

PACE/Labor Institute

Hazardous Materials WORKBOOK



Written and Produced by
THE LABOR INSTITUTE
for the
**PAPER, ALLIED-INDUSTRIAL, CHEMICAL AND ENERGY WORKERS
INTERNATIONAL UNION**

PACE/The Labor Institute

Hazardous Materials

Workbook

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Written and produced by
The Labor Institute

for the
Paper, Allied-Industrial, Chemical and Energy
Workers International Union

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This workbook is designed for use by PACE worker-trainers who are conducting 8-hour and 24-hour hazardous materials courses. Please be advised that this edition is in a continuous editing process based on the field experiences of the PACE worker-trainers. All requests to use or reproduce this material must be made to Joe Anderson at the Paper, Allied-Industrial, Chemical and Energy Workers International Union (address above) and The Labor Institute (address above). Funds for this project are provided by the National Institute of Environmental Health Sciences.

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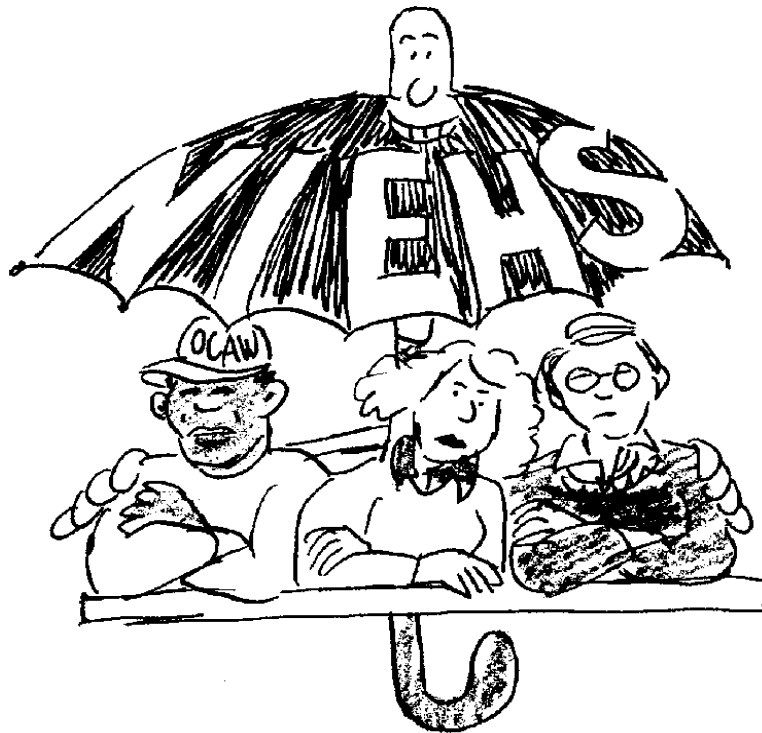
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Introduction

Why Is This Training Taking Place?

The Paper, Allied-Industrial, Chemical and Energy Workers Union, in cooperation with The Labor Institute of New York, received a training grant from the National Institute of Environmental Health Sciences (NIEHS). The grant was awarded to provide training to workers who handle hazardous materials and respond to chemical emergencies. Under the **Superfund Amendments and Reauthorization Act (SARA)**, Congress set aside \$20 million to support safety and health training programs which are specially designed for hazardous materials workers and chemical emergency responders.



A Short History of SARA and How It Affects Chemical Workers

In 1980, the U.S. Congress passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLA set up a "Superfund" of \$1.6 billion for the first five years to clean up toxic waste dumps. The program was severely criticized. Funding was inadequate, given the scope of the problem, and Environmental Protection Agency (EPA) enforcement efforts to clean up hazardous waste sites were sluggish.

In 1986, Congress amended this original program by passing the **Superfund Amendments and Reauthorization Act (SARA)**. This law, which was passed in response to grassroots activism by citizens living near toxic dump sites, increased funding for the cleanup of these sites to \$8.5 billion between 1986 and 1990. In addition, it sped up the timetable for cleaning up toxic dumps and imposed tighter standards to prevent companies from simply shuffling their hazardous wastes out-of-sight and out-of-mind. In 1990, CERCLA was reauthorized and \$5.1 billion was added to the fund.

In addition to providing financial support for health and safety training for hazardous materials workers, SARA also required OSHA to establish health and safety training requirements for workers engaged in hazardous materials removal, containment or emergency response. Importantly for us, SARA required OSHA to establish health and safety training requirements for workers at Treat, Storage, and Disposal (TSD) sites regulated by the Resource Conservation and Recovery Act (RCRA).

Following is some basic information about both the new OSHA Training Standard and new RCRA requirements for TSD facilities. Is your company complying? (For more details, see Activity 12: The Legal Octopus.)

OSHA Training Requirement for Hazardous Materials Workers

The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) is currently in effect.

Who must be trained and for how long?

- Cleanup workers at Superfund sites have to have a minimum of 40 hours of training, including hands-on instruction with the equipment they will be using.
- Chemical emergency response workers must have up to 24 hours of training, depending on their role in emergency response.
- Chemical workers who work at RCRA-permitted TSD sites must have at least 24 hours of training. Corrective action workers may need up to 40 hours of training.
- All of the above workers must have an 8-hour refresher course annually.
- Emergency response workers must have up to eight hours of annual training, depending on their role.

PACE is, at the moment, concentrating on providing courses for members who work at RCRA sites around the country.

What Is a RCRA-Permitted TSD Site?

Under the Resource Conservation and Recovery Act of 1976 (called RCRA for short), companies which generate more than 1,000 kilograms (about 2,200 pounds or five 55-gallon drums) of hazardous waste per month, and store that waste onsite for more than 90 days, must have a permit from the EPA. A company which stores its waste for fewer than 90 days and then ships it to a disposal site does not have to have an EPA permit.

Below is some basic information on the new RCRA requirements for TSD sites. (See Activity 12: The Legal Octopus for more details.)

New RCRA Requirements for TSD Facilities

Passed by Congress in 1976, RCRA attempts to regulate hazardous wastes from "cradle to grave." It sets out rules for treatment, storage and disposal of wastes and makes companies **legally responsible for what happens to the wastes they generate, for as long as those wastes are hazardous**. RCRA is administered by the Environmental Protection Agency.

In the process of making companies **disclose** how they handle and dispose of toxic substances, RCRA established requirements that workers and their unions can use in efforts to make workplaces safe. Under RCRA, companies have to:

- Identify all hazardous wastes and notify governmental agencies.
- Clearly label hazardous waste storage containers with the date the waste was accumulated (so you can easily tell how long it has been stored) and the type of waste.
- Submit detailed plans on how the waste will be treated, stored and disposed, and update those plans every two years.
- Develop plans for emergencies and for working with local emergency response agencies.
- Comply with safety standards on storage of wastes (such as making sure drums don't leak).
- Develop a program to reduce the volume and toxicity of the wastes we handle to the degree that it's "economically practical."

RCRA also sets up enforcement procedures through the EPA and state agencies so that companies (not workers) can be fined or lose their permits for handling wastes.

The PACE Worker-Trainers

PACE has a long history of involvement with health and safety efforts and training. **It is our belief that our membership is really the best resource for making our facilities safe and for protecting the community from harm.**

We are putting that belief into practice. That is why the PACE/Labor Institute* program is committed to conducting the **training by PACE rank and file worker-trainers**. In addition, the training will be done using a non-lecture approach, called the Small Group Activity Method, through which workers truly participate in their own education.

* The Labor Institute is a non-profit educational group, located in New York City, that provides innovative worker-oriented educational programs to unions and community groups around the country. The staff of the Labor Institute are dues-paying members of PACE Local 2-149.

The Small Group Activity Method (SGAM)

The training activities in this workbook use the Small Group Activity Method.

Why a Non-Lecture Approach?

Worker-oriented educators have learned the hard way that working adults learn best in situations that maximize active participation and involvement. The trainer-centered, lecture-style teaching methods used in most programs actually hurt the learning process, promote passivity on the part of workers, de-value our knowledge and skills, and make us feel inadequate. As we all know, too many lectures "go in one ear and out the other."

The Small Group Activity Method puts the learner in the center of the workshop. Participants are put to work in the workshop, solving real-life problems, building upon our own skills and experiences. Instead of learning by listening, as we are expected to do in a lecture-style course, **we learn by doing.**

Origins

The Small Group Activity Method is based on a training procedure developed by England's Trade Union Congress (TUC). (The TUC is the organizational equivalent of the AFL-CIO.) The TUC used this participatory, non-lecture method to train over 250,000 shop stewards on health and safety issues in the 1970s and early 1980s. The Labor Institute in New York, which had pioneered a similar method around economic issues for workers, further developed the procedure into the Small Group Activity Method.

Through the use of this non-lecture approach, the Labor Institute has succeeded in training workers to be trainers. Since 1980, the Labor Institute has shared this method with over 200 different unions and community groups in the United States and Canada.*

*Currently there are over 150 worker-trainers using this method in the Paper, Allied-Industrial, Chemical and Energy Workers International Union and the Service Employees International Union.

Basic Structure

The Small Group Activity Method is based on **activities**. An activity can take from 30 minutes to an hour. Each activity has a common basic structure:

- **Small Group Tasks**
- **Report-Back**
- **Summary**

1. Small Group Tasks: The workshop always operates with people working in groups at tables. (Round tables are preferable.) Each activity has a **task**, or set of tasks, for the groups to work on. The idea is to work together, not to compete. Very often there is no *one* right answer. The tasks require that the groups use their experience to tackle problems, and make judgements on key issues. Part of the task often includes looking at factsheets and reading short handouts.

2. Report-Back: For each task, the group selects a **scribe** whose job it is to take notes on the small group discussion and report back to the workshop as a whole. (The report-back person was first called the "scribe" by an OCAW worker-trainer during a 1982 session with Merck stewards in New Jersey.) During the **report-back**, the scribe informs the entire workshop on how his or her group tackled the particular problem. The trainer records these reports on large pads of paper in front of the workshop so that all can refer to it. After the scribe's report, the workshop is thrown open to general discussion about the problem at hand.

3. Summary: Before the discussion drifts too far and wide, the trainer needs to bring it all together during the **summary**. Here, the trainer highlights the key points, and brings up any problems and points that may have been overlooked in the report-back. Good summaries tend to be short and to the point.

Three Basic Learning Exchanges

The Small Group Activity Method is based on the idea that every workshop is a place where learning is shared. With SGAM, learning is not a one-way street which runs from trainer to worker. Nor is SGAM simply a bull-session where we all sit around and talk. Rather, SGAM is a structured procedure that allows us to share information. It is based on three learning exchanges:

- **Worker to Worker**
- **Worker to Trainer**
- **Trainer to Worker**

Worker to Worker: Most of us learn best from each other. We should never underestimate how much real education takes place worker to worker. SGAM is set up in such a way as to make this worker-to-worker learning exchange a key element of all of our workshops. We do this by first allowing people to learn from each other by solving problems in their small groups.

Worker to Trainer: Lecture-style training assumes that the trainer knows all the answers. SGAM believes that trainers also have a lot to learn. On many subjects, any group of workers will often have as much, or more, collective knowledge as any one expert or teacher. With SGAM the trick is to learn as much as possible from the workshop participants. This is done mainly during the report-backs. Because SGAM allows us to listen to those we are training, we get to learn more and more about the realities people face. Also, because our training method shows genuine respect for workers' knowledge, it helps build confidence among those we are training. Confidence is the key to adult learning.

Trainer to Worker: This is the traditional learning procedure of school. It also has its place in SGAM. It comes at the end. This is our chance to clear up confusion and make the points we think are key. By waiting until the summary section, we now know better what people need to know.

Activity 1: Job Fear

Purpose

To gain perspective on the relationship between job security and the protection of our health and safety and the environment.



Task 1

Please read the statement below. Then in your groups, make a list of what you agree with about this statement and with what you disagree. One person in each group should be selected to keep a master list of your discussion and be prepared to report back to the workshop as a whole.

Statement:

"Environmentalists and our union health and safety people have gone too far. We have so many regulations that our industry is losing profits. This leads to job loss and shutdowns.

"I care about my health and about the environment too, but I need this job to support my family.

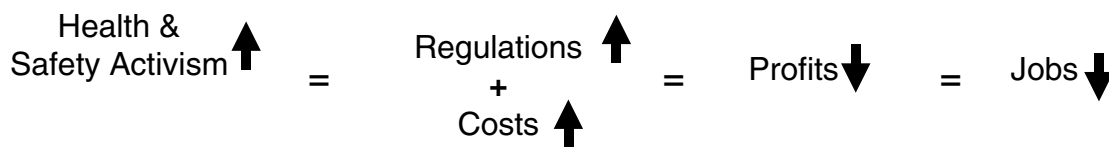
"Until the economy improves, the union must be less demanding about health and safety issues. The government must reduce regulations to protect jobs and company profits."

1. What do you agree with about this statement?

2. What do you disagree with about this statement?

Task 2

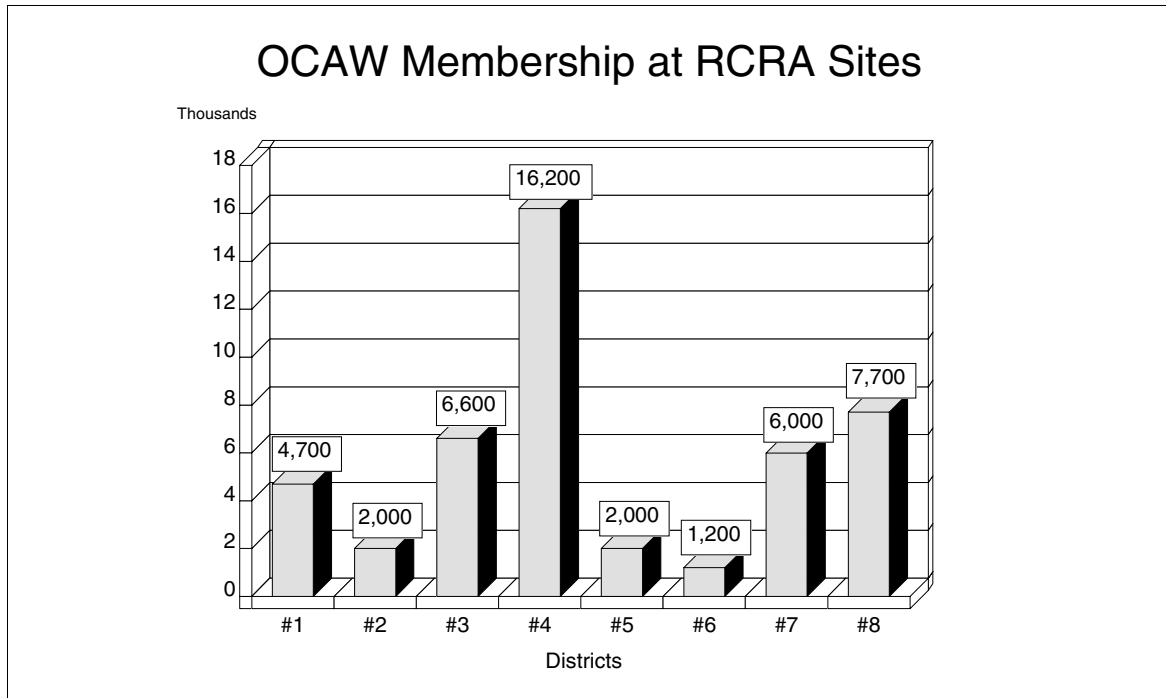
The statement on the previous page is based on a specific model of the relationship between profits, jobs and regulations (see diagram below). As a group please review the factsheets on pages 12 through 32 and develop a model which you believe describes the real relationship between health and safety regulations, regulations, profits and jobs. (In making your alternative, please refer to at least **two** of the factsheets which follow.)



1. What's your alternative?

1. How Many OCAW Members Work in Toxic Jobs?

Without a doubt many OCAW members work in facilities that deal with dangerous toxics and are heavily regulated. Below is a list of estimated OCAW members (totalling about 46,400), region by region, that work in RCRA sites covered by the legislation which is funding this training.



District 1: California, Nevada, Oregon, Washington

District 2: Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Wyoming

District 3: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia

District 4: Louisiana, Texas

District 5: Arkansas, Kansas, Missouri, Oklahoma

District 6: Iowa, Minnesota, Nebraska, North Dakota, South Dakota, Wisconsin

District 7: Illinois, Indiana, Michigan, Ohio

District 8: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

2. How Many Different Federal Regulations Affect Our Facilities?

It is also true there are many regulations, both federal and state, that attempt to prevent the toxics we use from affecting our health and safety as well as the community's environment. Below are listed some of the important federal regulations.

Regulating the Environment

Clean Air Act Amendments of 1970	1970
Resource Recovery Act – amends the Solid Waste Disposal Act	1970
Water Pollution Control Act Amendments	1972
Ocean Dumping Act – a title of the Marine Protection Research and Sanctuaries Act	1972
Surface Mining Control and Reclamation Act	1977
Emergency Planning and Community Right-To-Know Act	1986
Clean Air Act Amendments of 1990	1990
Oil Pollution Act	1990
Pollution Prevention Act	1990

Regulating Toxic Substances

Federal Environmental Pesticide Control Act – amended by the Federal Insecticide, Fungicide and Rodenticide Act	1972
Safe Drinking Water Act – amends the Public Health Service Act	1974
Resource Conservation and Recovery Act (RCRA) – amends the Resource Recovery Act, which focuses on hazardous wastes	1976
Toxic Substances Control Act	1976
Clean Air Act Amendments of 1977	1977
Clean Water Act of 1977 – amends the Water Pollution Control Act	1977
Federal Insecticide, Fungicide and Rodenticide Act Amendments of 1978	1978
Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)	1980
Hazardous and Solid Waste Amendments – amend the Resource Conservation and Recovery Act	1984
Superfund Amendments and Reauthorization Act (SARA)	1986

Regulating Consumer and Worker Health & Safety

Federal Railroad Safety Act – regulates shipment of hazardous substances by railroad	1970
Occupational Safety and Health Act (OSHA) – regulates workplace safety & health	1970
Consumer Product Safety Act	1972
Hazardous Materials Transportation Act – regulates the transport of toxic substances	1975
Federal Mine Safety and Health Act (MSHA) – regulates mine safety & health	1977

Source: Updated from Conservation Foundation, *State of the Environment: An Assessment at Mid-Decade*, Washington, DC: The Foundation, 1984.

3. Are Our Kinds of Jobs Growing or Declining?

Our members have reason to be concerned about what's happening to jobs in our sectors of the economy. As the list below shows, job growth in our kinds of industries has stagnated since 1979. Note that the exceptions are in services, which is where most of the subcontracting jobs are counted! Not including service jobs, there has been a net loss of 114,000 jobs in our industries in the last 16 years – a time when overall employment increased by 26.1 million.

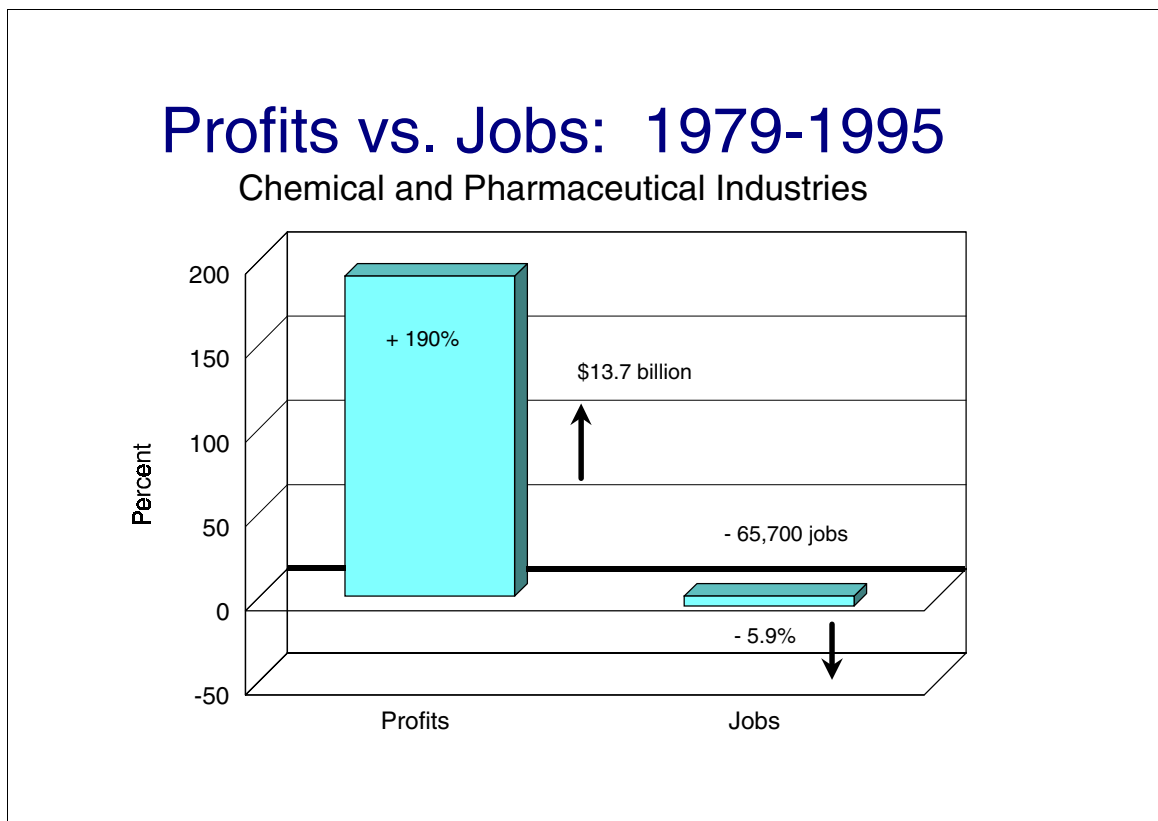
Changes in Production-Worker Jobs in OCAW Toxic Industries 1979-1995	
Industry	Percentage Change in Jobs
Industrial Inorganic Chemicals	– 34.9%
Petroleum and Coal Products	– 32.2%
Agricultural Chemicals	– 30.9%
Plastics Materials and Synthetics	– 26.3%
Soaps and Detergents	– 11.9%
Industrial Organic Chemicals	– 8.7%
Misc. Chemical Products	+ 5.9%
Polishing, Sanitation & Finishing Preps.	+ 11.7%
Drugs	+ 32.7%
Public Warehousing	+ 58.8%
Sanitary Services	+ 201.2%

Note: Industrial categories used are based on employment at OCAW sites covered by RCRA. Some adaptations have been made to avoid excessively broad categories.

Source: Data compiled from U.S. Department of Labor, Bureau of Labor Statistics, *Supplement to Employment and Earnings*, June 1982 and *Employment and Earnings*, March 1996.

4. Are Regulations Harming Profits and Jobs?

The most common argument about regulations and jobs is that these laws hurt profits which in turn destroy jobs. But the data by the Department of Commerce suggest that rising profits may not help save our jobs. The figures on the profits and jobs of the chemical and pharmaceutical industries show that from 1979 to 1995, profits jumped \$13.7 billion (from \$7.2 to \$20.9 billion) while 65,700 jobs were destroyed (from 1,111,000 to 1,045,300 jobs).



Source: U.S. Department of Commerce, *Survey of Current Business*, April 1996; U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, various issues, Washington, DC: U.S. GPO; and U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, March 1996.

5. Sometimes Corporations Cry Wolf – All the Way to the Bank

Sometimes corporations fight a new regulation or standard by claiming that it will drive the entire industry out of business, costing thousands of jobs. But after the regulation is passed, the jobs and the profits, somehow, are still there. The passage below describes one such incident concerning the vinyl chloride industry.

One of the more infamous examples was revealed after the vinyl chloride industry cried wolf over OSHA's proposed regulations to curb worker exposure to this chemical, known to cause a rare form of liver cancer. (Vinyl chloride is used in dozens of products such as water pipes, packaging, and tires.) The industry sponsored a study claiming that OSHA's proposed standard requiring "no detectable" concentrations of VC in the air would put 2.2 million people out of work and cost the economy \$65 to \$90 million. After OSHA went ahead and required a one part per million standard, the industry actually flourished. One year after the standard went into effect, in 1975, supplies of polyvinyl chloride were plentiful, prices were 10 percent lower, and four new plants had started operations (while one had closed down). "We were frankly surprised by some of the results" of the cleanup, R.N. Wheeler, Jr., a vinyl chloride superintendent for Union Carbide, told *The New York Times*.



Source: David Bollier and Joan Claybrook, *Freedom from Harm*, 1986, pp. 194-195 and *The New York Times*, December 28, 1975.

6. Profits and Jobs in Our Largest Corporations

If we look at the major corporations that employ our members, it is clear that rising corporate profits do not guarantee more jobs. If we look at the second column, it is clear that, as of 1995, **all of our major companies were profitable**. But, two-thirds cut jobs between 1979 and 1995, for a net loss of 149,461 jobs.

Profits and Jobs at Corporations with Most OCAW Workers			
Corporations	Profits (loss) 1995 (millions)	Change in Profits 1979 - 1995 (millions)	Change in Jobs 1979 - 1995
Amoco	\$1,862.0	+ \$355	– 9,593
Chevron	\$930.0	– \$855	+ 3,343
Lockheed Martin	\$682.0	+ \$448	+ 63,300
Merck	\$3,335.2	+ \$2,953	+ 14,400
Mobil	\$2,376.0	– \$369	– 163,100
Rohm & Haas	\$292.0	+ \$189	– 1,624
Shell Oil	\$781.0*	– \$345**	– 14,172**
Texaco	\$607.0	– \$1,152	– 37,567
Unocal	\$260.3	– \$240	– 4,448

*For 1993.

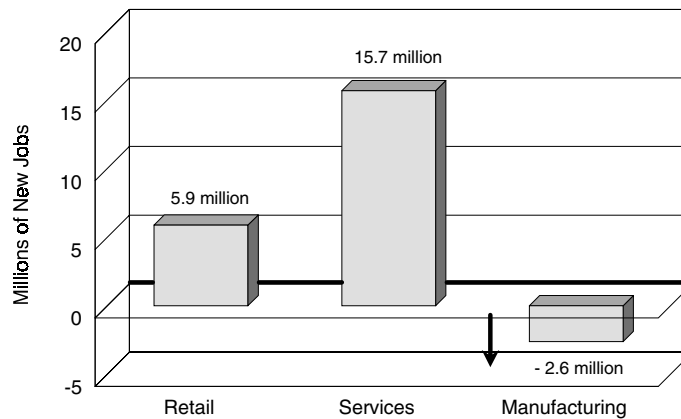
**For period 1979-1993.

Source: "The Fortune 500: Largest U.S. Corporations," *Fortune*, May 5, 1980 and April 29, 1996.

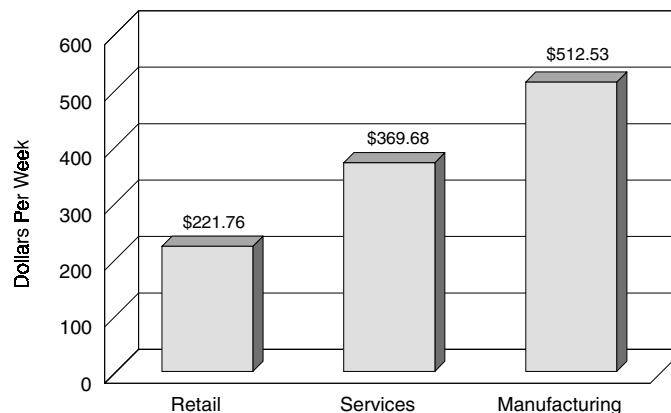
7. What Kinds of Jobs Are Growing in Our Economy?

It's only human for our members to be very worried about losing their jobs, given the way the economy is changing. We all know it would be very hard to find a job with comparable wages if our facilities closed for any reason. The charts below show that our economy is creating millions of low-paying service jobs while destroying the jobs with decent wages and benefits.

U.S. Job Growth, 1979-1995



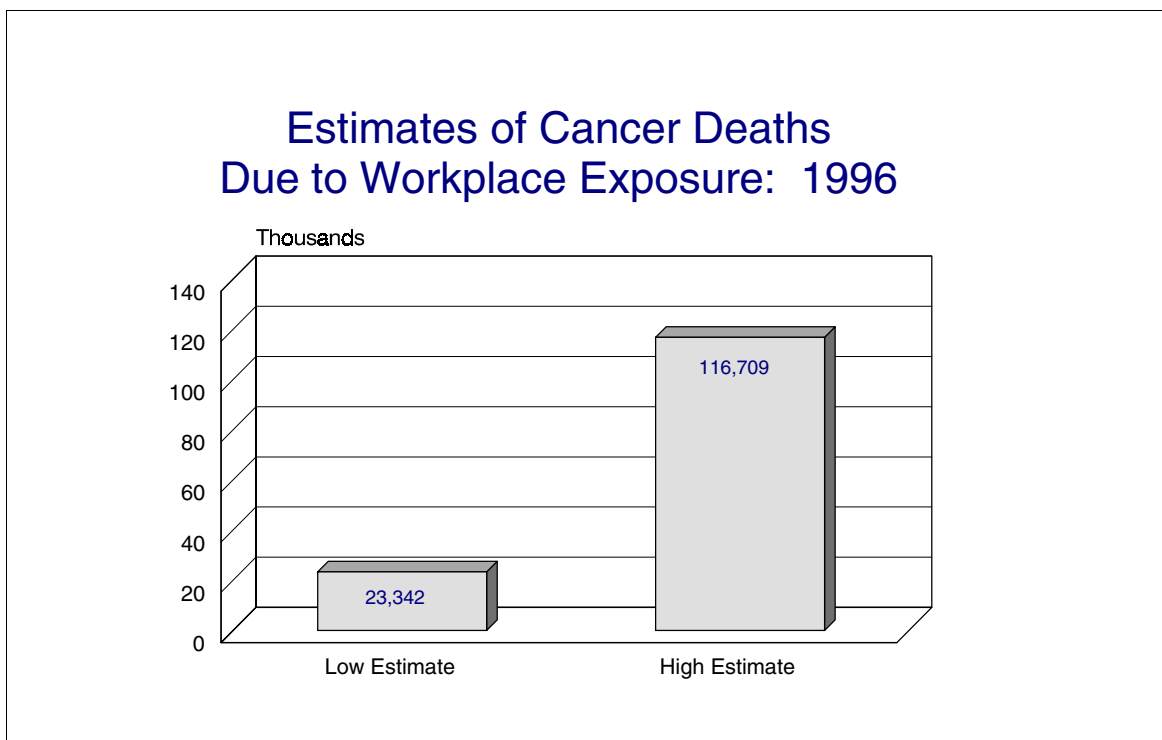
U.S. Average Weekly Pay, 1995



Source: U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, March 1996.

