

BEHAVIOR OF A SINGLE HRC APPLICATION IN EXCAVATION BACKFILL

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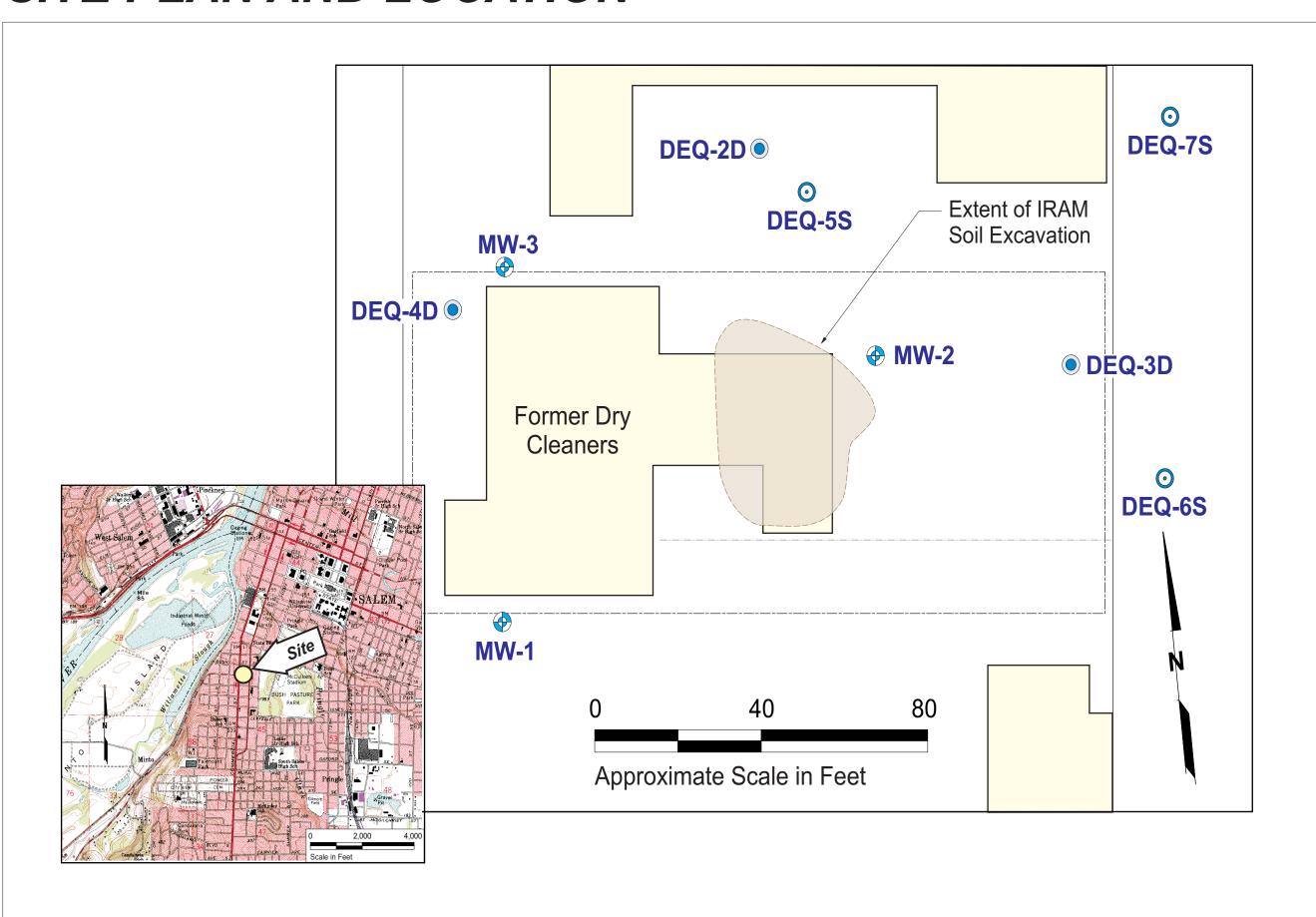
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ABSTRACT AND SITE BACKGROUND

