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Dry-Cleaning Sites:
Important Considerations for Environmental Due Diligence and Remediation

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Dry-Cleaning Sites:
Important Considerations for Environmental Due Diligence and Remediation

PRESENTED IN PARTNERSHIP WITH:

InControl Technologies
Environmental Consulting and Engineering

Environmental Considerations for Dry Cleaner Properties

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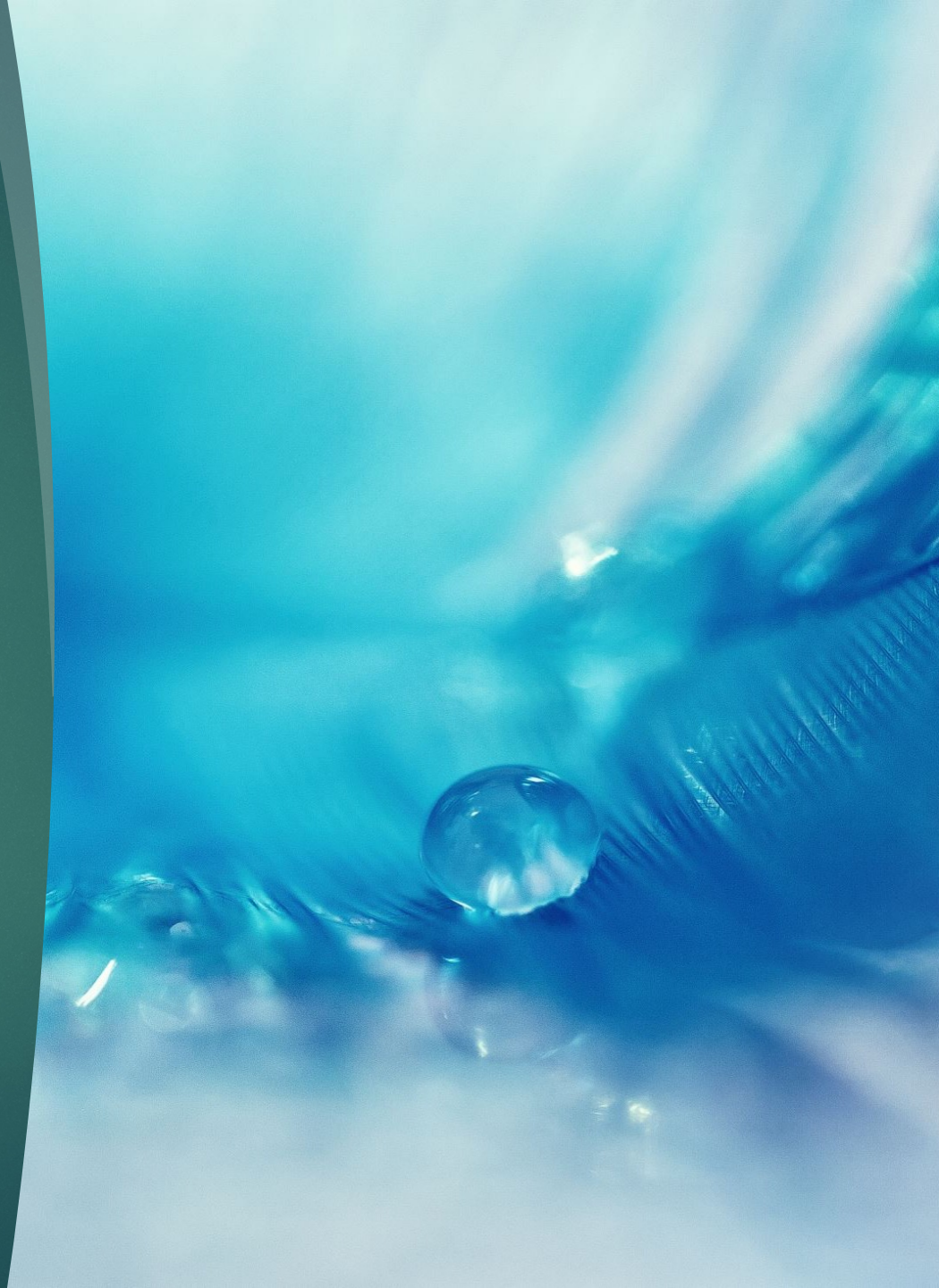
Introduction

- Overview and History of Dry-Cleaning Industry
- Types of Dry Cleaners
- Common Due Diligence Issues with Dry Cleaners
- Sources and Waste Issues Associated with Dry Cleaners
- Investigation Considerations for Dry Cleaners
- Remedial Design/Response Action Considerations
- Emerging Issues with Dry Cleaners

What is Dry Cleaning?

