the facility's Quality Assurance Project Plan (QAPP).

   The ROST is a Tunable Dye Laser pumped by an ND-Yag Laser. The yag laser generates a pulsed light at 532 nm wavelength. Light is produced using a flash lamp which acts like a strobe. As the flash lamp ages the amount of light energy it produces decreases. The average usable life time of a flash lamp is 30 to 40 million flashes.

   The 532 nm Yag light is used to pump the dye laser. The dye laser produces light at 580 nm which is doubled to 290 nm then filtered to remove visible light. The 290 nm light is transmitted down the hole through a fiber optic line to the window. When the photons of light strike a ringed hydrocarbon molecule the photons are absorbed by the molecule, raising the energy state of the molecule. It returns to its natural state by releasing energy in the form of photons. Some of the photons are captured by a second fiber optic line and returned to the equipment on the surface. A monochrometer breaks the light (photons) into individual wavelengths of light and sends four wavelengths (340nm, 390nm, 440nm and 490nm) to a photomultiplier which converts the light into an electrical signal which can be measured with a digital oscilloscope. The digital signal is sent to the computer during testing.

Prior to each test the fluorescence signature of a standard mixture of synthetic motor oil is recorded. The standard has a known fluorescence signature and is used to standardize the ROST test. The power output of the laser can change due to environmental conditions (i.e. temperature, humidity, etc.) and aging of the components of the system. Use of the standard normalizes the data. The area of the waveform for the M1 Standard becomes 100% fluorescence intensity for that test. The area of each waveform taken during a test is given as a percentage of the area of the M1 Standard waveform.

The ROST probe is ideally advanced into the soil at a rate of 2 cm per second. Readings are taken at 1 second intervals. The readings are displayed on the computer monitor in real time and saved to disk. The computer displays two graphs, fluorescence intensity vs. depth and current fluorescence waveform. The fluorescence waveform graph updates every second during the test. Background fluorescence is generally 1 to 1.5 percent or less.

Prior to testing at a site, a sample of the products present on the site are tested on the ROST window in the laboratory to determine the signature of the product and the intensity of fluorescence. Different fuels have different signatures. Pure gasoline and diesel fuels generally have fluorescence intensities of 100% or more. Intensities between 100% and 1000% have been observed in free product plums at various diesel sites around the country. Because the age of the fuel can influence the signature and intensity, smear zones are generally below 100%. Each site is different and requires verification locally.

The ROST equipment will be operated by the ROST contractor, according to their standard operating procedures. Because ROST equipment operation is an evolving science, there are not currently detailed written protocols available that can be incorporated into the site QAPP. Chevron will work with the ROST contractor to develop a SOP that can be integrated to the QAPP at a future date. Section 3.3.1 of the OMM Plan has been revised to reflect the above discussion.

4. The OMM Plan discusses the "sporadic" and "multiple" detection of contaminants in the sentinel wells. The OMM Plan indicates that "sporadic" detection of contaminants in the sentinel wells does not necessarily confirm the indication of plume migration. The OMM Plan further states "however, confirmed detection over multiple events, or an increasing concentration trend over time in a given sentinel well will likely provide an indication of dissolved-phase plume down-gradient migration." This approach to evaluating the monitoring results from the sentinel well is not consistent with the requirements of the AOC. The AOC (Section 11.b.1) specifically requires that "if monitoring shows that groundwater in a sentinel well contains concentration of a Contaminant of Concern (COC) listed in Table 1 exceeding the Safe Drinking Water Act Maximum Contaminant Level (MCL), which exceedance is not due to low water table conditions, the sentinel well shall be sampled again in two months." The AOC further states that "if resampling confirms and exceedance of the MCL, respondent shall resume operation of the site-wide ground water recovery system." Based on this language, the AOC does not use the mere detection of a COC, but rather the exceedance of the MCL, as an indication of plume movement. Additionally, there is no provision for trend monitoring to identify plume movement.

   The OMM Plan should be revised to include an approach for evaluating monitoring data from sentinel wells that is consistent with the AOC. Chevron may wish to consider specifying a statistical approach for identifying significant increases of COC concentrations above MCLs. The approach to evaluating monitoring data from sentinel wells should also provide a detailed discussion, with appropriate justification, of how it will be determined that low water table elevations are responsible for the observed increase in a COC's concentration in groundwater.

The OMM Plan has been revised to clarify that continuous groundwater recovery pumping will resume if a Table 1 COC exceeds an MCL and is confirmed present above the MCL during a subsequent re-sampling event, which will be performed within two months. Rather than attempt to define in advance when a confirmed Table 1 COC detection above an MCL would be attributed to low water table conditions, Chevron will take a conservative approach and resume continuous pumping once the presence of a Table 1 COC above the MCL is confirmed. If subsequent analysis indicates that the confirmed exceedance is due to an anomalous low-water table condition, and not to actual plume migration, Chevron will follow-up with USEPA to discuss the rational and seek approval to discontinue pumping.

Section 3.3.2, Interior Plume Monitoring

5. A group of monitoring wells have been identified in Table 3-2 for interior plume monitoring. The stated purpose of this interior plume monitoring program is to track degradation trends in dissolved-phase groundwater COCs. Section 3.4.3 of the OMM Plan (page 3-7) further indicates that the results from interior plume monitoring "will be used to track progress toward the overall plume natural attenuation goals discussion in subsection 3.4.3."

The OMM Plan provides no discussion or rationale for the selection of the specific wells included in the Interior Plume Monitoring Network. However, if data from the interior plume monitoring wells are to be used to track progress toward the natural attenuation goals established for the facility, the selection of these interior plume monitoring wells must be justified based on a full analysis of natural attenuation in the plume and a carefully developed program of monitoring and data analysis designed to demonstrate that natural attenuation goals established for the facility are being achieved (see Specific Comment Nos. 7 and 17). The OMM Plan should be revised to provide adequate justification for the selection of interior monitoring wells intended to evaluate natural attenuation in the groundwater plume.

Chevron concurs that monitoring of wells within the plume interior should be based on a full analysis of natural attenuation processes within the plume. As described in the response to OMM Specific Comment #7, monitoring of COCs in groundwater wells within the smear zone will be one component of the MNA program. Also included in the program will be monitoring of LNAPL composition in smear zone soils, vapor monitoring of COCs in soil gas above the smear zone, and groundwater monitoring of geochemical parameters within the smear zone. This will provide a comprehensive representation of natural attenuation processes within the smear zone.

Chevron also notes that the monitoring of groundwater COCs in the smear zone must be done in the context of the MNA plan for the entire site. To address this, a description of groundwater COC monitoring both within and outside of the smear zone is presented below.
Based on the Conceptual Site Model, groundwater COC concentrations are expected to be non-

detect up-gradient of the smear zone, relatively high within the smear zone, intermediate within the transition zone, and non-detect down-gradient of the transition zone, near US 50. The MNA plan has been designed to monitor COC concentrations in wells in each of these areas. Note that sampling wells have been added to the set proposed in the original draft OMM Plan in order to ensure adequate characterization of each zone. Groundwater COC concentrations will be monitored in all of these wells to provide a complete picture of spatial trends as one line of evidence relative to natural attenuation. In addition, the groundwater COC concentrations within the smear zone will be analyzed for temporal trends. Historical data for BTEX constituents in wells within the smear zone indicate a trend of decreasing concentrations versus time. The MNA plan will continue collection of this data, measuring all of the COCs listed in Table 2-1, not just BTEX.

The wells selected for monitoring of groundwater within the smear zone provide a relatively even sampling distribution for this area. Recognizing that groundwater generally flows from north to south in this area, the wells were selected to provide multiple samples from up-gradient to down-gradient. An example is the north-south alignment of monitoring wells MW-21, MW-18R, and MW-58S. In addition, multiple wells are located along some east-west transects such as MW-96S, MW-20S, and MW-88. This will allow for evaluation of groundwater COC concentrations in areas where the groundwater flow direction deviates from the general north to south trajectory.

