# Automated Continuous Real-Time Vapor Intrusion Monitoring and Response: Preventing Acute Exposures

Blayne Hartman (Blayne@hartmaneg.com) (Hartman Environmental Geoscience, Solana Beach, CA)
***Mark Kram*** (mark.kram@groundswelltech.com) (Groundswell Technologies, Inc., Santa Barbara, CA, USA)
Clifford Frescura (cliff.frescura@groundswelltech.com) (Groundswell Technologies, Inc., Santa Barbara, CA)

**Background/Objectives.** Indoor concentrations of acute toxins such as TCE can be dynamic. As such, traditional vapor intrusion indoor risk characterizations can result in inaccurate risk conclusions, ambiguities and unacceptable exposures. For instance, vapor intrusion risks are typically characterized using point-in-time and time-integrated sampling methods that can be susceptible to false negative and false positive results due to the lack of temporal resolution afforded by these approaches. In addition, these methods do not typically allow for exposure prevention before a duration of concern has transpired. Therefore, there is a need to employ high resolution methods capable of rapidly assessing and responding to acute toxin exposures. Using high-frequency geospatial monitoring techniques, practitioners can rapidly distinguish between indoor sources and vapor intrusion, and when vapor intrusion is confirmed, vapor entry locations are quickly identified. Most importantly, continuous monitoring and response allows for exposure prevention through automated alerting and engagement of ventilation controls. This presentation will cover cases where automated continuous monitoring systems have been deployed to more confidently evaluate potential vapor intrusion risks, identify vapor entry locations, evaluate cause and effect due to building manipulations and dynamic climatic events, and to automatically respond to risks and thereby prevent occupants from acute toxic exposures.

**Approach/Activities.** Continuous automated monitoring platforms have been deployed to track dynamic volatile organic constituent concentrations. A laboratory grade gas chromatograph has been modified to automatically collect and analyze vapor samples from up to 16 site locations per analytical instrument. These systems have been integrated with telemetry, GIS and geospatial mapping algorithms for automatically generating intuitive time stamped analyte concentration contour images, time series charts, risk exceedance alerts and engagement of controllers through a web-based visualization and response platform. The system has been deployed to automatically track the distribution of TCE, PCE, vinyl chloride and other VOCs of concern.

**Results/Lessons Learned.** High frequency continuous data collection, processing and automated visualization have resulted in more confident conclusions regarding whether or not vapor intrusion risks exist and overall risk management. More specifically, continuous monitoring results in intuitive understanding of spatial and temporal patterns, worst case acute exposure concentration, mean concentration estimates for chronic risk calculations, determination of whether risks are minimal or non-existent, identification of vapor entry locations, confirmation of mitigation and remediation system performance, and allows for occupant protection via automated response before an exposure duration of concern has transpired. With respect to site closure, continuous monitoring over multiple barometric cycles should provide sufficient evidence when risks do not exist. For sites where risks may exist, a continuous monitoring platform provides information appropriate for triggering interim and urgent responses.