- In the simplest of terms, dry cleaning is a process of cleaning clothes without the use of water. The absence of water in the process is where the name dry cleaning comes from (one mystery solved). Instead, dry cleaning uses non-water based chemical solvents to clean clothes.

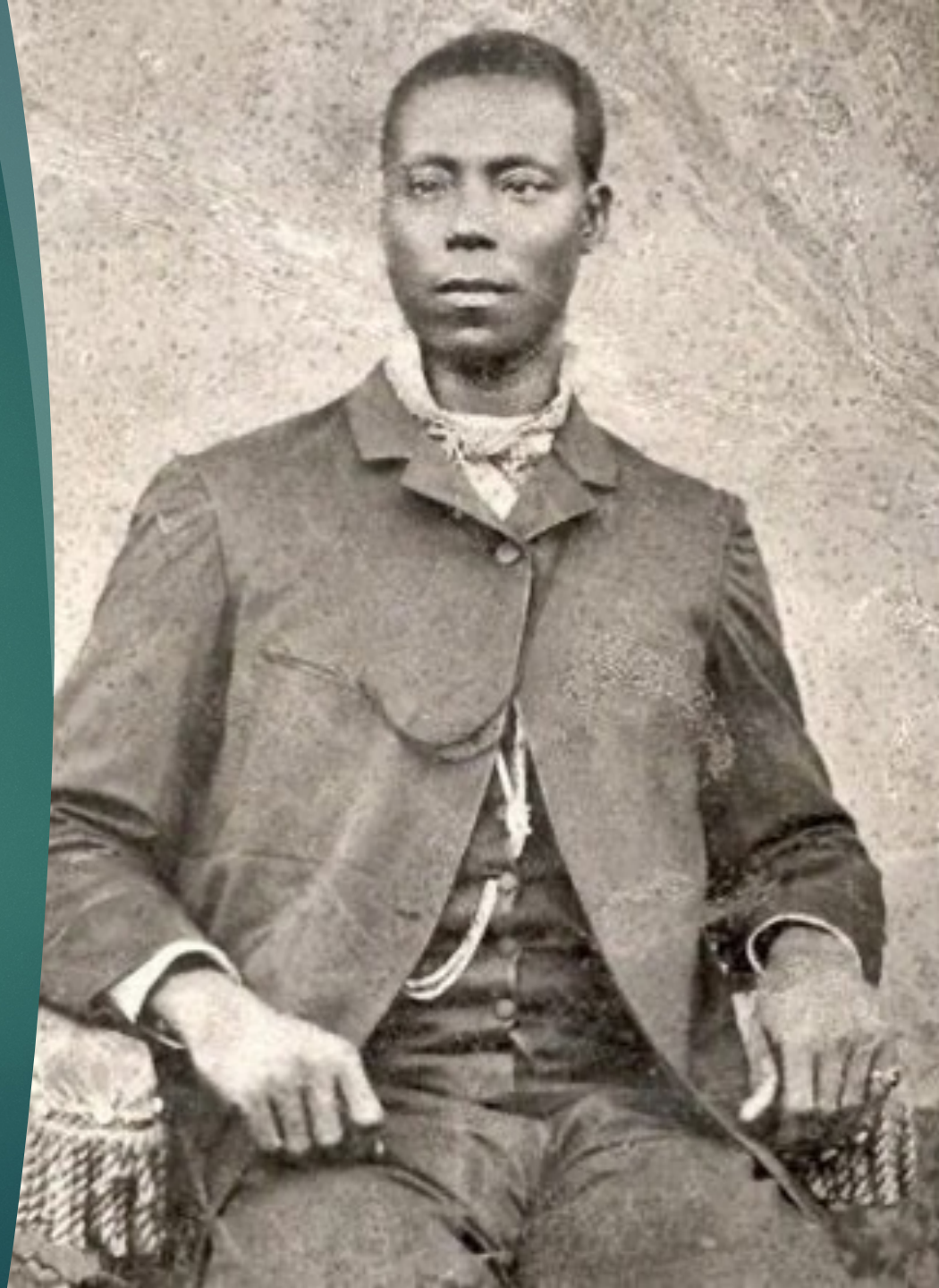


Overview and History of Dry Cleaning

- **Fun Fact:** Evidence of Dry-Cleaning has dated back to Pompei in 79 AD. They used a combination of ammonia derived from urine and Fuller Earth to clean the wool clothes of the time.

