175859-FI.01

Response Action Contract IX

DRAFT
QUALITY ASSURANCE PROJECT PLAN ADDENDUM NO. 1
FOR SAN GABRIEL VALLEY NPL AREA 3
REMEDIAL INVESTIGATION
FIELD ACTIVITIES

SAN GABRIEL BASIN
LOS ANGELES COUNTY, CALIFORNIA

U.S. Environmental Protection Agency
Contract No. 68-W-98-225

CH2M HILL, Inc.
and Team Subcontractors:
URS Group, Inc.
E2 Consulting Engineers, Inc.

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EPA WORK ASSIGNMENT NO. 141-RICO-09ES
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October 2004

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U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IX

Plan Title:	Draft Quality Assurance Project Plan Addendum No. 1 for San Gabriel Valley NPL Area 3 Remedial Investigation Field Activities
Site Name:	NPL Area 3
Site Location:	San Gabriel Valley
City/State/Zip:	Los Angeles County, California
Site EPA ID#:	CAD980818579
Anticipated Sampling Dates:	November 2004 to September 2005
Prepared By:	Amanda Berens — October 2004
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Quality Assurance Project Plan Addendum No. 1 NPL Area 3

This Quality Assurance Project Plan (QAPP) Addendum No. 1 provides supplemental information for field and laboratory activities associated with remedial investigation (RI) activities for National Priorities List (NPL) Area 3 of the San Gabriel Valley Superfund Site in Los Angeles County, California (Area 3). This work is being performed for the U.S. Environmental Protection Agency (EPA) under EPA Contract No. 68-W-98-225 and EPA Work Assignment No. 141-RICO-09ES.

Because this QAPP Addendum is a supplement to an existing, detailed QAPP, not all sections are included as required in the *EPA Guidance for Quality Assurance Project Plans* (EPA, 1998) and *EPA Requirements for Quality Assurance Project Plans* (EPA, 1999). Where required information would be repetitive, the original QAPP is referenced. The installation of one conventional, one cluster, and three multiport (MP) groundwater monitoring wells and subsequent initial and quarterly groundwater sampling through January 2005 was described in the February 2003 Field Sampling Plan (FSP) and QAPP for NPL Area 3, and was approved by the EPA Region IX Quality Assurance Office (QAO). This QAPP Addendum was prepared to describe the installation of two additional conventional and one additional MP groundwater monitoring well(s). This QAPP Addendum also describes associated initial groundwater sampling, and quarterly groundwater sampling at all existing and new groundwater monitoring wells as well as two production wells from February through August 2005.

A. Project Management/Data Quality Objectives

A.1 Project Organization

Project organization and the line of authority for CH2M HILL efforts are illustrated in Figure A-1. Data users and recipients are shown in Figure A-2 of the original QAPP (EPA, 2003b). Both EPA and CH2M HILL technical personnel and quality assurance personnel are shown.

A.2 Problem Definition/Background

A.2.1 Purpose

This QAPP Addendum presents supplemental information to the policies, organizations, objectives, and functional activities/procedures associated with the RI sampling and analysis activities at the San Gabriel Valley NPL Area 3 described in the QAPP (EPA, 2003b). Data quality objectives (DQOs) (EPA, 1994) can be found in Appendix A of the QAPP (EPA, 2003b).

A.2.2 Problem Statement/Background

EPA installed one conventional (MW1-1), one cluster (MW1-2A and MW1-2B), and three MP (MW1-3, MW1-4, and MW1-5) groundwater monitoring wells in Area 3 in 2003.

new groundwater monitoring wells, and quarterly groundwater samples will be collected at new and existing groundwater monitoring wells as well as two existing production wells in Area 3.

The sampling process design for investigation-derived wastes and quarterly monitoring in Area 3 includes the schedule of analyses and rationale for sampling design, as described in detail below.

B.1.2 Schedule of Analyses

The analytes scheduled for the RI field program are presented in Table A-3 of the QAPP (EPA, 2003) and in Table A-3 of this QAPP Addendum. Analytical services for all samples collected from the monitoring and production wells will be submitted for analysis to the EPA Region IX Analytical Program and to private laboratories under subcontract to CH2M HILL as described in Section B.4 of the QAPP (EPA, 2003b).

Sampling of investigation-derived wastes is expected to begin in January 2005, will occur periodically, and will last through February 2005.

An initial groundwater sampling event for VOCs will be conducted within approximately 2 weeks after completion of each monitoring well. It is anticipated that the initial sampling event will occur in two phases: one for MP well MW1-6 during January 2005 and one for conventional wells MW1-7 and MW1-8 during February 2005. Ongoing groundwater sampling events for new and existing monitoring wells as well as two existing production wells will be conducted on a quarterly basis for VOCs for 6 months, for a total of two quarterly sampling events, with the last event occurring in August 2005.

During the second quarterly sampling event at the new wells, anticipated to take place in August 2005, additional groundwater sampling will be conducted at each well for dissolved metals, semivolatile organic compounds (SVOCs), n-nitrosodimethylamine (NDMA), perchlorate, nitrate, 1,4-dioxane, hexavalent chromium, and 1,2,3-TCP. Additional or continued sampling for these analytes will depend on the results of the second quarterly sampling event. For example, one additional confirmation sample will be collected if an analyte is detected in a well. Existing RI monitoring wells will be sampled for VOCs only during the second quarterly sampling event.

It is likely that quarterly sampling will occur beyond the two events described in this QAPP Addendum. However, these activities will be conducted on a new work assignment.

B.1.3 Rationale for Sampling Design

The rationale for the sampling design is detailed in the subsections below.

Groundwater Monitoring

Sampling Locations. Figure 1 in Appendix A shows the locations of the proposed conventional and MP monitoring wells and proposed production well sampling locations (01900547 and 01902979) in Area 3. Proposed screen intervals for conventional and MP monitoring wells are shown in Table B-1. Note that there are several screen intervals at the MP monitoring well location.

The conventional wells (MW1-7 and MW1-8) are located in the western portion of Area 3 to collect groundwater data between existing production wells with VOC contamination toward the east and suspected sources in the west.

The proposed MP well (MW1-6) will be installed between the contamination source area identified near the Temple City Sheriff's Station and downgradient production wells impacted with PCE. The proposed MP well will be constructed with seven depth discrete groundwater sampling intervals. Groundwater data collected from the MP well will be used to assess the lateral and vertical nature and extent of this contamination.

The rationale for the proposed conventional and MP well locations and screen intervals is described in the *San Gabriel Valley NPL Area 3 Remedial Investigation Data Needs* memorandum (CH2M HILL, 2004), included as Appendix A.

The two existing production wells are located at the San Gabriel Valley Country Club and are used to irrigate the golf course. Most production wells in Area 3 are sampled approximately annually. Groundwater samples have not been previously collected at production well 01900547 and have not been collected at production well 01902979 since 1987. These production wells have narrow screen intervals compared to other production wells in Area 3. Therefore, samples from these wells will provide current water quality data from relatively specific depths.

Number of Samples. An initial groundwater sampling event will be conducted at new RI monitoring wells roughly 2 weeks after the completion of each monitoring well. Ongoing groundwater sampling events will be conducted on a quarterly basis at new and existing RI monitoring wells and proposed production well sampling locations for the remainder of a 6-month period, for a total of two quarterly sampling events. The quarterly sampling events at existing RI monitoring wells will be for VOCs. For new RI monitoring wells, the first quarterly groundwater sampling event will be for VOCs and the second quarterly groundwater sampling event will be for the expanded analyte list (VOCs, dissolved metals, SVOCs, NDMA, perchlorate, nitrate, 1,4-dioxane, hexavalent chromium, and 1,2,3-TCP). These sampling events will be used to evaluate temporal changes in the nature and extent of VOC contamination in Area 3 that might be related to groundwater production, evaluate any exceedances of regulatory limits, assist in identifying contaminant source areas, and assess the need for continued monitoring or future treatment. Future sampling for the expanded analyte list will depend on the results of the second quarterly sampling event at the new wells. At least one additional confirmation sample will be collected if the analyte is detected.

Groundwater sampling at production wells 01900547 and 01902979 will occur contemporaneous with quarterly monitoring well sampling for a total of two quarterly events. The schedule for groundwater sampling at the production wells will be coordinated with the San Gabriel Valley Country Club to occur while the wells are in use. The production well groundwater samples will be analyzed for the same analytes as the new monitoring wells.

Quality assurance (QA) sampling is described in Section B.1.3 of the QAPP (EPA, 2003b).

It is likely that quarterly sampling will occur beyond the two events described in this QAPP Addendum. These activities will be conducted on a new work assignment.

Laboratory Analyses. Analysis of VOCs with low-detection limits will be used to assess the magnitude of groundwater contamination in the monitoring and production wells and to determine whether any of the VOCs detected exceed regulatory limits. Sampling for VOCs will be included in each of the sampling events. In addition, sampling for dissolved metals, SVOCs, NDMA, perchlorate, nitrate, 1,4-dioxane, hexavalent chromium, and 1,2,3-TCP will be conducted at new monitoring wells as well as two San Gabriel Valley Country Club production wells during one sampling event to evaluate exceedances of regulatory limits and to assess the need for continued monitoring or future treatment for these analytes. The rationale for these analyses is described in the FSP (EPA, 2003a).

Investigation-Derived Wastes

Investigation-derived waste sampling is described in Section 4.2 of the FSP (EPA, 2003a). Drill cuttings and drilling mud samples previously collected during field investigation activities at Area 3 indicated an elevated pH due to the installation of cement seals during well construction. Therefore, in addition to the investigation-derived waste sampling described in the QAPP (EPA, 2003b), the drill cuttings and drilling mud may be analyzed for California Department of Health Services (DHS) 96-hour acute aquatic toxicity, according to local landfill requirements for samples with elevated pH.

