2nd ADDENDUM
TO
INTERIM REMEDIAL ACTION PLAN

Former Val Strough Chevrolet Site
327 34th Street, Oakland, California
Fuel Leak Case No. RO0000134

Prepared by
LRM Consulting, Inc.
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January 2010

January 13, 2010

MEMORANDUM

To: Ms. Barbara Jakub, P.G.
Alameda County Health Care Services Agency (ACHCSA)
1131 Harbor Bay Parkway
Alameda, California 94502-6577

From: Jing Heisler and Mehrdad Javaherian
LRM Consulting, Inc.

Re: **2nd Addendum to Interim Remedial Action Plan**
Former Val Strough Chevrolet
327 34th Street, Oakland, California
Site ID #3035, RO #0000134

On behalf of the Strough Family Trust, LRM Consulting, Inc. (LRM) has prepared this Memorandum which serves as the 2nd addendum to the Interim Remedial Action Plan (IRAP) for the above-referenced site. The original IRAP was prepared by LRM in August 2008 and later amended in May 2009 per the request of the ACHCSA. The first addendum to the IRAP (LRM 2009a) included installation of monitoring well MW9A within the residual source area at the site, in support of the proposed in-situ oxygen curtain (iSOC) pilot testing outlined in the original IRAP. Subsequent sampling of this well during the 3rd Quarter 2009 routine groundwater monitoring event (LRM, 2009b) at the site indicated the presence of elevated levels of petroleum hydrocarbons at the newly installed well MW9A (see Table 1). These concentrations included total petroleum hydrocarbons as gasoline (TPH-g) as high as 160,000 ug/L, which raised concerns over the applicability of iSOC technology. Based on discussions with the ACHCSA, another round of sampling was conducted prior to development of final conclusions regarding the potential application iSOC technology as part of the IRAP. This sampling was recently conducted as part of the 4th Quarter 2009 monitoring event at the site (LRM, 2009c), the results of which confirmed the continued presence of elevated hydrocarbons at well MW9A (see Figure 1 and Table 1).

Based on the observed results and in concert with the provisions outlined within the original IRAP, a revised interim remedial technology has been identified and proposed herein.

Proposed Interim Remedial Alternative

As outlined in the original IRAP, the objective of interim remedial measures is to reduce hydrocarbon levels within the localized residual source area present in the immediate vicinity of the former UST at the site. Based on monitoring results and soil/grab groundwater investigations in the past (LRM, 2009c), This residual source area appears limited to the localized area between MW2 and MW3. Importantly, away from the residual source area, hydrocarbon levels remain at low levels and the low-permeability soils at the site continue to restrict the extent of the hydrocarbon plume to well within the site boundaries (see Figure 1 and Table 1).

Based on the understanding of the site geology and the extent of petroleum hydrocarbon impacts, including the more concentrated area at well MW9, in-situ chemical oxidation (ISCO) is recommended as the preferred alternative for implementation as an interim measure. The proposed application of ISCO at the site, including potential advantages and disadvantages, is discussed in more detail below.

Remediation involving ISCO involves the injection of liquid or gas into the subsurface that causes oxidation, resulting in the direct destruction of petroleum hydrocarbon contamination dissolved in groundwater. This process may also result in the indirect decrease of petroleum contamination by increasing the dissolved oxygen content in groundwater, which in turn serves to enhance biodegradation. ISCO has been effective in rapidly reducing hydrocarbon mass at sites with similar conditions to the subject Site (Miller et. al, 2007). For example, its success through the application of Regenesis' proprietary compound, RegenOx™, in significantly reducing residual fuel concentrations in groundwater at several sites with similar geologic conditions has been documented in several case studies (www.regenesis.com). Discussions with Regenesis indicate that this technology is most effective on dissolved concentrations on the order of 150,000 µg/L range, similar to the maximum TPH-g concentrations detected within portions of the localized source area at the subject site.

The time-frame/effective duration for this alternative is considered to be short- to medium-term. Specifically, in the short-term, injections would be performed and followed by quarterly monitoring to evaluate the need, if any, for subsequent re-injections. Studies have show that this type of remediation has been achieved in time frames ranging from six to 18 months of active treatment (Miller et. al., 2007). To the extent that the residual source area at the site remains limited in extent, the application of this technology at an IRAP scale may be sufficient to address the source area. At a minimum, information from the proposed applications should provide useful information as to the need, if any, for expansion of this technology beyond the IRAP scale.

The advantages of the ISCO technology include: 1) potential for significant mass reduction in a relatively short period of time; 2) imposition of favorable declining concentration trends well beyond injection events; 3) limited construction, operation, and maintenance requirements; 4) limited interference with future daily site activities; and 5) limited costs.

Importantly, ISCO can also serve as an oxygen source for microbes in the subsurface to enhance biodegradation of contaminants. Therefore, many ISCO projects are designed to move into a second, longer-term bioremediation phase due to all the newly available oxygen in the subsurface. While RegenOx at higher concentrations may kill microbes, the oxygen rich treatment area will be attractive to indigenous populations in adjacent zones.

Challenges associated with ISCO include the fact that it is most effective in the absence of significant amounts of separate phase hydrocarbons (SPHs), typically limited to less than 0.5 inches. Correspondingly, ISCO focuses on residual mass adsorbed onto soils and resulting elevated dissolved concentrations. ISCO also requires a strong knowledge of the location and extent of mass present and optimal delivery through direct push techniques as opposed to monitoring wells. Moreover, injection in fine-grained soils may limit the ability to obtain significant oxidant distribution within the targeted area. Hence, in the presence of fine-grained soils, this technology may be most effective in areas where the source area is limited in extent (such as at the subject site). Lastly, a disadvantage of utilizing only RegenOx^{TM} would be that the product is only active within approximately one month, thereby requiring multiple rounds of treatment

As indicated through the routine monitoring events, SPHs have remained absent in site monitoring wells, including those within the residual source area, since 2006; the sole exception to this is a limited detection of SPHs in the second round of sampling (without purging due to limited water present in this well) at the newly installed well MW9A, which amounted to 0.36 inch (see LRM, 2010) and within the levels capable of being remediated by ISCO. This limited level of SPHs will be incorporated into the IRAP and will be targeted by the ISCO technology. In addition, if free product is encountered in any source area wells, it will be bailed out as part of routine site activities.

Discussion of Potential Concerns Associated with Chemical Oxidation:

Potential for Contaminant Spreading

In order to minimize the potential for the spreading of hydrocarbons, the injections will be conducted at low pressure. Typically, the injection pressure is an indication of how permeable the soil structure is. For example, an injection rate of 5 gallons per minute (gpm) at 20 pounds per square inch (psi) may work for well sorted sand, but more pressure would be required to overcome the formation resistance for silty sand or clayey sand.

To be conservative, an injection pressure of 20 psi will be used as a starting point, but may be adjusted based on field observations. Maintaining the injection pressure below 20 psi also will help avoid surfacing concern. To avoid operation safety concerns related to surfacing, it is considered safer to inject at a lower pressure, recognizing that more injection points would be required to achieve the targeted coverage. Also worth noting is that at these injection rates, the injected oxidant will treat/react with the hydrocarbons through the oxidation process, rather than displacing the contaminant.

Potential for Change in Soil Permeability

The hydrocarbons were observed in the silty sand or silt unit at the site (LRM 2008), so significant reactions between RegenOx and the organic carbon in soil are not expected. RegenOx will tend to react with multiple carbon bond chemicals like petroleum hydrocarbon first, and the single or double carbon bond chemicals like organic carbon in soil next. The target of the injection is to reduce the concentration of hydrocarbons, so the reaction between the oxidant and organic carbon in soil will be the last step; per discussions with Regenisis, typically, reactions do not proceed to this last step.. No quantitative study or literature could be found regarding the effect to the soil permeability at the time of writing this workplan. However, as long as the amount of the oxidant injected is well calculated and is not excessive, minimal impact to organic carbon in soil would be expected as a result of this technology.

Possible By-products

The by-products for RegenOx oxidation process are sodium, carbon dioxide, and water. According to the site history, no other chemicals other than petroleum hydrocarbons have been used at the site. Since the site has no known Chromium (Cr) contamination, significant chromium levels unlikely exist in soil and groundwater. With the expected background level of Cr in soil and groundwater, adding an oxidant like RegenOx to the aquifer can temporarily change the trivalent chromium (Cr+3) to the hexavalent chromium (Cr+6) or chromate, which is more soluble. However, this will only be observed in the treatment area, and the chromate usually oxidizes organics or inorganics, reverts back to the Cr+3 state and falls out of solution according to the observation at the RegenOx application sites. Therefore, Cr+6 is unlikely to be a concern because the Cr+6 ion reacts further to oxidize the hydrocarbons, transitioning back to Cr+3 in the presence of hydrocarbons. Moreover, since the target area is located at the most upgradient portion of the site, the potential for offsite migration of Cr is limited. Lastly, O&M sampling, discussed later herein, associated with implementing this methodology will include analysis of samples for Cr+6 to ensure excess amounts are not generated.

Potential for Vapor Generation and Migration

Unlike other chemical oxidation technologies, RegenOx has no detrimental impacts on groundwater. No significant chemically induced temperature or pressure has been detected at RegenOx application sites. RegenOx does not raise even one degree Fahrenheit temperature according to Regenesis personnel. Because RegenOx does not generate significant pressure, treating with RegenOx will not add to the vapor generation via physical transport phenomena. Therefore, vapor migration to the utility corrider is unlikely to be an issue based on the nature of the product.

Proposed Interim Remedial Action Plan

As part of implementing the IRAP activities using ISCO, the early parts of the applications will be used to generate/verify injection parameters (including injection rates, injection pressure, radius of influence (ROI) and volume), and to determine effectiveness by measuring oxidant persistence and the affect on hydrocarbon concentrations.

Figure 2 presents the proposed layout of ISCO application area. The areal dimensions and the depth interval over which RegenOx™ to be applied are further described below.

Historical depths to groundwater (since 1993) at the site have fluctuated from approximately 15.7 feet below ground surface (feet bgs) to 25 feet bgs at wells (MW2, MW3, O1, and MW9A) in the source area (see Table 1). TPH impacts in groundwater and saturated soils are typically smeared in the soil across the depth over which the groundwater table fluctuates; based on available site data, the depth interval over which this has occurred is anticipated to be between 15 feet to 25 feet bgs. However, TPHg has been detected at depths as high as 40 feet bgs in borings within the residual source area (LRM, 2009c, or Table 2). Therefore, the recommended treatment depth for the IRAP is 15 to 40 feet bgs within the residual source area.

As shown on Figure 2, RegenOx™ will be applied throughout an approximately 40 feet long by 30 feet wide area, immediate downgradient of the former USTs and across a vertical thickness of 25 feet (i.e., from 15 feet bgs to 40 feet bgs).

