Chemical Hazards

Most workplaces use or store chemicals of one kind or another. Chemicals can cause a number of health effects if not properly controlled.

How Do Chemicals Get Into the Body?

In order to cause health problems, chemicals must enter your body. There are three main "routes of exposure," or ways a chemical can get into your body.

Breathing (Inhalation): Breathing in chemical gases, mists, or dusts that are in the air.

Skin or Eye Contact: Getting chemicals on the skin, or in the eyes. They can damage the skin, or be absorbed through the skin into the bloodstream.

Swallowing (Ingestion): This can happen when chemicals have spilled or settled onto food, beverages, cigarettes, beards, or hands.

Once chemicals have entered your body, some can move into your bloodstream and reach internal "target" organs, such as the lungs, liver, kidneys, or nervous system.

What Forms Do Chemicals Take?

Chemical substances can take a variety of forms. They can be in the form of solids, liquids, dusts, vapors, gases, fibers, mists and fumes. The form a substance is in has a lot to do with how it gets into your body and what harm it can cause. A chemical can also change forms. For example, liquid solvents can evaporate and give off vapors that you can inhale. Sometimes chemicals are in a form that can't be seen or smelled, so they can't be detected.

Detecting some forms of chemicals can be difficult. Solids and liquids are easier to recognize since they can be seen. Dusts and mists may or may not be visible, depending upon their size and concentration. Fumes, vapors, and gases are usually invisible.

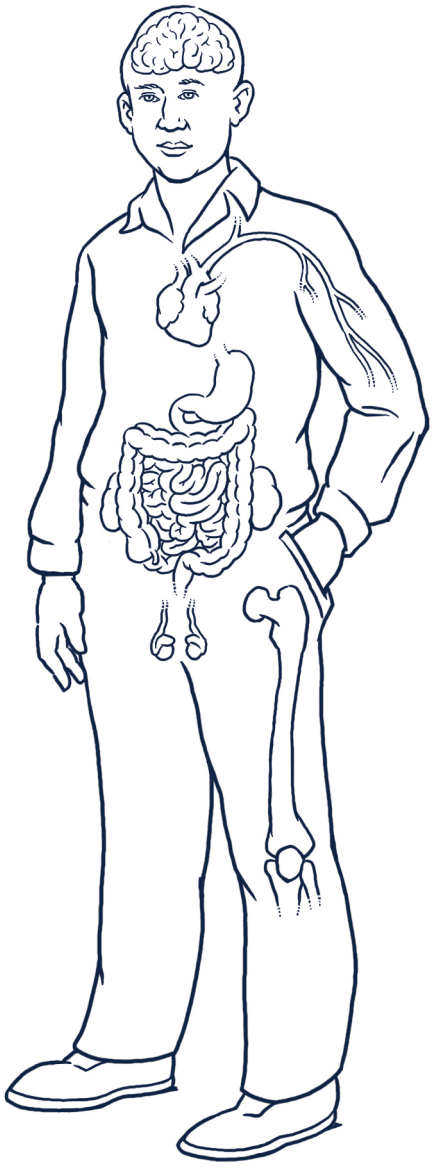
What Health Effects Can Chemicals Cause?

The effects of a toxic chemical on your body may be either acute or chronic.

Acute (short-term) effects show up immediately or soon after exposure to the chemical. They may be minor, like nose or throat irritation, or they could be serious, like eye damage or passing out from chemical vapors. What all these effects have in common is that they happen right away.

Chronic (long-term) effects may take years to show up. They are usually caused by regular exposure to a harmful substance over a long period of time. These effects are usually permanent.

Some chemicals cause both acute and chronic effects. For example, breathing solvent vapors might make you dizzy right away (an acute effect). But breathing the same vapors all the time for many years might eventually cause liver damage (a chronic effect).



What Symptoms May be Caused by Chemicals at Work?