8. How Much Cancer Is Caused by Workplace Exposures?

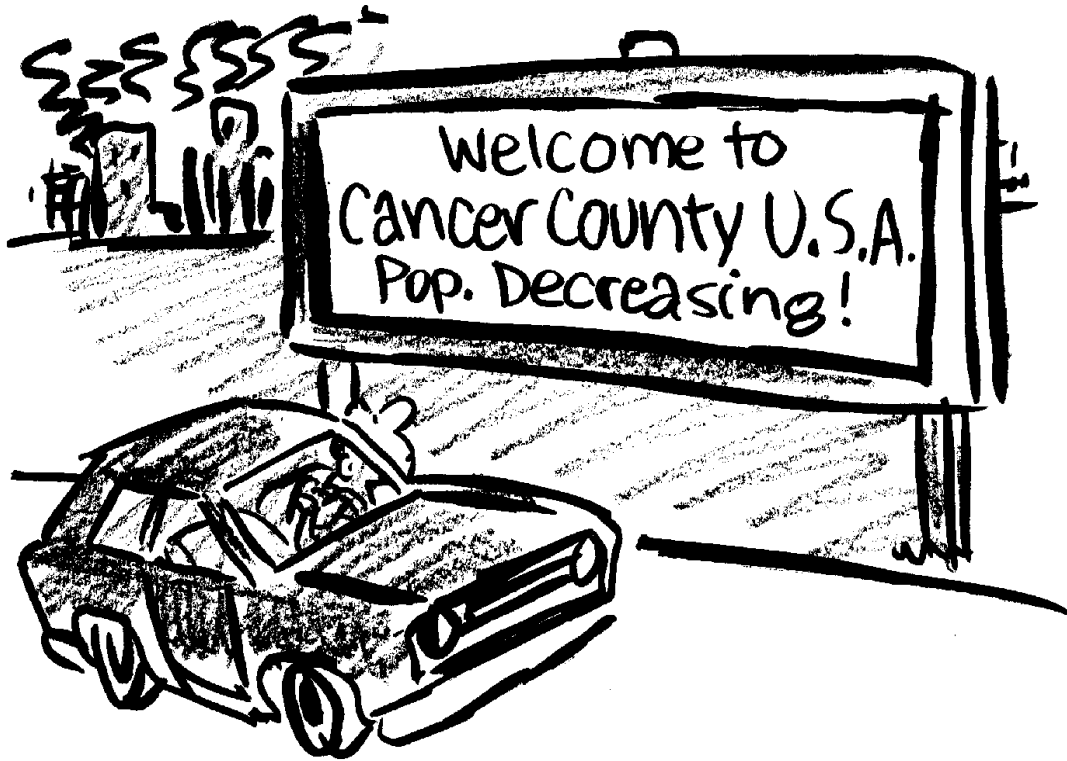
Not only do we need to worry about job security, but we also have reason to be concerned about cancer caused by our jobs. The American Cancer Society estimates that 554,740 people in the U.S. will die of cancer in 1996. Scientists disagree on the exact number of cancers caused by exposure at work. But even the most conservative estimates are bad news for us. (These numbers **do not** include estimates for those in the community who may die from cancer due to toxic releases into the air, water or food supply.)



Sources: These very conservative estimates are based on percentages of deaths by cause in Richard Doll and Richard Peto, "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today," *Journal of the National Cancer Institute*, Vol. 66, June 1981.

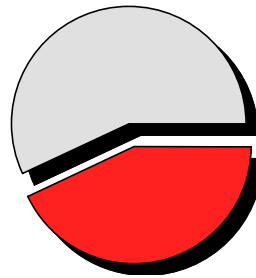
9. Are Cancer Rates Higher in Your Community?

Many community groups, indeed many OCAW members themselves, are concerned about the effects of our chemical operations on the health of their families. Do the facts support these concerns? A major report released by the National Cancer Institute showed "particularly high rates of cancer in counties where the chemical industry is heavily concentrated." Is your county one of them?



Percent of Counties With OCAW RCRA Sites With Above Average Rates of Cancer

Average Cancer Rates
57%



Higher Cancer Rates
43%

Counties With Higher Rates of Cancer

District 1

California

Contra Costa 1-5
Los Angeles 1-128, 1-547

District 3

Alabama

Boyd 3-523

Kentucky

Jefferson 3-367

District 4

Louisiana

Plaquemines 4-447
Jefferson 4-447

Calcasieu 4-500

Texas

Galveston 4-449
Harris 4-227, 4-367
 4-16000
Jefferson 4-23, 4-228
 4-243
Orange 4-836

District 5

Kansas

Wyandotte 5-114

Missouri

Jackson 5-348

continued

9. (continued)**Counties With Higher Rates of Cancer****District 7****Illinois**

Madison 7-15, 7-186,
7-776
Cook 7-91, 7-210,
7-507, 7-517
Peoria 7-807

Michigan

Wayne 7-196, 7-591, 7-627
Oakland 7-108, 7-389

Indiana

Lk. Newton 7-1, 7-210
Marion 7-535
Posey 7-368

Ohio

Allen 7-624, 7-626

District 8**Connecticut**

New Haven 8-149, 8-5370
Fairfield 8-845

New York

King 8-712
Niagara 8-77, 8-215
Erie 8-215

Delaware

New Castle 8-898

Massachusetts

Middlesex 8-366

Pennsylvania

Beaver 8-621
Chester 8-400
Delaware 8-234, 8-901, 8-993
Montgomery 8-86
Schuylkill 8-868

Maryland

Baltimore 8-2

New Jersey

Bergen 8-417
Middlesex 8-337, 8-397
Essex 8-284, 8-712
Burlington 8-669
Ocean 8-562
Passaic 8-95, 8-149,
8-328, 8-360
Union 8-190, 8-337,
8-492
Hudson 8-623

Rhode Island

Providence 8-975

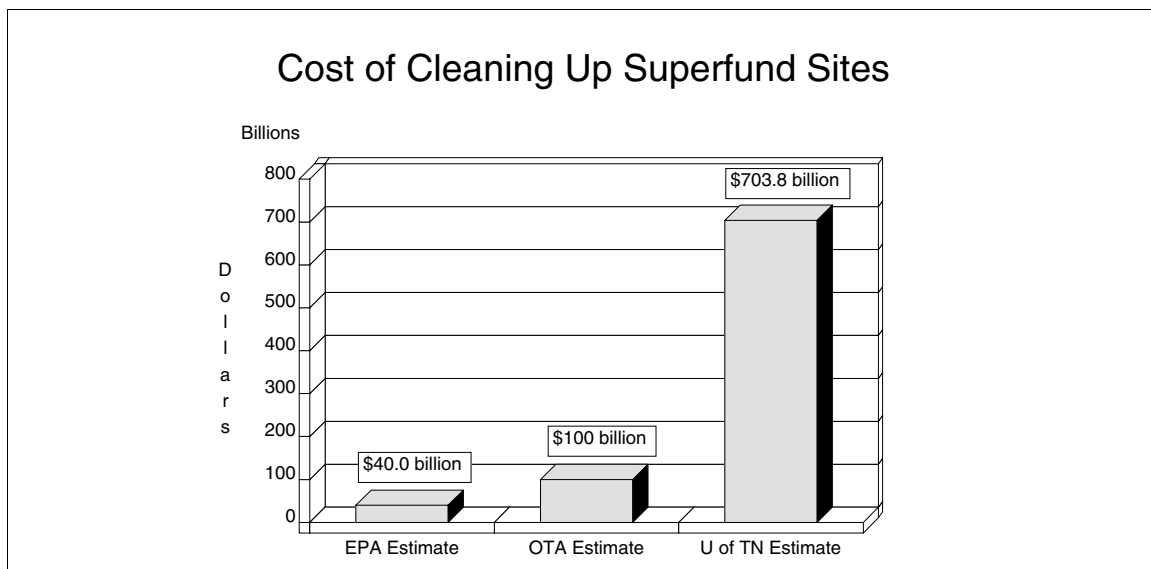
Districts 2 and 6 do not have OCAW RCRA sites in counties with above average rates.

Source: Compiled from W. B. Riggan, et al., *U.S. Cancer Mortality Rate and Trends*,

10. How Much Will It Cost To Clean Up Known Superfund Sites?

The American taxpayer also has reason to worry about the impact of toxics. It seems clear that it will cost billions of dollars to remove toxics from our environment. The chart below looks at three different estimates of how much it will cost to clean up just the national Superfund sites. The first bar looks at the estimate of the Environmental Protection Agency (EPA). The second looks at estimates of the Office of Technology Assessment (OTA), an agency of the U.S. Congress. The third bar shows an estimate from a study of the University of Tennessee. The EPA estimate covers cleanup of 1,275 sites. The OTA estimates that a minimum of 10,000 sites will require Superfund cleanup and that it may take 50 years. The University of Tennessee study estimates 6,000 sites requiring treatment of all contaminated materials with the best available technology.

From 1987 to 1993, \$10 billion had been spent on the Superfund program. Only half of the 1,320 Superfund sites had moved beyond the initial study phase and 52 sites (3.9 percent) had been cleaned up.

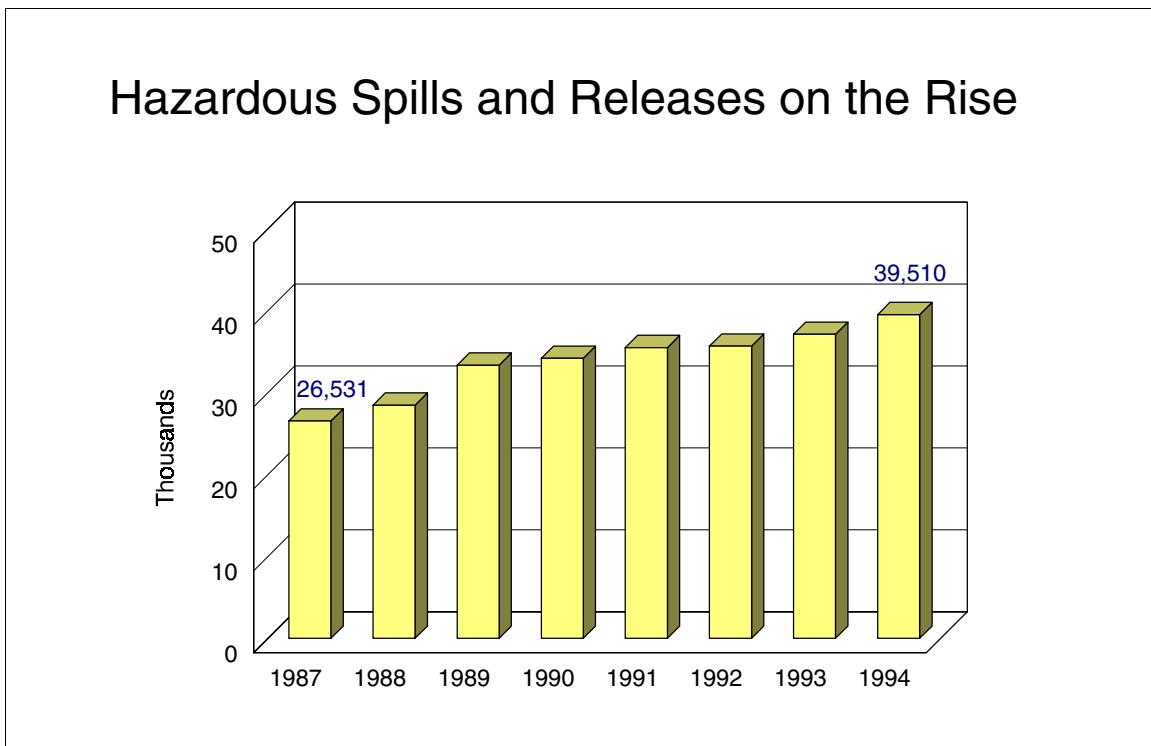


Sources: U.S. Government Accounting Office, *Superfund: Current Progress and Issues Needing Further Attention*, GAO/T-RCED-92-56, June 11, 1992; Office of Technology Assessment, *Superfund Strategy: Summary*, Washington, DC: U.S. GPO, March 1985; E.W. Colglazier, T. Cox, K. Davis, *Estimating Resource Requirements for NPL Sites*, University of Tennessee, 1991; United States General Accounting Office, *Superfund: Status, Cost and Timelines of Hazardous Waste Site Cleanups*, Washington, DC: U.S. GPO, September 1994.

11. Toxic Chemical Incidents on the Rise?

Both workers and community residents do have reason to worry about accidents at our facilities.

The following chart shows the numbers of releases of oil and other petrochemical products and hazardous substances reported to the Emergency Response Notification System (ERNS). Since 1986, more than 275,000 notifications of releases of these substances have been made to the ERNS. Not only have the numbers of releases increased each year, but by 1994 there were 49 percent more releases than in 1987!

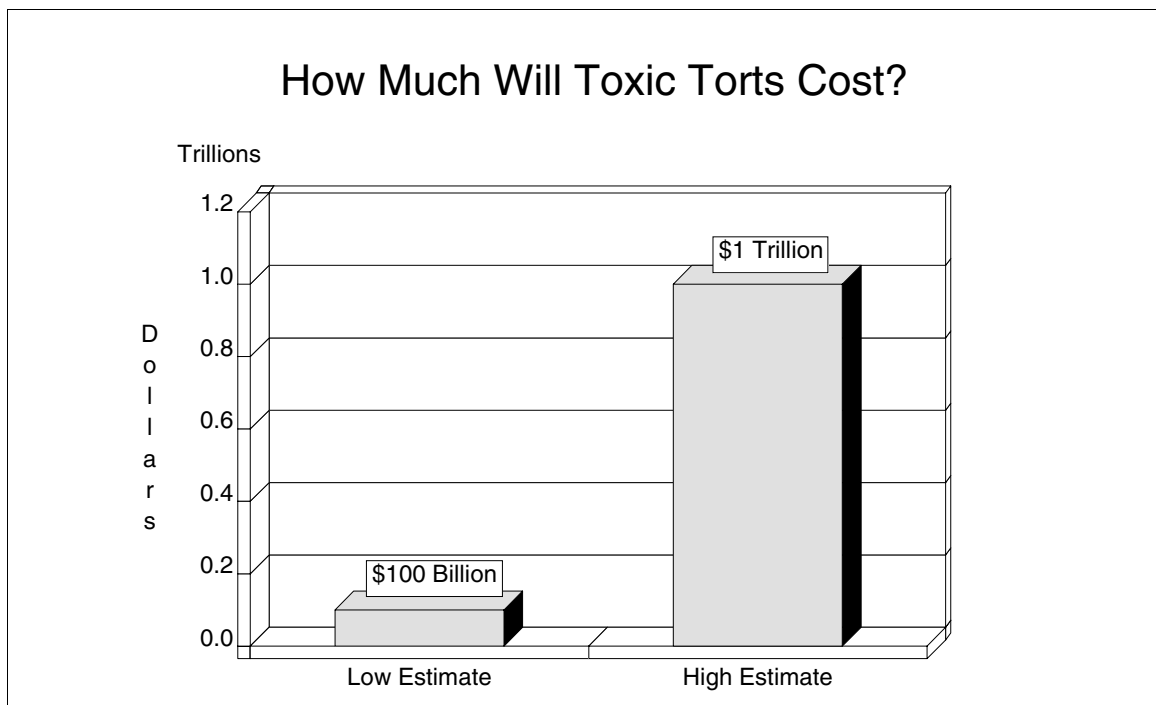


Source: The data is derived from the Emergency Response Notification System (ERNS), a national computer database, from reports filed with the National Response Center, a federal authority.

12. Toxic Torts on the Rise?

As toxic companies become involved in more toxic incidents, they will find themselves at the center of a growing number of lawsuits stemming from toxic releases. (These lawsuits are called toxic torts.)

The chart below looks at the projected estimates of the toxic tort liability that corporations are likely to face in the future based on the damage toxics have already been proven to have caused to the population outside of toxic facilities.



Source: Jay Gould, paper delivered at the Toxic Tort Symposium held by the Trial Lawyers for Public Justice, American Trial Lawyers Association, Phoenix, Arizona, January 19, 1987.

13. Recent Court Cases and Fines Involving Toxics

1996: Georgia-Pacific is settling a pollution suit with the EPA and Justice Department for **\$35 million** for pollution in eight southeastern states.

1996: Three corporations owned by a New York family was fined **\$75 million** for an oil spill in Puerto Rico.

1996: The Iroquois Pipeline Operating Company, owned by 10 gas suppliers and utilities, pled guilty to four felonies for federal environmental violations. The company agreed to pay **\$22 million** in fines.

1996: In April, **Rockwell International** pled guilty to three felony counts in connection with a 1994 chemical explosion in Simi Hills, California. The corporation will pay a **\$6.5 million** fine. Two scientists were killed as they illegally burned a volatile explosive to get rid of it.

1995: Occidental Chemical Corporation settled the Love Canal cleanup suit for **\$129 million**.

1995: Monsanto Co. agreed to pay **\$41 million** stemming from a Texas disposal site cleanup suit.

1995: General Chemical has settled 50,000 of 60,000 claims resulting from a railcar explosion for **\$180 million**. Punitive damages were set at **\$24 million**.

1995: Conrail was ordered to pay **\$2.5 million** in criminal fines for allowing oil to pollute the Charles River in Boston over the last 15 years. The company also agreed to donate \$250,000 to a local environmental group.

1995: Occidental Petroleum agreed to pay **\$65.7 million** as settlement of a class-action lawsuit brought by 8,600 plaintiffs stemming from a 1992 leak at its Robstown, Texas facility.

1995: DuPont was fined **\$101 million** for withholding data in the Benlate case in Columbus, Georgia.

1995: A jury in Hawaii ordered **DuPont** to pay **\$23.9 million** for damages resulting from two growers' use of the company's fungicide, Benlate.

1994: DuPont agreed to pay **\$214 million** to settle 220 lawsuits over damages caused by its fungicide, Benlate.

1993: Lawsuits representing as many as 70,000 residents have been filed in Harris County, Texas, seeking cleanup and medical damages from **100 oil and chemical** companies along the Houston Ship Channel. The lawsuits are seeking **\$100 billion**.

1993: Occidental Chemical agreed to pay up to **\$20 million** to clean up chemical wastes at its North Tonawanda facility.

1993: Witco Corp. agreed to pay **\$10.5 million** to settle a lawsuit over water discharge permit violations at its Perth Amboy, New Jersey plant. The company also agreed to establish procedures and install equipment to prevent future violations.

1992: Mobil agreed to pay **\$950,000** to settle a lawsuit over plant emissions from its polystyrene foam manufacturing plant in Bakersfield, California.

1992: Bristol-Myers pleaded guilty; was fined **\$3.5 million**; and agreed to build a waste-water treatment plant that might cost up to **\$30 million** to prevent the further pollution of Onondaga Lake in Syracuse, New York.

1992: Rohm & Haas and **Smith-Kline Beecham** agreed to spend some \$125 million to clean up a polluted pharmaceutical site in Myerstown, Pennsylvania.

1992: Champion International has agreed to set up a **\$6.5 million** trust to settle a lawsuit over toxic discharges into the Pigeon River from a plant in Canton, North Carolina. The company had been sued by landowners in Tennessee for \$367.5 million.

1992: Ciba-Geigy agreed to pay **\$62 million** to settle a lawsuit over environmental violations at its Toms River, New Jersey plant.

1992: Chevron agreed to pay **\$8 million** for violations of the Clean Water Act in the 1980s.

1991: Citgo Petroleum Corporation agreed to pay **\$5.8 million** for safety violations which resulted in a fire at their Louisiana refinery that killed six people on March 3, 1991.

1991: Alcoa agreed to pay **\$7.5 million** for violation of environmental laws at its Messena, New York plant. These fines included what was then the largest criminal penalty for hazardous waste violations – \$3.75 million.

1991: A settlement between **Exxon** and the government, totaling **\$1.1 billion**, was overturned by the courts as inadequate for cleanup of the Valdez oil spill in Alaska. A second settlement which raised the criminal fine from **\$100 million to \$125 million** was announced five months later. Civil cases have resulted in a jury award of **\$286.8 million** for compensatory damages to Alaskan fisherpeople; punitive damages of **\$5 billion**; and land damages of **\$9.7 million**.

1991: Marathon Oil Company agreed to pay **\$900,000** in fines and make **\$3 million** in environmental improvements to settle charges of illegally dumping petroleum wastes into Indianapolis sewers.

1990: Phillips Petroleum was fined **\$5.7 million** by OSHA – part of a \$6.4 million fine – for safety violations which resulted in the 1989 explosion at its Pasadena facility which killed 23 people and injured 270.

1990: ARCO Chemical Co. agreed to pay **\$3.5 million** to settle charges of workplace violations by OSHA. The settlement resulted from the 1989 explosion at its Channelview, Texas plant which killed 17 workers.

1990: ANGUS Chemical Company agreed to pay **\$10 million** – the largest OSHA fine ever. This was for safety violations which killed eight workers in their Sterlington, Louisiana facility.

1990: Unocal Corporation agreed to pay **\$4.22 million**, the largest civil penalty ever paid as a result of a citizen group's lawsuit alleging water pollution, for violating the Clean Water Act at its San Francisco refinery.

14. Can This Training Help Save our Jobs and Our Lives?

Every accident could potentially cost our jobs and our lives. When our corporations use lower-paid, inadequately trained subcontractors, or attempt to cut corners to save funds, the odds of a major accident happening increase. In the last few years we have seen many major accidents that have both harmed the community and had an impact on OCAW jobs. The following describe just a few, as reported in *BNA Occupational Safety & Health Daily*.

Montana Refining Company – Gas Exposures

On April 6, 1994, one worker was killed when he was exposed to hydrogen sulfide gas while performing routine tasks. OSHA proposed a total of \$178,600 in fines for job safety violations, including:

- A \$70,000 fine for willful violations of respirator standards for not monitoring worker exposure;
- Overexposing a worker to hydrogen sulfide and failing to provide proper protective equipment;
- Also, alleged serious violations of the process safety standard, including failure to:
 - Develop and implement written operating procedures;
 - Provide initial training on a newly assigned process;
 - Implement a written action plan regarding worker participation;
 - Consult with workers on frequency of training;
 - Explain to contract workers the application of emergency response plan;
 - Develop safe work practices involving lockout-tagout procedures;
 - Develop written procedures to maintain mechanical integrity of process equipment.

Mobil Oil Corporation – Refinery Explosion

On October 19, 1994, an explosion at the Torrance refinery of Mobil Oil injured 28 workers. According to the company's own investigation:

- A contractor it had hired to reroute piping did not inspect the job to “ensure mechanical completion.” As a result, a flange was left open. When the refinery resumed services to the line, a light hydrocarbon mixture leaked through the open flange and ignited.

Rohm and Haas Texas Inc. – Chemical Leak

On October 15, 1994, a leak of cyanide or ammonia at a Deer Park, Texas, Rohm and Haas plant injured 24 workers.

- Eighteen of the workers were contract employees. The workers were doing maintenance on an inactive processing unit;
- Another contract worker had been killed by a leak of cyanide at the plant a month earlier.

Conoco Oil Refinery – Reactor Explosion

On October 6, 1994, a contract employee died when he was blown from a reactor at the plant's hydrodesulfurization unit. Workers were attempting to vacuum spent catalyst wastes from a reactor that removes sulfur from hydrocarbon streams. The accident investigation revealed the following:

- The reactor had been purged with nitrogen which had apparently built up pressure under the crust of the catalyst;
- The pressure was released when the worker stepped on the catalyst as he was attempting to vacuum the substance;
- The force blew the worker from the reactor and killed him.

continued

14. *(continued)*

Rhone-Poulenc Chemical Plant Explosion

In August 1993, a fertilizer and pesticide manufacturing plant in Institute, West Virginia had an explosion and fire which killed one worker and seriously injured two others. The accident triggered the release of more than 45,000 pounds of over a dozen separate chemicals in a large cloud over the Kanawha River valley.

The facility, which Rhone-Poulenc purchased from Union Carbide, is the sister plant to the one which killed thousands and injured hundreds of thousands in Bhopal, India in 1984. OSHA issued citations alleging 23 willful and three serious violations of its PSM standard and one willful violation of the hazardous waste and emergency response standard. Alleged violations included failure to:

- Develop and implement safe hazard controls. The seven workers involved were considered “non-essential” and were not evacuated once the incident began;
- Implement a maintenance program to ensure integrity of process safety equipment;
- Inspect and test piping systems;
- Investigate near-miss incidents;
- Provide for worker involvement in process safety management programs;
- Give workers access to process safety information.

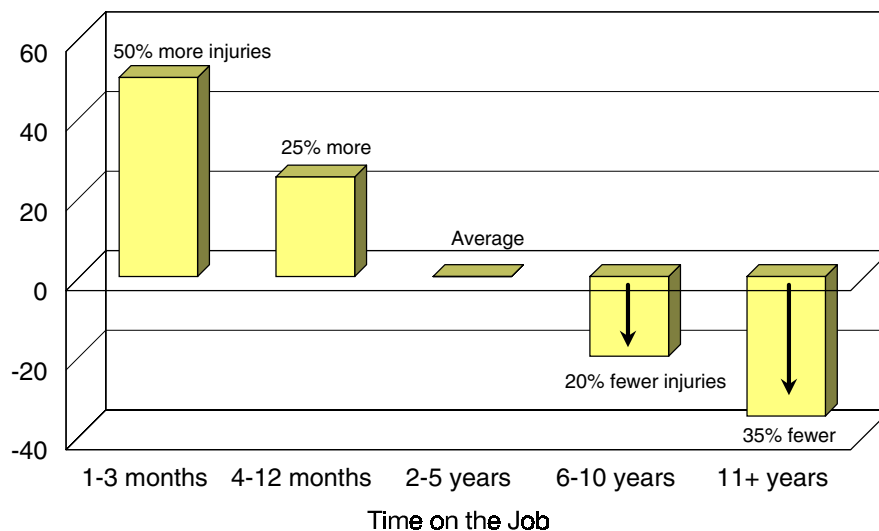
15. Lack of Experience = Injuries

When experienced workers are replaced by strike-breakers or by subcontractors, the community could be at greater risk.

Studies show that **the longer we are on the job, the safer we work**. Those on the job for only **one to three months** have **50 percent more injuries** than those with two to five years of seniority. Those with **four to 12 months** have **25 percent more injuries**. On the other hand, those with **11 years or more on the job** have **35 percent fewer injuries**.



Time on the Job and Injuries



Source: Fred Siskind, "Work Injuries and Job Experience," *Monthly Labor Review*, February 1982.

16. Why PACE Wants This Kind of Training

We have learned the hard way that we are the only people that can protect our health and our jobs. We can't just sit back and let the company go about business as usual. **We can't let fear of job loss stop us from getting involved.** If we don't get trained to spot problems and stop them before they start, we will be the ones to suffer the most.

Our PACE commitment to Crisis Prevention:

We are involved and plan to increase involvement in health and safety and environmental issues because it is our duty to our membership. This training for RCRA site workers is dedicated to stopping immediate- and long-term crises before they start. Our purposes are the following:

- To prevent long-term in-plant health problems of our members that result from exposure to toxics.
- To stop company practices, procedures and processes that expose the environment outside the plant to toxics.
- To protect jobs that could be lost due to major accidents, spills and neglect of the environment.

Welcome to the PACE Crisis Prevention Team!

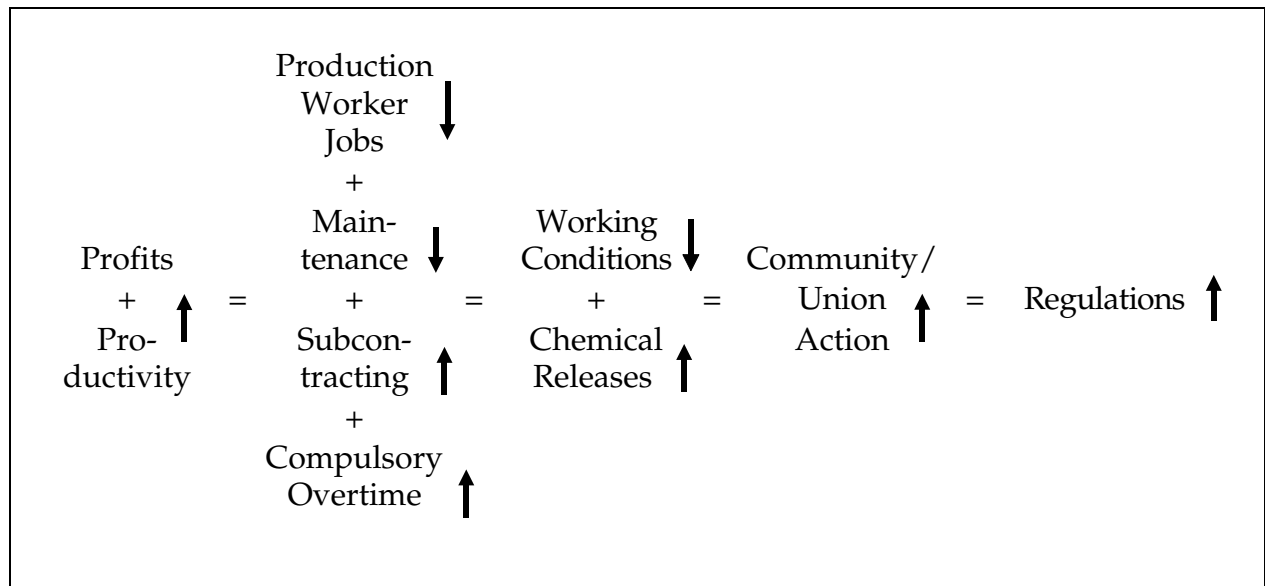


17. Job Loss Could Lead to More Releases and Regulations

Maybe the standard argument that blames job loss on regulations has it backwards.

