THE WEBINAR WILL BEGIN SHORTLY

Dry-Cleaning Sites
Part III: It's time to
REMEDIATE

ERIS WEBINARS

DISCLAIMER FOR ERIS CONTENT:

This disclaimer applies to all webinars, podcasts, videos and other reference materials (hereon referred to as 'online content') hosted by ERIS, and any associated documents, information or opinions presented, or obtained from, online content. Please read this disclaimer before participating in, reading, or making any other use of the material provided by ERIS or on ERISINFO.COM.

- ERIS makes no representations or warranties about the accuracy or suitability of information provided in the webinars and related materials such as reference materials, presentation documents and recordings.
- The information contained in the webinars and related materials are not intended to constitute advice of any kind or the rendering of consulting, or other professional services. Registering for a webinar only constitutes an agreement to attend, not a contract for consultancy or advice.
- The opinions expressed in a webinar are those of the speaker(s) only and may not represent the views of ERIS. To the extent permitted by law, ERIS excludes all liability for any loss, claim or damage, cost, or expense, including any indirect or consequential damages or lost profit, whether arising in negligence or otherwise, suffered in connection with the access to, participation in, or use of the webinar by you or any other person.
- ERIS reserves the right to suppress the posting of any webinar recordings it produces.

Dry-Cleaning Sites
Part III: It's time to
REMEDIATE

ERIS

THE ENVIRONMENTAL AND PROPERTY DUE DILIGENCE

POWER SUITE

Innovative start-to-finish solutions that make your work life easier.

Database Reports

City Directories

Aerial Photos

Fire Insurance Maps

Scriva - Report Writer

Digital Tools:

Xplorer, Figure Creator

Vapor Screening

Mobile Field App

Climate Risk Assessment

ERIS WEBINARS

WELCOME

Dry-Cleaning Sites Part III: It's time to REMEDIATE

PRESENTED IN PARTNERSHIP WITH:

InControl Technologies
Environmental Consulting and Engineering

Schnapf LLC
ENVIRONMENTAL LAW

Cleaning the Cleaners Considerations for Dry Cleaner Remediation

MICHAEL MARCON

INCONTROL TECHNOLOGIES LLC

Introduction

- Dry Cleaner Review
  - Types of Dry Cleaners
  - Sources and Waste Issues Associated with Dry Cleaners
  - Investigation Considerations for Dry Cleaners
- Remedial Design/Response Action Considerations
  - Technologies
  - Design Considerations
  - Soil, Water, and Air

What chemicals are used Today?

- Tetrachloroethylene/ Perchloroethylene/Perc
- Hydrocarbons/Stoddard Solvent
- Glycol Ethers
- Liquid Silicone
- Liquid Carbon Dioxide
- Professional Wet Cleaning

Regulatory Background

- **Federal Rules**
  - **40 CFR Parts 260-262:** Hazardous Waste Management requirements
  - **40 CFR Part 60 (Subpart JJJ):** Standards of Performance for Petroleum Dry Cleaners
  - **40 CFR Part 63 (Subpart M):** National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities
  - Perc Dry Cleaning will be banned in Residential properties
  - **Clean Water Act (CWA)** controls both direct discharges to surface waters as well as stormwater runoff and indirect discharge in the public sewer system
  - **State and Local Requirements**
  - **Waste Handling and Disposal Requirements**