A quick turnaround time (7 days) will be necessary for characterization and disposal of the drill cuttings and drilling mud to avoid costs associated with long-term storage of the wastes.

Purge water from the sampling of production wells will be used by San Gabriel Valley Country Club as irrigation water for the golf course. Therefore, samples for purge water disposal will not be collected.

B.2 Sampling Method Requirements

Sampling method requirements are described in Section 6 of the FSP (EPA, 2003a).

B.3 Sample Handling and Custody Requirements

Sample handling and custody requirements are described in Section B.3 of the QAPP (EPA, 2003b).

B.4 Analytical Method Requirements

Analytical method requirements are described in Section B.4 of the QAPP (EPA, 2003b).

B.5 Quality Control Requirements

QC requirements are described in Section B.5 of the QAPP (EPA, 2003b).

B.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Instrument/equipment testing, inspection, and maintenance requirements are described in Section B.6 of the QAPP (EPA, 2003b).

B.7 Instrument Calibration and Frequency

Instrument calibration and frequency requirements are described in Section B.7 of the QAPP (EPA, 2003b).

B.8 Data Acquisition Requirements (Nondirect Measurements)

Data acquisition requirements (nondirect measurements) are described in Section B.8 of the QAPP (EPA, 2003b).

B.9 Data Management

Data management is described in Section B.9 of the QAPP (EPA, 2003b).

C. Assessment/Oversight

Assessment and oversight actions are described in Section C of the QAPP (EPA, 2003b).

D. Data Validation and Usability

D.1 Data Review, Validation, and Verification Requirements

Data review, validation, and verification requirements are described in Section D.1 of the QAPP (EPA, 2003b). Investigation-derived waste analytical batches will be reviewed for specified analytical parameters for detections and nondetections, at Tier 1, as defined by the regional EPA QAO guidance. Data validation results will be submitted with final analytical data to facilitate disposal of the investigation-derived wastes.

D.2 Validation and Verification Methods

Validation and verification methods are described in Section D.2 of the QAPP (EPA, 2003b).

D.3 Reconciliation with Data Quality Objectives

Reconciliation with DQOs is described in Section D.3 of the QAPP (EPA, 2003b).

References

U.S. Environmental Protection Agency. 1992. *Interim San Gabriel Basin Remedial Investigation Report, Los Angeles County, California.* Prepared by CH2M HILL. June 15.

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———————. 2003a. *Field Sampling Plan for San Gabriel Valley NPL Area 3 Remedial Investigation Field Activities.* Prepared by CH2M HILL. February.

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Tables

Table A-1
Groundwater Sampling Results
San Gabriel Valley NPL Area 3
Preliminary

Well Name	Well/ Station ID	Well Depth (ft bgs)	Screened Interval(s) (ft bgs)	Date Sampled	Depth to Water (feet bgs)	TCE	PCE	1,1-DCE	cis-1,2-DCE	CCL	1,2-DCA	Carbon Disulfide	Benzene	Toluene	Chloromethane	2-Butanone	DFM	Chloroform	1,2,3-Trichloropropane	Acetone	NDMA	1,4-Dioxane	bis (2-Ethylhexyl) phthalate	Butyl benzyl phthalate	Nitrate-N	Perchlorate	Hexavalent Chromium
						Volatile Organic Compounds															Semi Volatile Organic Compounds				Anions		Metals
					Units	µg/L															µg/L				mg/L	µg/L	µg/L
MW1-1	EPAMW11	282	252-272	03/05/03	185.43	240/260	4/4	2/2	3/3	0.9/0.8	0.7/0.7	--	<1/<1	23/23	<1/<1	<4/<4	<1/<1	0.6J/0.6J	<1/<1	<4/<4	--	--	--	--	--	--	--
				07/18/03	185.72	200	5.4	2.3	3.6	0.9	0.7	--	<1	<1	<1	<4	<1	0.6J	<1	<4	--	--	--	--	--	--	--
				11/04/03	186.10	220/230	5.7/6.4	2.1/2.4	3.5/4.1	0.9/0.9	0.8/1.1	<1/<1	<1/<1	<1/<1	<1/<1	<4/2J	<1/<1	0.6J/0.7J	<0.002/<0.002	6.1/7.2	0.0006J	1.4J/1.4J	1.1J/0.9J	<1/<1	12/12	4.7/5	1.12/1.02
				02/03/04	186.22	260/250	7.8/7.7	2.4/2.4	4/4	1/1	0.8/0.8	<1/<1	<1/<1	<1/<1	<1/<1	<4/<4	<1/<1	0.7J/0.7J	<1/<1	<4/<4	--	--	--	--	--	--	--
				05/21/04	186.75	220/220	7.2/7.1	3.2/3.1	4.5/4.4	0.7/0.7	0.7/0.7	<1/<1	<1/<1	<1/<1	<1/<1	<4/<4	<1/<1	0.8J/0.8J	<1/<1	<4/<4	--	--	--	--	--	--	--
				08/03/04	186.77	270	7.7	2.6	4	1.1	0.74	<0.5	<0.5	<0.5	<0.5	<5	0.13J	0.78	--	2.3J							
MW1-2A	EPAMW12A	399	384-394	03/06/03	323.70	83	2	1	11	<0.5	<0.5	--	<1	21	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				07/17/03	326.04	71	1.9	1.1	9.5	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/05/03	330.00	84	2.2	1.2	10	<0.5	0.4J	<1	<1	0.5J	<1	<4	<1	<1	0.00331	<4	0.0005J	<1.1	<1.1	<1.1	1.1	1.9J	<0.2
				02/03/04	329.80	96	2.6	1.3	11	<0.5	<0.5	<1	<1	0.6J	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	330.59	73	2.2	1.4	11	<0.5	<0.5	<1	<1	1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	332.43	68/75	2.4/2.3	1.4/1.3	10/9.3	<0.5/<0.5	0.24J/0.2	0.26J/0.25	<0.5/<0.5	3.2/3.1	<0.5/<0.5	<5/<5	<0.5/<0.5	0.29J/0.31	--	2.6J/<5							
MW1-3	EPAMW13_05	800	350-360	03/06/03	311.79	1	<1	<1	0.5J	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	4	--	--	--	--	--	--	--
				07/15/03	313.85	1.7	<1	<1	0.6J	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	3.3J	--	--	--	--	--	--	--
				11/07/03	316.75	1.9	<1	<1	1.1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.002	<4	0.000933J	<1.1	2.3	<1.1	4.1	<2	4.89
				02/03/04	317.40	3	<1	<1	1.7	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	317.74	3.1	<1	<1	2	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/03/04	319.20	2.3	<0.5	<0.5	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	0.3J	--	<5							
	EPAMW13_04		480-490	03/06/03	315.63	1	<1	<1	0.5J	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	3J	--	--	--	--	--	--	--
				07/15/03	324.47	<10/3.8	<10/<1	<10/<1	<10/1.3	<5/<0.5	<5/<0.5	--	<10/<1	<10/<1	<10/<1	<40/<4	<10/<1	<10/<1	<10/<1	<40/<4	--	--	--	--	--	--	--
				11/06/03	325.18	3.6	<1	<1	1.7	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.002	<4	0.000933J	<1.3	9.6	0.8J	7.7J	<2	5.65
				02/03/04	323.80	4.7	<1	<1	2.4	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	324.26	9.4	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/03/04	329.43	3.8	<0.5	<0.5	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	0.34J	--	<5							
	EPAMW13_03		580-590	03/06/03	316.69	2	<1	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	8	--	--	--	--	--	--	--
				07/15/03	326.38	4.7	<1	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2.2J	--	--	--	--	--	--	--
				11/06/03	326.41	9.4	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.002	<4	0.000723J	<1.1	2.5	<1.1	0.88	<2	1.22
				02/03/04	324.19	10	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	326.91	4.4	<1	<1	2.2	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/03/04	331.09	11	<0.5	<0.5	0.63	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	0.27J	--	<5							
	EPAMW13_02		660-670	03/06/03	318.33	2	<1	<1	1	<0.5	<0.5	--	0.5J	<1	<1	<4	<1	<1	<1	4	--	--	--	--	--	--	--
				07/15/03	329.71	<1	<1	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2.5J	--	--	--	--	--	--	--
				11/06/03	328.41	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.002	<4	0.00109J	<1.1	3.2	<1.1	<0.10	<2	<0.2
				02/03/04	325.99	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	329.36	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/03/04	333.93	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.59	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
	EPAMW13_01		770-780	03/06/03	319.17	2	<1	<1	0.8J	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				07/15/03	332.28	<1	<1	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/05/03	330.39	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.002	5J	0.00245	<1	2.7	<1	<0.10	<2	<0.2
				02/03/04	326.81	<1	<1	<1	<1	<0.5	<0.5	0.6J	<1	<1	<1	2J	<1	<1	<1	<4	--	--	--	--	--	--	--
				05/24/04	331.05	<1	<1	<1	<1	<0.5	<0.5	1.3	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/03/04	335.32	0.25J	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
MW1-4	EPAMW14_04	635	380-390	07/16/03	356.90	1.9	<1	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2J	--	--	--	--	--	--	--
				11/10/03	355.66	8.7	<1	<1	1.5	<0.5	<0.5	<1	<1	<1	1.4	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/06/04	359.92	1.2	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.005	<4	0.00271	<1.2	1.2	<1.2	1.4	2.1	<1
				05/21/04	361.10	2.2	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/05/04	363.04	2.1	<0.5	<0.5	0.2J	<0.5	<0.5	0.1J	0.19J	<0.5	0.76	<5	<0.5	<0.5	--	3.5J							
	EPAMW14_03		460-470	07/16/03	359.19	44/54	0.6J/1	<1/0.6J	4.5/6.6	<0.5/<0.5	<0.5/<0.5	--	<1/<1	<1/<1	<1/<1	<4/<4	<1/<1	<1/<1	<1/<1	2.6J/<4	--	--	--	--	--	--	--
				11/10/03	361.65	52/62	0.9J/1	0.7J/0.7J	8.2/8.4	<0.5/0.3J	<0.5/<0.5	<1/<1	<1/<1	<1/<1	<1/<1	<4/<4	<1/<1	<1/<1	<1/<1	<4/<4	--	--	--	--	--	--	--
				02/06/04	360.50	35/53	0.5J/0.9J	<1/<1	3.6/5.9	<0.5/<0.5	<0.5/<0.5	<1/<1	<1/<1	<1/<1	1.8/3.4	<4/2.6J	0.8J/1.4J	<1/<1	<0.005/<0.005	<4/<4	0.000589J/0.00101J	<1.1/<1.1	3.7/2	<1.1/<1.1	9.7/9.7	3.5/3	3.6/3.5
				05/21/04	362.14	42/46	0.8J/1	0.5J/0.6J	6.9/8.6	<0.5/<0.5	<0.5/<0.5	<1/<1	<1/<1	<1/<1	1.5/<1	<4/<4	<1/<1	<1/<1	<1/<1	<4/<4	--	--	--	--	--	--	--
				08/05/04	365.83	54	0.88	0.58	6.6	0.22J	0.19J	<0.5	<0.5	<0.5	<0.5	<5	0.75	0.26J	--	<5							
	EPAMW14_02		545-555	07/16/03	372.79	12	<1	<1	1.4	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/10/03	371.34	6.4	<1	<1	1.2	<0.5	<0.5	1.0	<1	<1	0.6J	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/06/04	368.38	3.7	<1	<1	0.5J	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.005	<4	0.00976	<1.1	1.2	0.9J	0.05J	<2	<1
				05/21/04	373.16	3.1	<1	<1	0.7J	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/05/04	378.30	2.2	<0.5	<0.5	0.53	<0.5	<0.5	0.2J	<0.5	<0.5	<0.5	<5	0.1J	<0.5	--	<5							
	EPAMW14_01		605-615	07/16/03	373.67	18	<1	<1	2	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2.6J	--	--	--	--	--	--	--
				11/10/03	371.48	5.8J	<1	<1	0.8J	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/06/04	369.15	3.4	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<0.005	<4	0.00205	<1	2.2	0.7J	<0.1	<2	<1
				05/21/04	373.64	2.8	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/05/04	378.86	2.3	<0.5	<0.5	0.26J	<0.5	<0.5	0.19J	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	2.8J							