	SYMPTOMS	COMMON CAUSES
Head	Dizziness, headache	Solvents, paint, ozone, smoke (including tobacco)
Eyes	Red, watery, irritated, grainy feeling	Smoke, gases, various dusts, vapors from paint and cleaners
Nose and Throat	Sneezing, coughing, sore throat	Smoke, ozone, solvents, various dusts, vapors and fumes from paint and cleaners
Chest and Lungs	Wheezing, coughing, shortness of breath, lung cancer	Metal fumes, various dusts, smoke, solvents, vapors from paint and cleaners
Stomach	Nausea, vomiting, stomach ache, diarrhea	Some metal fumes, solvents, paint vapors, long-term lead exposure
Skin	Redness, dryness, rash, itching, skin cancer	Solvents, chromium, nickel, detergents and cleaners, paint on skin
Nervous System	Nervousness, irritability, sleeplessness, tremors, loss of balance or coordination	Long-term solvent exposure, long-term lead exposure
Reproductive System	For men: low sperm count, damage to sperm For women: irregularities in menstruation, miscarriage, damage to egg or fetus	Lead, toluene, some other solvents, ethylene oxide gas

What Factors Affect Your Risk?

1. How toxic the chemical is (toxicity).	The more toxic the chemical, the more likely it will cause health problems, even in small amounts. Asbestos and cyanide are considered highly toxic because a very small quantity can cause health effects.
2. How the chemical gets into the person's body (route of exposure).	The way a chemical enters your body affects your risk. Some chemicals, like the pesticide parathion, are very toxic whether they get into the body through the skin, by breathing, or by swallowing. On the other hand, asbestos is only harmful when inhaled or swallowed. A house may have asbestos insulation, but unless the asbestos is disturbed and becomes a dust in the air, it can't be breathed in, so it won't cause harm.
3. The amount of the chemical that you are exposed to (dose).	For some chemicals, the higher the amount, the greater the damage. For example, acetone is an industrial solvent that is also found in nail polish remover. It is more dangerous to the worker who uses large amounts than to the person who uses a little nail polish remover.
4. How long you are exposed to the chemical (duration).	The longer the exposure, the greater the danger. For example, someone may work with a chemical for half an hour per day, while another person is exposed for eight hours a day. Also, someone may be exposed for one month, while another person may have 20 years of exposure.
5. Reaction and interaction with other chemicals.	Some chemicals in combination can create a different chemical that is more hazardous than the original ones (reaction). For example, ammonia and bleach used together can produce a highly toxic chemical. Some chemicals, in combination, can increase the likelihood of harm. For example, workers who have been exposed to asbestos increase their likelihood of getting lung cancer if they smoke cigarettes.
6. Individual differences (like heredity, body size, age, smoking, drinking, allergies, sensitivities, or previous exposures to other toxic chemicals).	Chemicals can be more harmful to some people than to others. Lead is much more harmful to small children than adults because it affects their developing brain and nervous system. If two people work with asbestos and one of them smokes, the smoker is more likely to develop asbestos-related lung cancer than the non-smoker.

Controlling Chemical Hazards

Once chemical hazards are identified, various methods can be used to protect workers from them. These are called hazard controls. Not all controls are equally effective. There is a "hierarchy" of possible solutions. The most effective solutions, at the top of the pyramid, are those that actually remove the hazard. Further down are solutions that only reduce or limit the worker's exposure.

Often a combination of methods is needed to get the best protection.

REMOVE THE HAZARD

The best way to protect workers from hazards is to remove the hazards from the workplace altogether, or at least keep them away from workers. These methods are often called *engineering controls*. They directly address the hazard and do not depend on workers' actions to be effective. Workers don't have to wear special protective gear or take special precautions, because the hazard is gone.

Engineering controls include these methods:

