


Revised December 1997

Fact Sheet	
 The logo for the California Department of Health Services (dhs) is displayed. It features a green outline of the state of California. Overlaid on the map is a caduceus (a staff with two snakes and wings) in orange and yellow. Below the map, the letters 'dhs' are written in a large, bold, black font. Underneath 'dhs', the words 'DEPARTMENT OF HEALTH SERVICES' are written in a smaller, black, sans-serif font.	<p style="text-align: center;">Hazard Evaluation System and Information Service</p> <p style="text-align: center;">850 Marina Bay Parkway Building P, 3rd Floor Richmond, CA 94804</p> <p style="text-align: center;">(866) 282-5516</p>

Trichloroethylene (TCE)

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Health Hazard Summary: Trichloroethylene mainly affects the central nervous system (the brain), causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of being drunk. TCE can also damage the facial nerves, and it can cause skin rash. Heavy exposure can damage the liver and kidneys. TCE causes cancer in animals and may cause cancer in humans.

HOW TO KNOW IF YOU ARE WORKING WITH TRICHLOROETHYLENE

TCE is sometimes called by other names, such as trichloroethene, ethylene trichloride, or

ethinyl trichloride. It is sold under many different brand names, such as Tri-Clene, Trielene, Trilene, Trichloran, Trichloren, Algylen, Trimar, Triline, Tri, Trethylene, Westrosol, Chlorylen, Gemalgene, and Germalgene.

TCE looks like water and has a sweet odor like chloroform. It is mainly used in metal degreasing. It is also used as a raw material to make other chemicals, as a cleaner in electronics manufacturing, and for all sorts of general solvent purposes such as in paints, paint strippers, and adhesives. It has also been used as a low-temperature refrigerant and as a grain fumigant, and is still sometimes used in dry cleaning. It is no longer commonly used as a medical anesthetic gas.

Your Right To Know: Under California's Hazard Communication Standard (Cal/OSHA regulation GISO 5194), your employer must tell you if you are working with any hazardous substances, including TCE, 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. MSDSs can be very hard to read, and sometimes they are out of date or inaccurate or they leave out important information, but the MSDS should at least tell you what's in the product. An MSDS lists the hazardous chemicals in a product, describes its health and safety hazards, and gives methods for its safe use, storage, and disposal. An MSDS should also include information on fire and explosion hazards, chemical reactivity, first aid, and methods 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. The MSDS for a product that contains TCE should identify it in Section 2 by the CAS number 79-01-6.

HOW TRICHLOROETHYLENE ENTERS AND AFFECTS YOUR BODY

TCE enters your body when you breathe its vapors in the air. TCE can also be absorbed through your skin, especially with lengthy skin contact or if your skin is cut or cracked.

Overexposure to TCE mainly affects the central nervous system (the brain). Other symptoms can also occur, as described below.

TCE belongs to a large class of chemicals called organic solvents. Alcohols, acetone, methyl ethyl ketone, trichloroethane, methylene chloride, benzene, toluene, and xylene are just a few other examples of organic solvents. Most organic solvents share the same basic set of health effects, although some solvents also cause specific effects of their own.

Nervous System: Like most organic solvents, TCE can affect your brain the same way drinking alcohol does, causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of being drunk. This can increase your chances of having accidents. The effects of short-term overexposure usually clear up within a few hours after you stop being exposed. As your exposure level increases or you are exposed for a longer time, the effects get stronger, occur more quickly, and last longer. Drinking alcohol within a few hours of exposure will increase these effects and make them last longer. Very high exposures to TCE can cause a person to pass out, stop breathing, and die.

Most experts believe that repeated, frequent overexposure to organic solvents in general, over months or years, can have long-lasting and possibly permanent effects on the nervous system. The symptoms include fatigue, sleeplessness, poor coordination, difficulty in thinking, loss of short-term memory, and personality changes such as depression, anxiety, and irritability. We don't know how much exposure it takes to cause these effects, and these effects have not been studied in workers exposed only to TCE.