Wells located within the smear zone are expected to contain groundwater COC concentrations above MCLs until the later years of the remedy. Thus, early monitoring will be used to estimate rates of natural attenuation, rather than direct comparison to MCLs. Estimates of natural attenuation rates will be based on direct temporal trends in COC concentrations within the smear zone over time. The rates will also be estimated based on secondary lines of evidence, such as spatial and/or temporal trends in geochemical parameters. These estimates of natural attenuation rates are discussed in detail in the response to OMM Specific Comment #7

The OMM Plan has been revised to incorporate additional detail regarding the selection of interior monitoring wells intended to evaluate natural attenuation in the groundwater plume.

6. OMM has identified a set of interior plume monitoring wells that will be used to collect data to track degradation trends in dissolved-phase groundwater COCs (see Specific Comment No. 5). The OMM Plan indicates that these wells will be sampled on a semi-annual basis for the first four sampling events, in order to establish COC baseline data. Thereafter, these wells will be sampled only on a five year-year interval, six months prior to each five-year review. No justification for this sampling frequency has been provided.

As previously indicated in Specific Comment No. 5, the details of the interior plume monitoring program should only be specified in the context of a carefully developed program of monitoring and data analysis designed to demonstrate that natural attenuation goals established for the facility are being achieved. Such a program is not currently provided in the OMM Plan (see Specific Comment Nos. 7 and 17). It is important to note, however, that the monitoring frequency currently specified for the interior monitoring wells does not appear to meet the requirements of the Region 5 Framework for Monitored Natural Attenuation Decisions for Groundwater (Region 5 MNA Framework). The Region 5 MNA Framework requires that historical groundwater data used to demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration should be based on at least two years of quarterly sampling to evaluate seasonal effects on the contaminant concentrations. After this initial period of quarterly monitoring, it may be appropriate to reduce the sampling frequency somewhat. However, it does not appear that monitoring once every five years will provide an adequate basis for a meaningful trend analysis. The OMM Plan should be revised to include a suitable frequency for monitoring wells intended to identify trends in decreasing contaminant mass and/or groundwater concentrations.

Chevron has monitored groundwater BTEX concentrations within the smear zone wells since 1989 on at least a semi-annual basis. BTEX concentrations for the wells which are proposed for long-term monitoring, and for which historical data is available, have been plotted versus time and are presented in Appendix B to the OMM Plan. For most wells, the BTEX concentrations have decreased during this period. Moving forward, these trend graphs will be updated and BTEX degradation rates will be calculated for the wells included in the MNA Plan.

Because semi-annual monitoring of BTEX concentrations has already been performed for the smear zone wells, and the general weight of evidence indicates decreasing concentrations with time, Chevron maintains that the existing data set is adequate to provide the baseline trend information that is specified in the Region 5 MNA Framework. As described in the OMM plan, Chevron proposes sampling these wells for the COCs in Table 2-1 on a semi-annual basis. This will allow for the continued calculation of BTEX half-lives and tracking of COC degradation trends. After the first two years of the MNA program, sufficient data will have been collected to characterize seasonal variations in these trends. Also, semi-annual monitoring for two years will establish an appropriate baseline for wells with limited existing data, as seasonal variations in groundwater quality at the site tend to be correlated to the water table elevations, which tend to vary on a semiannual cycle, with lower water tables in mid summer to early winter, and higher groundwater elevations from early winter into early summer.

Because natural attenuation of the COCs is expected to occur over many years, the collection of high-frequency data will not add any additional clarity to the overall long-term trends. Nevertheless, the proposed long-term MNA parameter monitoring frequency has been revised to once per year in years 3 through 12, and once every two years thereafter, so that a more frequent interim analysis of continued trends may be performed.

Section 3.3.3, Monitored Natural Attenuation (MNA) Monitoring

7. The OMM Plan has not provided a clear and well-developed conceptual site model (CSM) of the natural attenuation processes that are expected to control and reduce contaminant mass and groundwater concentrations at the facility. Such a CSM is required by the Region 5 MNA Framework and typically includes the identification and description of all physical and biological processes that are expected to impact contaminant concentrations. The CSM also clearly identifies which constituents will be impacted by natural attenuation and describes the geochemical conditions that are necessary for the required biotic or abiotic reactions to occur, thereby providing a basis for the subsequent evaluation of MNA data. The CSM should also clearly identify source areas, groundwater flow directions, and anticipated contaminant migration pathways, both vertical and horizontal.

The OMM Plan has provided an extensive list of MNA parameters that will be routinely monitored (Table 3-3). Preliminary review of these parameters indicates that these are appropriate and sufficient for MNA monitoring of contaminant plumes comprised of petroleum hydrocarbons. The general purpose for each constituent has been identified in Table 3-4. However, no discussion has been provided regarding the conditions (concentrations or values) expected for each of these parameters in order to demonstrate effective natural attenuation of contaminants, additionally discussion of the Data Quality Objectives (DQOs) for these parameters. Similarly, no discussion has been provided of how these values are expected to vary throughout the plume and with time as remediation progresses via natural attenuation. The monitoring wells that will undergo routine monitoring for MNA parameters are shown in Figure 3-4. Only a limited set of wells has been identified for MNA monitoring, and these well are primarily located along the downgradient edge of the plume and beneath Hooven. The rationale for this distribution of wells is unclear. Additional wells in a more centrally located area of the plume appear to be necessary to evaluate natural attenuation throughout the plume.

The OMM Plan should provide a well-developed and detailed CSM for natural attenuation processes at the site. All aspects of the MNA monitoring program, including well locations, sampling parameters, and sampling frequencies, should be developed and justified based on this model.

The groundwater conceptual site model (CSM) has been discussed in past documentation submitted to USEPA regarding the site. In particular, the June 2005 Document titled "Update to Site Conceptual Model and Summary of Remedial Decision Basis, Chevron Cincinnati Facility", provided a comprehensive review of the CSM. In order to further update and integrate the CSM to the OMM Plan, an updated illustration of the groundwater CSM has been added to the OMM Plan as Figure 2-2. Figure 2-3 also pertains to the CSM, as it provides a cross-section of the subsurface conditions underneath Hooven. The following description of the CSM has been integrated to the OMM Plan text.

The primary attenuation pathways linked to the plume degradation are as follows:

1. *Dissolution of COCs from LNAPL in smear zone soils and subsequent biodegradation. Aerobic biodegradation is expected to be an important process at the periphery of the smear zone. Anaerobic biodegradation is expected to be the dominant process within the smear zone, and within the transition zone immediately downgradient of the smear zone. This trend of aerobic to anaerobic biodegradation is expected to occur in both the lateral and vertical dimensions:*

    - *Lateral dimension – groundwater upgradient of the smear zone will provide water with significant dissolved oxygen. This oxygen will be consumed via aerobic biodegradation as groundwater moves laterally into the smear zone. Subsequently, anaerobic processes will occur. A previous natural attenuation study identified sulfate reduction, nitrate reduction, ferric iron reduction, and methanogenesis as anaerobic processes occurring at the site.*

- *Vertical dimension – infiltrating groundwater from the ground surface, especially following precipitation events, will provide additional dissolved oxygen to the groundwater within the smear zone. Therefore, COCs in the upper portion of the aquifer will undergo aerobic biodegradation to some extent. Below the smear zone, aerobic processes may also contribute to biodegradation, although to a lesser extent, as sampling of "deep" groundwater has measured low dissolved oxygen concentrations.*

2. *Volatilization of COCs from LNAPL in smear zone soils and subsequent biodegradation in overlying soil gas. Degradation in this phase is thought to be primarily aerobic.*

The natural attenuation rates are expected to show some seasonal variation, with the primary driver of this variation being water table elevations. In periods when the water table is high, then the amount of groundwater entering the smear zone from upgradient will be larger than when the water table is low. This will tend to increase the amount of partitioning of COCs to groundwater and the supply of electron acceptors, leading to increased biodegradation. However, during these periods when the water table is high, the amount of smear zone exposed to soil gas will be small compared to when the water table is low. This will have the effect of decreasing the amount of volatilization of COCs to soil vapor and subsequent biodegradation.