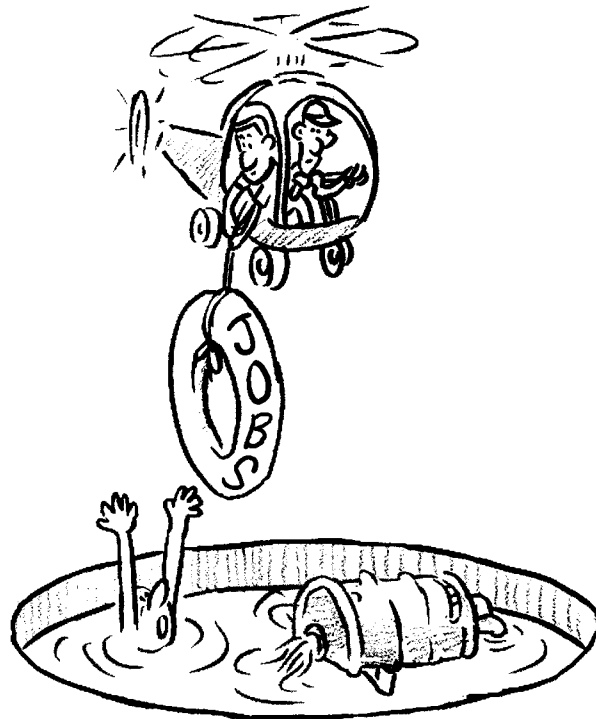
Here's another argument that might make more sense:

- The corporate drive for more **production** and **profits** leads to **cuts in unionized production jobs** and **cuts in the frequency of maintenance**.
- Facilities are now run by **fewer experienced production workers** and more **inexperienced subcontractors**. Both groups work **compulsory overtime**.
- The cuts in maintenance efforts and the cutbacks in experienced workers (combined with longer shifts and work-weeks) result in **unsafe working conditions** which can lead to an increase in **spills** and **toxic releases**.
- As the number of releases increase, so does **union and community action** to regulate the toxic producers.



Summary: Job Fear

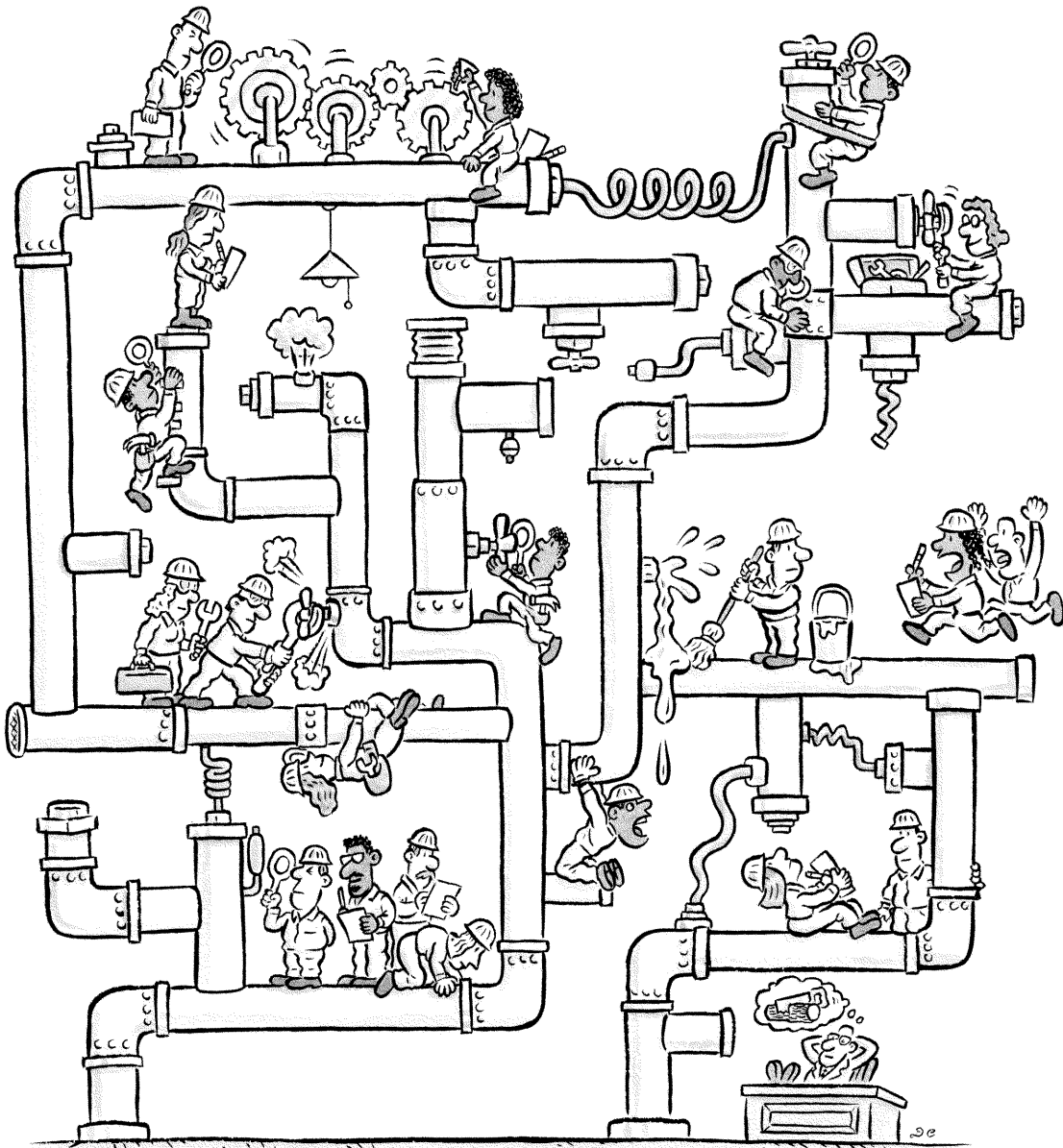
1. There is good reason to be worried about our jobs. Many of our profitable companies are trying to eliminate them. And the economy seems to be generating new jobs that are mostly low paying and/or part-time with few, if any, benefits.
2. **But we also have to worry about our health and our environment.** Too many of us are dying from cancer caused by toxics. Too many of our neighbors and family members are suffering from diseases caused by toxics entering the environment.
3. Job fear might be keeping some of us from getting more involved in trying to stop in-plant and community pollution. But if we don't get involved and accidents do take place, it could lead to more and more job loss. **Prevention of toxic exposure is the best job protection we can find.**



Activity 2: Systems of Safety

Purpose

To introduce the concept of systems of safety and accident prevention.



Task 1

On the next page is a newspaper report on a tragic train accident in India. Please read the article, and as a group, answer the following questions.

- 1. Based on this article and your own intuitions, make a list of all the probable causes of this accident.**
- 2. In your opinion which cause is the most important to rectify in order to prevent future accidents?**
- 3. In your opinion which causes mentioned in the article would be cheapest and which would be the most expensive to rectify?**

THE NEW YORK TIMES **INTERNATIONAL** TUESDAY, AUGUST 22, 1995

Signalman Is Hunted as Error Is Blamed for Indian Train Wreck

By SANJOY HAZARIKA

NEW DELHI, Aug. 21 — The authorities in India were searching today for the signalman who fled his post after allowing a train onto a track where another train was stopped, leading to a collision early Sunday that killed more than 340 people and injured more than 400.

While small groups of anxious relatives, friends and colleagues of travelers on the wrecked trains gathered at New Delhi Railway Station for information today, rescuers in Firozabad, 185 miles southeast of here, continued to pull mangled bodies from the wreckage with the aid of cranes and blowtorches.

The Associated Press reported that bodies of crash victims were piled 20 deep on trailers that were pulled by rented farmers' tractors to a local hospital and a playground. Relatives at the scene accused police officers of stealing valuables from the bodies.

Human error was blamed for the crash. It occurred when one train, the Kalindi Express, which was headed for New Delhi, stopped suddenly after striking a cow that became entangled in the train. The second train, approaching from Puri in east India and also en route to New Delhi, was not informed of the stalled train by the signalman and smashed into it, crushing several cars on both trains.

According to reports, there were at least 68 army personnel among the dead on the train from Puri as well as 16 young athletes returning from a training camp.

The disaster has focused attention on the slow pace of modernization of the world's fourth-largest railroad system, where much of the track is not electrified, where engine drivers depend on manually controlled signals from signalmen instead of automatic switching and where computerization of seat reservations is limited to major cities.

"The lack of automatic signals and the reliance on manual switching is a major problem," said a senior railways official here.

The disaster also reverberated in the Government. Prime Minister P. V. Narasimha Rao promised Parliament that those responsible would be brought to account.

"Heads will roll," he said today.

Mr. Rao said that he was concerned about the high density of passenger trains at night and that the schedules of the two trains that crashed Sunday morning were separated by barely nine minutes.

Angry opposition lawmakers disrupted Parliament all day, demanding the Government's resignation for its failure to assure safety on the state-run Indian Railways, a sprawling network that carries millions of passengers every day and about 377 million tons of goods every year over an estimated 37,000 miles of track.

An analysis by the railroads said that on average, nearly 70 percent of all accidents were the fault of the railroad staff. Failure of equipment was responsible for about 11 percent of the incidents, the report said.

Most of the train engines in India are diesel powered and a handful of steam engines remain, though these are to be phased out in the next two years, railroad officials said.

India's railroad stations and trains are a chaotic, smelly system where thousands of passengers pack unreserved coaches and sometimes bully their way into reserved coaches too, especially in northern India.

Cows and other animals frequently wander onto tracks and are swept aside without much damage to the trains, unlike the incident on Sunday when the cow was swept under the engine and damaged the brake system of the Kalindi Express.

While the total length of the railroad and its volume of passengers has changed little in the last five years, the amount of freight traffic has increased nearly 20 percent.

Task 2

The following is a report of an accident investigation which was conducted by OilChem's Incident Investigation Team. Fred was assigned to unload a rail car of sulfuric acid at the alkylation unit.

- I. Fred attached the unloading hose to the storage tank line with a two-inch union. (Other plants use quick-coupling connections for acid unloading lines.) The threads on the union were badly worn from being repeatedly connected and disconnected.
- II. He pressured up the rail car with nitrogen to 60 pounds and began unloading the acid. (He was unaware that 30 pounds was the prescribed safety limit.) The nitrogen pressure regulator was set at 30 pounds but had been by-passed for several months because it had been plugged off.
- III. A work order to repair the regulator had been written several months before, but the pipe fitters had been busy on more urgent jobs and the work order was part of their backlog.
- IV. The union started to leak and when Fred tried to tighten it, it popped apart, spraying acid everywhere. He ran to the emergency shower, but he had trouble finding one and getting out of his clothes. The practice of assigning a second worker (a buddy) for this job had been stopped due to reductions in staffing.
- V. Fred got under the shower, but it did not have a "worker in trouble" alarm so it was ten minutes before anyone was aware that Fred was hurt or that there was an uncontrolled release in progress. Luckily, Fred was not seriously burned.
- VI. The Hazmat Team responded and stopped the leak. However, there was no containment pad to catch the acid, so it had flowed unrestrained over a wide area, making it difficult to clean up.

The Incident Investigation Team’s report has resulted in finger-pointing between the maintenance department, the engineering department and the health and safety training department. Each is trying to blame the breakdown on the others’ "safety systems" for being the root cause of the accident. The plant manager has asked your group to review the report.

Your table represents the site PSM oversight committee. Based on your experiences, and the factsheets on pages 41 through 56, please complete the following:

1. Develop a list of the "safety system(s)" involved for each of the paragraphs in the report and list the flaw(s) in each system that contributed to the accident. There can be more than one flaw or system in any given paragraph.

System(s)	Flaw(s)
I.	I.
II.	II.
III.	III.
IV.	IV.
V.	V.
VI.	VI.

continued

Task 2 *(continued)*

2. In your opinion which flaw would you recommend be corrected first and why. Please explain your answer and refer to at least one factsheet in your report-back.

1.

2.

3.

1. What Are Systems of Safety?

We know that there are many systems involved in our lives. There is a political system, an economic system and a production system. But when we think about safety at our worksites we usually focus on the injuries suffered by individual workers. We generally do not spend much time thinking about the systems of safety that exist in our facilities.

A safety system can be defined as the use of special management programs which actively seek to identify and control hazards (a proactive system). This begins in the conceptual (planning) phase of a project and continues throughout the life of the process.

Major systems of safety include:

- Maintenance and inspection
- Procedures and training
- Warning devices (i.e., alarms)
- Process and equipment design
- Mitigation devices (i.e., relief valves)
- Human factors

There are many **sub-systems** which make up these major systems of safety. For example, operator refresher training is a sub-system of a facility's training system.

You may have additional systems of safety at your site. They may be organized differently and have different names. But all of our facilities have systems of safety in place.

Source: Adapted in part from Harold Roland and Brian Moriarty, *System Safety Engineering and Management*, New York: John Wiley and Son, 1983, p. 202.

2. OSHA and Systems of Safety

Although the Occupational Safety and Health Administration's (OSHA) Process Safety Management Standard (PSM) may not apply to your site, it provides an example of how systems of safety are used in hazardous industries. For instance, the PSM Standard requires that, at a minimum, companies formally establish certain systems, and sub-systems, of safety. The chart below shows how some of OSHA's PSM requirements fit into a safety system framework.

Maintenance and inspection system	Procedures and training system	Design, warning devices and mitigation systems
<ul style="list-style-type: none"> • Mechanical integrity • Subcontractors 	<ul style="list-style-type: none"> • Operating procedures • Training • Hot work • Emergency planning and response 	<ul style="list-style-type: none"> • Process safety information • Process hazard analysis • Management of change • Pre-startup safety review

Aspects of various systems, and sub-systems, of safety often overlap. For example, an effective maintenance safety system includes a major emphasis on training for mechanical employees and subcontractors.

OSHA also requires that compliance audits be implemented to evaluate each of the systems of safety included in the PSM Standard. In addition, OSHA requires an incident investigation program.

3. The Maintenance and Inspection System

Properly designed equipment can turn into unsafe junk if it is not appropriately maintained, inspected and repaired. **An effective maintenance and inspection system should be evaluated by its performance in eliminating the use of breakdown maintenance.**

Important elements of the maintenance and inspection system include:

- safety and skills training for employees and subcontractors involved in installing, maintaining, repairing or inspecting equipment;
- turnarounds* scheduled at a safe frequency and prior to the breakdown of equipment;
- turnarounds which are lengthy enough to make all needed inspections and repairs;
- spare parts are kept readily available;
- adequate staffing to eliminate work order and preventive maintenance backlogs;
- worker and union involvement in developing and overseeing this system;
- written procedures for each task performed;
- use of proper materials, equipment, tools and spare parts, including use of a quality control program.

*Turnarounds are scheduled shutdowns of process equipment for the specific purpose of performing preventive maintenance.

4. The Procedures and Training System

The operation and maintenance of processes require a system of written procedures and training. The greater the hazard of the process, the greater is the need for procedures and training.

Parts of an effective procedures and training system include:

- procedures and training which consistently incorporate the philosophy that safety is more important than production;
- worker and union involvement in developing and overseeing training and procedures activities;
- methods developed by management and the union to certify that training is understood, promotes safety, and is not punitive;
- permit programs for hot work, confined space and other hazardous activity as well as radiation work permits (RWPs);
- emergency response plan and training that are in place and are routinely practiced;
- operator training, including frequent drills and use of process simulators and mock-up exercises;
- procedures and training which identify all potential hazards, the possible consequences of these hazardous conditions and the actions needed to respond to each hazard or potential hazard;
- training which is conducted as often as needed and whenever the process or equipment changes.

5. The Warning System

The warning safety system includes the use of devices that warn employees that a dangerous or potentially dangerous situation is occurring. These warning components require worker intervention to control or to mitigate the hazardous situation. Workers must be able to understand the meaning of the warning, have the ability to respond in a timely manner and understand what actions are necessary.

Examples of warning devices include:

- facility and unit fire, spill and evacuation alarms;
- process control limit and critical alarms;
- annunciator panels;
- fixed continuous monitors and alarms for radiation and other toxic releases;
- emergency shower worker-in-trouble alarms;
- community and neighboring plant alarm systems.

6. The Design System

Many important safety decisions are made long before operators are asked to start up a new unit or machinists are assigned to prep a new compressor. **A central purpose of the design safety system is to eliminate hazards through the selection of inherently safe or low-risk processes and chemicals whenever possible. The design safety system is the place where primary prevention takes place.**

One example of primary prevention is the substitution of a less hazardous chemical (e.g., sodium hypochlorite (bleach), for chlorine in treating cooling water. A release of toxic chlorine gas can travel in the wind for miles while a spill of liquid sodium hypochlorite is inherently less dangerous.) Primary prevention eliminates the possibility for a disaster occurring.

Important elements of the design safety system are:

- use of lower process pressures and temperatures;
- reformulating products so that less hazardous materials or processes are used;
- reducing the inventory of hazardous materials;
- safe siting and spacing of process units, equipment and control rooms;
- choice of less toxic, reactive and flammable chemicals;
- enclosing processes;
- use of fail-safe engineering concepts;
- ergonomic design of equipment and control panels.

Source: Nicholas Ashford, *The Encouragement of Technological Change for Preventing Chemical Accidents*, Environmental Protection Agency, 1993.

7. The Mitigation System

The mitigation safety system involves the use of equipment that automatically acts to control or reduce the adverse consequences of hazardous incidents. Mitigation devices do not require any action on the part of employees in order for the equipment to function.

The mitigation system provides opportunities for secondary prevention. Mitigation equipment does not eliminate hazards, it only controls the severity of incidents.

Typical examples of mitigation devices are:

- relief valves
- vent gas scrubbers
- check valves
- remotely operated emergency isolation valves
- automatic fire systems (water and halon)
- mechanical ventilation
- automatic trip devices
- dikes

8. Treating Workers As Good as the Pipe: Understanding Human Factors

Human factors involve considering the worker element in the design of equipment and technical systems so that they will be safe for workers.

In the United States the term “ergonomics” is typically used to refer to the physical aspects of work while “human factors” encompass both physical and mental issues.

The Center for Chemical Process Safety (CCPS) has created a list of questions for auditing human factors programs. Sample questions include:

- Do control and display layouts minimize the chance for operator error...?
- Are there design standards that specify proper layout?
- Is there adequate space to access system elements for normal operations and maintenance?
- Have the psychological and physical demands of the job been considered for both routine and emergency operations?
- Have shift work and overtime schedules been designed to minimize operator fatigue and stress?
- Have environmental conditions such as noise, temperature and illumination been considered?
- Have employees made modifications to existing systems that would indicate failure to apply human factors principles in the original design?
- Have employees received training in human factors?

Like every other major safety system, the human factors system has several sub-systems. These include equipment lay-out, workload and staffing levels, shift schedule, and overtime. In order to effectively address these important safety issues, each facility needs a written human factors program. Many facilities have large staffs of engineers who perform extensive calculations on piping and other hardware so that the process will run safely. While the hardware receives lots of attention, little thought is given to human factors. Companies apply tight restrictions on the maximum safe process limits for the protection of piping and other hardware. But when it comes to scheduling unlimited and unsafe amounts of overtime, many times workers are treated far worse than the pipe.

Source: *Guidelines for Technical Management of Chemical Process Safety*, Center for Chemical Process Safety, 1989, pp. 99-103.

9. Getting to Prevention

Some systems are far more effective than others in their ability to maximize opportunities for prevention of disasters and injuries. **The most important safety system is the design system. This is the only system in which primary prevention takes place.** For example, by designing a process to use lower pressures and temperatures and less toxic and reactive chemicals, the potential for disaster and injury has been effectively reduced by the use of inherently safer equipment and materials. Another example is the design and use of unique couplings for the connection of nitrogen, air, steam and other hoses. Good design techniques like the use of unique couplings are the most effective way to eliminate the potential for accidents.

All of the other systems of safety provide **secondary prevention** by reducing the probability or severity of an accident. Good maintenance, inspection and training programs are important, but they will not make unsafely designed equipment safe.

Type of Prevention	Systems of Safety
Primary	Design & Engineering
Secondary	Mitigation Warning Preventive Maintenance Inspection Procedures & Training Human Factors

10. Systems vs. Symptoms

When we focus attention on worker injuries we are only seeing the tip of the safety iceberg. Changing the unsafe behaviors of an injured worker does not take us very far down the road to prevention.

Unsafe acts, unsafe conditions and accidents are symptoms of something wrong in management's systems of safety.

The root causes of incidents are found in management system failures, such as faulty design or inadequate training, which are responsible for unsafe acts and unsafe conditions. Prevention of accidents requires making changes in systems of safety.

Source: Center for Chemical Process Safety, *Guidelines for Investigating Chemical Process Incidents*, New York: American Institute of Chemical Engineers, 1992.

11. Proactive vs. Reactive Systems

Corporations are re-engineering themselves and cutting costs. How often have you heard the buzz words, "if it ain't broke, don't fix it"? Many corporate safety programs have been based on this reactive model.

The reactive safety model is the least effective method for preventing accidents.

This after-the-fact approach to safety creates a piecemeal safety program. Extensive standards are created after a disaster to address prevention of that particular type of event. If a disaster involving a particular process or chemical has not occurred yet, there are often few if any industry, trade association or government safety guidelines.

Proactive systems of safety are the best way to prevent disasters and injuries.

Effective systems of safety are based on the proactive identification and control of hazards prior to disasters and accidents taking place. For example, in a proactive safety system, running pumps until they fail is totally unacceptable. It is recognized that if you are performing breakdown maintenance, the thing that is really broken is the facility's preventive maintenance program.

Source: Harold Roland and Brian Moriarty, *System Safety Engineering and Management*, New York: John Wiley and Son, 1983, pp. 8-9.

12. Worker Involvement Creates Strong Systems of Safety

Many sites have Joint Health and Safety Committees. These committees often concentrate their activity on handling worker complaints and on promoting injury-rate reduction goals. Workers and their union representatives are usually not involved in creating or changing systems of safety.

OSHA recognizes in their PSM Standard that active worker and union involvement in the development and use of process systems of safety is essential for the prevention of disasters. Workers have a unique understanding of the hazards of the processes that they operate and maintain.

A report published by the Environmental Protection Agency made the same point:

"... operators have traditionally been more aware than management of the frequency, severity, and nature of chemical incidents. Similarly, workers are often more aware of the ineffectiveness of personal protective equipment and other mitigation devices. Were the company's technological decision-making to be informed by such worker insights, primary prevention would be significantly encouraged."

Source: Nicholas Ashford, *The Encouragement of Technological Change for Preventing Chemical Accidents*, MIT, EPA, 1993.

13. Finding the Root Cause

The Center for Chemical Process Safety defines "root causes" as:

"Management systems failures, such as faulty design or inadequate training, that led to an unsafe act or condition that resulted in an accident; underlying cause. If the root causes were removed, the particular incident would not have occurred."

The Environmental Protection Agency also emphasizes "root causes":

". . . an operator's mistake may be the result of poor training, inappropriate standard operating procedures (SOPs), or poor design of control systems; equipment failure may result from improper maintenance, misuse of equipment (operating at too high a temperature), or use of incompatible materials. Without a thorough investigation, facilities may miss the opportunity to identify and solve the root problems."

What we see is above ground, but what really matters is sometimes hidden from initial view.



Sources: American Institute of Chemical Engineers, *Guidelines for Auditing Process Safety Management Systems*, Environmental Protection Agency Proposed Rule, Risk Management Programs for Chemical Accidental Release Prevention.

14. Profit-Driven Decisions Can Cause Accidents

Root causes do not necessarily have immediate effects. It takes time for problems to take root. Corporate decisions made over the last decade in the name of profits are often the root cause of current and future "accidents." Such decisions may include:

- cutbacks in preventive maintenance
- less frequent equipment inspections
- inadequate training for employees and supervisors
- the failure to report and investigate previous near-misses
- longer and longer intervals between preventive maintenance shutdowns
- the use of skeleton crews for maintenance and operations
- increased use of untrained subcontractors
- dangerous hot work taking place on running units.

Accidents don't just happen, they take time to mature.



15. Is Human Error the Root Cause?

DuPont Corporation, which is considered by many to be an industry safety expert, says:

- All injuries are preventable.
- Management is responsible and accountable for safety.
- All operating exposures can be controlled.
- Working safely is a condition of employment.
- Employees must receive safety training.
- Management audits are a "must."
- Deficiencies must be corrected promptly.
- Off-the-job safety is important.
- Good safety is good business.
- Employees are the key.

Charles Perrow, a safety expert and the author of the book *Normal Accidents*, says:

- We have produced designs so complicated we cannot anticipate all the possible interactions.
- We added safety devices that are deceived or avoided or defeated by hidden pathways in the system.
- The operator is confronted by unexpected and unusually mysterious interactions among failures.
- Saying he should have zigged or zagged is possible only after the fact.

Sources: DuPont, *Essential Aspects of Excellence in Safety Management*, DuPont; and Charles Perrow, *Normal Accidents: Living with High-Risk Technologies*, New York: Basic Books, 1984.

Summary: Systems of Safety

1. Proactive systems of safety are the key to preventing disasters and injuries.
2. Major systems of safety include:
 - maintenance and inspection
 - procedures and training
 - warning devices
 - design
 - mitigation equipment
 - human factors
3. **The design system provides the opportunity for primary prevention by eliminating the possibility of a serious accident occurring. The other systems of safety are aimed at secondary prevention by reducing the probability or severity of an accident.**
4. Your plant may have different structures and names for its systems of safety, but all of our plants have systems of safety.
5. Active worker and union involvement in systems of safety is essential for these systems to be effective.

Activity 3: Assessing Our Workplace Hazards

Purpose

To get to know and analyze our hazards at work. To develop and share our methods for setting priorities. This activity has two tasks.



Task 1: Surveying Workplace Hazards

A basic tool used by many to help analyze the problems at a facility is a worker questionnaire. The people who perform the work on the process are in fact the greatest resource to recognize the problems and they also offer the most effective solutions.

Individually, please fill out the Plant Survey Form on the following pages.

Plant Survey Form

Date _____

Name (optional) _____

Basic type of operation _____

Total number of production workers _____

Date plant was built _____

Your job title _____

Name of your work area _____

Number of workers in your area _____

1. Please describe in some detail the work processes and operations in your area:

2. What chemicals do you work with?

3. Of the chemicals in your area, which one are you most concerned about and how is it used?

continued

Plant Survey *(continued)*

For questions 4 through 10, please refer only to the chemical you are most concerned about.

4. What form does the exposure take? (Please check one or more below.)

- ☐ Gas/Vapor
- ☐ Liquid
- ☐ Mist
- ☐ Dust
- ☐ Fume
- ☐ Other

At what point in the process does the exposure occur? _____

5. How is your body exposed?

- ☐ Inhalation
- ☐ Absorption through the skin
- ☐ Ingestion
- ☐ Contact to eyes or skin

6. How long is your exposure each day?

- ☐ 1 hour
- ☐ 1-2 hours
- ☐ 2-4 hours
- ☐ 4 or more hours

7. How much actual contact do you have with the chemical (by skin contact or smelling it, etc.)?

- ☐ Low
- ☐ Moderate
- ☐ High

8. Do you use personal protective equipment when working with the chemical you are most concerned about?

- ☐ No
- ☐ Yes

If yes, what kind? _____

9. Are there any ventilation or other engineering controls?

☐ No

☐ Yes

If so, what kind? _____

10. How severe do you believe the risk of exposure to be?

☐ Low

☐ Moderate

☐ High

Please explain briefly: _____

11. Do you believe you have any work-related health problems? If so, what kind? _____

12. Do you believe others in your area now have or have had any work-related health problems? If so, please describe: _____

13. Are you working compulsory overtime?

☐ No

☐ Yes

14. Are others in your area working compulsory overtime?

☐ No

☐ Yes

continued

Plant Survey *(continued)*

15. Are there subcontractors working in your area?

☐ No

☐ Yes

If so, how many? What do they do? Who is the contractor?

16. Are they doing jobs that the bargaining unit once did?

☐ No

☐ Yes

17. If bargaining unit jobs were lost to subcontractors, how did it happen?

☐ Layoffs

☐ Attrition

☐ Other

18. In relationship to the bargaining unit's health and safety training and procedures, how would you rate the health and safety practices of the subcontractors?

☐ Better than ours

☐ The same

☐ Worse than ours

Give an example: _____

19. Have there been chemical releases in your area of the plant?

☐ None

☐ Just a few

☐ Many

If so, please describe: _____

20. Are there any major accidents in your area waiting to happen? If so, please describe: _____

21. Is there a plant health and safety committee?
- ☐ No
 - ☐ Yes (If yes, please answer the following:)
 - a. How often does the committee meet? _____
 - b. Are minutes kept?
 - ☐ No
 - ☐ Yes
 - c. Are minutes sent to the International Union?
 - ☐ No
 - ☐ Yes
 - d. Are minutes posted or distributed?
 - ☐ No
 - ☐ Yes
 - e. Does the committee investigate accidents?
 - ☐ No
 - ☐ Yes
 - f. Does the committee do joint walkthrough inspections?
 - ☐ No
 - ☐ Yes
 - g. Is there a health and safety report to union local meetings?
 - ☐ No
 - ☐ Yes
 - h. Does the local's Workers' Compensation Committee work with the Health and Safety Committee?
 - ☐ No
 - ☐ Yes
 - i. Has the Workers' Compensation Committee ever provided training to the Health and Safety Committee?
 - ☐ No
 - ☐ Yes
22. (For Oil Groups Only.) Has the local sent health and safety members to the Oil School?
- ☐ No
 - ☐ Yes

Task 2

Although we all want to see every workplace hazard eliminated, we always are forced to set priorities. Now that you have conducted your surveys, we would like each table to develop a ranking of the top problems at our facility by answering the questions below. (If you come from more than one facility, assume during this task that you all work in one plant.)

Refer to the factsheets on pages 67 through 70 to assist you in rating the priority.

- 1. What are the top three problems with toxic chemicals at your facility? (Please list them in order of priority.)**
- 2. What are your reasons for selecting your number one priority?**
- 3. If you were the union's health and safety committee, which problem would you work on first and why?**

1. Assessing the Hazards at Work

In the **real world** workplace situation, workers, companies and unions are presented with a complex and interrelated web of health and safety hazards. Problems, unfortunately, don't occur one at a time. Instead, we are confronted by many problems of varying degrees of seriousness **all at the same time**. Not only does this strain limited resources, but it also presents enormous technical difficulties.

There are usually **two kinds of tough issues** to consider.

- **Technical Toxic Issues:** An example might be deciding if low-level exposure to a carcinogen is a more pressing concern than high-level exposure to a material that can cause allergic respiratory disease.
- **Organizing Issues:** Here, we might have to consider whether the issue will help (or hurt) build an ongoing shop-floor health-and-safety movement.

The overall picture, therefore, can be anything but clear. It can present an overwhelming job for us to establish priorities and decide which specific problems to tackle first and what concrete measures could actually be taken. On the next page we summarize the technical and organizing questions we need to consider.

