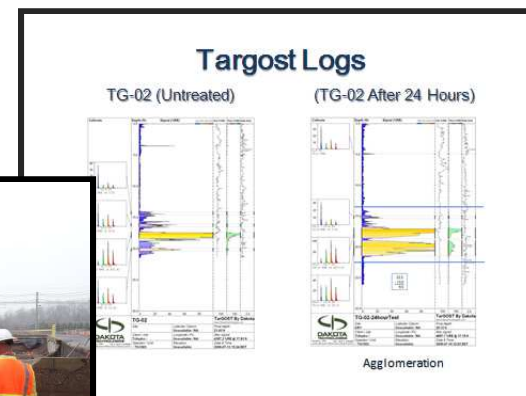
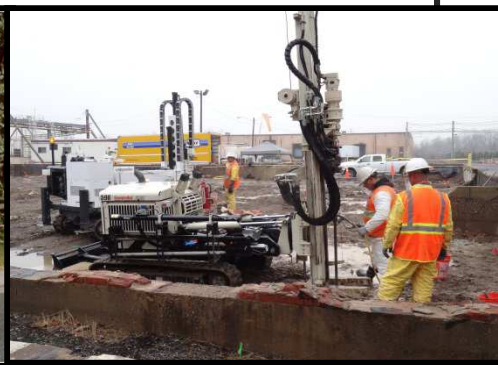




# Paying Attention To Site Characterization Can Save Big \$\$\$ and Increase Potential Success of Clean-up Remedies

*William L. Lundy, Principal  
DeepEarth Technologies, Inc.*



**Cool-Ox™**



# ***Results of Limited Site Characterization:***

---

***DeepEarth  
Technologies, Inc.***

Free Product on the site....



***Cool-Ox™***



# ***Results of Limited Site Characterization:***

---

***DeepEarth  
Technologies, Inc.***

Discovered “Unknown” Storage Tanks with Product



***Cool-Ox™***



# Challenges of Site Characterization:

---

**DeepEarth  
Technologies, Inc.**

- **Budget Limitations**

- Limited Sampling = Limited Data for designing remedies = Under Estimating the Time and Cost of the Remedy

- **Understanding Limitations of Tools:**

- LIF – great diagnostic tool... *but*:
  - Does not account for the material adsorbed to the soil
  - If Groundwater is historically high, fluorescents will not pick up the smear zone

**Cool-Ox™**



## Case Study:

---

**DeepEarth  
Technologies, Inc.**

- Releases at an Air Force Base, during the 1970's, of unknown quantities of gasoline associated with the operation of the UST's (removed in the 1990's), resulted in contamination in soil and groundwater.  
(2 waste oil UST's, 2 diesel UST's and one gasoline UST)
- Overhead and underground utilities service the area.
- Liquid petroleum hydrocarbon (LPH) had never been observed in the monitoring wells located at the site.

**Cool-Ox™**





## Case Study:

---

**DeepEarth  
Technologies, Inc.**

- Depth to groundwater: ~4-6 feet below grade
- Subsurface soil: 5 feet of fill overlying 8 feet of fine sand.
- Clay found at 13 feet below grade.
- Injection of a vendor's aerobic bioremediation substrate was performed in October/November 2008 & November 2009...the results were not positive.
- Laser Induced Fluorescence (LIF) was employed to characterize the site and locate contaminant sources



**DeepEarth Technologies, Inc.**





# Work Scope

---

- Treat soil and groundwater in the approx. 2,700 sft. total but split in to four (4) separate areas:
  - Zone 1 - (VTI) 4' to 8' bls
  - Zone 2 – (VTI) 5' to 9' bls
  - Zone 3 – (VTI) 4' to 7' bls
  - Zone 4 – (VTI) 4' to 6' bls.





# Treatment Areas

**DeepEarth Technologies, Inc.**



**Cool-Ox™**



# ***Finding the Source(s)***

**DeepEarth  
Technologies, Inc.**

- ***How do we do it?***
  - ***Reaction of Contaminant & Reagent!***
  -
- ***Why do we do it?***
  - ***Precisely Place the Reagents!***
- ***What are the Benefits?***
  - ***Target Source Areas!***
  - ***Optimize use of Reagent!***
  - ***Speeds up Remediation Closure!***
  - ***Saves Money for the Client!***



