

A Cooperative  
Project between  
the U.S. Environmental  
Protection Agency and  
the Garment and  
Textile Care  
Industry

# design FOR THE ENVIRONMENT



EPA 744-K-98-002, June 1998

## Garment and Textile Care Program



### Frequently Asked Questions About Drycleaning

#### 1. Why is EPA interested in drycleaning?

Since 1992, the U.S. Environmental Protection Agency (EPA) Design for the Environment Garment and Textile Care Program has been working in partnership with the drycleaning industry to reduce exposures to perchloroethylene, or "perc," the chemical solvent used by most drycleaners to clean garments and textile products. Approximately 85% of cleaners use perc as their primary solvent. The primary focus of these questions and answers are the potential health and environmental concerns associated with perc.

This document is one of a number of EPA publications about professional garment care. It is hoped that the information presented here will answer questions you may have about drycleaning and related issues.

#### 2. How does drycleaning work?

Despite its name, drycleaning is not totally dry. It involves the use of liquid chemicals called "solvents" that remove most stains from a variety of fabrics. Most drycleaners use perc as their primary solvent. Because the clothes are cleaned in a liquid solution that is mostly perc or some other solvent, with very little water if any, the term "drycleaning" is used to describe the process. There are some differences in the way drycleaners process clothes, but here is how it typically works:

- Drycleaners usually treat spots by hand before placing garments in large machines.
- Liquid solvents, detergents, and sometimes a small amount of water are added to the machines. The machines then agitate clothes in a manner similar to your own washing machine to remove dirt, oil, and stains.
- Once clean, the clothes are either dried in the same machine or transferred manually to a separate dryer, then pressed and shaped.

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- Used solvent is distilled so it can be purified. Distillation separates the solvent from waste residues such as detergents, dye, dirt, oil, so the solvent can be reused. In addition to distillation, most machines also use filters to clean used solvent.
- After the purification process, filters that contain the solvent in very small amounts, and certain solvent residues, such as perc, must be managed and disposed of as hazardous waste. Drycleaners can send them to special facilities for recycling or incineration.

### 3. What is perc?

Perchloroethylene, or Perc, is the dominant chemical solvent used in drycleaning. It is a clear, colorless liquid that has a sharp, sweet odor and evaporates quickly. It is an effective cleaning solvent and is used by most professional drycleaners because it removes stains and dirt from all common types of fabrics. Perc usually does not cause clothes to shrink, nor dyes to bleed. Perc is not flammable, unlike solvents commonly used to clean clothes in the 1930s and 40s. Since perc can be reused, it is a cost-effective and efficient solvent for cleaning clothes. Perc is also a toxic chemical with both human health and environmental concerns.

### 4. What are the human health concerns associated with perc?

The extent of any health effects from perc exposure depends on the amount of perc and how long the exposure lasts. People exposed to high levels of perc, even for brief periods, may experience serious symptoms. Those include dizziness, fatigue, headaches, confusion, nausea, and skin, lung, eye and mucous membrane irritation. Repeated exposure to high levels can also irritate the skin, eyes, nose, and mouth and can cause liver damage and respiratory failure. Perc might cause effects at lower levels as well.

Studies in laboratory animals indicate that exposures to high levels of perc can produce effects on the developing fetus that include altered growth, birth defects, and death. While there have been studies of people who are exposed to high levels of perc, the studies are limited and inconclusive. Scientists have not yet determined whether perc exposures can cause such adverse effects in pregnant women as increased incidence of miscarriage or reproductive effects, affect women's fertility, or affect children born to parents exposed to high levels of perc.

### 5. Can perc cause cancer?

The cancer-causing potential of perc has been extensively investigated. In laboratory studies, perc has been shown to cause cancer in rats and mice when they swallow or inhale it. There is also evidence, from several studies of workers in the laundry and drycleaning industry, suggesting a causal association between perc exposure and elevated risks of certain types of cancer. As with all health effects, the potential for an increased risk of cancer depends on several factors including how much perc exposure there is, how often the exposure occurs, and how long it lasts. Also important is the way the exposure occurs, as well as the individual's overall state of health, age, lifestyle, and family traits.