Table A-1
Groundwater Sampling Results
San Gabriel Valley NPL Area 3
Preliminary

						Volatile Organic Compounds															Semi Volatile Organic Compounds				Anions		Metals
					Units	µg/L															µg/L				mg/L	µg/L	µg/L
Well Name	Well/ Station ID	Well Depth (ft bgs)	Screened Interval(s) (ft bgs)	Date Sampled	Depth to Water (feet bgs)	TCE	PCE	1,1-DCE	cis-1,2-DCE	CCL	1,2-DCA	Carbon Disulfide	Benzene	Toluene	Chloromethane	2-Butanone	DFM	Chloroform	1,2,3-Trichloropropane	Acetone	NDMA	1,4-Dioxane	bis (2-Ethylhexyl) phthalate	Butyl benzyl phthalate	Nitrate-N	Perchlorate	Hexavalent Chromium
MW1-5	EPAMW15_06	800	325-335	07/17/03	294.07	2.6	2.5	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/07/03	296.74	3.9	2.8	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	294.37	2.6	2.4	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	0.413	<4	0.000699J	1.9	11	1.4J	19	2.7	2.7
				05/20/04	294.71	4	4.2	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	298.01	3.3	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
	EPAMW15_05		400-410	07/17/03	296.24	1.7	7.6	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/07/03	298.04	1.6	21	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	295.18	1.4	18	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	0.15	<4	0.000397J	<1.3	8.2	0.6J	16	2.4	4.7
				05/20/04	296.22	1.8	20	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	299.84	0.89/1.5	14/22	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	2.4J/1.6J	<0.5/<0.5	<0.5/0.12J	--	2.4J/<5							
	EPAMW15_04		480-490	07/17/03	301.99	2	2.2	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2.8J	--	--	--	--	--	--	--
				11/07/03	302.10	<1	0.8J/1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	299.22	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	0.0102	<4	0.000519J	<1.1	3.2	1.8J	2	<2	7.1
				05/20/04	301.39	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	2.7J	--	--	--	--	--	--	--
				08/04/04	305.01	<0.5	0.35J	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
	EPAMW15_03		590-600	07/17/03	323.70	2.2	3.5	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	2.6J	--	--	--	--	--	--	--
				11/07/03	315.40	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	311.18	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	0.00356	<4	0.000661J	<1.1	6.1	1.7J	1.2	<2	8.1
				05/20/04	319.60	<1	0.7J	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	323.45	<0.5	0.73	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
	EPAMW15_02		670-680	07/17/03	323.91	1.2	1.3	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	4	--	--	--	--	--	--	--
				11/07/03	317.11	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	310.58	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	0.00495	<4	0.000462J	<1.1	6.8	1.9J	0.06J	<2	0.32J
				05/20/04	319.78	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	323.84	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4J	<0.5	<0.5	--	<5							
	EPAMW15_01		770-780	07/16/03	318.23	2.3	2.5	<1	<1	<0.5	<0.5	--	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				11/07/03	309.56	0.5J	0.6J/1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				02/04/04	303.79	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	2J	<1	<1	0.034	<4	0.00314	<1.1	5.5	2J	<0.1	<2	<1
				05/20/04	314.47	<1	<1	<1	<1	<0.5	<0.5	<1	<1	<1	<1	<4	<1	<1	<1	<4	--	--	--	--	--	--	--
				08/04/04	318.76	0.11J	0.17J	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.5	--	<5							
MCL(µg/l; mg/L for dissolved metals and nitrate)						5[1]	5[1]	6[1]	6[1]	0.5[1]	0.5[1]	160[4]	1[1]	150[1]	None	None	1[4]	None	0.005[4]	None	0.010[4]	3[4]	4[1]	None	10[1]	6[4]	None

NOTES: TCE=Trichloroethene; PCE=Tetrachloroethene; CCL=Carbon Tetrachloride; 1,1,-DCE=1,1-Dichloroethene; cis-1,2-DCE=cis-1,2-Dichloroethene; 1,2-DCA=1,2-Dichloroethane; NDMA=N-Nitrosodimethylamine; DFM=Dichlorodifluoromethane.

-- = Not sampled.

Except for calcium, magnesium, potassium, and sodium, only compounds with a state or federal regulatory level and detected concentrations are shown.

MCL=EPA or California Maximum Contaminant Level (whichever is lower).

[1] = California

[2] = EPA

[3] = Secondary MCL

[4]= California Action Level

J-Indicates results that are considered estimates because they fall between the instrument detection limit and the contract-required quantitation limit.

All other reported VOCs were not detected above laboratory detection limits (generally 1 µg/L).

Not all analytes are sampled for each quarter. The analyses performed each quarter are based on rationales provided in EPA's FSP.

Monitoring well MW1-2B has not been sampled due to the groundwater level falling below the screen interval.

TABLE A-2
Data Needs and Uses – Regulatory Limits for Inorganic Parameters

Inorganic Parameter	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable or Relevant and Appropriate Requirements (ARAR) (2)	California DHS DLR (µg/L) (3)	Additional ARARs (µg/L)
Groundwater and Well Development Water					
Perchlorate(1)	Define nature and extent of contamination Compare data to Federal and State drinking water standards Assess source of contaminants Assess need for monitoring or treatment	6	CA DHS State Action Level (4)	6	1(5)
Investigation-Derived Waste					
Drill Cuttings and Drilling Mud:					
DHS 96-Hour Acute Aquatic Toxicity screening Test	Compare to Federal, State and TSDF-specific limits for proper disposal.	Not Applicable	Landfill-specific	NA	LC50 < 500 mg/L(6)

NOTES:

(1) Perchlorate is included in Table 2B of the QAPP (EPA, 2003b). Perchlorate is included in this QAPP Addendum No. 1 because the applicable regulatory limit has changed since the QAPP (EPA, 2003b) was finalized.

(2) Applicable or Relevant and Appropriate Requirements (ARARs) from August 2000 California EPA Compilation of Water Quality Goals and Updates through November 2001.

(3) California Department of Health Services required Detection Limit for Purposes of Reporting (DLR).

(4) California Department of Health Services State Action Level for toxicity.

(5) Per EPA revised draft toxicity assessment.

(6) California Code of Regulations, Title 22, Article 3, Section 66261.24(a)(6).

TABLE A-3
Measurement Performance Criteria

Parameter	Method	Reporting Limit/Target Detection Limit	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Investigation-Derived Waste Drill Cuttings and Drilling Mud:					
DHS 96-Hour Acute Aquatic Toxicity Screening Test	Cal-DHS[a]	NA	NA	NA	90

Notes:
[a] A project Standard Operating Procedure (SOP) is provided in Appendix B as this analyte may be analyzed by laboratories other than the EPA regional laboratory.