Unlike most other solvents, TCE can damage the nerves of the face. Vision, smell, taste, and sometimes control of the muscles of the face and mouth can be impaired. There is some evidence that hearing might also be affected. The most obvious cases result from short-term high exposure, although effects may not appear until hours or even as much as two days after the exposure. Long-term lower-level exposure may also cause less obvious damage. TCE can also damage the nerves of the arms and legs, causing tingling, loss of feeling, weakness, and paralysis. The effects are probably caused by contaminants, rather than by TCE itself, but those contaminants are usually present.

Skin: TCE, like other organic solvents, can dissolve your skin's natural protective oils. Frequent or prolonged skin contact can cause irritation and dermatitis (skin rash), with dryness, redness, flaking, and cracking of the skin. TCE can be absorbed into the body slowly through healthy skin, or rapidly through damaged skin. TCE quickly penetrates most ordinary clothing (see [Personal Protective Equipment](#)) and can get trapped in gloves and boots; such exposure can cause burns and blistering.

Eyes, Nose, and Throat: TCE vapor in the air can irritate your eyes, nose, and throat. Liquid TCE splashed in the eye can sting, but any damage to the eye usually heals within a few days.

Lungs: Exposure to TCE at high levels can irritate the lungs, causing chest pain and shortness of breath. Extreme overexposure (for example, inside an enclosed or confined space such as a degreasing tank) can cause pulmonary edema, a potentially life-threatening condition in which the lungs fill with fluid. However, there is no evidence that repeated, low-level exposure has any long-term effects on the lung.

Heart: Extremely high concentrations of TCE or other chlorinated solvents can cause heart fibrillation (irregular heartbeats) that can cause sudden death.

Liver and Kidneys: At very high levels of exposure such as might occur in an enclosed space or during a spill TCE can injure the liver and kidneys. Liver or kidney damage is rare; it's not at all likely to happen without substantial effects on the nervous system first, and it's not likely to happen if exposures are kept within the legal workplace limits. Generally, such liver or kidney damage is not permanent. However, long-term exposure can contribute to liver damage from drinking alcohol.

Immune System: There have been reports of certain rare immune diseases such as systemic sclerosis (scleroderma) and lupus erythematosus among people exposed to TCE, but there has been no good study to show whether TCE is actually related to any immune system disorder.

Cancer: TCE causes cancer in mice, and there is some evidence that it may also be a weak carcinogen in rats. Humans exposed to TCE have not been studied well enough to give much information, but the human studies also suggest that TCE may cause cancer. You should treat TCE as a likely cause of human cancer.

Genetic Changes: There are many ways to test whether a chemical causes genetic mutations. In most tests, TCE causes little or no mutation.

Reproductive System: Several animal studies and at least one human study have suggested that TCE might cause birth defects, loss of the fetus, or impaired growth and performance of the offspring. However, there has been very little consistency among the tests; each experimenter has tended to get results very different from those of other

experimenters, and most tests find little or no effect on pregnancy. You should treat TCE as a possible hazard to pregnancy.

Other: People who drink alcohol and breathe TCE vapors at nearly the same time can develop degreaser's flush, a reddening of the face, shoulders, and back that usually goes away within an hour or so after exposure stops.

TESTS FOR EXPOSURE AND MEDICAL EFFECTS

There are ways to measure the amount of TCE in your body. Unlike many other organic solvents, TCE's breakdown products remain in the body for up to three weeks, so testing does not necessarily have to be done right after exposure. Biological Exposure Indexes have been developed to help interpret the various types of test results. However, because people vary greatly, these tests are mainly useful for evaluating groups of exposed workers, not individual workers. There are also other tests to look for certain unusual specific health effects. A health care provider can select specific tests on a case-by-case basis to evaluate chemical exposure and its effects. HESIS physicians can provide advice for such medical evaluations. However, routine testing is not recommended or required.

If symptoms such as memory loss, confusion, and mood changes occur, neuropsychological testing may be useful.

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

LEGAL EXPOSURE LIMITS

California's Division of Occupational Safety and Health (Cal/OSHA) sets and enforces standards for workplace chemical exposure. Cal/OSHA sets Permissible Exposure Limits (PELs) for the amounts of certain chemicals in workplace air. The PELs are intended to protect the health of a person who is exposed every day over a working lifetime.