2. Making Priorities: The Technical Side

The three major types of questions that need to be answered to establish technical toxic priorities are:

- Is the chemical toxic? How toxic? What can it do to the body?
- Is there any exposure occurring? How much?
- How many people are at risk?

In ranking the seriousness of a hazard, we must look at the toxicity of a chemical (how hazardous it is) and the extent or level of worker exposure. There are some basic guidelines to "red-flag" particular exposures for further evaluation and monitoring. Following are some key questions to ask about chemicals in order to begin to prioritize the toxic risks in your plant.

A. What Is "Highly" Hazardous?

You should consider a substance highly hazardous if:

- It is a carcinogen.
- It causes reproductive damage.
- It causes acute eye, nose, throat, skin and/or lung corrosion or burns if you are exposed at moderate levels.
- It is a chemical which causes serious harm, has no warning properties, and you are exposed to it at moderate or higher levels.

(For chemicals that are carcinogens, cause reproductive damage, or cause an allergic reaction, there are no safe exposure levels. Therefore, they should always be regarded as highly toxic.)

B. What Is "High" Exposure?

Your level of exposure is affected by a number of variables. An exposure can be potentially high if:

- The ventilation system is inadequate or poorly maintained.
- Your respiratory protection is inadequate if, for example, you have a poorly fitted respirator, inappropriate filters or canisters for the exposure, filters that are not changed regularly, or a respirator with an inadequate protection factor.
- Your work practices create increased exposures. For example, sweeping, hand charging a dusty material or cleaning sludge from a clogged filter.
- You have prolonged physical contact with a chemical without adequate ventilation or protective equipment.

Essentially, information on toxicity and level of exposure should be collected for each chemical in the workplace. Then you consider the number of workers affected in deciding which problem to address first. For example, Solvent A might only cause skin irritation but you might place it on your priority list for action if a lot of workers work with it, have extensive contact with it, have developed skin rashes, or you have heard a lot of complaints about the solvent.



3. Ranking and Making Priorities: The Organizing Side

First, look at the toxicity and exposure levels of all chemicals in the workplace. This should be done for each exposure; then we should consider the number of workers affected in deciding which problem to address first.

A local union might look at some additional factors when evaluating priorities. Some of those factors are:

- Which areas are members **most concerned** about?
- Which areas can the company improve and how quickly can changes be made? Where can **victories** be achieved?
- Where can the local **build the health-and-safety movement among workers in the shop?**
- Sometimes selecting the most toxic chemical, if it is fairly well enclosed and affects only a few workers, should not be the first priority of the Health and Safety Committee because it may not really help build the movement in the shop.

These priority decisions are the tough choices the Health and Safety Committee has to make. This is where your training and experience come in.

Summary: Assessing Our Workplace Hazards

1. MSDSs can be valuable resources in understanding the hazards of specific chemicals.

2. We have looked at procedures and developed a list and prioritized that list as to what new procedures need to be developed. Each one here plays a part in the procedure process by:

- requesting (procedures to be developed);
- writing (helping write procedures);
- reviewing (when others write procedures);
- using (procedures to complete difficult tasks); and
- updating (making note of any corrections necessary).

3. No one knows your job as well as you do. Sometimes we do things a certain way because it was the way we were taught to do a certain task. We have looked today at our routine job duties and sought better ways of completing them, by making them safer or more efficient.

4. When assessing health and safety problems, we should attempt to establish our priorities in deciding which problem to tackle first.

5. There are three questions that need to be answered when establishing toxic priorities:

- Is the chemical toxic? How toxic? What can it do to the body?
- Is there any exposure occurring? How much?
- How many people are at risk?

continued

Summary *(continued)*

6. A substance should be considered highly hazardous if:
 - it's a carcinogen;
 - it causes reproductive damage;
 - it causes acute effects when you are exposed at moderate levels; or
 - it can cause serious harm but has no warning signs.

7. High exposure to a chemical occurs when:
 - ventilation is poor;
 - respiratory protection is inadequate;
 - work practices create increased exposure; or
 - there is physical contact without ventilation or protective equipment.

Activity 4: Tackling Toxic Chemical Myths

Purpose

To increase our ability to see through the common myths about the impact of toxic chemicals at the workplace on our health. This activity has three tasks.



Task 1

Assume that you have been asked by the union to respond to a worker who made the statement below. In your groups, evaluate the statement and prepare a brief response for this worker. In doing so, please review the factsheets on pages 75 through 86 and try to **refer to at least one factsheet** when you present your response.

Statement:

"The danger of these chemicals is overstated. If you use your nose to warn you and don't breathe the stuff, it won't harm you. Of course, you must respect acids and avoid them. They can blow your lungs away.

"I don't buy this panic about cancer. I know some people who got cancer and never worked with chemicals. I also know people who work with chemicals and have not gotten cancer.

"It is obvious all cancer doesn't come from chemicals. The way they do lab tests is to shoot tons of chemicals into rats. How can they avoid getting cancer?

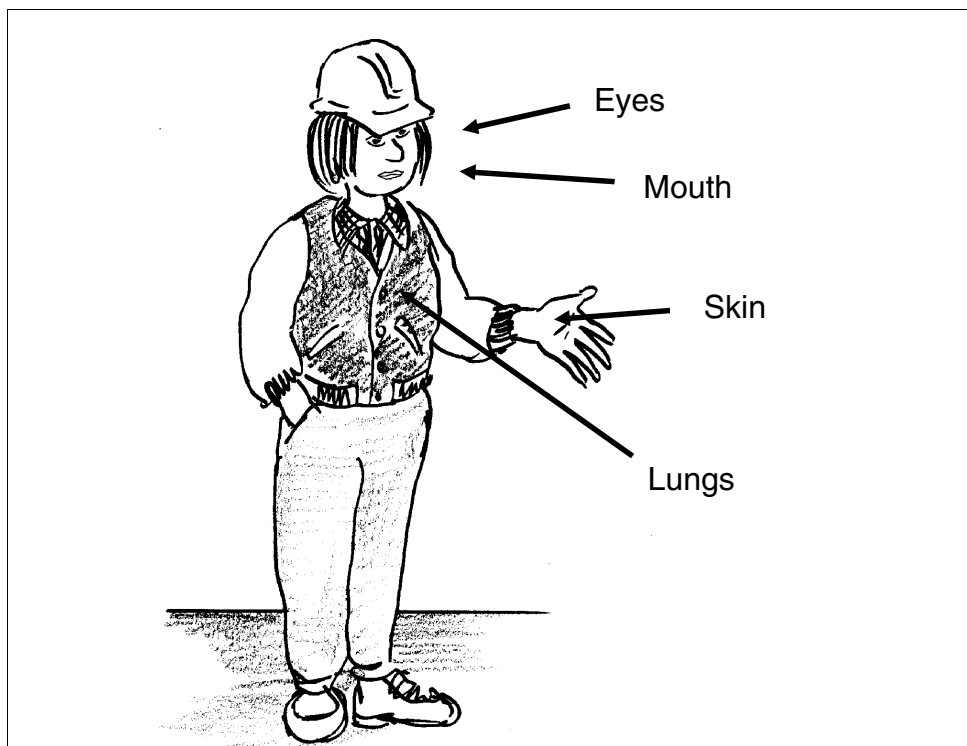
"In my opinion, I've worked with this stuff for 20 years and I'm okay. So, what's all the fuss about?"

1. What would you say to this worker?

1. How Hazardous Materials and Other Toxic Chemicals Enter Your Body

The four basic ways toxics enter your body are:

- Direct Contact: on the skin or eyes
- Absorption: through the skin
- Ingestion: through the mouth with food, etc.
- Inhalation: through the lungs



Direct Contact = Surface

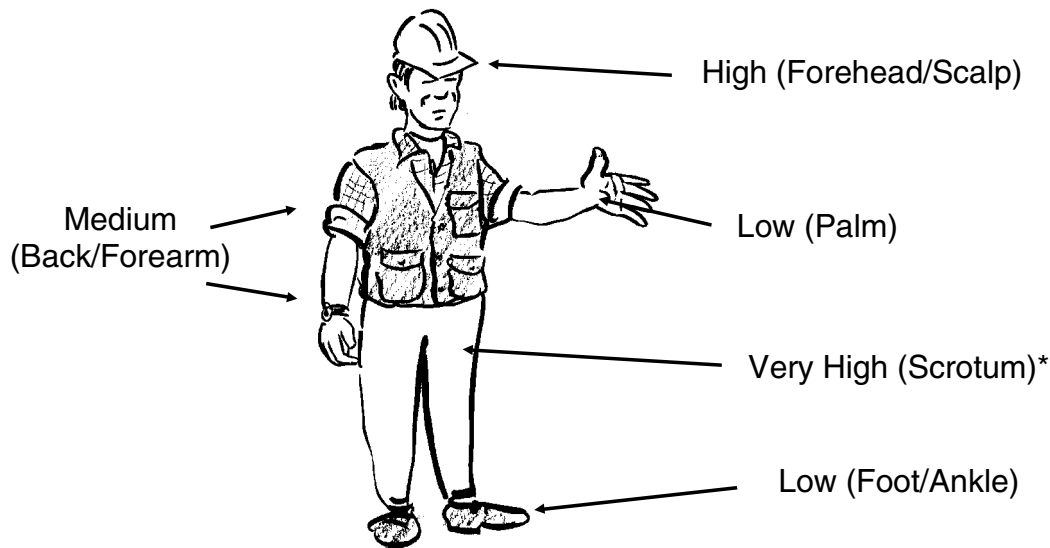
Some chemicals burn or irritate the skin or eyes on contact, causing damage on the surface. Dermatitis (inflammation of the skin) and conjunctivitis (inflammation of the eye membrane) are two examples. Many acids – as liquids or vapors – can burn the skin or eyes.

Absorption = Penetration

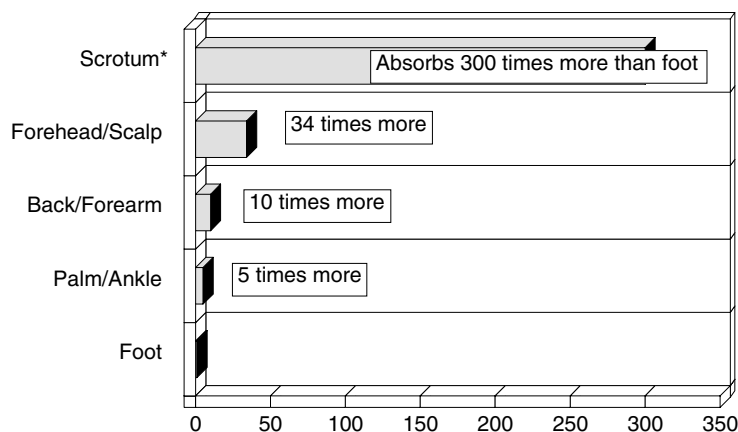
Some chemicals can pass right through the skin undetected and enter the bloodstream. They are carried throughout the body, causing harm. Broken skin or puncture wounds greatly increase the rate at which chemicals are absorbed. Examples include many solvents and pesticides. Watch out for both toxic liquids and vapors.

2. Absorption of Toxic Chemicals by Your Body

Toxics can enter and harm your body even if you don't breathe them in. They can enter your system by being absorbed through the skin or by being ingested with your food and drink. In fact, as the chart below shows, when it comes to absorption through the skin, different parts of your body absorb chemicals at very different rates. (Wash your hands **BEFORE** using the bathroom.)



**Absorption of Chemicals into the Skin
at Different Sites of the Body**



*For men (studies of female workers yet to be done).

Source: E. Hodgson and P.E. Levi, *A Textbook of Modern Toxicology*, New York: Elsevier Science Publishing Co., 1987, pp. 34-35.

3. Your Nose Doesn't Always Know

You can't really rely on your sense of smell to protect you from exposure to toxic chemicals. Let's face it, your nose has some important limitations. Here are three basic ones:

- First of all, there are dangerous chemicals that are odorless, such as carbon monoxide. No nose can smell it.
- Secondly, for some chemicals, you can only detect the smell when the toxic is around you in such large quantities that your health is already being harmed by it. For example, by the time you can smell phosgene, you're already in trouble.
- Thirdly, our noses can become accustomed to chemicals with very strong odors. That means that after a while we can no longer smell even very powerful odors. For example, our noses can learn not to smell such strong odors as ammonia and chlorine.



4. Dose and the Body's Response

Toxic chemicals and their wastes react with the body. For most toxic substances to cause harm, there needs to be an exposure to the chemical of sufficient dose.

“Dose” refers to how much of a substance reacts with the body. It is measured by the concentration of the substance and the time period of the exposure.

The higher the concentration, the larger the dose.

The longer the exposure, the larger the dose.

There are basically two ways the body reacts to the dose of a toxic substance:

- For any dose, no matter how small, the body may have a reaction. This type of response may be found with cancer-causing chemicals and cancer-causing physical agents, such as radiation.
- There needs to be a certain level of dose before there is a response. This type of response is found with most toxic chemicals (not for cancer-causing agents and chemicals). For example, low-level exposure to the freon used to cool machinery in a gaseous diffusion plant is not harmful, but at high concentrations it will cause the heart to beat irregularly. This has caused occupational fatalities.

5. The Short and Long of It

Toxics can cause disease quickly after exposure or they can take years to cause disease. The two words that describe this are **acute** and **chronic**.

Acute Effects

“Acute” is a word that means that health effects are felt at the time of exposure or shortly after.

- Hydrogen fluoride, when inhaled, causes an immediate irritation to the respiratory tract. You know it.
- Caustic soda corrodes the skin. It burns. You know it.
- Carbon monoxide binds up your red blood cells. It acts almost immediately, and if enough red blood cells are bonded, you may die.

Chronic Effects

“Chronic” is a word that means that the disease will not be seen for some time after exposure. It is associated with low exposures over a period of time.

- Cancer is a chronic effect.
- Lung diseases, like bronchitis and emphysema are examples of non-cancerous, chronic diseases.
- Solvents can cause early senility, another chronic disease.

Many chemicals will cause chronic and acute effects.

The difference is in the amount of the dose. High doses generally cause acute effects. Low doses over time cause chronic effects.

- Exposure to PCBs of large doses can cause a skin disease called chloracne.
- Exposure to benzene, over a long period of time, can cause leukemia, a chronic effect.
- Exposure to arsenic, over a long period of time, can cause lung cancer, a chronic effect.

6. Some of the Chemicals That Are Known To Cause Cancer in Humans

Although we are a long way from knowing all the causes of cancers, we have learned the hard way that a certain number of chemicals and technological processes do cause cancer in humans. In addition, there are 200 to 300 chemicals suspected of causing cancer. (The list below includes only known human carcinogens.) The sad fact is that science found out about these carcinogens from workers who already experienced the terrible impact of these substances.

Known Human Carcinogens	
Aflatoxins	Chromium and Certain Chromium Compounds
4-Aminobiphenyl	Conjugated Estrogens*
Analgesic Mixtures Containing Phenacetin	Cyclophosphamide*
Arsenic and Certain Arsenic Compounds	Diethylstilbestrol*
Asbestos	Erionite
Azathioprine*	Melphalan*
Benzene	Methoxsalen with Ultraviolet A Therapy (PUVA)*
Benzidine	Mustard Gas
Bis (Chloromethyl) Ether and Technical Grade Chloromethyl Methyl Ether	2-Naphthylamine
1,4-Butanediol Dimethylsulfonate (Myleran)*	Radon
Chlorambucil*	Thorium Dioxide
1-(2-Chloroethyl)-3-(4-Methylcyclohexyl)-1-Nitrosourea (MeCCNU)	Vinyl Chloride
Manufacturing Processes and Mixtures of Chemicals Known To Cause Cancer**	
Aluminum Production	Hematite Underground Mining
Auramine Manufacture	Isopropyl Alcohol Manufacture by the Strong Acid Process
Boot and Shoe Manufacture and Repair	Nickel Refining
Certain Combined Chemotherapies for Lymphomas*	Painter (Occupational Exposure)
Coke Oven Emissions	Rubber Manufacture (Certain Occupations)
Furniture Manufacture	Soots, Tars, and Mineral Oils

*Therapeutic substances known to cause cancer.

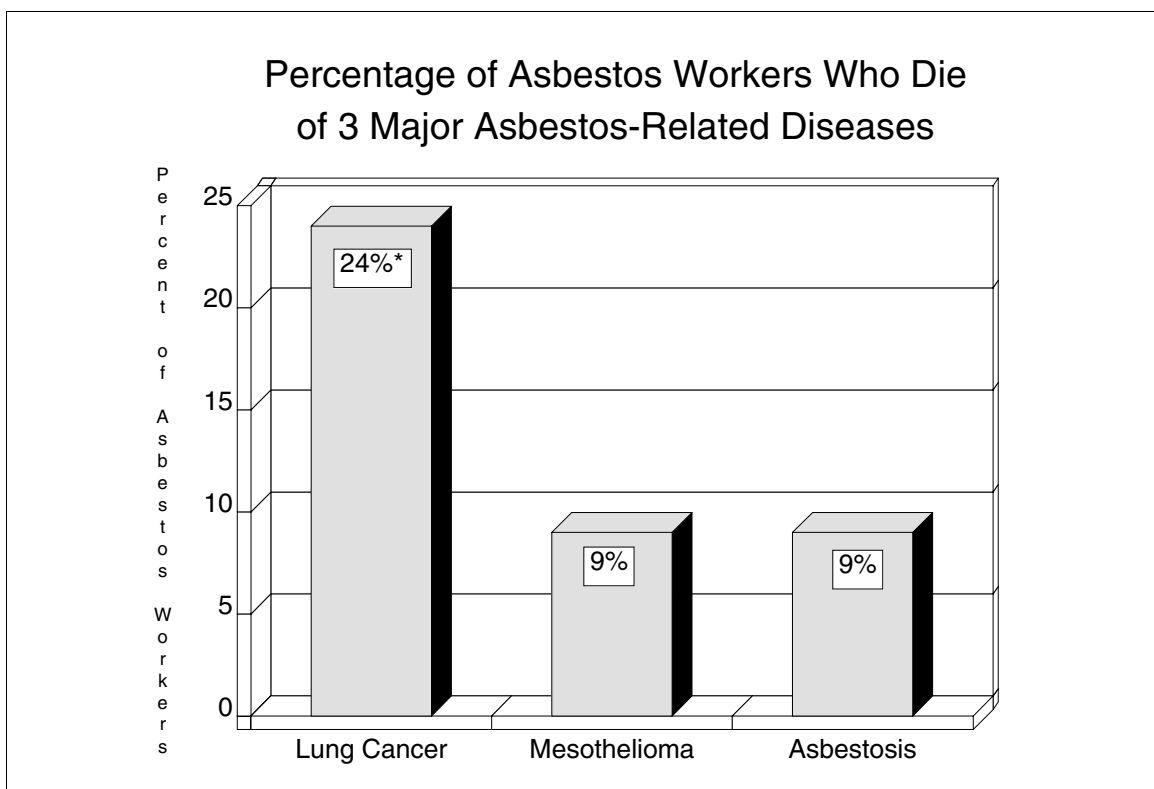
**The *Seventh Annual Report* no longer lists these processes (with the exception of coke oven emissions and soots, tars and mineral oils) because neither the specific substance nor the specific steps in the manufacturing processes that are likely to cause the cancers have been identified, but they are still considered by the International Agency for Research on Cancer as human carcinogens.

Source: U.S. Department of Health and Human Services, National Toxicology Program, *Seventh Annual Report on Carcinogens*, Research Triangle Park, NC: NTP, 1994.

7. The Odds of Getting Disease

A funny thing about humans is that while we are all pretty much the same, we're also different as individuals. For example, even if a large group of us gets a very large dose of a toxic chemical, not all of us will develop disease. But, we do know that such an exposure will give some of us disease, and there is really no way of knowing who that might be.

For example, let's look at asbestos insulators. We now know that as a group they run a very high risk of dying from lung cancer, mesothelioma, and asbestosis (see the factsheet on page 82). **But not all asbestos workers get these diseases.** The chart below shows just what the odds are for asbestos insulators who died between 1967 and 1986.



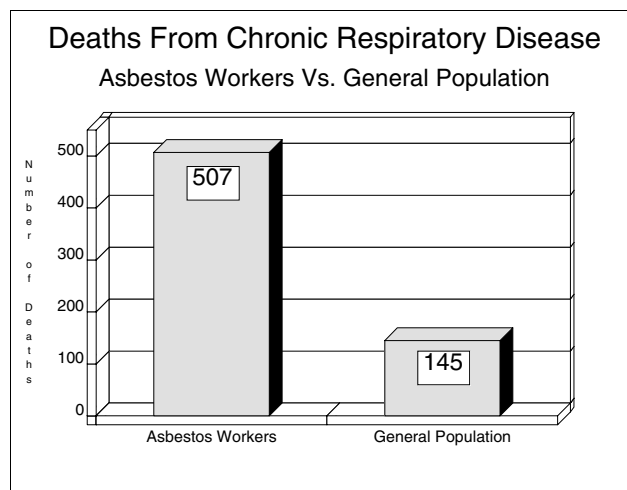
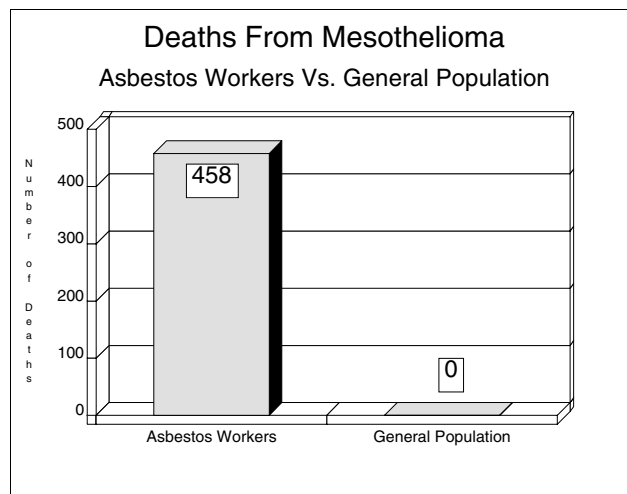
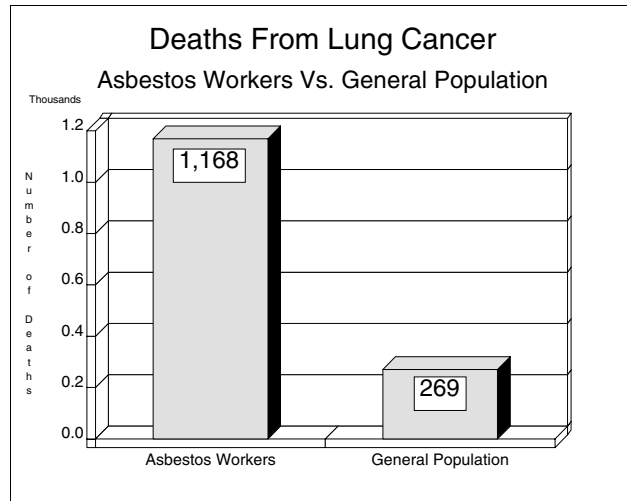
*14-19% of these deaths could have been avoided if these workers had not been exposed to asbestos.

Source: I. J. Selikoff, "The Third Wave of Asbestos Disease: Exposure to Asbestos in Place, Public Health Control," *Annals of the New York Academy of Sciences*, vol. 643, 1991.

8. How Do We Know When a Toxic Substance Really Causes Human Disease?

It is true that in most cases people who aren't exposed to workplace toxic chemicals get the same kinds of cancers as workers exposed to carcinogens. But the numbers are very different. When we say something is a human carcinogen, we know that exposed workers suffer more cases of a particular kind of cancer than we would find in the population at large. In fact, this is how scientists "prove" something is a human carcinogen. They study groups of **exposed** workers and groups of people **not exposed** but who are otherwise similar. If the workers' rates of cancer are higher, the exposure is considered to be a cause of cancer. (The branch of science that does this is called **epidemiology**.) The graphs compare deaths in a population of 17,800 asbestos workers and 17,800 people in the general population from 1967 to 1986.

Source: I.J. Selikoff, "The Third Wave of Asbestos Disease: Exposure to Asbestos in Place, Public Health Control," *Annals of the New York Academy of Sciences*, vol. 643, 1991.



9. Do Animals Tell the Truth?

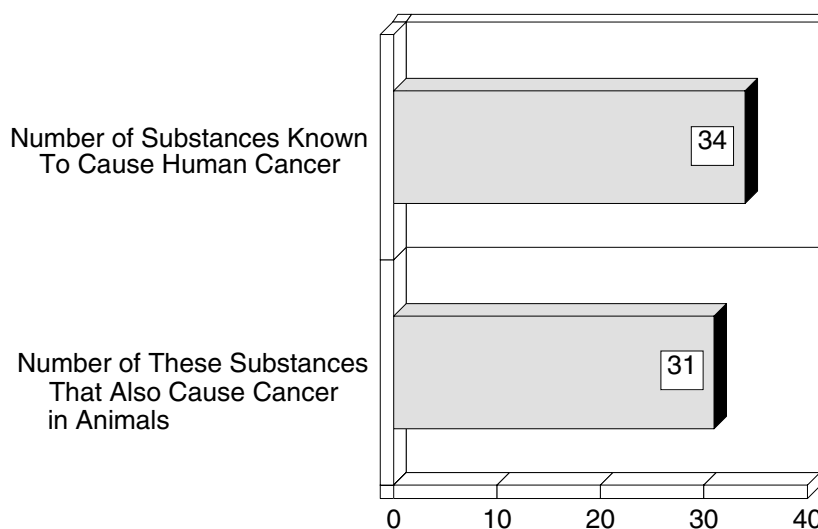
There are some pretty good reasons to pay serious attention to cancer studies on animals. Almost all the substances that have been found to cause cancer in humans have also been found to cause cancer in animals. It can therefore be assumed that substances that cause cancer in animals will most likely also cause cancer in humans. It is true that the animals are given large doses, but the real reason for this is that it speeds up the time it takes for the cancer to show up.

Large doses in themselves don't cause cancer. If you give an animal a large dose of a safe substance, they don't get cancer.



How Accurate Are Animal Studies?

Substances Known To Cause Human Cancer

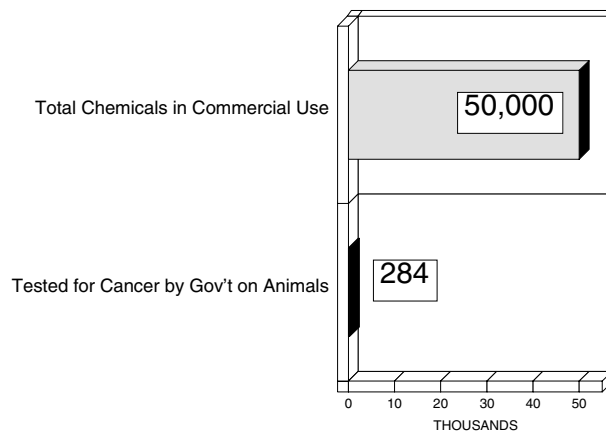


Source: David P. Rall, "Carcinogens and Human Health: Part 2," *Science*, January 4, 1991, p. 10.

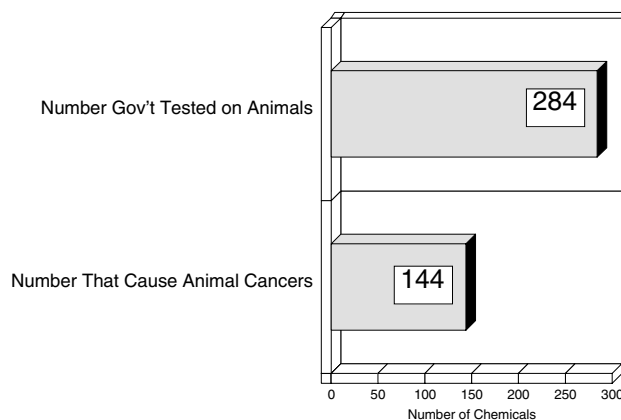
10. What We Don't Know May Hurt Us

The vast majority of chemicals in use have not even been tested on rats. The U.S. Congress's Office of Technology Assessment reviewed the evidence on identifying cancer-causing chemicals in 1987. **They found that of the more than 50,000 chemicals in commercial use, only 284 had been tested on animals by the government in the preceeding 10 years. Of those 284 chemicals, about half (144) had been shown to cause cancer in animals.**

How Many of the 50,000 Chemicals in Use
Are Gov't Tested for Cancer on Animals

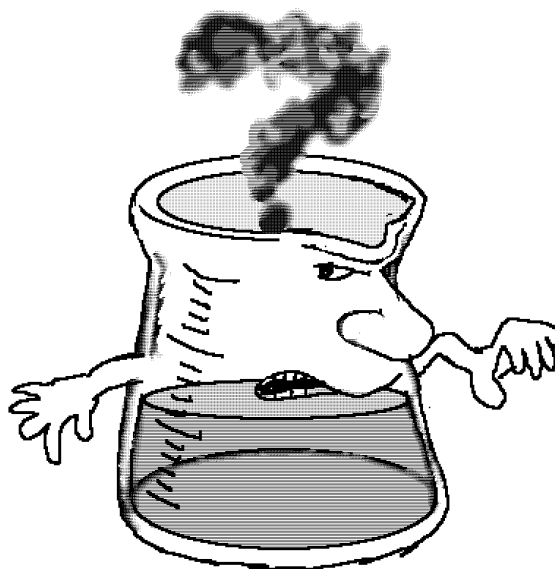


Not All Government Tested Chemicals
Cause Cancer

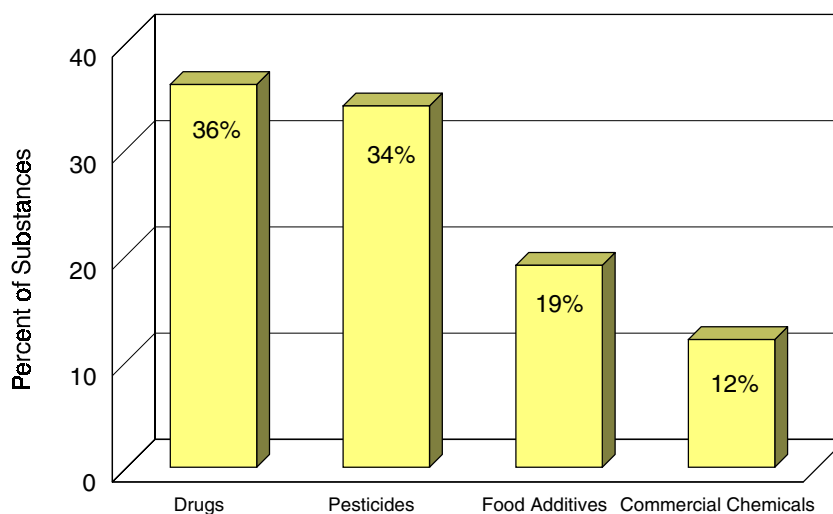


Source: U.S. Congress, Office of Technology Assessment, *Identifying and Regulating Carcinogens*, OTA-BP-H-42, Washington, DC: U.S. Government Printing Office, November 1987, p. 18.