TABLE B-1
Proposed Screen Intervals for Conventional and Multiport Monitoring Wells

Well Name	MW1-6	MW1-7	MW1-8
Well Type	Multiport	Conventional	Conventional
Screen Intervals (feet bgs)	270-290 350-360 440-450 520-530 600-610 680-690 770-780	270-290	270-290

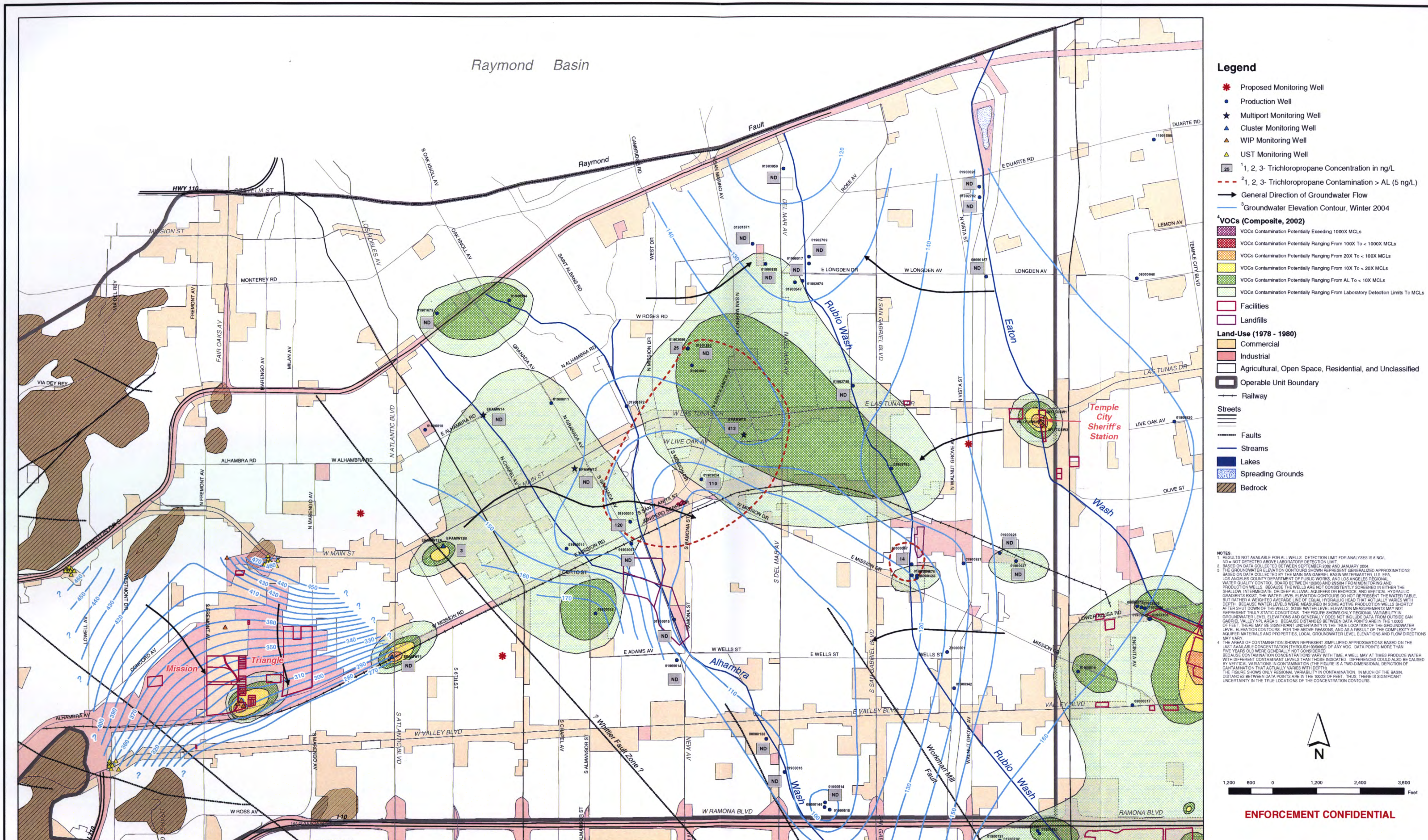
Raymond Basin
Raymond
Fault
HWY 110
Rubio Wash
Eaton Wash
Alhambra Wash
Rubio Wash
Workman Mill Fault
? Whittier Fault Zone ?
Mission
Triangle
Temple City Sheriff's Station
Legend
Proposed Monitoring Well
Production Well
Multiport Monitoring Well
Cluster Monitoring Well
WIP Monitoring Well
UST Monitoring Well
1, 2, 3- Trichloropropane Concentration in ng/L
1, 2, 3- Trichloropropane Contamination > AL (5 ng/L)
General Direction of Groundwater Flow
Groundwater Elevation Contour, Winter 2004
VOCs (Composite, 2002)
VOCs Contamination Potentially Exeeding 1000X MCLs
VOCs Contamination Potentially Ranging From 100X To < 1000X MCLs
VOCs Contamination Potentially Ranging From 20X To < 100X MCLs
VOCs Contamination Potentially Ranging From 10X To < 20X MCLs
VOCs Contamination Potentially Ranging From AL To < 10X MCLs
VOCs Contamination Potentially Ranging From Laboratory Detection Limits To MCLs
Facilities
Landfills
Land-Use (1978 - 1980)
Commercial
Industrial
Agricultural, Open Space, Residential, and Unclassified
Operable Unit Boundary
Railway
Streets
Faults
Streams
Lakes
Spreading Grounds
Bedrock
NOTES:
1. RESULTS NOT AVAILABLE FOR ALL WELLS. DETECTION LIMIT FOR ANALYSES IS 5 NG/L
ND = NOT DETECTED ABOVE LABORATORY DETECTION LIMIT.
2. BASED ON DATA COLLECTED BETWEEN SEPTEMBER 2002 AND JANUARY 2004.
3. THE GROUNDWATER ELEVATION CONTOURS SHOWN REPRESENT GENERALIZED APPROXIMATIONS BASED ON DATA COLLECTED BY THE MAIN SAN GABRIEL BASIN WATERMASTER, U.S. EPA, LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS, AND LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD BETWEEN 12/2/03 AND 2/25/04 FROM MONITORING AND PRODUCTION WELLS. BECAUSE THE WELLS ARE NOT CONSISTENTLY SCREENED IN EITHER THE SHALLOW, INTERMEDIATE, OR DEEP ALLUVIAL AQUIFERS OR BEDROCK, AND VERTICAL HYDRAULIC GRADIENTS EXIST, THE WATER LEVEL ELEVATION CONTOURS DO NOT REPRESENT THE WATER TABLE, BUT RATHER A WEIGHTED AVERAGE LINE OF EQUAL HYDRAULIC HEAD THAT ACTUALLY VARIES WITH DEPTH. BECAUSE WATER LEVELS WERE MEASURED IN SOME ACTIVE PRODUCTION WELLS SHORTLY AFTER SHUT DOWN OF THE WELLS, SOME WATER LEVEL ELEVATION MEASUREMENTS MAY NOT REPRESENT TRULY STATIC CONDITIONS. THE FIGURE SHOWS ONLY REGIONAL VARIABILITY IN GROUNDWATER LEVEL ELEVATIONS AND GENERALLY DOES NOT INCLUDE DATA FROM OUTSIDE SAN GABRIEL VALLEY NPL AREA 3. BECAUSE DISTANCES BETWEEN DATA POINTS ARE IN THE 1,000S OF FEET, THERE MAY BE SIGNIFICANT UNCERTAINTY IN THE TRUE LOCATION OF THE GROUNDWATER LEVEL ELEVATION CONTOURS. FOR THE ABOVE REASONS, AND AS A RESULT OF THE COMPLEXITY OF AQUIFER MATERIALS AND PROPERTIES, LOCAL GROUNDWATER LEVEL ELEVATIONS AND FLOW DIRECTIONS MAY VARY.
4. THE AREAS OF CONTAMINATION SHOWN REPRESENT SIMPLLIFIED APPROXIMATIONS BASED ON THE LAST AVAILABLE CONCENTRATION (THROUGH 03/06/03) OF ANY VOC. DATA POINTS MORE THAN FIVE YEARS OLD WERE GENERALLY NOT CONSIDERED.
BECAUSE CONTAMINATION CONCENTRATIONS VARY WITH TIME, A WELL MAY AT TIMES PRODUCE WATER WITH DIFFERENT CONTAMINANT LEVELS THAN THOSE INDICATED. DIFFERENCES COULD ALSO BE CAUSED BY VERTICAL VARIATIONS IN CONTAMINATION (THE FIGURE IS A TWO-DIMENSIONAL DEPICTION OF CANTAMINATION THAT ACTUALLY VARIES WITH DEPTH).
THE FIGURE SHOWS ONLY REGIONAL VARIABILITY IN CONTAMINATION. IN MUCH OF THE BASIN, DISTANCES BETWEEN DATA POINTS ARE IN THE 1000'S OF FEET. THUS, THERE IS SIGNIFICANT UNCERTAINTY IN THE TRUE LOCATIONS OF THE CONCENTRATION CONTOURS.
N
1,200 600 0 1,200 2,400 3,600 Feet
ENFORCEMENT CONFIDENTIAL

