Commingled Plumes – Petroleum and Chlorinated Solvent Sites in OLQ Remediation Programs

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• Introduction
• Release Reporting
• Remediation Closure Guide (RCG)
• Commingled Plumes/Background on Breakdown
• Case Studies
• Obstacles to Closure
Introduction

• Remediation Branch – Bruce Oertel, Chief
  – State Cleanup Program
    • Sites enter program via referrals from other programs
  – Voluntary Remediation Program
    • Parties voluntarily address contaminated property via application
  – Federal Programs
    • Hazardous substance sites, National Priorities List
  – Indiana Brownfields Program
    • Provides financial, technical, legal, and education assistance
    and works with the U.S. Environmental Protection Agency (U.S. EPA)
Introduction (cont.)

• Underground Storage Tanks (USTs) Branch – Doug Louks, Chief
  – UST Section
    • Compliance of UST systems
  – Leaking UST Section
    • Clean up petroleum releases
  – Excess Liability Trust Fund Claims Section
    • Reimbursement of cleanup costs for eligible parties
Introduction (cont.)

• In 2017, 92 new LUST incidents
  – Total active releases: ~1450

• Voluntary Remediation Program, 22 new applicants
  – Total active sites: 350

• State Cleanup Program, 137 new incidents
  – Total active releases: 724

• IDEM is developing a cross-referencing database to identify commingled plumes managed in different Remediation Programs
New Incident, Investigation, and Closure

• Release Reporting to OLQ Gatekeeper
  – Spill Line: (888) 233-7745
  – Internal Referrals

• Investigation: IDEM requires VOC analyses at LUST releases

• Risk-based Closure
Remediation Closure Guide (RCG) 2012

• Remediation Branch and LUST Section use RCG for cleanup guidance

• Risk-Based Site Closure
  – Protects human health and the environment
  – Conceptual Site Model (CSM)
    ▪ Evaluate exposure risks
      » Direct Contact
      » Ingestion
      » Inhalation
    ▪ Lines of Evidence
Commingled Ground Water Plumes

• Three primary commingled ground water plume situations in Indiana based on source type:
  – Commingled chlorinated solvent compounds (cVOC) plumes
  – Commingled petroleum plumes
  – Commingled cVOC/petroleum plumes
• This talk focuses on Indiana case studies of commingled cVOC/petroleum plumes
Commingled Ground Water Plumes

- Commingled petroleum/chlorinated plumes are common where gas station refueling facilities are near dry cleaner facilities, such as original downtown areas, or strip malls.
- Industrial parks, and printing facilities often contain USTs or cVOC waste generation.
Commingled Ground Water Plumes

- Remediation of one plume will affect the remediation of the other contaminant plume
Contaminant Breakdown

• Chlorinated Volatile Organic Compounds (cVOCs) contamination does not readily degrade in an oxygen-rich environment
  – Perchloroethylene (PCE)
  – Trichloroethylene (TCE)

• Dehalogenating Microbes
  – *Dehalococcoides* mccartyi breakdown PCE to ethene
Aerobic Co-metabolism and/or Reductive Dechlorination

- Very simply put, cVOCs break down by replacing chlorine atoms with hydrogen atoms

\[ \text{R-CL} + 2e^- \rightarrow \text{R-H} + \text{CL}^- \]

- Occurs via microbial degradation and chemically
Contaminant Breakdown

• Petroleum Hydrocarbons
  – Compounds that easily degrade in oxygen-rich environments
    • Benzene, toluene, ethylbenzene, xylenes, naphthalene
  – Volatilization
  – Biodegradation via aerobic microbes
  – Petroleum plume core can be anaerobic as microbes deplete available oxygen, decreasing breakdown rate
Case Studies

Commingled petroleum and chlorinated solvent plumes in Remediation Programs
Commimgled Plume Remediation Management

• IDEM is working on databases to identify and categorize commingled plumes
  – Dry cleaners
  – Commingled Petroleum/Chlorinated Plumes

• To maintain consistency, Science Services Branch support team can be the same staff (geologist, chemist, risk assessor) for Remediation Programs

• Every site has unique conditions
Pete’s Service Center, 4902 N. Pennsylvania Street, Indianapolis

• FID 7947; LUST # 200704164
  – Gasoline, diesel, and used oil
• Meridian Cleaners; SCP #200708051; Brownfields #4131004
  – Phase II discovery
• LUST release initiated based on contamination detected on down-gradient Sullivan Hardware site
Pete’s Service Center, 4902 N. Pennsylvania Street, Indianapolis

• Site Setting:
  – Ground water flow is affected by subsurface utility lines along Pennsylvania but generally flow to south, with southwest and southeast seasonal flow direction changes
  – Significant decrease in petroleum and chlorinated solvent contamination where plumes merge
Former Veedersburg Shell, 2\textsuperscript{nd} and Mill Street, Veedersburg