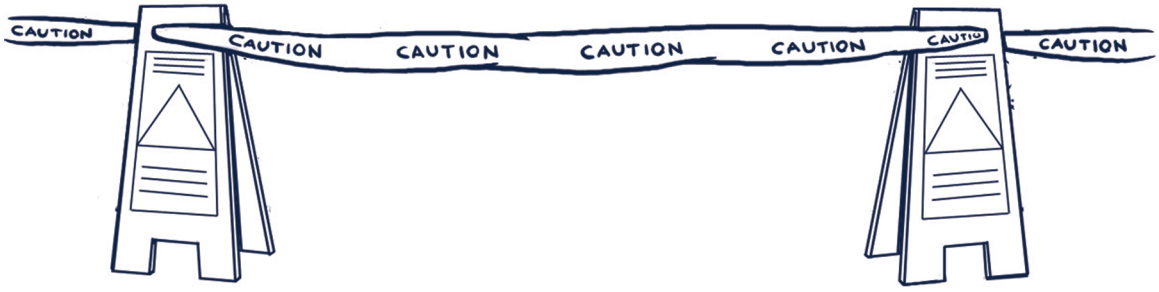
- **Redesign the process.** For example:
  - Replace gasoline motors with electric motors to eliminate exhaust fumes.
  - Use wet methods when grinding, sanding, or using other tools to reduce dust levels.
- **Substitute safer products for hazardous ones.** For example, use chemicals that are less toxic or dangerous, such as some water-based cleaners.
- **Isolate the process, or isolate the worker from the process.** For example, use glove boxes when working with dangerous substances like radioactive material.
- **Install ventilation systems.** These remove chemicals from the air that workers breathe. The best systems remove vapors and fumes close to the source (local exhaust ventilation).

IMPROVE WORK POLICIES AND PROCEDURES

When the hazard cannot be eliminated altogether, another option is to set rules that will limit workers' exposure to the danger. These measures are often called *administrative controls*.

Administrative controls include:

- **Rotate workers** between a hazardous task and a non-hazardous task so that the length of exposure is reduced.
- **Increase the number of breaks** to reduce the time of exposure.
- **Restrict access** to the work area.
- **Improve personal hygiene facilities and practices.** Provide a way for workers to wash their hands and faces before eating and drinking. Prohibit eating in work areas. Set up facilities for showering after the shift, and leaving contaminated clothes at the workplace.
- **Provide worker training programs**. Increase workers' ability to recognize and evaluate chemical hazards, and to take action to protect themselves.



PROVIDE PERSONAL PROTECTIVE EQUIPMENT

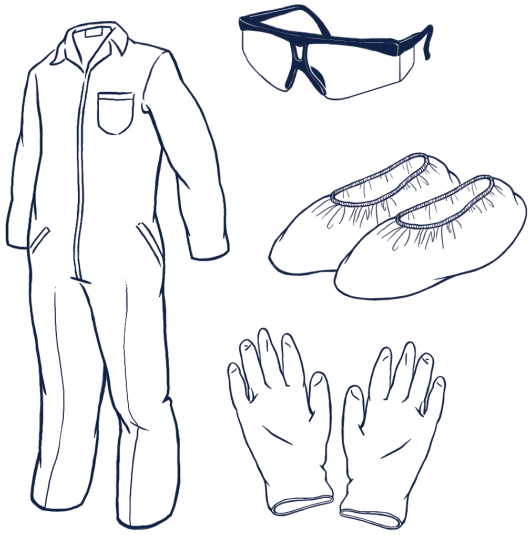
A third method of reducing hazards is to use *personal protective equipment (PPE)*. PPE is worn on the body and protects you from exposure to chemicals. It includes gloves, goggles, respirators, and coveralls. Wear PPE when other methods of hazard control aren't possible or don't give enough protection.

For PPE to be effective, workers must be given the correct PPE and trained in its use, care, and storage. PPE is usually considered less protective than the other methods because:

- It doesn't get rid of the hazard itself. However, it can reduce the **amount** of exposure by placing a barrier between the hazard and the worker.
- Workers may not want to wear it because it can be uncomfortable and hot, and may make it hard to communicate.
- It has to fit properly to work. In many cases, it must be cleaned and inspected often.
- It has to be the right type for the particular hazard, such as the right respirator cartridge or glove for the chemical being used.
- Workers must know and remember how to use it properly.
- Some PPE creates its own hazards, such as heat, heavy weight, reduced visibility and reduced hearing, restricted movement, and discomfort.
- PPE depends entirely on human action to be effective.

USE A COMBINATION OF METHODS

Sometimes you may need a combination of methods to control a chemical hazard. While engineering controls may be the most effective method, you also need to have training programs and good workplace policies to supplement them. There may also be situations where PPE is essential. It's important to consider as many solutions as possible before settling on a strategy for controlling chemical hazards.



How Do You Find Out About Chemicals at Work?