Figure 1

Figure

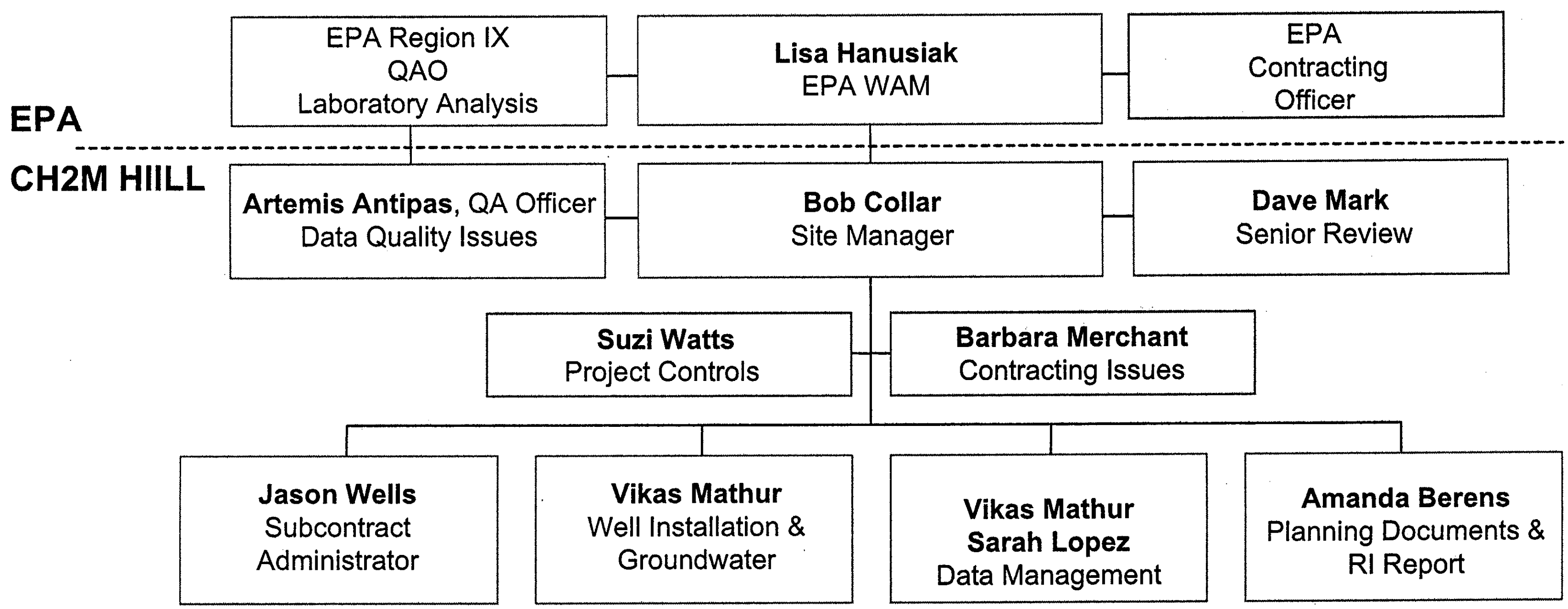

Figure A-1
San Gabriel Valley NPL Area 3
Project Organization
RI Field Activities

SCO175859.FI.01 RI ProjectOrg rev.ppt 10/04

Appendix A
San Gabriel Valley NPL Area 3 Remedial Investigation Data Needs

MEMORANDUM **CH2MHILL**

San Gabriel Valley NPL Area 3 Remedial Investigation Data Needs

TO: Lisa Hanusiak/U.S. EPA Region IX

COPIES: File

FROM: Bob Collar/CH2M HILL/SCO

DATE: June 30, 2004

The purpose of this memorandum is to briefly status and summarize Remedial Investigation (RI) information collected to date in San Gabriel Valley NPL Area 3 and to recommend additional information needed for completion of the RI.

Key RI activities performed to date include:

- Preparation of the January 2001 draft Data Evaluation Report (functional equivalent of an RI work plan), including land use information
- Installation (completed in July 2003) and sampling of five deep monitoring wells
- Preparation of groundwater level elevation contours for the Area 3 OU
- Preparation of hydrogeologic cross sections through the Area 3 OU, including the interpreted extent of VOC contamination
- Preparation of two VOC contamination maps for the 1) shallow and 2) deeper aquifers in the Area 3 OU
- Preparation of charts for numerous production wells showing PCE, TCE, and pumping data versus time

The information above and limited facility-specific data available have been used to develop a conceptual model of VOC contamination in the Area 3 OU. The ultimate goal of the RI is to refine this model sufficiently so that it can be used to support: 1) preparation of a Feasibility Study (FS) for the Area 3 OU and selection of a remedy (i.e., Record of Decision) and 2) identification of potentially responsible parties (PRPs) who would perform the FS and remedial action.

At this point in the RI, it is most convenient to describe the Area 3 conceptual model relative to specific geographic areas, which are based on the distribution of various contaminants such as TCE, PCE, and 1,2,3-trichloropropane. These conceptual sub-models are described below, along with current data gaps, and data needs identified as key to completing the RI as soon as possible. Selected and supporting RI information is shown in attached Figure 1, and recommended actions, including approximate costs, are summarized in Table 1.

WESTERN AREA 3

Conceptual Model

VOC contamination source areas have been identified in the Mission Triangle portion of the western Area 3 OU (Figure 1). TCE groundwater contamination has been identified in both facility and EPA monitoring wells in this sub-area, which is west of production wells impacted by TCE. Thus, this area is likely a source area for TCE observed in production wells to the east and northeast. While TCE is the predominant VOC in production wells in the western portion of Area 3 and is found in facility monitoring wells in the Mission Triangle area, an evaluation of soil gas data shows that PCE is also present in facility monitoring wells and at relatively higher concentrations in soil gas beneath the same facilities. Although PCE use has been documented at these facilities, the reason for the greater concentrations of TCE in groundwater are not fully understood. Given the relatively greater age of PCE use at one of the Mission Triangle facilities, it is possible that biologically-mediated degradation of PCE has occurred, leading to elevated TCE in groundwater, along with other degradation by-products such as cis-1,2-dichloroethyene.

A fault that acts as an impedance to groundwater flow from west to east has been identified between the Mission Triangle area and production wells to the east. Historic groundwater flow was from the Mission Triangle Area towards production wells to the east. Groundwater levels east of the fault, tentatively associated with the Whittier Fault Zone (see Lamar, D.L., ***Geology of the Elysian Park-Repetto Hills Area, Los Angeles County, California***, California Division of Mines and Geology Special Report 101, 1970), have declined more than 100 feet over the last 75 years, while groundwater levels in the Mission Triangle area appear to have declined less and at a lower rate. Current groundwater flow in the Mission Triangle area may be to the southeast, as opposed to toward production wells east of the fault. However, groundwater monitoring well data in the Mission Triangle area and to the east are very limited. And, some of the monitoring wells are close to shallow bedrock, which may affect the direction of groundwater flow. As discussed below, the groundwater flow direction may be different from what is currently interpreted, particularly near the fault noted above and shown on Figure 1. Multiport monitoring well and other data suggest that TCE contamination is limited in vertical extent. The current conceptual model of the western OU suggests that containment of TCE-contaminated groundwater emanating from the Mission Triangle area using new and/or existing extraction wells may be an interim remedial measure to be considered for the western Area 3 OU.

Data Gap(s)/ Need(s)

Although potential contaminant sources have been identified in the Mission Triangle area, contaminant migration across the Whittier Fault Zone has not yet been confirmed. Moreover, although historic groundwater level elevation maps show suggest west to east groundwater flow across the trace of the fault, such flow has not been documented. Thus, understanding past and current groundwater flow conditions near the fault is necessary to 1) assist with selection of remedial alternatives and 2) assist in naming of PRPs in the western Area 3 OU.

Sources of TCE in groundwater have tentatively been identified in the Mission Triangle area, though the relationship between PCE use at some facilities and TCE in groundwater needs to be better understood. EPA requested that CH2M HILL evaluate this relationship. In doing so, CH2M HILL has determined that this is not a high priority data need in terms of identifying sources of groundwater contamination. This is partly because PCE is also present in the groundwater, which is consistent with documented PCE use at some of the Mission Triangle facilities. Nevertheless, understanding this relationship will be useful in confirming whether or not such facilities are in fact sources of relatively high concentrations of TCE in groundwater in the Mission Triangle area.

Recommended Action(s)

We recommend that EPA's FEFLOW groundwater model be updated to adequately simulate the newly documented fault and to be used in assessing historic and current groundwater flow between the Mission Triangle area and the rest of the OU (see Table 1, item 6). In addition, we recommend the installation of two additional monitoring wells to be used to assess current groundwater flow directions west of and near the fault separating the Area 3 OU (Figure 1). Data from these wells will help assess the groundwater flow direction between the Mission Triangle area and production wells to the east. This information will help to 1) assess whether or not contamination in the Mission Triangle area is a continuing source of TCE contamination observed in nearby production wells and 2) link contaminant sources in the Mission Triangle area to the contamination to the east. The evaluation of soil gas data in the Mission Triangle area should be expanded to assess the relationship between PCE use at facilities and the predominant TCE groundwater contamination beneath the facilities. This would involve characterization of the soil gas and groundwater chemistry with respect to VOCs to assess whether biologically-mediated degradation of PCE could have resulted in the observed groundwater contamination. The recommended actions are summarized in Table 1.

CENTRAL AREA 3

Conceptual Model

1,2,3-trichlorpropane is a VOC that is not as readily removed from groundwater as other VOCs such as TCE and PCE. As a result of this, and the stringent treatment goals related to a low Action Level (AL), treatment costs can increase if this chemical is present in groundwater. 1,2,3-trichloropropane has been detected below the California DHS AL in one out of four EPA monitoring wells located just east of the fault in the western portion of the OU. On the other hand, 1,2,3-trichloropropane in excess of the AL of 5 ng/L exists in groundwater in the central portion of the OU (Figure 1). The highest concentrations have been found in EPA's multiport monitoring well MW1-5 and are in the shallowest two intervals, consistent with the detection of VOCs in only these two intervals. Lower concentrations have been measured in a few nearby production wells. These lower concentrations are likely the result of mixing of the relatively shallow 1,2,3-trichloropropane contamination over the relatively long screened intervals of production wells. The prevalence of 1,2,3-trichloropropane in the shallower intervals of the central portion of the OU suggests that the source for the 1,2,3-trichlorpropane contamination lies in the central or eastern portion of the OU and that it may be relatively close to the affected wells. Most of the wells with detected 1,2,3-trichloropropane, which are slightly east of center in the OU, are also impacted by PCE. However, the relationship between these two contaminants and their source(s) is not understood. PCE contamination in this portion of the OU appears to be coming from a source, or sources, near the Temple City Sheriffs Station, though this has not been confirmed.