Based on discussions with Regenesis, three rounds of injection events will be required to reduce the elevated TPHg concentration in groundwater at the site. Each event will occur 3 weeks apart, with injections occurring through direct push drilling methods (see Appendix A for details of injection procedures). A 10-foot spacing is recommend for each injection location within each round (see Figure 2). Hence, subsequent rounds of injection will result in placement of injection points 5 feet from the injection locations in previous rounds. Based on this orientation, about 12 injection points will be applied for each round (see Figure 2). Note that the injection points need to be at least 5-feet away from the existing wells and utility lines; hence, the actual injection points will be adjusted accordingly in the field if any issues encountered (e.g., utility lines, site structures, and possible surfacing). LRM recommends injecting RegenOx in the first two rounds. Depending on the results from these two rounds, it may be beneficial to inject RengOx mixed with Advanced ORC in the last round (3rd round) in an effort to help transition subsurface conditions toward reducing conditions. Worth noting is that according to Regenesis, ORC advanced has been shown to be effective for up to 12 months when hydrated, ensuring reducing conditions will persist beyond the period of oxidizing conditions.

During the each round of injection, the volume of RegenOx and/or ORC Advanced injected, the pump pressure, manifold pressures on the injection points, and flow rates will be recorded. At the conclusion of injection, all data collected will be gathered and analyzed.

Proposed Groundwater Monitoring Plan

Baseline Groundwater Sampling

To provide an assessment of baseline groundwater conditions prior to initiation of ISOC injection events, groundwater samples will be collected from wells (MW1 through MW5, MW9A/9B, and O1) in the IRAP target area. The samples will be analyzed for the analytes listed below (see Figure 1 for well locations).

- TPH-gasoline range and BTEX by EPA Method 8260B
- Total organic carbon (TOC) by EPA Method SW 9060
- Chemical oxygen demand (COD) by EPA Method 410.4
- Total iron and total chromium by EPA Method SW 6020
- Bromide, Nitrate and Sulfate by EPA Method 300.0
- Bromate by EPA Method 300.1
- Hexavalent chromium by EPA Method 7199

In addition to the above referenced parameters, field measurements of temperature, pH, oxidation reduction potential (ORP), dissolved oxygen (DO), and ferrous iron (Hach kit) will be obtained prior to beginning chemical oxidation injection activities.

Groundwater Monitoring Associated with the IRAP

As part of the IRAP activities, O&M sampling at wells MW1 through MW5, MW9A/9B, and O1 will be conducted to monitor the TPHg, BTEX concentrations, changes in oxidation conditions, and the ROI of injections. Specifically, supplementing the baseline sampling, three rounds of O&M sampling will implemented two weeks after each RegenOx injection event and one week prior to the next event. A fourth round of sampling will be conducted six weeks after the final injection event. If possible, O&M sampling will be combined with routine groundwater monitoring events at the site. O&M samples will be analyzed for the parameters identified for the baseline sampling.

Reporting and Schedule

LRM will prepare a detailed IRA report summarizing all field activities and analytical findings associated with the IRAP activities proposed herein. The report will include conclusions and recommendations for future activities, including the potential for extension of the IRAP or transition to full-scale remediation as necessary.

The timeframe for designing, preparing, implementing, and documenting the IRAP activities proposed herein is estimated at six months following approval by the ACHCSA.

CLOSING

We appreciate your assistance with this project. If you have any questions or require further information, please contact Jing Heisler (jing@lrm-consulting.com) or Mehrdad Javaherian (mjavaherian@lrm-consulting.com) of LRM Consulting, Inc.

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ATTACHMENTS

Table 1 – Cumulative Groundwater Elevation and Analytical Data
Table 2 – Grab Groundwater Sample Analytical Data

Figure 1 –TPHg Iso-concentration in Groundwater, December 2009
Figure 2 –Proposed ISCO Application Area

Appendix A – RegenOx and ORC Application Procedures

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TABLES

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW1	07/27/93	100.00	a	20.79	79.21	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	--	--	--
MW1	10/02/97	100.00	a	21.22	78.78	0.00	<0.50	<0.50	<0.50	<0.50	<50	--	--	<2.0	--
MW1	06/30/98	100.00	a	18.21	81.79	0.00	<0.50	<0.50	2.1	0.6	84	--	--	2.1	--
MW1	07/29/98	100.00	a	18.74	81.26	0.00	--	--	--	--	--	--	--	--	--
MW1	08/26/98	100.00	a	19.28	80.72	0.00	--	--	--	--	--	--	--	--	--
MW1	10/01/98	100.00	a	19.93	80.07	0.00	<1.0	<1.0	<1.0	<1.0	<50	--	--	<2.0	--
MW1	10/30/98	100.00	a	20.22	79.78	0.00	--	--	--	--	--	--	--	--	--
MW1	11/30/98	100.00	a	19.99	80.01	0.00	--	--	--	--	--	--	--	--	--
MW1	12/28/98	100.00	a	19.81	80.19	0.00	--	--	--	--	--	--	--	--	--
MW1	01/25/99	100.00	a	19.62	80.38	0.00	<1.0	<1.0	<1.0	<1.0	<50	--	--	<2.0	--
MW1	02/26/99	100.00	a	17.18	82.82	0.00	--	--	--	--	--	--	--	--	--
MW1	03/24/99	100.00	a	17.28	82.72	0.00	--	--	--	--	--	--	--	--	--
MW1	05/12/99	100.00	a	17.91	82.09	0.00	--	--	--	--	--	--	--	--	--
MW1	12/15/99	100.00	a	21.01	78.99	0.00	<0.50	<0.50	<0.50	<0.50	<50	--	--	<0.50	--
MW1	03/20/00	100.00	a	16.25	83.75	0.00	--	--	--	--	--	--	--	--	--
MW1	07/20/00	100.00	a	19.63	80.37	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	3.4	--
MW1	10/11/00	100.00	a	20.80	79.20	0.00	--	--	--	--	--	--	--	--	--
MW1	04/10-11/01	100.00	a	18.81	81.19	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	1.2	--
MW1	07/10/01	100.00	a	20.51	79.49	0.00	--	--	--	--	--	--	--	--	--
MW1	11/20/01	64.69	b	21.36	43.33	0.00	<0.50	1.3	<0.50	0.81	<50	<50	<300	<2.0	--
MW1	02/19/02	64.69	b	18.95	45.74	0.00	--	--	--	--	--	--	--	--	--
MW1	05/21/02	64.69	b	19.82	44.87	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	<2.0	--
MW1	06/27/03	64.69	b	19.93	44.76	0.00	--	--	--	--	--	--	--	--	--
MW1	09/29/03	64.69	b	21.24	43.45	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW1	12/12/03	64.69	b	21.27	43.42	0.00	<0.50	<0.50	<0.50	1.1	<50	58	<500	<0.50	--
MW1	03/15/04	64.69	b	18.18	46.51	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW1	06/24/04	64.69	b	20.48	44.21	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW1	09/29/04	64.69	b	21.37	43.32	0.00	<0.50	0.51	<0.50	<1.0	<50	<50	<500	<0.50	--
MW1	12/13/04	64.69	b	20.63	44.06	0.00	--	--	--	--	--	--	--	--	--
MW1	03/14/05	64.69	b	18.69	46.00	0.00	<0.50	<0.50	<0.50	<1.0	<50	73	<500	<0.50	--
MW1	06/15/05	64.69	b	20.32	44.37	0.00	--	--	--	--	--	--	--	--	--
MW1	09/26/05	64.69	b	22.10	42.59	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW1	12/12/05	64.69	b	22.39	42.30	0.00	--	--	--	--	--	--	--	--	--
MW1	03/29/06	64.69	b	15.24	49.45	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	74	--
MW1	06/19/06	64.69	b	18.27	46.42	0.00	--	--	--	--	--	--	--	--	--
MW1	09/29/06	64.69	b	20.06	44.63	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	7.9	--
MW1	12/12/06	64.69	b	20.32	44.37	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	9.4	--
MW1	03/01/07	64.69	b	18.68	46.01	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	3.5	--
MW1	06/12/07	64.69	b	20.28	44.41	0.00	--	--	--	--	--	--	--	--	--
MW1	09/25/07	64.69	b	21.37	43.32	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	1.8	--
MW1	12/20/07	64.69	b	21.48	43.21	0.00	--	--	--	--	--	--	--	--	--
MW1	03/26/08	64.69	b	20.98	43.71	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	--
MW1	06/03/08	64.69	b	20.70	43.99	0.00	--	--	--	--	--	--	--	--	--
MW1	09/25/08	64.69	b	22.30	42.39	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	0.57	<5.0
MW1	12/29/08	64.69	b	21.77	42.92	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW1	03/24/09	64.71	l	18.68	46.03	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW1	06/02/09	64.71	l	19.60	45.11	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW1	09/10/09	64.71	l	21.20	43.51	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW1	12/04/09	64.71	l	22.86	41.85	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW2	07/27/93	101.27	a	22.10	79.17	0.00	10,000	27,000	2,900	20,000	120,000	--	--	--	--
MW2	10/02/97	101.27	a	22.91	78.36	0.43	*	*	*	*	*	*	*	*	--
MW2	06/30/98	101.27	a	19.69	81.58	0.45	7,300	18,000	2,500	15,600	72,000	--	--	5,500	--
MW2	07/29/98	101.27	a	20.11	81.16	0.29	--	--	--	--	--	--	--	--	--

