AMPLIFIED GEOCHEMICAL IMAGING LLC

CASE HISTORY

MONITORING ACTIVE REMEDIATION USING AN AGI SURVEY

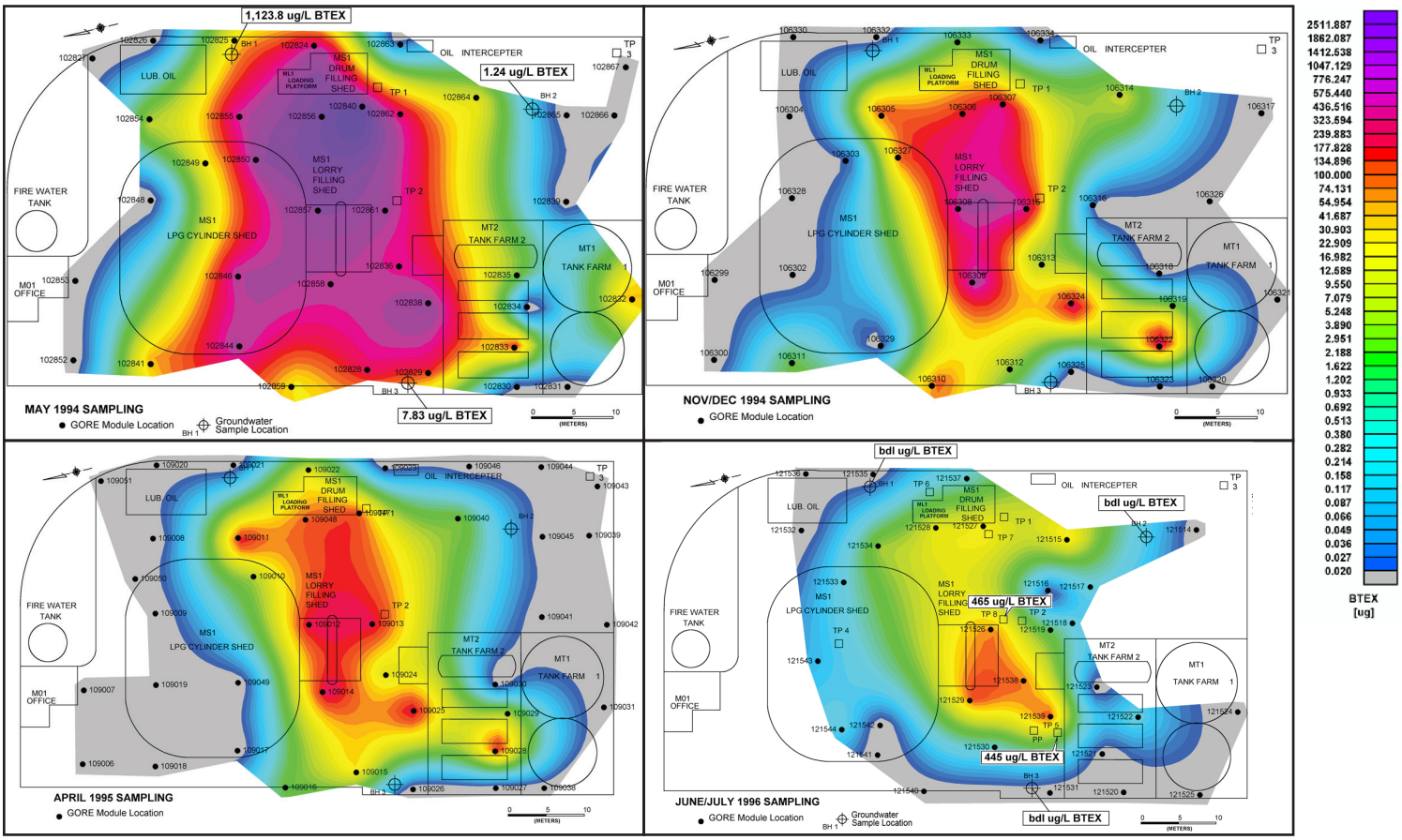

Figure 1. BTEX – Passive soil gas survey results, May 1994, Nov/Dec 1994, April 1995, and June/July 1996.

