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<b>Fact Sheet</b>	
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# Perchloroethylene (tetrachloroethylene or "perc")

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**Health Hazard Summary:** *The most common effects of overexposure to perchloroethylene are irritation of the eyes, nose, throat, or skin, and effects on the nervous system similar to the effects of alcohol. Perc causes cancer in laboratory animals at exposure levels close to the level legally allowed in the workplace. Based on the animal tests, you should treat perc as a potential human cancer-causing substance.*

## **HOW TO FIND OUT IF YOU ARE WORKING WITH PERC**

**Jobs Where Perchloroethylene Is Used:** Perc is the main solvent used in the dry-cleaning

process. It is also used in metal degreasing, and during the production of fluorocarbons (commonly known as Freons). It is used in some adhesives, aerosols, paints, and coatings.

**Odor and Appearance:** Perchloroethylene is a clear, colorless, non-flammable liquid with a sweetish smell like the smell of ether. Perc may be listed on a label or Material Safety Data Sheet (MSDS) by its chemical formula ( $\text{Cl}_2\text{C}=\text{CCl}_2$ ) or by one of its chemical names and synonyms:

tetrachloroethylene	perc ("perk")
tetrachloroethene	perchlor
ethylene tetrachloride	carbon dichloride
1,1,2,2-tetrachloroethylene	

**Your Right to Know:** Under the state Hazard Communication Standard (California *GISO 5194*), your employer must tell you if you are working with any hazardous substances, including perchloroethylene, and must train you to use them safely.

If you think you may be exposed to hazardous chemicals at work, ask to see the Material Safety Data Sheets (MSDSs) for the products in your work area. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for its safe use, storage, and disposal. The MSDS should also include information on fire and explosion hazards, reactivity, first aid, and procedures for handling leaks and spills. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make the MSDS available to employees on request.

This Fact Sheet is an aid for worker training programs. It does not take the place of a Material Safety Data Sheet.

## **HOW PERCHLOROETHYLENE ENTERS AND AFFECTS YOUR BODY**

Perc enters your body when you breathe its vapors in the air. Liquid perc can be absorbed through your skin, to a limited extent. The most common effects of overexposure to perchloroethylene are irritation of the eyes, nose, throat, or skin, and effects on the nervous system, as described below.

**Skin:** Lengthy or repeated skin contact with liquid perc removes the natural protective oils from your skin. This can cause irritation, dryness, cracking, and dermatitis (skin rash).

**Eyes, Nose, and Throat:** Perc vapors in the air at levels above 75 parts per million (see "Legal Exposure Limits") may irritate your eyes, nose, and throat, causing burning and coughing. Perc

does not have any long-term effects on the eyes, nose, throat, or lungs.

**Nervous System:** Perc, like most organic solvents, affects your brain the same way drinking alcohol does. Drinking alcohol within a few hours of exposure increases these effects, because the effects of perc and alcohol add together. The symptoms of short-term overexposure usually clear up within hours after exposure stops. The mildest effects listed below may start occurring at exposure levels of about 100 ppm. Effects occur more quickly and become more noticeable and serious as the exposure level increases. These effects may increase your chances of having accidents.

<b>Effects of Perc on the Nervous System</b>		
<u>mild</u>		<u>severe</u>
feeling "high"	nausea	confusion
lightheadedness	vomiting	slurred speech
dizziness	tiredness	loss of balance
headache	weakness	poor
coordination		

At very high exposure levels (above about 5,000 to 10,000 ppm) such as might occur in a tank or other enclosed space, perc and other solvents can cause loss of consciousness and even death.

If you are repeatedly overexposed for several days, you may be less affected as you develop a tolerance for overexposure. If a day or two then passes with no exposure, you may feel withdrawal symptoms such as nervousness, anxiety, and shakiness.

Some studies suggest that repeated, frequent overexposure to some organic solvents over months or years may have long-lasting and possibly permanent effects on the nervous system. The exposure levels at which these effects occur are not known, and the effects have not been studied in workers exposed only to perc.

The symptoms of these long-term effects include fatigue, poor muscle coordination, difficulty in concentrating, loss of short-term memory, and personality changes such as increased anxiety, nervousness and irritability.

**Liver and Kidney:** Exposure to high levels of perc - such as might occur in an enclosed space or during a spill - can damage the liver or kidneys. Unless you experience some of the more severe symptoms described above under "Nervous System," your exposure probably is not high enough to cause liver or kidney damage.

**Cancer:** Perc causes cancer in laboratory animals at exposure levels close to the level legally allowed in the workplace. The animals were exposed to only twice the current legal exposure limit for California workers.

Although perc has been widely used in the dry-cleaning industry for the past 20 years, studies of dry-cleaners have not been adequately designed to show whether perc causes cancer in humans. Based on the animal tests, you should consider perc to be a potential cancer-causing substance (carcinogen).

Exposure to a carcinogen does not necessarily mean that you will get cancer. In general, the greater the exposure, the greater the risk of developing cancer. The best way to protect your health is to keep your exposure as low as possible.

**Reproductive System:** Perc does not appear to cause birth defects in lab animals. However, like other organic solvents, perc can harm a developing fetus if the mother is frequently overexposed. Perc inhaled by a pregnant woman can reach a developing fetus. Perc can also contaminate breast milk. Therefore, pregnant or nursing women should avoid overexposure, just as they should avoid exposure to alcohol, tobacco, and other drugs.

## **TESTS FOR EXPOSURE AND MEDICAL EFFECTS**

Perc does not remain in your body very long after exposure. Routine testing for the amount of perc in your body or for effects it may have caused is not recommended.

