Adaptive Response to Vapor Intrusion during Thermal Remediation Based on Continuous Vapor Monitoring and Web-Based Real-Time Data Reporting

Nova Clite**,** P.G. (nclite@otie.com) and Mike Lawson, PE (Oneida Total Integrated Enterprises, Walnut Creek, CA, USA)
Kelly Manheimer (US Environmental Protection Agency Region 9, San Francisco, CA, USA)
Mark Kram, Ph.D. (Groundswell Technologies, Inc.)
Blayne Hartman, Ph.D. (Hartman Environmental Geosciences)

Background/Objectives. Thermal remediation is being implemented to address halogenated volatile organic compound (VOC) source zones at an EPA Superfund Site located in the San Francisco Bay Area. An on-site automated continuous vapor monitoring system quantifies and reports in near-real time trichloroethylene (TCE), tetrachloroethylene (PCE) and vinyl chloride (VC) using a TO-14 modified method with less than 1 microgram per liter detection limits. The objective is to detect increases in soil gas and treatment plant emissions during heating to prevent and facilitate mitigation of public and worker exposures to toxic compounds. This project represents the first time automated continuous VC monitoring has ever been implemented.

Approach/Activities. A multiplexed laboratory-grade gas chromatograph was modified to automatically collect and analyze vapor samples from 14 monitoring locations including at crawl-spaces beneath residential structures adjacent to the Site, occupied on-site buildings, outdoor air in the heating zone, and at the on-site extracted vapor treatment plant stack. Two analytical ports are dedicated to testing calibration gases for analytical quality control. The system has been integrated with telemetry and GIS for automatically generating concentration location images, time-series charts, risk exceedance alerts and engagement of controllers through a Cloud-based visualization and response platform.

Select project team members receive daily summary reports via email and automated triggered concentration threshold exceedance alerts to ensure rapid response to changing site conditions. Data are also automatically delivered to EPA's VIPER data management and reporting platform for public notification. Automated reporting system provides the project team with 24-7 access to a data dashboard providing current and historical results and flexible data graphing capabilities. Trends in the remediation system effluent, particularly for VC, are used to anticipate when system component changes are needed.

Results/Lessons Learned. Approximately 7 days into subsurface heating, the vapor monitoring system began sending the control team real-time alarms indicating TCE was exceeding exposure limits in an occupied on-site structure. The site manager and engineering team were able to rapidly respond and bring TCE concentrations down to below exposure limits through adjustments to an existing subfloor vapor-migration control system. Continuous monitoring results were used to detect elevated concentrations in near-real time and rapidly implement measures to mitigate potential exposures. This project demonstrates that, even with vapor intrusion mitigation measures in place, thermal remediation may induce vapor migration. An integrated automated continuous vapor monitoring system with real-time alarms is a protective measure against public exposure to toxic compounds.