The Hard Facts

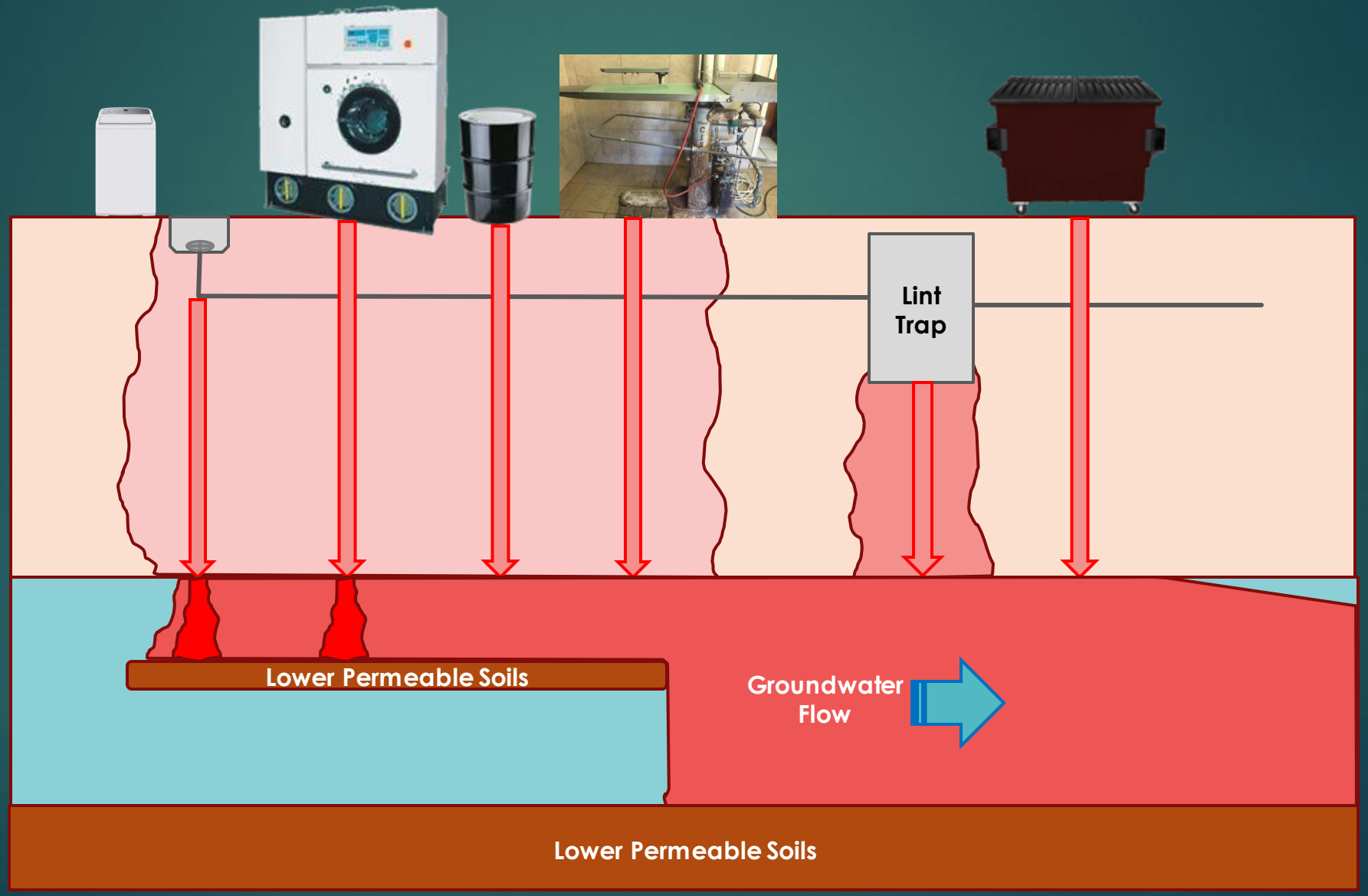
- EPA studies along with the State Coalition for Remediation of Dry Cleaners
  - 75% of the approximately 30,000 dry cleaners currently in operation have contaminated the environment.
  - Does not include historical dry cleaners.
  - Estimates as high as 90,000 historical sites likely exist.
- Dry Cleaners are a major contributor to soil and groundwater contamination.
- Over 150 dry cleaners are listed in the EPA CERCLIS Database.