However, it is generally recommended that workers who are frequently exposed to hazardous substances receive a complete physical examination, including an occupational and medical history, at the beginning of their employment. They should also have regular periodic follow-up examinations.

A physician or other health care provider should choose specific tests on a case-by-case basis to evaluate effects of chemical exposure. HESIS physicians can provide advice for such medical evaluations.

## **LEGAL EXPOSURE LIMITS**

California's Division of Occupational Safety and Health (Cal/OSHA) sets and enforces workplace chemical exposure limits. Cal/OSHA has adopted a Permissible Exposure Limit (PEL) for the amount of perchloroethylene in your breathing zone. The PEL for perc is 50 parts of perc per million parts of air (50 "parts per million," or 50 "ppm"). This is sometimes stated as 335 milligrams of perc per cubic meter of air (335 "mg/m<sup>3</sup>").

The PEL for perc is based on preventing eye, nose, and throat irritation and nervous system effects. Because of the recent cancer findings in animals, HESIS has recommended that Cal/OSHA review and consider lowering the PEL.

Federal OSHA has reduced its 8-hour average PEL for perc to 25 ppm. Cal/OSHA will probably soon reduce its PEL accordingly.

Legally, your exposure may be above the PEL at times, but only if it is *below* the PEL at other times, so that your *average* exposure for any 8-hour workshift is 50 ppm or less. There is also an "excursion" limit of 200 ppm which can be exceeded for no more than 5 minutes every 3 hours, and a "ceiling" limit of 300 ppm which must never be exceeded for any period of time.

You should not rely on your sense of smell to warn you that you are being overexposed to perc. Some people can smell perc when the concentration in the air is well below the PEL, but others may not smell it even at much higher levels. Moreover, your sense of smell can become dulled after being around an odor for awhile. Measuring the amount of a substance in the air is the only reliable way to determine the exposure level.

If you work with perchloroethylene and think you may be overexposed, talk to your supervisor and/or your union. If any worker might be exposed to a substance at more than the legal exposure limit, the employer must measure the amount of the chemical in the air in the work area (Cal/OSHA regulation *GISO 5155*). You have the right to see the results of such monitoring relevant to your work (*GISO 3204*).

You also have the right to see and copy your own medical records and records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. If your employers have such records, they must keep them and make them available to you for at least 30 years after the end of your employment.

## REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed at levels that are above the PEL. For information about how Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer, see the "Resources" section on page 4.

**Substitution:** The most effective way to reduce hazardous chemical exposures is to use a safer chemical, if one is available. However, the health and safety hazards of the substitute must also be carefully considered to ensure that it is actually safer.

Trichlorotrifluoroethane (F-113) has been used as a substitute for perc in dry-cleaning and degreasing, but only to a limited extent since it requires special equipment. Replacing perc with a

petroleum solvent, such as Stoddard solvent, may reduce the health hazards of exposure but greatly increases the potential for fire.

**Engineering Controls:** When possible, employers must use engineering and administrative controls rather than personal protective equipment to prevent overexposure. Engineering control methods include installing ventilation, changing the work process, and changing work practices.

A dry-cleaning shop should have modern dry-to-dry equipment that does not require you to transfer wet perc-soaked clothing from one machine to another. If you do have to handle wet clothing, be sure to wear plastic or rubber gloves.

A closed system should be used to refill solvent tanks. Containers of perc or perc-soaked materials should be tightly closed or covered to prevent evaporation. Dry-cleaning filters should be changed during off hours, and the shop should be well ventilated after filters are changed. Respiratory protection may be needed.

Local exhaust ventilation systems ("hoods") are the most effective type of ventilation control. These systems capture contaminated air at its source before it spreads into the air in your breathing zone. A local exhaust hood should be placed at the source of the perc evaporation; the floor ducts that are common in dry-cleaning establishments are much less effective. An industrial hygienist should evaluate the ventilation in your workplace to determine whether it is sufficient. Cal/OSHA Consultation may be able to give employers free assistance with such an evaluation.

**Personal Protective Equipment:** When engineering controls cannot sufficiently reduce exposures, a respirator must be worn and a respiratory protection program must be developed, as outlined by Cal/OSHA regulations (*GISO 5144*). An industrial hygienist or other knowledgeable person should be consulted to ensure that the equipment is appropriate and is used correctly. If respiratory equipment is necessary, a NIOSH- or MSHA-approved air-purifying respirator with organic vapor cartridges or canisters must be used.

Perc vapors can build up to deadly levels inside tanks or other closed areas. *Do not enter a degreaser, storage tank, or still that contains perc until it has been emptied and thoroughly ventilated.* When you enter any confined space where there may be high vapor concentrations, use a rescue harness with life-line and a supplied-air or self-contained breathing apparatus. A second person similarly equipped must be stationed outside the confined space to observe you at all times while you are inside. Before entering any confined space, consult Cal/OSHA regulations *GISO 5144* and *GISO 5156-5159*.

If frequent or prolonged skin contact with liquid perc is unavoidable, or if splashing may occur, other protective equipment such as gloves or a faceshield should be worn. Protective clothing should be made of a material which is resistant to perc, such as polyvinyl alcohol (PVA), nitrile, or Viton<sup>R</sup>. Even the most resistant materials will be penetrated quickly and should be replaced

often.

**Note concerning perc and high temperatures:** Do not use perc around an open flame, welding arc, or intense ultraviolet light source. Don't smoke where perc is being used. Like most solvents containing chlorine, perc can break down into very hazardous compounds such as phosgene, hydrochloric acid, and chlorine.