Overview and History of Dry Cleaning (Fun Fact 2)

- 1820, Thomas Jennings, a tailor in New York, develops method to clean his customer's clothing without damaging the delicate garments.
- Filed a patent with the U.S Patent Office for a process he called "dry scouring."
- First African American to hold a patent in the United States.



Overview and History of Dry Cleaning

(Fun Fact 3)

- Solvent-based Dry Cleaning started as an accident.
- Jean-Baptiste Jolly's maid accidently spilt kerosene from a kerosene lamp on a linen tablecloth in the late 1800s.
- Kerosene removed the stains from the tablecloth after it had dried and more importantly, did not shrink or damage the cloth.
- He creates a cleaning service and coins the term "dry cleaning".

Overview and History of Dry Cleaning **(Fun Fact 3)**

- The original "dry cleaners experimented with several different organic compounds such as turpentines, benzene and kerosene.
- William Joseph Stoddard, is credited with developing the first non-gasoline-based solvent.
- After World War I, chlorinated solvents were used due to limited supply of petroleum solvents.
- Michael Faraday, a prominent chemist, discovered tetrachloroethylene, which quickly becomes the solvent of choice starting in mid to late 1940s.

What chemicals are used today?

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

What are the chemicals used in Dry Cleaning?

- The number of dry cleaners using perc has started to decline due to regulatory requirements and environmental liability.
- At the peak of the dry-cleaning industry, 80-85% of dry cleaners in the U.S. used PERC.
- Today, 60–65% of dry cleaners use PERC as their primary solvent and most of the remainder use a high-flashpoint hydrocarbon.
- As of 2017 in the US, there are ~20,600 dry cleaning shops and the industry employs nearly 160,000 workers.

The Future of Dry Cleaning

- Several States and Communities are starting to ban and/or limit the use of PERC solvent in the dry-cleaning process.
- Some States and Communities are providing incentives to dry cleaners to change machines or adopt alternative cleaning processes.
- New EPA Standards will start to limit and/or restrict the use of PERC dry cleaning equipment in certain applications such as residential developments.
- The cost to cleanup a dry cleaner combined with the shrinking industry makes cleanup of these sites a significant burden on society.