Unfortunately, we produce chemicals first and ask questions later. The chart below shows just how few chemicals we actually know about when it comes to health and safety. The chart refers to the percent of chemicals of different types about which science has any health and safety information at all.



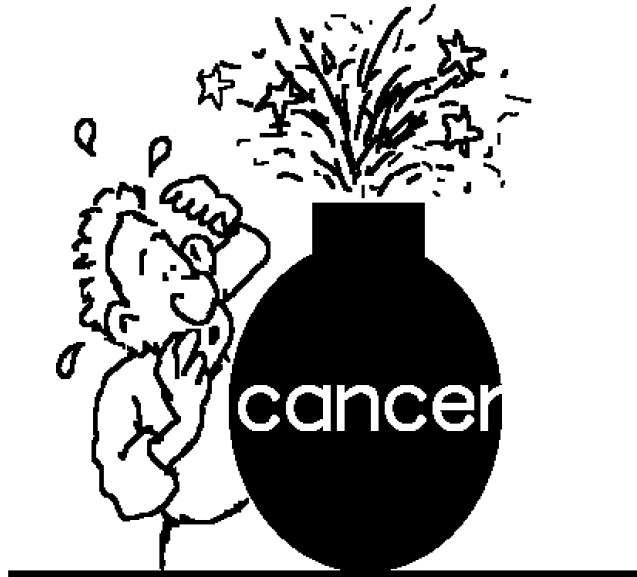
Percent of Substances for which We Have at Least Limited Information



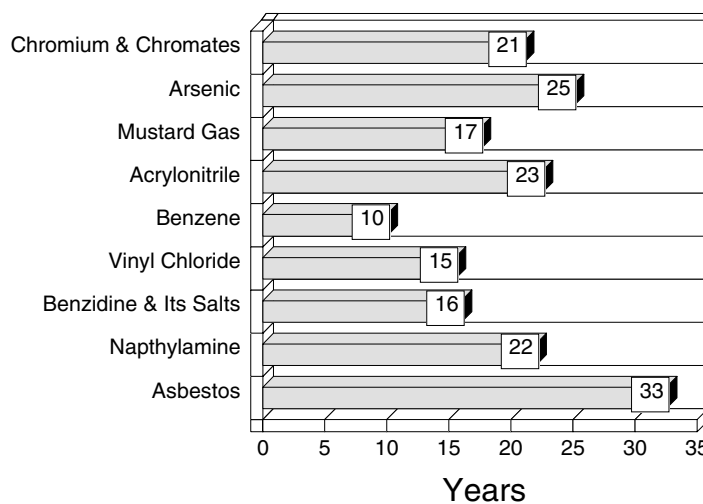
Source: *Toxicity Testing – Strategies to Determine Needs and Priorities*, National Research Council, 1984.

11. The Toxic Time Bomb

It's a big mistake to feel confident that because you've been exposed for many years and have no symptoms, all is well. The sad fact of the matter is that it can take 10 to 40 years to see the results of a harmful exposure to a cancer-causing chemical. You may be healthy for 20 years and get it the very next year. The time it takes to show up is called the latency period. The chart below shows some of the latency periods for different carcinogens. Unfortunately, there may be thousands of unknown time bombs ticking in our workplaces that have not been discovered yet.



**Average Number of Years After Exposure
for Cancer First To Appear**



Source: B. S. Levy and D. H. Wegman, eds., *Occupational Health: Recognizing and Preventing Work Related Disease*, Boston: Little Brown & Co., 1983.

Task 2

Review the statement below in your groups and prepare a group response to this worker and other members who might hold similar views. In doing so, please review the factsheets on pages 88 through 92 and try to use at least one factsheet in your group's response.

Statement:

"Hey, just look around. So many of us already smoke, drink and eat too much. These are things which harm our health that we could control. But most of us don't.

"So what right do we have to get all worked up about the impact of chemicals on our health? How can we demand that the company clean up its act, when we won't clean up our own? Besides, we're not about to get our companies to eliminate all these toxics and all the exposures.

"Instead, we should concentrate on a good medical surveillance program. Modern medicine really has come up with cures that can stop the diseases caused by toxic exposure."

1. What is your group's response to this statement?

12. Smoking and Drinking Are Addictions That Kill

There is no question that smoking and drinking are bad for us. The "pushers" of these addictive toxics are the corporations that profit greatly. Once we are hooked on these substances, the habits are very difficult to kick. The charts below look at the diseases caused by smoking and drinking, how few people are able to kick the habit, and how profitable those industries are.

Diseases Caused by Cigarette Smoking

Cancer

Lung, Oral Cavity, Urinary, Kidney, Larynx, Esophagus, Bladder, Pancreas

Cardiovascular Diseases

Heart Attack/Angina, Peripheral Vascular Disease, Aortic Aneurysm

Lung Diseases

Chronic Bronchitis, Emphysema

Gastrointestinal Diseases

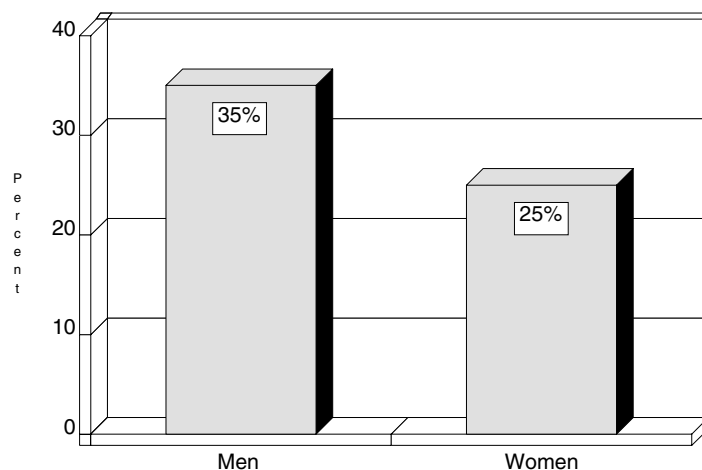
Peptic Ulcers

Source: U.S. Dept. of Health, Education and Welfare, *Smoking and Health; Report of the Surgeon General*, Washington, DC: U.S. Government Printing Office, 1979, Chapter 1.

*Based on National Health Interview Survey, 1978-80, by the National Center for Health Statistics.

Source: U.S. Dept. of Health and Human Services, *The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace: A Report of the Surgeon General*, Washington, DC: U.S. Government Printing Office, 1985, p. 34.

Percent of Blue Collar Smokers Who Have Successfully Kicked the Habit*



13. Making a Killing

Profits of Tobacco and Alcoholic Beverage Corporations Among the Fortune 500: 1995

Tobacco

Philip Morris	\$5,450 million
American Brands	540 million
RJR Nabisco	519 million
United States Tobacco	430 million

Alcoholic Beverages

Anheuser-Busch	\$ 642 million
Brown-Forman	149 million
Coors	43 million

Source: "The Fortune 500: The Largest U.S. Corporations," *Fortune*, April 29, 1996.



14. Smoking and Toxics: A Dangerous Combination

While it's true that many of us still smoke, toxic chemicals make matters even worse. For reasons that we are just beginning to understand, the combination of certain toxics with smoking is more dangerous than either one on its own or than the two just added together. The following looks at the risks associated with smoking, asbestos exposure, and the two combined.



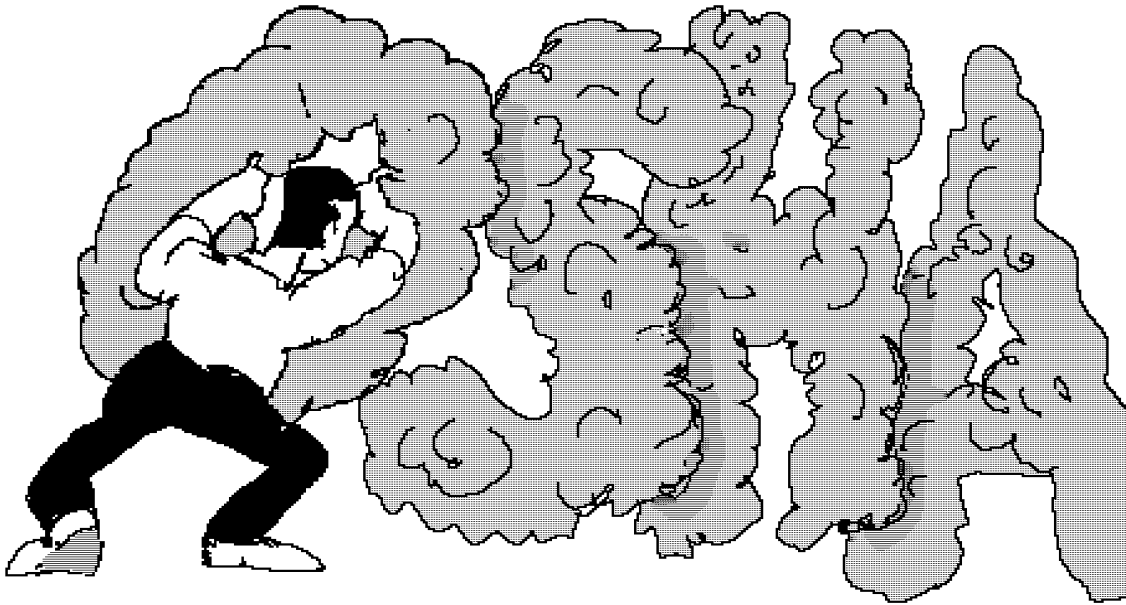
Comparison of Risk of Lung Cancer: Smoking and Asbestos



Source: E. C. Hammond, I. J. Selikoff, and H. Seidman, "Asbestos Exposure, Cigarette Smoking and Death Rates," *Annals of the N.Y. Academy of Sciences*, vol. 330: 473-490, 1979.

15. Fighting Through the Smoke-Screen

Some employers attempt to use the smoking issue as a smoke-screen to avoid fulfilling their responsibilities. In our country, we have the right to a safe and healthy workplace. Whether you smoke or not, the employer has no right to poison you on the job. Below is the specific language from the OSHA law.



Section 5(a)(1) of the Occupational Safety and Health Act requires that an employer:

"shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

This is known as the OSHA "general duty clause."

16. The Strengths and Limitations of Modern Medicine and Science

Modern medicine has the ability to detect some diseases early (see first list below) and to cure and control them. But many of the serious occupational diseases we face cannot be treated at all (see second list). And even if tests are used to detect the disease early, by the time it shows up on the test, nothing can be done about it. The truth is that we cannot count on medicine to protect us from exposure. Our goal must always be to stop the exposure before it starts the disease.



Diseases That Can Be Detected Early and Can Be Cured or Controlled	Diseases That <i>Usually Cannot</i> Be Reversed Even When Detected Early
Bladder Cancer Colon Cancer Asthma Cotton Dust Disease	Asbestosis Lung Cancer Leukemia Silicosis Black Lung Disease

Sources: William Rom, *Environmental and Occupational Medicine*, Boston: Little Brown and Company, 1983; and James Merchant, *Occupational Respiratory Disease*, U.S. Health and Human Services, September 1986.

Task 3

In your groups, please evaluate the statement below and prepare a response. Again, review the factsheets on pages 94 through 98 and refer to at least one factsheet in giving your group's response.

Statement:

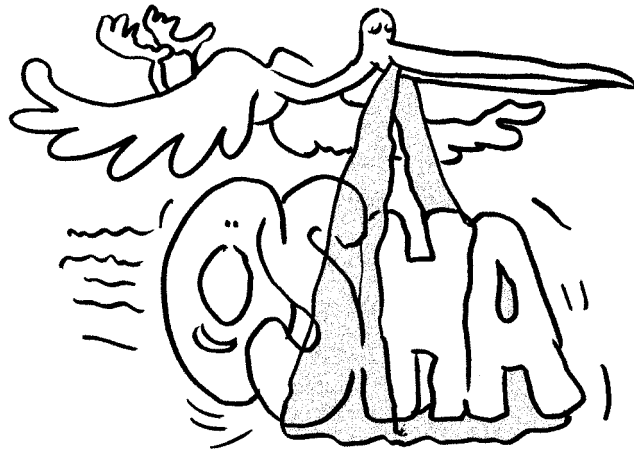
"Because our company and union have really tried hard to prevent exposures to toxic chemicals, we now have all our readings below the OSHA permissible exposure limits.

"While it's true that we still use carcinogenic chemicals, the exposures are low. So we can now honestly tell our members that we have created a safe work place."

1. What is your group's response to this worker's statement?

17. How OSHA Health Standards Were Born

OSHA standards did not simply come from impartial scientists who were deeply concerned about our health. In fact, many of the standards were adopted from unpublished industry studies (which means nobody could verify them). Before OSHA had begun setting standards in 1970, **threshold limit values** (TLVs) were established by the American Conference of Governmental Industrial Hygienists (ACGIH). Despite the governmental sounding name, this is not a government organization. Every year since 1946, ACGIH has published an annual report of TLVs. These TLVs were never meant to be mandatory standards; instead they were workplace exposure guidelines to be followed by government contractors. In 1971, OSHA adopted nearly all of the ACGIH 1968 standards. In 1989, OSHA updated the exposure standards based upon the 1987 ACGIH TLV list, but because there was no input from workers or other scientific agencies, the new standards were challenged and are not currently in effect. The standards in effect now are from the 1968 ACGIH TLVs, covering only approximately 425 substances out of the tens of thousands in the workplace.



Source: B. I. Castleman and G. E. Ziem, "Corporate Influence on Threshold Limit Values," *American Journal of Industrial Medicine*, 13: 531-559, 1988.

18. How OSHA Standards Are Changed

Standard setting by OSHA is a political process. It usually takes a very strong effort from worker and public interest groups to get any of the standards changed. Often, **power – not just science** – determines which levels are changed and how much they change. (See case study below.)

The Benzene Story

- 1974** When disturbing levels of leukemia appeared among Ohio tire builders exposed to benzene, NIOSH issued a criteria document urging further investigation.
- 1976** With more evidence from Ohio, NIOSH recommended that benzene be added to the list of carcinogens. NIOSH urged OSHA to issue an emergency temporary standard reducing the permissible time-weighted exposure limit from 10 ppm to 1 ppm, with a 5 ppm limit over any 15-minute period.
- 1977** OSHA issued the emergency standard.
- 1978** The American Petroleum Institute and other industry representatives went to court to challenge OSHA's standard. The Fifth Circuit Court of Appeals overturned the standard based on employer arguments that OSHA failed to estimate the costs to industry that would result from the regulation.
- 1980** Unions appealed this decision to the U.S. Supreme Court. The Supreme Court backed the lower court's decision.
- 1983** Armed with more data from NIOSH showing that workers exposed to benzene for even brief periods were six times more likely to die from leukemia, a coalition of unions and public health groups petitioned OSHA for a new emergency standard. OSHA issued a notice of proposed rule-making, the first step in a lengthy process of issuing a new regulation. The unions accused OSHA of ignoring a six-year history of efforts to lower the benzene standard.
- 1984** OSHA rejected the coalition's petition for an emergency temporary standard. The agency promised a standard by the end of the year. Nothing happened and in December a group of unions filed suit against OSHA with the Washington, D.C. Circuit Court.
- 1986** OSHA agreed to issue a standard by February 1987; the D.C. Court accepted this.
- 1987** In September, OSHA lowered the standard to 1 ppm with a short-term exposure limit (STEL) of 5 ppm.
- 1994** ACGIH published notice of intent to change limit to 0.3 ppm.

Source: Compiled by Cate Poe from interviews with Diane Factor and Peg Seminario, AFL-CIO Health and Safety Department, and from *The New York Times*, April 23, 1983 and *BNA Reporter*, March 29, 1984.

19. OSHA Tries to Adopt New and Improved Standards – Still Little Protection

Until 1989, it took OSHA **17 years** to issue standards for 24 toxic substances. In 1989, OSHA picked up the pace by adding, strengthening and reaffirming Permissible Exposure Limits for 428 toxic substances. Unfortunately, in developing these standards, OSHA relied entirely on the TLVs (threshold limit values) established by the ACGIH (American Conference of Governmental Industrial Hygienists). These TLVs are based largely on **corporate** information.

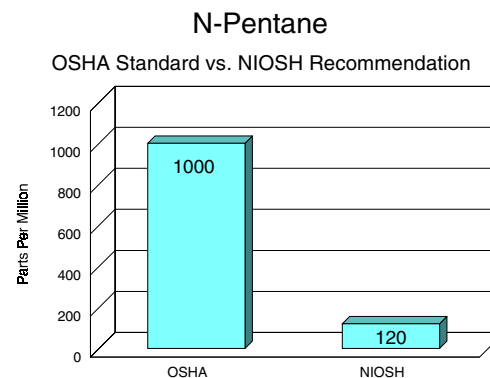
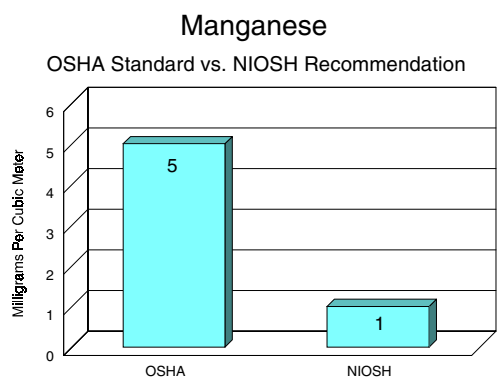
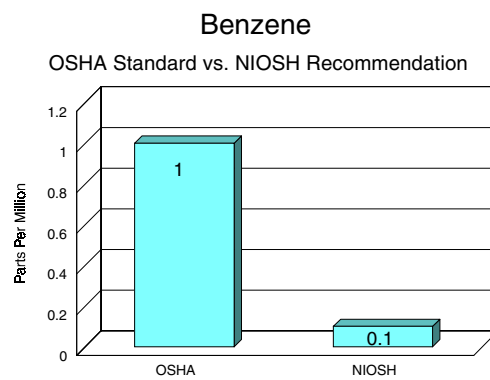
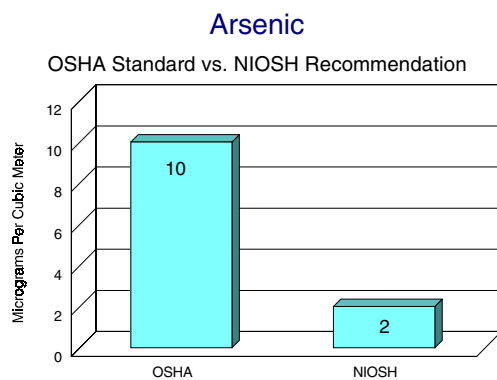
- In the process, OSHA chose to ignore recommendations of the National Institute for Occupational Safety and Health (NIOSH). (NIOSH bases its recommended standards on the best **scientific** evidence available.)
- NIOSH testified that **for 98 substances, the OSHA Permissible Exposure Limits based on the ACGIH TLVs were too high**. For some substances, such as arsine, chlorodiphenyl, chromium, and zinc chromate, NIOSH recommends standards that are **between 100 and 1,000 times more restrictive**.
- According to a recent article published in the *American Journal of Industrial Medicine*, "It is particularly disturbing that OSHA would turn to the ACGIH TLV committee, an anachronistic group with no legal authority and with limited resources, rather than to NIOSH, a governmental body with clear responsibility for developing criteria for standards under the Occupational Safety and Health Act."

Because OSHA did not seek or incorporate recommendations from other agencies, and did not have a comment period or public hearings, the new standards were thrown out in 1992. Therefore, we are still using the original standards developed in 1971. These standards do not take into account any of the important improvements in scientific understanding of what substances, at what levels, can hurt or kill workers.

Source: James C. Robinson, et al., "Implications of OSHA's Reliance on TLVs in Developing the Air Contaminants Standard," *American Journal of Industrial Medicine* 19, no. 1, 1991.

20. How and Why NIOSH and OSHA Differ

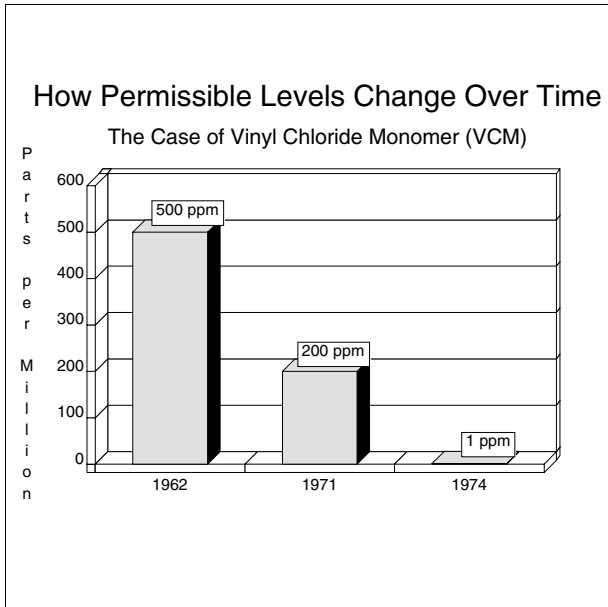
The National Institute for Occupational Safety and Health (NIOSH) recommends standards to OSHA based on scientific studies of hazards; the OSHA standards that are eventually enforced are often compromises among government, industry and labor. As a result, **in many cases, NIOSH's recommended standards are stricter than OSHA levels (see charts). This means that even if a company is below OSHA standards, we still may be receiving deadly exposures.**



Source: U.S. Department of Health and Human Services, *NIOSH Pocket Guide to Chemical Hazards*, June 1990.

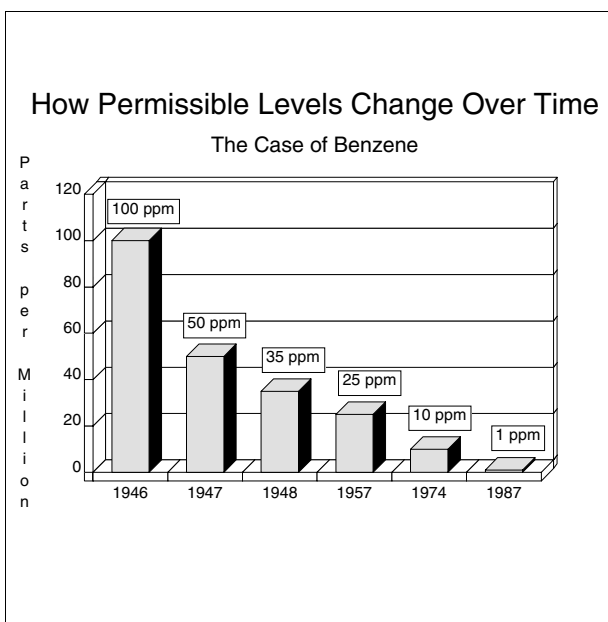
21. Safe Today; A Killer Tomorrow

Unfortunately for us, there is no proof that there are any safe levels of exposure to chemicals that are known to cause cancer. The history of "safe levels" shows us that as more scientific knowledge is gathered, it almost always turns out that lower levels are needed. The charts below show how the standards change.



In the case of vinyl chloride monomer (VCM) which is used to make polyvinyl chloride (PVC), a plastic, a **limit of 500 parts per million (ppm) was set in 1964** because the substance made people drowsy.

Then, animal research, which showed it hurt the liver, bones and kidneys, resulted in threshold limit values (TLVs) **of 200 ppm**. In 1974, a company announced that three of its VCM workers died of liver cancer. This ultimately caused the limit to be **reduced to 1 ppm**.



The standards for benzene have also declined. Benzene was first known to be a cause of leukemia in 1942.

Summary: Toxicology in Brief

1. There are a variety of ways a toxic chemical can enter our bodies. We should take notice that **absorption through the skin is often ignored, but can be a dangerous route of entry into our system.**
2. With many toxic chemicals, **it takes a long time after exposure before the disease appears.** This latency period may give us a false sense of security when we work with very dangerous toxic chemicals.
3. It is true that not everyone who gets exposed to a toxic chemical gets sick. But **it is impossible to identify which exposed person will get sick.** You are playing Russian roulette with your life if you think you are immune to toxic chemicals.
4. Yes, many of us do have lifestyle factors, such as smoking and drinking, which can harm us. But **these problems will be made worse by toxic chemical exposures.**
5. **Not all chemicals cause cancer, either in animals or in humans.**
6. Toxic chemicals cause other serious problems **in addition to cancer.** We now know that the **reproductive** systems of men and women workers may be damaged or impaired. Also, research suggests that many toxic chemicals affect the **brain and nerves** throughout the body.
7. **Animal studies are, in fact, very useful** for warning us which chemicals might cause cancer in humans. **The alternative to animal studies is to wait until human exposure shows cancer.** By that time, millions may have been exposed.
8. **Most carcinogens are not regulated properly.** The official OSHA standards do not universally protect you from getting cancer. In many cases the OSHA standard is too high to protect you adequately. **Even if your exposure level is below OSHA standards, you may still be exposed to very dangerous levels of cancer-causing chemicals.**

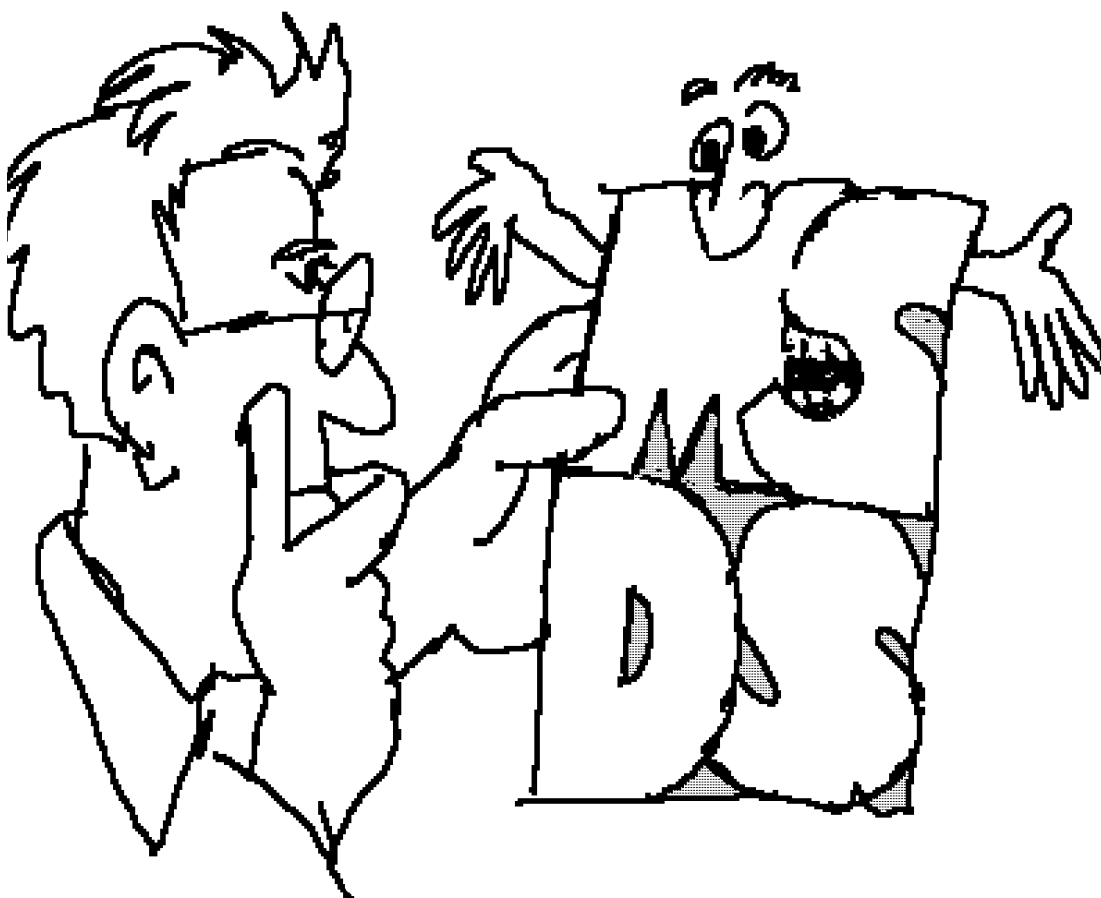
Summary written by Dr. Steven Markowitz, Mt. Sinai School of Medicine.

Activity 5: MSDSs and Safety

Purpose

To gain some experience using MSDSs (material safety data sheets).

To familiarize ourselves with some basic chemistry that could help us prevent explosions, releases and accidents.



Task

Imagine that your group is the union health and safety committee and that the local's members who work at the outdoor hazardous waste drum storage area have expressed a concern about some of the stored chemicals. Here's the situation:

Several drums of various toxic wastes are stored close together. Some are corroded and show evidence of leakage.

The workers in the storage area can smell the chemicals and suspect airborne exposure.

The chemicals stored are propylene oxide, Product No. 1063, and Spray 'N Away.

Using the questions on the next two pages, the MSDSs on pages 106 through 119 and the factsheets on pages 120 through 135, your task is to develop a list of major concerns that you see in this area. Please refer to the following sections in the relevant MSDSs.

- Physical Data
- Fire and Explosion Information
- Storage and Handling Requirements

1. Is there a fire or explosion hazard?

☐ Yes

☐ No

a) Which substance do you think has the greatest chance of causing a fire or explosion?

b) In terms of a fire hazard, which would you worry about the least?

c) Why?

2. What are the short-term (acute) health hazards that could result from exposure to the three chemicals listed in the MSDSs?

continued

Task *(continued)*

3. What are the long-term (chronic) health hazards that could result from exposure to these three chemicals?

4. Make a "worry list," in order of importance, of the most critical problems in this storage area:

5. Did you find working with MSDSs difficult or confusing? Why or why not?

6. Will the MSDSs be useful health and safety resource tools at your facility?



Material Safety Data Sheet

The Dow Chemical Company
Midland, Michigan 48674
Emergency 517-636-4400

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Page: 1

24-Hour Emergency Phone Number: 517-636-4400

Product: PROPYLENE OXIDE

Product Code: 70557

Effective Date: 10/26/94 Date Printed: 01/06/95 MSD: 000293

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Propylene oxide	CAS# 000075-56-9	99.9%
-----------------	------------------	-------

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

* Colorless liquid. Extremely flammable. Causes severe eye burns. *
* Harmful if inhaled. *
* *

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Vapors may irritate eyes.