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Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW2	01/25/99	101.27	a	20.80	80.47	0.01	9,000	26,000	3,800	27,500	130,000	--	--	5,800	--
MW2	02/26/99	101.27	a	18.00	83.27	sheen	--	--	--	--	--	--	--	--	--
MW2	03/24/99	101.27	a	18.27	83.00	trace	--	--	--	--	--	--	--	--	--
MW2	05/12/99	101.27	a	19.08	82.19	trace	--	--	--	--	--	--	--	--	--
MW2	12/15-16/99	101.27	a	22.42	78.85	0.025	*	*	*	*	*	*	*	*	--
MW2	03/20/00	101.27	a	17.09	84.18	0.026	--	--	--	--	--	--	--	--	--
MW2	07/20/00	101.27	a	20.86	80.41	0.017	*	*	*	*	*	*	*	*	--
MW2	10/11/00	101.27	a	22.10	79.17	0.00	--	--	--	--	--	--	--	--	--
MW2	04/10-11/01	101.27	a	19.98	81.29	0.00	8,000	22,000	2,600	23,500	150,000	1,500	<600	3,600	--
MW2	07/10/01	101.27	a	21.85	79.42	0.00	5,900	15,000	2,300	12,100	83,000	5,700	<1,500	2,800	--
MW2	11/20/01	65.95	b	22.75	43.20	0.00	--	--	--	--	--	--	--	--	--
MW2	02/19/02	65.95	b	20.12	45.83	0.00	--	--	--	--	--	--	--	--	--
MW2	05/21/02	65.95	b	21.10	44.85	0.00	8,600	25,000	3,500	26,000	150,000	31,000	<3,000	4,800	--
MW2	06/27/03	65.95	b	21.48	44.47	0.35	--	--	--	--	--	--	--	--	--
MW2	09/29/03	65.95	b	23.04	42.91	0.48	*	*	*	*	*	*	*	*	--
MW2[e]	12/12/03	65.95	b	22.75	43.31	0.16	*	*	*	*	*	*	*	*	--
MW2[e]	03/15/04	65.95	b	19.24	46.72	0.01	*	*	*	*	*	*	*	*	--
MW2[e]	06/24/04	65.95	b	22.10	44.06	0.31	*	*	*	*	*	*	*	*	--
MW2[e]	09/29/04	65.95	b	22.81	43.14	sheen	*	*	*	*	*	*	*	*	--
MW2[e]	12/13/04	65.95	b	22.06	43.95	0.08	3,700	12,000	1,900	10,000	47,000	2,600	<500	1,200	--
MW2[j]	03/14/05	65.95	b	25.00	40.95	0.00	780	3,700	920	6,400	43,000	43,000	<5,000	<200	--
MW2	06/15/05	65.95	b	21.14	44.81	0.00	2,900	15,000	2,400	22,000	120,000	13,000	<2,500	810	--
MW2	07/18/05	65.95	b	NM	NC	NM	2,700	13,000	1,800	15,000	120,000	17,000	--	530	--
MW2	09/26/05	65.95	b	22.93	43.02	0.00	570	4,000	620	6,200	31,000	63,000	28,000	<50	--
MW2	12/12/05	65.95	b	25.40	40.55	0.00	670	5,300	1,100	9,800	34,000	2,800	<500	65	--
MW2	03/29/06	65.95	b	15.66	50.29	sheen	620	2,800	540	4,700	33,000	<4,000	<100	37	--
MW2	06/19/06	65.95	b	19.14	46.81	sheen	680	5,200	990	16,000	120,000	<30,000	1,900	170	--
MW2	09/29/06	65.95	b	21.16	44.79	0.00	1,200	5,100	1,200	9,300	59,000	<8000	300	230	--
MW2	12/12/06	65.95	b	21.46	44.49	0.00	850	4,400	1,100	8,900	45,000	<10000	360	110	--
MW2	03/01/07	65.95	b	19.48	46.47	0.00	1,400	5,200	980	9,500	71,000	<18000	460	160	--
MW2	06/12/07	65.95	b	20.98	44.97	0.00	1,300	4,900	1,200	8,900	40,000	<3000	<100	130	--
MW2	09/25/07	65.95	b	22.57	43.38	0.00	1,400	6,500	1,900	13,000	68,000	<12000	250	240	--
MW2	12/20/07	65.95	b	22.70	43.25	0.00	1,400	7,000	2,400	16,000	75,000	<5000	650	270	--
MW2	03/26/08	65.95	b	22.51	43.44	0.00	1,400	6,200	1,800	16,000	83,000	<10000	360	480	--
MW2	06/03/08	65.95	b	21.85	44.10	0.00	1,900	11,000	2,500	18,000	98,000	<12000	500	660	--
MW2	09/25/08	65.95	b	23.30	42.65	0.00	740	3,500	1,700	10,000	46,000	<8000	170	340	180
MW2	12/29/08	65.95	b	22.95	43.00	0.00	260	1,500	1,100	6,400	29,000	<4000	<100	110	<50
MW2	03/24/09	65.71	l	19.58	46.13	0.00	410	2,000	900	8,900	45,000	<8,000	420	300	210
MW2	06/02/09	65.71	l	20.50	45.21	0.00	680	3,100	1,200	10,000	80,000	<12000	480	330	180
MW2	09/10/09	65.71	l	22.40	43.31	0.00	700	3,000	1,300	9,400	45,000	< 8000	190	370	220
MW2	12/04/09	65.71	l	24.30	41.41	0.00	290	1,500	930	4,900	24,000	< 2000	170	200	92
MW3	07/27/93	101.29	a	22.28	79.01	0.02	9,100	24,000	5,300	33,000	330,000	--	--	--	--
MW3	10/02/97	101.29	a	22.71	78.58	0.03	4,200	11,000	1,800	10,600	36,000	--	--	3,500	--
MW3	06/30/98	101.29	a	19.47	81.82	0.00	4,800	11,000	1,200	7,100	51,000	--	--	3,900	--
MW3	07/29/98	101.29	a	20.01	81.28	0.00	--	--	--	--	--	--	--	--	--
MW3	08/26/98	101.29	a	20.62	80.67	0.00	--	--	--	--	--	--	--	--	--
MW3	10/01/98	101.29	a	21.33	79.96	0.00	3,900	8,500	1,200	6,000	38,000	--	--	2,300	--
MW3	10/30/98	101.29	a	21.62	79.67	0.00	--	--	--	--	--	--	--	--	--
MW3	11/30/98	101.29	a	21.31	79.98	0.00	--	--	--	--	--	--	--	--	--
MW3	12/28/98	101.29	a	21.15	80.14	0.06	--	--	--	--	--	--	--	--	--
MW3	01/25/99	101.29	a	20.79	80.50	0.00	4,000	10,000	1200	6700	5,100	--	--	2900	--
MW3	02/26/99	101.29	a	18.02	83.27	0.00	--	--	--	--	--	--	--	--	--
MW3	03/24/99	101.29	a	18.37	82.92	0.00	--	--	--	--	--	--	--	--	--
MW3	05/12/99	101.29	a	19.22	82.07	0.0083	--	--	--	--	--	--	--	--	--
MW3	12/15-16/99	101.29	a	22.43	78.86	0.00	*	*	*	*	*	*	*	*	--
MW3	03/20/00	101.29	a	17.14	84.15	0.00	--	--	--	--	--	--	--	--	--
MW3	07/20/00	101.29	a	20.98	80.31	0.00	5,700	14,000	1,600	9,300	69,000	2,900	<300	3,300	--
MW3	10/11/00	101.29	a	22.24	79.05	0.00	--	--	--	--	--	--	--	--	--
MW3	04/10-11/01	101.29	a	20.70	80.59	0.00	7,200	<0.001	2,300	12,900	110,000	4,700	<1,500	4,300	--

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW3	07/10/01	101.29	a	21.97	79.32	0.00	--	--	--	--	--	--	--	--	--
MW3	11/20/01	65.99	b	22.80	43.19	0.00	6,300	16,000	2,400	14,900	100,000	5,900	<900	4,000	--
MW3	02/19/02	65.99	b	20.11	45.88	0.00	--	--	--	--	--	--	--	--	--
MW3	05/21/02	65.99	b	21.20	44.79	0.00	6,500	17,000	2,200	12,700	91,000	14,000	<3,000	2,200	--
MW3	06/27/03	65.99	b	21.32	44.67	sheen	--	--	--	--	--	--	--	--	--
MW3	09/29/03	65.99	b	22.79	43.20	sheen	*	*	*	*	*	*	*	*	--
MW3[e]	12/12/03	65.99	b	22.73	43.27	0.01	*	*	*	*	*	*	*	*	--
MW3[e]	03/15/04	65.99	b	19.32	46.67	sheen	*	*	*	*	*	*	*	*	--
MW3	06/24/04	65.99	b	21.99	44.00	0.00	3,400	7,700	1,000	4,800	39,000	1,700	<500	1,100	--
MW3	09/29/04	65.99	b	22.54	43.45	0.00	2,900	6,700	980	4,300	29,000	2,200	<500	1,100	--
MW3	12/13/04	65.99	b	22.06	43.93	0.00	1,700	2,900	790	3,400	17,000	1,300	<500	490	--
MW3[j]	03/14/05	65.99	b	24.00	41.99	0.00	680	1,700	380	1,600	10,000	670	<500	67	--
MW3	06/15/05	65.99	b	21.13	44.86	0.00	260	960	330	1,400	12,000	1,200	<500	31	--
MW3	07/18/05	65.99	b	NM	NC	NM	1,000	5,600	1,100	4,300	23,000	1,700	--	81	--
MW3	09/26/05	65.99	b	22.92	43.07	0.00	4,000	17,000	1,900	17,000	79,000	5,100	540	270	--
MW3	12/12/05	65.99	b	23.30	42.69	0.00	200	710	450	1,400	7,000	550	<500	<10	--
MW3	03/29/06	65.99	b	15.70	50.29	0.00	110	300	130	490	3,800	<200	<100	13	--
MW3	06/19/06	65.99	b	19.11	46.88	0.00	160	500	320	840	7,000	<300	<100	3.1	--
MW3	09/29/06	65.99	b	21.15	44.84	0.00	1,300	2,300	720	2,900	22,000	<1500	<100	110	--
MW3	12/12/06	65.99	b	21.38	44.61	0.00	1,400	2,200	670	2,600	21,000	<1500	<100	130	--
MW3	03/01/07	65.99	b	19.50	46.49	0.00	1,100	2,500	510	2,200	17,000	<600	<100	51	--
MW3	06/12/07	65.99	b	21.00	44.99	0.00	1,800	4,000	800	3,300	22,000	<1500	<100	150	--
MW3	09/25/07	65.99	b	22.59	43.40	0.00	2,400	5,000	1,000	4,600	29,000	<500	<100	220	--
MW3	12/20/07	65.99	b	22.59	43.40	0.00	2,400	4,900	1,100	4,700	36,000	<2000	<100	240	--
MW3	03/26/08	65.99	b	22.13	43.86	0.00	4,500	11,000	1,700	7,800	54,000	<1500	<100	340	--
MW3	06/03/08	65.99	b	21.81	44.18	0.00	3,900	8,700	1,500	7,000	47,000	<1500	<100	470	--
MW3	09/25/08	65.99	b	23.30	42.69	0.00	1,600	3,700	700	3,300	22,000	<3000	<100	220	180
MW3	12/29/08	65.99	b	22.92	43.07	0.00	310	910	320	1,300	11,000	<1500	<100	35	23
MW3	03/24/09	65.70	l	19.43	46.27	0.00	1,400	4,200	600	2,500	19,000	<1,000	<100	160	60
MW3	06/02/09	65.70	l	20.70	45.00	0.00	2,800	7,600	1,300	5,600	39,000	<1,500	<100	240	180
MW3	09/10/09	65.70	l	22.32	43.38	0.00	1,800	3,900	790	3,500	22,000	< 1500	< 100	190	110
MW3	12/04/09	65.70	l	24.20	41.50	0.00	1,600	3,400	860	3,900	25,000	< 800	< 100	210	81
MW4	06/30/98	98.65	a	16.93	81.72	0.00	2,200	930	850	2,100	10,000	--	--	1,800	--
MW4	07/29/98	98.65	a	17.48	81.17	0.00	--	--	--	--	--	--	--	--	--
MW4	08/26/98	98.65	a	18.65	80.00	0.00	--	--	--	--	--	--	--	--	--
MW4	10/01/98	98.65	a	18.74	79.91	0.00	570	46	130	36	1,100	--	--	1,300	--
MW4	10/30/98	98.65	a	19.02	79.63	0.00	--	--	--	--	--	--	--	--	--
MW4	11/30/98	98.65	a	18.74	79.91	0.00	--	--	--	--	--	--	--	--	--
MW4	12/28/98	98.65	a	18.60	80.05	0.00	--	--	--	--	--	--	--	--	--
MW4	01/25-26/99	98.65	a	18.32	80.33	0.00	230	<8.3	<8.3	<8.3	290	--	--	1,300	--
MW4	02/26/99	98.65	a	15.81	82.84	0.00	--	--	--	--	--	--	--	--	--
MW4	03/24/99	98.65	a	16.01	82.64	0.00	--	--	--	--	--	--	--	--	--
MW4	05/12/99	98.65	a	17.71	80.94	0.00	--	--	--	--	--	--	--	--	--
MW4	12/15-16/99	98.65	a	19.83	78.82	0.00	5.8	<0.50	<0.50	<0.50	<50	--	--	1,400	--
MW4	03/20/00	98.65	a	14.9	83.75	0.00	--	--	--	--	--	--	--	--	--
MW4	07/20/00	98.65	a	18.38	80.27	0.00	91	4.6	19	12.9	210	<50	<300	1,500	--
MW4	10/11/00	98.65	a	19.61	79.04	0.00	--	--	--	--	--	--	--	--	--
MW4	04/10-11/01	98.65	a	17.55	81.10	0.00	110	<5.0	<5.0	<5.0	350	<50	<300	1,100	--
MW4	07/10/01	98.65	a	19.34	79.31	0.00	--	--	--	--	--	--	--	--	--
MW4	11/20/01	63.35	b	20.16	43.19	0.00	<2.5	4	<2.5	3.7	96	<50	<300	2,500	--
MW4	02/19/02	63.35	b	17.34	46.01	0.00	--	--	--	--	--	--	--	--	--
MW4	05/21/02	63.35	b	18.57	44.78	0.00	340	5.7	70	<1.0	940	83	<300	1,600	--
MW4	06/27/03	63.35	b	18.72	44.63	0.00	--	--	--	--	--	--	--	--	--
MW4	09/29/03	63.35	b	20.11	43.24	0.00	<5.0	<5.0	<5.0	<10	1,100	<50	<500	1,700	--
MW4	12/12/03	63.35	b	20.06	43.29	0.00	<13	<13	<13	<25	<1,300	<50	<500	1,000	--
MW4	03/15/04	63.35	b	16.89	46.46	0.00	1.5	<0.50	<0.50	<1.0	54	<50	<500	41	--
MW4	06/24/04	63.35	b	19.31	44.04	0.00	69	<5.0	<5.0	<10	920	<50	<500	1,100	--
MW4	09/29/04	63.35	b	20.20	43.15	0.00	<5.0	<5.0	<5.0	<10	940	<50	<500	1,200	--
MW4	12/13/04	**	b	20.44	NC	0.00	<5.0	<5.0	<5.0	<10	740	<50	<500	860	--