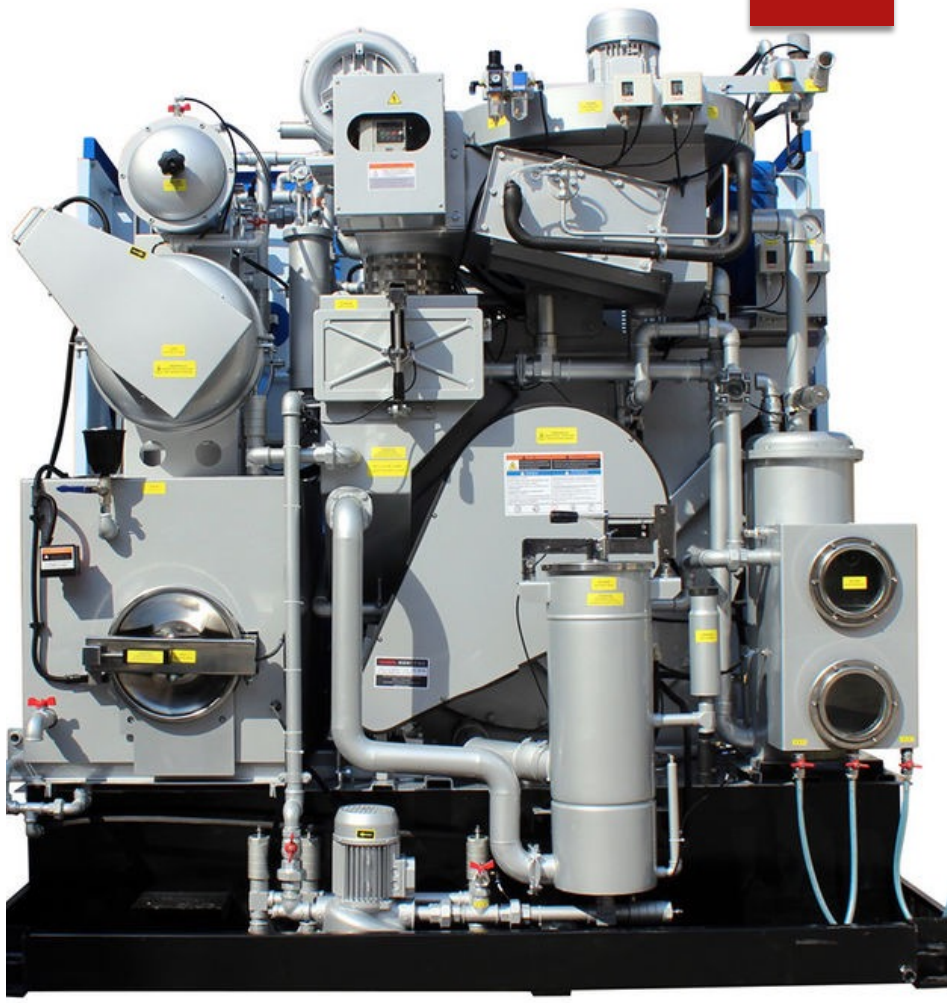
Dry Cleaning Equipment

There are five different generations of dry-cleaning equipment

- **1st Generation:**
- Wet to Dry Equipment.
  - Wet clothes were transferred between the washer and dryer.
  - Some have vapor recovery unit or sniffer.
- High consumption of solvent.

Dry Cleaning Equipment

- **2nd Generation:**
  - First dry-to-dry equipment.
  - Clothes go in dry and come out dry.
- **3rd Generation:**
  - First "closed-loop" system.
  - Solvent recovery is integrated into the machine.
- **4th Generation:**
  - Refrigerated condensers and carbon adsorbers to recover solvent vapors.
- **5th Generation:**
  - Incorporates a number of safety interlocks to reduce exposure to solvent vapors.

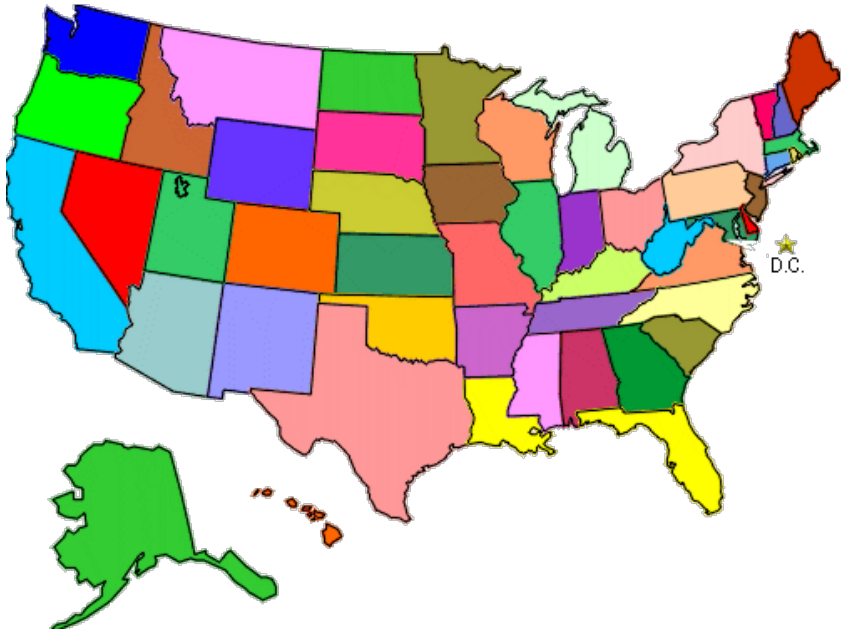


Regulatory Background

- **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

Regulatory Background

- **State and Local Regulations**
  - Waste regulations typically mimic federal rules
  - Registration requirements vary by State
  - Clean-Up Rules vary by State
  - Some States will ban Perchloroethylene for dry cleaning.



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.