PCE Waste Streams

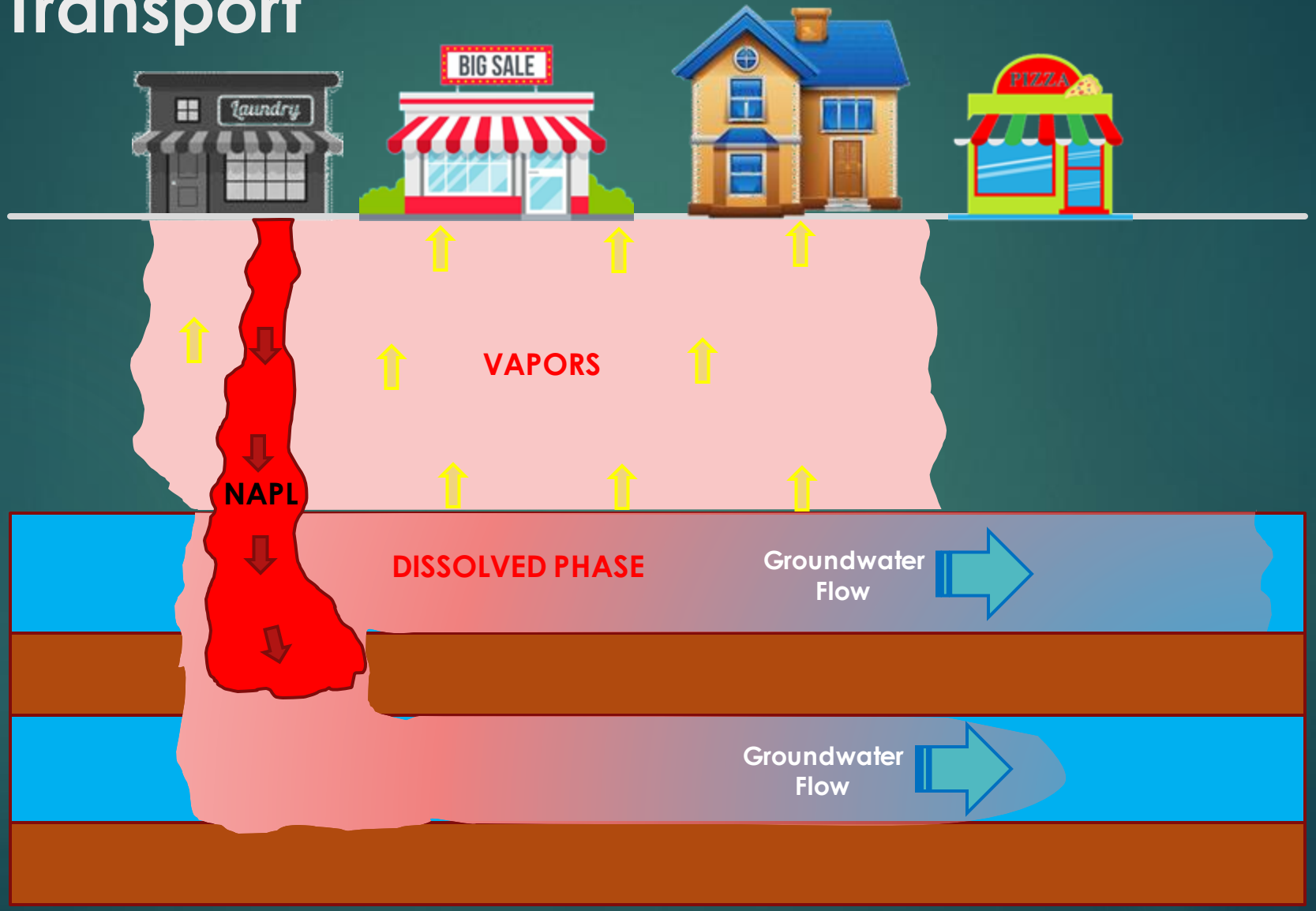
Typical wastes include:

- Spent PCE/solvent,
- Still bottom residues from solvent distillation,
- Spent filter cartridges, and
- PCE/Solvent contaminated water or separator water.
- Waste streams from PERC and Hydrocarbon are hazardous waste streams.

The Dry Cleaner



Contaminant Fate & Transport



Remediation Technologies

- **Soil**
  - Excavation/Removal
  - Soil Vapor Extraction
  - Chemical Oxidation
    - Permanganate
    - Fenton's Reagent
  - Bioremediation
  - Zero-Valent Iron (ZVI)

- **Groundwater**
  - Pump and Treat
  - Multi-Phase Extraction (e.g., DPHVE)
  - Air Sparging
  - Bioremediation
  - Chemical Oxidation
  - Reactive Barrier Walls (e.g., ZVI)
  - Carbon Solutions

Issued facing Typical Dry Cleaner Remediation

- **Limited Funding** from Cleaners (Some are State Funded with limited funds)
- The Dry Cleaner Footprint is typically small.
- Building/Tenant Space Present vrs Part of Site Redevelopment
- **Soil Issues** – Typically small footprint (20-feet x 20-feet)
- **Groundwater Issues** – Plume Size versus Transmissive Unit Characteristics
- **Vapor Issues** – Indoor Air Concerns versus Migration

Soil Issues

- Typically, Small Footprint
- Technologies typically involve excavation with
  - Limited Treatment
  - Chemical Oxidation
  - Biological Amendments
  - Offsite Disposal versus Placement Back into Excavation
- Must Consider Waste Classification (RCRA Regulations)
- Confined area if inside a building or dry cleaner space.