SKIN: Prolonged or repeated exposure not likely to cause significant skin irritation. May cause more severe response if confined to skin. Aqueous solutions may cause more severe effects including burns. A single prolonged exposure may result in material being absorbed in harmful amounts.

(Continued on page 2)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 2****Product: PROPYLENE OXIDE**

Product Code: 70557

Effective Date: 10/26/94

Date Printed: 01/06/95

MSD: 000293

INGESTION: Single dose oral toxicity is moderate. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing amounts larger than that may cause serious injury, even death.

INHALATION: In confined or poorly ventilated areas, vapors can readily accumulate and can cause unconsciousness and death. A single prolonged (hours) excessive inhalation exposure may cause serious adverse effects, even death. Excessive exposure may cause irritation to upper respiratory tract. Observations in animals include lung and mild central nervous system effects.

SYSTEMIC (OTHER TARGET ORGAN EFFECTS): Repeated excessive exposures may cause eye and respiratory irritation. Excessive exposure may cause peripheral neuropathy (injury to nerves of the extremities). Early studies in laboratory animals report lung injury.

CANCER INFORMATION: For hazard communication purposes under OSHA Standard 29 CFR Part 1919.1200, this chemical is listed as a potential carcinogen by IARC and NTP. Lifetime inhalation studies in laboratory animals with propylene oxide suggest a weak carcinogenic effect.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother.

REPRODUCTIVE EFFECTS: In animals studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYES: Immediate and continuous irrigation with flowing water for at least 30 minutes is imperative. Prompt medical consultation is essential. Seek medical attention immediately.

SKIN: In case of contact, immediately flush skin with plenty of

(Continued on page 3)

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M A T E R I A L S A F E T Y D A T A S H E E T

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water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician if irritation persists. Wash clothing before reuse. Destroy contaminated shoes. Seek medical attention immediately.

INGESTION: If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Consult medical personnel.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

NOTE TO PHYSICIAN: If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: < -20F, -29C

METHOD USED: TCC

AUTOIGNITION TEMPERATURE: 465C

FLAMMABILITY LIMITS

LFL: 2.3%

UFL: 36.0%

HAZARDOUS COMBUSTION PRODUCTS: Hazardous combustion products may include and are not limited to: aldehydes, carbon dioxide, carbon monoxide and organic acids.

EXTINGUISHING MEDIA: Water fog, carbon dioxide, dry chemical, foam. For large scale fires, straight or direct water streams may be ineffective to extinguish fire, but copious fine water spray will help control situation by its cooling action. For large scale fires, alcohol resistant foams are preferred if available. General purpose synthetic foams or protein foams may function, but much less effectively.

(Continued on page 4)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 4****Product: PROPYLENE OXIDE**

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FIRE FIGHTING INSTRUCTIONS: In advanced or massive fires, fire fighting should be done from a safe distance, or from a protected location. Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. Keep vapors away from possible ignition sources.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive pressure, self-contained breathing apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

ACTION TO TAKE FOR SPILLS/LEAKS: The area must be evacuated and only reentered by persons equipped for decontamination. In most situations there will be an extremely high fire and explosion potential and personnel should act accordingly. Copious water may be used to dilute the material and minimize fire hazard.

Respiratory Protection: Wear positive pressure self-contained breathing apparatus. Since material is flammable, do not wash directly into sewer. Protect personnel and equipment by draining away from facility if possible. Avoid the use of high surface area adsorbent material.

7. HANDLING AND STORAGE

HANDLING: Avoid breathing vapors. Do not get in eyes, and avoid contact with skin.

STORAGE: This product is not normally cooled during storage; neither is it necessary to cool product while it is being stored. Storage facilities should be insulated against fire exposure of storage vessels. All storage tanks and shipments of PO must be padded with nitrogen.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines. Lethal concentrations may exist in areas with poor ventilation.

(Continued on page 5)

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M A T E R I A L S A F E T Y D A T A S H E E T

PAGE: 5

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PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION: Use chemical goggles. If vapor exposure causes eye discomfort, use a full-face respirator. Eye wash fountain should be located in immediate work area.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as faceshield, gloves, boots, apron, or full-body suit will depend on operation. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse. Contaminated leather items, such as shoes, belts and watchbands, should be removed and destroyed.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required, use an approved air-purifying or positive-pressure supplied-air respirator depending on the potential airborne concentration. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved positive-pressure self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. In confined or poorly ventilated areas, use an approved positive-pressure supplied-air respirator.

EXPOSURE GUIDELINE(S): Propylene oxide: Dow IHG is 3 ppm. ACGIH TLV and OSHA PEL are 20 ppm. PELs are in accord with those recommended by OSHA, as in the 1989 revision of PELs.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless liquid.
ODOR: Not available.
VAPOR PRESSURE: 440.7 mmHg @ 20C, 68F
VAPOR DENSITY: 2.0
BOILING POINT: 93.6F, 34C
SOLUBILITY IN WATER: 40.5 gms/100g
SPECIFIC GRAVITY: 0.826 @ 25/25C, 77F

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under normal storage and handling

(Continued on page 6)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 6****Product: PROPYLENE OXIDE**

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conditions. Avoid contact with heat since propylene oxide will begin to oxidize at 188C.

CONDITIONS TO AVOID: Avoid acid and base type catalysts and high surface area adsorbents.

INCOMPATIBILITY WITH OTHER MATERIALS: Acid, base, oxidizing material.

HAZARDOUS DECOMPOSITION PRODUCTS: Combustion may produce carbon dioxide and toxic carbon monoxide. Unidentified organic compounds may be formed during combustion.

HAZARDOUS POLYMERIZATION: May occur when in contact with highly active catalytic surfaces such as anhydrous chlorides of iron, tin, aluminum, peroxides of iron and aluminum, alkali metal hydroxides, and some solid adsorbents such as alumina. (Anything to change neutrality of PO can cause polymerization).

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

SKIN: The LD50 for skin absorption in rabbits is 1240 mg/kg.

INGESTION: The oral LD50 for rats is in the range of 300-1000 mg/kg.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): In vitro mutagenicity studies were positive. Results of most mutagenicity studies in animals have been negative; some have been positive.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations.

(Continued on page 7)

(R) Indicates a Trademark of The Dow Chemical Company

M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 7****Product: PROPYLENE OXIDE**

Product Code: 70557

Effective Date: 10/26/94

Date Printed: 01/06/95

MSD: 000293

Regulations may vary in different locations. Waste characterization and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS VIRGIN, WITHIN-SPECIFICATION CONDITION. ANY PROCESSING, STORING OR USE OF THIS MATERIAL MAY RENDER THE INFORMATION PRESENTED HERE INAPPROPRIATE. Contact The Dow Chemical Company for further assistance.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.):

For DOT regulatory information, if required, consult transportation regulations, product shipping papers or contact your Dow representative.

CANADIAN TDG INFORMATION: For guidance, the Transportation of Dangerous Goods Classification for this product is:

Propylene Oxide/Class 3.1, (9.2)/UN1280/I ERP2-0011

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

=====

SARA 313 INFORMATION: This product contains the following substances

(Continued on page 8)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 8****Product: PROPYLENE OXIDE**

Product Code: 70557

Effective Date: 10/26/94

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MSD: 000293

REGULATORY INFORMATION (CONTINUED)

subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
PROPYLENE OXIDE	000075-56-9	99 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
 A delayed health hazard
 A fire hazard

CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer. (See Section 6 of the MSDS for details on carcinogenicity.)

OSHA HAZARD COMMUNICATION STANDARD:

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

CANADIAN REGULATIONS

=====

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials

(Continued on page 9)

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M A T E R I A L S A F E T Y D A T A S H E E T

PAGE: 9

Product: PROPYLENE OXIDE

Product Code: 70557

Effective Date: 10/26/94

Date Printed: 01/06/95

MSD: 000293

REGULATORY INFORMATION (CONTINUED)

Information System (WHMIS) Classification for this product is:

B2

D1B

D2A

D2B

16. OTHER INFORMATION

WARNING PROPERTIES: Odor threshold for most people is 45 ppm (mean, with a range of reported values of 10-199 ppm). Odor is inadequate warning of concentrations exceeding the exposure guideline.

MSDS STATUS: Revised sections 3, 5, 6, 7, 10, 13 and 15.

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The Information Herein Is Given In Good Faith, But No Warranty,
Express Or Implied, Is Made. Consult The Dow Chemical Company
For Further Information.



ZEP MANUFACTURING COMPANY
FIRST IN MAINTENANCE PRODUCTS

MATERIAL SAFETY DATA SHEET

01/09/95

PAGE 1 OF 3

AND SAFE HANDLING AND DISPOSAL INFORMATION
ISSUE DATE: 01/28/92 ZEP-A-LUME
SUPERSEDES: 04/21/90 PRODUCT NUMBER: 1063
Aluminum Cleaner

SECTION I - EMERGENCY CONTACTS

ZEP MANUFACTURING COMPANY TELEPHONE: (404)352-1680 BETWEEN 8:00 AM-5:00 PM (EST)
P.O. BOX 2015 NON-OFFICE HOURS, WEEKENDS, AND HOLIDAYS: AREA CODE 404
ATLANTA, GEORGIA 30301 435-2973, 351-2952, 432-2873
LOCAL POISON CONTROL CENTER
TRANSPORTATION EMERGENCY: CHEMTREC: TOLL FREE 1-800-424-9300 ALL CALLS RECORDED
(404)922-0923 or DISTRICT OF COLUMBIA (202)483-7616 ALL CALLS RECORDED

SECTION II - HAZARDOUS INGREDIENTS

DESIGNATIONS	TLV (PPM)	EFFECTS (SEE REVERSE)	% IN PROD.
@** HYDROFLUORIC ACID ** hydrogen fluoride; hydro- fluoride; CAS# 7664-39-3; RTECS# MW7875000; OSHA PEL-3PPM; OSHA/ACGIH STEL-6 PPM	3	HTX COR	5-10
@** SULFURIC ACID ** oil of vitriol; CAS# 7664-93-9; RTECS# WS5600000; OSHA PEL-1 mg/m3 (for mists only).	0.25	TOX COR	10-20
@** PHOSPHORIC ACID ** CAS# 7664-38-2; RTECS# TB6300000; OSHA PEL-1 MG/M3; OSHA/ACGIH STEL- 3 MG/M3	0.25	TOX COR	< 5
@** ETHYLENE GLYCOL MONOBUTYL ETHER ** 2-butoxyethan- ol; butyl cellosolve; CAS# 111-76-2; RTECS# KJ8575000; OSHA PEL (SKIN)- 25 ppm	25	TOX IRR CBL	< 5

@ IDENTIFIES CHEMICALS LISTED UNDER SARA-SECTION 313 FOR RELEASE REPORTING.
SECTION III - HEALTH HAZARD DATA

SPECIAL NOTE: MSDS data pertains to the product as dispensed from the container.
Adverse health effects would not be expected under recommended conditions
of use (diluted) so long as prescribed safety precautions are practiced.

ACUTE EFFECTS OF OVEREXPOSURE:

CORROSIVE TO EYES AND SKIN ON CONTACT. EYE CONTACT MAY CAUSE CORNEAL DAMAGE OR
BLINDNESS. SKIN CONTACT MAY CAUSE DELAYED BURNS WITH LITTLE NOTICEABLE PAIN,
TAKING UP TO 24 HOURS TO APPEAR. IMMEDIATE FIRST AID IS NECESSARY IN CASE OF
CONTACT. CONTACT RESULTS IN IMMEDIATE SKIN ABSORPTION, WHICH MAY CAUSE HYPOCAL-
CEMIA. SEVERE OVEREXPOSURE BY ABSORPTION CAN RESULT IN DEATH. INHALATION CAN IR-
RITATE RESPIRATORY TRACT LEADING TO INFLAMMATION AND CHEMICAL PNEUMONIA. ING-
ESTION CAN CAUSE GASTROINTESTINAL TRACT BURNS AND MAY ALSO CAUSE KIDNEY DIS-
FUNCTION. CAN BE FATAL IF INHALED OR INGESTED. ** FLUSH CONTACT AREA IMMEDIATE-
LY WITH LARGE AMOUNTS OF WATER (AT LEAST 15 min.) THEN IMMERSE OR SOAK IN A
0.13% SOLUTION OF ZEPHIRAN CHLORIDE (DO NOT use around the eyes) SEE FIRST AID.*



ZEP MANUFACTURING COMPANY
FIRST IN MAINTENANCE PRODUCTS

MATERIAL SAFETY DATA SHEET

AND SAFE HANDLING AND DISPOSAL INFORMATION PAGE 2 OF 3
ISSUE DATE: 01/28/92 ZEP-A-LUME
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Aluminum Cleaner

SECTION III - HEALTH HAZARD DATA (CONTINUED)

CHRONIC EFFECTS OF OVEREXPOSURE:

REPEATED OR PROLONGED CONTACT WITH ACID VAPORS MAY CAUSE NASAL ULCERATION, BRONCHIAL IRRITATION AND FREQUENT ATTACKS OF BRONCHIAL INFECTION. IN EXTREME CASES, TEETH EROSION COULD RESULT. REPEATED OR PROLONGED EXPOSURE TO VAPORS MAY CAUSE CHRONIC EYE IRRITATION OR FREQUENT EYE INFECTIONS. PROLONGED OR REPEATED EXPOSURE CAN RESULT IN HYPOCALCEMIA AND BONE/JOINT DESTRUCTION.

ANIMAL STUDIES INDICATE A POTENTIAL FOR LIVER, KIDNEY, OR RED BLOOD CELL DAMAGE. RELEVANCE OF THESE STUDIES OR EXPOSURE LEVELS WHICH MIGHT PRODUCE THESE EFFECTS IN HUMANS HAS NOT BEEN ESTABLISHED.

NONE OF THE INGREDIENTS ARE LISTED AS CARCINOGENS BY IARC, NTP, OR OSHA.

EST'D PEL/TLV: NOT ESTABLISHED PRIMARY ROUTES OF ENTRY: INH, SKIN.

HMIS CODES: HEALTH 3; FLAM. 0; REACT. 0; PERS. PROTECT. K ; CHRONIC HAZ. YES

FIRST AID PROCEDURES:

SKIN : IMMEDIATELY FLUSH CONTACT AREA WITH WATER FOR 15 min. IMMEDIATELY GET MEDICAL ATTENTION WHILE SOAKING SKIN WITH ZEPHIRAN CHLORIDE per SEC. 3.
EYES : IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES, OCCASIONALLY LIFTING UPPER AND LOWER LIDS. GET MEDICAL ATTENTION AT ONCE.
INHALE: MOVE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. GET MEDICAL ATTENTION IMMEDIATELY.
INGEST: IF THIS PRODUCT IS SWALLOWED, DO NOT INDUCE VOMITING. IF VICTIM IS CONSCIOUS GIVE PLENTY OF WATER TO DRINK. GET MEDICAL ATTENTION AT ONCE.

SECTION IV - SPECIAL PROTECTION INFORMATION

PROTECTIVE CLOTHING : WEAR RUBBER GLOVES, A RUBBER RAINSUIT, AND RUBBER BOOTS WHEN USING THIS PRODUCT OR WHEN WORKING IN A USE AREA.
EYE PROTECTION : USE TIGHT-FITTING, SPLASH-PROOF SAFETY GOGGLES. CONTACT LENSES SHOULD NOT BE WORN WHEN HANDLING THIS MATERIAL.
RESPIRATORY PROTECTION: WHEN EXPOSURE LEVELS EXCEED PEL/TLV, USE ZEP MODEL 2245 RESPIRATOR (OR EQUIVALENT) AS DIRECTED BY MANUFACTURER.
VENTILATION : PROVIDE LOCAL EXHAUST/VENTILATION AS NEEDED TO KEEP CONCENTRATION OF VAPORS BELOW EXPOSURE LIMITS (PEL/TLV).

SECTION V - PHYSICAL DATA

BOILING POINT (F) : 220	SPECIFIC GRAVITY : 1.13
VAPOR PRESSURE(MMHG): N/D	PERCENT VOLATILE BY VOLUME (%) : 75
VAPOR DENSITY(AIR=1): N/D	EVAPORATION RATE(WATER =1): 1.0
SOLUBILITY IN WATER : COMPLETE	PH(CONCENTRATE) : < 1.0
	PH(USE DILUTION OF 1%) : 1.0-2.0

APPEARANCE AND ODOR : A CLEAR, COLORLESS LIQUID WITH A SOUR ACID ODOR

SECTION VI - FIRE AND EXPLOSION DATA

FLASH POINT(F) (METHOD USED): None (TCC)
FLAMMABLE LIMITS LEL N/A UEL N/A
EXTINGUISHING MEDIA : NON-COMBUSTIBLE.
SPECIAL FIRE FIGHTING: ENCAPSULATED SUIT WITH SCBA OR SUPPLIED AIR.
UNUSUAL FIRE HAZARDS : TOXIC AND CORROSIVE GASES AND/OR FUMES WHEN HEATED.



ZEP MANUFACTURING COMPANY
FIRST IN MAINTENANCE PRODUCTS

MATERIAL SAFETY DATA SHEET

AND SAFE HANDLING AND DISPOSAL INFORMATION PAGE 3 OF 3
ISSUE DATE: 01/28/92 ZEP-A-LUME
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SECTION VII - R E A C T I V I T Y D A T A

STABILITY : STABLE
INCOMPATIBILITY(AVOID) : STRONG ALKALIS AND OXIDIZING AGENTS.
POLYMERIZATION : WILL NOT OCCUR.
HAZARDOUS DECOMPOSITION: HYDROGEN FLUORIDE AND TOXIC/CORROSIVE FUMES AS OXIDES OF PHOSPHORUS AND SULFUR.

SECTION VIII - S P I L L A N D D I S P O S A L P R O C E D U R E S

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
OBSERVE SAFETY PRECAUTIONS IN SECTIONS 4 & 9 DURING CLEAN-UP. ABSORB SPILL ON AN INERT ABSORBENT MATERIAL (eg ZEP-O-ZORB); PICK UP AND PLACE IN A CLEAN D. O. T. SPECIFICATION CONTAINER FOR DISPOSAL. WASH AREA THOROUGHLY WITH A DETERGENT SOLUTION AND THEN RINSE WELL WITH WATER.

WASTE DISPOSAL METHOD:
LIQUIDS CANNOT BE SENT TO LANDFILLS UNLESS SOLIDIFIED. UNUSABLE PRODUCT AND SOME COLLECTED, SPENT USE-DILUTIONS MAY REQUIRE DISPOSAL AS A HAZARDOUS WASTE AT A PERMITTED TREATMENT/STORAGE/DISPOSAL FACILITY. IN MOST STATES HAZARDOUS WASTES IN TOTAL AMOUNTS OF 220 LBS. OR LESS PER MONTH MAY BE DISPOSED OF IN A CHEMICAL OR INDUSTRIAL WASTE LANDFILL. IF COMPANY EFFLUENT IS ULTIMATELY TREATED BY A PUBLICLY OWNED TREATMENT WORKS, NEUTRALIZATION OF SPENT TANK-SOLUTIONS WITH SUBSEQUENT DISCHARGE TO THE SEWER MAY BE POSSIBLE. CONSULT LOCAL, STATE AND FEDERAL AGENCIES FOR PROPER DISPOSAL METHOD IN YOUR AREA.

RCRA HAZ. WASTE NOS.: D002

SECTION IX - S P E C I A L P R E C A U T I O N S

PRECAUTIONS TO BE TAKEN WHEN HANDLING AND STORING:
Store tightly closed container in a dry area at temps. between 40-120 degrees F.
Store away from highly alkaline products and oxidizing compounds.
KEEP PRODUCT AWAY FROM SKIN AND EYES.
DO NOT BREATHE SPRAY MISTS OR VAPORS.
Clothing or shoes which become contaminated with substance should be removed promptly and not reworn until thoroughly cleaned.
KEEP OUT OF THE REACH OF CHILDREN.

SECTION X - T R A N S P O R T A T I O N D A T A

DOT PROPER SHIPPING NAME Small sizes one gallon or less may be shipped as ORM-D
HYDROFLUORIC ACID AND SULFURIC ACID MIXTURE
DOT HAZARD CLASS: 8, 6, 1,
DOT I. D. NUMBER : UN1786 DOT LABEL/PLACARD: COR & POIS
EPA TSCA CHEMICAL INVENTORY - ALL INGREDIENTS ARE LISTED
EPA CWA 40CFR PART 117 SUBSTANCE(RQ IN A SINGLE CONTAINER): SULFURIC ACID, 1000#
PHOSPHORIC ACID, 5000#; HYDROFLUORIC ACID, 100#

Material Safety Data Sheet

Complies with OSHA's Hazard Communication
Standard 29 CFR 1910.1200

NFPA
FIRE 0
HEALTH 2
REACTIVITY 0

SECTION I - IDENTITY AND MANUFACTURER'S INFORMATION

Manufacturer's Name & Address	The Fuller Brush Company PO Box 729 Great Bend, Kansas 67530	Product Name	SPRAY N' AWAY
Chemical Family	Aqueous based detergent	Product Number	9015
E.P.A. Reg. No.	N/A	Package Size	32FL.OZ
Emergency Telephone No.	1-316-792-1711		
Preparer	Lewis Gray	Date	3/22/92
		Signature	<i>Lewis Gray</i>

SECTION II - HAZARDOUS INGREDIENTS / IDENTITY INFORMATION

Hazardous Components	CAS#	OSHA TWA	ACGIH TWA	Percent
**2-Butoxyethanol	111-76-2	50 ppm	25 ppm	5.0
Sodium Metasilicate*	6834-92-0	NE	NE	2.0
*Water	7732-18-5	N/A	N/A	
*Tetrasodium EDTA	64-02-8	N/A	N/A	
*Nonylphenoxy(ethoxy)ethanol	25154-52-3	N/A	N/A	

*2mg/m3 supplier recommendation

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

No Physical Hazards	<input checked="" type="checkbox"/>	Flammable Aerosol	<input type="checkbox"/>	Unstable - Reactive	<input type="checkbox"/>
Combustible Liquid	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Water Reactive	<input type="checkbox"/>
Compressed Gas	<input type="checkbox"/>	Flammable Liquid/Solid	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>
Flammable Gas	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>

Boiling Point °F	212°F	Specific Gravity (water = 1)	1.025
Vapor Pressure (mm Hg)	Unknown	%Volatiles by Weight	94
Vapor Density (air = 1)	N/A	Evaporation Rate (water = 1)	1
Solubility in Water	Complete	pH	12.8
Appearance and Odor	Blue-green crystal clear liquid/solvent & fragrance odor.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	None to boiling	Flammable Limits	LEL	UEL
---------------------------	-----------------	------------------	-----	-----

Extinguishing Media N/A

Special Fire Fighting Procedures

N/A

Unusual Fire and Explosion Hazards

N/A

SECTION V - REACTIVITY DATA

Stability: Unstable ☐ Conditions to Avoid N/A
Stable ☒

Incompatibility (Materials to Avoid) Mix only with water

Hazardous Decomposition Products or By Products None

Hazardous Polymerization May Occur ☐ Will Not Occur ☒
Conditions to Avoid N/A

*Added to comply with the Pennsylvania Worker Right To Know Act (1984) & the New Jersey Worker/Community Right To Know Act (1983).

9015

SECTION VI - HEALTH HAZARD DATA

Route (s) of Entry	Inhalation <u> x </u>	Skin <u> x </u>	Eye <u> x </u>	Ingestion <u> x </u>
No Health Hazard <u> </u>	Reproductive Toxin <u> </u>	Sensitizer <u> </u>		
Toxic <u> </u>	Irritant <u> x </u>	Carcinogen <u> </u>		
Highly Toxic <u> </u>	Corrosive <u> </u>	See Target Organs <u> x </u>		
TARGET ORGANS				
Lungs <u> </u>	Prostate <u> </u>	Central Nervous System <u> </u>		
Heart <u> </u>	Blood <u> x </u>	Cardiovascular System <u> </u>		
Kidney <u> x </u>	Liver <u> x </u>	Mucous Membranes <u> x </u>		
Eyes <u> x </u>	Mutagen <u> </u>	Autonomic Nervous System <u> </u>		
Skin <u> x </u>	Teratogen <u> </u>	Respiratory System <u> x </u>		
Carcinogenicity: None Known <u> x </u>	NTP <u> </u>	IARC Monographs <u> </u>	OSHA Regulated <u> </u>	
Medical Conditions Generally Aggravated by Exposure: None known				

Signs and Symptoms of Exposure:

Redness, irritation of eyes or skin. Nausea, irritation of mouth, throat, etc. if ingested. Possible hemolysis and hemoglobinuria with overexposure.

Emergency and First Aid Procedures:

EYES: Flood with water, call a physician. SKIN: Flood with water, contact a physician if irritation persists. INGESTION: Do not induce vomiting, contact a physician or Poison Control Center immediately.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE**Steps to be taken in case Material is released or Spilled:**

Mop up and rinse with water.

Waste Disposal Method:

Single Unit: Wrap container and dispose in trash receptacle. Large Amount: Dispose in accordance with local, state, and federal regulations.

Potential EPA Hazardous Waste Code(s): D002

Precautions to be taken in Handling and Storage:

Store in original, tightly sealed container at 40-90°F. Follow Label Use Directions. KEEP OUT OF REACH OF CHILDREN.

SECTION VIII - CONTROL MEASURES**Respiratory Protection (Specify Type)**

None required

Ventilation:	Local Exhaust <u>None required</u>	Special <u> </u>
	Mechanical <u> </u>	Other <u> </u>

Protective Gloves: Recommended

Eye Protection: Recommended

Other Protective Clothing and Equipment:

None Required

SECTION IX - SHIPPING INFORMATION**DOT Proper Shipping Name and Number:**

CORROSIVE LIQUID, N.O.S. (UN1760) (ERG26) or CONSUMER COMMODITY, ORM-D

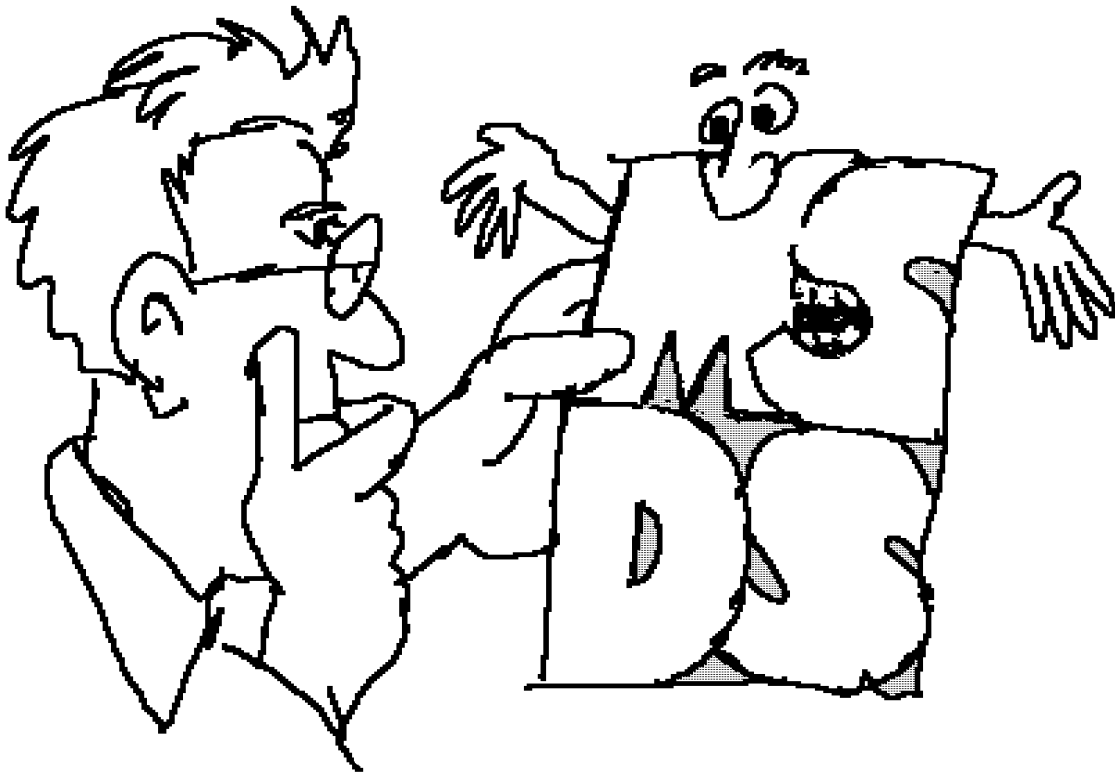
NE = Not Established

N/A = Not Applicable

1. The Problems With MSDSs

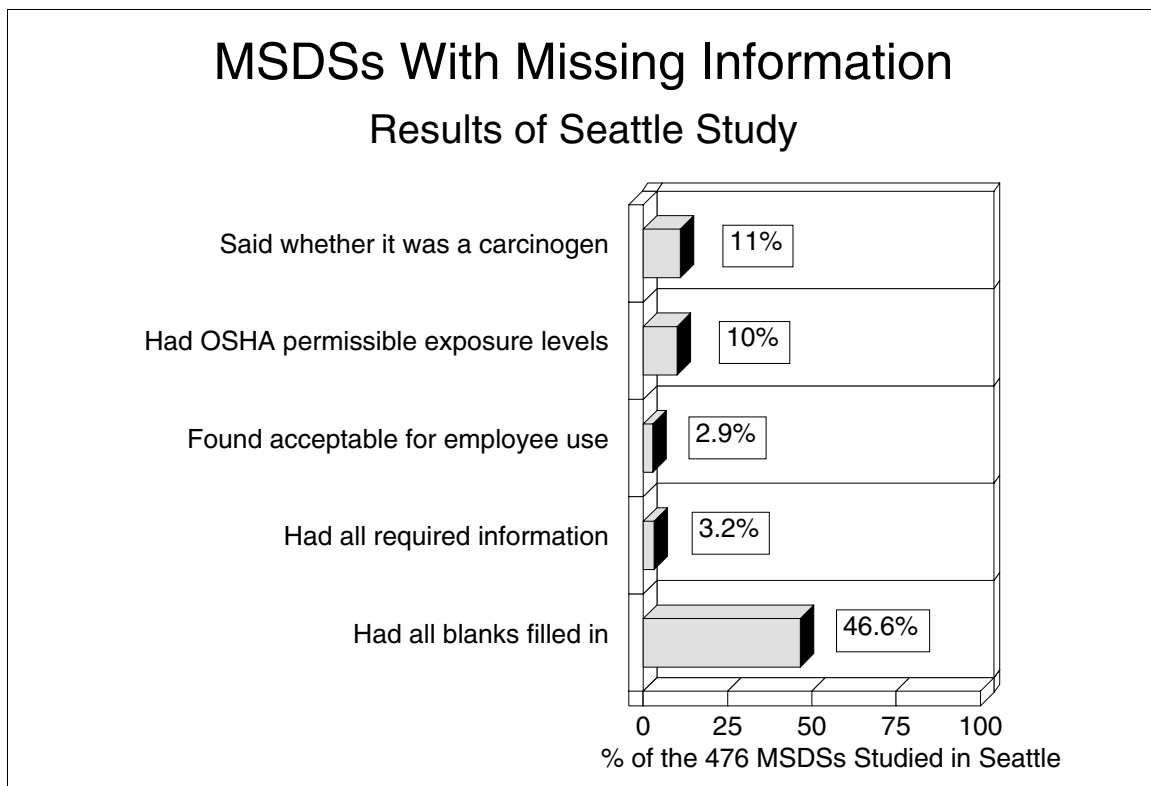
Employers are required by OSHA, and by many state laws, to provide Material Safety Data Sheets (MSDSs). The MSDS is prepared by the product's manufacturer and provides basic information on the chemical's physical properties and related health effects. The MSDS gives guidance on using, storing and handling substances safely on the job and in emergencies such as fires and spills. But these sheets have problems. Here's how the American Lung Association puts it:

"Unfortunately, information presented on an MSDS may be incomplete or inaccurate. This is particularly true for information on health effects that workers may experience from low-level chemical exposure over a long period of time."