Finally, the amount of COCs that are depleted from the smear zone is expected to change over the long term. Many models simplify natural attenuation as a first-order process, meaning that the amount of attenuation of a COC at any given time is proportional to the concentration of the COC at that time. While this is a simplification of the complex partitioning/degradation system, it does provide for a general picture of the future of natural attenuation processes at the site. At some point in the future, the amount of COCs that are attenuated from the smear zone will be small compared to that in previous years. This is because the COC concentrations will have decreased in the LNAPL and the vapor and groundwater "daughter" phases. However, the COC concentrations will continue to decrease, though at a lower rate, indicating continued natural attenuation processes. Only when COC concentrations are extremely low (presumably when they are lower than MCLs in groundwater) would natural attenuation no longer be a viable process.

Attenuation processes via both the groundwater and the vapor pathway will be monitored by the OMM plan. In groundwater, COCs and geochemical parameters will be monitored in wells upgradient, within the smear zone, in the transition zone, and downgradient near US 50. In soil gas, vapor concentrations will be monitored in nested wells installed in the vadose zone. Below is a discussion of DQOs for monitoring these natural attenuation pathways.

<u>Step 1 – State the Problem</u>
Monitored natural attenuation processes must be tracked. Attenuation occurs as COCs partition from LNAPL in the smear zone and are subsequently consumed via aerobic and anaerobic biodegradation in both the aqueous and vapor phases.

<u>Step 2 – Identify the Decision</u>
Qualitative evidence of natural attenuation and quantitative estimates of natural attenuation rates of COCs based are desired.

<u>Step 3 – Identify Inputs to the Decision</u>

Because natural attenuation in groundwater and vapor occurs via multiple steps (dissolution of COCs from smear zone soils, followed by biodegradation of COCs in groundwater, and volatilization of COCs from exposed smear zone soils and dissolved phase groundwater into vadose zone soil and subsequent biodegradation), multiple sets of data will be collected. The first set is dissolved COCs in groundwater. The COCs are listed in Table 2-1. The second set is geochemical parameters in groundwater. These parameters are listed in Table 3-3. The third set is COCs and related indicator parameters in soil vapor. The COC data can be used directly to identify natural attenuation processes; decreasing COC concentrations in groundwater within the smear zone over time are indicators of natural attenuation. The COCs concentrations can also be used in conjunction with geochemical data. The rate of dissolution of COCs can be estimated by comparison of COC concentrations upgradient and within the smear zone. Similarly, the rate of consumption of electron acceptors, and generation of reduced species, can be estimated by comparison of geochemical trends upgradient to within the smear zone. Taken together, the sum of these processes provides an estimate of the natural attenuation rate.

<u>Step 4 – Define the Boundaries of the Study</u>

***Lateral dimension** - Upgradient of the smear zone, groundwater supplies electron acceptors for biodegradation. Within the smear zone, COCs will partition to groundwater. The electron acceptors provided by the upgradient water are used in biodegradation processes. Immediately downgradient of the smear zone (i.e., the "transition zone"), COCs no longer partition to groundwater. In this transition zone, biodegradation processes continue until the COCs are consumed. Downgradient of the transition zone, biodegradation processes no longer occur as the COC concentrations have been depleted.*

***Vertical dimension** – Above the smear zone, water infiltrates vadose zone soil during precipitation events. Some of this water migrates to the top of the groundwater. This water is expected to supply electron acceptors, especially dissolved oxygen, that are used in biodegradation processes. Below the smear zone, some groundwater may enter the smear zone during periods of water table rise. Based on previous investigations, this water likely provides lesser amounts of dissolved oxygen, as well as other electron acceptors that are used in anaerobic biodegradation processes within the oxygen-depleted, contaminant rich portions of the plume.*

<u>Step 5 – Develop a Decision Rule</u>

Spatial trends in geochemical parameters will be used to qualitatively demonstrate that natural attenuation is occurring. Because each of the geochemical parameters listed in Table 3-3 plays a different role in natural attenuation processes, the decision rule for each parameter is also different. The decision rules for the individual parameters have been added to the OMM Plan as Table 3-5.

The decision rule for all organic COCs are the same. To demonstrate natural attenuation processes qualitatively, COC concentrations up-gradient of the smear zone should be low/non-detect. Within the smear zone, COC concentrations should be higher than any other concentrations in the study area. Within the transition zone, COC concentrations should be intermediate to low. Downgradient of the transition zone, COC concentrations should be low/non-detect.

The rate of natural attenuation will be estimated for each sample event based on the spatial distributions of geochemical parameters and COCs. Both sets of data will be input to the calculation so that the rate of dissolution and the rate of subsequent biodegradation can be estimated. The rate of natural attenuation will also be estimated by plotting COC concentrations vs. time.

Step 6 – Specify Tolerable Limits to Decision Errors
Natural attenuation will be demonstrated qualitatively by consideration of spatial trends in geochemical parameters and COCs. Natural attenuation rates will also be estimated quantitatively using both approaches described in Step 5 above. Also, though not discussed in detail here, natural attenuation processes will also be monitored by measurement of LNAPL composition in smear zone soils. All of these approaches considered together will be used to provide a weight of evidence of natural attenuation processes. Natural attenuation will not be considered to be a viable remedy if none of these approaches demonstrates ongoing natural attenuation.

Step 7 – Optimize the Design for Obtaining Data
The spatial distribution of monitoring wells is described in the Responses to RIP Comment #2 and OMM Comment #5. Note that a number of wells have been added to the sampling list in order to characterize the entire study area. The wells have been selected to provide relatively even spatial coverage of the aquifer upgradient, within the smear zone, within the transition zone, and downgradient of the transition zone near US 50.

As described in the OMM plan, Chevron proposed that these wells will be sampled on a semi-annual basis for the first two years of the MNA process. This will allow for evaluation of geochemical parameters and COCs at both high and low water table elevations. The water table elevations and groundwater flow directions, important inputs to quantitative estimates of natural attenuation rates, will be determined by the semi-annual fluid level gauging described in Section 3.3.5 of the OMM. After the first two years, it is anticipated that the effect of different water table elevations will be sufficiently characterized. Thus, after the first two years, the sampling frequency will be reduced to annually for the next ten years, and every two years thereafter, with the sampling event varied between different times of the year to account for seasonal effects.

8. The sampling frequency for monitoring MNA parameters is specified as semi-annual for the first two years. Thereafter, these wells will be sampled only on a five year-year interval, six months prior to each five-year review. No justification for this sampling frequency has been provided. The sampling frequency for MNA parameters should be based on the CSM for natural attenuation established for the site (see Specific Comment No. 7). The frequency should be sufficient to verify expected trends in parameter values.

   As described in the Response to OMM Specific Comment #7, natural attenuation rates are expected to show some seasonal variation. The primary driver of this variation will be the water table elevation in the smear zone. A high water table elevation will mean a larger contact area of groundwater with the smear zone, increasing the supply of electron acceptors and therefore increasing the attenuation rate via the groundwater pathway. The high water table will also mean a lower contact area of soil gas within the smear zone, decreasing the amount of volatilization and therefore decreasing the attenuation rate via the vapor pathway.

The seasonal variation in groundwater elevations at the facility can be divided into two sets: seasonal high water elevations (typically mid-December to mid-August) and seasonal low water elevations (mid-August to mid December). This variation is driven primarily by regional groundwater conditions, which are likely influenced by seasonal precipitation trends. A previous natural attenuation investigation performed during these two periods (April and November 2002) did not identify significant temporal variation in most groundwater geochemical parameters. It did identify higher COC concentrations in smear zone groundwater in November than April. Chevron proposes testing confirming these past results and providing a solid baseline with semi-annual sampling for the first two years of the MNA program. Once the data trends have been established by the two years of semi-annual sampling, the sampling frequency will be reduced to annually for the next ten years, then every two years thereafter, with the sampling varied between spring and fall in alternating years to assess seasonal effects on natural attenuation processes. This long-term frequency is appropriate to the time-scale over which degradation is expected to occur. With progress toward the end remedial goals expected to occur over the next few decades, staggered annual sampling in years 3 through 12 and biennial sampling thereafter, will provide an appropriate level of detail needed to track degradation trends and progress.