- FID 16041; LUST Incident #200711504
  - Gas and waste oil
- Unknown Chlorinated Source
  - Former dry cleaner west on Mill Street
  - Former Ceramics Factory directly west
- LUST release due to closure activities, PCE in soil and ground water samples near former waste oil UST
Former Veedersburg Shell, 2\textsuperscript{nd} and Mill Street, Veedersburg

- Site Setting
  - Ground water flow to the south along Mill Street, with topographic highs causing flow toward Mill Street from west and east
  - Increasing PCE detections off-site
  - LUST incident for gasoline release has no further action status
  - Chlorinated contamination referred to OLQ Gatekeeper
Former Fuel Mart, 325 North Anderson, Elwood IN

- FID 7466; LUST Incident #201512502
  - Diesel and gasoline USTs
- Wyant Ford; Spill #200409150
  - Parts washer (solvent) waste water release
- LUST release due to UST closure activities, vinyl chloride detected in soil and ground water samples
Former Fuel Mart, 325 North Anderson, Elwood IN

- Site Setting
  - Ground water flows North
  - Former Fuel Mart is down-gradient of the Wyant Ford spill
  - Internal Referral to OLQ Gatekeeper in November, 2017
Former Quick Trip, 360 W Lincolnway, Valparaiso IN

• FID 6974; LUST Incident #200912025
  – Gasoline and used oil
• Mercury Cleaners; SCU #200912025; VRP #6120302
• LUST release initiated through Phase II sampling, detected chlorinated VOCs, sent Investigation Request to Mercury Cleaners
Former Quick Trip, 360 W Lincolnway, Valparaiso IN

• Site Setting
  – Ground water flow direction is W/SW
  – Initially Mercury Cleaners was managed in the State Clean Up Program in December 2009
  – Approved for VRP in March 2012; SVE system installed
  – LUST plume is “inside” of the chlorinated plume footprint
Circle K #2268, 1008 Darlington Avenue, Crawfordsville

- FID 9599; LUST Incident #2009089507
  - Gasoline
- Former Dry Cleaner side-gradient
- LUST release initiated after tank leak
- cVOC contamination referred to OLQ Gatekeeper
Circle K #2268, 1008 Darlington Avenue, Crawfordsville

- Site Setting
  - Ground water flow direction is W/NW
  - Dry cleaning facility is vacant
  - Referred to SCP
Keystone Conoco, 3360 N. Keystone Avenue, Indianapolis

- FID 24784; LUST Incident #200908020
  - Gasoline
- Former Quick Stop; SCP #000000295
  - Release referred after cVOCs detected from Conoco samples
- LUST incident reported after UST system failed a tank tightness test
Keystone Conoco, 3360 N. Keystone Avenue, Indianapolis

- Site Setting
  - Ground water flow direction is W/SW, interbedded sand with thick clay on northeast portion of LUST site
  - Property access denials prevented LUST sampling off-site where cVOCs detected
  - AS/SVE at Former Quick Stop, currently preparing to close site.
Former Rensberger Oil Bulk Facility, 1604 Rupel Street, South Bend

• SCU #000000150
  – Gasoline, lubricating oil, and waste oil

• Monarch Textiles Rental Service; SCU #000000232; VRP #6160602
  – Release of PCE from dry cleaning

• Investigation of other petroleum releases identified contamination at Rensberger Oil and Monarch Textile
Former Rensberger Oil Bulk Facility,
1604 Rupel Street, South Bend

• Site Setting
  – Ground water flow to the northeast; Monarch Textile is down-gradient from Former Rensberger Oil and cross-gradient to additional sources
  – Petroleum impacts caused anaerobic conditions that allowed for complete reductive dechlorination to begin
  – Biological injections ensured continued reductive dechlorination after SVE system was added
Next Research Project
Bowes Industries, Inc. 5902 E 34th Street, Indianapolis

• FID 2559; LUST Incident #198909101
  – 10 USTs, hazardous petroleum, 10 removed in 1990
• Paper Art; VRP #6970204 was a LUST site, Covenant Not to Sue October 2012
Bowes Industries, Inc., 5902 E 34th Street, Indianapolis
Shallow and Deep Plumes
Obstacles to Closure for LUST Sites

- Property owners sometimes hesitant to include chlorinated solvent compounds on Environmental Restrictive Covenants at petroleum sites
- Property access denials, unresponsive party, and property transfers
- Remediation work at a neighboring site can cause contaminant migration if not properly designed
Obstacles to Closure for LUST Sites (cont.)

- Different consultants for each site can lead to extraneous monitoring wells unless both responsible parties agree to share data.

- IDEM collaboration can help identify effective remedies at neighboring sites to help determine the appropriateness at an adjacent site.
• Conclusion
  – Remediation and Closure
  – Obstacles
  – Next Steps
    ▪ Coordination within Office of Land Quality, development of several databases
Thank You!

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