Corrective Action LUST Site Remediation Case Study, Surfactant Enhanced Remediation of BTEX, PAH and Diesel Free Product Recovery, UST Soil & Groundwater Plume, *Chicago Area Interstate Truck Stop* Monee, Illinois, USA

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REMTECH 2009 REMEDIATION TECHNOLOGIES SYMPOSIUM OCTOBER 14-16, 2009 BANFF, ALBERTA

PROJECT OVERVIEW

► This site is a Chicago Area Interstate Truck Stop, Monee, Illinois, USA .

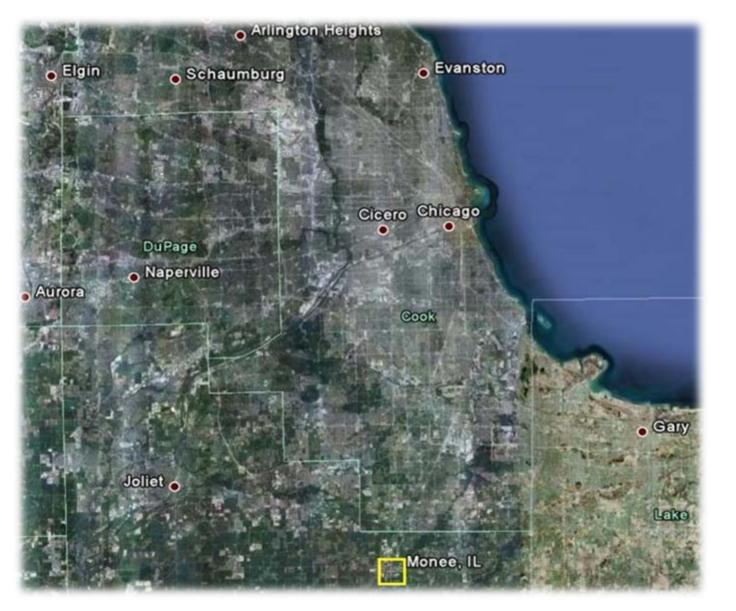
► Properties surrounding the site are commercial and agricultural.

► The diesel underground storage tank (UST) system consists of two (2) 20,000-gallon diesel USTs, located in the same tank basin on the east portion of the property.

► A newly installed 20,000-gallon bio-diesel UST is located in a separate tank basin, north of the petro-diesel USTs.

► There are two petro-diesel basin observation wells (ON, OS), and two bio-diesel basin observation wells (NW, SW).

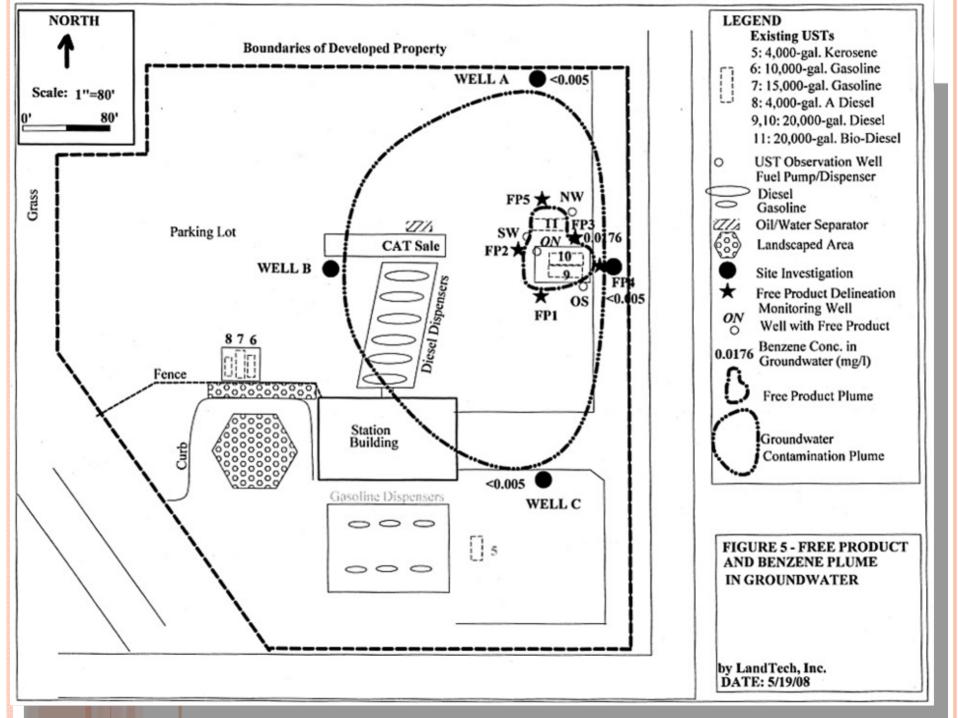
► There are no potable drinking water supplies within close proximity of this site.



