PSCase Study for Selecting and Implementing Practical and Cost-Effective Technologies to Remediate Soil and Groundwater from Natural Gas Compression Facilities, West Panhandle Field, Texas*

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Search and Discovery Article #80049 (2009) Posted June 10, 2009

*Adapted from poster presentation at AAPG International Conference and Exhibition, Cape Town, South Africa, October 26-29, 2008.

Abstract

In 2001, an environmental assessment of soil and groundwater contamination associated with natural gas production was conducted by Pioneer Natural Resources USA Inc. The gas compression and production facilities are located in the West Panhandle Field, Moore and Potter Counties, Texas, and have been in operation since the 1930s. Shallow and/or deep soil contamination, primarily from used lube oil and natural gas condensate was discovered at most of the gas compression facilities. Limited amounts of non-aqueous phase liquids (NAPL) were observed on shallow perched water-bearing zones at two sites and dissolved phase (BTEX) plumes with benzene concentrations exceeding drinking water standards were observed at a total of six sites. The depths to the shallow perched water-bearing zones at these sites varied from approximately 20 to 40 feet below ground surface.

Pioneer Natural Resources USA, Inc. designed a proactive, practical, and cost effective program for the selection and implementation of active systems to remediate these sites as part of the Operator and Voluntary Cleanup Programs (OCP/VCP) administered by the Railroad Commission of Texas. In 2005, five biovent (BV), two soil vapor extraction (SVE), one biosparging (BS), and one multiphase extraction (MPE) systems were designed, constructed, and operated to achieve cleanup of soil and groundwater at the six sites. Remediation was completed at five of the six sites within two years of startup, with completion of the final site expected in 2008.

In 2005, the remediation program was nominated by the Texas Railroad Commission for the Interstate Oil and Gas Compact Commission's Environmental Stewardship Award and received Honorable Mention.

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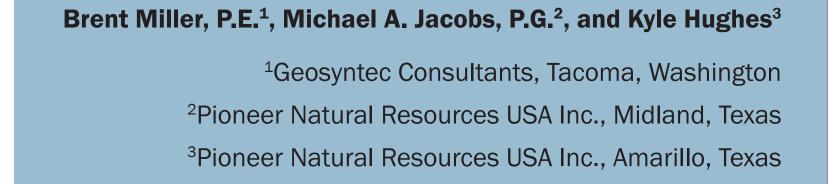
Case Study For Selecting and Implementing Practical and Cost Effective Technologies to Remediate Soil and Groundwater at Natural Gas Compression Facilities

WEST PANHANDLE FIELD, TEXAS



PIONEER

WEST PANHANDLE REMEDIATION PROJECT Nominated by the Texas Railroad Commission in 2005



Interstate Oil and Gas Compact Commission "Environmental Stewardship Award"

Introduction

In 2001, an environmental assessment of soil and groundwater contamination associated with natural gas production was conducted. The gas compression and production facilities are located in the West Panhandle Field, Moore and Potter Counties, Texas, and have been in operation since the 1930s. Shallow and/or deep soil contamination, primarily from used lube oil and natural gas condensate was discovered at most of the gas compression facilities. Limited amounts of non-aqueous phase liquids (NAPL) were observed on shallow perched waterbearing zones at two sites and dissolved phase (BTEX) plumes with benzene concentrations exceeding drinking water standards were observed at a total of six sites. The depths to the shallow perched water-bearing zones at these sites varied from approximately 20 to 40 feet below ground surface.



Regulatory Environment

Pioneer Natural Resources USA, Inc. designed a proactive,

Contaminants & Source Areas

Pipeline condensate. lube oils, and coolants were released from ASTs. USTs, compressor pads, scrubbers, separators and other process equipment. Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), and TPH are the primary contaminants of concern. Free-phase NAPL was observed at

Awards

In 2005, the remediation program was nominated by the Texas Railroad Commission for the Interstate Oil and Gas Compact Commission's Environmental Stewardship Award and received Honorable Mention.