9. The OMM Plan provides for no routine monitoring of the LNAPL within the LNAPL plume. Since reduction in contaminant mass via natural attenuation mechanisms within the LNAPL plume is expected to play an important role in site remediation, a program of routine sampling and analysis of LNAPL throughout the LNAPL plume should be developed and included in the OMM Plan. This routine LNAPL sampling and analysis plan should be based on a thorough analysis of the changes expected in LNAPL composition over time and should include sampling throughout the vertical extent of the LNAPL smear zone to verify that the expected changes in LNAPL composition are, in fact, occurring.

The changing chemical composition of LNAPL within the smear zone over time is an important indicator of natural attenuation processes. Specifically, the amount of COCs in smear zone soils should decrease over time as they are depleted from the LNAPL. Thus, Chevron proposes collecting soil samples from the smear zone for analysis of the COCs listed in Table 2-1 and for a modified TPH analysis that provides general information about the range of hydrocarbons in the sample.

The soil samples will be collected from the 4 locations shown in Figure 3-4. These locations are oriented along the smear zone axis, moving upgradient to downgradient. At each location, three soil samples will be collected: from the top, middle, and bottom of the smear zone. Because the attenuation of COCs in LNAPL is expected to take many years to demonstrate statistically meaningful changes, samples will generally be collected once every five years, preceding the five-year progress reviews specified in the Final Remedy.

To the extent feasible, Chevron will attempt to extract LNAPL from the soil samples. This will allow for direct conversion of COC concentrations to mole fractions in LNAPL. These mole fractions will be plotted vs. time to estimate the rate of natural attenuation of the COCs. This will be a line of evidence for natural attenuation that will be considered along with trends in groundwater and vapor.

It is expected that, as the amount of LNAPL decreases in smear zone soils over time, it may become infeasible to extract sufficient volume of LNAPL from the soil samples for laboratory analysis. In these cases, the soil samples will be analyzed directly for the COCs and modified TPH. Issues of heterogeneity of soil samples may mean that, at best, these results will be useful as qualitative evidence of natural attenuation. Valid quantitative estimates of natural attenuation rates may not be practicable for these soil sampling results.

Section 3.3.4, River Monitoring

10. The OMM Plan provides no schedule for monitoring three hyporheic zone wells during long-term monitoring. Revise the OMM Plan to include the monitoring schedule of these hyporheic zone wells.

Chevron's intent in Section 3.3.4 of the OMM Plan was to provide only a preliminary overview of the form that a long-term River monitoring program would take, not to seek approval for the plan. As provided for in Section 11 of the Order, the long-term River monitoring plans will be specified in the detailed River Stabilization engineering designs, which will be submitted to USEPA on a separate tract per the schedule outlined in the Order and the approved River Engineering Analysis Report. This approach is necessary because the placement and design of long-term River monitoring infrastructure will be dependent on the exact alignment and design of the River bank stabilization measures.

Section, 3.3.5, Fluid Level Monitoring

11. The OMM Plan indicates that fluid levels will be monitored both manually and using data logging probes. The network of wells that will be subject to manual fluid level monitoring is shown on Figure 3-6 and appears extensive. The network of monitoring wells in which data logging probes will be installed are shown on Figure 3-5. These wells are limited in number and appear to be concentrated in downgradient areas of the plume, particularly at the leading edge of the plume and beneath Hooven. No explanation has been provided for the selection of the location of the wells in which data logging probes will be installed. The OMM Plan should be revised to provide a rationale and justification for selecting the monitoring wells in which data logging probes will be installed.

The network of monitoring wells in which data logging probes are to be installed for purposes of LNAPL and dissolved-phase plume monitoring are concentrated down-gradient of the plumes because this is where tracking for potential plume migration and protection of the River is most critical. The OMM Plan will be revised to clarify the basis for selecting monitoring wells in which data logging probes in support of plume monitoring are to be installed.

12. The OMM Plan indicates that transducers will be used to monitor fluid levels. The OMM Plan indicates that the data will be downloaded from the transducers as driven by the data needs and the memory capacity of the transducer. The data needs and the memory capacity are not included in this section. Revise the OMM Plan accordingly.

Data collected by data logging probes in support of plume monitoring will be used to map *groundwater gradients, radius of influence during production well operations, and drawdown to calculate specific capacity of production wells. The memory capacity of data logging will be sufficient for the site's needs, as the data will be downloaded at least quarterly. The probes have 1MB of memory, and at the anticipated logging rate of one reading every day, there is over 30,000 days of data storage capacity. The OMM Plan has been revised to include this information.*

13. The OMM Plan indicates that water level gauging will be performed on a bi-monthly basis, with the frequency increasing to monthly when groundwater is below the trigger level established at monitoring well MW-20S. A bi-monthly frequency for monitoring water levels does not appear adequate for first identifying the low groundwater elevations that may result in initiation of high-grade pumping. A much more frequent groundwater elevation monitoring program, particularly in those wells that are used to assess the viability of high grade pumping, appears appropriate during the season when drought or low water-level conditions are likely to occur. The frequency for the fluid-level monitoring should be increased to provide an adequate notification so that conditions potentially favorable for the high-grade pumping may be developing. Consideration should be given to a weekly schedule in select wells during the summer and fall.

During periods when high-grade pumping is not being conducted, weekly operational manual fluid level gauging is performed in a group of monitoring wells deemed representative of area groundwater level trends and critical to monitoring for trigger levels associated with the proposed high-grade area. See also response to USEPA OMM specific comment #24 for additional details.

Section 3.4.1, LNAPL and Dissolved Phase Perimeter Plume Monitoring

14. The OMM Plan indicates that once the site-wide groundwater recovery system is restarted in response to the confirmed detection of LNAPL or COCs above MCLs in a sentinel or POC well, "operation of the groundwater recovery system will cease should future monitoring confirm the absence of LNAPL and that the concentrations of all COCs listed in Table 2-1 are less than MCLs." However, operation of the site-wide groundwater recovery system may itself become responsible for the improvement in COC concentrations in groundwater and potentially, though not as likely, for movement of LNAPL in the LNAPL plume. Thus, it would not be appropriate to stop the site-wide groundwater recovery unless it was clearly demonstrated that, once the operation of the recovery system was stopped, exceedance(s) in COCs concentrations or further movement of LNAPL was not likely to occur. Such a demonstration would require EPA's review and approval. The OMM Plan should be revised accordingly.

The OMM Plan has been revised to indicate that, should continuous groundwater pumping be resumed during the Final Remedy, USEPA concurrence will be obtained prior to again discontinuing continuous pumping, should an analysis indicate that the continuous pumping is no longer necessary or beneficial.

15. The OMM Plan (Section 3.3.1) establishes a set of general plume monitoring wells in addition to the sentinel and POC monitoring wells. These wells are identified in Table 3-1 and their locations are shown on Figure 3-2. The OMM Plan (page 3-4) indicates that these wells will be sampled at the same frequency as the sentinel and POC wells and further states that the samples

will be "analyzed for groundwater COCs listed in Table 2-1 for comparison against MCL standards." Performance metrics or contingencies have not been provided for these general plume monitoring wells in Section 3.4.1 of the OMM Plan. The OMM Plan should be revised to more clearly indicate how the groundwater quality data from the general plume monitoring wells will be evaluated and if these data will be used to trigger any contingent actions.

General plume monitoring wells were established to provide supplemental data to track overall plume degradation trends. MCLs will be exceeded for many years to come in these wells; however, tracking of their long-term trends will provide additional data regarding the activity of attenuation processes. Monitoring results will be graphed, and a continued, long-term declining trend in COC concentrations will be taken as an indication of attenuation progress. If an increasing concentration trend is noted in any of the general plume monitoring wells at the second 5-year review, additional corrective actions in the area of the affected well will be evaluated and proposed to USEPA. Section 3.4.1 of the OMM Plan has been revised accordingly.

16. The OMM Plan (page 3-7) states that "if ROST or fluid level monitoring detects LNAPL in an inner ROST boring located outside the current smear zone boundary, then operation of the site-wide groundwater recovery system will be resumed." Based on the design details provided in Figure 4-3 of the RIP, it does not appear that it will be possible to monitor fluid levels at the ROST locations. This apparent discrepancy between the OMM Plan and the RIP should be reconciled, as appropriate.