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW4	03/14/05	**	b	18.30	NC	0.00	20	<5.0	<5.0	<10	930	<50	<500	930	--
MW4	06/15/05	**	b	20.03	NC	0.00	350	6.1	<5.0	<10	2100	89	<500	1,100	--
MW4	07/18/05	**	b	NM	NC	NM	11	<5.0	<5.0	<10	540	<50	--	1,100	--
MW4	09/26/05	**	b	21.79	NC	0.00	<5.0	<5.0	<5.0	<10	960	<50	<500	660	--
MW4	12/12/05	**	b	21.89	NC	0.00	<5.0	<5.0	<5.0	<10	820	<50	<500	1,000	--
MW4	03/29/06	**	b	14.85	NC	0.00	49	160	120	300	2,400	<100	<100	130	--
MW4	06/19/06	**	b	17.96	NC	0.00	100	940	540	1,800	8,800	<400	<100	55	--
MW4	09/29/06	63.35	b	19.85	43.50	0.00	18.0	2.6	1.5	3.5	370.0	<50	<100	180	--
MW4	12/12/06	63.35	b	20.03	43.32	0.00	11.0	0.77	<0.5	<0.5	230.0	<50	<100	260	--
MW4	03/01/07	63.35	b	18.33	45.02	0.00	63.0	7.10	40.0	190.0	1,800.0	<50	<100	130	--
MW4	06/12/07	63.35	b	19.70	43.65	0.00	9.3	<0.5	<0.5	<0.5	70.0	<50	<100	150	--
MW4	09/25/07	63.35	b	21.27	42.08	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	300	--
MW4	12/20/07	63.35	b	21.30	42.05	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	370	--
MW4	03/26/08	63.35	b	20.89	42.46	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	260	--
MW4	06/03/08	63.35	b	20.51	42.84	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	190	--
MW4	09/25/08	63.35	b	22.03	41.32	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	380	<5.0
MW4	12/29/08	63.35	b	21.62	41.73	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	230	<5.0
MW4	03/24/09	64.37	l	18.38	45.99	0.00	<0.5	<0.5	<0.5	<0.5	<50	<50	<100	370	<5.0
MW4	06/02/09	64.37	l	19.32	45.05	0.00	0.64	<0.5	<0.5	<0.5	<50	<50	<100	320	<5.0
MW4	09/10/09	64.37	l	21.00	43.37	0.00	< 0.50	< 0.50	< 0.50	< 0.50	< 50	< 50	< 100	280	< 5.0
MW4	12/04/09	64.37	l	22.76	41.61	0.00	< 0.50	< 0.50	< 0.50	2.9	< 50	< 50	< 100	430	< 5.0
MW5	06/30/98	100.9	a	20.60	80.30	0.00	<0.50	<0.50	<0.50	<0.50	<50	--	--	23	--
MW5	07/29/98	100.9	a	21.52	79.38	0.00	--	--	--	--	--	--	--	--	--
MW5	08/26/98	100.9	a	22.21	78.69	0.00	--	--	--	--	--	--	--	--	--
MW5	10/01/98	100.9	a	22.95	77.95	0.00	<1.0	<1.0	<1.0	<1.0	<50	--	--	<2.0	--
MW5	10/30/98	100.9	a	23.23	77.67	0.00	--	--	--	--	--	--	--	--	--
MW5	11/30/98	100.9	a	23.12	77.78	0.00	--	--	--	--	--	--	--	--	--
MW5	12/28/98	100.9	a	23.18	77.72	0.00	--	--	--	--	--	--	--	--	--
MW5	01/25-26/99	100.9	a	22.61	78.29	0.00	<1.0	<1.0	<1.0	<1.0	<50	--	--	<2.0	--
MW5	02/26/99	100.9	a	19.78	81.12	0.00	--	--	--	--	--	--	--	--	--
MW5	03/24/99	100.9	a	20.25	80.65	0.00	--	--	--	--	--	--	--	--	--
MW5	05/12/99	100.9	a	21.06	79.84	0.00	--	--	--	--	--	--	--	--	--
MW5	12/15-16/99	100.9	a	24.19	76.71	0.00	<0.50	<0.50	<0.50	<0.50	<50	--	--	<0.50	--
MW5	03/20/00	100.9	a	19.15	81.75	0.00	--	--	--	--	--	--	--	--	--
MW5	07/20/00	100.9	a	21.84	79.06	0.00	<0.50	0.98	<0.50	<0.50	<50	<50	<300	1.9	--
MW5	10/11/00	100.9	a	23.4	77.50	0.00	--	--	--	--	--	--	--	--	--
MW5	04/10-11/01	100.9	a	22.3	78.60	0.00	<0.50	2.6	<0.50	0.6	<50	<50	<300	1.5	--
MW5	07/10/01	100.9	a	23.64	77.26	0.00	--	--	--	--	--	--	--	--	--
MW5	11/20/01	65.59	b	24.65	40.94	0.00	0.83	12	1.2	11	140	860	2,500	10	--
MW5	02/19/02	65.59	b	22.37	43.22	0.00	--	--	--	--	--	--	--	--	--
MW5	05/21/02	65.59	b	23.10	42.49	0.00	<0.50	<0.50	<0.50	<0.50	<50	2,200	<300	<2.0	--
MW5	06/27/03	65.59	b	23.07	42.52	0.00	--	--	--	--	--	--	--	--	--
MW5	09/29/03	65.59	b	24.38	41.21	0.00	<0.50	0.52	7.1	35	100	<50	<500	1.4	--
MW5	12/12/03	65.59	b	23.90	41.69	0.00	<0.50	<0.50	<0.50	<1	<50	<50	<500	1.5	--
MW5	03/15/04	65.59	b	20.82	44.77	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW5	06/24/04	65.59	b	23.57	42.02	0.00	<0.50	<0.50	<0.50	<1.0	<50	130	<500	0.79	--
MW5	09/29/04	65.59	b	24.44	41.15	0.00	--	--	--	--	--	--	--	--	--
MW5	12/13/04	65.59	b	23.87	41.72	0.00	--	--	--	--	--	--	--	--	--
MW5	03/14/05	65.59	b	20.18	45.41	0.00	<0.50	1.3	1.5	8.6	82	<50	<500	<0.50	--
MW5	06/15/05	65.59	b	12.96	52.63	0.00	--	--	--	--	--	--	--	--	--
MW5	09/26/05	65.59	b	23.60	41.99	0.00	--	--	--	--	--	--	--	--	--
MW5	12/12/05	65.59	b	23.84	41.75	0.00	--	--	--	--	--	--	--	--	--
MW5	03/29/06	65.59	b	17.19	48.40	0.00	<0.50	<0.50	<0.50	<0.50	73	<50	<100	<0.50	--
MW5	06/19/06	65.59	b	20.22	45.37	0.00	--	--	--	--	--	--	--	--	--
MW5	09/29/06	65.59	b	22.80	42.79	0.00	--	--	--	--	--	--	--	--	--
MW5	12/12/06	65.59	b	23.08	42.51	0.00	--	--	--	--	--	--	--	--	--
MW5	03/01/07	65.59	b	21.02	44.57	0.00	<0.50	<0.50	<0.50	<0.50	54	<50	<100	<0.50	--
MW5	06/12/07	65.59	b	22.78	42.81	0.00	--	--	--	--	--	--	--	--	--
MW5	09/25/07	65.59	b	24.45	41.14	0.00	<0.50	1.5	<0.50	<0.50	<50	<50	<100	0.64	--