In 1995, the International Agency for Research on Cancer (IARC), convened a panel of internationally regarded experts who concluded that perc is "probably carcinogenic to humans," based on limited evidence of carcinogenicity in humans and sufficient evidence in animals.

To further understand risks associated with the use of perc, the Agency will be conducting a comprehensive, in-depth health effects assessment of perc through the Agency's Integrated Risk Information System (IRIS) process. IRIS is EPA's electronic on-line database of summary health risk assessment and regulatory information on specific chemicals and was developed to provide consistent risk information for EPA decisions. The comprehensive health effects assessment will be peer reviewed, and the data and conclusions will be available in 1999 or 2000.



## 6. Am I exposed to perc and do I need to worry about it?

We all may be exposed to perc because it is found in the air and drinking water nationwide. Fortunately, the amounts are usually small enough that they are not hazardous to the average person's health. If you work in or live next to a drycleaning facility, you might be exposed to higher levels and may have cause for concern.

## 7. Do I need to worry about wearing drycleaned clothes?

As a consumer of drycleaning services, you may be exposed to levels of perc that are slightly higher than what is normally found in the outdoor air; however, these amounts are not expected to be hazardous to the average person's health. Therefore, it is very unlikely that people will get cancer from having their clothes drycleaned. As with all health effects, the potential for an increased risk of cancer depends on several factors including how much perc exposure there is, how often the exposure occurs, and how long it lasts. Also important is the way the exposure occurs, as well as the individual's overall state of health, age, lifestyle, and family traits.

Professional cleaners remove perc from drycleaned clothes as part of the overall cleaning process. You cannot tell by odor alone whether all the perc has been removed from your clothes. If you think all of the solvent was not removed, or if your newly drycleaned clothes smell like solvent, ask your cleaner to re-process your order or take them to another cleaner for re-cleaning.

## 8. Do people who work in drycleaning shops need to worry about perc exposures?

Based on occupational studies, there is some concern for drycleaning workers because people who work in traditional drycleaning shops are expected to have the highest exposures to perc. This is because they spend a lot of time inside the shops where the perc air levels are usually higher than levels found outside the shops.

There are many factors that influence perc air levels in drycleaning shops and each shop is unique. Perc evaporates quickly and can enter the air of drycleaning shops in many ways:

- From poorly maintained machines;
- Through equipment leaks;
- From perc that is open to the air, such as when liquid solvent is being added to the machines or when there are open drums and tanks containing perc or perc waste materials;
- From clothes that are not completely dry or improperly processed; and
- From clothes being transferred from a washer to a dryer in older "transfer" machines that have separate washers and dryers.

New drycleaning equipment, control technology, and cleaning practices can significantly reduce or eliminate these exposures. For example, "dry-to-dry" machines, which clean and dry garments in a single unit and eliminate the need to transfer wet garments from a washer to a dryer, have replaced many transfer machines and lowered exposures as a result. However, recent reports indicate worker exposures can be high even with new emission control equipment if proper maintenance and operation practices are not followed.

## 9. What about people who live or work in the same building as a drycleaner?

"Co-located" is a term used to describe cleaners that clean clothes on premises and are located in buildings that also house other businesses and/or residences. People who live or work in the same building as a co-located drycleaner can have greater than average exposures to perc. This is because perc vapors can pass through floor, ceiling, and wall materials of the drycleaning shop and into adjacent building space. Perc can also travel outside and re-enter nearby building spaces through holes, vents, and other means. A drycleaner could contaminate the air in neighboring apartments or offices if the cleaner has old equipment, does not properly maintain equipment, or does not follow proper safety procedures.

High perc levels in residences would be of special concern for irritation and other health effects, including a potential for cancer for occupants who are at home a lot and might be exposed to perc for extended periods of time, such as the elderly, young children, or pregnant women. Scientists do not know if perc exposures cause developmental changes in children.

## 10. How does perc pollute the environment?

Perc can get into the air, water and ground during the cleaning, purification, and waste disposal phases of drycleaning. Through recent improvements in equipment and more careful operating practices, perc consumption and losses to the environment are being reduced.

