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Fact Sheet	
 The logo for the California Department of Health Services (dhs) features a green outline of the state of California. Inside the outline, there is a caduceus symbol (a staff with two snakes and wings) in orange and yellow. Below the state outline, 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>

Glycol Ethers

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Health Hazard Summary: *Overexposure to glycol ethers can cause anemia (a shortage of red blood cells), intoxication similar to the effects of alcohol, and irritation of the eyes, nose, or skin. In laboratory animals, low-level exposure to certain glycol ethers can cause birth defects and can damage a male's sperm and testicles. There is some evidence that workplace exposure can reduce human sperm counts. Based on the animal tests and on studies of workers, you should treat certain glycol ethers (see page 2) as hazards to your reproductive health.*

HOW TO FIND OUT IF YOU ARE WORKING WITH GLYCOL ETHERS

Odor and Appearance: "Glycol ethers" is a name for a large group of chemicals. Most glycol ether compounds are clear, colorless liquids. Some have mild, pleasant odors or no smell at all; others (mainly the acetates) have strong odors. The common belief that glycol ethers never evaporate fast enough to create harmful levels in the air is false. Some evaporate quickly and can easily reach hazardous levels in the air; others evaporate very slowly and therefore are less hazardous by inhalation. For example, EGME and EGEE evaporate very quickly.

Jobs Where Glycol Ethers Are Used: The glycol ethers are widely used industrial solvents. Each of them may be used alone, or as an ingredient in products such as coatings (paints, varnishes, dyes, stains, inks, and semiconductor chip coatings), cleaners (for degreasing, dry-cleaning, film cleaning, and circuit board manufacture), jet fuel de-icing additives, brake fluids, and perfumes and cosmetics.

Some commonly used glycol ethers are listed on page 2, along with their abbreviations and chemical names, to help you identify which ones you may be working with. Some brand names for glycol ethers include Cellosolve,^R Carbitol,^R Dowanol,^R and Ektasolve.^R

Your Right to Know: A product may contain a glycol ether without listing it on the label or in the ingredients. However, under the state and federal Hazard Communication Standards (California *GISO 5194* and U.S. *29 CFR 1910.1200*), your employer must tell you if you are working with any hazardous substances, including glycol ethers, and must train you to use such substances safely.

If you think you may be exposed to hazardous substances at work, ask to see the Material Safety Data Sheets (MSDSs) for the products you are using. 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 GLYCOL ETHERS ENTER AND AFFECT YOUR BODY

Glycol ethers enter your body when they evaporate into the air you breathe, and they are rapidly absorbed into your body if the liquids contact your skin. Cases of poisoning have been reported where skin contact was the main route of exposure, even though there was no effect on the skin itself. The effects of overexposure can include anemia, mild intoxication (somewhat like the effects of drinking alcohol), and irritation of the skin, eyes, nose, and throat. Some glycol ethers

are hazardous to the male and female reproductive systems.

Reproductive System: Certain glycol ethers have been found to cause birth defects and damage to the testicles in laboratory animals. These effects occurred at lower exposure levels than other effects did, so there were no obvious symptoms to warn that the animals were being harmed. Recent studies of exposed workers indicate that glycol ethers can reduce sperm counts in men. Glycol ethers for which there is evidence of effects on animal reproduction include EGME, EGMEA, EGEE, EGEEA, EGDME, EGDEE, DEGME, DEGDME, and TEGDME (see the list of abbreviations below).

Based on animal tests, certain other glycol ether compounds either don't cause birth defects and sperm damage, or are much weaker. These include EGPE, EGBE, DEGBE, PGME, PGMEA, and DPGME. Other glycol ethers have not yet been adequately tested. However, like most organic solvents, all glycol ethers probably can reach a developing fetus and can enter the mother's breast milk. Therefore, pregnant or breast-feeding women should minimize their exposure, just as they should minimize their exposure to alcohol, tobacco, and other drugs.

Blood: Most *ethylene* glycol ethers (but not *propylene* glycol ethers) can damage red blood cells or damage the bone marrow, where blood cells are formed. This can cause anemia. Symptoms may include tiredness, weakness, and shortness of breath, especially during or just after exercise. You can easily have anemia without knowing it; it can be diagnosed with a blood test.

Nervous System: At exposure levels well above Cal/OSHA's Permissible Exposure Limits (PELs - see page 3), the glycol ethers can intoxicate you in much the same way that drinking alcohol can. You may feel dizzy, "high," disoriented, confused, sluggish, or unusually tired while working with glycol ethers. Other symptoms include headache, nausea, trembling, appetite loss, weight loss, and personality changes.

Skin, Eyes, Nose, and Throat: Most glycol ethers are easily absorbed through your skin; thus, skin contact can be the major route of exposure. Also, like other organic solvents, glycol ethers can dissolve your skin's natural protective oils, causing dryness, redness, flaking, cracking, and dermatitis (skin rash). Liquid glycol ethers splashed into your eyes could be painful, but they are not likely to cause any lasting problems; you should flush your eyes thoroughly with water to minimize the effects. Glycol ether vapors can irritate your eyes, nose, and throat if the levels in the air exceed Cal/OSHA's PELs.