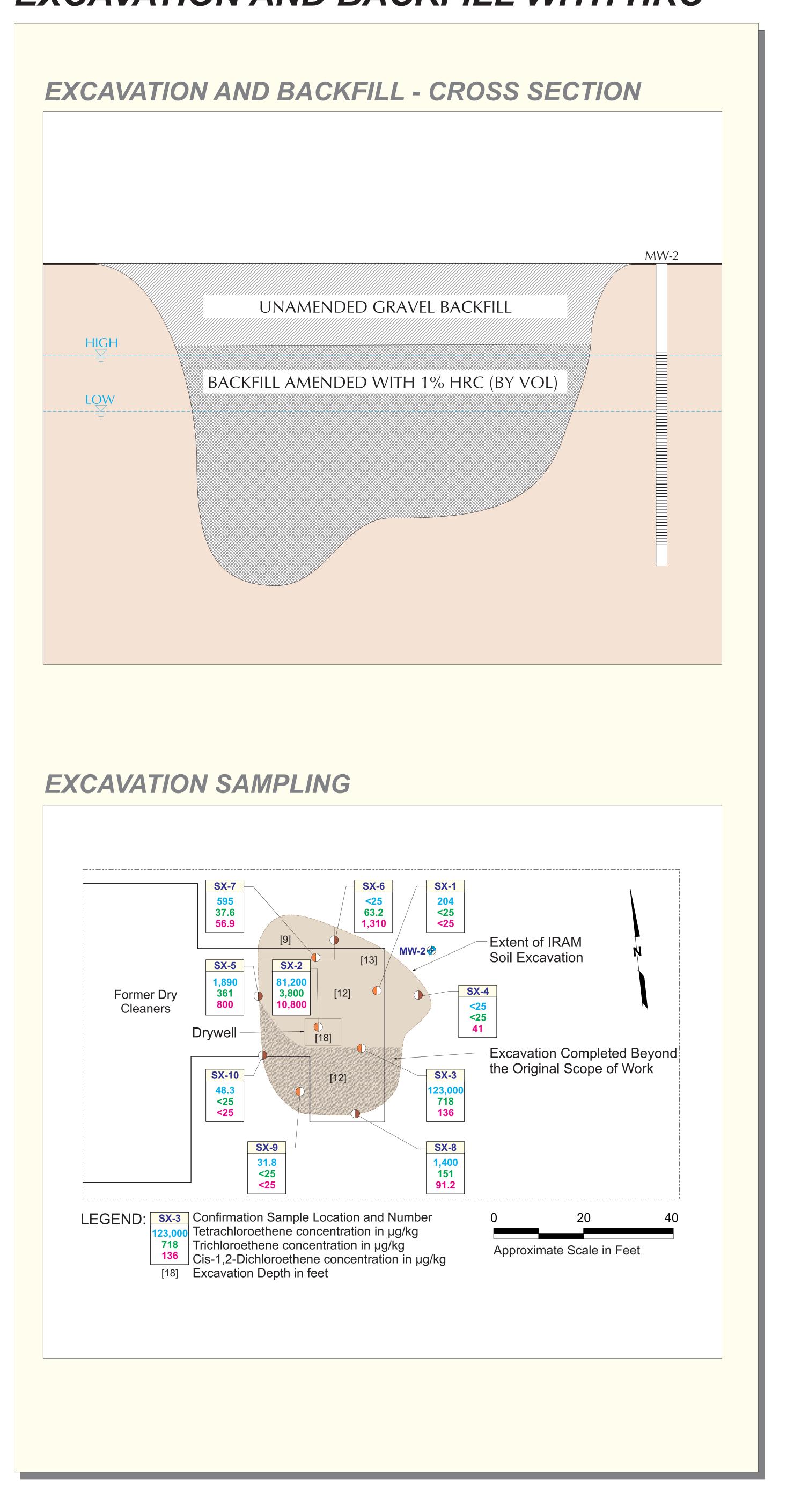
Abstract: In early 2002, a remedial action consisting of soil removal and enhanced bioremediation was initiated at the former Foreman's Dry Cleaners site in Salem, Oregon. Previous investigations identified soil under the former dry cleaner building that contained up to 418 mg/kg PCE, and groundwater concentrations as high as 136 mg/L of PCE. The selected interim action remedy involved excavation and disposal of hot-spot soil, followed by enhanced bioremediation of the residual contamination. The excavation work was initiated shortly after the site building was demolished by the property owner as part of a site redevelopment. During the excavation, an unexpected drywell was uncovered beneath the building. The concentrations of PCE encountered in the vicinity of the drywell were significantly higher than those previously encountered (as high as 930 mg/kg PCE in soil). A total of 477 tons of soil were excavated and transported to a hazardous waste landfill. The excavation was then backfilled with imported crushed rock that was amended uniformly with 1 percent HRC (by weight) to enhance bioremediation at the site. A groundwater monitoring program was established to evaluate the effectiveness of the remediation. Prior to the remediation work, groundwater concentrations in the monitoring well nearest to the excavation were 0.66 mg/L PCE, 0.36 mg/L TCE, 5.6 mg/L cis-1,2-DCE, and 0.06 mg/L vinyl chloride. The results of groundwater monitoring completed through November 2002 showed a rapid decrease in PCE and TCE concentrations (to non-detect levels), a moderate decrease in cis-1,2-DCE concentrations, and an initial increase in the vinyl chloride concentrations. Within 6 months of the initial application, the vinyl chloride concentrations dropped significantly, and the total molar concentration of VOCs had dropped more than three orders of magnitude from the preapplication levels. The removal of a significant mass of contaminants in the source area excavation is responsible for some of this reduction, but the excavation did not (and was not intended to) remove all of the source soil the introduction of HRC into the backfill (and the resultant increase in microbial activity) is largely responsible for the observed decrease in VOC concentrations. The results of later sampling, however, show a decrease in microbial activity, and an increase in the total molar VOC concentrations. Overall, we have observed an 80 percent reduction in the total molar VOC concentration, and concentrations of PCE and TCE continue to hover near the detection limit (a reduction of at least two orders of magnitude from the pre-remediation levels). However, the concentrations of cis-1,2-DCE and vinyl chloride have increased significantly in the most recent sampling events (to about 20 percent of the peak concentrations). The increase in VOC concentrations is not unexpected, considering residual source soils are known to exist adjacent to and beneath the former excavation. Continued monitoring of the site is planned to better quantify the impact of the excavation and initial HRC application on VOC concentrations, and additional future measures (such as a second application of HRC), are being