Data Gap(s)/ Need(s)

Data collected to date suggest that VOC contamination in the central portion of the Area 3 OU may be limited to the upper part of the groundwater aquifer and hence amenable to focused extraction, containment, and treatment. However, the location of any future optimal remedial action is uncertain due to uncertainty about the source for 1,2,3-trichlorpropane contamination and it's relationship to PCE contamination. Thus, understanding the source of 1,2,3-trichloropropance contamination is necessary to: 1) assist with selection of a remedial action and 2) assist in naming of PRPs in the central Area 3 OU. To date, only limited testing of production wells in Area 3 using low-detection-limit 1,2,3-trichloropropane analyses has been performed as directed by DHS. Additional production well data are needed to better define the extent of 1,2,3-trichlorpropane contamination. In addition, low-detection-limit 1,2,3-trichloropropane analyses are needed at potential PRP facilities to facilitate source identification.

Recommended Action(s)

EPA's January 2001 Draft Data Evaluation Report identified an area of industrial land use associated with a rail corridor near the central OU (Figure 1). This area, and other surrounding commercial and industrial areas, should be evaluated to identify potential 1,2,3-trichloropropane and PCE sources/PRPs. In addition, evaluation of 1,2,3-trichloropropane sources can be facilitated by developing a profile of typical businesses who have used or use this chemical. EPA may wish to coordinate Area 3 remedial investigation activities with DHS in an effort to expedite the testing of production wells in Area 3 for 1,2,3-trichloropropane using low (<5 ng/L) detection limit analytical methods. EPA should request that low-detection-limit 1,2,3-trichloropropane analyses be conducted at the Temple City Sheriffs Station monitoring wells and at other potential PRP wells in the OU. The recommended actions are summarized in Table 1.

EASTERN AREA 3

Conceptual Model

A VOC contamination source area has been identified near the Temple City Sheriff's station (Figure 1). PCE groundwater contamination exceeding 100x the MCL of 5 ug/L has been identified in monitoring wells at this facility, to the east of production wells impacted by PCE contamination. Current groundwater flow in this area is from east to west, suggesting a causative relationship between contamination beneath the sheriff's station and contamination in production wells to the west. Multiport monitoring well data from the central OU suggest that PCE contamination may be limited in vertical extent.

Data Gap(s)/ Need(s)

Although PCE is the most prevalent VOC in production wells in the eastern portion of the OU, the vertical distribution is not fully understood. San Gabriel County Water District (SGCWD) well 01902786 was sampled in the late 1980s to evaluate the vertical distribution of nitrate and other contaminants. However, the sampling results were somewhat inconclusive and have not been evaluated in light of more recent data and the history of operation of this well. In addition, a few of the production wells (i.e., 01902786) in the eastern OU have apparently not been sampled in several years. There is a potential for other sources in the vicinity of the Temple City Sheriff's station area. In the eastern OU, time series charts of PCE in production wells in the area do not necessarily confirm that the Temple City Sheriff's station area is the only source for PCE contamination in the eastern OU. Because the vertical distribution of VOC contamination in the eastern portion of the OU is not clearly understood, and because other PCE source areas may exist, containment using new and/or existing extraction wells may or may not be a suitable interim remedial measure.

Recommended Action(s)

EPA should obtain and evaluate any available data for SGCWD wells 01902785 and 01902786 (e.g., vertical sampling data and more recent sampling results). CH2M HILL previously prepared charts showing PCE, TCE, and groundwater pumping versus time at many of the production wells in the OU. These charts have proved useful in 1) evaluating the relative impact of TCE versus PCE on production wells, 2) evaluating the effects of pumping of production wells on contamination migration, and 3) interpreting the vertical distribution of contaminants in the OU. These charts should be updated with the latest VOC and pumping data since they were last prepared about 3 years ago. In updating these charts, EPA should contact either the California Department of Health Services (DHS) or well owners to obtain purveyor-collected water quality data not routinely furnished to EPA. Similar information was recently obtained from DHS for the South El Monte OU, where in one instance DHS had approximately 3 times more data for a production well compared to EPA's database. Particular emphasis should be placed on obtaining water quality data collected by well owners from inactive production wells, as this information is not readily available or regularly provided to EPA. Having owner-collected data will facilitate EPA's efforts to develop a clear and recent portrayal of groundwater contamination in the OU.

A multiport monitoring well should be installed west of the Temple City Sheriff's station, between the station and production wells to the west. This well will be used to evaluate and monitor the vertical distribution of VOC contamination and to assist in identifying contaminant sources near the Temple City Sheriff's station. The recommended actions are summarized in Table 1.

NORTH CENTRAL AREA 3

Conceptual Model

Well 01901679, which is just north of Huntington Drive and east of Garfield Avenue in the north central portion of the OU, is the only well in the western half of the OU impacted by just PCE (Figure 1). Other wells in the western portion of Area 3 are impacted by essentially TCE groundwater contamination. This difference in VOC contamination suggests that a separate source area exists for well 01901679. The observation that other wells in the area are not impacted by PCE contamination suggests that the PCE source area may be relatively small and close to well 01901679. If this is the case, source control and wellhead treatment may be the preferred alternatives for dealing with this contamination.

Data Gap(s)/ Need(s)

No source for PCE in the north central portion of the OU has been clearly identified. In addition, whether or not VOC contamination in Area 3 originates in groundwater north of the Raymond Fault (Figure 1) has not been assessed.

Recommended Action(s)

EPA's January 2001 Draft Data Evaluation Report identified several small areas of commercial land use near well 01901679 (Figure 1). These areas should be evaluated to identify potential PCE sources/PRPs, such as a dry cleaning facility. Additionally, potential sources of groundwater contamination in the Raymond Basin should be identified. This would involve some research and contacting the water agency (Raymond Basin Management Board [RBMB]) responsible for managing groundwater in the Raymond Basin. The RBMB can be contacted at: 4536 Hampton Road, PO Box 686, La Canada Flintridge, CA 91012 (818) 790-4036. In addition, other information on the Raymond Basin is available at the Agency for Toxic Substances and Disease Registry (http://www.atsdr.cdc.gov/HAC/PHA/jetprop/jpl_toc.html), the Los Angeles Regional Water Quality Control Board (http://www.swrcb.ca.gov/rwqcb4/html/perchlorate/) and the California Department or Water Resources (http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/4-23_Raymond.pdf). The recommended actions are summarized in Table 1.

ENTIRE AREA 3 OU: ADDITIONAL ACTION(S)

In addition to updating of time-series plots for wells in the eastern OU, as described above, all production wells should be evaluated throughout the OU to ensure that no data gaps are present (i.e., well 01901679, with PCE contamination in the north-central portion of the OU). An additional concern is that there is no clear picture (i.e., snapshot) of which wells have been impacted, and how, by VOC contamination in the OU. This information will be particularly useful if existing production wells are contemplated as components of a remedial action. Based on previous discussions between EPA and CH2M HILL, the need to obtain this information from DHS has been identified. EPA has initiated a request with DHS and this information is forthcoming. It will be used together with other information (e.g., maps showing the distribution of VOCs, groundwater level elevation contours, and charts of VOC contamination and groundwater pumping at production wells) to further refine the conceptual model of the entire OU. The recommended actions are summarized in Table 1.