### *Outdoor Air*

Most of the perc used by the drycleaning industry escapes into the outdoor air through open windows, vents, and air-conditioning systems. In older drycleaning systems, perc may still be vented directly to the outdoors as part of the drycleaning process. Fortunately, many drycleaners now use new machines that control or eliminate the amount of perc that escapes during the cleaning process.

Once outdoors, perc can remain in the atmosphere for several weeks, and although small amounts are always in the air, perc itself does not deplete the ozone layer of the atmosphere. After a few weeks, perc breaks down into other chemicals--some of which are toxic, and some of which are suspected to deplete the ozone layer.

### *Ground*

Perc is known to be toxic to plants. It can enter the ground in liquid form through spills, leaky pipes, leaky tanks, machine leaks, and from improperly handled waste. Significant amounts of perc have been found in the waste resulting from drycleaning, which is considered a hazardous waste by the EPA. Most of the solid waste materials, which are filters used during the drycleaning process as well as residual solvent and soils, are picked up by hazardous waste management companies for recycling and/or incineration.

### *Water*

At the end of the cleaning process, the cleaning fluid is separated from waste water by distillation. In the past, the waste water was often poured down floor drains. In newer equipment, the waste water is collected and evaporated or removed by hazardous waste handlers and disposed of through EPA-approved methods.

Perc can seep through the ground and contaminate surface water, groundwater, and potentially drinking water. A small amount of perc can contaminate a large amount of water and people can be exposed by drinking or using the water. EPA has a limit on the amount of perc that is allowed to be in drinking water. Well water can be tested to be sure it is below the EPA standard.

Small amounts of perc in the water have been shown to be toxic to aquatic animals who can store the chemical in their fatty tissues.

## 11. Are there any new cleaning methods that may prove to be environmentally preferable?

Driven by concerns about perc and other drycleaning solvents, recent advances in both technology and garment care have resulted in a sophisticated machine-based process called "wetcleaning" which uses water as the solvent. Wetcleaning is done in specially-designed machines that have to be operated by garment care professionals. While professional cleaners have always employed some form of water-based cleaning methods, often by hand, these historic methods bear little resemblance to the new machine-based wetcleaning process.

Wetcleaning is not the same thing as home laundry and can only be done successfully by trained professional cleaners using the specialized machines and specially-formulated detergents and additives to gently wash and dry clothes. These machines are usually computerized, and like drycleaning machines, can be programmed to control many variables and allow cleaners to customize cleaning for different garments. Wetcleaned garments can require more work to press and specialized labor-saving equipment has been developed to press and finish wet- (or dry-) cleaned garments.



Wetcleaning is appealing from an environmental point of view because the cleaning process is done in a solution of water with a few percent of additives. As with any new technology, there are unanswered questions about the potential environmental impact of wetcleaning, in particular regarding water and energy use. Wetcleaning detergents and additives usually end up going down the drain, and the potential environmental effects of these new products are largely unknown. Certain chemicals traditionally used in detergents may pose concern for aquatic toxicity if they are also found in wetcleaning products.

## 12. What garments can be successfully wetcleaned and where can I get this service?

Properly trained professional cleaners are now able to successfully wetclean most garments that are typically drycleaned. Silks, wool sweaters, linens, suedes and leathers can usually be wetcleaned, sometimes with superior results. Some cleaners offer wetcleaning to their chemically-sensitive customers. An increasing number of commercial cleaners are incorporating wetcleaning into their businesses. This trend is demonstrated by both the dramatically increasing number of machines that wetcleaning machine manufacturers report they have sold in the past few years, and the growth of the number of new wetcleaning products on the market.

For more information about wetcleaning and to get a partial list of cleaners nationwide that offer wetcleaning services, call the Pollution Prevention Information Clearinghouse (PPIC) at (202) 260-1023 and ask for EPA publication called *Wetcleaning* (EPA 744-K-96-002). The most current list of self-identified wetcleaners can be found at the following web site:

<http://www.greenpeaceusa.org/campaigns/toxics/wetlist.html>.

Also available from PPIC is a curriculum for teaching drycleaners how to wetclean: *Training Curriculum for Alternative Clothes Cleaning* (EPA 744-R-97-004a). The manual also contains useful information on fabrics and fibers. Current news and information on wetcleaning can also be found at the following web site:

<http://www.cnt.org/wetcleaning>.