As discussed in Chevron's response to USEPA specific RIP comment #2, pore pressure testing will provide a means of identifying the approximate water level in ROST well. However, the sole basis for indication of LNAPL mobility in a ROST well previously located outside the smear zone will be a fluorescence above background (as established during each ROST coring event), and the sole indicator of LNAPL mobility in a groundwater well will be the detection of LNAPL with a fluid level monitoring probe. The OMM Plan text has been revised accordingly.

Section 3.4.3, Monitored Natural Attenuation Monitoring

17. The AOC (Section 11.f) requires that "periodic long term monitoring of the plumes and five-year review of the progress of natural attenuation, *as specified in the RIP/OMM Plan*, shall be conducted by the Respondent [emphasis added]." However, the OMM Plan provides no program of data analysis to evaluate the progress of natural attenuation. The OMM Plan should be revised to provide a detailed program of data analysis and evaluation that is capable of demonstrating that reductions in contaminant mass and concentrations via natural attenuation are sufficient to meet remedial goals for the site. This data analysis program should be based on the detailed CSM for natural attenuation processes at the site that was used to establish the MNA monitoring program (see Specific Comment No. 7). The data analysis program should address contaminant mass reductions in the LNAPL plume as well as in the dissolved-phase plume.

Below is a summary of the data analysis program that has been incorporated to the OMM Plan.

Qualitative Evidence of Natural Attenuation Processes

- *The data for groundwater geochemical parameters and COC concentrations for each sampling event will be analyzed for spatial trends. The analysis will group the sample locations into these categories:*
  - *Upgradient of the smear zone*
  - *Within the smear zone*
  - *Within the transition zone immediately downgradient of the smear zone*
  - *Downgradient of the transition zone near US 50*
- *The data for groundwater COC concentrations will be analyzed for temporal (i.e., from sampling event to sampling event) trends in the wells within the smear zone.*
- *The data for vapor COC concentrations in soil gas will be analyzed for trends in the vertical direction.*
- *The data for vapor COC concentrations in soil gas will be analyzed for temporal trends.*
- *The data for soil/LNAPL COC concentrations and TPH fingerprint analysis will be analyzed for temporal trends.*

Quantitative Estimates of Natural Attenuation Rates

- *Natural attenuation rates via the groundwater pathway will be estimated using the spatial trends in geochemical parameters and COC concentrations:*
  - *The differences in geochemical parameters moving upgradient to within the transition zone will be calculated, and stoichiometrically converted to equivalent changes in hydrocarbon mass.*
  - *The differences in COC concentrations moving upgradient to within the smear zone will be calculated.*
  - *The sum of the two bullets above will be an estimate of natural attenuation rates via the groundwater pathway.*
  - *The same process will be used for the transition zone and downgradient of the transition zone near US 50, with appropriate consideration given to the absence of a collocated smear zone source for COCs in these areas.*
- *Natural attenuation rates via the groundwater pathway will also be estimated by plotting COC concentrations vs. time for wells within the smear zone.*
- *Natural attenuation rates via the vapor pathway will be estimated using vertical trends in COC vapor concentrations and other soil gases, such as oxygen, carbon dioxide, and methane.*
- *Natural attenuation rates of COC's from LNAPL will be estimated using the temporal trends in COC mole fractions in LNAPL.*

Section 3.4.4, River Monitoring

18. The paragraph entitled "Short-Term Monitoring" indicates that the results of the dissolved-phase groundwater and river monitoring will be compared to the Ohio EPA surface water standards. However, the Ohio EPA surface water standards have not been provided in the OMM Plan. Revise the OMM Plan to include the Ohio EPA surface water standards.

As stated in Chevron's Response to USEPA Comments, Evaluation of Engineering Options Along the Great Miami River, Chevron Cincinnati Facility, Hooven, Ohio *dated April 30, 2007, and discussed during a subsequent phone conversation between Chevron and the USEPA, development of the Ohio surface water standards is being performed in conjunction with design* *on the River bank stabilization engineering controls and an associated long-term River Monitoring Plan. The OMM Plan has been revised accordingly.*

Section 3.4.5, Fluid Level Monitoring

19. The OMM Plan (page 3-9) indicates that "additional details regarding proposed progress metrics related to LNAPL thickness monitoring results and the long-term plan for high-grade operations will be included in the plan that Chevron will submit to the USEPA by October 31, 2008." It is presumed that the referenced plan is the "criteria for determining that High Grade Pumping is no longer contributing to reducing the timeframe for reaching the groundwater cleanup standards" that the AOC (Section 11.a) requires to be submitted within two years of the effective data of the AOC. To avoid confusion, the OMM Plan should be revised to clearly indicate the context in which the referenced plan will be submitted.

    The above-referenced OMM Plan text has been revised to state "In accordance with the 2006 Order, additional details regarding proposed progress metrics related to LNAPL thickness monitoring and the future of the high-grade operation as it relates to the timeframe for reaching the groundwater cleanup standards will be addressed in the plan that Chevron will submit to USEPA by October 31, 2008."

Section 4.1, Component Description

20. The OMM Plan states that "although the remaining LNAPL has been shown to be stable, additional recovery will further increase certainty regarding LNAPL stability at the lowest natural water table conditions." While a short-term test suggests that the LNAPL plume is stable, the long-term stability of the LNAPL plume under natural groundwater flow conditions has not, as yet, been clearly demonstrated. The long-term stability of the LNAPL plume will be demonstrated by the long-term monitoring program established in the OMM Plan. The above-referenced statement should be revised accordingly.

    As previously noted, the LNAPL and dissolved phase plume stability are indicated not just by the 2005 short-term shut-down tests, but also by extensive monitoring and analysis, including LNAPL residual saturation, LNAPL frequency, thickness, and recovery trends, and declining or stable dissolved phase constituent trends. The above-referenced OMM Plan text has been revised to state that "Although extensive testing and analysis, as well as short-term containment shut-down testing suggests that the LNAPL plume is stable, long-term stability of the plume will be demonstrated by the long-term monitoring programs detailed in this Plan. Additional high-grade recovery will provide further assurance against potential LNAPL mobility at the lowest natural water table conditions…"

21. Groundwater elevation trigger levels will be used to initiate and terminate seasonal high-grade pumping. Trigger levels have been identified for five monitoring wells in the southwestern portion of the plume. However, the basis used for establishing these trigger levels has not been provided. Since it is expected that these trigger levels will have to be adjusted over time as the removal of LNAPL progresses, it is important that the criteria or basis for identifying and adjusting trigger levels be firmly established. The OMM Plan should be revised to provide a detailed discussion of the factors that influence the establishment of groundwater elevation trigger

levels. This discussion should provide the criteria that have been and will be used in the future to establish these trigger levels.

When discussing trigger levels, the OMM Plan indicates that the seasonal high-grade pumping will only partly rely on groundwater elevation trigger levels to initiate and cease high-grade pumping. The OMM Plan indicates that the decision to initiate or cease high-grade operations will also be based in part on whether LNAPL is recoverable. This implies that trigger levels will not be set based on whether LNAPL is recoverable (i.e., at groundwater levels where LNAPL begin to collect in monitoring wells). The discussion in the OMM Plan should be expanded to clarify how the recoverability of LNAPL is to be determined and to explain why such considerations are not implicit in the establishment of trigger levels.

The OMM Plan has been revised to provide additional background regarding the development of trigger levels and their application to high-grade pumping based on the following high-grade operations plan:

Pumping Triggers

The goal of high-grade pumping is to use groundwater extraction to maximally expose the smear zone for hydrocarbon drainage and recovery during the seasonal low water table period that occurs in most years. Maximal exposure of the smear zone occurs when the water table is drawn down to just below the previous depth of maximum exposure. The previous depth of maximum exposure can be approximated as the minimum historical water table elevation at monitoring locations within the smear zone. Thus, the minimum historical water table elevation is used to establish targets for high-grade pumping. Prior to high-grade pumping, the pumping targets are simply the historical low water table elevations on record, most of which occurred during the drought in 1999. With each successful high-grade event, the depth of maximum smear zone exposure will be lowered slightly to induce hydrocarbon drainage, thereby establishing new, lower pumping targets for high-grade pumping in the following year.

