

## Dry cleaner alternatives to reduce waste and emissions

This fact sheet provides an overview of improved operating techniques, perchloroethylene equipment upgrades and alternative cleaning systems that help cut costs by reducing perc use.

When perchloroethylene (perc), a commonly used solvent in the dry cleaning industry, is used, it is released into the environment from clothes transfer, waste removal, and fugitive or uncontrolled emissions. Employee exposure to perc should be carefully monitored, as perc is a suspected carcinogen that has been associated with dizziness, confusion, headache, nausea, and eye irritation. Overexposure may cause central nervous system and liver disorders.

The Minnesota Occupational Safety and Health Administration (OSHA) limits employee exposure to perc to 25 ppm during an eight hour period. Perc is also listed as a hazardous air pollutant under the Clean Air Act and its use at dry cleaning facilities is regulated by the National Emission Standard for Hazardous Air Pollutants (NESHAP). Some local hazardous waste rules may also regulate it.

Reducing or eliminating perc use will lower employee exposure and reduce regulatory requirements. Additional benefits include:

- Cost savings on perc purchase and disposal
- Minimized potential for property contamination
- Greater environmental protection
- Reduced liability

Opportunities for reducing or eliminating perc use include:

- Improved operating and maintenance practices
- Equipment upgrades for greater efficiency
- Alternative cleaning systems

### Operating and Maintenance Practices

Proper employee training is critical for using dry cleaning chemicals and equipment efficiently. Dry cleaning equipment runs most efficiently when operated and maintained according to manufacturer specifications.

Operating and maintenance practices fall into four categories: 1) the machine itself, 2) auxiliary equipment, 3) control devices, and 4) general housekeeping. The NESHAP requires pieces from all four categories to be checked for leaks. Beginning July 28, 2008, a halogenated hydrocarbon detector or a perc gas analyzer may be used monthly to detect leaks in addition to weekly perceptible leak detections. Dry cleaners should always consult operating manuals and service companies for specific recommendations for the machines and their control devices.

### Machine Maintenance

Regular machine maintenance procedures include checking for leaks around door seals and gaskets, hose connections, pipe fittings, exhaust dampers, ductwork, lint trap lids, and water separators. Certain component parts should be cleaned regularly including condensing coils, strainers, and lint bags.

### Auxiliary Equipment

Auxiliary equipment includes filters, water separators, and distillation units. Regularly clean and change filters, and clean the perc/water separator tank and steam/condensation coils if necessary. Correctly adjust the perc/water separator and check seals, gaskets, and vents for leaks. Solvent containment troughs are a safety measure for both new and existing machines. The machine sits in the trough, which is designed to capture solvent spilled when adding solvent to or cleaning the still, or from a broken fitting or leaking tank on the machine. Transferring perc directly from truck to machine via hose fittings also will help prevent spills, leaks, and fugitive emissions.

### Control Devices

Control devices include external refrigerated condensers and carbon adsorbers. For these devices, lint filters should be cleaned daily, and lint should be removed monthly from refrigerated condenser coils. Check for leaks

regularly around gaskets, seals, valves, and ductwork. Desorb carbon adsorbers daily to keep them effective at removing perc from exhaust vents. Over time, the carbon does not desorb as effectively and needs to be replaced in the unit. Measure exhaust-air perc concentrations weekly. Take temperature or pressure measurements weekly on refrigerated condenser units and on exhaust for machines to ensure that units are operating optimally. Many of these activities are required under the NESHAP.

## General Housekeeping

General housekeeping practices include keeping lids on all containers, properly labeling all perc and waste containers, keeping machine doors and traps closed, sizing garment-loads correctly, and using spigots, pumps, and funnels when transferring perc and waste materials. Many of these practices are required under the NESHAP and hazardous waste rules.

## Perc Equipment Upgrades

Dry cleaners using perc should consider upgrading to more-efficient equipment to significantly reduce perc loss. Perc costs rose to \$28.70 per gallon in 2007 including taxes and fees, some of which are designed to discourage perc use. Facilities constructed or reconstructed on or after December 21, 2005 must use a closed loop dry-to-dry machine with a refrigerated condenser followed by a carbon adsorber operated immediately before the door is opened.

