

## Flexibility in the Field Leads to Success

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**Background/Objectives.** A natural gas liquids (NGL) pipeline release resulted in subsurface hydrocarbon contamination in an agricultural field in Kansas. While the majority of the plume consisted of dissolved phase hydrocarbons, phase separated hydrocarbons (PSH) were present in the area of the rupture.

Alpine Remediation, Inc. (Alpine) was contracted to perform an in situ injection of Remediation Product's BOS 200® within both the PSH and dissolved phase plumes.

Very little was known about the extent of the contamination beyond the groundwater data before Alpine arrived on site. Analytical soil data and boring logs were not available and the lithology was thought to be clay.

**Approach/Activities.** Alpine knew that more information was necessary to successfully remediate the site. The client agreed and gave Alpine flexibility in the field to not only obtain more data, but also time in the field to discover the best technique for the installation. Upon arriving on site, Alpine took several continuous soil cores throughout the plume. The cores were logged and soil samples were taken a minimum of every 2 feet. The soil samples were analyzed for BTEX and TVPH to produce an accurate 3-D picture of the contamination. While Alpine waited for the analytical results, a few days were spent evaluating the best tools and equipment for the installation of the product. This was done by conducting pump tests and sampling to get a better idea of the radius of influence (ROI) of the injections.

The continuous soils revealed that the injections would not be performed in clays as originally believed, but in sand. Injections of slurries into sand require higher pressures and flow rates to create the radial mixing needed for good distribution. The equipment Alpine had brought to the site was designed for optimal injections in clay. Alpine performed several test injections to evaluate the ROI. The ROI was gauged by sampling the groundwater in various locations within the estimated ROI, and then soil sampling to confirm the results of the groundwater sampling. Alpine discovered that the confirmed ROI was significantly less than the estimated ROI and that changes needed to be made to the injection process. Alpine performed the same basic procedure changing one factor each time until the confirmed and estimated ROIs were equal. In order to execute a successful in situ remediation plan, Alpine ended up bringing a second injection truck from their office in Colorado. The new injection truck was equipped with dual inline diaphragm pumps which doubled the slurry flow rate.

**Results/Lessons Learned.** The field flexibility that was granted to Alpine by the client proved to be instrumental in executing a successful in situ injection plan. Had Alpine not been allowed to take the additional samples or investigate the optimal equipment for injections in sand, the ROI would have been significantly less and the remediation effort would have failed.