The Seattle Area Hospital Council conducted a study on 476 MSDSs to see how accurate they were. Here's what they found:

Only 46.6% of the 476 MSDSs reviewed had all the blanks filled in, and 70% were internally consistent (that is, did not have information included that contradicted itself). Only 3.2% had all required elements present. Only 2.9% were found to be acceptable for employee use. The OSHA Permissible Exposure Limits appeared on only 10%. Whether the chemical was a carcinogen appeared on only 11%.



Source: *Industrial Hygiene News Report* 29, Lake San Marcos, CA: Flournoy Publisher, November 1986.

2. What's in an MSDS?

Section I: Product Identity

This information gives you the product's name as it appears on the label and on the company's chemical inventory list. This is usually the shop floor name, e.g. "Solvent 460" or "Trichlor." The manufacturer is listed along with a contact person you can call to get more information on the product – before an emergency occurs.

Section II: Hazardous Ingredients

This section is the key part of the MSDS. It gives you the basic ingredients in the product and tells you the legal and recommended limits for workplace exposures. Remember to get the exact spelling of the chemicals because many chemicals have similar names but different health effects.

It's easy to get confused when talking about exposure limits. There are many different types of exposure limits, levels set by different agencies, and lots of short-cut names. Here are the ones you will see in the *Pocket Guide* and on MSDSs. The following explains some technical language you might find on data sheets related to exposure limits:

PEL (Permissible Exposure Limit): This is an exposure limit established by OSHA. It can be a time-weighted average (TWA) exposure limit, a "ceiling" exposure limit, or a "peak" exposure limit. These are all **legal** standards.

TLV (Threshold Limit Value): This is a **recommended** average concentration over an 8-hour day. This term is used to express the airborne concentration of a material to which nearly all persons supposedly can be exposed without adverse effects day after day. TLVs can be expressed in three different ways (see below). (TLVs are **suggested – not legal – standards** established by the American Conference of Governmental Industrial Hygienists (ACGIH), which is not a government agency.)

- **TLV-TWA (Time-Weighted Average):** is related to long-term exposure. The theory is that a worker will not get sick if he or she works at or below this level for a long time. A "long time" usually means 8 hours per day, 5 days per week for your whole working life. These are averages, which means that your exposure can be higher than this limit for part of the day, as long as it is also lower for part of the day. If the MSDS only lists "TLV," it usually means the time-weighted average.
- **TLV-STEL (Short-Term Exposure Limit):** is the amount you can be exposed to for no more 15 minutes. This is also an average. Short-term limits are higher than 8- or 10-hour exposure limits. (This is like the OSHA "ceiling" limit.)

-
- **TLV-C (Ceiling Exposure Limit):** Never exceed this amount at any point during the work day. Ceiling limits are set for some chemicals that are fast-acting. (This is like the OSHA "peak" limit.)

LD50 or LC50 (Lethal Dose and Lethal Concentration): These terms refer to the dose or concentration of a chemical which, in experiments, kills 50 percent of the test animals.

Skin or "S": This means the substance may be absorbed through the skin by liquid contact or through the mucous membranes and eyes by direct contact or airborne contact.

Here are some explanations for the numbers used (note that for most substances, mg/m^3 can be converted into ppm):

- **mg/m^3 :** This is milligrams of substance per cubic meter of air. The term is most commonly used for measuring concentrations of dusts, metal fumes, or other particles in the air.
- **mg/kg :** This is milligrams of substance per kilogram of body weight. It is used generally to measure toxic chemicals we ingest.
- ***ppm*:** This means parts per million. It is used for measuring the concentration of a gas or vapor in a million parts of air.

Section III: Physical Data

This section provides critical information about the properties of chemicals – like vapor pressure, vapor density, boiling point and evaporation rate. If you understand these measurements, you can learn a lot about hazards of a particular chemical. For example, chemicals with high vapor pressure in sealed containers are more likely to explode if temperatures rise. Chemicals with a vapor density greater than one (1) tend to collect in low areas or confined spaces, replace your oxygen, and can suffocate you. (See the factsheets on pages 127 through 129 for more on these terms.)

Section IV: Fire and Explosion Hazard Data

This section provides basic information on fire prevention and control. It includes the flashpoint of the chemical – the lowest temperature at which a liquid will give off enough flammable vapor to be ignited if there is an ignition source (heat) and oxygen. The lower the flashpoint the greater the risk of fire. (See the factsheet on page 130 for more on flashpoint.) **Section IV** also covers what type of fire extinguisher to use.

continued

2. *(continued)*

Section V: Reactivity Data

This section tells us whether or not the chemical is likely to break down or react with other substances causing fires, explosions, or the release of different, even more hazardous substances.

Section VI: Health Hazard Data

This section explains how the chemical enters the body, whether it causes cancer and what are its short- and long-term health effects. Most of what you can learn from an MSDS will be about short-term reactions to high exposures rather than long-term health consequences from working with a chemical every day. You may want to get some assistance from a health and safety person to verify the health effects information.

Section VII: Precautions for Safe Handling and Use

This section should give you information to plan for emergencies (type of emergency respirators to have on hand, exit routes and ways to deal with small spills). It also provides procedures for proper waste disposal and precautions for storage and handling. Unfortunately, this section is often incomplete for emergency planning.

Section VIII: Control Measures

This section provides information on appropriate respirators, protective clothing, ventilation and safe work practices. These almost always represent the bare minimum in protection and tend to emphasize protective gear and respirators over engineering controls which control the problem at the source of exposure. So, you may want to demand more from your employer.

Your Rights Under the Law

Your company is required by OSHA and many state laws to:

- Have an MSDS for every hazardous chemical used in the workplace and must provide you with a copy no later than 15 days after the request, at no charge.
- Ensure that they are readily accessible to all workers during each shift.
- Provide training to you and your co-workers so that you understand the health effects of these chemicals and how to work with them safely.

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

Emergency Telephone Number

Address (Number, Street, City, State and ZIP code)

Telephone Number for Information

Date Prepared

Signature of Preparer (optional)

Section II – Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))

OSHA PEL

ACGIH TLV

Other Limits Recommended

% (optional)

Section III – Physical/Chemical Characteristics

Boiling Point

Specific Gravity (H₂O = 1)

Vapor Pressure (mm Hg)

Melting Point

Vapor Density (AIR=1)

Evaporation Rate (Butyl Acetate =1)

Solubility in Water

Appearance and Odor

Section IV – Fire and Explosion Hazard Data

Flash Point (Method Used)

Flammable Limits

LEL

UEL

Extinguishing Media

Special Fire Fighting Procedures

Unusual Fire and Explosion Hazards

(Reproduce locally)

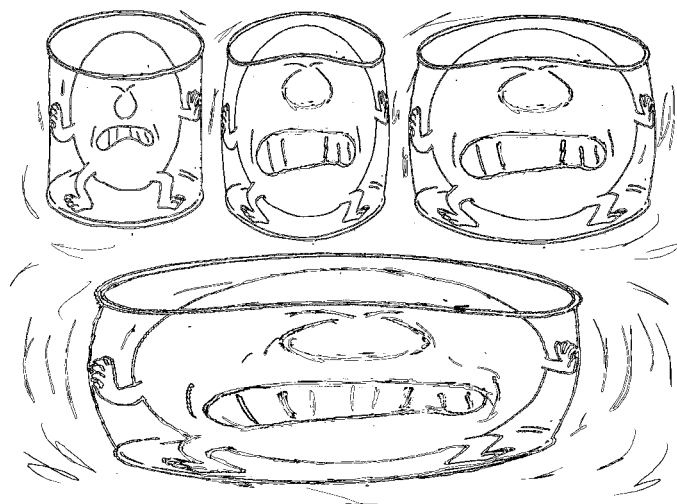
OSHA 174, Sept. 1985

Section V – Reactivity Data			
Stability	Unstable	Conditions to Avoid	
	Stable		
Incompatibility (Materials to Avoid)			
Hazardous Decomposition or Byproducts			
Hazardous Polymerization	May Occur	Conditions to Avoid	
	Will Not Occur		
Section VI – Health Hazard Data			
Route(s) of Entry:	Inhalation?	Skin?	Ingestion?
Health Hazards (Acute and Chronic)			
Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulated?
Signs and Symptoms of Exposure			
Medical Conditions Generally Aggravated by Exposure			
Emergency and First Aid Procedures			
Section VII – Precautions for Safe Handling and Use			
Steps to Be Taken in Case Material Is Released or Spilled			
Waste Disposal Method			
Precautions to Be Taken in Handling and Storing			
Other Precautions			
Section VIII – Control Measures			
Respiratory Protection (Specify Type)			
Ventilation	Local Exhaust	Special	
	Mechanical (General)	Other	
Protective Gloves		Eye Protection	
Other Protective Clothing or Equipment			
Work/Hygienic Practices			

3. Vapor Pressure

Vapor pressure is a measure of how much vapor is given off by a chemical at a given temperature. Chemicals with high vapor pressure readings are more likely to contaminate the air than are chemicals with low vapor pressure readings. The vapor pressure of a chemical rises when it is heated.

It is referred to as a vapor pressure because it is measured by seeing how "hard" the vapor of a material "pushes" against the sides of a closed container. If the liquid is heated, the vapor pressure will rise. Vapor pressure is measured in millimeters of mercury (mmHg) at a certain temperature.



Chemicals whose vapor pressure is less than one (1) at room temperature are not likely to pose airborne vapor hazards. Chemicals whose vapor pressures exceed fifty (50) or so at room temperature are more likely to present airborne exposure hazards.

continued

3. (continued)

The practical significance of this measure is:

- If a chemical has a high vapor pressure, more of it will be in the air than a chemical with a low vapor pressure. Given two liquids with the same toxicity rating, the most hazardous one will be the one with the higher vapor pressure.
- Vapor pressure can also warn us about the possibility of explosions. High vapor pressure chemicals in sealed containers can explode if, for instance, there is a fire nearby or temperatures rise.
- Liquids with a high vapor pressure may be particularly hazardous if you are working in an enclosed or confined area, especially if the liquid is flammable.

This chart can tell you, for example, that:

If both acetone and sulfuric acid were released during an accident, you would expect to find more acetone in the air than sulfuric acid.

High Vapor Pressure	
Acetone	266 mm
Benzene	75 mm
Moderate Vapor Pressure	
Ethylene glycol diethyl ether	9.4 mm
Methyl cellosolve	6.2 mm
Low Vapor Pressure	
PCBs	.001 mm
Sulfuric acid	.001 mm

4. Vapor Density

Vapor density is a measure of the relative weight or "heaviness" of a vapor or gas compared with an equal volume of air. It tells you something about where you might expect to encounter the vapor of a particular chemical – in the bottom of a reaction vessel, along the floor or near the ceiling.

- A vapor density of less than one (1) means that the vapor will rise in the air.
- A vapor density of greater than one (1) means that it will fall.

This is because air is assigned a vapor density of one (1). Any chemical which has a vapor density greater than one (1) is heavier than air and will sink toward the floor. These dense vapors may "roll" along the ground and collect in "pools" and low-lying areas such as the bottom of a reaction vessel.

Chemicals with vapor densities less than one (1) are lighter than air and will rise. These vapors can collect in pockets near the ceiling.

Worry if the vapor density is greater than one (1):

- Dense vapors, both toxic and non-toxic, collect in low areas and confined spaces and displace the oxygen that is there. If enough oxygen is displaced, you can suffocate. Thus, even non-toxic dense vapor can be hazardous.
- High vapor density chemicals can also be flammable. Vapors can travel far from their liquid source and concentrate in low-lying areas where you might not expect them. A carelessly thrown away match or cigarette could easily ignite these flammable vapors.
- Vapor density tells us where to expect to find a chemical vapor. Knowing where to look for a vapor is important for monitoring purposes. Air monitoring in a worker's breathing zone may not show some of the real dangers if the vapor density is greater than one!

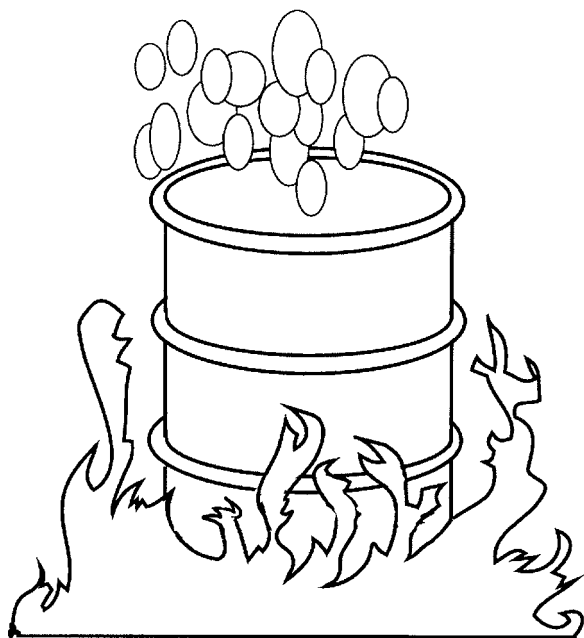
5. Flashpoint

Flashpoint (FP) is the temperature to which you must heat a liquid chemical so that it gives off enough vapor to catch on fire in the presence of an ignition source (e.g., spark or match) and oxygen. The lower the flashpoint, the greater the hazard.

Flashpoint less than 100° F = High Fire Risk (Flammable)
Flashpoint between 100° F and 200° F = Moderate Risk (Combustible)
Flashpoint greater than 200° F = Low Fire Risk (Combustible)

Here's an example:

Benzene (a liquid at normal room temperature) has a FP of 12° F. This means that if a drum of liquid benzene is heated or is warmer than 12° F (which is obviously the case in a work area) it will give off enough vapor that a fire could be caused by a spark, a lit match or some other ignition source.



In general, any time you have a chemical whose flashpoint is less than the temperature surrounding it, you have reason to worry.

Another example:

Once the temperature of liquid toluene exceeds 81° F, there will be enough vapor about the liquid to ignite. This means that if workplace temperatures climb above 81° F, and there is liquid toluene around, there will be enough vapor to catch fire if there is a spark, flame or other ignition source.

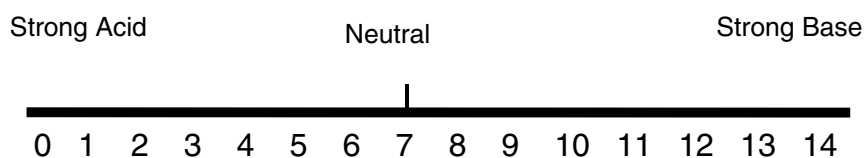
In a practical sense, whenever you work with a chemical whose flashpoint is less than room temperature (i.e. less than 65° F), there is a real fire hazard.

6. Some Other Basic Chemical Terms: pH and Oxidizer

pH

The **pH** of a chemical tells you if the chemical is an acid, a base (also called alkali or caustic), or neutral. The pH scale goes from 0 to 14, with 7 being neutral (water).

- pH less than 7 = acid
- pH more than 7 = base



The lower the pH (below 7), the stronger the acid. The higher the pH (above 7) the stronger the base. Many organic hydrocarbons (e.g., gasoline, benzene, kerosene, etc.) have almost neutral pHs (i.e., close to 7).

Here are some things to remember about pH:

- Chemicals with pHs much lower or much higher than 7 will **cause irritation and burns** to the part of the body coming into contact with the material.
- Basic chemicals (i.e., those with **pHs above 7**) are **much more dangerous to the eyes than are acids**. Acids "sit" on the surface of the eyes, if splashed, and can therefore be washed off (if done quickly), often without resulting in permanent damage.
- Basic substances rapidly penetrate the eye tissue; often causing quick and lasting damage.
- **Store like with like.** Chemicals with lower or higher pH should only be stored with chemicals of like pH and never with their opposite or a neutral chemical.

continued

6. (continued)

Oxidizers

These are chemicals that give off oxygen. That's important to know because **giving off oxygen feeds a fire** and can cause materials normally hard to burn to burn at much higher temperatures.

Fires (and explosions) need three things to exist:

- a **fuel** (wood, paper, oil, etc.)
- an **ignition source** (flame, spark, electrical source, etc.)
- and **oxygen**.

Oxidizers can be extremely dangerous. They make it easier for a fire to start.

Under normal circumstances you probably couldn't start a fire in a pile of wood from the kind of spark or "shock" you get when you walk across a rug and then touch a metal door knob. But if there were an oxidizer around and you had that kind of spark, there would be a much greater fire hazard.

Therefore, oxidizers must never be stored near combustible or flammable chemicals.



7. The Ups and Downs of Flammability Limits

All fires and most explosions are chemical reactions. (Note that some explosions are not due to chemical reactions.) For the reaction to occur, certain conditions must be met, such as an ignition source, fuel and oxygen (or other oxidizing agents).

The fuel and oxygen need to be mixed in certain proportions for the reaction to be able to start. These are commonly referred to as the lower flammability limit (LFL) and the upper flammability limit (UFL). Often these same limits are called lower and upper explosive limits (LEL and UEL).

The LFL and UFL are defined as percentages of the substance to air. For example, 92 octane gasoline will be able to ignite if the gasoline is between 1.4% gas to air (LFL) and 7.6% gas to air (UFL). If the mixture is too lean (below 1.4%) the gas/air mixture will not burn and if the mixture is too rich (higher than 7.6%) the mixture will not burn.

Never work in any atmosphere that is above 10 percent of the LFL or the LEL (ANSI Z117.1 1989). For example, 92 octane gasoline would reach its 10% LFL @ .14% gas to air.*

It is never safe to work in atmospheres that are too rich to burn. Many workers have died and suffered burns when working in atmospheres they were told were "too rich" to burn. That's because the oxygen content is not controllable in work areas (this includes confined spaces, ditches, pump pits, etc.), and the edge of the work area will always have a zone in the flammability range. See the chart on the next page.

*Note: The 10 percent guideline does not protect you from the toxics in the material. For example, gasoline, which averages 4 percent benzene, would at 10 percent LEL, expose you to 56 times the PEL for benzene.

continued

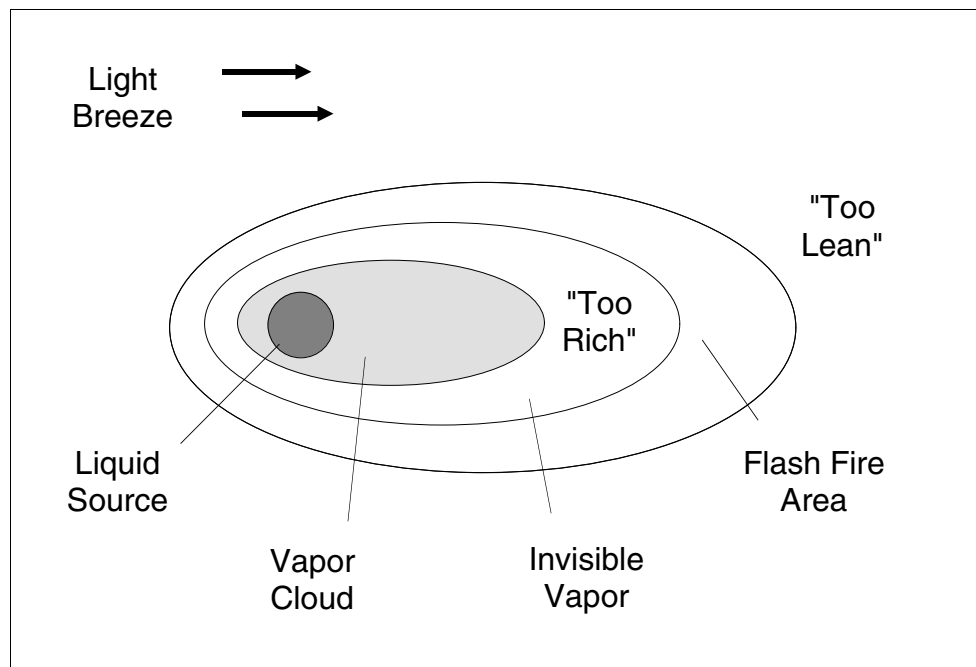
7. (continued)

Too Rich = Too Dangerous

Grayco Booster Plant

Pampa, Texas; March 7, 1991

Three workers were badly burned when working on a compressor using a "rich" method. The Booster plant was handling unrefined gasoline when two of several compressors failed. No nitrogen was provided for purging purposes at this remote facility, so gasoline was used to purge the compressor in order to make the air too rich to burn. Unfortunately, the gasoline vapor close to the compressor picked up enough oxygen to be in the flammability range. Sure enough, it found an ignition source and exploded, badly burning the workers.



8. The Fearsome Incompatibles

Keep These. . .		Away From These. . . Or You May Get These	
Acids	+	Bases	→ Heat Violent Reaction
Acids or Bases	+	Reactive Metals (Aluminum, Beryllium, Calcium, Lithium, Potassium, Magnesium, Sodium, Zinc Powder) Metal Hydrides	→ Fire Explosion Hydrogen Gas
Water or Alcohols	+	Concentrated Acids or Bases Calcium, Lithium, Potassium Metal Hydrides Other Water Reactive Waste	→ Heat Fire Explosion Flammable and Toxic Gases
Reactive Organic Compounds or Solvents (Alcohols, Aldehydes, Nitrated Hydrocarbons)	+	Concentrated Acids or Bases Reactive Metals and Metal Hydrides	→ Fire Explosion
Cyanide or Sulfide Solutions	+	Acids	→ Toxic Hydrogen Cyanide Sulfide Gas
Strong Oxidizers (Chlorates, Chlorine, Chlorites, Chromic Acid, Hypochlorites, Nitrates, Perchlorates, Permanganates, Peroxides)	+	Organic Acids Concentrated Mineral Acids Reactive Metals Metal Hydrides Reactive Organic Compounds or Solvents Flammable or Combustable Waste	→ Fire Explosion

Summary: MSDSs

1. Your company is **required by OSHA to have an MSDS for every hazardous chemical** in the workplace.
2. Your company is also **required by OSHA to make these MSDSs "readily accessible during each work shift to employees** when they are in their work area."
3. Sometimes the information on the MSDS is incomplete, unclear or even placed in the wrong section of the data sheet. Read the entire MSDS carefully and ask questions before you do the work.
4. The MSDS usually provides more detailed and accurate information on immediate health effects than on long-term health effects like cancer.
5. You may need help interpreting the information on the MSDS or may have questions about the accuracy of the information. There are a lot of resource people out there to help. These include the International Union Health & Safety Department, Safety & Health groups in your area (COSH Groups), and government agencies like OSHA, NIOSH, Poison Control Centers, or departments within a local or county health department. (See Resource List in Appendix.)
6. Compare the work practices, protective equipment and ventilation in your work area with the recommendations on the MSDS. **If your controls are inferior, demand more.**
7. Sometimes the recommendations found on the MSDS are inconsistent with the Health Hazard section. **If the manufacturer recommends personal protective equipment (PPE), special work practices or ventilation but says that there are no or little potential health effects, a warning signal should go off in your head.**
8. **Animal and laboratory studies are good indicators of the potential health effects** of a chemical on humans. When this information is reported (very often it is not), it is found in the Hazardous Ingredients section or the Health Effects section of the MSDS. The data sheet might say the chemical causes cancer, neoplasms, reproductive effects, mutation, teratogenesis, early death or DNA abnormalities in rats or other testing animals or bacteria. **This means that the chemical is likely to be hazardous to humans too.** Evaluate the way these chemicals are used in the workplace and keep exposures as low as possible.

Summary written by Deborah Nagin, MPH and Joel Carr, IH.

Activity 6: Monitoring the Monitors

Purpose

To develop our skills in evaluating monitoring reports of the exposures we face in working with toxics and hazardous materials.

To understand some of the limitations of airborne exposure monitoring.



Task

In your groups, please review the "monitoring report" on pages 139 through 140, submitted by the OilChem Company to the union health and safety committee. Then review the completed "plant survey form" on pages 141 through 144 from a union member in the hazardous waste area. (Assume the surveys from other workers in that area showed similar problems.)

Your group task is to make a recommendation to the union on what needs to be changed in the OilChem monitoring program by answering the questions on pages 145 through 146.

OilChem**OilChem Monitoring Report**

We understand that your union survey suggests that many of our production workers in the Hazardous Waste Storage Area are exposed to toxic chemicals. The evidence from our extensive air monitoring program suggests that your survey is not accurate. Here is what we did and what we have found:

We collected air samples for a number of chemicals in and near the Hazardous Waste Area, including gasoline and benzene. All monitoring results were safe and well below OSHA limits (see next page for summary). For example, the result for benzene was only 0.7 parts per million.

In addition, during the past year, whenever we received a worker complaint about over-exposure, we sent our safety supervisor to use detector tubes to collect air samples for benzene. Although this was done dozens of times, we only found one problem area and that was because the sample was collected too close to the waste vessel.

To protect your health and to maintain an efficient monitoring program, we collected air samples once a week, every week, for three months between 1 pm and 4 pm. Again, the results were acceptable under OSHA regulations for these chemicals.

To be certain that we got workers with significant risk, we put personal sampling pumps on all the hazardous waste workers in your bargaining unit working at the RCRA area of the facility for one day. To make sure we covered all the chemicals, each worker was tested for a different one. Again, the results were well within the legal limits.

continued

Task *(continued)*

OilChem

Clearly, we have gone out of our way to make certain that our monitoring program is adequate to protect your health and safety.

OilChem Air Sampling Report for the Hazardous Waste Area Average* of Results from the 3-Month Period			
Contaminant	Sample Time	Monitoring Results	OSHA Standard
Benzene	1pm-4pm	0.7 ppm	1 ppm
Gasoline	1pm-4pm	73.0 ppm	None **

*Actual exposures during any particular sampling period varied by a factor of as much as three times (i.e., if the average result for the three-month period reported above was 60 ppm, then the exposures found during each sampling period may have varied between 20 ppm and 180 ppm).

**But ACGIH standard is 300 ppm.

Plant Survey Form

Plant name: *OilChem*

Basic type of operation: *Petro-chemical, chemical*

Total number of production workers: *400*

Your job title: *Environmental Laborer*

Name of your work area: *Hazardous Waste Area*

Number of workers in your area: *4 on each shift*

1. Please describe in some detail the work processes and operations in your area. Give us a step-by-step description of what you do, what materials you handle, and the procedures you use.

On arrival at the work site, at approximately 8 am, I proceed to the hazardous waste storage area station where there are a number of 55-gallon drums containing various waste solvents including gasoline, benzene, and methylene chloride. Some of the drums also include dirt from the areas of the plant where these chemicals spilled on the ground.

My first task is to look at the drums to make sure none are leaking. If any are, we open them up and pour the contents into new drums and clean up the substances from the ground. Next, we remove the sludge from the waste separator. We open up the unit and begin shoveling the waste into empty drums. After the drums are filled, I load them into stacks in the fenced-off waste area. From time to time I am also called upon to shovel up the dirt from the small spills that take place around the solvent units. In the afternoon, I usually go over to the maintenance sheds and collect the contaminated clothing, place it in the drums, and cart it away.

It's during the morning time period, when I am around the waste separator or when I'm in a spill area, that I can smell the different chemicals; sometimes they really bother me, causing my eyes to sting or sometimes my skin to burn, or causing a headache.

2. What toxic chemicals do you work with?

Benzene, gasoline, methylene chloride

continued

Plant Survey *(continued)*

3. Of the toxic chemicals in your area, which ones are you most concerned about?

Benzene, methylene chloride

4. How is it used?

(see my description above)

5. What form does the exposure take? (Please check one or more below.)

- | | |
|--|---|
| <input type="checkbox"/> gas | <input checked="" type="checkbox"/> vapor |
| <input checked="" type="checkbox"/> liquid | <input type="checkbox"/> mist |
| <input type="checkbox"/> dust | <input type="checkbox"/> fume |
| <input type="checkbox"/> other | |

Please explain:

6. How does the exposure enter your body?

- ☒ inhalation
- ☒ absorption through the skin
- ☐ ingestion
- ☒ contact to eyes or skin

7. How long is your exposure each day?

- ☐ 1 hour
- ☐ 1-2 hours
- ☐ 2-4 hours
- ☒ 4 or more hours

8. How intense is the exposure?

- ☒ High *(for about 5 hours)*
- ☐ Moderate
- ☒ Low *(for about 3 hours)*

9. Is personal protective equipment used during operations or handling?

☐ No

☒ Yes

What kind? *Sometimes a respirator or gloves*

10. Are there any ventilation or other engineering controls?

☒ No

☐ Yes

What kind?

11. How severe do you believe the risk to be?

☐ Low

☒ Moderate

☐ High

Please explain briefly: *Benzene, I know, can cause cancer, and I can smell chemicals and sometimes get them on my skin – especially when cleaning the waste separator. Also, sometimes chemicals spill or leak and, once in a while, drums accidentally get knocked over.*

12. Do you believe you have any work-related health problems? If so what kind?

Yes. Skin rashes, headaches, tiredness.