Table 1. San Gabriel Valley NPL Area 3 Data Needs

										Priority (for new recommendations; 1 = highest or soonest)	
Item	**Recommended Action**	**Location of Action Within OU**	**Purpose or Objective**	**Work Completed?**	**Consequence(s) if Not Done (if new work or work not completed)**	**Within Scope of RAC IX Contract?**	**Budgeted for in Work Plan?**	**Approximate Cost (if new work within scope of RAC IX work plan)**	**Comment(s)**	**Relative Importance**	**Proposed Schedule**
Draft Data Evaluation Report Recommendations											
1	Spinner logging and depth-specific sampling of 4 production wells	West and Central	Evaluate vertical extent of TCE and PCE contamination and help locate and design (e.g., screen intervals and depths) RI monitoring wells	No	without prior knowledge of the vertical distribution, may result in increased cost of RI monitoring wells due to constructing screen intervals in and monitoring portions of the aquifer not impacted by contamination	Yes	Yes	--	no suitable production wells were identified from review of applicable data; this task will likely not be performed	--	--
2	Aquifer testing of 4 production wells	West and Central	Obtain aquifer property data to update groundwater model	No	adds to uncertainty in remedy costs because potential extraction well locations and rates are from groundwater model where aquifer parameters (e.g., aquifer hydraulic conductivity) are based on approximations rather than field measurements and estimates	Yes	Yes	--	recommend obtaining these data from purveyors, Watermaster, or power utility coincident with model update	--	--
3	Install 3 deep multiport monitoring wells and 2 shallow monitoring well clusters	West and Central	Evaluate lateral and/or vertical extent of contamination throughout impacted portion of OU; link source area contamination to production well contamination	Yes	--	Yes	Yes	--	--	--	--
4	Update conceptual model of site	Throughout	Support remedy selection process	Ongoing	--	Yes	Yes	--	--	--	--
5	Investigate contamination at facilities	Throughout	Identify contamination source(s)	Ongoing by LARWQCB	can not identify sources and PRPs; limits remedy options to containment, instead of source control	No	No	--	--	--	--
New Recommendations											
6	Update groundwater model	Throughout	Identify contamination source area(s); link identified sources to regional contamination in production and RI monitoring wells; support remedy selection remedial design	No	significantly inhibits ability to link PRPs to regional groundwater contamination, to prepare risk assessment and feasibility study, and to select a remedy and perform remedial design	Yes	Yes	--	--	--	--
7	Install 2 shallow wells in western OU	West	Assess link between PRPs in the Mission Triangle area and impacted production wells east of the Whittier Fault Zone-both under current and historical groundwater flow conditions; this will also aid significantly in identifying contamination source areas	No	may be difficult to demonstrate link between PRPs in Mission Triangle area and regional contamination to the east, which will make it very challenging to negotiate implementation of the FS and RD/RA by PRPs, who will cite lack of documented connection between contamination at facilities and production wells to east; limits the ability to validate the groundwater model in the vicinity of the fault that acts as a partial barrier to groundwater flow and contamination, which will impact the ability to conduct the FS and remedial design;	Yes*	Yes	$ 50,000	use $ scoped for installation of facility monitoring wells; amend SAP, community relations support; assess whether alternative data collection activities are planned as part of facility-specific or other investigation to avoid spending EPA $	3	3
8	Evaluate Mission Triangle study area soil gas and groundwater data	West	Confirm suspected link between shallow contamination at PRP facilities and underlying groundwater contamination by evaluating natural chemical degradation processes in the unsaturated and saturated zones	No	places burden for naming PRPs on other forms of evidence such as chemical usage and confirmed contamination	Yes*	No	$ 2,500	--	10	10
9	Evaluate industrial areas in central OU for contamination sources	Central	Identify source area(s) of 1,2,3-trichloropropane and PCE impacting production wells in Central OU	No	may not be able to identify major sources and PRPs, which will shift FS and RD/RA costs on to EPA and other PRPs; not knowing location of 1,2,3-trichloropropane sources limits remedy options to containment, instead of source control	No	No	--	to be performed by other EPA contractor and LARWQCB	--	--
10	Develop profile of which industries use 1,2,3-trichloropropane	Throughout	Developing profile will cost effectively focus search for 1,2,3-trichloropropane sources in the Central OU	No	without focusing search, costs to identify sources and PRPs will increase due to investigation of unlikely sources	Yes	No	$ 5,000	could conduct work under same subtask as LARWQCB meetings and PRP naming action plan	9	4

Table 1. San Gabriel Valley NPL Area 3 Data Needs

Item	Recommended Action	Location of Action Within OU	Purpose or Objective	Work Completed?	Consequence(s) if Not Done (if new work or work not completed)	Within Scope of RAC IX Contract?	Budgeted for in Work Plan?	Approximate Cost (if new work within scope of RAC IX work plan)	Comment(s)	Priority (for new recommendations; 1 = highest or soonest): Relative Importance	Proposed Schedule
11	Work with DHS to ensure that all production wells in OU are sampled for 1,2,3-trichloropropane	Throughout	Further refine currently understood lateral and vertical extent of 1,2,3-trichloropropane contamination; this will cost-effectively facilitate source identification and will focus remedy options	No	without refining understanding of the extent of 1,2,3-trichloropropane contamination, source identification and remedy selection process will be more costly	Yes	No	$ 2,500	--	4	5
12	Sample facility monitoring wells for 1,2,3-trichloropropane	Throughout	Rule out and identify source(s) of 1,2,3-trichloropropane impacting production wells in Central OU	No	may not be able to identify key sources and PRPs, which will shift FS and RD/RA costs on to EPA and other PRPs; not knowing location of 1,2,3-trichloropropane sources limits remedy options to containment, instead of source control	No	No	--	should be required by LARWQCB	--	--
13	Evaluate water quality data from SGCWD wells	East	Evaluate vertical extent of PCE contamination in eastern OU, which will allow for selection of appropriate remedy	No	by being less certain of vertical distribution of contamination, there is more uncertainty in the OU conceptual model, which may lead to a more costly remedy (e.g., conservatively-designed extraction wells and treatment systems)	Yes	Maybe	$ 5,000	--	5	6
14	Obtain recent data for production wells from DHS	Throughout	Cost-effectively fill data gap by using inactive and active production well data collected by others to evaluate lateral and vertical extent of contamination, contamination migration, source area identification, and current status of production wells throughout the OU	No	might otherwise spend money to evaluate sampling of active or inactive production wells where data actually exist; by being less certain of horizontal and vertical distribution of contamination, there is more uncertainty in the OU conceptual model, which may lead to a more costly remedy (e.g., conservatively-designed extraction wells and treatment systems); will make source identification more costly and may shift cost of FS and RD/RA on to EPA and other PRPs	Yes	Maybe	$ 4,000	--	6	7
15	Update TCE, PCE, and pumping time-series plots for production wells	Throughout	Evaluate lateral and vertical extent of contamination using data from impacted production wells; evaluate contamination migration using data from impacted and non-impacted production wells	No	by being less certain of distribution of contamination, there is more uncertainty in the OU conceptual model, which may lead to a more costly remedy (e.g., conservatively-designed extraction wells and treatment systems); will make source identification more costly and shift cost of FS and RD/RA on to EPA and other PRPs	Yes	Maybe	$ 4,000	--	7	8
16	Install 1 deep multiport monitoring well west of Temple City Sheriff's station	East	Evaluate lateral and vertical extent of PCE contamination in eastern OU and link source area PCE contamination to production well contamination; this will allow for selection of appropriate remedy	No	by not establishing a link between PCE-impacted production wells and likely source(s) near the Temple City Sheriff's station, identification of source(s) and PRPs will be more difficult and costly; costs of the FS and RD/RA will potentially be shifted on to EPA and other PRPs; by not knowing the source(s) of PCE contamination in production wells, will significantly increase the difficulty in developing appropriate remedial actions; by being less certain of vertical distribution of contamination, there is more uncertainty in the OU conceptual model, which may lead to a more costly remedy (e.g., conservatively-designed extraction wells and treatment systems)	Yes*	No	$ 350,000	see item 7 for amended SAP cost; includes 3 sampling events of 800-foot-deep well; assess whether alternative data collection activities are planned as part of facility-specific or other investigation to avoid spending EPA $	2	2

Table 1. San Gabriel Valley NPL Area 3 Data Needs

										Priority (for new recommendations; 1 = highest or soonest)	
Item	**Recommended Action**	**Location of Action Within OU**	**Purpose or Objective**	**Work Completed?**	**Consequence(s) if Not Done (if new work or work not completed)**	**Within Scope of RAC IX Contract?**	**Budgeted for in Work Plan?**	**Approximate Cost (if new work within scope of RAC IX work plan)**	**Comment(s)**	**Relative Importance**	**Proposed Schedule**
17	Evaluate commercial areas in north-central OU for contamination sources	North central	Identify or rule out source area(s) of PCE impacting production well in north-central OU	No	may not be able to identify key sources and PRPs, which will shift FS and RD/RA costs on to EPA and other PRPs; not knowing location of PCE sources limits remedy options to containment, instead of source control	No	No	--	to be performed by other EPA contractor and LARWQCB	--	--
18	Evaluate area beyond and north of OU boundary (i.e., Raymond Fault) for contamination sources	North central	Identify or rule out source area(s) of PCE and TCE impacting production wells in western and north-central OU	No	leaves open to question possible source area with significant implications on remedy selection, which will make negotiation with PRPs to implement the FS and RD/RA more challenging	Yes*	No	$ 10,000	--	8	9
19	Assess impact of contamination on production wells (update status)	Throughout	Evaluate seriousness of water supply problems and establish level of urgency for remedy selection; assess possible future use of wells as remedy components	No	will be more difficult to justify need for remedial action and may lead to cost-ineffective decisions; limits key information needed to select remedy	Yes	Maybe	$ 5,000	--	1	1

* indicates work plan amendment is required to adjust scope and/or budget

Appendix B
DHS 96-Hour Acute Aquatic Toxicity Screening Test

DEPARTMENT OF HEALTH SERVICES
TITLE 22
96-HOUR ACUTE AQUATIC AQUATIC
TOXICITY SCREEN TESTING

TABLE OF CONTENTS

INTRODUCTION

Title 22, Article 3, Section 66261.24 (6) of the California Code of Regulations (CCR) establishes the criteria for the identification of hazardous and extremely hazardous waste. The Department of Health Services (DOHS) compiles and evaluates analytical data for compliance with the toxicity criteria for potentially hazardous waste.

The California DOHS 96-Hour Acute Aquatic Toxicity testing assures CCR compliance and minimizes risk to the environment or threat to public health.

Laboratory certification by the DOHS standardized the toxicity testing program by requiring certification of testing laboratories and by utilizing the procedures set forth in "Static Acute Bioassay Procedures for Hazardous Waste Samples." Department of Fish and Game, Water Pollution Control Laboratory (Nov. 1988). Following this methodology, a waste can be evaluated for potential hazardous waste declassification.

Currently; CCR, Title 22, Section 66261.24, Article 6 requires wastes to pass the 96-hour aquatic toxicity screen testing with greater than 50% survival at the 500 mg/l concentration. In addition to this regulation, the DOHS protocol requires wastes to pass the 96-hour aquatic toxicity screen testing with a minimum of 60% survival at the 750 mg/l concentration for compliance. When these screening criteria are not achieved, the DOHS test protocol requires additional definitive serial dilution toxicity testing with a minimum of five test concentrations prior to making a hazardous waste compliance determination.