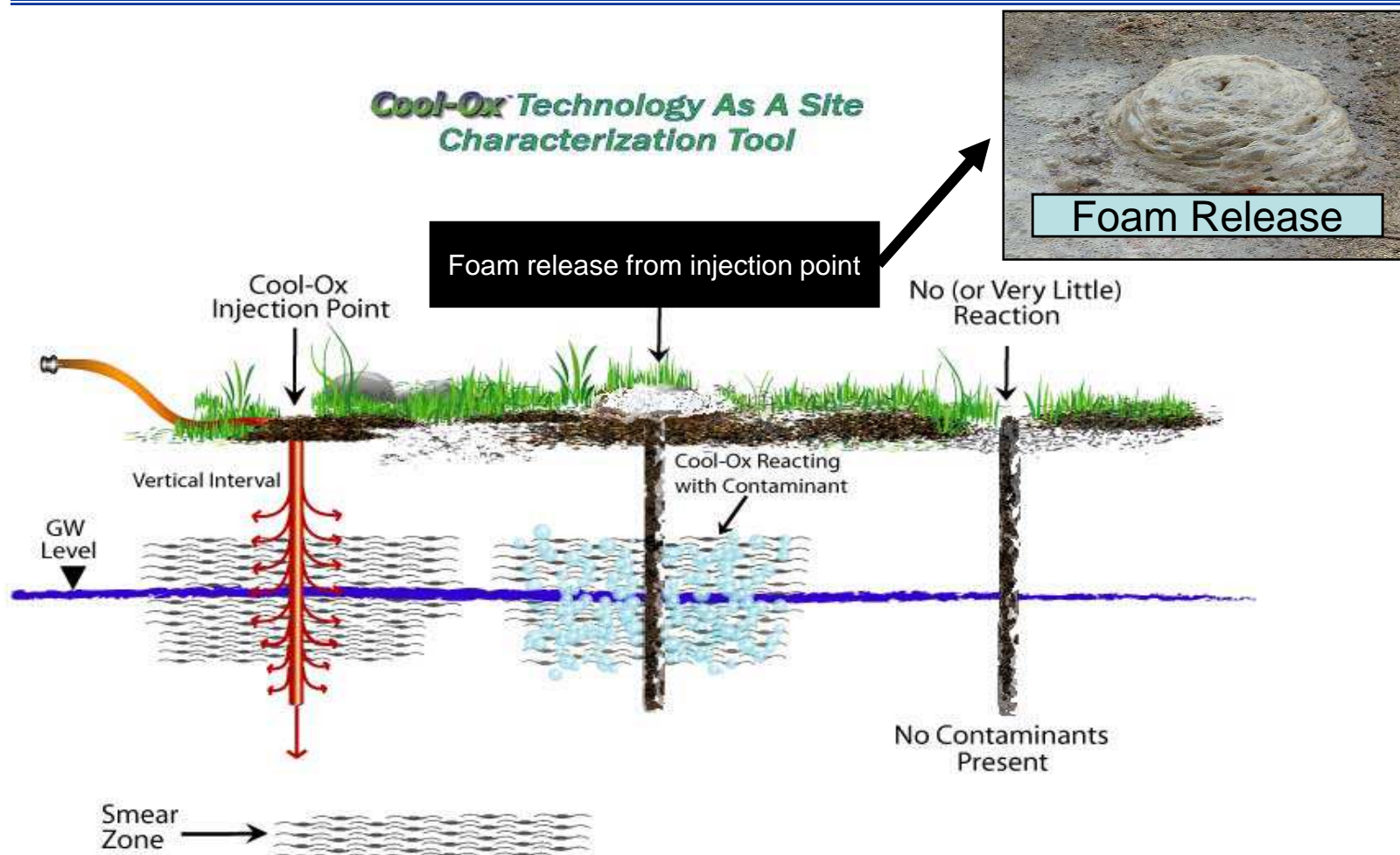
**Cool-Ox™**



# Cool-Ox<sup>®</sup> Site Characterization Tool

**DeepEarth Technologies, Inc.**

**Cool-Ox Technology As A Site Characterization Tool**



**Cool-Ox<sup>™</sup>**





**DeepEarth  
Technologies, Inc.**

# Angled DPT Injections



**Cool-Ox™**



# ***Free Product during Injections***

---

**DeepEarth  
Technologies, Inc.**



**Cool-Ox™**





# Foam Reactions

---

**DeepEarth  
Technologies, Inc.**



**Cool-Ox™**





# Foam Reactions

---

**DeepEarth  
Technologies, Inc.**



**Cool-Ox™**



**DeepEarth  
Technologies, Inc.**

## ***More Product Discovered***

---



Although only mild soil contamination was referred to in the site data, free product was encountered once the soil/groundwater interface had been reached.