Historical fluid level trends and operational data suggest that hydrocarbon recovery via high-grade pumping will only be possible in years when pumping lowers the water table elevation below the pumping targets. Pumping triggers will be used to determine when high-grade pumping can be expected to achieve pumping and recovery targets. Pumping triggers are defined by the following equation:

Pumping Trigger $= PT_i + s_{i,j}$

Where:

PT_i *= Pumping target of the* i^{th} *monitoring well location; value is the historical minimum water table elevation in feet above mean sea level*

$s_{i,j}$ = Expected drawdown at the i^{th} monitoring well location caused by pumping at the j^{th} production well

As noted by the subscripts in the above equation, pumping triggers are location-specific with respect to the monitoring location and the high-grade pumping well. Prior to each high-grade season, new pumping triggers will be calculated as follows. First, pumping targets will be established by analyzing the fluid level data from the preceding high-grade event. New pumping targets will be established at locations where the water table was lowered to a new minimum elevation. Otherwise, pumping targets from the preceding year will be carried forward. The expected drawdown will be based on fluid level monitoring during prior high-grade pumping events. Drawdown created by PROD_20 and PROD_19 has been measured during the 2005 and 2006 high-grade tests, respectively. Other pumping locations will require a pumping event to estimate drawdown. For example, pumping trigger calculations for the 2007 monitoring locations are shown below.

Table 4-1 High-Grade Trigger Levels for 2007

Monitoring Well	Historical Low Groundwater Elevation (feet MSL)	Date of Historical Low Groundwater Elevation	Drawdown 2005 (Pumping Well PW-20)	Drawdown 2006 (Pumping Well PW-19)	Pumping Trigger (feet MSL)
MW-20s	461.2	01-Nov-99	3.6	4.2	464.8
MW-24	461.7	22-Nov-99	4.0	No Data	465.6
MW-93S	462.4	22-Jan-01	3.9	1.3	466.2
MW-96S	462.3	24-Sep-99	3.6	2.4	465.9
MW-99S	462.1	24-Sep-02	3.4	3.5	465.5

Note: Pumping Trigger = Historical low groundwater elevation + 2005 drawdown

The pumping triggers presented above are designed for the southwestern portion of the plume near Hooven for high-grade pumping at PROD_20 or PROD_19. Pumping triggers for other production wells will be established at these and other nearby monitoring wells following the first successful high-grade event using each well. Until triggers have been established for each production well, the pumping triggers listed in Table 4-1, as updated annually, will be used globally.

<u>Seasonal Operation Plan</u>

Pre-Startup

Prior to each high-grade season (generally summer-fall), operational plans will be presented in the preceeding semi-annual progress report to summarize the preceding high-grade pumping event and present plans for the upcoming event. Plans for the upcoming event may include proposed production well(s) to be operated, updated pumping trigger levels, planned system modifications, and other pertinent information.

Startup

As discussed above, pumping triggers are indicators used to determine when high-grade pumping can be expected to achieve pumping targets. Chevron will initiate high-grade pumping once 50% of the pumping triggers have been met.

Operational Parameters

The primary operational parameters for high-grade operation are the production well(s), water table elevation, and oil recovery rate. Each year, the production well(s) will be selected based on historical performance and current well conditions (i.e. need for well rehabilitation, pump condition, etc). As described above, Chevron will present the proposed production well(s) in the preceding semi-annual progress report. The selected production well(s) will be operated such that the water table is lowered below the historical maximum water table elevation at the monitoring locations while also maximizing the oil recovery rate. It is anticipated that this will require pumping rates of approximately 1,000 to 3,000 gallons per minute (gpm), depending on hydrological conditions, the pumping targets at the time of the event, and any constraints imposed by treatment system capacity and the entrainment of LNAPL in the recovered groundwater.

Performance Criteria and Shutdown

Once high-grade pumping has been initiated, the water table will eventually rise in response to recharge events. Such events can cause the water table to rise above target elevations and may also reduce product recovery rates or preclude product recovery altogether. In some cases this effect will be short-lived and will be overcome through continued pumping. In other cases, the pumping targets will not be reached again that year and/or oil recovery will decline to unacceptably low rates despite continued pumping. Given these conditions, a clear decision framework is needed to determine when to terminate the high-grade event during each event. The decision framework is as follows.

Upon seasonal startup, high-grade pumping will continue for a minimum of thirty days. The following performance criteria will be used to determine when high-grade pumping will be terminated.

1. Pumping Targets

a. High-grade pumping may be terminated if pumping targets at 50% or more of the monitoring locations are not met during a period lasting more than two weeks.

2. Oil Recovery

b. High-grade pumping may be terminated once a two-week running average oil recovery rate of 500 gallons per day (gpd) cannot be sustained at the production well.

<u>*High-Grade Pumping Final Endpoints*</u>

Each successful high-grade event will reduce the volume of recoverable hydrocarbon, decrease product mobility, and will successively lower the pumping target elevations. Ultimately, high-grade pumping will reach a practical endpoint when either hydrocarbon recovery has become negligible and/or pumping targets are too deep to achieve. Chevron expects that two to three high-grade events under low water table conditions will be needed to achieve these endpoints in each of the two concentrated high-grade pumping areas (Chevron, 2005). Based on historical records, Chevron expects that this will occur in six to ten years in each area (Chevron, 2005). After successful high-grade events have been completed under low water table conditions, Chevron expects that it will be fairly self-evident that final endpoints have been met based on the results of one or more subsequent, unproductive high-grade seasons have been conducted during years of average or below average precipitation. Based on the results of high-grade operations over the next two seasons, additional interpretation and a proposed plan for identifying when proposed endpoints have been reached, will be provided to USEPA by October 31, 2008.

22. Table 4-1 provides groundwater elevation trigger levels for five monitoring wells in the southwestern portion of the plume. However, based on the discussion provided in the OMM Plan, it is not clear if each of these trigger levels or only one must be reached before initiation of high-grade pumping will be considered. The OMM Plan should be revised to clearly indicate how these initial trigger levels will be evaluated when considering the initiation of seasonal high-grade pumping.

    As discussed in Chevron's response to OMM Specific Comment No. 21, the OMM Plan has been revised to clarify the basis for present and future development and application of high-grade trigger levels.

23. The AOC (Section 12.b) requires that pumping rates be specified in the OMM Plan. Pumping rates during high-grade pumping have not been discussed in the OMM Plan. The OMM Plan should be revised to specify pumping rates during high-grade pumping. If it is not possible to specify precise pumping rates, the OMM Plan should provide anticipated pumping rates for prospective production wells and a discussion of the factors that may influence actual pumping rates during high-grade pumping.

    The OMM Plan has been revised to address general high-grade pumping rates and factors affecting pumping rates, as discussed above under Chevron's response to USEPA OMM Specific Comment No. 21.

Section 4.3.1, Preparatory Monitoring

24. The discussion of actual preparatory monitoring provided in the OMM Plan (page 4-3) is limited to stating that "manual fluid level gauging will be conducted as needed in preparation of each high-grade event in order to collect operational baseline data and to measure against established trigger elevations in surrounding monitoring wells." The OMM Plan should be revised to clearly state the goals and objectives of the preparatory monitoring program (e.g., identification of

background trends in groundwater levels). The OMM Plan should similarly provide the details of a preparatory monitoring program that will clearly meet the established objectives for the program.

Section 4.3.1 presents details regarding transducer deployment in preparation for high-grade pumping critical to the collection of data for defining well drawdown, radius of influence, and well specific capacity during pumping, which is the most extensive component of fluid level gauging in preparation for high-grade. The 'actual' monitoring referred to in the above-noted comment is the relatively limited weekly manual gauging performed at times during which high-grade pumping is not being conducted, for purposes of collecting routine operational data. See also response to USEPA OMM specific comment #13. Weekly gauging is performed in a group of monitoring wells deemed representative of area-wide groundwater level trends and as necessary to monitor for trigger levels associated with the proposed high-grade area(s). The list of monitoring wells gauged weekly is routinely revised as operational data needs change. For example, weekly gauging in the spring may result in added proposed high-grade production wells and surrounding monitoring wells as the site prepares for the next high-grade event. During times of high-grade pumping, weekly fluid level gauging may be limited to a few select wells or suspended altogether due to extensive gauging in support of high-grade pumping. While weekly gauging is considered operational data rather than a component of the long-term remedy, the OMM Plan has been revised to address it as such.