Remedial Systems

In 2005, five biovent (BV), two soil vapor extraction (SVE), one biosparging (BS), and one dual phase extraction (DPE) systems were designed, constructed, and operated to achieve cleanup of soil and groundwater at the six sites. Remediation was completed at five of the six sites within two years of startup, with completion of the final site expected in 2009.





Case Study For Selecting And Implementing Practical And Cost Effective Technologies
To Remediate Soil And Groundwater At Natural Gas Compression Facilities

WEST PANHANDLE FIELD, TEXAS





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Dual Phase Extraction System

Excavation and Treatment

filled at sites throughout the West Panhandle Field.

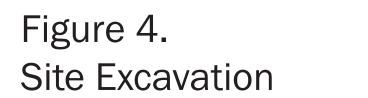




Figure 5. Bioventing System

Bioventing

The bioventing system design included installing temporary, transferable, prefabricated venting equipment that required minimal infrastructure, low O&M requirements, and were convertible to SVE operation.

Impacted shallow soils were excavated, treated on-site via soil shredding, and back-

Main system components included bioventing wells, transfer piping (PVC), venting equipment, flow meters and pressure gauges, and electrical control equipment.

Soil Vapor Extraction

The SVE system design included installing temporary, transferable, prefabricated venting equipment that required minimal infrastructure, low O&M requirements, vapor treatment, and were convertible to bioventing operation.

Main system components include SVE wells, transfer piping (PVC), extraction equipment, flow meters and pressure gauges, vapor phase granular activated carbon vessels, and electrical control equipment.



Soil Vapor Extraction System

Figure 7. DPE Schematic Design

O Dual Phase Extraction

The DPE system design included installing temporary, transferable, prefabricated extraction system that required minimal infrastructure, moderate O&M requirements, vapor treatment, and groundwater disposal (deep well injection).

Main system components include DPE wells, transfer piping (PVC), extraction equipment, flow meters and pressure gauges, electric catalytic oxidizer, and electrical control

Biosparge

The biosparge system design included installing temporary, transferable, prefabricated sparge equipment that required minimal infrastructure and low 0&M requirements.

Main system components include biosparge wells, transfer piping (PVC), sparge equipment, flow meters and pressure gauges, and electrical control equipment.

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WEST PANHANDLE FIELD, TEXAS



Geosyntec

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Excavation and **Treatment**

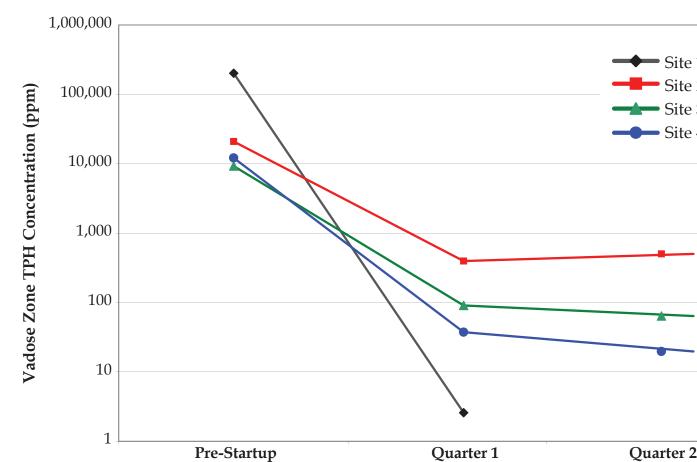
50,000 cubic yards of soil treated onsit below Texas Risk Reduction Program (TRRP) residential levels (benzend < 0.026 mg/kg, TPH < 210 mg/kg).