**Cool-Ox™**



**DeepEarth  
Technologies, Inc.**

## ***More Product Discovered***

---



Approximately 2 1/2 inches of viscous free product (light oil, diesel fuel, and gasoline) were present.

PID readings collected indicated VOCs present at approximately 1,200 ppm and strong odors were present.



The reaction of the free phase product approximately 5 min. after the Cool-Ox<sup>®</sup> oxidizer had been applied.

The strong odors were gone!

**Cool-Ox<sup>™</sup>**



# ***Insitu Soil Blending***

***DeepEarth  
Technologies, Inc.***



***Cool-Ox™***





# Reactions

---

**DeepEarth  
Technologies, Inc.**



**Cool-Ox™**



# ***Insitu Soil Blending***

**DeepEarth  
Technologies, Inc.**



**Cool-Ox™**





# Odors Eliminated

**DeepEarth  
Technologies, Inc.**



The contrast between treated contaminated soil (light tan color) and the backfill material.

The PID readings collected from the excavation dropped from the untreated concentrations (1,200 ppm) to approximately (3) ppm indicating that the contaminants have been completely remediated.

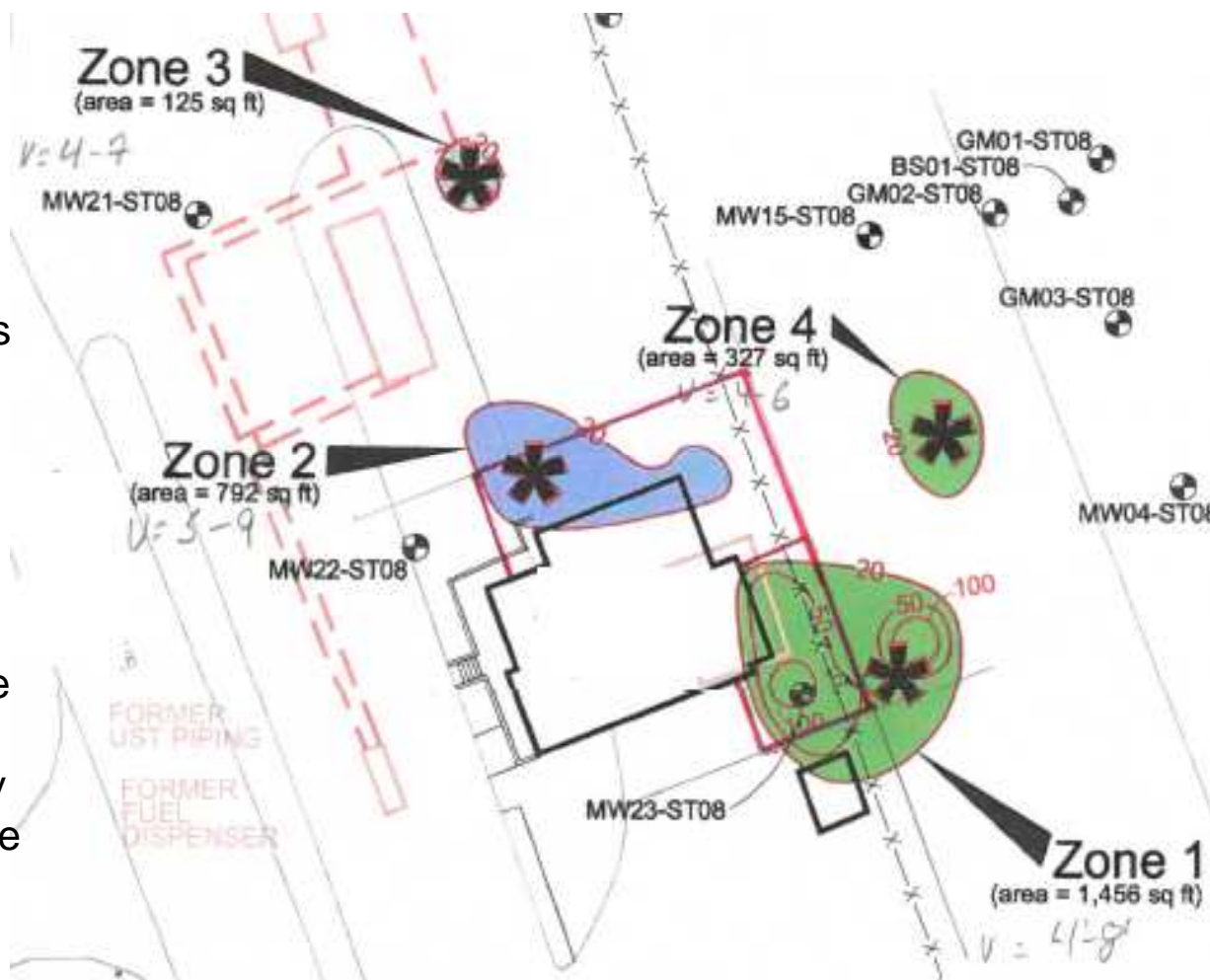
The odor had completely disappeared.

