Alternatives to Perchloroethylene In Garment Care

NEWMOA
Regional Multi-Program Meeting on Promoting Safer Garment Cleaning
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What is Perc and Why is it a Problem?
Able to dissolve most organic materials, perchloroethylene (PCE or perc) is the most widely used dry cleaning solvent in Massachusetts and nationally. A typical dry cleaning machine...

Though perc machines have improved emissions over time, there is still exposure to workers and even co-located residences and clothes taken home.
Short and long term health effects linked to use of perc include:

- Dizziness, confusion
- Damage to liver & kidneys
- Neurotoxicity
- Reproductive toxicity
- Developmental toxicity
- Cancer

Misuse of perc can lead to soil and groundwater contamination.

75% of drycleaner sites in the US are contaminated.

Many are Superfund sites.

Alternatives Studied

- Wet cleaning
- CO₂
- High flash point hydrocarbons
- Acetals
- Propylene-glycol ethers
- Volatile methyl siloxanes
- n-Propyl bromide
### Key Criteria: 1st set

#### Technical/Performance
- Cycle time and load capacity
- Difficult materials
- Pretreatment and finishing requirements

#### Economic
- Equipment costs
- Chemical costs
- Energy costs

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**Key Assessment Criteria**

<table>
<thead>
<tr>
<th>Category</th>
<th>Perox</th>
<th>Water</th>
<th>Cycle</th>
<th>Hydro</th>
<th>Aqueous</th>
<th>Solvol</th>
<th>Silvone</th>
<th>Glycol polyester</th>
<th>Propylene oxide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical/Performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle time (min)</td>
<td>45</td>
<td>20-80</td>
<td>35-65</td>
<td>60-75</td>
<td>60-65</td>
<td>&gt;45</td>
<td>53-58</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Load capacity (lb)</td>
<td>50</td>
<td>20-75</td>
<td>70</td>
<td>35-90</td>
<td>40-60</td>
<td>43</td>
<td>55</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

| **Materials system may have difficulty with** | Leather, suede, | Leather, suede and for | Triacetate, | Vinal, polyester | Applicates or decorations glued to | None identified | None identified | Leather, suede, | Leather, suede, |
|                                               | delicate        | delicate             | specially dyed | textile             | fabric                          |                  |                  | delicate         | delicate        |

| **Spooling requirements** | Moderate | Low | High | Moderate | Low | Low | High | Low |

| **Equipment** | $40,000 - 60,000 | $36,000 - 50,000 | $30,000 - >$30,000 | $38,000 - $75,000 | $50,000 - >$80,000 | $56,000 | $30,500 - $55,000 | $48,000 - >$65,000 |

| **Chemical cost per gallon** | $3.08 | $2.03 | $2.03 | $2.03 | $2.03 | $2.03 | $2.03 | $2.03 |

| **Electricity usage** (kWh/100 lb) | 26.6 | 9.3 | 10.9 | 10.9 | 10.9 | 10.9 | 12.3 | 12.3 |

| **Typical cost per pound cleaned** | $0.69 - $1.94 | $0.57 - $1.32 | $0.63 - $1.94 | $0.63- $1.94 | $0.63- $1.94 | $0.63- $1.94 | $0.63- $1.94 | $0.63- $1.94 |
Are Alternatives Effective and Affordable?

**All** options are technically feasible
Some may have impact on throughput
Some have limitations on the fabrics they can handle

**Most** options are affordable
CO$_2$-based options not economically feasible (for majority of smaller MA shops)

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Key Criteria – 2$^{nd}$ set

**Environmental**
- Persistence
- Bioaccumulation
- Aquatic Toxicity

**Health and Safety**
- Exposure limits
- CNS effects
- Carcinogenicity
- Repro/developmental toxicity
- Flammability
Are the Alternatives Safer than Perc?

