THE DIRTY SIDE OF A CLEAN SUIT



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Lesley Reid, M.Eng., P.Eng., CSAP Christine Patterson, P.Eng.

History

- Petroleum based solvent < 1950s
- Chlorinated based solvent > 1950s
- Current solvent of choice
 - Perchloroethylene
 - Tetrachloroethylene
 - PERC - PCE



AECOM

The Equipment

- Four Basic Components
 - Holding Tank (solvent)
 - Pump
 - Filter
 - Basket



Equipment Evolution

- First Generation (Transfer)
- Second Generation (Dry to Dry)
 - Air discharged to atmosphere with or without a carbon adsorber
- Third Generation (Dry to Dry Closed)
 - Refrigerated condenser (primary control)

Equipment Evolution

- Fourth Generation
 - Refrigerated condenser and carbon adsorber (secondary control)
- Fifth Generation
 - Monitoring of vapours at end of cycle

The Equipment

- First Generation banned January 2004
- Second Generation banned August 2005
- Third and Fourth Generation most common



The Process

- "Washing Phase"
 - Constant flow of clean solvent
 - Spent solvent cleaned via filter
 - 1,500 gallons of solvent/hour

The Process

- "Extraction Phase"
 - Solvent physically captured
 - Solvent in air vapourized and condensed
 - Solvent distilled and water and vapours separated
 Clean solvent returned to tank

What is the big deal?

- All a matter of the nature of the contamination
- PERC is a Dense Non-Aqueous Phase Liquid (DNAPL)
- DNAPLs are heavier than water

What is the big deal?

- Migration governed by gravity and geological stratigraphy
- Low solubility
- A little goes a long way
- Source of environmental, health & financial liability

LNAPL vs DNAPL



Primary Degradation Products



- Configuration of space
- History of operations
- Generation of equipment
- ASTs
- Waste management (back door dumping)

- Floor anchors/bolts
- Missing floor tiles or damaged flooring
- Location of floor drains
- Chemical storage
- Waste management

- Always Ask How Can The Operations Impact The Environment?
- Operation History
- Waste Management
 - Filters
 - Sludge
 - Wastewater

- Chemical Usage/Storage
 - Volume of solvent/1000 kg of clothing
- Drains
- PERC resistant drain plugs
 - Equipment
 - Secondary Containment (size, construction, material)

Dry Cleaning Fluid Added



Rag Storage

Filters on Closed Loop Systems



Wastage during adding/removing Fluids

Staining on Tile



Waste Storage

Waste Handling



Challenges with Chlorinated Solvent Sites

Delineation

- Good CSM
- Large Plumes

	CSR Schedule 6/10 Commercial Drinking Water (μg/L)
PCE	30
TCE	5
VC	2

- Deep Depths
- DNAPL (Chemical compatibility)

Successful Remediation

- Adequate Delineation
- Understanding Technology Limitations on Target
- Remediation Timelines

Typical Remedial Strategies

	Advantage	Disadvantage
Excavation	 Quick timeframes Removal of DNAPL and high source areas Can provide access for insitu phase Visual of contamination 	 Limited impact on residual gw Limitations near/under building Not practical for large area deep plumes which are typical
DPE/ MPE (high vacuum)	 can address gw, vapour, and soil at one time Can be installed under buildings Mitigate vapour migration during active remediation 	 Longer timeframe Limitations to reach low level concentrations (DW PCE 30 ug/L) Requires pilot scale for final design High operating costs (electrical \$\$\$)

Typical Remedial Strategies (Cont.)

	Advantage	Disadvantage
Insitu (ISCO or Bio)	 an be used at operating sites as limited site disruption Can be used on deep contamination plumes where there are limited options. 	 ISCO requires direct contact with contaminants Bio degradation can cause increase in more harmful contaminates (VC) tight geology bench and pilot scale testing Higher Risk for clients due to uncertainty on cost and timeline Utilities NOD can limited applicability



Innovative Integrated Strategies for Sites

Risk Assessment Approach

Human Health

- Drinking Water Exclusion Zone
- Vapours RA or control
- Eco Biochlor to Model impact to Environment
- Administrative
 - NOMs

Criteria- Groundwater

	CSR Schedule 6/10 Commercial Drinking Water (µg/L)	From EPA IRIS DW Unit Risk (µg/L)
PERC	30	200
TCE	5	5
VC	2	0.48
EPA IRIS risk level E-5 (1 in 100,000) Lifetime exposure during adulthood		

Criteria- Vapours

	CSR Schedule 11 Commercial (µg/m3)	From EPA IRIS RfC (µg/m3)
PERC	2000	120
TCE	0.5	6
VC	3.5	7
EPA IRIS risk level E-5 (1 in 100,000) Commercial Exposure factor of 0.33 ILifetime exposure during adulthood	as per BC MOE CSR CSST	





Questions?