**Cool-Ox™**



## Design vs. Actual

As the application in Zone 2 proceeded, it was evident from reactions that the contaminant plume extended northward (toward blending Zone 3) by approximately 30 feet outside the designed area.



Concluded that Zone 1 and Zone 2 were actually a continuous extension of the same plume as opposed to plumes in two different locations.



# Conclusion

---

**DeepEarth  
Technologies, Inc.**

- It was discovered that the extent of the contaminants in Zone 2 included an area reaching almost all the way up to soil blending Zone 3.
- It was estimated that the heavily smeared, and/or free phase product areas could be as much as double those indicated in Figure 2-1.

**Cool-Ox™**



# Conclusion

---

**DeepEarth  
Technologies, Inc.**

- The LIF areas denoted as Zones 1, 3 and 4 were small, encompassing by and large those points where LIF indicated high contaminant concentrations.
- High concentrations in areas adjacent to those characterized by LIF contain a mass of contaminants which will continue to provide a problematic impact on groundwater.

**Cool-Ox™**



## ***Conclusion***

---

- Imperative that the treatment area be expanded to mitigate these areas of lower concentrations which were shown as contaminant free by LIF
- Therefore, it was concluded that the heavily smeared, and/or free phase product areas could be as much as double those indicated in Figure 2-1.



## **Plume Identification Saves the Client \$\$\$**

**DeepEarth  
Technologies, Inc.**

<b><i>Project Design:</i></b>	<b><i>2,386 IPs</i></b>
<b><i>Sources Identified:</i></b>	<b><i><u>1,846</u></i></b>
<b><i>IPs Saved:</i></b>	<b><i>540</i></b>

***@ 5' Design Matrix: 13,500 sf***

***3 More Areas Treated***

***Additional Cost to Client: \$0.00***





**DeepEarth  
Technologies, Inc.**

# **Why Cool-Ox® ?**

---

## **Previous successful applications:**

- Pipeline site at a natural gas condensate release (NFA closure)
- Large benzene release (now meeting closure criteria)

**Cool-Ox™**



**DeepEarth  
Technologies, Inc.**

# **Contaminants & Sites**

---

## **Contaminants**

- Free Product (NAPL)
- BTEX
- Coal Tars
- Vinyl Chloride & DCE
- Chlorobenzenes
- PAHs
- Creosote
- Jet Fuel
- Gas Condensate
- Fuel Oil (GRO/DRO/TPH)
- Herbicides
- Pesticides
- Pentachlorophenol (PCP)
- Dioxins
- Chlorinated Solvents
- PCBs
- Ethylene dibromide (EDB)

## **Sites**

- Service Stations
- Railroads
- Pipelines
- Agchem Formulators
- Mfg. Gas Plants (MGP)
- Wood Treating
- Military Bases
- Dry Cleaners
- Marine Bulk Terminals
- Slabs & Basements
- Sediments
- Mixed Plumes
- Refineries & Chem Plants
- Steel Mills

**Cool-Ox™**



**DeepEarth  
Technologies, Inc.**

## ***Every Projects Objectives***

---

Source Removal (Destruction) - Primary

Direct Oxidation

Groundwater Mitigation - Secondary

Direct Oxidation

Bioremediation

Goal - Site Closure

**Cool-Ox™**



# Contact is Everything

**DeepEarth  
Technologies, Inc.**

## Field Application Techniques

- DPT Injection
- *Hydro-Dart*<sup>TM</sup>
- *Grizzly*<sup>TM</sup> Soil Blending
- *Twister*<sup>TM</sup>
- *Pit-Stop*<sup>TM</sup> (over spray)

***Experience – The value of DTI Turn-Key Installations***

***Cool-Ox***<sup>TM</sup>



**DeepEarth  
Technologies, Inc.**

# Questions?

---

## *Thank You !*

***J. Bradley Stephenson  
Conestoga-Rover & Associates  
for***

***DeepEarth Technologies, Inc.***

***Alsip, IL 60803***

***[www.deepearthtech.com](http://www.deepearthtech.com)***

**Remember Total Green**



***Cool-Ox™***