Site Location Map

Site Evaluation:

- On July 5, 2006, a petro-diesel release was reported to the Illinois Emergency Management Agency, because free product was noted in observation well (ON).
- ► The indicator contaminants for a diesel release in Illinois are Benzene, Toluene, Ethylbenzene, total Xylenes (BTEX), and polynuclear aromatic hydrocarbons (PNAs) in accordance with 35 Ill. Adm. Code 734.405.
- ► On August 8, 2006, LandTech conducted a subsurface investigation to collect representative soil samples at the diesel USTs' location and along the piping, in accordance with 35 Ill. Adm. Code 743.210 (h)(2).
- Four soil borings (B1 through B4) were drilled around the USTs in proximity of east property line, and six soil borings (P1 through P6) were advanced on both sides along the piping from the USTs to the diesel dispensers. Soil borings locations are depicted on next Figure.



► One soil sample was collected at each 5-foot depth interval and analyzed for BTEX and PNAs.

Based on analytical results, the soil was not impacted with petroleum hydrocarbons around the diesel fuel USTs and petro-diesel fuel dispensers.

Groundwater Flow Direction and Hydraulic Conductivity:

► Groundwater flow direction was to the north, under a hydraulic gradient of 0.003,

► Hydraulic conductivity (K) tested in wells MWA and MWC returned values of 4.25 x 10⁻⁴ cm/sec and 6 x 10⁻⁵ cm/sec, respectively.

► The groundwater contamination plume will be excluded according to 35 Ill. Adm. Code Part 742, Section 742.925.

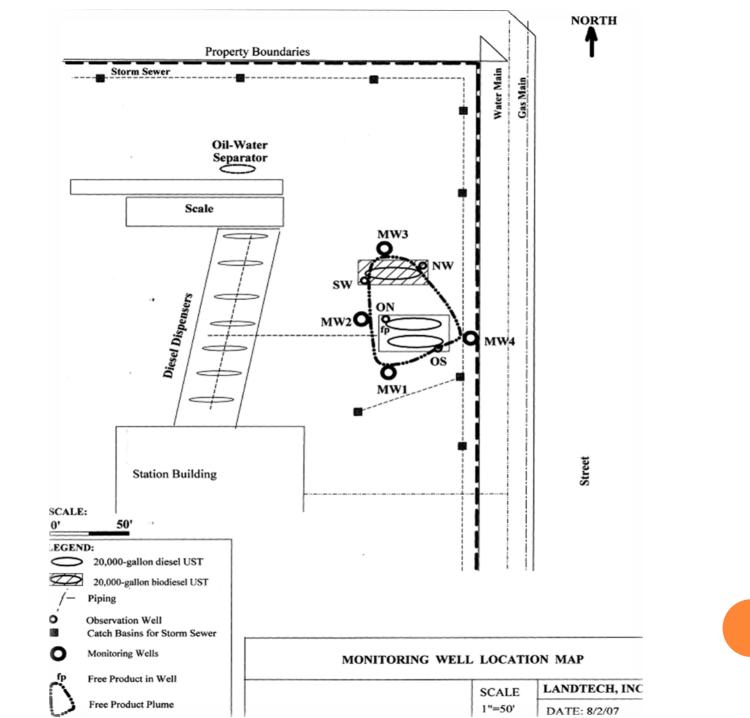
Free Product Removal Activities:

► The free product plume was delineated by installing five monitoring wells (FP1 through FP5) to a depth of 12 feet.

► The initial free product plume is shown on attached Figure.

▶ Illinois EPA defines the maximum size of the free product plume (and dissolved contamination plumes) as extending from "clean well" to "clean well".

At this site, free product was only found in well ON and a trace or sheen in well OS, at the time of the spill.



► LandTech conducted weekly and biweekly free product removal activities in observation well ON from <u>August 29, 2006 through January 9, 2008 (18 months)</u>.

► Approximately <u>20 site visits</u> used traditional bailers with angled "cookie cutter" tips to recover free product.

► When this technique failed to reduce the volume of free product, LandTech used a 2-inch diameter passive free product recovery bailer with a hydro-phobic screen to selectively collect free product for <u>10 more site visits</u>.

