

# A Sleeping Giant in Your Shopping Center



Image Source: Dayton Daily News



## Richard Ordeman, CP, PG

Operations Manager

Mr. Ordeman has over 30 years of professional experience providing environmental consulting services to a wide variety of clients on a wide variety of sites. He has expertise in the following area:

- Investigation and remediation of petroleum, solvent, volatile and semi-volatile organic compound, PCBs and metals contaminated soil and groundwater
- In-situ and ex-situ remedial expertise and large-scale site demolition and environmental construction management
- Brownfield grant preparation and implementation (federal, state, and local)
- The issuance of over 100 BUSTR No Further Action (NFA) letters and four Ohio EPA Covenant-Not-to-Sue's (CNS) for clients across Ohio



# Dry Cleaning - Potentially Dirty Words for Your Shopping Center

- What do dry cleaning facilities do to clean your clothes?
- What are the chemicals used?
- What Processes have been, and are currently used?
- How can these facilities impact my shopping center?
- What can I do to protect my tenants and my investment?
- What are the regulators' concerns?



Image Source: Curtis Gregory Perry

# How Dry Cleaning Facilities Clean Clothing



Image Source: Wauwatosa, Wisconsin

- Dry cleaning machines use solvents to remove oils from fabric
- Sometimes they will add a bit of water to also remove some non-oily dirt
- Clothes are washed and dried in a single machine
- Clothes are then pressed using steam presses
- Clothes are hung and bagged to keep them fresh



# Chemicals Used

- Perchloroethylene (a.k.a.: Perchloroethene, Tetrachloroethene and PCE) is the primary solvent used by the majority of facilities
- Stoddard Solvent has been used in the past but is explosive and flammable, with a flash point of 100°F
- Petroleum-based solvents are less aggressive but also less effective than PCE and are combustible
- Dibutoxymethane (SolvonK4) is a bipolar solvent that removes water-based stains and oil-based stains (this is an emerging solvent)
- Brominated solvents have higher KB-values than PCE which means they can clean faster, but can damage some synthetic items like beads and sequins if not used correctly (this is an emerging solvent)



Image Source: Los Angeles Fire Dept.

# Health Effects of Exposure to PCE

The following is summarized from Agency for Toxic Substances and Disease Registry (ATSDR).

- PCE exposure may harm the nervous system, liver, kidneys, and reproductive system, may be harmful to unborn children and may put you at a higher risk of getting certain types of cancer.
- If you are exposed for short time periods (a few hours to less than 14 days), PCE may cause effects on your health. If you breathe in air containing a lot of PCE, you may become dizzy or sleepy, develop headaches, and become uncoordinated; exposure to very large amounts in the air can cause unconsciousness. Some people have died after being exposed in tanks or other small spaces, or after intentionally breathing in a large amount of PCE.
- People who are exposed for longer time periods to lower levels of PCE in air may have changes in mood, memory, attention, reaction time, or vision. Studies in animals exposed to PCE have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

# Health Effects of Exposure to PCE cont.

- **PCE may have effects on pregnancy and unborn children.** Studies in people are not clear on this subject, but studies in animals show problems with pregnancy (such as miscarriage, birth defects, and slowed growth of the baby) after oral and inhalation exposure. A **2016 study showed exposures to PCE vapor in first trimester could cause heart defects in fetus.**
- **Exposure to PCE for a long time (years) may lead to a higher risk of getting cancer,** but the type of cancer that may occur is not well-understood. Studies in humans suggest that exposure to PCE may lead to a higher risk of getting **bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma.**
- **The EPA considers PCE to be “likely to be carcinogenic to humans by all routes of exposure”** based on suggestive evidence in human studies and clear evidence of mononuclear cell leukemia in rats and liver tumors in mice exposed for 2 years by inhalation or stomach tube.
- **The International Agency for Research on Cancer considers PCE “probably carcinogenic to humans”** based on limited evidence in humans and sufficient evidence in animals.
- **The National Toxicology Program considers PCE to be “reasonably anticipated to be a human carcinogen.”**