Section 5.1, Component Description

25. The OMM Plan indicates that the granulated activated carbon (GAC) is designed to treat benzene, ethylbenzene, toluene, and xylenes. The COCs specified in the AOC include additional contaminants (arsenic, chlorobenzene, and lead). The OMM Plan should verify that National Pollutant Discharge Elimination System (NPDES) requirements for these contaminants are met at the point of discharge to surface water.

The site waste-water treatment system includes treatment components in addition to the GAC, including a sedimentation pond and constructed treatment wetlands which provide treatment of waste-water from the site such that it complies with the site's NPDES Permit at the point of discharge to surface water. The OMM Plan text has been modified accordingly.

Section 6.2, Component Installation/Operation

26. The OMM Plan (page 6-2) states that "in addition to high grade pumping events, the HSVE system will be operated when fluid level gauging shows the groundwater elevation at monitoring well MW-20S to be 464.8 feet above mean sea level or lower, and regional weather conditions are such that the groundwater elevation is expected to stay at or below this level." The OMM Plan further states "the trigger for operation of the HSVE system is expected to decline over time, as continued mass removal and natural degradation reduces the remaining LNAPL that is amenable to removal through vapor recovery." No rationale or basis is provided for selecting water levels in MW-20S for use as a trigger for operating the horizontal soil vapor extraction (HSVE) system. Similarly, no rationale or basis is provided for identifying 464.8 feet above mean sea level as the water level in MW-20S to use as the actual trigger level.

The trigger cited to initiate operation of the HSVE is the same as the trigger used to initiate high-grade pumping. Since the same triggers have been established for the operation of both systems, it would appear that the HSVE would only be operated during periods of high-grade pumping. However, the Final Decision Document clearly envisions that there may be times when the HSVE should be operated due to low water table conditions and an exposed LNAPL smear zone beneath Hooven, although high-grade pumping is not operating. This would seem to require that water level triggers be located more centrally beneath Hooven and be developed based on water elevations beneath Hooven that result in exposure of the smear zone in this area.

The OMM Plan should be revised to provide an adequate rationale for selecting trigger levels to initiate the operation of the HSVE system beneath Hooven independent of the operation of the high-grade pumping system. Based on this rationale and an evaluation of the existing observations of groundwater and LNAPL levels, the OMM should propose monitoring well(s) and associated trigger level(s) for current use to initiate the HSVE system independent of high-grade pumping program.

Paragraph 11.c of the AOC states "At any time, Respondent may submit to U.S. EPA for approval for approval criteria for permanent shutdown of the HSVE system. The approved criteria shall be incorporated into the RIP/OMM Plan." Chevron does not list specific criteria for permanent shutdown and state they will propose shutdown when "… likely once high-grade operations have been completed, and when a period of two or more years have passed when conditions have not been amenable to the system accomplishing significant additional LNAPL mass removal." Please quantify these terms "amenable" and "significant" to satisfy the need for approved criteria.

As discussed during negotiations to develop the Order, the primary benefit provided by the HSVE system is removal of hydrocarbon mass and the drawing of oxygen to soil vapor at depth, which contributes to enhanced aerobic biodegradation of residual hydrocarbons in the smear zone. Past HSVE system performance has indicated that meaningful hydrocarbon mass removal is only accomplished when the middle to lower reaches of the smear zone are exposed. MW-96S, centrally located in Hooven between HSVE Well lines #1 and #3, provides an accurate indication of this condition. The OMM Plan has been revised accordingly to include MW-96S as the trigger level well for HSVE system operation. The precise startup date of the HSVE system will still be subject to deferral pending collection of nested vapor well samples after initial high-grade startup, and the system will be shut-down if substantial hydrocarbon vapors are not being *recovered, as discussed in the OMM Plan.*

As discussed above under Chevron's response to USEPA OMM Specific comment No. 21, adjustments to the depth triggers will be appropriate over time as residual LNAPL is further depleted. The HSVE trigger levels will be adjusted over time, in similar fashion to the protocol described for the high-grade trigger levels.

As noted above, the Order indicates that Respondent may submit to USEPA for approval, criteria for permanent shut-down of the HSVE, <u>at any time</u>. Since operation of the HSVE is anticipated for many years to come, and the final shutdown criteria are expected to be developed based on future high-grade and HSVE system operational results, Chevron will plan to defer submittal of the proposed final shut-down criteria, to a later date. As insight into the anticipated criteria for a future shut-down determination are developed with ongoing operational and monitoring results, Chevron will present them to USEPA in future semi-annual monitoring reports.

Section 7.3, Sampling/Monitoring

27. Chevron has proposed that vapor monitoring well VW-128 be included in the long-term vapor monitoring program instead of VW-93, as specified in the Final Decision Document. The stated reasons for the proposed substitution are to collect additional data near the school and to ensure that one of the wells monitored over the long term is located over the dissolved phase. The additional data from VW-128 would be useful and provide added confidence to long-term vapor monitoring. However, all of the vapor monitoring wells originally specified in the Final Decision Document should be included in the long-term vapor monitoring program. Vapor monitoring well VW-128 should be added to the program rather than substituted for one of the specified wells.

    OMM Plan Section 7.0 text, tables, and figures have been revised to add VW-128 to the list of vapor monitoring wells specified in the Final Decision Document (VW-93, VW-96, VW-99, and VW-129) for inclusion in the long-term vapor monitoring program.

28. The Final Decision Document (page 7) specifies that the "vapor wells will be tested twice annually during the Spring and Fall or to account for the high and low water table conditions for the first two years of sampling, once per year during years three to five, and then every three years thereafter." However, the OMM Plan (page 7-1) states that the vapor monitoring wells "will be sampled semiannually for the first two years, annually for the next three years, biennially for the next five years, and every five years thereafter." The proposed vapor monitoring schedule after the first five years is not consistent with that specified in the Final Decision Document. While Chevron may sample biennially between year five and year ten, the three-year schedule specified in the Final Decision Document must be followed for subsequent years. The OMM Plan should also clearly specify the schedule for the first two years of sampling contained in the Final Decision Document.

    For consistency with the Final Decision Document, the above-referenced OMM Plan text has been revised to state that "vapor wells will be sampled twice annually during the Spring and Fall, or to account for high and low water table conditions, for the first two years, annually for the next three years, and then every three years thereafter."

29. The OMM Plan indicates that the wells will be sampled utilizing the suggested soil vapor sampling operating procedure provided in Appendix A. While not clearly stated, it is assumed that the suggested procedure in Appendix A is different than that used in the past to sample soil vapor in Hooven. Chevron should provide a detailed comparison between the two procedures, clearly indicating how the suggested procedure differs from the current sampling procedure. An analysis of how the differences between the two procedures are likely to impact soil vapor measurements should also be provided. The impact on the comparability of data previously collected and collected in the future using the new procedure should be evaluated. If available, peer-reviewed articles supporting the suggested procedures should be provided.

The procedure for soil vapor sampling provided in Appendix A of the OMM Plan is in fact the same procedure that has been used in the past. The OMM Plan has been revised to clarify this.

30. The Final Decision Document (page 7) states that "the vapor monitoring wells will be sampled at 5 and 10 feet below ground surface and at 10 foot intervals to the groundwater table." While it indicates that "soil vapor probes are positioned at 5- and/or 10-foot intervals extending from the ground surface to between 50 and 60 feet below groundwater surface (ft-bgs)," the OMM Plan does not clearly indicate from which probe samples will be taken or that these probes extend to the water table. The OMM Plan should be revised to include specifications for soil vapor sampling that are clearly consistent with the requirement established in the Final Decision Document.

OMM Plan Section 7.3 text has been revised to clarify specifications for soil vapor sampling and incorporate the Final Decision Document text stating that the vapor monitoring wells will be sampled at 5 and 10 feet below ground surface and at 10 foot intervals to the groundwater table.