**All** are less persistent; HC and Siloxanes are more bioaccumulative and toxic in aquatic environment.

**Most** are safer to humans ...  **EXCEPT** ...
- nPB is carcinogenic, reproductive toxic and neurotoxic – **NOT** a safer alternative
- **Data gaps** present concern for alternatives that are new to the market (e.g., Solvon K4 acetals)
Key Criteria – 3rd set: Applicable Regulations

Hazardous Air Pollutants

Designated VOCs

Massachusetts regulations
- Listed toxics under TURA
- Environmental Results Program

Hazardous waste disposal issues

Wastewater discharge restrictions

<table>
<thead>
<tr>
<th>Key Assessment Criteria</th>
<th>Perc.</th>
<th>Water</th>
<th>Carbon Disodde</th>
<th>Fluorinated Ingredients</th>
<th>Acetal</th>
<th>Aromatic Alcohols</th>
<th>Propylene Glycol</th>
<th>Siloxane</th>
<th>Silicone</th>
<th>Ethylene Glycol</th>
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</thead>
<tbody>
<tr>
<td>Clean Air Act</td>
<td>Yes, HAP</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Hazardous Air Pollutant (HAP)</td>
<td>No, Exempt</td>
<td>No, HAP</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Clean Air Act, NACOS VOC</td>
<td>Yes, HAP</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Massachusetts regulated (TURA, ERD)</td>
<td>Yes, Listed hazardous waste</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Hazardous waste disposal required</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Wastewater discharge restrictions</td>
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<td>Discharge to sewer or holding tank</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
### Are the Alternatives More Regulated than Perc?

| **Most** options are combustible or flammable, requiring additional control for safety |
| **Several** options are VOCs |
| **Most** options involve industrial waste disposal, though not hazardous waste disposal |
| **Wet Cleaning** poses issues for facilities on septic |
| **nPB** newly regulated under TURA and now... HHS is coming! |

### Have you seen something like this…

![Image of signs promoting non-toxic cleaning products]

- **GreenEarth Cleaners**: Non-toxic, Environmentally Friendly
- **Bush Quality Cleaners**: Non-toxic, Express Service
- **Organic Dry Cleaners**: Non-toxic, Organic Ingredients

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“Green Washing: Site Visit Data Summary

35 Cleaners visited

13 did not have “green” claims
- Drop store (1)
- Green Earth (8)
- Solvon K4 (3)
- Hydrocarbon (1)

22 did have “green” claims
- Drop store (2)
- Green Earth (13)
- Solvon K4 (5)
- Hydrocarbon & Wet Cleaning (2)

Wet Cleaning and CO2 are considered the most environmentally friendly options. Wet Cleaning technology is the more affordable of the two.

Washer and dryer use biodegradable detergents, and conditioners

Finishing equipment re-shapes and dries the slightly damp clothes
MA Conversions to Wet Cleaning

From 2008 through 2014 TURI has given 10 grants to dry cleaners to eliminate the use of perc and switch to dedicated professional wet cleaning

- Cleaners save money on solvent, waste, water, and electricity
- Cleaners are fully satisfied with the process and product; there is less regulatory oversight and risk of contamination
- The work environment is greatly improved
- Customers are very pleased with quality

KMK Cleaners in Walpole Creates Healthier Workplace

- 40% reduction in electricity costs
- Greater than 50% drop in water use
- Saving about $1,500 per month in operating costs

“As a family run business, we’ve been interested in getting away from perc for quite a while, and professional wet cleaning was the right answer. It makes the shop a healthier place for my Dad and me, our employees, and for future generations.” – Kristy Mead, Manager KMK Cleaners
AB Cleaners in Westwood Creates Safer Work Environment with Improved Quality

- Reduced electric use by almost 30%
- Reduced water use by over 50%
- Saving over $400 per month in operating costs

“We knew that perc was not good for us. I was concerned for the health of my pregnant wife and baby and also for my employees. With wet cleaning, there has been a huge improvement in the way the air smells and the clothes come out cleaner without any shrinkage or the feel of chemicals.” – Joon Han, owner of AB Cleaners

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