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW5	12/20/07	65.59	b	24.52	41.07	0.00	--	--	--	--	--	--	--	--	--
MW5	03/26/08	65.59	b	24.08	41.51	0.00	<0.50	1.5	<0.50	<0.50	<50	<50	<100	<0.5	--
MW5	06/03/08	65.59	b	23.68	41.91	0.00	--	--	--	--	--	--	--	--	--
MW5	09/25/08	65.59	b	25.00	40.59	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	0.66	<5.0
MW5	12/29/08	65.59	b	24.92	40.67	0.00	<0.50	<0.50	<0.50	<0.50	71	<50	<100	<0.5	<5.0
MW5	03/24/09	65.59	l	21.85	43.74	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	0.54	<5.0
MW5	06/02/09	65.59	l	22.70	42.89	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.5	<5.0
MW5	09/10/09	65.59	l	24.12	41.47	0.00	< 0.50	< 0.50	< 0.50	< 0.50	< 50	< 50	< 100	0.56	< 5.0
MW5	12/04/09	65.59	l	dry	--	0.00	--	--	--	--	--	--	--	--	--
MW6	07/20/00	96.60	a	18.30	78.30	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	160	--
MW6	10/11/00	96.60	a	18.69	77.91	0.00	--	--	--	--	--	--	--	--	--
MW6	04/10-11/01	96.60	a	17.85	78.75	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	180	--
MW6	07/10/01	96.60	a	18.43	78.17	0.00	--	--	--	--	--	--	--	--	--
MW6	11/20/01	59.60	b	18.67	40.93	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	450	--
MW6	02/19/02	59.60	b	17.40	42.20	0.00	--	--	--	--	--	--	--	--	--
MW6	05/21/02	59.60	b	17.68	41.92	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	170	--
MW6	06/27/03	59.60	b	17.73	41.87	0.00	--	--	--	--	--	--	--	--	--
MW6	09/29/03	59.60	b	18.48	41.12	0.00	<1.0	<1.0	<1.0	<2.0	230	<50	<500	340	--
MW6	12/12/03	59.60	b	17.89	41.71	0.00	<2.5	<2.5	<2.5	<5.0	<250	51	<500	190	--
MW6	03/15/04	59.60	b	16.46	43.14	0.00	<1.0	<1.0	<1.0	<2.0	200	<50	<500	220	--
MW6	06/24/04	59.60	b	17.97	41.63	0.00	<1.0	<1.0	<1.0	<2.0	130	<50	<500	190	--
MW6	09/29/04	59.60	b	18.55	41.05	0.00	<0.50	0.61	<0.50	1.2	210	<50	<500	190	--
MW6	12/13/04	59.60	b	17.88	41.72	0.00	--	--	--	--	--	--	--	--	--
MW6	03/14/05	59.60	b	16.82	42.78	0.00	<0.50	<0.50	<0.50	1.8	160	<50	<500	190	--
MW6	06/15/05	59.60	b	17.60	42.00	0.00	--	--	--	--	--	--	--	--	--
MW6	09/26/05	59.60	b	NM	NM	0.00	--	--	--	--	--	--	--	--	--
MW6	12/12/05	59.60	b	18.33	41.27	0.00	0.62	<0.50	<0.50	1.0	81	<50	<500	140	--
MW6	03/29/06	59.60	b	14.53	45.07	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	120	--
MW6	06/19/06	59.60	b	16.46	43.14	0.00	--	--	--	--	--	--	--	--	--
MW6	09/29/06	59.60	b	17.60	42.00	0.00	0.87	<0.50	<0.50	<0.50	<50	<50	<100	140	--
MW6	12/12/06	59.60	b	16.93	42.67	0.00	0.67	<0.50	<0.50	<0.50	<50	<50	230	89	--
MW6	03/01/07	59.60	b	16.30	43.30	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	78	--
MW6	06/12/07	59.60	b	17.38	42.22	0.00	--	--	--	--	--	--	--	--	--
MW6	09/25/07	59.60	b	18.36	41.24	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	89	--
MW6	12/20/07	59.60	b	17.90	41.70	0.00	--	--	--	--	--	--	--	--	--
MW6	03/26/08	59.60	b	17.37	42.23	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	68	--
MW6	06/03/08	59.60	b	17.11	42.49	0.00	--	--	--	--	--	--	--	--	--
MW6	09/25/08	59.60	b	18.82	40.78	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	78	<5.0
MW6	12/29/08	59.60	b	18.30	41.30	0.00	0.77	<0.50	<0.50	<0.50	<50	<50	<100	44	<5.0
MW6	03/24/09	59.60	l	16.80	42.80	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	51	<5.0
MW6	06/02/09	59.60	l	17.27	42.33	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	59	<5.0
MW6	09/10/09	59.60	l	18.20	41.40	0.00	< 0.50	< 0.50	< 0.50	< 0.50	< 50	< 50	< 100	73	< 5.0
MW6	12/04/09	59.60	l	19.07	40.53	0.00	< 0.50	< 0.50	< 0.50	< 0.50	< 50	< 50	< 100	50	< 5.0
MW7	07/20/00	96.75	a	15.93	80.82	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	<0.50	--
MW7	10/11/00	96.75	a	16.90	79.85	0.00	--	--	--	--	--	--	--	--	--
MW7	04/10-11/01	96.75	a	15.80	80.95	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	<0.50	--
MW7	07/10/01	96.75	a	16.71	80.04	0.00	--	--	--	--	--	--	--	--	--
MW7	11/20/01	59.47	b	16.17	43.30	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	<2.0	--
MW7	02/19/02	59.47	b	14.92	44.55	0.00	--	--	--	--	--	--	--	--	--
MW7	05/21/02	59.47	b	15.18	44.29	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<300	<0.50	--
MW7	06/27/03	59.47	b	16.28	43.19	0.00	--	--	--	--	--	--	--	--	--
MW7	09/29/03	59.47	b	16.88	42.59	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	0.62	--
MW7	12/12/03	59.47	b	14.95	44.52	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW7	03/15/04	59.47	b	14.77	44.70	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--
MW7	06/24/04	59.47	b	16.33	43.14	0.00	<0.50	<0.50	<0.50	<1.0	<50	300	<500	<0.50	--
MW7	09/29/04	59.47	b	16.88	42.59	0.00	--	--	--	--	--	--	--	--	--
MW7	12/13/04	59.47	b	15.26	44.21	0.00	--	--	--	--	--	--	--	--	--
MW7	03/14/05	59.47	b	15.00	44.47	0.00	<0.50	<0.50	<0.50	<1.0	<50	<50	<500	<0.50	--

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)		Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
							Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA
MW7	06/15/05	59.47	b	15.32	44.15	0.00	--	--	--	--	--	--	--	--	--
MW7	09/26/05	59.47	b	NM	NM	0.00	--	--	--	--	--	--	--	--	--
MW7	12/12/05	59.47	b	15.99	43.48	0.00	--	--	--	--	--	--	--	--	--
MW7	03/29/06	59.47	b	12.65	46.82	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	--
MW7	06/19/06	59.47	b	14.49	44.98	0.00	--	--	--	--	--	--	--	--	--
MW7	09/29/06	59.47	b	16.67	42.80	0.00	--	--	--	--	--	--	--	--	--
MW7	12/12/06	59.47	b	15.21	44.26	0.00	--	--	--	--	--	--	--	--	--
MW7	03/01/07	59.47	b	14.68	44.79	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	--
MW7	06/12/07	59.47	b	16.2	43.27	0.00	--	--	--	--	--	--	--	--	--
MW7	09/25/07	59.47	b	16.72	42.75	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	--
MW7	12/20/07	59.47	b	15.02	44.45	0.00	--	--	--	--	--	--	--	--	--
MW7	03/26/08	59.47	b	15.95	43.52	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	--
MW7	06/03/08	59.47	b	14.24	45.23	0.00	--	--	--	--	--	--	--	--	--
MW7	09/25/08	59.47	b	17.07	42.40	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW7	12/29/08	59.47	b	15.64	43.83	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW7	03/24/09	59.49	l	14.57	44.92	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW7	06/02/09	59.49	l	16.10	43.39	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW7	09/10/09	59.49	l	17.10	42.39	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW7	12/04/09	59.49	l	17.10	42.39	0.00	--	--	--	--	--	--	--	--	--
MW8	12/29/08	NS	b	15.71	NC	0.00	<0.50	0.64	<0.50	0.78	<50	<50	<100	1.5	<5.0
MW8	03/24/09	57.07	l	16.08	40.99	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW8	06/02/09	57.07	l	15.46	41.61	0.00	<0.50	<0.50	<0.50	<0.50	<50	<50	<100	<0.50	<5.0
MW8	09/10/09	57.07	l	15.58	41.49	0.00	< 0.50	< 0.50	< 0.50	< 0.50	< 50	< 50	< 100	2.4	< 5.0
MW8	12/04/09	57.07	l	16.27	40.80	0.03	--	--	--	--	--	--	--	--	--
MW9A	09/10/09	65.90		22.51	43.39	0.00	7,800	33,000	4,500	25,000	160,000	< 20,000	410	1,800	780
MW9A	12/04/09	65.90		24.42	41.48	0.00	--	--	--	--	--	--	--	--	--
MW9A (m)	12/28/09	65.90		24.62	41.28	sheen	12,000	34,000	4,300	24,000	180,000	<200,000	3,400	2,100	680
MW9B	09/10/09	65.85		22.30	43.55	0.00	640	4,500	1,100	6,500	36,000	< 3,000	< 100	61	< 50
MW9B	12/04/09	65.85		24.00	41.85	0.00	63	250	180	620	5,600	< 300	< 100	3.1	< 5.0
O1	09/10/09	65.91		22.44	43.47	0.00	960	2,400	1,000	4,600	23,000	< 1,500	< 100	180	84
O1	12/04/09	65.91		24.33	41.58	0.00	1,000	3,700	1,700	7,400	38,000	< 1000	< 100	310	200

SPH	Separate-phase hydrocarbons.
GW	Groundwater.
TPH-g	Total Petroleum Hydrocarbons as gasoline.
TPH-d	Total Petroleum Hydrocarbons as diesel.
TPH-mo	Total Petroleum Hydrocarbons as motor oil.
MTBE	Methyl tertiary butyl ether.
TBA	Tertiary Butyl Alcohol
NC	Not calculated.
NS	Not surveyed
µg/L	Micrograms per liter.
*	SPH present; not sampled.
**	Well MW4 elevation modified due to site renovation activities. Not Surveyed.
--	Not analyzed or not sampled.
<	Less than the laboratory reporting limits.
a	Elevations are referenced to monitoring well MW1, with assumed datum of 100.00 feet.
b	Elevations based on a survey conducted August 2002 and referenced benchmark with known elevation (NGVD 29) of 60.40 feet above mean sea level.
c	Analysis not conducted due to broken sample containers.
d	Hydrocarbon reported in the gasoline range does not match laboratory gasoline standard.
e	Groundwater elevation in wells with LPH are corrected by multiplying the specific gravity of gasoline (0.69) by the LPH thickness and adding this value to the water elevation.
f	Hydrocarbon reported is in the early diesel range, and does not match the laboratory diesel standard.
g	Sample contained discrete peak in gasoline range and identified by lab as MTBE.
h	Quantity of unknown hydrocarbon(s) in sample based on diesel.

