NACT 287 – Dry Cleaning

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>250</td>
<td>***</td>
<td>90</td>
<td>92</td>
</tr>
<tr>
<td>Stoddard</td>
<td>140-150</td>
<td>310</td>
<td>103</td>
<td>118</td>
<td>28-45</td>
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<tr>
<td>CFC-113</td>
<td>187.5</td>
<td>118</td>
<td>***</td>
<td>63</td>
<td>31</td>
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<tr>
<td>1-1-1, Trich.</td>
<td>***</td>
<td>165</td>
<td>***</td>
<td>104</td>
<td>124</td>
</tr>
<tr>
<td>DF-2000</td>
<td>140</td>
<td>***</td>
<td>147</td>
<td>***</td>
<td>27</td>
</tr>
</tbody>
</table>

### PERC Properties

- Physical
- Chemical

![Tetrachloroethylene](image)
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

PERC, in million Kg

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>“</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
Refrigerated Condensers

Water Separators

- SOLVENT/WATER MIXTURE FROM CONDENSER
- WASTE WATER
- AIR SPACE
- VENT TO MACHINE
- SOLVENT TO STORAGE TANK
- SOLVENT
Water Separators
Solvent Filtration

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

Pre-lint filter
Cartridge Filters

Torpedos
Spin Disk Filter
Button Traps
Stills

- Distillation
- PERC Recovery
- Muck Cookers
- Hazardous waste
- Azeotrope
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
- Fugitive 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 (i.e. pollution prevention activities)
- 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. Major sources also need carbon adsorber.
• Dry to dry installed between 12/9/91 and 9/22/93 need refrigerated condenser or carbon adsorber.
• Small area dry to dry installed prior to 12/9/91 need NO additional control

Standards
All Source Classifications

• 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
Standards
All Source Classifications

• 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 adsorber 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 Adsorbers

• 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 adsorbers used immediately upon opening of doors, limit is 100 ppm at adsorber outlet

Standards Carbon Adsorbers

• For machines that pass vapor through adsorber 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.


• All other perc systems must be removed by 12/21/2020.
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

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

Standards

- 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 Cartridges
- Storing Waste
- RCRA
- Wastewater

New Technologies

- Wet Cleaning
- Liquid CO₂
- Ultrasonic
- New Solvents
Liquid Carbon Dioxide

- LCO$_2$
- 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

**Glycol Ether Solvent**

- **Advantages:**
  - Not Regulated as a Toxic
  - Excellent For Water Soluble Stains
  - 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

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