Background: The subject site is located in a mixed commercial-residential neighborhood. The site was used as a dry cleaning establishment from 1936 to 2000. The dry cleaning operation used Stoddard solvent (petroleum solvent) between 1936 and the mid-1980s, after which tetrachloroethene (PCE) was used as the dry cleaning solvent. The dry cleaning machinery was located in the east half of the building. An exterior door was adjacent to the location of the dry cleaning machinery, leading to a gravel parking lot behind the building. Still bottom wastes were temporarily stored outside of this door until 1982. Soil with concentrations of COPCs above screening levels was located predominantly beneath the northeast corner of the building and to the north and east of the building. Off-site impacts in soil were apparently limited to the north of the subject property. The chlorinated hydrocarbon groundwater plume covers much of the subject property and extends to the north and the east. The IRAM work included: excavation and disposal of accessible contaminated soil exceeding Oregon "hot spot" concentrations (100 times the applicable Risk-Based Concentration [14 mg/kg PCE]); and backfilling to previously existing grade with clean imported aggregate amended with 1 percent Hydrogen Releasing Compound (HRC) to address residual chlorinated hydrocarbons in soil and groundwater.

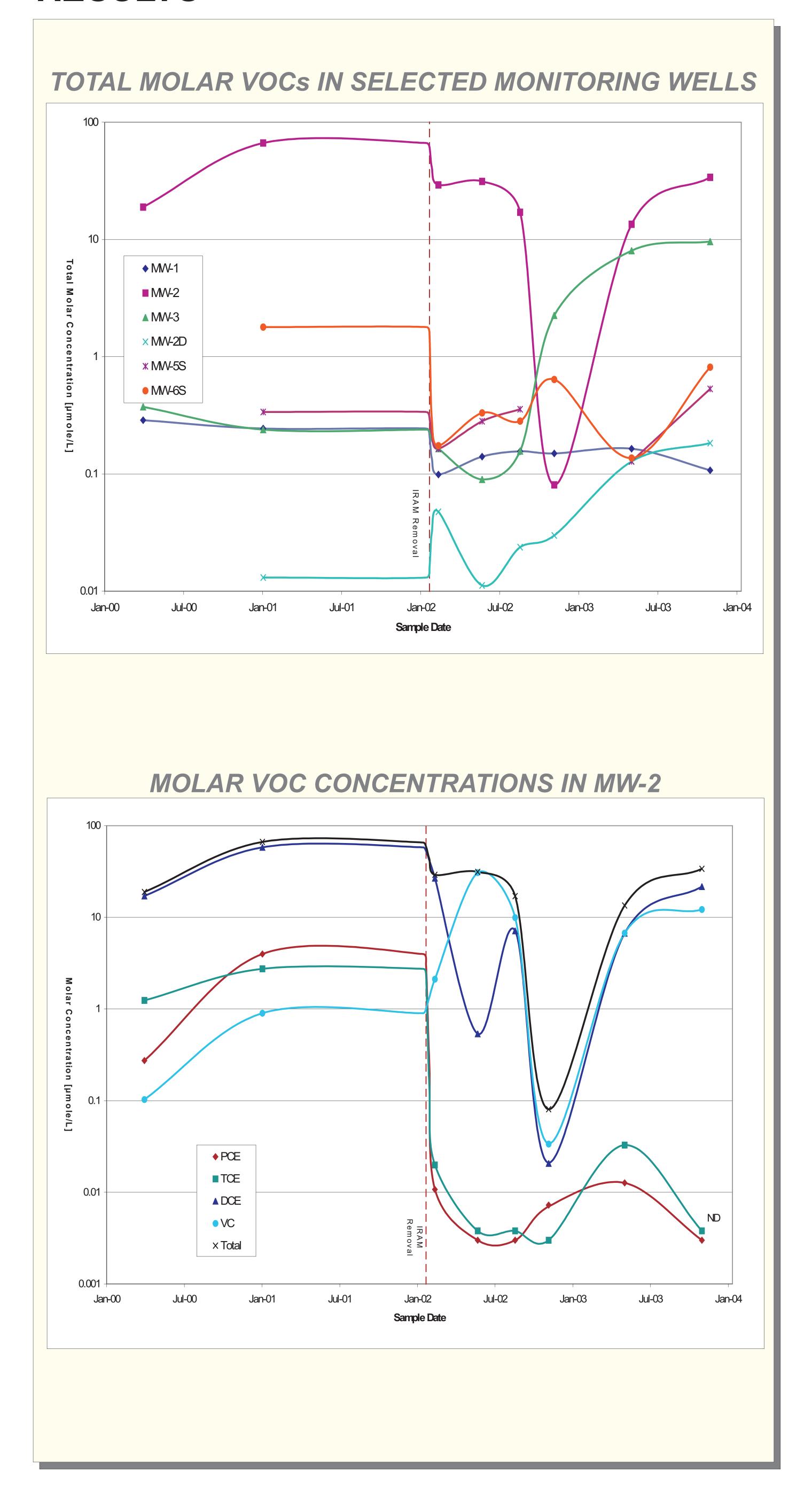
SITE PLAN AND LOCATION



EXCAVATION AND BACKFILL WITH HRC



RESULTS



CONCLUSIONS

Approximately 430 Mg of chlorinated hydrocarbon-contaminated soil (with concentrations 100 times the risk-based cleanup level for the site contaminants) were excavated and disposed of off site, and the goals of the IRAM were successfully achieved. The excavation was backfilled to match the surrounding grade with imported crushed