Groundwater Issues

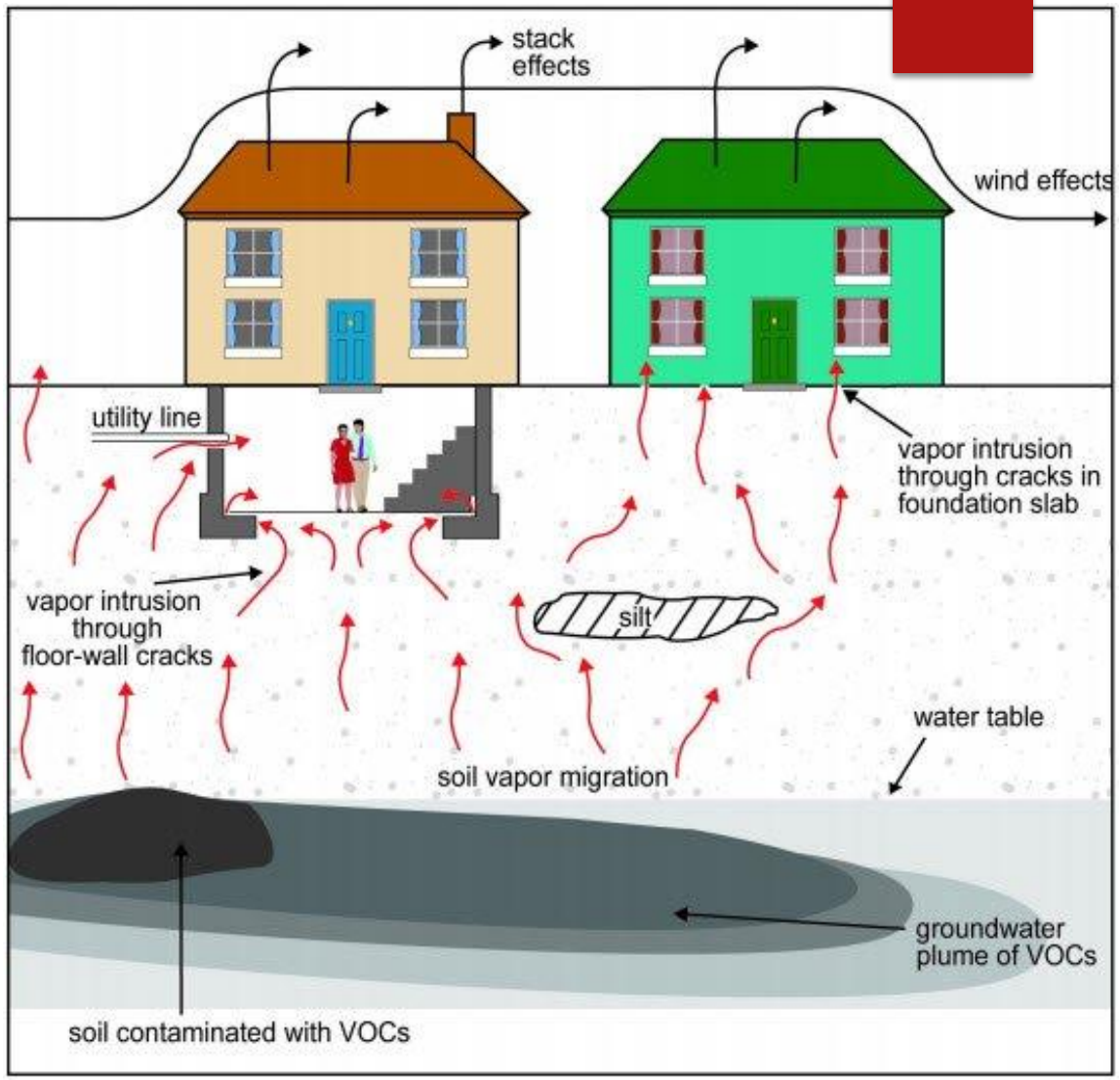
- **Balance between plume size and transmissive unit characteristics**
  - Sands/Gravels
  - Silty Clays
  - Fractured shales and limestones
- **DNAPL (greater than 1 percent of solubility)**
  - Discoverable
  - Surfactants
  - Microdroplets
  - Vertical Migration

Groundwater Limitations that Affect Response Actions

- Access to Source Area
- DNAPL issues with microdroplets
  - Long-Term source if not removed
  - Creates opportunity for Vertical Migration
  - Difficult to remediate
- Low permeable transmissive units
- Poor characterization
- Insufficient data for technology development

Vapor Issues

- Poor understanding of Source
- Poor understanding of Fate and Transport
- Understanding vertical migration pathways
- In door air
- Vapor barriers versus source elimination
- Long-term source in groundwater



