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<p><b>Fact Sheet</b></p>	
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# Toluene (Toluol)

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**Health Hazard Summary:** *Toluene mainly affects the central nervous system (the brain), causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of drunkenness. It can also cause skin rash.*

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

**Physical Appearance and Odor:** Toluene is a clear, colorless, flammable liquid. It has a sweet, sharp odor. Most people, but not all, can smell toluene at levels that are not hazardous. Toluene belongs to a large class of chemicals called organic solvents. Alcohols, acetone, methyl ethyl ketone, trichloroethane, and xylene are a few other examples of organic solvents. Toluene is sometimes called "toluol," "methylbenzene," or "phenylmethane."

### **Products That Contain Toulene**

paints, varnishes, and shellacs  
 paint and varnish thinners  
 nail polish  
 adhesives and glues

metal cleaners  
rust preservatives  
fuel system antifreezes  
asphalt removers  
flame retardants  
high-octane gasoline blends  
aviation gasolines  
rotogravure printing processes

Toluene is often used in the manufacturing of other products, although it may not be found in the finished product. Toluene is used in the production of:

chemicals	dyes and inks
plastics	medicines
detergents	perfumes

**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 toluene, 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 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.

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

## HOW TOLUENE ENTERS AND AFFECTS YOUR BODY

Toluene enters your body when it evaporates into the air you breathe. Toluene can also be absorbed through your skin, especially with lengthy skin contact.

Overexposure to toluene mainly affects the central nervous system (the brain), causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of drunkenness. Other symptoms can also occur, as described below.

**Nervous System:** Toluene, like most organic solvents, can affect your brain the same way drinking alcohol does. Drinking alcohol within a few hours of exposure increases these effects and makes them last longer, because the effects of alcohol and other organic solvents on the brain add together. The symptoms of short-term overexposure usually clear up within hours after exposure stops. Effects occur more quickly and become more noticeable and serious as the level and time of exposure increase. These symptoms can increase your chances of having accidents.

The table below lists exposure levels at which various effects of toluene are likely to appear. The

table gives exposure levels in "ppm" ("parts per million" - the number of parts of toluene in each million parts of air).

Most experts believe that repeated, frequent overexposure to organic solvents over months or years can have long-lasting and possibly permanent effects on the nervous system. The symptoms of these long-term effects include fatigue, sleeplessness, poor coordination, difficulty in concentrating, loss of short-term memory, and personality changes such as depression, anxiety, and irritability. We do not know at what exposure levels these effects occur, and the effects have not been studied in workers exposed only to toluene.

<b>Nervous Systems Effects of Toluene</b>	
<u>Level</u>	<u>Effects of 8-Hour Average Exposure</u>
100 ppm	headache, dizziness, drowsiness, fatigue
200 ppm	nausea, weakness, poor coordination, numbness, tingling,
600 ppm	sleepiness, lack of emotional control, staggering
800 ppm	severe nervousness, muscular fatigue, insomnia which lasts for days
>10,000 ppm	loss of consciousness, death

**Skin:** Toluene, 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. Toluene penetrates most ordinary clothing (see "Personal Protective Equipment," page 4) and can get trapped in gloves and boots. Such exposure can cause burns and blistering.

**Eyes, Nose, and Throat:** Toluene in the air can irritate your eyes, nose, and throat. Liquid toluene splashed in the eye can sting, and may slightly damage the surface of the eye, but the eye usually heals within a few days.

**Hearing:** One study suggested that toluene, and possibly other organic solvents, may be able to cause hearing loss.

**Lungs:** Exposure to toluene at high levels can irritate the lungs, causing chest pain and shortness of breath. Extreme overexposure (for example, in an enclosed or confined space) 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.

**Liver and Kidneys:** At very high levels of exposure - such as might occur in an enclosed space or during a spill - toluene can injure the liver and kidneys. This is extremely unlikely to occur without substantial effects on the nervous system first. Generally, such liver or kidney damage is not permanent.

**Cancer:** In a U.S. National Toxicology Program test, rats and mice exposed to high levels of toluene

in the air throughout most of their lives did not show any sign of increased cancer rates. There is no good reason to believe that toluene causes cancer. However, toluene is often contaminated with small amounts of benzene, which is a known cause of leukemia and other cancers. In a workplace where toluene is used, a proper health and safety evaluation should consider the possibility of benzene exposure.

**Genetic Changes:** Most studies show that toluene does not easily damage the genes or chromosomes, although at least one study found minor effects among workers exposed to high concentrations for 10-20 years.

**Reproductive System:** Toluene's effects on the reproductive system have not been thoroughly studied. A number of women who have abused toluene throughout their pregnancy (by sniffing glue or paint) have had children with birth defects and delayed development. Toluene is on the State of California's Prop 65 list of chemicals known to harm the developing fetus. We don't know whether normal workplace exposure to toluene can affect pregnancy or other reproductive function. Pregnant and nursing women should avoid overexposure to toluene.

In a U.S. National Toxicology Program test, toluene did not affect the sperm of male rats or mice.

## TESTS FOR EXPOSURE AND MEDICAL EFFECTS

There are tests that can determine the amount of toluene in your body. However, toluene is quickly eliminated from your body, so these tests are only useful if they are done very soon after exposure (generally at the end of a workshift), and the tests only provide useful information about that day's exposure. Routine testing is not recommended or required. A health care provider can select specific tests on a case-by-case basis to evaluate effects of chemical exposure. HESIS physicians can provide advice for such medical evaluations.

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 toluene is 100 ppm. This is equal to 375 milligrams of toluene per cubic meter of air (375 mg/m<sup>3</sup>). Legally, your exposure may be above 100 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 100 ppm.

There is also a Short Term Exposure Limit (STEL) of 150 ppm, which must not be exceeded during any 15-minute averaging period, and a "ceiling" limit of 500 ppm that must never be exceeded for

any period of time.

The American Conference of Governmental Industrial Hygienists has recommended a Threshold Limit Value (TLV) of 50 ppm. Cal/OSHA will probably adopt this more protective recommendation as a legal PEL soon.

Cal/OSHA requires (*GISO 5155(d)*) that employers provide appropriate protective clothing as necessary to prevent skin contact with toluene.

When two chemicals have similar health effects (such as toluene 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.

You should not rely on your sense of smell to warn you that you are being overexposed to toluene. Most people can smell toluene when the concentration in the air is well below the PEL (at about 3 ppm, on average), so smelling it does not mean that you are overexposed. Moreover, some people may not smell it even at much higher levels. Also, 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 think you may be overexposed, 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 (Cal/OSHA regulation *GISO 5155(e)*). You have the legal right to see the results of 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 legal limits. Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer - see the "Resources" section below.

**Substitution:** The most effective way to prevent overexposures 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.

**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 and vats 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 you breathe.

**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.

If frequent or prolonged skin contact with toluene cannot be avoided, or if splashing may occur, other protective equipment such as gloves, goggles, or faceshields should be worn. Most protective clothing materials have very little resistance to toluene. Some of the protective clothing materials that are most resistant to toluene are Teflon, Silvershield, and neoprene/Viton. Even the most resistant materials can be penetrated very quickly, so protective clothing should be replaced often.