TABLE 1 CUMULATIVE GROUNDWATER ELEVATION AND ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

Well Number	Date	Casing Elevation (feet)	Depth to Water (feet)	GW Elevation (feet)	SPH Thickness (feet)	Concentration (µg/L)								
						Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH-g	TPH-d	TPH-mo	MTBE	TBA

i The concentration reported reflect(s) individual or discrete unidentified peaks not matching a typical fuel pattern.

j Depth to groundwater is based on the depth of the stingers.

k Quantity of unknown hydrocarbon(s) in sample based on mtor oil.

l Resurveyed Prior to 1st Quarter 2009 Measurements

m The well was not purged due to insufficient water. Sheen was observed during sampling.

TABLE 2 GRAB GROUNDWATER SAMPLE ANALYTICAL DATA
FORMER VAL STROUGH CHEVROLET, 327 34th STREET OAKLAND, CALIFORNIA

			Concentrations (µg/L)							
Boring ID	Date	Depth (feet)	Benzene	Toluene	Ethyl-benzene	Total Xylenes	MTBE	TPH-g	TPH-d	TPH-mo
HP1	12/18/2003	26-30	<5.0	<5.0	<5.0	11	**480**	410	180	<500
HP3	12/18/2003	32-36	<0.50	<0.50	<0.50	<1.0	0.55	<50	75	<500
SB3	12/26/2007	24	0.75	28	35	180	0.59	1,800	<1000	<100
SB3	12/26/2007	40	<0.50	1.1	5.3	33	1	240	<400	<100
SB4	12/26/2007	23	160	120	200	240	1.8	3,500	<1500	<100
SB4	12/26/2007	40	250	1,400	280	2,000	3.2	9,900	<1500	<100
SB5	12/26/2007	24	**660**	**11,000**	**4,200**	**20,000**	34	**110,000**	<100000	310
SB5	12/26/2007	40	74	1,000	380	2,400	31	13,000	<3000	<100
SB6	12/26/2007	25	<0.5	6.6	3.6	27	1.2	210	<100	<100
SB6	12/26/2007	40	85	1,500	620	6,900	15	35,000	<18000	<100
SB7	12/26/2007	40	120	1,100	470	2,900	8	20,000	<6000	<100
SB8	12/26/2007	40	320	1,300	920	3,100	100	17,000	<3000	<100
SB9	12/26/2007	34	<0.5	<0.5	<0.5	<0.5	92	<50	69	<100
SB10	12/26/2007	21.3	<0.5	<0.5	<0.5	<0.5	30	<50	2,200	5,000
SB11	12/26/2007	17	<0.5	<0.5	<0.5	<0.5	<50	<50	200	220
SB12	12/26/2007	20	<0.5	<0.5	<0.5	<0.5	43	67	950	1,200
SB13	12/26/2007	26	<0.5	<0.5	<0.5	<0.5	160	<50	**3,800**	**6,600**

TPH-g Total Petroleum Hydrocarbons as gasoline.

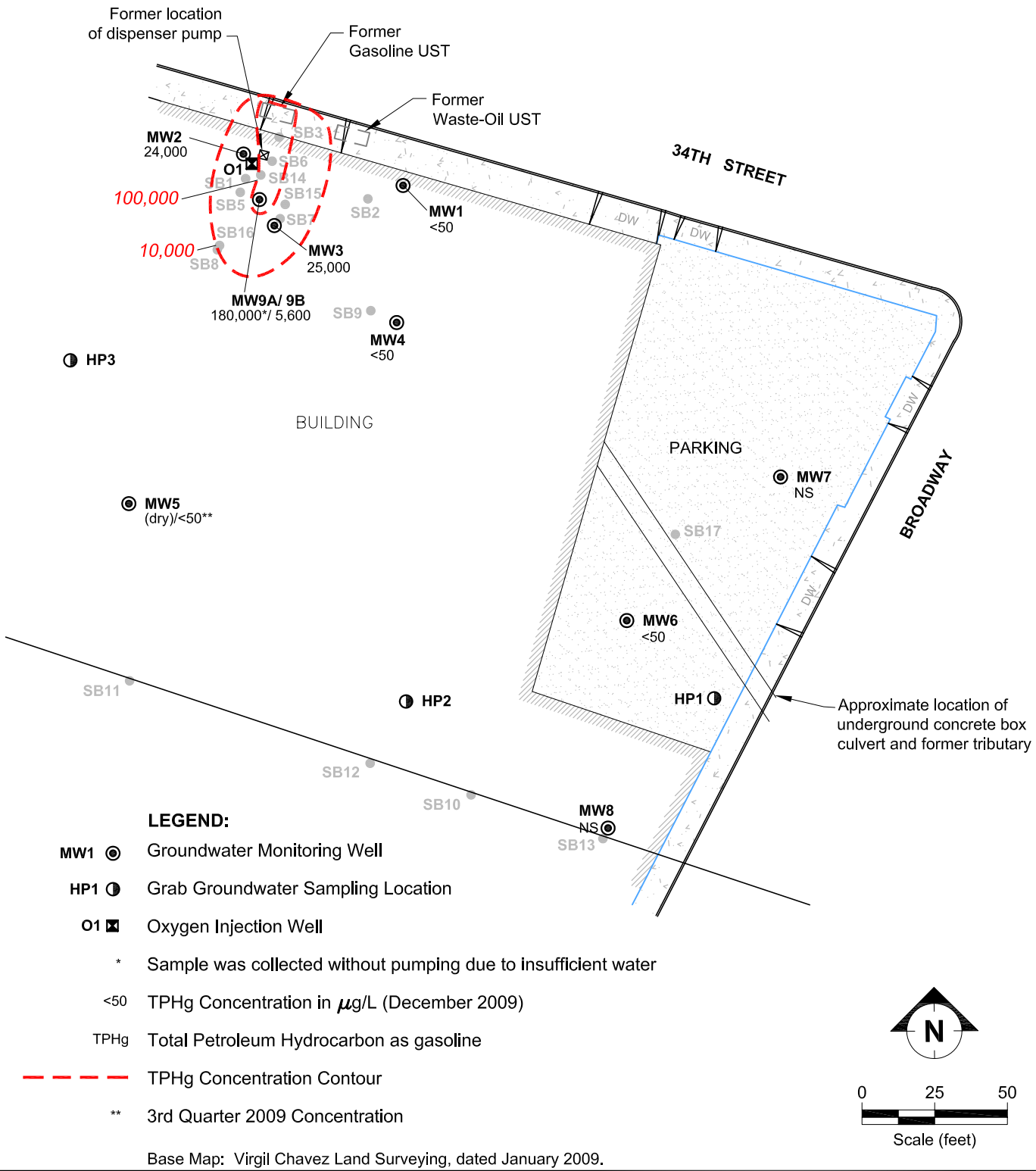
TPH-d Total Petroleum Hydrocarbons as diesel.

TPH-mo Total Petroleum Hydrocarbons as motor oil.

< less than the laboratory reporting limits.

660 Bold values reflect maximum detected concentrations

FIGURES



LEGEND:

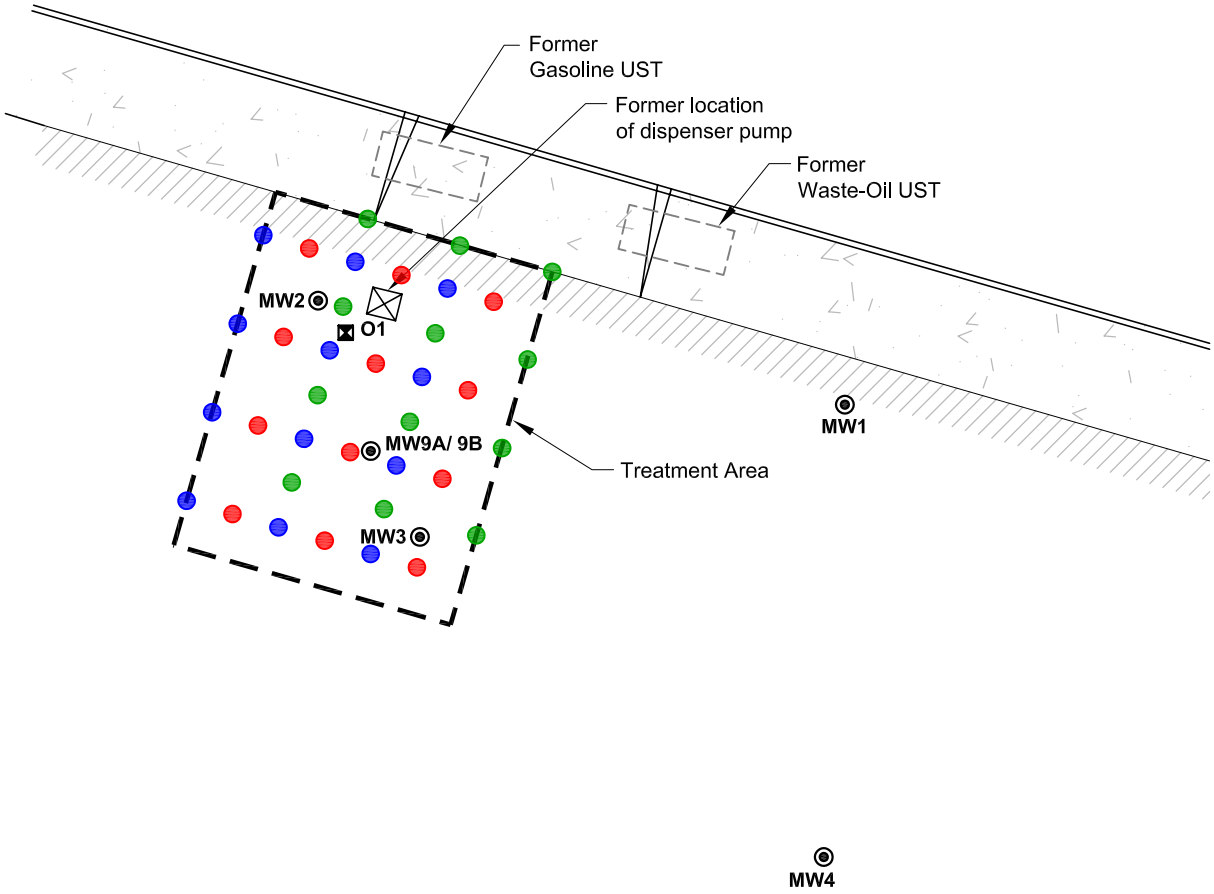
MW1 ◉	Groundwater Monitoring Well
HP1 ◑	Grab Groundwater Sampling Location
O1 ⊠	Oxygen Injection Well
*	Sample was collected without pumping due to insufficient water
<50	TPHg Concentration in μg/L (December 2009)
TPHg	Total Petroleum Hydrocarbon as gasoline
– – – –	TPHg Concentration Contour
**	3rd Quarter 2009 Concentration

Base Map: Virgil Chavez Land Surveying, dated January 2009.

