History of DC Solvents

- Petroleum Solvents
  - 140°F Solvent
  - Stoddard
  - DF 2000
- TCE & Carbon Tet
- PERC
- TCA, CFC-113, HCFC's
- New Solvents

### Physical Properties

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Molecular Weight</th>
<th>Boiling Point (°F)</th>
<th>Flash Point (°F)</th>
<th>Latent Heat of Vaporization</th>
<th>Kauri Butanol Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERC</td>
<td>165.8</td>
<td>280</td>
<td>***</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Stoddard</td>
<td>140-150</td>
<td>310</td>
<td>163</td>
<td>110</td>
<td>28-45</td>
</tr>
<tr>
<td>CFC 113</td>
<td>187.5</td>
<td>138</td>
<td>***</td>
<td>0.3</td>
<td>31</td>
</tr>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>***</td>
<td>145</td>
<td>***</td>
<td>104</td>
<td>124</td>
</tr>
<tr>
<td>DF-2000</td>
<td>140</td>
<td>200</td>
<td>147</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>
PERC Properties

- Physical
- Chemical

\[ \text{Cl} - \text{C} - \text{Cl} \]
\[ \text{Cl} - \text{C} - \text{Cl} \]

Tetrachloroethylenne

---

PERC Usage In California

Total Usage (1992)
1,870,000 gal/yr

Dry Cleaning Usage
60% of all usage

ATCM Reduction
78% expected
PERC Usage In California

Health Effects of PERC

• Perc is a HAP
• Chronic & Acute Exposure
• Health Risks From Dry Cleaning

What is a TAC?

“An air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness” HSC 39655 (a)
Air Toxics Program History

- PERC Identified Through A Formal Public Process in 1993
  - OEHHA Evaluation
  - ARB Evaluation
- HAP Listing

PERC Exposure Thresholds

<table>
<thead>
<tr>
<th>Type of Limit</th>
<th>(ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>State OSHA PEL</td>
<td>25</td>
</tr>
<tr>
<td>Federal OSHA PEL</td>
<td>100</td>
</tr>
<tr>
<td>Federal OSHA Ceiling</td>
<td>200</td>
</tr>
<tr>
<td>State OSHA Ceiling</td>
<td>300</td>
</tr>
<tr>
<td>Federal OSHA Peak</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Potential Health Effects From PERC Dry Cleaning

- Health Risks
- Individual Cancer Risk
- Non-Cancer Risk
- Non-Cancer Health Effects
The Dry Cleaning Process

- Wash Cycle
- Extraction Cycle
- Drying Cycle
- Cool Down Cycle

Dry Cleaning Equipment and Operations

- Types Of Dry Cleaning Machines
- Machine Requirements Of MACT
- Major Dry Cleaning Components
- Primary, Secondary, and Fugitive Controls

Equipment Evolution

- Machine Generations:
  1st: Transfer Machines
  2nd: Dry-To-Dry Vented
  3rd: Dry-To-Dry Nonvented
  4th: Refrigerated and Carbon Adsorber
  5th: Secondary Control w/Drum Monitor
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Refrigerated Condensers

Water Separators

SOLVENT/WATER MIXTURE FROM CONDENSER

WASTE WATER

AIR SPACE

SOLVENT TO STORAGE TANK

VENT TO MACHINE

SOLVENT/WATER MIXTURE FROM CONDENSER

WASTE WATER

AIR SPACE

SOLVENT TO STORAGE TANK

VENT TO MACHINE

Water Separators
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Solvent Filtration

- Purpose
- Pre Filters
- Cartridge Filtration
- Disk Filtration
- Regenerative or Flex-Tube Filters

Pre-lint filter
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- Cartridge Filters
- Torpedos
- Spin Disk Filter
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Button Traps

Button Trap
Stills

- Distillation
- PERC Recovery
- 75% Capacity
- Muck Cookers
- Hazardous waste
- Azeotrope

Common Leak Points

Secondary Control Devices

- Vapor Adsorbers
- During End Of Cool Down Cycle
- Decreases Emissions
- Lowers Operator Exposure
**Misc. Equipment & Operations**

- Water Separators
- Inductive Door Fans
- Spill Containment Systems
- Ventilation/Exhaust Systems
- Drying Cabinet
- Water Repelling Operations

**Floor to Ceiling Around Machine**

**Vapor Barrier Curtain**
Waste Water Treatment Units

- What are They?
- Why Use One?
- How Do They Work?
- What Types Are There?
Emissions From Dry Cleaners

• Door Fan Emissions

Federal Air Regulations

• National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities
  40 CFR 63 Subpart M
• Standards of Performance for Petroleum Drycleaners
  40 CFR 60 Subpart JJJ

40 CFR 63 Subpart M
Dry Cleaning MACT

• Applicability
• Standards
• Monitoring
• Reporting
• Recordkeeping
**Applicability**