Toxicity testing conducted under the CCR, Title 22, Section 66261.24, Article 6 requirements is a static non-renewal acute toxicity screen test following Standard Methods and the procedures in the "Static Acute Bioassay Procedures for Hazardous Waste Samples". Death is the effect measured and toxicity is reported as percent survivorship at 250 mg/l, 500 mg/l and 750 mg/l concentrations and a LC_{50} calculated from these data. Original data worksheets will remain on file at the lab for ten years.

MATERIALS AND METHODS

Facilities

The toxicity tests should be conducted in a laboratory located away from disturbances of non-laboratory personnel or other laboratory or heavy equipment.

Lighting should be provided by cool white fluorescent fixtures that are regulated by a 24-hour timer. The lighting remaining on for 16 hours and off for 8 hours.

The temperature of the toxicity testing laboratory should be maintained by a climate control unit which provides accuracy to ± 2 °C. The laboratory's temperature should be continuous monitored 24 hours per day, with "backup" provided. Maximum-minimum thermometers should be maintained within the laboratory to provide temperature variation information.

Low pressure, filtered air should be supplied to the laboratory for the purpose of slowly bubbling air into the exposure tanks to maintain an acceptable dissolved oxygen concentration. Air should be bubbled into the aquaria at a rate of approximately 30 ml/min following the guidelines of Kopperdahl (1976) and Peltier and Weber (1985).

Test Containers

Toxicity tests should be conducted in 5-gallon glass aquariums. For the definitive test, the aquariums contain a total of 10 liters of waste material and/or dilution softwater which provides a water depth within the test aquariums of approximately 14 cm.

Test containers should be cleaned thoroughly with commercial glassware detergent and warm tap water, rinsed five times with warm tap water, rinsed with reagent grade acetone, rinse five times with deionized water, rinsed with 5% HCl, and then rinsed three times with deionized water.

Determination of Water Quality Parameters

Water quality measurements should be taken and recorded for pH, dissolved oxygen and temperature after dosage of the appropriate concentration of waste sample to the test aquariums, and at 24, 48, 72, and 96 hours subsequent to initiation of the toxicity test exposures. Total alkalinity and hardness, both expressed as mg/l $CaCO_3$, should be determined from sub-samples of dilution water and the 750 mg/l concentration obtained immediately prior to initiation and at the completion of toxicity testing.

After stabilization of the reading, the pH should be recorded on the static toxicity test worksheet to the nearest 0.1 pH unit.

Dissolved oxygen concentrations (mg/l) should be recorded on the static toxicity test worksheet to the nearest 0.1 mg/l, only after stabilization of the reading.

Exposure temperature should be determined thermometer graduated to O.1°C with calibration traceable to the National Institute of Standards and Technology (NIST).

Alkalinity values should be achieved by utilizing Method 2320B, *Standard Methods* (18th Edition) or EPA 310.1.

Hardness values should be achieved by utilizing Method 2340C, *Standard Methods* (18th Edition).

TOXICITY TEST PREPARATION

Receiving and Acclimating Fish

The fathead minnows, *Pimephales promelas*, should be received from the supplier at least 10 days prior to initiation of toxicity testing. Shipment of the test fish should be in insulated containers with freshwater and an atmosphere of bottled oxygen via Federal Express overnight. Upon receipt of the test fish, the plastic bags containing the fathead minnows should be floated on the surface of an appropriately sized aquarium containing aged local (hard) drinking water in the temperature controlled toxicity test laboratory. When the temperature of the water in the plastic bags containing the fathead minnows is within 0.5°C of the holding tank, each plastic bag is opened and the fish are gentry eased into the initial acclimation water containing penicillin. This antibiotic is effective against both gram-negative and gram-positive bacteria as well as fungus. The antibiotic is maintained in the acclimation water for 24 hours while the hardness is slowly decreased to that of the reconstituted moderately hardwater utilizing a reservoir and siphons to slowly change over the water following guidelines in *Standard Methods* (18^{th} Edition). The test fish should be subsequently gently transferred using a fine mesh dip net to the holding tank for further acclimation until initiation of the toxicity testing.

During the acclimation period, up until 48 hours prior to initiation of the toxicity testing, the fathead minnows should be maintained on a consistent diet, while observing the behavior and monitoring the quality of the acclimating fish. The quantity of food delivered at each feeding should be based upon the quantity that the tank population would completely consume within approximately five minutes of feeding. During these observations, any sick or dead fish are removed and the numbers of each, as well as any observations, are noted In the acclimation tank log book.

Dilution Water Preparation

Dilution water for the toxicity tests should be prepared following the formulation of Kopperdahl (1976) and Homing and Weber (1985) for artificially reconstituted softwater. Table I indicates the quantities of reagent grade chemicals utilized in preparing the synthetic freshwater. Reconstituted softwater should be prepared by addition of the salts to deionized water followed by thorough mechanical mixing at least 48 hours prior to initiation of the toxicity testing. The reconstituted softwater should be maintained in an isolated area of the same temperature-controlled laboratory in which the test fish are acclimated and the toxicity tests are performed to ensure against any significant difference between acclimation and test water temperature that might induce additional stress in the test fish.

Table 1. Quantities of reagent grade chemicals required to prepare reconstituted softwater and expected water qualities.

$NaHCO_3$:	48.0 mg/l
$CaSO_4\ 2H_2O$:	30.0 mg/l
$MgSO_4$:	30.0 mg/l
KCl:	2.0 mg/l
pH:	7.2-7.8
Total Hardness:	40-48 mg/l $CaCO_3$
Total Alkalinity:	30-35 mg/l $CaCO_3$

WASTE SAMPLE PREPARATION

Dry Waste Material

Each sample should be identified as a Type i, Type ii or Type iii material. The samples should be weighed into pre-tared Erlenmeyer flasks to yield final replicate sample concentrations of 250 mg/l, 500 mg/l, and 750 mg/l. Approximately 200 ml of dilution water is added to each flask. The flasks should be capped with parafilm, a neoprene stopper and aluminum foil and mechanically shaken for six hours.

Liquid Waste of Low Viscosity

To determine the volume of a low viscosity liquid sample needed to dose the toxicity test, the specific gravity is measured.

The waste sample to be used in the toxicity test is first mechanically shaken or homogenized so as to evenly distribute any particulate matter in the sample. A known amount of sample, usually 20 ml, is drawn up through a volumetric pipette and dispensed into a 100 ml beaker that has previously been weighed on a Mettler balance to four decimal places. The beaker containing the known volume of sample is then re-weighed on the Mettler balance. The difference in weight of the beaker with the sample and the weight of the beaker when it is empty is divided by the known volume of the sample (in milliliters) to determine the specific gravity. This process is repeated in triplicate and the mean specific gravity is used in subsequent dosage determinations.

The sample is measured by pipette into pre-tared Erlenmeyer flasks to yield final replicate sample concentrations of 250 mg/l, 500 mg/l, and 750 mg/l. Approximately 200 ml of dilution water is added to each flask. The flasks are capped with parafilm, a neoprene stopper and aluminum foil and mechanically shaken for six hours.

TOXICITY TESTING

Dosing Test Aquaria

After shaking, the samples are dosed into the appropriately marked aquarium containing approximately 9 liters of dilution water. Dilution water is then added to the 10 liter mark to yield a final volume of 10 liters for all test conditions.

Reconstituted softwater (dilution water only) controls are established as a quality assurance measure. All test conditions and controls are run concurrently.

Initial Water Quality Measurements

Prior to the addition of the test fish, preliminary water quality measurements are taken for dissolved oxygen and pH to determine if adjustment is necessary (Polisini 1988).

An initial hardness and alkalinity test analysis is performed on the control and the 750 mg/l concentrations.

Addition of Test Fish

The test fish (fathead minnows) should be gently corralled and dip netted in small groups from the holding tank into smaller aquarium to confirm species identity and the healthy condition of each individual fish to be utilized in the test. Fish exhibiting any abnormalities, disease, wounds or unusual behavior or color patterns are removed and destroyed. Those fish that passed the individual screening inspection are randomly allocated to test and control aquariums.

Ten fathead minnows are gently released into each of the test replicate and the control aquariums, taking care not to allow the dip nets to contact the exposure media.

Observations

Water quality parameters, enumeration of live organisms and any ancillary observations pertinent to the conduct of the toxicity tests are taken and recorded on the toxicity test worksheets at initiation and subsequently at 24, 48, 72, and 96 hours after initiation of the toxicity test exposures. Daily water quality parameters, live organism enumeration, and ancillary observations are recorded on individual toxicity testing worksheets.

Alkalinity and Hardness Analysis

Total alkalinity and hardness, both expressed as mg/l $CaCO_3$, are determined by replicate samples. Sub-samples of the dilution water control and the 750 mg/l concentration are obtained immediately prior to initiation and at the completion of toxicity testing and the results are presented on the toxicity test worksheets.

Determination of Test Fish Lengths and Weights

At the conclusion of testing, 20 of the surviving fish are wet weighed to the nearest 0.1 gram on an analytical balance and measured to the nearest millimeter. The data are recorded on a Fish Weight/Length Measurements form. All surviving fish are then destroyed following the procedures in *Standard Methods* (18^{th} Edition).

RESULTS

Standard DOHS Toxicity Screen Testing

Death is the effect measured and toxicity is reported as percent survivorship at 250 mg/l, 500 mg/l and 750 mg/l concentrations and a LC_{50} calculated from these data. Original data worksheets will remain on file at the lab for ten years.

REFERENCES

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