Exposure levels that are high enough to cause intoxication or eye and nose irritation are *more* than high enough to cause anemia and to damage the reproductive systems of test animals. *If you experience intoxication or eye and nose irritation, your exposure should be reduced.*

Cancer: We don't know whether any of the glycol ethers can cause cancer. EGEE is currently being tested in laboratory animals, and EGME and EGBE have been selected for testing in the

near future.

<u>Common Name</u>	<u>Abbreviation</u>	<u>Chemical Name</u>
ethylene glycol monomethyl ether	EGME	2-methoxyethanol
ethylene glycol monomethyl ether acetate	EGMEA	2-methoxyethyl acetate
ethylene glycol monoethyl ether	EGEE	2-ethoxyethanol
ethylene glycol monoethyl ether acetate	EGEEA	2-ethoxyethyl acetate
ethylene glycol monopropyl ether	EGPE	2-propoxyethanol
ethylene glycol monobutyl ether	EGBE	2-butoxyethanol
ethylene glycol dimethyl ether	EGDME	1,2-dimethoxyethane
ethylene glycol diethyl ether	EGDEE	1,2-diethoxyethane
diethylene glycol	DEG	
diethylene glycol monomethyl ether	DEGME	2-(2-methoxyethoxy)
ethanol diethylene glycol monoethyl ether ethoxyethoxy)ethanol	DEGEE	2-(2-
diethylene glycol monobutyl ether ethanol	DEGBE	2-(2-butoxyethoxy)
diethylene glycol dimethyl ether	DEGDME	bis(2-methoxyethyl)ether
triethylene glycol dimethyl ether	TEGDME	
propylene glycol monomethyl ether	PGME	1-methoxy-2-propanol
propylene glycol monomethyl ether acetate	PGMEA	
dipropylene glycol	DPG	
dipropylene glycol monomethyl ether	DPGME	

TESTS FOR EXPOSURE AND MEDICAL EFFECTS

It is recommended that workers who are regularly exposed to glycol ethers receive a complete physical examination, including an occupational and medical history, at the beginning of their employment. This examination should include a complete blood count and should give attention to the reproductive system. The examination should be repeated on a regular basis.

LEGAL EXPOSURE LIMITS

California's Division of Occupational Safety and Health (Cal/OSHA) sets and enforces workplace chemical exposure limits. Cal/OSHA has set Permissible Exposure Limits (PELs) for the amounts of certain glycol ethers in your workplace air. The PELs are measured in parts of chemical per million parts of air ("parts per million," or "ppm"). All the PELs are listed below. Your exposure may legally 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 below the PEL.

EGME 5 ppm - S	EGBE 25 ppm - S
EGMEA 5 ppm - S	PGME 100 ppm
EGEE 5 ppm - S	DPGME 100 ppm
EGEEA 5 ppm - S	

All glycol ethers can be absorbed through your skin, to varying extents. Your employer must provide you with protective clothing if necessary in order to protect you from skin contact with the glycol ethers marked with an "S" in the table above.

If you 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 present in the air in the work area. You have the right to see the results of such monitoring relevant to your work (Cal/OSHA regulation *GISO 3204*).

You also have the right to see and copy your own medical records and records of 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.

You should not rely on symptoms or on your sense of smell to warn you that you are being overexposed. You can be overexposed without feeling any effects at all. Many glycol ethers have very little odor. Some people can smell certain glycol ethers even when the concentrations in the air are below the PELs, but others cannot; 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.

REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed to chemicals at levels above the legal limits. 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 exposure is to use a safer substance, if one is available. The health and safety hazards of substitutes must also be carefully considered, to ensure that they are actually safer. Within the class of glycol ethers, the toxicity varies greatly. All *propylene* glycol ethers are currently believed to be relatively safe; most *ethylene* glycol ethers with "*methyl*" in their names are relatively toxic.

Engineering Controls: When possible, employers must use engineering and administrative controls rather than personal protective equipment to prevent overexposures. Engineering control

methods include installing ventilation, changing the work process, and changing work habits. 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 in your breathing zone.

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. Most glycol ethers have very little odor and aren't very irritating, so the cartridge on an air-purifying respirator can wear out and need replacement without your knowing that it is no longer effective. Therefore, only a supplied-air respirator is approved.

If frequent or prolonged skin contact with glycol ethers is unavoidable, or if splashing may occur, other protective equipment such as gloves or faceshields should be worn. Protective clothing should be made of a material which is resistant to the specific chemical being used (butyl rubber, neoprene, and nitrile rubber are recommended materials for protection from glycol ethers). Even these materials will be penetrated quickly and should be replaced often. Remember, most of your exposure to glycol ethers could come through skin contact.