► When this second technique also failed to eliminate the volume of free product, an Aggressive Power Vacuuming (APV) technology consisting of surfactant injection followed by high power vacuuming was applied twice, in August and again in October 2008.

► Four subsequence site visits since October 2008 have confirmed that there is no free product in any UST observation well or groundwater monitoring well in the vicinity of the active diesel USTs.



TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO)

► TACO is the Illinois EPA's method for developing remediation objectives for contaminated soil and groundwater.

► These remediation objectives protect human health and take into account site conditions and land use.

► Remediation objectives generated by TACO are risk-based and site-specific.

HOW CAN TACO HELP?

Previously, the Illinois EPA's Bureau of Land (BOL) used conservative *"one-size-fits-all"* remediation objectives at nearly every site. Baseline remediation objectives still exist, but other options also protective of human health have been added.

TACO provides flexibility to site owners and operators in developing site-specific remediation objectives. It's now the site owners and operators who decide how best to manage their sites within TACO guidelines. However, this determination of site-specific remediation objectives is subject to Illinois EPA review and approval.

By exercising these new choices, site owners and operators may reduce remediation costs, return more sites to productive use, hasten property redevelopment, and still fully comply with environmental laws and regulations.

Under TACO, a site may qualify to receive a *No Further Remediation Letter* acknowledging the site owner or operator has satisfied the applicable BOL program requirements.

EXCLUSION WITHIN THE TIER I TACO GUIDELINES

Excluding the Ingestion of Groundwater Pathway

► To exclude the groundwater ingestion pathway, you must demonstrate that the groundwater in the area of the release will not be consumed as drinking water; and

► That contamination will not migrate to a location where it could be consumed.

Resulting Remediation Objective Achieved For This Site Was...

<u>That The Free Product Has To Be</u> <u>Removed To The Extent Practicable</u>

To achieve this they had to demonstrate the following:

That Free Product Has Been Removed To The Extent Practicable

► THE SOURCE OF THE RELEASE IS NOT WITHIN A SETBACK ZONE OR A REGULATED RECHARGE AREA OF A POTABLE WATER SUPPLY WELL;

► ALL AREAS WITHIN 2,500 FEET OF THE SOURCE OF THE RELEASE ARE GOVERNED BY AN ORDINANCE ADOPTED BY A UNIT OF LOCAL GOVERNMENT THAT PROHIBITS THE USE OF GROUNDWATER AS A POTABLE WATER SUPPLY;

► USING EQUATION R26 IN APPENDIX C, TABLE C, ALL CONTAMINANTS WILL MEET THE TIER 1 OBJECTIVE AT THE NEAREST SETBACK ZONE; AND

► USING EQUATION R26, ANY CONTAMINATED GROUNDWATER DISCHARGING TO A SURFACE WATER BODY WILL MEET THE SURFACE WATER QUALITY STANDARDS UNDER 35 IAC 302. SURFACTANT ENHANCED REMEDIATION OF BTEX, PAH AND DIESEL FREE PRODUCT RECOVERY, UST SOIL & GROUNDWATER PLUME, CHICAGO AREA INTERSTATE TRUCK STOP, MONEE, ILLINOIS, USA

August 2009 to October 2009

► Aggressive Power Vacuuming (APV) technology consisting of surfactant injection followed by high power vacuuming was applied twice; and

► This free product recovery technique was applied twice at the site, in August and October 2008.



Injection of Surfactant Solution Into UST Area Via Two (2) Observation Wells (July 30, 2008)



Injection of *Ivey-sol*® Surfactant Solution At UST Area Via Two (2) Observation Wells October 9, 2008

Power Vacuum Of Observation Wells Followed Days Latter





DETERMINATION AT UST OBSERVATION WELL 1.5 TO 2 INCHES (4 CM TO 5 CM)

PRE SURFACTANT INJECTIONS (AUGUST & OCTOBER 9, 2008)

Post *Ivey-sol* Surfactant Injection (October 9, 2008)

No Observable Free Product Observed over the next four monthly visits...











Aggressive Power Vacuuming Free Product Recovery (APV)

► Aggressive Power Vacuuming (APV) Free Product Recovery involves the *simultaneous application of vacuum enhanced free product extraction/recovery, and controlled hydraulic gradient depression to facilitate the collection and removal of LNA*PL contamination, such as floating diesel fuel at the Chicago area Truck Stop Site.