LRM consulting inc.

TPHg ISOC CONCENTRATION MAP
FORMER VAL STROUGH CHEVROLET
327 34TH STREET, OAKLAND, CALIFORNIA
DECEMBER 2009

FIGURE: **1**



MW5

LEGEND:

MW1	Groundwater Monitoring Well
HP1	Grab Groundwater Sampling Location
O1	Oxygen Injection Well
	Proposed ISCO Injection Point (1st round)
	Proposed ISCO Injection Point (2nd round)
	Proposed ISCO Injection Point (3rd round)
ISCO	In-Situ Chemical Oxidation

Base Map: Virgil Chavez Land Surveying, dated January 2009.

N

0 10 20

Scale (feet)

LRM consulting inc.

PROPOSED ISCO APPLICATION AREA
FORMER VAL STROUGH CHEVROLET
327 34TH STREET, OAKLAND, CALIFORNIA

FIGURE: **2**

Appendix A

RegenOx and ORC Application Procedures

REGENESIS

RegenOx™

CHEMICAL OXIDATION REDEFINED

RegenOx™ *In Situ* Chemical Oxidation Application Instructions

Using Direct-Push Injection (Step-by-Step Procedures)

RegenOx™ is the new generation of chemical oxidation. RegenOx™ is a proprietary (patent-applied-for) *in situ* chemical oxidation process using a solid oxidant complex (sodium percarbonate/catalytic formulation) and an activator complex (a composition of ferrous salt embedded in a micro-scale catalyst gel). RegenOx™ with its catalytic system has very high activity, capable of treating a very broad range of soil and groundwater contaminants including both petroleum hydrocarbons and chlorinated solvents.

Instructions

1) Prior to the installation of RegenOx™, any surface or overhead impediments should be identified as well as the location of all underground structures. Underground structures include but are not limited to utility lines; tanks; distribution piping; sewers; drains; and landscape irrigation systems. The planned installation locations should be adjusted to account for all impediments and obstacles. These considerations should be part of the SSHP or HASP.

2) Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.

3) Set up the direct push unit over each point and follow the manufacturer standard operating procedures (SOP) for the direct push equipment. Care should be taken to assure that probe holes remain in the vertical.

4) For most applications, Regenesis suggests using 1.5-inch O.D./0.625-inch I.D drive rods. However, some applications may require the use of 2.125-inch O.D./1.5-inch I.D. or larger drive rods.

5) Advance drive rods through the surface pavement, as necessary, following SOP.

6) Push the drive rod assembly with an expendable tip to the desired maximum depth. Regenesis suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities.

7) After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. Then the expendable tip can be dropped from the drive rods, following SOP. If an injection tool was used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.

8) In some cases, introduction of a large column of air prior to RegenOx™ application may be problematic because the air can block water flow to the treatment area. This is particularly the case in deep injections (>50 ft) with large diameter rods (>1.5-inch O.D.). To prevent the injection of air into the aquifer during RegenOx™ application, as well as to prevent problems associated with heaving sands, fill the drive rods with water, or the RegenOx™ mixture prior dropping the expendable tip or exposing the injection tool.

9) The RegenOx™ percent of the oxidizer in solution should range between 3% to 5%. Although solutions up to 8% may be used, this will likely increase the difficulty of injection due to reactivity. Solutions with greater than 8% oxidizer in solution will result in excess reaction and flocculation prior to injection and are not typically recommended

   Measure the appropriate quantity of RegenOx™ Oxidizer for one to four vertical foot of injection into a 55 gallon drum or mixing tank. The volume of water per injection location can be calculated from the following formula:

$$\frac{\text{RegenOx Oxidizer lbs/foot}}{(8.34\ \text{lbs/gal water})(\%\ \text{R}egenOx\_Oxidizer\ \text{solids})}\left[1-(\%\ \text{R}egenOx\_Oxidizer\ \text{solids})\right]$$

   Tighter formations (clays and silts), and even some fine sand formations will likely require higher oxidant percentages since less volume can be injected per location. The following are guides to various RegenOx™ mixing ratios based on the above equation.

   - to make a roughly 3% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 38 gallons of water.
   - to make a roughly 4% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 28 gallons of water.
   - to make a roughly 5% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 22 gallons of water.

10) Pour the pre-measured quantity of RegenOx™ Oxidizer into the pre-measured volume of water to make the desired target % oxidant in solution. NOTE: always pour the Oxidizer into water, do not pour water into the Oxidizer. Mix the water and oxidant with a power drill and paint stirrer or other mechanical mixing device to ensure that the Oxidizer has dissolved in the water.

11) Pour the applicable quantity of the pre-mixed RegenOx™ Activator into the oxidant:water solution. Mix the Oxidant and Activator using a power drill paint stirrer or other mechanical mixing device for at least 5 minutes until a homogenous mixture is formed. After mixing the RegenOx™ mixture should be injected into the subsurface as soon as possible.

12) Do not mix more RegenOx™ material than will be used over roughly 1 to 4 feet of injection so as to minimize potential above ground reaction/flocculation prior to injection.

    Transfer the contents of the mixing tank to the pump using gravity feed or appropriate transfer pump. (See Section 9.2: Pump Selection) For some types of pumps, it may be desirable to perform a volume check prior to injecting RegenOx™

13) Connect the delivery hose to the pump outlet and the delivery sub-assembly. Circulate RegenOx™ though the hose and the delivery sub-assembly to displace air in the hose. NOTE: an appropriately sized pressure gauge should be placed between the pump outlet and the delivery sub-assembly in order to monitor application pump pressure and detect changes in aquifer backpressures during application.

14) Connect the sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the RegenOx™ through the delivery system to displace the water/fluid in the rods.

15) Slowly withdraw the drive rods. Commonly RegenOx™ injection progress at 1-foot intervals. However, continuous injection while slowly withdrawing single lengths of drive rod (3 or 4 feet) is an acceptable option. The pre-determined volume of RegenOx™ should be pumped into the aquifer across the desired treatment interval.

16) Remove one section of the drive rod. The drive rod may contain some residual RegenOx™. Place the RegenOx™-filled rod in a clean, empty bucket and allow the RegenOx to drain. Eventually, the RegenOx™ should be returned to the RegenOx™ pump hopper for reuse.

17) Monitor for any indications of aquifer refusal. This is typically indicated by a spike in pressure as indicated or (in the case of shallow applications) RegenOx™ "surfacing" around the injection rods or previously installed injection points. At times backpressure caused by reaction off-gassing will impede the pumps delivery volume. This can be corrected by bleeding the pressure off using a pressure relief/bypass valve (placed inline between the pump discharge and the delivery sub-assembly) and then resume pumping. If aquifer acceptance appears to be low, as indicated by high back pressure, allow sufficient time for the aquifer to equilibrate prior to removing the drive rod.

18) Repeat steps 13 through 23 until treatment of the entire contaminated vertical zone has been achieved. It is recommended that the procedure extend to the top of the capillary fringe/smear zone, or to the top of the targeted treatment interval.

19) Install an appropriate seal, such as bentonite, above the RegenOx™ material through the entire vadose zone. Prior to emplacing the borehole seal, we recommend placing clean sand in the hole to the top of the RegenOx™ treatment zone (especially important in holes that stay open). Bentonite chips or granular bentonite should be placed immediately above the treatment zone, followed by a cement/bentonite grout to roughly 0.5 feet below ground surface. Quick-set concrete should then be used as a surface seal.

20) Remove and clean the drive rods as necessary.

21) Finish the borehole at the surface as appropriate (concrete or asphalt cap, as needed). We recommend a quick set concrete to provide a good surface seal with minimal set up time.

22) A proper borehole and surface seal assures that the RegenOx™ remains properly placed and prevents contaminant migration from the subsurface. Each borehole should be sealed immediately following RegenOx™ application to minimize RegenOx™ surfacing during the injection process. If RegenOx™ continues to "surface" up the direct push borehole, an appropriately sized (oversized) disposable drive tip or wood plug/stake can be used to plug the hole until the aquifer pressures equilibrates and the RegenOx™ stops surfacing. If wells are used for RegenOx™ injection the RegenOx™ injection wells and all nearby groundwater monitoring wells should be tightly capped to reduce potential for surfacing through nearby wells.

23) Periodically compare the pre- and post-injection volumes of RegenOx™ in the holding tank or pump hopper using the pre-marked volume levels. Volume level may not be present on all tanks or pump hoppers. In this case, volume level markings can be temporarily added using known amounts of water and a carpenter's grease pencil (Kiel crayon).

24) Move to the next probe point, repeating steps 8 through 29. We recommend that the next RegenOx™ injection point be as far a distance as possible within the treatment zone from the previous RegenOx™ injection point. This will further minimize RegenOx™ surfacing and short circuiting up an adjacent borehole. When possible, due to the high volumes of liquid being injected, working from the outside of the injection area towards the center will limit expansion of the plume.

REGENESIS

Pump Selection

Regenesis has evaluated a number of pumps and many are capable of delivering RegenOx™ to the subsurface at a sufficient pressure and volumetric rate. However, even though a number of the evaluated pumps may be capable of delivering the RegenOx™ to the subsurface based on adequate pressures and delivery rates, each pump has its own set of practical issues that may make it more or less difficult to manage in a field setting.

In general, Regenesis strongly recommends using a pump with a pressure rating of 200 pounds per square inch (psi) in sandy soil settings, and 800 psi in silt, clay or weathered bedrock settings. Any pump under consideration should have a minimum delivery rate of 5 gallons per minute (gpm). A lower gpm rated pump may be used; however, they are not recommended due to the amount of time required to inject the volume of liquids typically associated with a RegenOx™ injection (i.e. 1,000 lbs of RegenOx™ [500 lbs Oxidant/500 lbs Activator] require roughly 1,100 gallons of water to make a 5% Oxidant solution).

Quite often diaphragm pumps are used for the delivery of chemical oxidants. Generally, these pumps operate pressures from 50-150 psi. Some of these pumps do not have the pressure head necessary to overcome the back pressure encountered in silt and clay lenses. In these cases the chemical oxidant thus ends up being delivered to the surrounding sands (the path of least resistance) and is not delivered to soil with residual adsorbed contamination. The use of a positive displacement pump such as a piston pump or a progressing cavity pump is may be superior because these pumps have the pressure necessary to overcome the resistance of low permeability soils. NOTE: be aware that application at pressures that are too high may over-consolidate the soil and minimize the direct contact of the oxidant. The key is to inject at a rate and pressure that maximizes the radius of influence without causing preferential flow. This can be achieved by injecting at the minimum pressure necessary to overcome the particular pressures associated with your site soil conditions.