Short-Term versus Long-Term Remedies

- **Short-Term**
  - Source Removal in Soil through Excavation
  - Balanced Groundwater Remedy using Groundwater Extraction with Enhanced Technologies
  - Chemical Oxidation of suspect source area
  - Carbon Solutions for chemical absorption
- **Long-Term**
  - Enhance Biological Treatment
  - Chemical Oxidation
  - Reactive Barriers

More Aggressive Technologies

- **Source Area Removal (Soil Excavation)**
- **Pump & Treat, Dual Phase, & Soil Vapor Extraction**
  - Shorter response action time
  - Typically, very expensive
  - High Operation and Maintenance Costs
  - Should be reserved for the highest risk sites
  - Sites with critical development schedules/criteria
- **Can be used to enhance other Technologies**

Versus Longer-Term Remedies

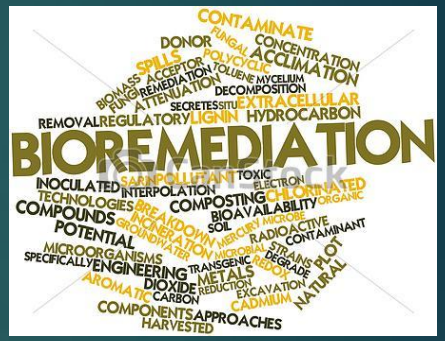
- **Source Area Removal (small scale)**
  - Ideal for property redevelopment
  - Reduce vapor Infiltration
- **In Situ Groundwater Response Actions**
  - In Stu Chemical Oxidation
  - Enhanced Bioremediation
  - Carbon Solutions

Enhanced Bioremediation

- Enhanced Bioremediation can have long term effectiveness
- The technology has a typical effective lifespan of 3 to 5 years
- Allows response action to work over a longer period with minimal O&M
- Continues to actively address groundwater with minimal additional costs

Enhanced Bioremediation (Continued)

- Relying on natural processes already active in the environment
- **Aerobic Technologies**
  - Short effective lifespan (6 to 12 months)
  - Reintroduce over multiple events
- **Inoculants with Pseudomonas sp. bacteria**
  - Efficiencies derived by optimizing the inoculant through the intentional culturing and blending of different bacterial species
  - Establishing high population densities of the appropriate microbes, which was anticipated to lead to contaminant degradation

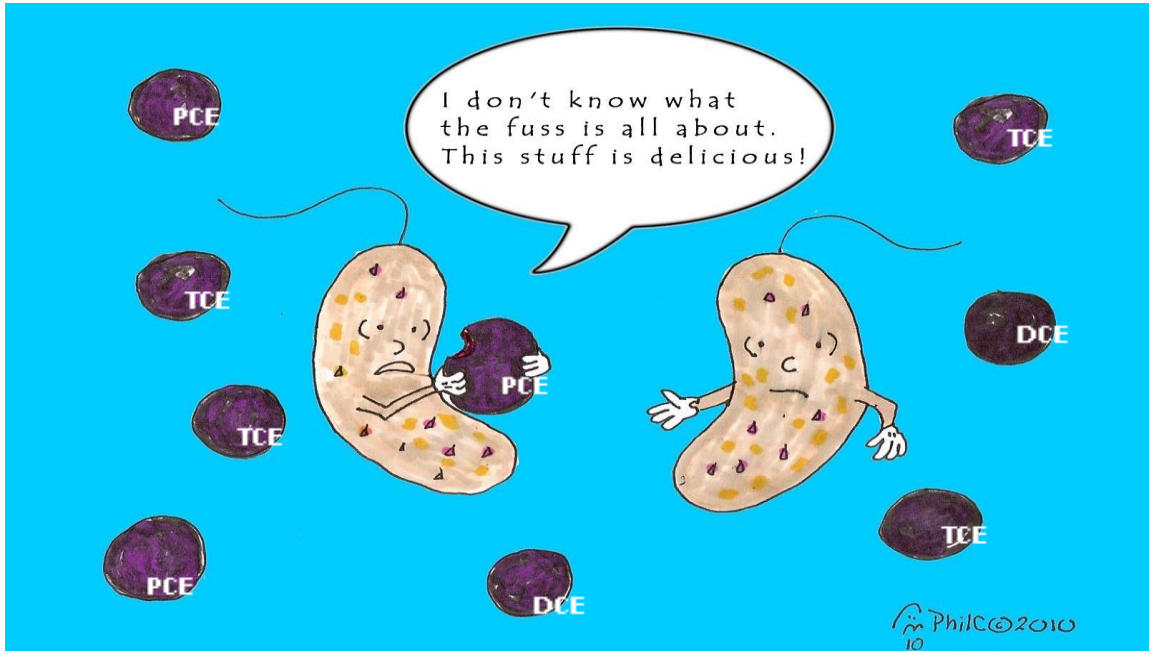


Enhanced Bioremediation (Continued)

