



Paradigm Shift in Liability Management

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A gasoline pipeline leak resulted in pooled petroleum at the surface. The leak was repaired and affected soil was excavated down to 12 feet. Released petroleum percolated through complex stratigraphy consisting of alternating sand, silt, clay, and sandstone lenses before reaching groundwater at approximately 60 feet. The leak site was placed under an Agreed Order. Contamination was delineated, and the following remedial goals were established: permanently remove all measurable Non-Aqueous Phase Liquids (NAPL) and reduce Benzene and TPH groundwater concentrations to ≤ 0.050 mg/L and ≤ 25.0 mg/L, respectively. Remedial design was developed solely using existing assessment data. Five remedial technologies were applied over a 13-year period. Significant rebound occurred at the conclusion of each remedial technology. None of the remediation goals were achieved. At a hearing on year 13, the presiding Judge informed the Responsible Party that effort does not equal progress and an alternate strategy must be developed. Geologic Science and Technology Group, Inc. was retained to develop a path forward that quantitatively demonstrates progress toward achieving remedial goals.

A new Conceptual Site Model was developed incorporating High Resolution Site Characterization (HRSC) and 3D contaminant modeling. This study revealed laterally discontinuous pooled hydrocarbons, which occurred at multiple vertical intervals. These hydrocarbon pockets were serving as secondary sources leaching to groundwater resulting in chronic post-remedial rebound. A revised remediation plan was created to focus on eliminating all secondary sources in the vadose zone before remediating the dissolved phase contaminants. A non-ionic surfactant blend was used to selectively desorb, mobilize, and remove hydrocarbons sequestered in the vadose zone. HRSC data allowed targeted injection that abated the secondary source with precision. After secondary source abatement was complete, the dissolved phase contamination was remediated by incorporating ISCO.

By eliminating the ongoing secondary sources prior to dissolved phase remediation, contaminant reduction efficiencies were drastically improved. Within 45 days of surfactant treatment, all measurable NAPL (< 0.01 ft) was

eliminated from all monitoring wells without rebound. Approximately 45 days after initiating ISCO, Benzene and TPH groundwater concentrations were reduced below their regulatory goals. Reductions were sustained in post-remedial groundwater monitoring. In a subsequent hearing for the Agreed Order, the presiding Judge agreed with the Regulator's recommendation and issued No Further Action Status.

During the first 13 years of active remediation, effort and money was split between remediation, managing annual cash flow, and avoiding enforcement. This resulted in considerable time, cost and effort spent trying different technologies with little progress. A revised CSM prompted a change in remediation tactics and an aggressive, more thoughtful treatment strategy was employed. Development, permitting, implementation and validation was achieved in under two years. Although annual allocated expenditure increased, overall project costs were substantially reduced from the projected budget (on a net present value basis). More importantly, a significant liability was quickly mitigated, rather than perpetuated for several decades. This success resulted in a paradigm shift for the responsible party regarding future liability management by minimizing the time to No Further Action Status using a precise and aggressive remedial strategy.

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George A. Ivey an environmental professional with 35 years of international remediation experience, who has working on greater than 3000 remediation projects, which have taken him to over 60 countries. He holds more than 20 international patents and trademarks, and the recipient of several international environmental awards. His education includes: Synthetic Organic Chemistry, Geological Engineering, and Master's in Project Management. George A. Ivey an environmental professional with 35 years of international remediation experience, who has working on greater than 3000 remediation projects, which have taken him to over 60 countries. He holds more than 20 international patents and trademarks, and the recipient of several international environmental awards. His education includes: Synthetic Organic Chemistry, Geological Engineering, and Master's in Project Management.