Predictive Soil Vapor Assessment

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Background/Objectives. Redevelopment of brownfield sites often involves a delicate balance regarding potential vapor risks under future commercial/industrial scenarios. Too much mitigation adds to cost, too little increases the potential vapor intrusion risk. In this investigation, several years of accumulated soil and groundwater data were used to predict locations with elevated vapor intrusion potential for field verification. The resultant predictive tool was used to refine areas needing treatment and/or vapor management, achieving considerable cost savings to the client.

Assessing vapor intrusion risk is fairly simple when you have existing buildings to sample or simple contaminants. What do you do however with a brownfields site, a former chemical manufacturing facility, with no buildings left, a diverse range of volatile contaminants, a lot of soil and groundwater data, under a proposed commercial/industrial redevelopment? These challenges led to the development of a predictive vapor assessment tool for assessing site-specific sub-slab vapor risks using international and Australian vapor intrusion guidance. The assessment tool allowed predictions of those locations with highest potential sub-slab vapor risks that could then be validated in field assessments.

Approach/Activities. Using the accumulated 800,000 soil and 80,000 groundwater data points, four vapor risk scenarios were identified for field assessment:
- Scenario 1 – neither soil contaminant concentrations nor groundwater contaminant concentrations pose a sub-slab vapor risk.
- Scenario 2 – groundwater contaminant concentrations pose a sub-slab vapor risk, but overlying soil contaminant concentrations do not.
- Scenario 3 – soil contaminant concentrations pose a sub-slab vapor risk, but underlying groundwater contaminant concentrations do not.
- Scenario 4 – both soil contaminant concentrations and groundwater contaminant concentrations pose a sub-slab vapor risk.
- Field assessments of each scenario were used to validate predicted vapor intrusion risks, and to calibrate the assessment tool, thereby providing confidence in its ongoing application. The calibrated predictive vapor assessment tool has been used to identify specific locations requiring soil and groundwater treatment and/or vapor management. We estimate the use of the tool represents a cost saving to the client of around two orders of magnitude compared with alternative approaches and has enabled more rapid site redevelopment.

Results/Lessons Learned. As predicted by guidance, field vapor results indicate current vapor intrusion guidance (e.g., OSWER 2015) to be moderately to highly conservative. In all situations the guidance under-estimated vapour attenuation through sub-surface clay present at the site. Results from this investigation indicate site specific calibration of vapor guidance can be very cost effective in fine tuning locations with realizable vapor intrusion risk compared with broader application of treatments or mitigation measure to achieve standard guidance criteria that might never materialize. Application of the predictive soil vapor assessment tool

significantly benefited plans for redevelopment of the site and assisted in strategic implementation of targeted treatment and/or management approaches.