# The Dry Cleaning Process - Then and Now

- Original dry cleaning process involved a washing machine and a separate drying machine
- Items were manually transferred from one to the other much like we do at home or at the laundromat
- Machines updated to a “dry-to-dry” machine where the washing and drying was completed in a single machine
- An update to the dry-to-dry machine was the addition of carbon filters to the exhaust lines from the driers to capture the solvent evaporated and vented during the drying cycle
- Later upgrades added a steel pan beneath the machine and eliminated the roof vent from the machine so the solvent was essentially contained in the machine (closed-loop system)



# Equipment Images



Image Source: Wauwatosa, Wisconsin

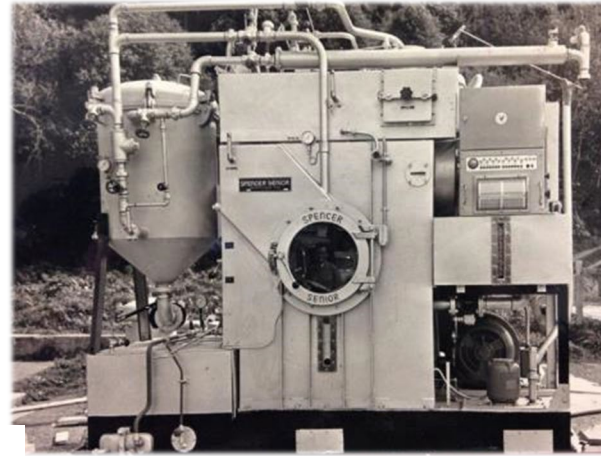


Image Source: Newtowne Drycleaners



Image Source: Oasis Max Clean

# Impacts Over The Years

Focus is on PCE impacts as PCE represents roughly 90% of the industry

- PCE can soak through concrete so the old transfer systems allowed PCE to drip on the floor and soak through the floor and get into the environment
- PCE is volatile so heated wet clothes would volatilize PCE in drier and vent it out through the vent
- PCE is heavier than air so the vented vapor would settle on the roof then wash off the roof during a rain and enter the ground
- PCE is denser than water so PCE that enters the soil migrates downward into the groundwater then downward through the groundwater

# Sources of Impacts



Image Source: Google Earth



Image Source: Town of Chapel Hill



Image Source: Dougherty Sprague Enterprises, Inc.



Image Source: zsv3207 / Fotolia

# Routes of Exposure

- Direct contact with product
  - Spills in facility
  - Spills or discharge outside of facility
- Inhalation of product vapors due to operations
  - In facility
  - In adjacent spaces
- Inhalation of product vapors due to vapor intrusion
- Direct contact with impacted soil
  - Landscaping
  - Construction / Renovation
  - Excavation / utility repair



Image Source: Dougherty Sprague Enterprises, Inc.



Image Source: Master Locators



# Routes of Exposure, cont.

- Direct contact with surface water
  - Stormwater runoff
  - Retention pond
  - Stream
- Direct contact with groundwater
  - Sprinkler supplied by onsite well
  - Springwater
- Consumption of groundwater



Image Source: DrDrainage



Image Source: thelostogle.com



Image Source: Mario Tama/Getty Images



# Assessing the Problem

- Walk through of facility and shopping center and look for evidence of releases
- Indoor air sampling
- Sub-slab vapor sampling
- Soil sampling
  - Interior by machine, sewer lines
  - Exterior by back door, down spouts, edge of pavement
- Groundwater sampling
  - Typically in soil sampling locations
  - Down-gradient from the facility
- Surface water sampling (if present)

# Remediating the Problem

## Sub-slab Vapor

- Install sub-slab vapor depressurization system
- Seal floors with chemically resistant epoxy vapor barrier

## Indoor Air

- See above
- Improve interior ventilation
- Increase air pressure inside facility

## Soil

- Soil excavation and off-site disposal at a licensed treatment/disposal facility
- Air Sparging with Soil Vapor Extraction (SVE)
- In-situ chemical oxidation
- In-situ bioremediation



# Remediating the Problem cont.

## Groundwater

- In-situ chemical oxidation
- In-situ bioremediation
- Groundwater pump & treat
  - Air stripping tower
  - Activated carbon
- Air sparging with soil vapor extraction (SVE)