## 13. Are there any other new methods for cleaning clothes?

There are several new technologies on the horizon but only two are commercially available at this time: wetcleaning and a synthetic petroleum solvent process. The new petroleum solvent process has a reduced potential for fire hazards and is currently being used by some drycleaners. Even with the new process changes, some local fire codes still restrict or prohibit the use of these solvents because they are considered a fire hazard.

EPA hopes that in the near future, professional cleaners will have a wide range of environmentally-preferable cleaning processes to choose from. There are a number of new processes at different stages of development, such as:

- Cleaning processes based on liquid carbon dioxide are being tested and show promise as environmentally sound cleaning systems. This innovative process has been recognized for pollution prevention achievements by both the prestigious Presidential Green Chemistry Challenge and the R&D 100 Awards Programs.
- A process based on glycol ethers is currently in the development and testing stage.
- A water-based process using ultrasonic energy is under development.
- Several other new solvents are also being developed.

## 14. What can I do to help reduce environmental and health risks from drycleaning?

The most important thing you can do is to choose a high quality cleaner who acts responsibly toward the environment. Most professional drycleaners are experts in fabric care and are already familiar with these issues. They will be able to advise you on whether or not your garments can be successfully cleaned in new cleaning processes. Some specific things you can do include:

- Know what you are buying. Learn about cleaning processes and know what options are available to you from your local professional cleaners.
- Ask your cleaner about her/his cleaning methods, safety and maintenance practices, and how s/he handles her/his solvent waste streams.
- Bring your clothes to a professional cleaner who carefully follows safety requirements, and properly maintains her/his cleaning equipment.
- If your professional cleaner offers the new machine wetcleaning process as an option, consider asking your cleaner to wetclean your clothes.
- Help your cleaner determine the best way to clean your clothes by telling her/him how they were soiled (e.g., food, ink, make-up), and by giving her/him the fabric content information off the care labels if you remove the labels for any reason.
- If you smell solvent when you enter a cleaning shop, you might want to consider going somewhere else as solvent odors can indicate improper processing or solvent use.
- If you think all of the solvent was not removed, or if your newly drycleaned clothes smell like solvent, ask your cleaner to re-process your order or take them to another cleaner for re-cleaning.

### 15. What are drycleaners doing to reduce environmental and health risks from drycleaning?

The approximately 30,000 drycleaners in the United States share the public's concerns about risk to the environment and human health from exposure to cleaning solvents. Many professional cleaners have taken significant steps to reduce releases. A chemical industry survey reports that in the past 10 years, drycleaners have reduced their use of perc by more than 60%. Most of this was accomplished through the replacement of old perc equipment with machines designed to reduce perc vapors going into the air, and better waste management.

Increasing numbers of drycleaners use new work practices that can significantly reduce perc exposures even in older equipment. Regular cleaning, inspection, and maintenance of equipment (e.g., ensuring repairing leaking gaskets and cleaning clogged dampers) help reduce perc emissions. In addition, some drycleaners install vapor barriers and build room enclosures that help keep perc from entering neighboring spaces, and provide safety training for workers to reduce worker exposures to perc.

An increasing number of commercial cleaners are incorporating new "greener" cleaning methods, such as wetcleaning, into their facilities. Some cleaners are involved in testing some of the emerging technologies still in development.

### 16. What is the government doing to reduce environmental and health risks of perc?

The US EPA regulates environmental releases of perc through a variety of laws including the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act (disposal), and the Comprehensive Environmental Response, Compensation and Liability Act (Superfund). For example, drycleaners are required to comply with EPA's perc drycleaning National Emission Standard for Hazardous Air Pollutants (NESHAP). This NESHAP has reduced the amount of perc released from drycleaning shops across the country.

The Federal Trade Commission (FTC) regulates the cleaning guidance on garment care labels. FTC is proposing changes to allow the labeling of garments now labeled "dryclean only" for environmentally preferable cleaning technologies.

Perc exposures to workers in drycleaning shops are regulated by exposure limits set by the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA). OSHA is expected to propose a new lower limit in the near future.

Some state and local governments are taking action to control, phase out, or ban certain types of older perc machines, as well as where cleaners are located.