- **Anaerobic Technologies through dehalorespiration (*dehalococcoides sp.*)**
  - Most rely on using some proprietary substrate for an electron donor while enhancing naturally occurring microbes
  - Can supplement natural microorganisms
  - With new developments, microbes/nutrients can last 3 to 5 years
- **Long-term treatment is consistent with generally lower costs**
- Because of longer effective lifespans, less need to managed

Anaerobic Bioremediation

- Microorganisms belonging to the genus *dehalococcoides sp.* have demonstrated the capacity to dechlorinate through to ethene
- *Dehalococcoides* microorganisms appear to be widespread
- However, the **specific microorganisms required to achieve complete dechlorination may not be ubiquitous in the site's environment**



Anaerobic Bioremediation (Continued)

- **It is not uncommon for "Stalling" to occur**
- **Problem: Degradation stalls at DCE**
  - Evidence suggests that the lack (or very low numbers) of competent microorganisms are present in environment.
  - DCE is almost 4 times more soluble than TCE and can "emerge" and be retained in ways that would simulate a build-up related to poor metabolic response in the aquifer; and
  - Competing processes can also inhibit conversion (e.g., high levels of bioavailable iron and conversions from ferric to ferrous forms can interfere with electron flow to DCE)

Anaerobic Bioremediation (Continued)

- **Solution: Minimize stalling/ restart degradation process**
  - Confirmation from appropriate monitoring wells to observe contaminant degradation results
  - Monitor water quality parameters including Dissolved Oxygen (DO), Oxygen Reduction Potential (ORP)
  - Monitor degradation parameters including iron, nitrate, nitrite, sulfate, chloride
  - Conduct Bioassays

Bioassays

- **What does the bioassay tell us:**
  - If there is sufficient population for reductive dechlorination
  - Presence/ absence of genes responsible for reductive dechlorination of TCE to cis-1,2-DCE
  - Presence/ absence of genes responsible for reductive dechlorination of VC to ethene
- Helps to determine whether bioaugmentation is needed
- Helps to determine the need for additional nutrients and/or substrates

Vapor Mitigation

- **Best Option**
  - Eliminate the source
  - Reduce mass in groundwater
- **I can't achieve the "Best Option" – Now what?**
  - Vapor Barriers
    - Liners
    - Applied Materials
  - Vapor Extraction/Sub Slab Depressurization
    - Similar to Radon Gas Mitigation
    - More difficult in existing buildings

Summary

- Response Actions must be effective
- Balance Short-Term versus Long-Term
- Biggest Issues:
  - Tight working spaces
  - Small Source area in soil
  - Groundwater Unit Issues
- Developing a Response action Strategy
  - Source in Soil
  - Groundwater
  - Vapor

Legal Issues to Ponder

Pre-remedial decisions	self-directed cleanups state dry cleaning funds Anticipated tenant uses
During Remediation	Listed Wastes vs Characteristic wastes Variable State Vapor Intrusion Requirements Notification requirements to tenants/adjacent owners
Post-Remedial	Complying with and enforcing appropriate care/due care requirements to preserve defenses
Lender Concerns	Adequacy of cleanup Toxic tort exposure Environmental insurance
Contractual issues for sellers and purchasers of property with remediated dry cleaner.	Litigation risk of former owners and operators , and adjacent property owners

QUESTIONS

Dry-Cleaning Sites
Part III: It's time to
REMEDIATE

infoHUB

erisinfo.com

THANK YOU

To learn more:

Michael Marcon, PG, CAPM

VP & Principal, InControl Technologies
(832) 559-5802
mmarcon@incontroltech.com

Larry Schnapf

Principal, Schnapf LLC
(212) 876-3189
larry@schnapflaw.com

ERIS WEBINARS

Dry-Cleaning Sites
Part III: It's time to
REMEDIATE

PRESENTED IN PARTNERSHIP WITH:

InControl Technologies
Environmental Consulting and Engineering

Schnapf LLC
ENVIRONMENTAL LAW