Section 7.4, Performance Metrics and Contingencies

31. The OMM Plan (page 7-2) states that "additional corrective measures will be evaluated to prevent vapors from migrating upward from the LNAPL plume into occupied buildings in Hooven at concentrations exceeding the VI Guidance residential screening standards." While not clearly identified, it is presumed that the VI Guidance refers to the U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 2002 Draft Vapor Intrusion (VI) Guidance. To avoid confusion, the OMM Plan should clearly identify the VI Guidance as the above document.

The above-referenced OMM Plan text has been revised to state: "Additional corrective measures will be evaluated to prevent vapors from migrating upward from the LNAPL plume into occupied building in Hooven at concentrations exceeding residential screening standards set forth in USEPA Office of Solid Waste and Emergency Response (OSWER) 2002 Draft Vapor Intrusion (VI) Guidance."

Section 8.3, Sampling/Monitoring

32. When specifying the monitoring program for the Gulf Park bioventing system, the OMM Plan identifies a series of components that *may be included* in the system performance monitoring

Section 8.3, Sampling/Monitoring

32. When specifying the monitoring program for the Gulf Park bioventing system, the OMM Plan identifies a series of components that *may be included* in the system performance monitoring program. These monitoring program components are also frequently only described generally, without any specific details (e.g., groundwater elevation in selected wells). The OMM Plan never actually identifies the specific monitoring program that will be followed at Gulf Park. The OMM Plan should be revised to clearly specify the details of the performance monitoring program that will be conducted at Gulf Park.

    The OMM Plan text has been revised to include additional specific information regarding the performance monitoring program at Gulf Park.

If you should have any questions regarding this correspondence or the proposed revisions to the RIP and OMM Plan, please contact me at (714) 671-3532 or Keith Rittle at (307) 745-7474, ext. 4832.

Sincerely,

Randy W Jewett By Keith Rittle (Trihydro Corporation) as agent for Chevron Environmental Management Company

Randy W. Jewett – Site Manager
Chevron Cincinnati Facility
Chevron Environmental Management Company

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

November 15, 2007

REPLY TO THE ATTENTION OF:

DE-9J

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Mr. Randy Jewett
Mr. Paul Ryan
Chevron U.S.A. Inc.
5000 State Route 128
Cleves, OH 45002

Re: Operation, Maintenance, and Monitoring Plan & the Remedy Implementation Plan for the Final Groundwater Remedy, Chevron Cincinnati Facility OHD 004 254 132

Dear Mr. Jewett/Ryan:

On February 28, 2007, Chevron submitted the Operation, Maintenance, and Monitoring (OMM) Plan for the Groundwater Remedy, Cincinnati Facility Hooven, Ohio and an additional report the Remedy Implementation (RIP) Plan for the Final Groundwater Remedy, Cincinnati Facility Hooven, Ohio to the U.S. Environmental Protection Agency (U.S. EPA). The submittal was required under paragraph 11 and 12 of the RCRA Section 3008(h) Administrative Order on Consent between Chevron U.S.A. Inc. and U.S. EPA signed November 1, 2006, Docket No. RCRA-05-2007-0001. U.S. EPA had reviewed and commented on this document in a letter dated July 17, 2007. U.S. EPA received a revised version of both reports from Chevron dated August 24, 2007. U.S. EPA has reviewed the August 24, 2007 versions and hereby approves with modifications the Operation, Maintenance, and Monitoring Plan for the Groundwater Remedy and the Remedy Implementation Plan for the Final Groundwater Remedy. The modifications are enclosed. Chevron shall submit the final modified document to U.S. EPA. If you have any questions, please contact me at (312) 886-1451.

Sincerely yours,

Christopher J. Black
Corrective Action Section 2
Remediation and Reuse Branch
Land and Chemicals Division
enclosure

MODIFICATIONS OF THE OPERATION, MAINTENANCE, AND MONITORING PLAN FOR THE GROUNDWATER REMEDY, CINCINNATI FACILITY HOOVEN, OHIO
DATED AUGUST 24, 2007

MODIFICATIONS

1. **Section 2.0, page 2-1:** Paragraph one states that "Groundwater will be monitored for dissolved Contaminants of Concern (COCs) listed in Table 2-1 for compliance with Maximum Contaminant Limits (MCLs) standards". Lead and arsenic are the non-volatile metal contaminants in Table 2-1. These metals are located in portions of the plume and changes in the metals concentrations are anticipated to decline, yet due to their non-volatile nature they are not directly linked to the remedial choices. Please modify the report to address the metals and their anticipated long term monitoring results.

2. **Section 3.3.4, page 3-17:** In the short-term monitoring section it states "...river surface water samples will be collected on the same frequency using a dipper from locations immediately adjacent to each of the three groundwater wells." The concern here is with the use of the dipper. Is there a better way to sample that will limit volatilization? Are the locations of the surface water sample consistent over time? Please modify the report to add the rationale for the use of the dipper given the concerns, or an alternate way to sample groundwater that addresses the volatilization and repeatable location concerns.

3. **Section 3.3.3, page 3-11:** The third paragraph states "The primary mass loss mechanisms will initially be quantified and tracked following the protocol described in a recent paper by Johnson and Lundegard, and Liu titled "Source Zone Natural Attenuation at Petroleum Hydrocarbon Spill Sites—I: Site-Specific Assessment Approach", in Ground Water Monitoring & Remediation 26, no. 4/ Fall 2006/pages 82–92." This article is also referenced in Section 3.3.3.4, page 3-14 in association with analyzing vapor mass loss of the plume. U.S. EPA sees the benefit of the use of this article in core plume analysis and does not oppose its use. However, the overriding document referenced for consistency of MNA analysis is the U.S. EPA Region 5 Framework for Natural Attenuation Decisions for Groundwater, 2000 as stated in paragraph 11(f) in the 2006 Consent Order. Also included by reference in the Region 5 Guidance is the OSWER Directive, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites, 1999.

4. **Section 4.3, page 4-4:** In the last sentence of the subsection 4.3 please modify the sentence to provide additional clarification by including the exact date of November 1, 2008 for submission of the plan to provide criteria for permanent shutdown of high-grade pumping for U.S. EPA review.

5. **Section 7.4, page 7-2:** In the first sentence of the subsection 7.4 it states "If the analysis of the soil vapor sampling data in Hooven indicates that 1) there is a complete pathway from the hydrocarbon vapors emanating from the LNAPL plume to the ground surface, and 2) COCs originating from the plume listed in Table 7-2 are observed in the five- or ten-foot samples at concentrations exceeding the USEPA Vapor Intrusion Guidance screening criteria for a residential scenario, USEPA will be notified of the monitoring results within five (5) days of receipt of qualified data." Please modify the sentence to read "... samples at concentrations exceeding the *soil gas screening standards set forth for residential indoor air (for houses with dirt basement)* in the USEPA Vapor Intrusion Guidance screening criteria for a residential scenario, ...".

MODIFICATIONS OF THE REMEDY IMPLEMENTATION PLAN FOR THE GROUNDWATER REMEDY, CINCINNATI FACILITY HOOVEN, OHIO
DATED AUGUST 24, 2007

MODIFICATIONS

1. **Section 8.1, page 8-1:** Paragraph one states that nested vapor wells will be constructed at four grouped media locations which include MW-93S location. Nested vapor well VW-93 already exists. Please modify this section to clarify the number of nested vapor well constructed.

2. **Section 8.1, page 8-1:** Paragraph 2 states "Results of subsequent analyses will be used to estimate the total vapor mass loss occurring from the plume over time, and may be used for planning engineering and institutional controls as appropriate relative to the redevelopment at the site." It is important the institutional controls that are specifically stated in the Order are complied with in relation to any new vapor data acquired. Those specific controls are that the Respondent shall execute and record an Environmental Covenant in accordance with Ohio Revised Code ("ORC") Sections 5301.80 to 5301.92 imposing the following activity and use limitations upon the refinery and land farm portions of the Facility: No use of groundwater; No subgrade development; No residential use; No daycare or preschools. Please modify this section to make it consistent with the Order.