## Dry-to-Dry Machines

The newest dry-to-dry machines are equipped with a refrigerated condenser, which is efficient at recovering perc and recycling it back through the machine. The new, tightly sealed machine design also significantly reduces fugitive emissions. Perc recovery from waste is increased with the new spin-filter design or disc filtration. This results in less waste generated, lower perc emissions from waste removal, reduced operator exposure to perc, less overall perc loss, and lower disposal costs.

Emission-free stills from new machines dramatically reduce perc in sludge and lower operator exposure to perc fumes. With this system, the sludge is pumped from the still to a waste barrel with fumes vented back into the cleaning machine. New machines are equipped with a perc drying sensor that monitors perc concentrations in the clothes by sensing perc returning from the condenser during drying. When properly programmed, it prevents shortened cycling loads which release perc to the atmosphere, and reduces operator exposure to excess vapors.

## Refrigerated Condensers

If purchasing a new refrigerated dry-to-dry machine is not cost effective, an external refrigerated condenser can be added to a non-refrigerated dry-to-dry machine. It may be required to meet the NESHAP and OSHA standards. Refrigerated condensers cost about \$10,000 installed, compared to a new dry-to-dry machine that starts at \$30,000 installed for a 30-pound capacity machine.

## Carbon Adsorption Units

Carbon adsorption units may be added to refrigerated dry-to-dry machines to achieve greater perc recovery. Machines with internal refrigerated condensers recover perc efficiently, therefore adding a carbon adsorber may not be cost effective. The old carbon adsorbers, or sniffers, required a high level of maintenance. New carbon units, which desorb with heat after refrigeration, are less costly to operate and do not produce large quantities of contact water from steam use, like sniffers did. Carbon adsorbers may be required to meet the NESHAP standards

## Alternative Cleaning Systems

In any industrial setting, minimizing solvent use will help cut costs, reduce employee exposure, protect the environment, and reduce the burden of environmental regulations. Minimizing perc use to clean garments is a goal for these reasons. Alternatives to solvent cleaning are rapidly gaining acceptance in many types of cleaning applications.

Alternative garment-cleaning systems may not completely replace perc dry cleaning in all cases. However, by using them in combination, reliance on perc can be minimized.

## Aqueous Cleaning

Aqueous or “wet” cleaning uses water and detergents in washing and drying machines with computer controlled temperature and agitation. It has the potential to replace perc cleaning for 80 to 100% of garments. A wide range of garments can be run in the wet cleaning unit, including: wedding gowns, wool suits, silks, cottons, leather and bead-trimmed garments, comforters, and some rayon-acetates.

Aqueous cleaning machines can accommodate most “dry clean only” garments because they reduce agitation during washing, increase water extraction prior to drying, use specifically formulated wet cleaning soaps and spotting agents, and closely monitor heat and moisture content during the drying process. Wet cleaning may be preceded by spotting, steaming, or hand washing techniques.

A wet cleaning system may be operated in tandem with a perc cleaning unit to meet cleaning needs and to help operators gain confidence in the wet system’s cleaning abilities.

New equipment must be purchased to accommodate wet cleaning, and equipment costs are roughly equivalent to perc equipment. Revised care labels and consumer education will improve the acceptance of wet cleaning.

A number of dedicated wet cleaning shops are opening across the country. Most dry cleaning industry analysts agree that wet cleaning is a key piece of the future of professional garment cleaning.

## GreenEarth

GreenEarth is a liquid silicone compound, methyl siloxane, that has a low surface tension allowing quick wetting of fibers. Its density, close to water’s, helps remove insoluble soils with proper mechanical action. Detergents help remove water-soluble soils. Cleaning performance of GreenEarth is

roughly equivalent to perc and it can handle garments that are normally dry cleaned. Capital costs are comparable to a dry-to-dry refrigerated perc machine. GreenEarth solvent costs are \$22.70/gallon in 2007. Labor costs are not significantly different between GreenEarth and perc processing. The slightly higher operating cost for GreenEarth is offset by reduced waste disposal costs and reduced labor in finishing. It also has a flash point of 170°F and is currently not regulated under environmental laws.