- Dry Cleaning systems using PERC
- Many construction, reconstruction and installation dates in regulation but only a few matter

**Applicability Dates**

- Transfer machines banned as of July 28, 2008
- Small area source dry to dry installed prior to or after 12/9/91 have different control requirements
- All other sources should already be in compliance with regulation

**Applicability Source Classification**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Perc purchases (gallon/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Area</td>
<td>Less than 140</td>
</tr>
<tr>
<td>Large Area</td>
<td>140-2100</td>
</tr>
<tr>
<td>Major</td>
<td>Greater than 2100</td>
</tr>
</tbody>
</table>

Annual Perc purchases calculated on a 12 month rolling total
**Applicability**

- Comply with new requirements within 180 days of moving up in classification
- Coin-ops exempt
- Area sources not subject to Title V unless major for something else

**Standards**

**All Source Classifications**

- Dry to dry installed after 9/22/93 need refrigerated condenser.
- Dry to dry installed between 12/9/91 and 9/22/93 need refrigerated condenser or carbon absorber.
- Small area dry to dry installed prior to 12/9/91 need NO control

- Close door immediately after transferring articles and keep closed at all other times
- Maintain equipment according to manufacturers specs and recommendations
- Drain all cartridge filters in sealed container for 24 hours or equiv. before removing from facility
**Standards**

**All Source Classifications**

- Store all PCE and PCE wastes in containers with no perceptible leaks

- Weekly (biweekly for small area) inspection for perceptible leaks while operating for: hose and pipe connections and valves, door gaskets, filter gaskets, pumps, solvent tanks and containers, water separators, muck cookers, stills, exhaust dampers, diverter valves, filter housings

- Monthly vapor leak monitoring for all components while operating.
- Area sources may use halogenated hydrocarbon detector or PCE gas analyzer.
- Majors must use PCE gas analyzer and EPA Method 21.
Standards
All Source Classifications

• Repair all perceptible or monitored leaks within 24 hours of detection.
• If repair parts need to be ordered, order within 2 working days and install within 5 working days of receipt

Standards
All Source Classifications

• Perceptible Leak – Leak detected by odor, sight, or feel.
• Monitored Leak – Instrument that alarms or shows perc values of 25ppm

Standards
Major Sources

• Pass perc vapor from inside machine through a carbon absorber immediately before or as the door of the machine is opened
Standards
Refrigerated Condensers

• Operate to not vent perc vapor stream to atmosphere while drum is rotating
• Prevent air drawn into machine when door is open from passing through condenser

Standards
Refrigerated Condensers

• Monitor weekly at outlet side of condenser before end of cool-down or drying cycle with temperature sensor to determine if temp is equal or less than 45 degree F.
• Can also monitor pressures of refrigeration system

Standards
Carbon Absorbers

• Operate to not vent perc vapor stream to atmosphere at any time
• Weekly monitoring with colorimetric detector tube or PCE gas analyzer
• For 91-93 machines and absorbers used immediately upon opening of doors, limit is 100 ppm at absorber outlet
### Standards

**Carbon Absorbers**

- For machines that pass vapor through absorber prior to opening door, limit is 300 ppm at a location above clothes at the rear of the drum immediately upon opening door.

### Standards

**Control Equipment Repairs**

- For monitored parameters not meeting limits, adjustments or repairs shall be made to meet limits
- If repair parts are needed, they must be ordered within 2 working days and installed within 5 working days of receipt.

### Standards

**Co-Location with Residential**

- Residential means dwellings other than short term such as hotels, whether occupied or not
- Systems installed after 12/21/2005 cannot use perc
- All other perc systems must be removed by 12/21/2020
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**Reporting**

- Initial Notification report
- Notification of compliance status
- Notice of exceeding consumption limit

**Recordkeeping**

- Perc purchases and 12 month rolling total purchases
- Inspection log
- Leaking equipment and repair log
- Control equipment monitoring log
- Keep for 5 years
- Keep design specs and operating manuals onsite

**40 CFR 60 Subpart JJJ Petroleum NSPS**

- Applicability
- Standards
- Monitoring
- Recordkeeping
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Applicability

- Petroleum dry cleaning plants with total manufacturer's rated dryer capacity equal to or greater than 84 pounds

Standards

- All dryers shall be solvent recovery dryers
- Dryers shall be properly installed, operated and maintained

- Cartridge filters shall be drained for 8 hours prior to removal
- Manufacturers must provide leak inspection and repair procedures and recommend inspections every 15 days
Standards

- Perform initial performance test to demonstrate that recovery rate of solvent at end of cycle is no greater than 0.05 liters per minute

Recordkeeping

- Keep record of initial performance test

Other Regulatory Requirements

- Transferring - Contaminated Waste
- Transferring Lint & Used Cartridge
- Storing Waste
- RCRA
- Wastewater
New Technologies