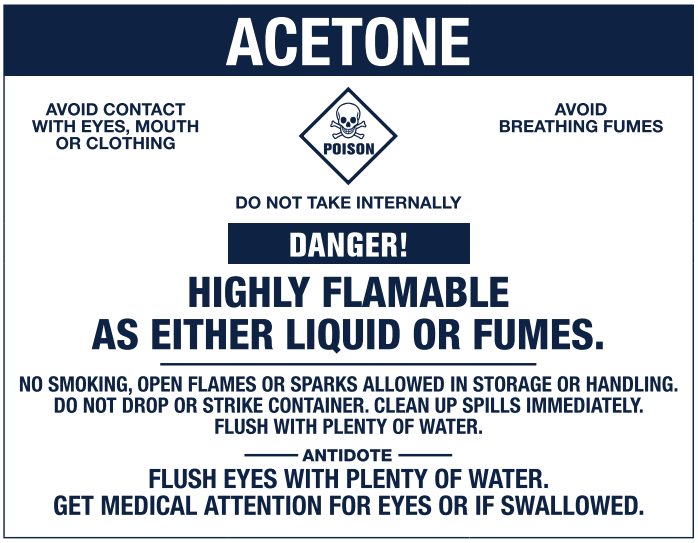
The Cal/OSHA Hazard Communication standard (Title 8 CCR § 5194), gives you the right to information about the chemicals and other hazardous substances you may be exposed to at work. It requires employers to inventory the chemicals in the workplace; to ensure chemicals are properly labeled; to make sure there are up-to-date Safety Data Sheets (SDSs) on each chemical from the chemical manufacturers; and to train workers about the hazards of working with chemicals.

Chemical Labels

Under the current "Right to Know" law, (California's Hazard Communication standard), labels from suppliers are only required to contain the following information:

- Product identity, specifically the chemical name.
- Hazard warnings, including what type of hazard (for example, fire or lung damage).
- Name and address of the manufacturer.

Some labels may include additional information and include words like "caution" or "harmful if breathed."



By December 2015, all chemical manufacturers and suppliers will be required to label their products with information that complies with the new Globally Harmonized System (GHS) for hazard classification and labeling. Labels under GHS must include the following information for each chemical product:

- Product identifier
- Supplier identification
- Signal word
- Pictogram
- Hazard statement
- Precautionary statement

The pictograms are symbols that alert chemical handlers about the dangers of the product. They include:

FLAME OVER CIRCLE	FLAME	EXPLODING BOMB
		
• Oxidizers	• Flammables • Pyrophorics • Self-heating • Emits flammable gas • Self reactives • Organic peroxides	• Explosives • Self reactives • Organic peroxides
SKULL AND CROSSBONES	**CORROSION**	**GAS CYLINDER**
		
• Acute toxicity (severe)	• Corrosives	• Gases under pressure
HEALTH HAZARD	**ENVIRONMENT**	**EXCLAMATION MARK**
		
• Carcinogen • Mutagenicity • Reproductive toxicity • Respiratory sensitizer • Target organ toxicity • Aspiration toxicity	• Aquatic toxicity	• Irritant • Skin sensitizer • Acute toxicity (harmful) • Narcotic effects • Respiratory tract irritation • Hazardous to ozone layer

REMEMBER: All chemical products in the workplace should have labels. If a chemical is poured into a smaller container and taken elsewhere in the workplace, it still needs to have a label. The only exception is if the worker who poured it can carry a portable container at all times and empties it at the end of the shift.

Safety Data Sheets

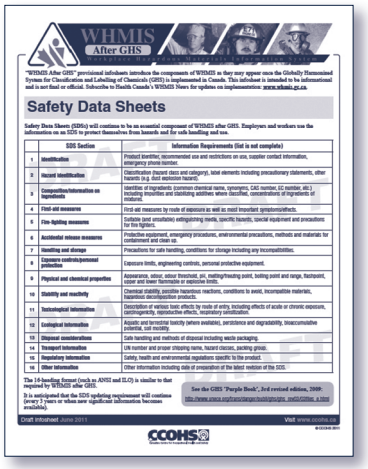
Safety Data Sheets (SDSs), previously called "Material Safety Data Sheets (MSDSs), are data sheets that contain information about the health and safety properties of workplace chemical products. They are written by the supplier or manufacturer of the product and provided to purchasers. When employers receive an SDS, they are required to let workers see and copy it.