### Liquid Carbon Dioxide Cleaning

Carbon dioxide (CO<sub>2</sub>) cleaning is an alternative garment dry cleaning method that uses liquid CO<sub>2</sub> as a cleaning solvent and a gently rotating drum to achieve the mechanical action necessary for soil removal. Liquid CO<sub>2</sub> is nonflammable, non-ozone depleting, and uses an unlimited natural resource. The process does not produce a hazardous waste and associated waste management and disposal problems. Because liquid CO<sub>2</sub> is a nonpolar solvent, cleaning can be accomplished with additives. Tests indicate that this technology effectively removes stains and body odors while reducing color bleeding and graying.

### Hydrocarbon Cleaning

Some dry cleaners are switching to hydrocarbon cleaning, a petroleum based solvent with a mineral spirit base. These non-chlorinated solvents are inexpensive and have been used for many years in dry cleaning applications. Petroleum solvents are incompatible with existing perc equipment and must be carefully handled to prevent explosions. Equipment with a rated dryer capacity of 38 kilograms (84 pounds) or more may have to undergo testing to ensure that it meets a New Source Performance Standard.

Dry Cleaning Fluid 2000 (DF-2000) is a solvent with a flash point above 140°F that provides safe, effective, odorless cleaning. When used with properly designed machines, cleaning processes and additives, DF-2000 can provide cleaning performance comparable to perc. DF-2000 cost \$17.70/gallon in 2007.

### Emerging Technologies

A number of emerging technologies are expected to be available to the dry cleaning industry within the next few years.

- Green Jetwater—based cleaning solutions
- Cold Water Cleaning Systems—water and detergents
- Resolve Dry Cleaning Systems—dipropylene glycol normal butyl ether (DPNB)
- Impress Solvent—propylene glycol ether
- Hydroclene Fluids—a mixture of normal-, iso-, and cyclo-paraffins

## Environmental Certification

Dry cleaners who wish to become a certified environmental dry cleaner through the Drycleaning and Laundry Institute must pay a fee and pass an exam. The certification covers equipment, operating procedures, environmental regulations and proper waste handling. A self-study guide is available to prepare for the exam from the Professional Testing Corporation (see Additional Resources for contact information).

Certified environmental dry cleaners and dry cleaners that have three years of industry experience are eligible to become certified professional environmental dry cleaners. This certification covers business management, customer service, fibers and fabrics, and the dry cleaning process. Certification is good for three years.

## Additional Resources

Find links to additional information about the alternative cleaning systems discussed above in the online version of this fact sheet at <[www.mntap.umn.edu](http://www.mntap.umn.edu)>.

The following resources are available for more information about waste and emission reduction alternatives for dry cleaners.

### Drycleaning and Laundry Institute

Jon Meijer  
301.622.1900 or 800.638.2627  
<[www.ifi.org](http://www.ifi.org)>

### Minnesota Cleaners Association

Michelle Powers  
612.483.9023  
<[www.minnesotadrycleaners.org](http://www.minnesotadrycleaners.org)>

### Minnesota Pollution Control Agency (MPCA) Small Business Environmental Assistance Program

Kim Grosenheider  
651.282.6143 or 651.297.4012 or 800.657.3938  
<[www.pca.state.mn.us/programs/sbap-sectors.html#drycleaners](http://www.pca.state.mn.us/programs/sbap-sectors.html#drycleaners)>

### Minnesota Technical Assistance Program (MnTAP)

Cindy McComas  
612.624.4678 or 800.247.0015  
<[www.mntap.umn.edu](http://www.mntap.umn.edu)>

### Professional Testing Corporation

212.356.0660  
<[www.ptcny.com](http://www.ptcny.com)>



## For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency and reduce costs. Our information resources are available online at <[mntap.umn.edu](http://mntap.umn.edu)>. For personal assistance call MnTAP at 612.624.1300 or 800.247.0015.