Whether direct injection or wells are used, it is best to start by injecting RegenOx™ outside the contaminated area and spiral laterally inwards toward the source. Similarly, RegenOx™ should be applied starting vertically at the bottom elevation of contamination, through the layer of contamination, and a couple of feet above the layer of contamination. The reagents can be pushed out from the well bore with some water.

Pump Cleaning

For best results, flush all moving parts and hoses with clean water at the end of the day; flush the injection system with a mixture of water and biodegradable cleaner such as Simple Green.

For more information or technical assistance please call Regenesis at 949-366-8000

REGENESIS

February 26, 2007

RegenOx and ORC *Advanced* Simultaneous Application

RegenOx™ is a two part chemical oxidant capable of treating a broad range of soil and groundwater contaminants. RegenOx was designed as an easily handled and applied high-contaminant-concentration mass reduction technology. RegenOx is an aggressive fast acting oxidative technology that can be coupled with a less aggressive slow release technology like Oxygen Release Compound Advanced (ORC *Advanced*) without negative effects on either products contaminant destructive ability or the aquifer/soil geochemistry.

ORC *Advanced*™ is a state-of-the-art innovative product designed to stimulate aerobic bioremediation through controlled release of oxygen within the subsurface. It offers unparalleled, maximum oxygen release for periods up to 12 months on a single injection and is specifically designed to minimize oxygen waste while maximizing contaminant remediation.

Preliminary Aquifer Volume Testing

Prior to application of the RegenOx + ORC *Advanced* material, it is critical that a clear water injection be performed at the site. The injection a non-reactive (clear water) material at a volume that is approximately 25% greater than the anticipated application volume of RegenOx will provide good evidence of the aquifers capacity to accept the designed volume of RegenOx + ORC-*Advanced*.

RegenOx Solution Mixing Calculation

RegenOx s a two part product, the RegenOx Part A is an oxidant and the Part B is an activator. Depending on the relative aquifer capacity (effective pore volume) of the target zone soil matrix a RegenOx solution should be applied as a solution ranging from 3-5% by weight. The volume of water required to make a 3-5% RegenOx solution can be calculated using the formula provided below (a detailed discussion on RegenOx Mixing Instructions is attached).

Volume of water (gallons/vertical foot of injection):

$$\frac{\text{RegenOx Oxidizer lbs/foot}}{(8.34\,\text{lbs/gal water})(\%\,\text{R}egenOx\_Oxidizer\ \text{solids})}\left[1-(\%\,\text{R}egenOx\_Oxidizer\ \text{solids})\right]$$

Quick Reference Solution Estimates

- Approximate 3% oxidant solution: 10 lbs of Part A oxidant mixed with 39 gallons of water.
- Approximate 4% oxidant solution: 10 lbs of Part A oxidant mixed with 29 gallons of water.
- Approximate 5% oxidant solution: 10 lbs of Part A oxidant mixed with 23 gallons of water.

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ORC *Advanced* Solutions Mixing Calculation

ORC *Advanced* can be mixed in to a slurry solution ranging from 15-35% by weight with water. This slurry is well documented in the literature. For a detailed discussion of these techniques please see the ORC/ORC *Advanced* mixing instructions available on the Regenesis website (www.regenesis.com).

NOTE: for this coupled technology application we strongly recommend that ORC-A be applied as an amendment to the site specific design volume of RegenOx material. This will ensure that the more reactive RegenOx material is applied in a stable and format that will facilitate optimal oxidative contaminant destruction.

RegenOx + ORC-A Solution Mixing & Application

A solution ranging from 3-5% RegenOx solution can be easily mixed directly together with the recommended quantity of ORC *Advanced* and injected simultaneously as described below:

1. Prepare the site specific designed RegenOx Part A solution (3-5% solution).

2. Open the 5-gallon bucket and remove the pre-measured bag of ORC *Advanced* (each bag contains 25 lbs of ORC *Advanced*).

2. Measure and pour the ORC Advanced powder into the previously prepared RegenOx solution.

3. Use an appropriate mixing device to thoroughly mix the ORC *Advanced* into the RegenOx solution. A hand-held drill with a "jiffy mixer" or a stucco mixer on it may be used in conjunction with a small paddle to scrape the bottom and sides of the container. Standard environmental slurry mixers may also be used, following the equipment instructions for operation.

4. Transfer the contents of the mixing tank to the pump hopper using a gravity drain or a sump pump.

5. For some types of pumps (e.g. piston pumps), it may be desirable to perform a volume check prior to injecting RegenOx/ORC *Advanced*. Determining the volume displaced per pump stroke can be accomplished in two easy steps.

    a) Determine the number of pump strokes needed to deliver 3 gallons of RegenOx/ORC *Advanced* (use a graduated bucket for this)

    b) Divide the resulting 3 gallons by the results from the first step to determine the number of gallons of RegenOx/ORC *Advanced* delivered by each pump stroke.

6. Connect the delivery hose to the pump outlet and the delivery sub-assembly. Circulate RegenOx/ORC *Advanced* through the hose and the delivery sub-assembly to displace air in the hose.

7. Connect the sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the RegenOx/ORC *Advanced* through the delivery system to displace the water/fluid in the rods.

8. Slowly withdraw the drive rods. Commonly RegenOx/ORC *Advanced* injection progress at 1-foot intervals. However, continuous injection while slowly withdrawing single lengths of drive rod (3 or 4 feet) is an acceptable option. The pre-determined volume of RegenOx/ORC *Advanced* should be pumped into the aquifer across the desired treatment interval.

9. Remove one section of the drive rod. The drive rod may contain some residual RegenOx/ORC *Advanced* solution. Place the RegenOx/ORC *Advanced*-filled rod in a clean, empty bucket and allow the RegenOx/ORC *Advanced* to drain. Eventually, the RegenOx/ORC *Advanced* should be returned to the pump hopper for reuse.

10. Observe any indications of aquifer refusal. This is typically indicated by a high-pitched squeal in the pump's hydraulic system or (in the case of shallow applications) RegenOx/ORC *Advanced* "surfacing" around the injection rods or previously installed injection points. At times backpressure caused by gassing will impede pump movement. This can be corrected by bleeding the pressure off using a pressure relief/bypass valve (placed inline between the pump discharge and the delivery sub-assembly) and then resume pumping. If aquifer acceptance appears to be low, allow enough time for the aquifer to equilibrate prior to removing the drive rod.

11. Repeat steps 1 through 11 until treatment of the entire contaminated vertical zone has been achieved. It is recommended that the procedure extend to the top of the capillary fringe/smear zone, or to the top of the targeted treatment interval.

12. Install an appropriate seal, such as bentonite, above the RegenOx/ORC *Advanced* material through the entire vadose zone. Prior to emplacing the borehole seal, we recommend placing clean sand in the hole to the top of the RegenOx/ORC *Advanced* treatment zone (especially important in holes that stay open). Bentonite chips or granular bentonite should be placed immediately above the treatment zone, followed by a cement/bentonite grout to roughly 0.5 feet below ground surface. Quick-set concrete should then be used as a surface seal.

13. Remove and clean the drive rods as necessary.

14. Finish the borehole at the surface as appropriate (concrete or asphalt cap, if necessary). We recommend a quick set concrete to provide a good surface seal with minimal set up time.

15. A proper borehole and surface seal assures that the RegenOx/ORC *Advanced* remains properly placed and prevents contaminant migration from the surface. Each borehole should be sealed immediately following RegenOx/ORC *Advanced* application to minimize RegenOx/ORC *Advanced* surfacing during the injection process. If RegenOx/ORC *Advanced* continues to "surface" up the direct push borehole, an appropriately sized (oversized) disposable drive tip or wood plug/stake can be used to plug the hole until the aquifer equilibrates and the RegenOx/ORC *Advanced* stops surfacing. If wells are used for RegenOx/ORC *Advanced* injection the injection wells and all nearby groundwater monitoring wells should be tightly capped to reduce potential for surfacing through nearby wells.

16. Periodically compare the pre- and post-injection volumes of RegenOx/ORC *Advanced* in the pump hopper using pre-marked volume levels. Volume level indicators are not on all pump hoppers. In

this case, volume level markings can be temporarily added using known amounts of water and a carpenter's grease pencil (Kiel crayon). We suggest marking the water levels in 3-gallon increments.

17. Move to the next probe point, repeating steps 1 through 17. We recommend that the next RegenOx/ORC *Advanced* injection point be as far a distance as possible within the treatment zone from the previous RegenOx/ORC *Advanced* injection point. This will further minimize RegenOx/ORC *Advanced* surfacing and short circuiting up an adjacent borehole. When possible, due to the high volumes of liquid being injected, working from the outside of the injection area towards the center will limit expansion of the plume.

Pump Information

Regenesis has evaluated a number of pumps that are capable of delivering RegenOx/ORC *Advanced* to the subsurface at a sufficient pressure and volumetric rate. Although a number of pumps may be capable of delivering the RegenOx/ORC *Advanced* to the subsurface at adequate pressures and volume, each pump has a set of practical issues that make it difficult to manage in a field setting. In general, Regenesis strongly recommends using a pump with a minimum pressure rating of 200 pounds per square inch (psi) in sandy formations or 800 psi in silt, clay or weathered bedrock formations, and a minimum delivery rate of 5 gallons per minute (gpm). A lower gpm rated pump can be used; however, they are not recommended due to the amount of time required to inject the volume of liquids typically associated with a RegenOx/ORC *Advanced* injection.

Pump Cleaning

For best results, use a hot water pressure washer (150 - 170 °F or 66 - 77 °C) to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by circulating hot water and a biodegradable cleaner such as Simple Green through the pump and delivery hose. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

Personal Protective Equipment

Personnel working with or in areas of potential contact with RegenOx/ORC *Advanced* should be required at a minimum to be fitted with modified Level D personal protective equipment:

- Eye protection – Wear well sealed goggles or a face shield (face shield recommended for full face protection)
- Head – Hard hat when required
- Respiratory – Use dust respirator approved by NIOSH/MSA
- Hands – Wear neoprene gloves
- Feet – Wear steel toe shoes with chemical resistant soles or neoprene boots
- Clothing – Wear long sleeve shirts and long pant legs. Consider using a Tyvek® body suit, Carhartt® coverall or splash gear

Typical Installation Equipment

- Direct push rig
- Drive Rods (typically 1 ½-inch O.D.) & Injection Tooling with fluid deliver sub-assembly
- Injection Pump rated for 5 gpm @ 200 psi for sandy formations and 800 psi for silt and clay formations (Geoprobe DP-800, Yamada, Moyno, Rupe Models 9-1500 and 9-1600, Wilden, etc.)
- Injection hosing and a pressure relief valve with a bypass
- Clear hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Three to four 55-gallon drums or similarly sized mixing tanks for RegenOx and ORC *Advanced* mixing
- Sand, bentonite chips, granular bentonite, cement, hydraulic cement, and quick-set concrete for closing and sealing temporary injection holes
- Wood plugs or similar for temporarily sealing injection holes prior to grout sealing
- Access to water
- Access to electricity