Figure 8. **On-Site Treatment**

Bioventing

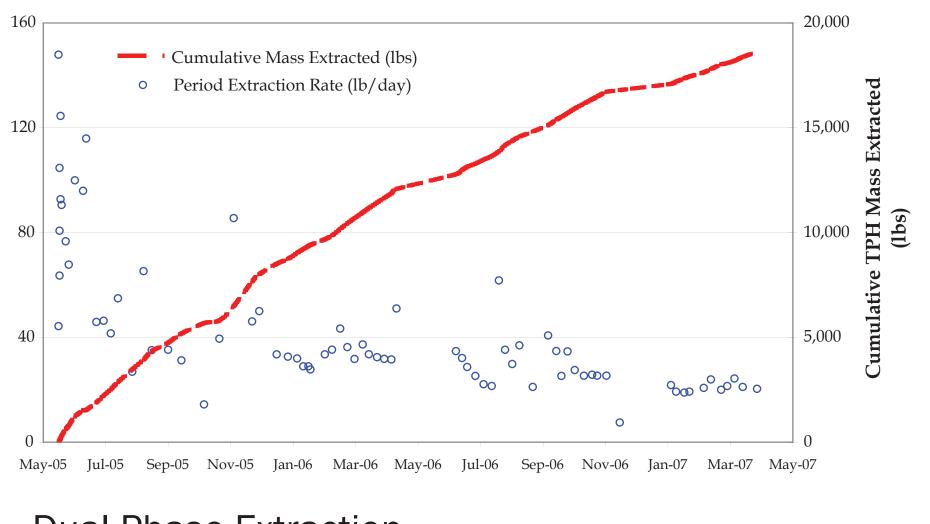
Bioventing systems were operated at 5 sites to treat vadose zone soils. All systems achieved cleanup goals below TRRP cleanup levels (benzene <0.026 mg/kg, TPH <210 mg/kg). Remediation was completed within 18 months at all sites.



Bioventing Soil Vapor Concentrations West Panhandle Field, Texas

O Dual Phase Extraction

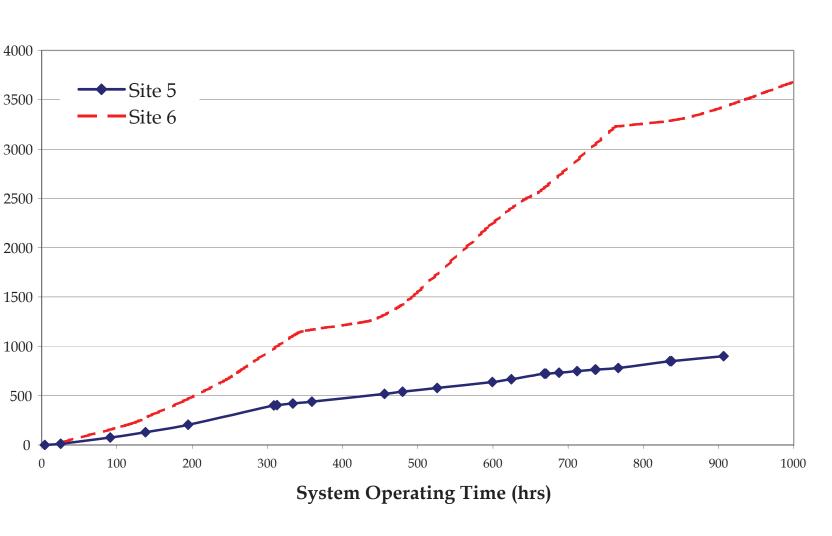
A DPE system was installed at on site to remove LNAPL and treat impacted soil and groundwater. The system operated for two years removing over 175,000 gallons of water, 18,000 lbs of TPH and reducing NAPL levels to less than 0.1 feet in all monitoring wells. Cleanup was achieved in 24 months.



Dual Phase Extraction West Panhandle Field, Texas

Soil Vapor Extraction

SVE systems were operated at 2 sites to treat high TPH concentration vadose zone soils. Both system were operated for approximately one month before they were converted to bioventing operation to complete the final treatment.



Soil Vapor Extraction West Panhandle Field, Texas

Biosparge

One biosparge system was installed to treat dissolved phase hydrocarbons. A series of 7 wells were installed on the property boundary as a barrier to treat hydrocarbons migrating from the site. The system is currently in operation.