- Wet Cleaning
- Liquid CO₂
- Ultrasonic
- New Solvents

Exhibit 2-3: Simplified Process Flow Diagram for Machine Wetcleaning

Liquid Carbon Dioxide

- LCO₂
- Jet Agitation
- High Pressure (1000 psi)
Ultrasonic Cleaning

• Aqueous Based
• Surfactants and Detergents
• Electrical Pulses
  Dislodges
  Insoluble Particles
• Temp. 90-122°F
• Research Since 1993

Alternative Solvents

• Silicone-Based (Green Earth)
• Glycol Ether (Rynex) and others

Silicone-based Solvent

• Advantages:
  – Not Regulated as a Toxic, Non VOC
  – High Flash Point (170°F)
  – Safe For Delicate Garments
  – No Permitting Required

• Disadvantages:
  – Does Not Clean As Well As Perc
  – Problems With Water Separation
  – Requires A Modified Hydrocarbon Machine

Electrical Pulses

Insoluble Particles

Problems With Water Separation
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**Glycol Ether Solvent**

- **Advantages:**
  - Not Regulated as a Toxic
  - Excellent For Water Soluble
  - High Flash Point (>200 F)

- **Disadvantages:**
  - Standard D2D Machine Requires A $20,000 Conversion Kit
  - Does Not Clean All Garments Well

**Other Alternative Solvents**

- ExxonMobil DF-2000®: synthetic hydrocarbon, CAS 64742-48-9
- Chevron Philips EcoSolv®: highly refined hydrocarbon, CAS 68551-17-7
- Sasol (LPA-142)®: highly refined hydrocarbon, CAS 64742-47-8
- SolvonK4™: dibutoxymethane, CAS 2568-90-3, by Kreussler
- DC-142®: aliphatic hydrocarbon solvent, CAS 64742-88-7, by Essential Solvents

**Inspection of The Facility**

- **What Will the Inspector Have?**
  - Permits and Inspection Forms
  - Complaint History
  - Safety Equipment
  - Monitoring Equip.
Inspector's Thoughts
Entering Facility

- Do I Smell PERC?
- Is The Shop Clean?
- Is The PTO Visible?
- “Wall to Wall”
- Trained Operator Present?

The Inspection

- Verify Equipment and Current Owners
- Conduct Leak Inspections
- Check For Closed Containers
- Verify Refrigerated Condenser Temp
- Check All Records
- Review The Inspection Results

What Records Should The Inspector Ask To See?

- Operations & Maintenance Log
- Weekly Leak Inspection Log
- PERC Purchase Receipts
- Hazardous Waste Manifests
- Permit To Operate
What About Violations?

- Notice Of Violation (NOV)
  - Emissions Related
  - Same Problem At Last Inspection

What About Violations?

- Notice To Comply (NTC)
  - Minor Deficiency
  - Non-Emissions Related
  - Non-Recurring

Notice Of Violation

- Purchased Too Much PERC
- No Hydrocarbon Detector On-Site
- Missing Or Incomplete Records To Determine PERC Usage
- Open Container With PERC In It
- Same Violation As Last Inspection
Notice To Comply

• Incomplete Records
• Recently Expired Certificate
• Ownership Change Without Notifying The AQMD
• Some Records Missing (If Not Emissions Related)

Vapor Leak Inspections

• Definitions
• Halogenated Hydrocarbon Detector
• Areas To Check
• When To Check
• How Do You Do It?
• If a Leak is Found?

Vapor Leak Inspections

• Check Halogen Detector
• Tip Within 1 cm
• Slow & Direct
• Check All Openings & Gaskets
• Check Machine While Running
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Summary of Components Most Likely to Leak

<table>
<thead>
<tr>
<th>Component</th>
<th>Typical ppm</th>
<th>Leaks Found %</th>
<th>Reason for leak</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading Door</td>
<td>10-35</td>
<td>55%</td>
<td>Gasket</td>
<td>1st</td>
</tr>
<tr>
<td>Still</td>
<td>300</td>
<td>33%</td>
<td>Cover &amp; Sight Glass</td>
<td>2nd</td>
</tr>
<tr>
<td>Lint Trap</td>
<td>120</td>
<td>25%</td>
<td>General &amp; Gasket</td>
<td>3rd</td>
</tr>
<tr>
<td>Button Trap</td>
<td>20</td>
<td>14%</td>
<td>General &amp; Gasket</td>
<td>4th</td>
</tr>
<tr>
<td>Water Separator</td>
<td>10</td>
<td>12%</td>
<td>Not Specified</td>
<td>5th</td>
</tr>
<tr>
<td>All Others</td>
<td>Varies</td>
<td>&lt;5%</td>
<td>Not Specified</td>
<td>6th-14th</td>
</tr>
</tbody>
</table>

Vapor Leak Inspections

What Happens When a Leak Is Found?

- Fix Component
- Order Parts
- Installing Parts
- Extensions
Now, For The Exam And The Field Visit