Due Diligence Facts

- For years, the dry cleaner was overlooked by many environmental professional as a potential source of contamination.
- Today, environmental professionals are acutely aware of the environmental concerns associated with dry cleaners.
- A dry cleaner was a common anchor tenant within larger shopping centers.
- Dry Cleaners can generate a large volume of hazardous waste. EPA estimates the waste to be around 660 gallons per year.
- Dry Cleaner clean-ups cost on average $500,000 to $700,000.

The Hard Facts

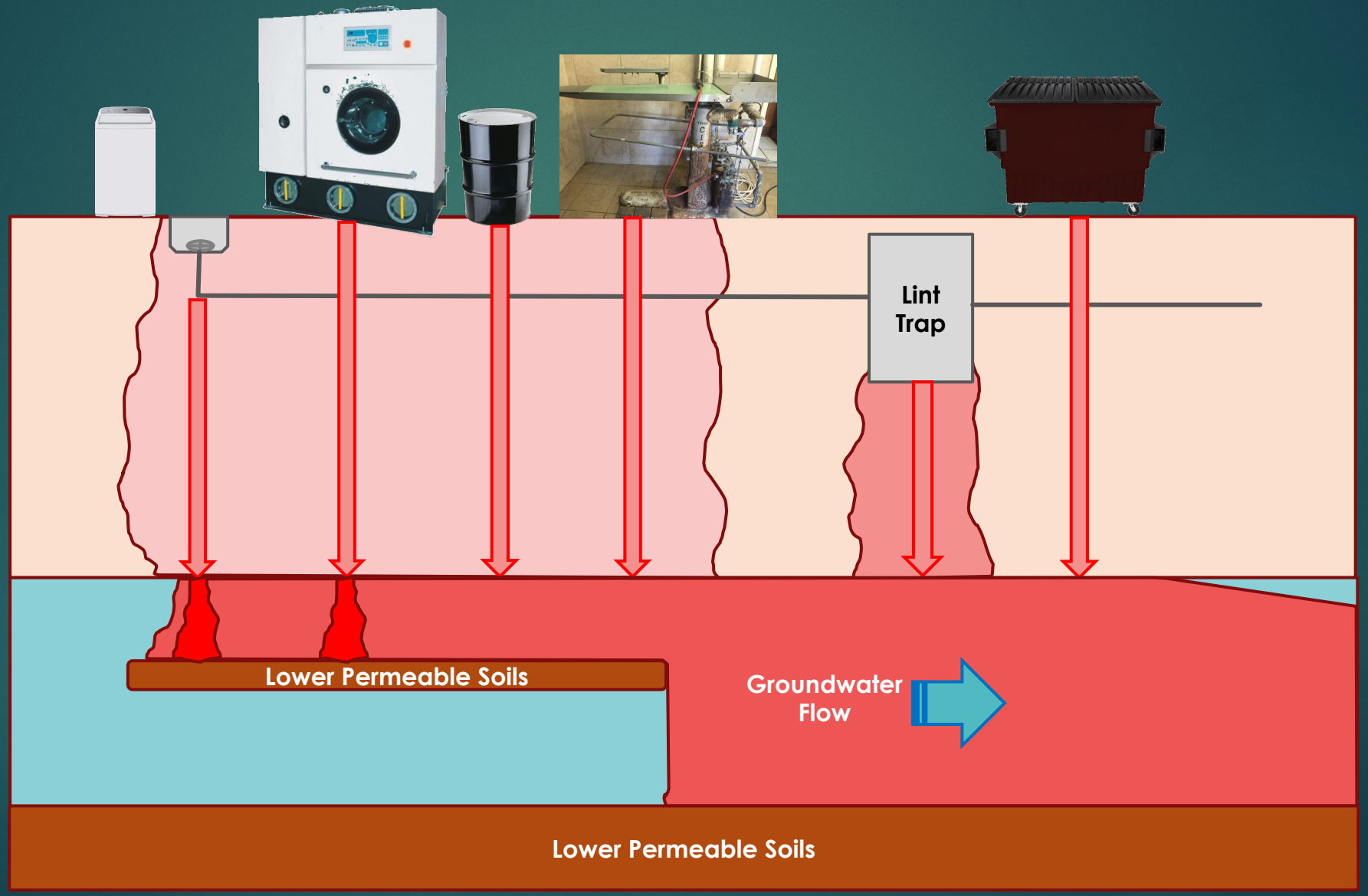
- The Dry-Cleaning Business is an extremely competitive business with low margins and shrinking consumer demand.
- Historically, dry cleaners were unaware of the chemical hazards to PERC.
- Poor housekeeping and waste management = high frequency of releases.
- Dry Cleaners historically placed waste products down the sanitary sewer.
- Used filters/DE used in filters were placed in dumpsters.