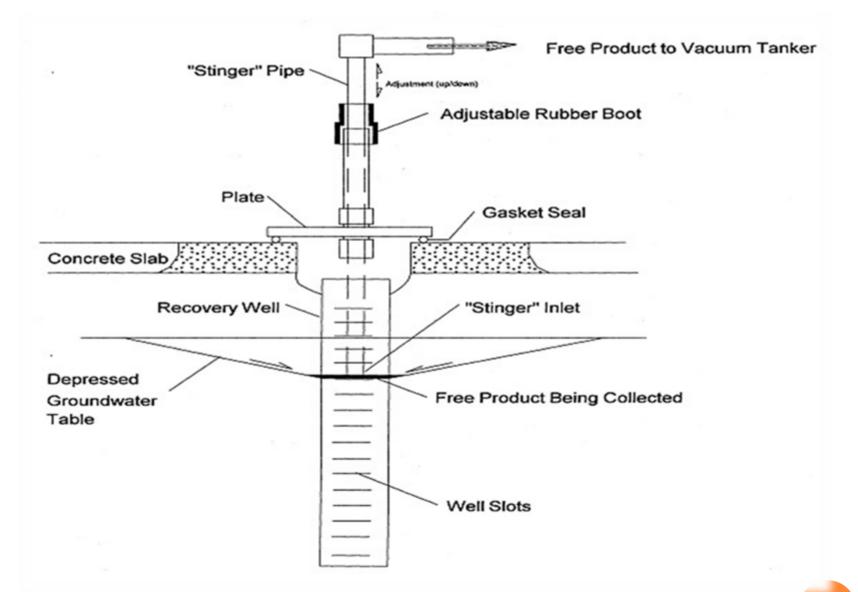
► The APV System *uses a depth adjustable vacuum "stinger pipe*" that connects to a high volume vacuum tanker truck. The adjustable stinger pipe allows for a controlled groundwater water table depression, ranging from a few inches to several feet of depression. The submerged stinger pipe inlet also provides vacuum extraction/recovery of floating free product, along with a limited volume of underlying contaminated groundwater.

- ► In operation, the APV unit is positioned over a recovery well and a foam seal is pulled airtight against the concrete surface. The resulting vacuum begins to remove free product (with some groundwater) into the tanker. After vacuum liquid recovery exposes the stinger pipe inlet, a vacuum induced negative pressure zone is created around the well, which promotes additional diesel fuel flow towards the well. This negative pressure vacuum also draws diesel fuel trapped in sand backfill pores (above the groundwater table) towards the recovery well.
- In addition, lowering the groundwater table a few feet (using a vacuum) creates a localized zone of groundwater depression around the well so that a gravity assisted hydraulic gradient is created to further increase the diesel fuel recovery process.

Limiting the total depth of groundwater drawdown to create a cone of depression also *limits the creation of a large "smear zone*" that would result from uncontrolled vacuum removal of product and a large volume of groundwater.

This technique should not be used on "non-free product" wells because the high vacuum and gravity induced gradients could spread and smear the localized contamination over a much larger area, and create significant cross-contamination within previously productfree areas.

LandTech normally applies this <u>APV technique for a period</u> of several hours on each free product impacted recovery well in order to allow the vacuum induced and gravity induced gradients to facilitate the maximum effective collection of free product while minimizing the total volume of collected groundwater.



Aggressive Power Vacuum System At Recovery Wells For Surfactant Enhanced Free Product Recovery



Power Vacuum System Operating At UST Extraction Wells After Surfactant Injections:

► August 19, 2009 and

► October 13,2009





CONCLUSIONS

► Free product recovery via hand bailing (20 Site Visits) and/or using 2-inch (5 cm) diameter passive free product recovery bailer with a hydro-phobic screen (10 Site Visits) to selectively collect free product were not effective at this site;

► The decision to apply an Aggressive Power Vacuuming (APV) technology consisting of Surfactant injections followed by high power vacuuming was an effective free product recovery method requiring only two (2) field applications of this approach (August & October 2009), was determined to have been effective following four (4) follow-up site visits with no recurrence of free product;

► The project cost to apply the Ivey-sol surfactant were <\$5,000 USD to achieve free product removal within a < 3 month period; and

► This free product method was a considerable accomplishment given thirty (30) site visits to apply other free product methods over a 23 month (2 year period) could not achieve what this approach completed in less than 3 months.



DETERMINATION AT UST OBSERVATION WELL 1.5 TO 2 INCHES (4 CM TO 5 CM)

PRE SURFACTANT INJECTIONS (AUGUST & OCTOBER 9, 2008)

Post *Ivey-sol* Surfactant Injection (October 9, 2008)

No Observable Free Product Observed over the next four monthly visits...







"Today's Environmental Solutions For A Better Tomorrow"

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