Image Source: Robert Heling

## Surface water

- Air sparging
- Pump & treat
  - Air stripping tower
  - Activated carbon
  - Bioremediation

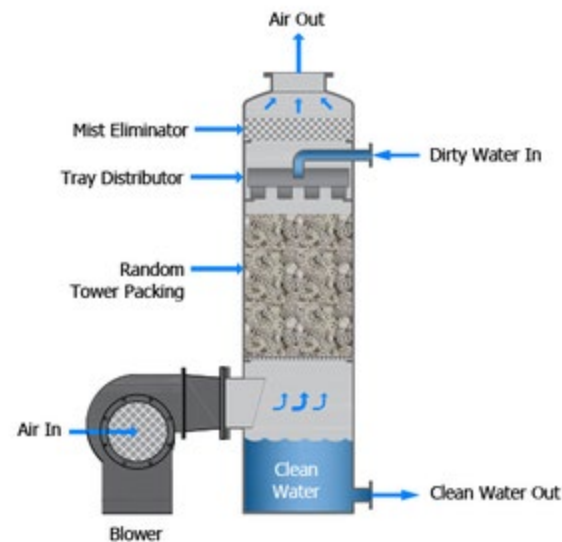


Image Source: Branch Environmental Corp.

# Ongoing Approved Operations That Can Cause a Release

- Improper transferring of solvent during change-out
  - Result in spills behind machine
  - Result in spills adjacent to storage drum (inside or out)
- Mopping of floors following spills or small releases
  - Dump mop water containing solvent out back door
  - Dump mop water containing solvent down the drain
- Discharge of condensate water down drain



Image Source: Ohio EPA



# Addressing Current Issues

- Transferring of spent and new solvent should be handled by a recycling company that uses hoses attached to the truck, so the solvent is transferred through a hose and there is little opportunity for spills.
- The floor of the facility can be sealed with a chemical resistant epoxy that will prevent any spilled solvent from soaking into and through the concrete
- The epoxy coating will also stop any vapor intrusion caused by previous releases
- Any discharges to the sanitary sewer system that might include any concentration of PCE must be stopped and the solutions containerized for disposal or treated prior to discharge to the sewer





# Regulatory Concerns - Ohio

## Vapor Intrusion from soil and groundwater

- Pregnant women
- Small children (Daycare facilities)

## Groundwater Plume Migration

- Plume migrating beneath other shops in center
- Plume migrating off site onto residential properties
- Plume migrating off site toward drinking water sources

## Worker exposures to soil or groundwater

- Construction / Renovation
- Excavation / utility repair

A stronger focus is likely in the future for dry cleaning facilities

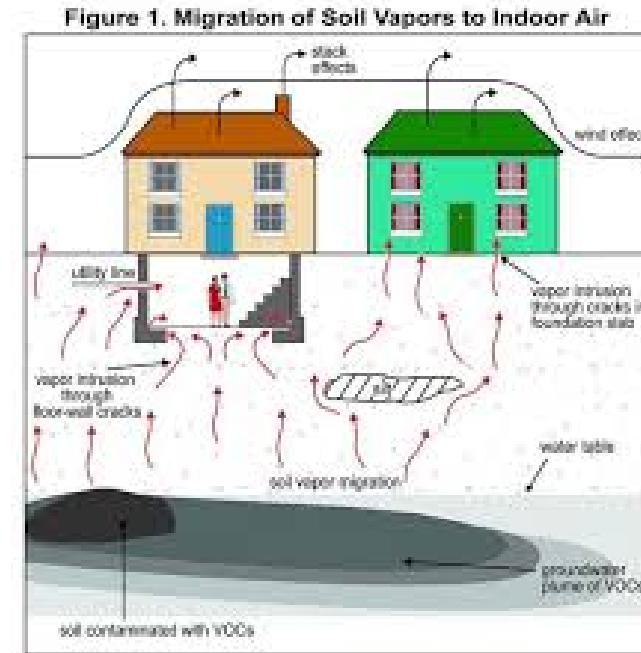


Image Source: Ohio EPA



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