Cal/OSHA's PEL for TCE is 25 parts of TCE per million parts of air (25 parts per million, or 25 ppm). This is equal to about 135 milligrams of TCE per cubic meter of air (135 mg/m³). Legally, your exposure may be above 25 ppm at times, but only if it is below the

PEL at other times, so that your average exposure for any 8-hour workshift is no more than 25 ppm.

There is also a Short Term Exposure Limit (STEL) of 200 ppm (1075 mg/m³), which must not be exceeded during any 15-minute averaging period, and a Ceiling Limit of 300 ppm (1612 mg/m³) that must never be exceeded for any period of time.

The American Conference of Governmental Industrial Hygienists has recommended a Short-Term Exposure Limit of 100 ppm. Cal/OSHA will probably adopt this more protective recommendation as a legal STEL in about 1998.

You should not rely on your sense of smell to warn you that you are being overexposed to TCE. TCE has fairly good warning properties; on average, people begin to smell TCE just about when the concentration in the air reaches the PEL (at about 28 ppm, on average). However, many people can smell TCE at lower levels, when they are not being overexposed; and many people cannot smell it even at much higher levels. Also, your sense of smell becomes dulled after being around TCE for a short time. Measuring the amount of a substance in the air is the only reliable way to determine the exposure level.

When two or more chemicals have similar health effects (such as TCE and other organic solvents that affect your central nervous system or irritate your eyes, nose, and throat), there are special rules (GISO 5155(c)(1)(B)) that set lower limits on your combined exposure.

If you work with TCE and think you may be over-exposed, talk to your supervisor or your union. If any worker might be exposed to a substance at more than the legal limit, the employer must measure the amount of the substance in the air in the work area (GISO 5155(e)). You have the legal 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. Employers who have such records 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 to chemicals at levels above

the PELs. Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer see [Resources](#).

Substitution: The most effective way to prevent over-exposures is to use a safer chemical, if one is available. However, the health and safety hazards of substitutes must also be carefully considered, to make sure that they are actually safer. One advantage of TCE is that it does not burn or explode. One disadvantage is that TCE vapors are much heavier than air, so they can settle into pockets and depressions (such as an open degreasing tank) and reach very dangerous concentrations. TCE evaporates very quickly; in a closed container, it can build up to levels three hundred times as high as the Ceiling Limit that must never be exceeded.

Engineering Controls: When possible, employers must use engineering control methods rather than personal protective equipment to prevent overexposure. Engineering control methods include installing ventilation, changing the work process, and changing work practices. Containers, vats, and tanks should be tightly covered to prevent evaporation. Certain work processes can be isolated, enclosed, or automated to reduce exposures.

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. The local exhaust intake should pull dirty air away from you and not towards you.

Personal Protective Equipment: When engineering controls cannot reduce exposures enough, a respirator must be worn and a respiratory protection program must be developed, as described in detail in Cal/OSHA regulations (GISO 5144). An industrial hygienist or other trained person should be consulted to ensure that the equipment is appropriate and is used correctly. An organic vapor filter cartridge can effectively filter out TCE. However, many people cannot smell TCE even when they are exposed at levels above the PEL, so they cannot tell when the cartridge has worn out. Therefore, filter respirators are not approved; a supplied-air respirator must be provided.

If frequent or prolonged skin contact with TCE cannot be avoided, or if splashing may occur, other protective equipment such as gloves, goggles, or faceshields should be worn. TCE quickly penetrates the material of most types of protective gloves and aprons; materials that may be a little more resistant include Teflon, Silvershield, chlorobutyl rubber, and possibly SBR/neoprene rubber. Even the most resistant materials can be

penetrated very quickly, so protective clothing should be replaced often. If TCE penetrates gloves, it may be worse than working bare-handed, because the gloves keep the TCE from evaporating off of your skin.

TCE usually contains trace amounts of stabilizers (much less than 1% by weight) to keep it from decomposing into toxic and corrosive acidic by-products. The stabilizers usually don't change the toxicity of the product much, although certain ones may be a bit more carcinogenic than TCE itself.