Survey Summary

Location: Hong Kong (Southeast Asia)

Property: Former petroleum refining and storage facility

Objective: Monitor the progress of an active remediation system using an AGI Survey

Survey Objective

Initial groundwater data at a former petroleum refining and storage facility indicated impact to the groundwater was significant. An AGI Survey was implemented originally to delineate the extent of the subsurface impact. Periodically, an AGI Survey was conducted and revealed the reduction in spatial extent of the subsurface impact as a result of the active, ongoing remediation.

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Site Background & Geology

- Former petroleum refining and storage facility
- Sand and gravel fill materials
- Groundwater depth: approximately 1.75 meters
- Petroleum impact to the groundwater known

AGI Survey

- 30 to 35 AGI passive samplers over 0.7 acres
- Five to ten meter grid spacing, one meter deep
- Narrow diameter, permanent sampling tubes with perforated lower ends
- 14-day exposures
- Modified EPA method 8260/8270 GC/MS analysis at AGI labs
- Contouring limits held constant to illustrate changes in soil gas mass

Survey Results

As a result of the site assessment, a total fluids (petroleum and groundwater) extraction remediation program was implemented. Remediation progress monitoring was established using the AGI Survey in conjunction with limited groundwater sampling. Passive soil gas sampling occurred between approximately six and 12 months over a two year period. Groundwater data were collected at the beginning and end of the same period.

Results of the soil gas surveys clearly show a reduction in the overall BTEX plume (Figure 1) as a function of the remediation program. The soil gas and groundwater data compare well. The reduction in BTEX amounts reported from the core of the plume, as per the soil gas, is the most significant (from 4,600 µg to 146 µg).

Survey Conclusions

The results of the periodic passive soil gas surveys clearly demonstrate the effectiveness in monitoring active remediation programs using the AGI Survey. The time-integrated sampling limited any undue influence in the data by seasonal, atmospheric or other variations over the two-year period that could impact short term sampling periods. By holding the exposure period constant, sampling at the same depths and locations, and maintaining an effective analytical QA/QC program, the decrease in the groundwater contamination was reflected in the soil gas results.

Monitoring Remediation Efficiently

The reasons to monitor natural attenuation or active remediation at an impacted site are obvious, and the methods employed depend on the objective of the program. Monitoring the remedial progress provides time critical information as to: 1) the accuracy of the original site characterization; 2) the effectiveness of the remedial process in general; 3) decreasing or increasing risk to health; 3) are modifications to the program required; and 4) determine if acceptable regulatory levels have been reached.

Passive soil gas sampling continues to be a cost-effective and accurate method for site assessment. The results can optimize injection point locations for remediation programs involving chemical augmentation. Further, the chemical injection levels can be tailored to maintain the desired effectiveness of the remediation or eventually reduced. Thus, the amount of chemicals required and the time needed to remediate a site will decrease by employing passive soil gas surveys during both the assessment and remediation monitoring phases.

Regulators will require quantitative data from soil and groundwater to illustrate that contaminant levels no longer pose a risk. However, the limited number of monitoring wells at a site, for example, may not reveal the overall effectiveness of the remedial program. Passive soil gas sampling, using a larger number of fixed sampling points, can provide a high resolution image of the spatial extent and effectiveness of an active remedial program, and can be used to monitor natural attenuation.

To monitor remediation effectively, each subsequent passive soil gas survey should be identical to the initial or baseline survey. In other words, AGI passive samplers are placed at the same sample locations and depths, and exposed to the soil gas for the same period of time as the initial survey. Analysis of the samples must be conducted identically to the baseline sample analyses. By holding each of these variables constant, changes in the soil gas mass will reflect changes in the subsurface contamination as a function of the remedial program and not due to sampling variability. Contour maps illustrate the changes in soil gas levels, and visually and spatially reveal the effectiveness of the remediation program over time.

AGI Surveys have been used effectively and efficiently to monitor remedial progress at petroleum refining, dry cleaner, and gas station sites which involve site cleanup and/or real estate transactions.

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