The Hard Facts

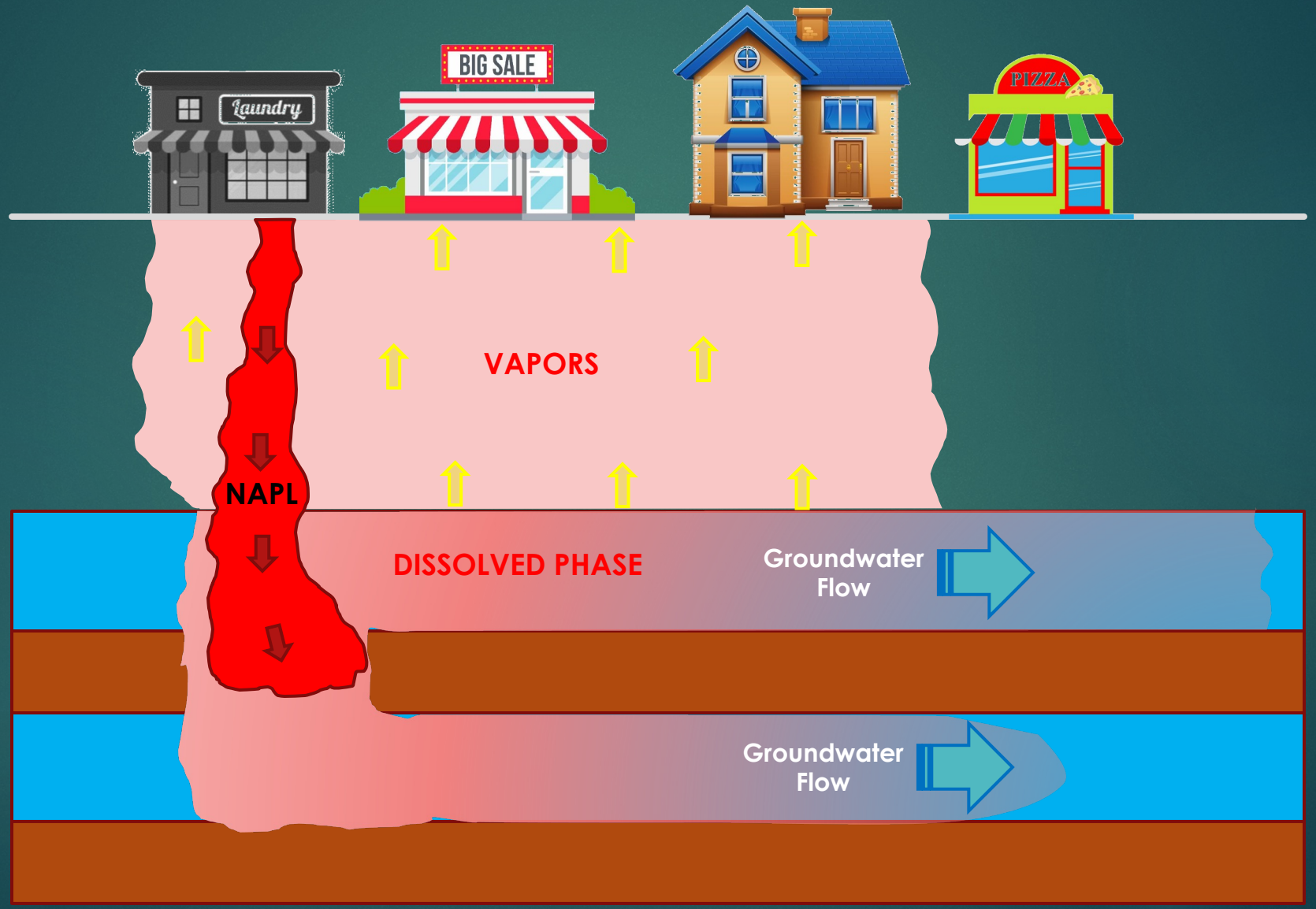
- EPA studies along with the State Coalition for Remediation of Dry Cleaners
  - 75% of the approximately 30,000 dry cleaners currently in operation have contaminated the environment.
  - Does not include historical dry cleaners.
  - Estimates as high as 90,000 historical sites likely exist.
- Dry Cleaners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