An SDS is divided into sections, and must have certain required information. Each section provides a different type of information about the chemical product. In the past, these sections have not always been the same on every SDS.

What's Required on a Safety Data Sheet?

Under Cal/OSHA's Hazard Communication standard, an SDS must contain certain information. This includes:

- **Section 1, Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- **Section 2, Hazard(s) identification** includes all hazards regarding the chemical; required label elements.
- **Section 3, Composition/information on ingredients** includes information on chemical ingredients; trade secret claims.
- **Section 4, First-aid** measures includes important symptoms/effects, acute, delayed; required treatment.
- **Section 5, Fire-fighting** measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- **Section 6, Accidental release** measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.


WHMIS After GHS

Safety Data Sheets

	SDS Section	Information Requirements (list is not complete)
1	Identification	Product identifier; recommended use and restrictions on use, supplier contact information, emergency phone number.
2	Hazard identification	Classification (hazard class and category), label elements including precautionary statements, other hazards (e.g. dust explosion hazard).
3	Composition/information on ingredients	Identities of ingredients (common chemical name, synonyms, CAS number, EC number, etc.) including impurities and stabilizing additives where classified, concentrations of ingredients of mixtures).
4	First-aid measures	First-aid measures by route of exposure as well as most important symptoms/effects.
5	Fire-fighting measures	Suitable (and unsuitable) extinguishing media, specific hazards, special equipment and precautions for fire fighters.
6	Accidental release measures	Protective equipment, emergency procedures, environmental precautions; methods and materials for containment and clean up.
7	Handling and storage	Precautions for safe handling, conditions for storage including any incompatibilities.
8	Exposure controls/personal protection	Exposure limits, engineering controls, personal protective equipment.
9	Physical and chemical properties	Appearance, odour, odour threshold, pH, melting/freezing point, boiling point and range, flashpoint, vapor and lower flammable or explosive limits.
10	Stability and reactivity	Chemical stability, possible hazardous reactions, conditions to avoid, incompatible materials, hazardous decomposition products.
11	Toxicological information	Description of various toxic effects by route of entry, including effects of acute or chronic exposure, carcinogenicity, reproductive effects, respiratory sensitization.
12	Ecological information	Aquatic and terrestrial toxicity (where available), persistence and degradability, bioaccumulative potential, soil mobility.
13	Disposal considerations	Safe handling and methods of disposal including waste packaging.
14	Transport information	UN number and proper shipping name, hazard classes, packing group.
15	Regulatory information	Safety, health and environmental regulations specific to the product.
16	Other information	Other information including date of preparation of the latest revision of the SDS.

The 16-heading format (such as ANSI and ILO) is similar to that required by WHMIS after GHS.

It is anticipated that the SDS updating requirement will continue every 3 years or when new significant information becomes available).

See the GHS "Purple Book", 3rd revised edition, 2009: http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html

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CCOHS

- **Section 7, Handling and storage** lists precautions for safe handling and storage, including incompatibilities.
- **Section 8, Exposure controls/personal protection** lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).
- **Section 9, Physical and chemical properties** lists the chemical's characteristics.
- **Section 10, Stability and reactivity** lists chemical stability and possibility of hazardous reactions.
- **Section 11, Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
- Section 12, Ecological information*
- Section 13, Disposal considerations*
- Section 14, Transport information*
- Section 15, Regulatory information*
- **Section 16, Other information,** includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, Cal/OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

Cal/OSHA is requiring employers to train their employees about the new labeling and SDS requirements by December 1, 2013.

The table below lists some of the information you can find about a chemical product by looking at its SDS.