## 17. Is EPA working with the drycleaning industry to reduce pollution voluntarily?

The US EPA has a voluntary partnership program that emphasizes pollution prevention rather than pollution control. Through its Design for the Environment Garment and Textile Care Program, EPA is working with drycleaners and other interested parties to promote the development of environmentally preferable drycleaning processes.

## 18. What is EPA's Design for the Environment Program?

The US EPA's Design for the Environment (DfE) Program is a voluntary initiative that forges partnerships with a variety of industries, including drycleaning, printing, and the electronics industry, in an effort to encourage the design of safer processes and products by eliminating or minimizing pollution. The overall mission of DfE is to prevent pollution in ways that allow businesses to remain successful. In this way, a critical link can be made between environmental protection and economic productivity. DfE usually works with small- and medium-sized businesses. DfE partners typically include industry, professional groups, academia, environmental groups, public interest groups, labor unions, and other government agencies.

The DfE Program relies on EPA's expertise and leadership to share information and jointly research risk reduction and pollution prevention efforts. A major tool developed by the DfE Program is a Cleaner Technologies Substitutes Assessment (CTSA), which presents relative comparisons of traditional and substitute technologies on the basis of cost, performance and risk. This unique tool is intended to inform business decisionmakers, and to encourage them to consider environmental issues along with the traditional parameters of cost and performance.

In addition to the substantial technical effort to produce a CTSA, all DfE projects have large education and outreach components aimed at developing and sharing information, and promoting more environmentally preferable technology choices.

## 19. What is the DfE Garment and Textile Care Program?

The DfE Garment and Textile Care Program (GTCP) is a voluntary collaboration among the professional clothes cleaning industry, labor, research and environmental groups, other government agencies, and the EPA. The GTCP is dedicated to reducing risks and preventing pollution associated with chemicals used in the textile and garment care industries. To date the program has been focused on three major activities: development of a drycleaning CTSA, outreach and education on new cleaning technologies, and long-term planning for change in the garment and textile care industries.

The goal of the drycleaning CTSA, [Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes](#), is to provide a comparative assessment of clothes cleaning technologies available to professional cleaners so they can incorporate environmental concerns into their day-to-day and long-term business decisions. It is a highly technical document designed for use by fabricare experts, professional cleaners, owners, environmental health and safety personnel, equipment manufacturers, and technically-informed business decisionmakers.

In order to facilitate making the information in the CTSA available to a broader audience, the CTSA is also available in a summary form, [Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes: Summary](#). There is also a fact sheet, [Fact Sheet on Cleaner Technology Substitutes Assessment for Professional Fabricare Processes](#), which describes the goals and purpose of the new CTSA.

In the near future, the DfE GTCP plans to use the fabricare CTSA as the basis of a variety of user-friendly information products designed specifically for small business cleaners.

## 20. Where can I get more information?

Information packets about the DfE Program and the DfE GTCP, as well as single copies of other DfE project publications, are available upon request from the US EPA Pollution Prevention Information Clearinghouse (PPIC). Most of these publications are also available on the US EPA DfE web site.

For your convenience, here is the information necessary to order copies of the newest DfE GTCP publications: the CTSA, a summary version of the CTSA, a CTSA Fact Sheet, and this set of questions and answers on drycleaning.

### Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes

(EPA 744-B-98-001, June 1998).

### Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes: Summary

(EPA 744-S-98-001, June 1998)

### Fact Sheet on Cleaner Technology Substitutes Assessment for Professional Fabricare Processes

(EPA 744-F-98-011, June 1998)

### Frequently Asked Questions About Drycleaning

(EPA 744-K-98-002, June 1998)

- *To request single copies of publications, write, phone, fax, or email:*  
U.S. EPA PPIC (7409)  
401 M Street, SW  
Washington, D.C. 20460  
Phone: 202-260-1023  
Fax: 202-260-0178  
Email: [ppic@epa.gov](mailto:ppic@epa.gov)
- Visit the EPA DfE Garment & Textile Care Program Web Site:  
<http://www.epa.gov/dfe/garment/garment.html>
- Visit the EPA DfE Program Web Site:  
<http://www.epa.gov/dfe>

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