Inside a Perc Dry Cleaner

The Dry Cleaner



Contaminant Fate & Transport



Preliminary Site Assessment

- **Phase I ESA Review:**
  - When did dry cleaner operate?
    - Pre 1950s, likely used petroleum or Stoddard Solvent
    - Post 1950s, likely used PERC
    - Linen service companies typically used petroleum-based solvents
  - Dry Cleaner no longer present – Physical Evidence
    - Look for evidence of historical features such as laundry sumps, boiler rooms, floor staining bolting pattern in floor or piping structures in ceiling area.
    - Delivery doors where clothes were brought into space.
    - Drum ring stains around space.

Site Assessment Activities

- **Limited Site Assessment**
  - Baseline Assessments of Phase II ESAs
  - Limited soil sampling through push probes, hand augers and/or coring machines
  - Groundwater samples from temporary groundwater monitoring wells or open soil borings
  - Test for target list of compounds
    - PERC dry cleaner includes PCE, TCE, cis- and trans-1,2-DCE, 1,1-DCE and Vinyl Chloride. Possibly included expanded VOC list looking for other compounds.
    - Stoddard Solvents include VOC and Total Petroleum Hydrocarbons

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
  - Experimental Technologies
    - Co-solvent extraction
  - Reactive Barrier Walls (e.g., ZVI)

States with Dry Cleaner Regulatory Programs

- Alabama (Chtr 287-1-1)
- Conn (CGS Sect 12-263M)
- Florida (Chtr 376, Sect 3078)
- Kansas (Chtr 65-34,141)
- Illinois (PA 101-400)
- Minnesota (p-f2-01c)
- Missouri (Sundown)
- North Carolina (15A NCAC 02S)
- Oregon (ORS 465.500)
- South Carolina (Reg 61-33)
- Tennessee (Rule 0400-15-03)
- Texas (30 TAC 337)
- Wisconsin (Chtr 292.65)

State Dry Cleaner Programs

While the formal programs in SCRD member-states vary, most consist of:

- A fee or tax mechanism that funds drycleaner site cleanup.
  - annual registration fees;
  - fees on dry cleaning solvent; and/or
  - collect gross receipts taxes.
- Eligibility requirements for funding assistance.
- Prioritizing drycleaner sites for funded cleanups.
- Regulations for implementing the program, usually on a state-lead or reimbursement basis.
- All States with dry cleaner programs have regulatory authorities.