rock that was amended uniformly with 1 percent HRC by weight to enhance bioremediation at the site (below 2 m from ground surface). Quarterly groundwater monitoring soon after implementation demonstrated more than 99% removal of PCE and its breakdown products from the groundwater in the source area (due to both the removal of the "hot spot" soil and addition of the HRC to the backfill). The chlorinated hydrocarbon concentrations fell below the applicable risk-based screening level (DEQ residential vapor intrusion into buildings) in all site wells. With only one application of HRC, we have observed a rebound of contaminant concentrations (though still at levels significantly below those observed prior to the IRAM). Evidence suggests that source materials continue to contribute to groundwater contamination in the vicinity of the former drywell. It would be expected that additional applications of HRC (or similar material) would maintain acceptable groundwater concentrations until the contaminant mass was reduced to levels no longer needing attention.

		TPH in mg/L (ppm)	Chlorinated VOC Concentration in mg/L (ppm)				
Well Number	Sample Date	Gasoline (NWTPH-G)	cis-1,2- Dichloroethene (c-DCE)	trans-1,2- Dichloroethene (t-DCE)	Tetrachloro- ethene (PCE)	Trichloro- ethene (TCE)	Vinyl chloride
MW-2	2-Oct-98	NA	0.86	0.0069	0.012	0.15	< 0.002
	30-Mar-00	0.526	1.66	0.0153	0.0453	0.163	0.00642
	2-Jan-01	0.619	5.63	0.0694	0.66	0.361	0.0562
	12-Feb-02	0.577	2.59	0.0262	0.00178	0.00261	0.132
	24-May-02	0.775	0.052	< 0.001	< 0.001	< 0.001	1.92
	20-Aug-02	0.49	0.69	< 0.001	< 0.001	< 0.001	0.62
	7-Nov-02	0.32	0.002	< 0.001	0.0012	< 0.001	0.0021
	5-May-03	0.16	0.65	< 0.001	0.0021	0.0043	0.42
	3-Nov-03	0.50	2.1	< 0.010	< 0.010	< 0.010	0.76
Notes:					8	§	<u> </u>

Bold indicates a concentration exceeding the RBC Screening Values.