QUESTIONS	WHAT TO LOOK FOR	SECTION OF THE SDS
What is this product?	• Name of chemical? • Who makes it?	• Identification (Section 1) • Manufacturer (Section 1)
Can this product harm my health?	• Ingredients • Health effects • Symptoms • Cancer hazard • Emergency and First aid procedures	• Hazard identification (Section 2) • Composition/information on ingredients (Section 3) • First aid measures (Section 4) • Toxicological information (Section 11)
Does this product have other dangers?	• Fire and explosion hazard • Incompatible materials to avoid • Stable or unstable	• Fire-fighting measures (Section 5) • Physical and chemical properties (Section 9) • Stability and reactivity (Section 10)
How can you protect yourself?	• Personal protective equipment to use • Other control measures	• Accidental release measures (Section 6) • Handling and storage (Section 7) • Exposure controls (Section 8)
How should the product be handled?	• Safe handling and storage • Spill and accidental release procedures • Waste disposal	• Accidental release measures (Section 6) • Handling and storage (Section 7) • Exposure controls (Section 8)
Where do you get more information?	• Name and phone number of manufacturer	• Identification (Section 1)

What Are the Strengths and Limitations of an SDS?

Why are SDSs useful?

- An SDS provides more information than a label. If it's well-written, it can be a valuable tool.
- It should give detailed health information.
- It should give comprehensive information on how to protect yourself and what your employer should do to protect you.
- It should give you information on safe storage, legal exposure limits, incompatibility, and what to do in an emergency.

What are the limitations of SDSs?

- One chemical could have many different SDSs from different suppliers.
- An SDS may be missing information.
- An SDS may be difficult to read and understand. It may require a lot of reading. It may be too technical. If you don't read English, it may not be available in your own language. However, some companies have successfully asked their suppliers (the chemical manufacturers) to provide SDSs in other languages, like Spanish.
- It's also important to use other sources of information about chemical hazards, including the internet, factsheets, Cal/OSHA Consultation Service, and materials available from the Worker Occupational Safety and Health Training and Education Program (WOSHTEP) Resource Centers.

Evaluating Your Workplace Hazard Communication Program

Cal/OSHA regulations require employers to provide information to employees about the chemicals and other hazardous substances to which they may be exposed at work by providing SDSs, chemical labels and training. Use this checklist to see if your employer's hazard communication program meets Cal/OSHA requirements. See Title 8, California Code of Regulations, section 5194 for details.

Does your workplace have the following elements in place?

YES	NO	A WRITTEN HAZARD COMMUNICATION PROGRAM
❑	❑	Is there a written hazard communication program for your workplace and is there someone who is responsible for preparing and maintaining the program?
❑	❑	Does the written program describe how chemical containers will be labeled, how Safety Data Sheets (SDSs) will be compiled and maintained for each chemical at the worksite, and how employee information and training requirements will be met?
❑	❑	Does the written program include a list of the hazardous substances that are present in the workplace (either for the workplace as a whole or for individual work areas)?
❑	❑	Does the written program include the methods the employer will use to inform employees of the hazards that may be created by non-routine tasks or situations?
❑	❑	Is the written hazard communication program made available, upon request, to employees and their designated representatives?
❑	❑	For workplaces that have more than one employer, does the written program include the methods to be used to inform all employees in the workplace of the hazards and suggestions for protective measures?

YES	NO	LABELS ON CHEMICALS
❑	❑	Is someone responsible for making sure chemicals are properly labeled?
❑	❑	Does each chemical container have a clear label with the product name, hazard warnings, and the name and address of the manufacturer, importer, or other responsible party?

YES	NO	SAFETY DATA SHEETS (SDSs)
❑	❑	Is someone responsible for obtaining and maintaining SDSs for each chemical used in the workplace and making sure they are up-to-date?
❑	❑	Is there an SDS for each chemical used in the workplace?
❑	❑	Are SDSs readily accessible to workers? Do workers know where SDSs are kept?

YES	NO	TRAINING
❑	❑	Is someone responsible for providing health and safety training to workers?
❑	❑	Are training and information on the hazardous substances in employees' work areas provided both at the time of their initial assignment and whenever a new hazard is introduced into their work area?
❑	❑	Does training include information on the following topics? • The Hazard Communication standard requirements; • The location and availability of the employer's written hazard communication program; • An explanation of the labeling system and where Safety Data Sheets are kept; • The hazards of the specific chemicals used and how to protect oneself from exposure.

SDS Worksheet

Name of Product:

1. How is this chemical used?

2. What are the routes of entry for this chemical?

3. What are the potential acute health effects of exposure to this chemical?

4. What are the potential chronic health effects of exposure to this chemical? (Use colored dots to mark target organs on the flipchart with the outline of a body on it.)

5. Which health effect concerns you most, and why?