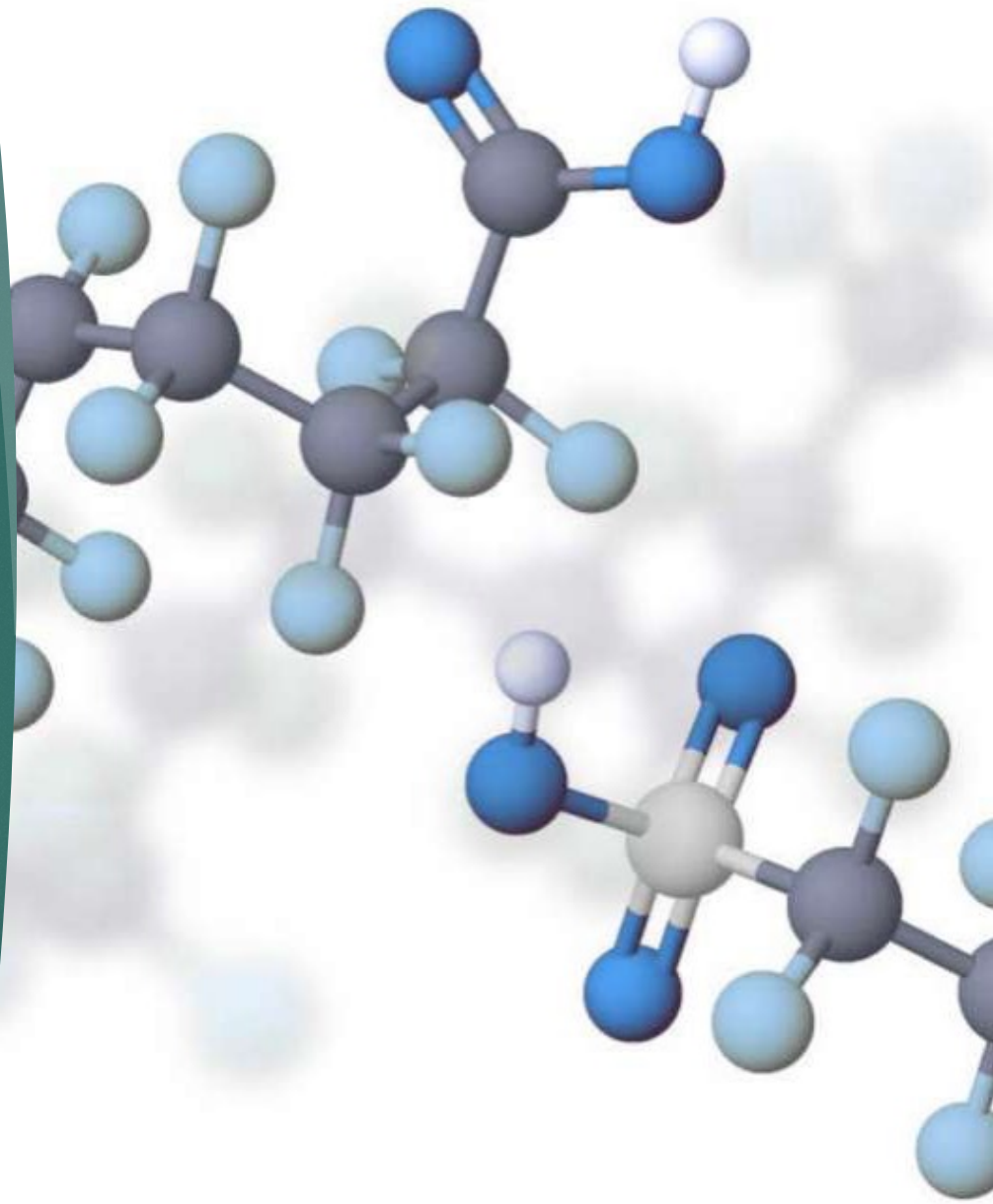
State Dry Cleaner Programs

- Major benefits offered to drycleaner participants in these programs are some level of liability protection and funds for cleaning up their sites.
- Most of programs require pollution prevention/ best management practices to reduce or eliminate future releases.

Emerging Contaminants

Florida DEP's Waste Cleanup Program Study regarding PFAS with dry cleaner.

- 15 dry cleaning facilities eligible for state funded cleanup to investigate Per-and polyfluoroalkyl substances (PFAS).
- PFAS was not typically used by the dry-cleaning industry;
- Some cleaners may have applied water resistant coating on fabrics that contained PFAS compounds.



PFAS Prevalence

The Florida PFAS study evaluated both virgin and spent dry cleaning products.

- Virgin cleaning products at 2 out of 7 facilities contained detectable concentrations of PFAS.
- Some virgin dry cleaning products contain PFAS.
- PFAS were detected in dry cleaning wastes (spent solvents, solids, filters) in 6 out of 7 facilities. PFAS compounds on treated fabrics may come off the fabrics during the cleaning process.

These compounds have been phased out years ago; however, the effects will continue for a while.

PFAS Prevalence

The Florida study went even further and evaluated PFAS in virgin and spent products.

- One out of 4 laundry detergents contained PFAS.
- PFAS were detected in every wastewater discharge sample analyzed.
- PFAS likely from treated clothing.

It should be noted that PFAS were detected at low concentrations in the incoming potable water at most of these facilities.

Summary

- Pre-1950s likely used petroleum or Stoddard solvent
- 1950s through present likely used PERC
- Potential source areas may include:
  - Dry cleaning machines
  - Laundry sumps
  - Boiler rooms
  - Filter and waste storage areas
  - Lint traps
- State Dry Cleaner programs available for facility owner and landowner participation

QUESTIONS

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THANK YOU

To learn more:

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