13. Do you believe others in your area now have, or have had, any work-related health problems? If so, please describe.

Yes, most of the other operators have the same complaints.

14. Are you working compulsory overtime?

☐ No

☒ Yes Five 10-hour days and one 4-hour day

15. Are others in your area working compulsory overtime?

☐ No

☒ Yes

continued

Plant Survey (continued)

16. Are there subcontractors working in your area?

☒ No

☐ Yes

How many? What do they do?

17. Are they doing jobs that the bargaining unit once did?

☒ No

☐ Yes

18. If bargaining unit jobs were lost to subcontractors, how did it happen?

☐ layoffs

☐ attrition

☐ other

19. In relationship to the bargaining unit's health and safety training and procedures, how would you rate the health and safety practices of the subcontractors?

☐ better than ours

☐ the same

☐ worse than ours

Give an example:

20. Have there been toxic chemical accidents in your area of the plant?

☐ none

☒ just a few

☐ many

Please describe: *leaks and spills from drums – maybe once a month.*

21. Are there any major accidents in your area waiting to happen?

If so, please describe:

Task *(continued)*

1. Which chemicals that the workers were concerned about did the company fail to monitor? (Please review the company monitoring report on pages 139 through 140 and compare with the worker survey, pages 141 through 144.)

2. How many hours did the company sample for each chemical? In order to compare these results with OSHA Standards, how long should they have monitored?

3. Were the company's sample results above or below the OSHA levels? Were they above or below the NIOSH levels? (See the MSDSs on pages 147 through 175.)

4. Given the results of your survey, what time of day should the sampling take place for the most hazardous chemicals? (See the factsheet on page 176 on right and wrong times to measure.)

continued

Task *(continued)*

5. Based on the results of your survey, did the company test the right workers? Who should they have tested and why? (See the factsheet on page 179 on selecting the right workers for monitoring. Monitor either the highest risk workers or all workers, but not just the workers with the lowest risk of exposure.)

6. Is there skin or body contact with the chemicals? Is there a "skin" notation for methylene chloride, benzene or gasoline on the MSDS?

7. Did the company take enough samples to make certain that the testing took into account the wide variation of work routines of the toxic workers? (See the factsheet on page 177 on testing when the work routine varies.)

8. Based on the answers you have found, what would be your response to the official monitoring report?



MATERIAL SAFETY
DATA SHEET

BENZENE

MSDS NO: 02003201

MANUFACTURER/SUPPLIER:
Amoco Oil Company
200 East Randolph Drive
Chicago, Illinois 60601

EMERGENCY HEALTH INFORMATION: (800) 447-8735
EMERGENCY SPILL INFORMATION: (800) 424-9300
CHEMTREC, U.S.A.
OTHER PRODUCT SAFETY INFORMATION: (312) 856-3907

IMPORTANT COMPONENTS: Benzene (CAS 71-43-2), current OSHA PEL 1 ppm (8-hr. TWA),
5 ppm STEL (15 min.), ACGIH TLV 10 ppm (30 mg/m³).

WARNING STATEMENT: Danger! Extremely flammable! Can cause eye and skin irritation.
Causes headaches, dizziness, drowsiness, and nausea. Harmful or
fatal if swallowed and/or aspirated into the lungs. Danger.
Contains Benzene. Cancer hazard. Can cause blood disorders.
Harmful when absorbed through the skin.

HMS/NFPA CODES:(HEALTH;2)(FLAMMABILITY;3)(REACTIVITY;0)

APPEARANCE AND ODOR: Colorless liquid, sweet odor.

HEALTH HAZARD INFORMATION

EYE

EFFECT: Can cause eye irritation.

FIRST AID: Flush eyes with plenty of water for at least 15 minutes, get medical
attention if irritation persists.

PROTECTION: Do not get in eyes. Wear eye protection.

SKIN

EFFECT: Can cause skin irritation. Can produce dermatitis upon prolonged or
repeated contact. Harmful when absorbed through skin.

FIRST AID: Wash exposed skin with soap and water. Remove contaminated clothing,
including shoes, and thoroughly clean and dry before reuse. Get medical
attention if irritation develops.

PROTECTION: Do not get on skin or clothing. Wear protective clothing and gloves.

INHALATION

EFFECT: Cancer hazard. Can cause blood disorders. Inhalation causes headache,
dizziness, drowsiness and nausea. See Toxicology Section.

FIRST AID: If adverse effects occur, remove to uncontaminated area. Give artificial
respiration if not breathing. Get prompt medical attention.

PROTECTION: Do not breathe mist or vapor. If ventilation is inadequate, use
supplied-air respirator approved by NIOSH/MSHA.

BENZENE
MSDS NO: 02003201

PAGE 02 OF 04

HEALTH HAZARD INFORMATION - CONTINUED

INGESTION

EFFECT: Harmful or fatal if aspirated into lungs. See Toxicology Section.

FIRST AID: If swallowed, do NOT induce vomiting. Get immediate medical attention.

FIRE AND EXPLOSION INFORMATION

FLASHPOINT: 12°F

AUTOIGNITION TEMPERATURE: 928°F

EXTINGUISHING MEDIA: Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, halogenated agents, foam, steam) or water fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable liquid. Vapor may explode if ignited in enclosed area.

PRECAUTIONS: Keep away from ignition sources (e.g., heat, sparks and open flames).
Keep container closed. Use with adequate ventilation.

FLAMMABLE LIMITS: 1.5-8.0% by volume.

REACTIVITY INFORMATION

DANGEROUS REACTIONS: None identified.

HAZARDOUS DECOMPOSITION: Incomplete burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

STABILITY: Stable.

CHEMICAL AND PHYSICAL PROPERTIES

BOILING POINT: 176°F

MELTING POINT: 42°F

SOLUBILITY IN WATER: Slight, 0.1 to 1.0%.

SPECIFIC GRAVITY (WATER = 1): 0.88

VAPOR PRESSURE: 74.6 mmHg @ 20°C

BENZENE
MSDS NO: 02003201

PAGE 03 OF 04

STORAGE AND ENVIRONMENTAL PROTECTION

STORAGE REQUIREMENTS: Store in flammable liquids storage area. Store away from heat, ignition sources, and open flame in accordance with applicable federal, state, or local regulations. Keep container closed. Outside storage is recommended.

SPILLS AND LEAKS: Remove or shut off all sources of ignition. Remove mechanically or contain on an absorbent material. Increase ventilation if possible. Water spray can be used to absorb vapors. Keep out of sewers and waterways.

WASTE DISPOSAL: Disposal must be in accordance with applicable federal, state, or local regulations. Enclosed-controlled incineration is recommended unless directed otherwise by applicable ordinances. Residues and spilled material are hazardous waste due to ignitability.

TOXICOLOGICAL INFORMATION

INHALATION: LC50 = 10,000 ppm (7 hours) (rats).

INGESTION: LD50 = 3.8 g/kg (rat).

Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, or excitation. Exposure to very high levels can result in unconsciousness and death.

Long-term overexposure to benzene has been associated with certain types of leukemia in humans and OSHA, IARC and NTP consider benzene a human carcinogen. Chronic exposures to benzene at levels of 100 ppm and below have been reported to cause adverse blood effects including anemia. Benzene exposure can occur by inhalation and absorption through the skin.

Inhalation and forced feeding studies of benzene in laboratory animals have produced a carcinogenic response in a variety of organs, including possibly leukemia, other adverse effects on the blood, chromosomal changes and some effects on the immune system. Exposure to benzene at levels up to 300 ppm did not produce birth defects in animal studies; however, exposure to the higher dosage levels (greater than 100 ppm) resulted in a reduction of body weight of the rat pups (fetotoxicity). Changes in the testes have been observed in mice exposed to benzene at 300 ppm, but reproductive performance was not altered in rats exposed to benzene at the same level.

Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Therefore, emptying the stomach should only be done under medical supervision.

REGULATORY INFORMATION

CERCLA REPORTABLE QUANTITY:

This product is reportable under 40 CFR Part 302.4 because it contains the following substance(s):

COMPONENT/CAS NUMBER	REPORTABLE QUANTITY (RQ)
Benzene (71-43-2)	10 lbs.

BENZENE
MSDS NO: 02003201

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REGULATORY INFORMATION - CONTINUED

DOT SHIPPING DESCRIPTION: Benzene, 3, UN1114, II, RQ.

OSHA HAZARD COMMUNICATION STANDARD: Flammable liquid. Carcinogen. Irritant. CNS effects. Target organ effects.

RCRA STATUS:

This product is not subject to the 40 CFR Part 268.30 land ban on the disposal of certain hazardous wastes.

SARA STATUS:

This product is regulated under the following section(s) of SARA Title III, 42 USC 9601. Spills or releases of the product may be reportable as determined by the information given below:

SECTIONS 311 AND 312 OF SARA AND 40 CFR PART 370:

This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d).

SECTION 313 OF SARA AND 40 CFR PART 372:

This product contains the following substance, which is on the Toxic Chemicals List in 40 CFR Part 372:

COMPONENT/CAS NUMBER	WEIGHT PERCENT
Benzene (71-43-2)	100

TSCA STATUS: All of the components of this product are listed on the TSCA Inventory.

ISSUE INFORMATION

BY:



G. I. Bresnick, Director
Product Stewardship & Toxicology

ISSUED: April 05, 1993
SUPERSEDES: March 09, 1992

This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in this data sheet which we received from sources outside our company. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either express or implied.



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MATERIAL SAFETY DATA BULLETIN

 1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 11/14/94

PRODUCT NAME: MOBIL UNLEADED
 SUPPLIER: MOBIL OIL CORP.
 PRODUCTS AND TECHNOLOGY DEPT.
 3225 GALLOWS RD.
 FAIRFAX, VA 22037

24 - Hour Emergency (call collect): 609-737-4411
 Product and MSDS Information: 800-662-4525 703-849-3265
 CHEMTREC: 800-424-9300 202-483-7616

 2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

Substance Name	Wt%
GASOLINE (8006-61-9)	100

COMPONENT(S) OF PRODUCT INGREDIENTS INCLUDE:

XYLENE (1330-20-7)	10
ISOPENTANE (78-78-4)	9
TOLUENE (108-88-3)	5
PSEUDOCUMENE (95-63-6)	5
BUTANE (106-97-8)	4
2-METHYLPENTANE (107-83-5)	4
PENTANE (109-66-0)	4
ETHANOL (64-17-5)	4
TRIMETHYL BENZENE (25551-13-7)	3
3-METHYLPENTANE (96-14-0)	2
BENZENE (71-43-2)	2
2,3-DIMETHYLBUTANE (79-29-8)	2
N-HEXANE (110-54-3)	2

(Section continued next page)



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ETHYL BENZENE (100-41-4)	2
3- METHYLHEXANE (589-34-4)	2
2- METHYLHEXANE (591-76-4)	1
METHYLCYCLOHEXANE (108-87-2)	1

NOTE: The concentration of the components shown above may vary substantially. Because of volatility considerations, gasoline vapor may have concentrations of components very different from those of liquid gasoline. The major components of gasoline vapor are: butane, isobutane, pentane and isopentane. Oxygenates such as MTBE or ethanol may or may not be present depending on regional environmental requirements. The reportable component percentages, shown in the Regulatory Information section, are based on API's evaluation of a typical gasoline mixture.

See Section 16 for a generic product description.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined to be hazardous.

EFFECTS OF OVEREXPOSURE: Eye irritation, respiratory irritation, dizziness, nausea, loss of consciousness. Skin irritation. Studies (sponsored by API) conducted in the U.S. examining the mortality experience (causes of death) of distribution workers with long-term exposure to gasoline have not found any gasoline-related health effects. Case reports of chronic gasoline abuse (such as gasoline sniffing) and chronic misuse of gasoline as a solvent or as a cleaning agent have reported a range of neurological effects (nervous system effects), sudden deaths from cardiac arrest (heart attacks), hematologic changes (blood effects) and leukemia. These effects are not expected to occur at exposure levels encountered in the distribution and use of gasoline as a motor fuel.

EMERGENCY RESPONSE DATA: Yellow to Orange Liquid. Extremely flammable. Vapor accumulation could flash and/or explode if in contact with open flame. DOT ERG No. - 27

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse.

INHALATION: Remove from further exposure. If respiratory irritation,

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dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a physician. If breathing has stopped, use mouth to mouth resuscitation.

INGESTION: Not expected to be a problem. However, if greater than 1/2 liter (pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

NOTE TO PHYSICIANS: Material if ingested may be aspirated into the lungs and can cause chemical pneumonitis. Treat appropriately.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon Dioxide, Foam, Dry Chemical, Water Fog.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate area. For large spills, fire fighting foam is the preferred agent and should be applied in sufficient quantities to blanket the gasoline surface. Water spray may be used to flush spill away from exposures, but good judgement should be practiced to prevent spreading of the gasoline into sewers, streams or drinking water supplies. If a leak or spill has not ignited, apply a foam blanket to suppress the release of vapors. If foam is not available, a water spray curtain can be used to disperse vapors and to protect personnel attempting to stop the leak.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable. Vapor accumulation could flash and/or explode if in contact with open flame. Flash Point C(F): -40(-40) (ASTM D-56). Flammable limits - LEL: 1.4%, UEL: 7.6%.

NFPA HAZARD ID: Health: 1, Flammability: 3, Reactivity: 0

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Eliminate all ignition sources. Runoff may create fire or explosion hazard in sewer system. Adsorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.

PERSONAL PRECAUTIONS: See Section 8



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7. HANDLING AND STORAGE

HANDLING: NEVER SIPHON GASOLINE BY MOUTH. GASOLINE SHOULD NOT BE USED AS A SOLVENT OR AS A CLEANING AGENT. Use non-sparking tools and explosion-proof equipment. Avoid contact with skin. Avoid inhalation of vapors or mists. Use in well ventilated area away from all ignition sources.

STORAGE: Drums must be grounded and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters. Store away from all ignition sources in a cool area equipped with an automatic sprinkling system. Outside or detached storage preferred. Storage containers should be grounded and bonded.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: Use in well ventilated area with local exhaust ventilation. Ventilation required and equipment must be explosion proof. Use away from all ignition sources.

RESPIRATORY PROTECTION: Approved respiratory equipment must be used when airborne concentrations are unknown or exceed the TLV.

EYE PROTECTION: If splash with liquid is possible, chemical type goggles should be worn.

SKIN PROTECTION: Impervious gloves should be worn. Good personal hygiene practices should always be followed.

Substance Name (CAS-No.)	Source	---TWA---		---STEL---		NOTE
		ppm	mg/m3	ppm	mg/m3	
GASOLINE (8006-61-9)						
	MOBIL	300	890			
	OSHA	300	900	500	1500	
	ACGIH	300	890	500	1480	
XYLENE (1330-20-7)						
	O, M, P, -Isomers	MOBIL	100	434		
	O, M, P, -Isomers	OSHA	100	435	150	655
	O, M, P, -Isomers	ACGIH	100	434	150	651
ISOPENTANE (78-78-4)						
	MOBIL	600	1770			
TOLUENE (108-88-3)						
	Skin	MOBIL	50	188		
		OSHA	100	375	150	560
	Skin	ACGIH	50	188		
PSEUDOCUMENE (95-63-6)						
	MOBIL	25	125			
BUTANE (106-97-8)						
	MOBIL	800	1900			

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	OSHA	800	1900		
	ACGIH	800	1900		
2-METHYLPENTANE (107-83-5)					
Isomer of N-Hexane	MOBIL	500	1760		
	ACGIH	500	1760	1000	3500
PENTANE (109-66-0)					
	MOBIL	600	1770		
	OSHA	600	1800	750	2250
	ACGIH	600	1770	750	2210
ETHANOL (64-17-5)					
	MOBIL	1000	1880		
	OSHA	1000	1900		
	ACGIH	1000	1880		
TRIMETHYL BENZENE (25551-13-7)					
	MOBIL	25	123		
	OSHA	25	125		
	ACGIH	25	123		
3-METHYLPENTANE (96-14-0)					
Isomer of N-Hexane	MOBIL	500	1760		
	ACGIH	500	1760	1000	3500
BENZENE (71-43-2)					
	MOBIL	1	3.2		
	OSHA	1		5	
	ACGIH	10	32		
2,3-DIMETHYLBUTANE (79-29-8)					
Isomer of N-Hexane	MOBIL	500	1760		
	ACGIH	500	1760	1000	3500
N-HEXANE (110-54-3)					
N-Hexane	MOBIL	50	176		
Other Isomers	MOBIL	500	1760		
	OSHA	50	180		
N-Hexane	ACGIH	50	176		
Other Isomers	ACGIH	500	1760	1000	3500
ETHYL BENZENE (100-41-4)					
	MOBIL	100	434		
	OSHA	100	435	125	545
	ACGIH	100	434	125	543
3- METHYLHEXANE (589-34-4)					
	MOBIL	400	1640		
2- METHYLHEXANE (591-76-4)					
	MOBIL	400	1640		
METHYLCYCLOHEXANE					

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(108-87-2)

MOBIL	400	1610
OSHA	400	1600
ACGIH	400	1610

NOTE: Limits shown for guidance only. Follow applicable regulations.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
 COLOR: Yellow to Orange
 ODOR: Hydrocarbon
 ODOR THRESHOLD: NA
 pH: NA
 BOILING POINT C(F): > 35(95)
 MELTING POINT C(F): NA
 FLASH POINT C(F): -40(-40) (ASTM D-56)
 FLAMMABILITY: NA
 AUTO FLAMMABILITY: NE
 EXPLOSIVE PROPERTIES: NA
 OXIDIZING PROPERTIES: NA
 VAPOR PRESSURE-mmHg 20 C: > 400.0
 VAPOR DENSITY: 3.0
 EVAPORATION RATE: NA
 RELATIVE DENSITY, 15/4 C: 0.7-0.76
 SOLUBILITY IN WATER: 1
 PARTITION COEFFICIENT: NE
 VISCOSITY AT 40 C, cSt: < 1.0
 VISCOSITY AT 100 C, cSt: NA
 POUR POINT C(F): NA
 FREEZING POINT C(F): NE
 VOLATILE ORGANIC COMPOUND: NE
 NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable
 CONDITIONS TO AVOID: Heat, sparks, flame and build up of static electricity.
 INCOMPATIBILITY (MATERIALS TO AVOID): Halogens, strong acids, alkalies, and oxidizers.
 HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.
 HAZARDOUS POLYMERIZATION: Will not occur.

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11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less).

SKIN IRRITATION (RABBITS): Irritant. (Primary Irritation Index: 3 or greater but less than 5).

OTHER ACUTE TOXICITY DATA: Inhalation of vapors/mists may cause respiratory system irritation. HAZARDS OF COMBUSTION PRODUCTS: Exposure to high concentrations of carbon monoxide can cause loss of consciousness, heart damage, brain damage and death. Exposure to high concentrations of carbon dioxide can cause simple asphyxiation by displacing oxygen.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

90-day oral gavage studies with rats resulted in kidney effects at 1200 mg/kg MTBE, but these effects are not considered significant to humans. Thirteen week inhalation studies with rats on MTBE resulted in increased organ weights and decreased body weight and anaesthetic effects at levels > 800 ppm.

---NEUROTOXICOLOGY (SUMMARY)---

No significant adverse effects were observed at 8000 ppm MTBE in a 90-day neurotoxicity study with rats.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Inhalation teratology studies with mice at 8000 ppm MTBE during gestation resulted in maternal and fetal toxicity, reduced viable implantations and an increased incidence of cleft palate. The NOEL was 1000 ppm. In another study, mice showed some evidence of fetotoxicity at 250 ppm, but no significant adverse effects occurred in rats exposed to 2500 ppm during gestation. In a single-generation inhalation reproductive/fertility study with rats, no significant effects were observed at 2500 ppm. Two-generation reproductive/fertility studies in rats showed no reproductive effects at 8000 ppm MTBE.

---CHRONIC TOXICOLOGY (SUMMARY)---

An increased incidence of kidney and liver tumors was observed in laboratory animals exposed to > 3000 ppm MTBE. These effects are not considered significant to humans.

---SENSITIZATION (SUMMARY)---

****Skin sensitization: Negative guinea pig test.

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---OTHER TOXICOLOGY DATA---

Gasoline and Refinery Streams: Studies conducted by the American Petroleum Institute examined a reference unleaded gasoline for mutagenic, teratogenic and sensitization potential; no evidence of these hazards was found. However, isolated constituents of gasoline may display these or other potential hazards in laboratory tests. There were no significant adverse effects in three-month subchronic inhalation studies in rats or monkeys, or in a two-year skin cancer study in mice. Studies with laboratory animals have shown that gasoline vapors administered at high concentrations over a prolonged period of time caused kidney damage and kidney cancer in male rats and liver cancer in female mice. Studies carried out by Mobil's Environmental and Health Sciences Laboratory on some of the major refinery streams from which gasoline is formulated support the results of the API studies. There was no evidence of significant adverse systemic or reproductive effects for light catalytic cracked naphthas and reformed naphthas. Components: Gasoline consists of a complex blend of petroleum/processing derived paraffinic, olefinic, naphthenic and aromatic hydrocarbons which include up to 5% benzene (with 1-2% typical in the U.S.), n-hexane, mixed xylenes, toluene, ethylbenzene and trimethyl benzene. Repeated exposures to low levels of benzene have been reported to result in blood abnormalities including anemia and, in rare cases, leukemia in both animals and humans. Prolonged exposure to n-hexane may result in nervous system damage, including numbness of the extremities and, in extreme cases, paralysis. The adverse effects associated with these components have not been observed in studies with gasoline or the refinery streams from which it is formulated. Generally, human exposures to gasoline vapors are considerably less than those used in the animal toxicity studies. As far as scientists know, low level or infrequent exposures to gasoline vapor are unlikely to be associated with cancer or other serious diseases in humans.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS: Not established.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning for fuel value in compliance with applicable laws and regulations.

RCRA INFORMATION: Disposal of unused product may be subject to RCRA regulations (40 CFR 261) due to the characteristic(s)/chemical(s) listed below. Disposal of the used product may also be regulated due to ignitability, corrosivity, reactivity, or toxicity as determined by the Toxicity Characteristic Leaching Procedure (TCLP).

BENZENE: 2.3200 PCT (TCLP)

FLASH: -40(-40) C(F)



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 14. TRANSPORT INFORMATION

USA DOT:

SHIPPING NAME:	Gasoline
HAZARD CLASS & DIV:	3
ID NUMBER:	UN1203
ERG NUMBER:	27
PACKING GROUP:	PG II
STCC:	4908178
DANGEROUS WHEN WET:	No
POISON:	No
LABEL(s):	Flammable Liquid
PLACARD(s):	Flammable
PRODUCT RQ:	NA
MARPOL III STATUS:	NA

RID/ADR:

HAZARD CLASS:	3
HAZARD SUB-CLASS:	3(b)
LABEL:	3
DANGER NUMBER:	33
UN NUMBER:	1203
SHIPPING NAME:	Hydrocarbons, liquid having a flash point below 21deg C
REMARKS:	NA

IMO:

HAZARD CLASS & DIV:	3.1
UN NUMBER:	1203
PACKING GROUP:	PG II
SHIPPING NAME:	Gasoline
LABEL(s):	Flammable Liquid
MARPOL III STATUS:	NA

ICAO/IATA:

HAZARD CLASS & DIV:	3
ID/UN Number:	1203
PACKING GROUP:	PG II
SHIPPING NAME:	Gasoline
SUBSIDIARY RISK:	NA
LABEL(s):	Flammable Liquid

 15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA, and EINECS/ELINCS.

EU Classification and Labeling:

Symbol/Classification: F+ T Extremely flammable, Toxic.

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Risk Phrase(s): R12-45-38-22.

Extremely flammable. May cause cancer. Irritating to skin.
Harmful if swallowed.

Safety Phrase(s): S53-45-2-23-24-29-43-62.

Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Keep out of the reach of children. Do not breathe vapor. Avoid contact with skin. Do not empty into drains. In case of fire use carbon dioxide, foam, dry chemical or water fog. If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES:
FIRE CHRONIC ACUTE

This product contains the following SARA (313) Toxic Release
Chemicals:

CHEMICAL NAME	CAS NUMBER	CONC.
BENZENE (COMPONENT ANALYSIS)	71-43-2	2.32%
PSEUDOCUMENE (COMPONENT ANALYSIS)	95-63-6	4.55%
ETHYL BENZENE (COMPONENT ANALYSIS)	100-41-4	1.6%
TOLUENE (COMPONENT ANALYSIS)	108-88-3	4.65%
XYLENES (COMPONENT ANALYSIS)	1330-20-7	9.9%
METHYL-TERT-BUTYL	1634-04-4	2.7%
ETHER (COMPONENT ANALYSIS)		

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
ETHYL ALCOHOL (COMPONENT ANALYSIS)	64-17-5	1, 10, 17, 18, 19, 20, 21, 23, 25, 26
BENZENE (COMPONENT ANALYSIS) (2.32%)	71-43-2	1, 3, 4, 6, 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
ISOPENTANE (COMPONENT ANALYSIS)	78-78-4	19, 21, 24, 25
2,3-DIMETHYLBUTANE (COMPONENT ANALYSIS)	79-29-8	1, 19, 21, 25
PSEUDOCUMENE (COMPONENT ANALYSIS)	95-63-6	11, 15, 20, 24, 25
PENTANE, 3-METHYL- (COMPONENT ANALYSIS)	96-14-0	1, 19, 25
METHYL CYCLOPENTANE (COMPONENT ANALYSIS)	96-37-7	11, 15, 19, 21, 25, 26
ETHYL BENZENE (COMPONENT ANALYSIS)	100-41-4	1, 10, 18, 19, 20, 21, 23, 24, 25, 26
BUTANE (COMPONENT ANALYSIS)	106-97-8	1, 10, 19, 20, 21, 23, 24, 25, 26

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PENTANE, 2-METHYL- (COMPONENT ANALYSIS)	107-83-5	1, 19, 23, 25
METHYLCYCLOHEXANE (COMPONENT ANALYSIS)	108-87-2	1, 10, 18, 19, 20, 21, 23, 25, 26
TOLUENE (COMPONENT ANALYSIS) (4.65%)	108-88-3	1, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
PENTANE (COMPONENT ANALYSIS)	109-66-0	1, 10, 18, 19, 20, 21, 23, 24, 25, 26
N-HEXANE (COMPONENT ANALYSIS)	110-54-3	1, 10, 11, 15, 18, 19, 20, 21, 23, 25, 26
2-METHYL 2-BUTENE (COMPONENT ANALYSIS)	513-35-9	19, 25
3-METHYLHEXANE (COMPONENT ANALYSIS)	589-34-4	19, 25
HEXANE, 2-METHYL- (COMPONENT ANALYSIS)	591-76-4	19, 25
1-HEXENE (COMPONENT ANALYSIS)	592-41-6	19, 25
XYLENES (COMPONENT ANALYSIS) (9.90%)	1330-20-7	1, 10, 18, 19, 20, 21, 22, 23, 24, 25, 26
METHYL-TERT-BUTYL ETHER (COMPONENT ANALYSIS)	1634-04-4	1, 11, 15, 24, 25
GASOLINE	8006-61-9	1, 8, 10, 18, 19, 20, 21, 23, 26
TRIMETHYL BENZENE (COMPONENT ANALYSIS)	25551-13-7	1, 10, 19, 20, 21, 23, 25, 26

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen



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16. OTHER INFORMATION

OSHA Precautionary Label Text:

GASOLINE.

DANGER!

EXTREMELY FLAMMABLE LIQUID AND VAPOR.
VAPORS MAY CAUSE FLASH FIRE; EYE, NOSE, THROAT OR LUNG IRRITATION,
DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS.
LIQUID MAY CAUSE SKIN IRRITATION.
LOW VISCOSITY MATERIAL, IF INGESTED, MAY BE ASPIRATED AND CAN
CAUSE SERIOUS OR FATAL LUNG DAMAGE.
LONG-TERM EXPOSURE TO GASOLINE VAPOR HAS CAUSED KIDNEY AND LIVER
CANCER IN LABORATORY ANIMALS.

KEEP AWAY FROM HEAT, SPARKS AND FLAME.
AVOID PERSONAL CONTACT AND PROLONGED EXPOSURE TO VAPOR.
KEEP CONTAINER CLOSED.
USE IN WELL VENTILATED AREA.

MISUSE MAY CAUSE SERIOUS INJURY OR ILLNESS.
FOR USE AS A MOTOR FUEL ONLY.
DO NOT USE AS A SOLVENT OR CLEANING AGENT.
NEVER SIPHON BY MOUTH.

FIRST AID: IF INHALED AND SYMPTOMS DEVELOP, REMOVE TO FRESH AIR.
IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-
TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET MEDICAL
ATTENTION.
IF SWALLOWED, DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL
ATTENTION. ONLY INDUCE VOMITING AT THE INSTRUCTION OF A PHYSICIAN
NEVER INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONCIOUS
PERSON.
IN CASE OF CONTACT, WASH SKIN WITH SOAP AND PLENTY OF WATER.
REMOVE CONTAMINATED CLOTHING AND WASH BEFORE REUSE. IF IRRITATION
OCCURS, GET MEDICAL ATTENTION.

EMPTY CONTAINERS MAY CONTAIN PRODUCT RESIDUE, INCLUDING FLAMMABLE
OR EXPLOSIVE VAPORS, DO NOT CUT, PUNCTURE OR WELD ON OR NEAR
THE CONTAINER. ALL LABEL WARNINGS AND PRECAUTIONS MUST BE
OBSERVED UNTIL CONTAINER HAS BEEN THOROUGHLY CLEANED OR
DESTROYED.

THIS WARNING IS GIVEN TO COMPLY WITH CALIFORNIA HEALTH AND
SAFETY CODE 25249.6 AND DOES NOT CONSTITUTE AN ADMISSION OR
A WAIVER OF ANY RIGHTS.
DETECTABLE AMOUNTS OF CHEMICALS KNOWN TO THE STATE OF CALIFORNIA

(Section continued next page)

Mobil

MOBIL UNLEADED

35014-00 PAGE 13 OF 13

TO CAUSE CANCER, BIRTH DEFECTS, OR OTHER REPRODUCTIVE HARM MAY BE FOUND IN THIS PRODUCT. READ AND FOLLOW LABEL DIRECTIONS AND USE CARE WHEN HANDLING OR USING THIS PRODUCT. REFER TO PRODUCT MATERIAL SAFETY DATA BULLETIN FOR FURTHER SAFETY AND HEALTH INFORMATION.

MPL-304 (10/94)

CHEMICAL NAMES AND SYNONYMS: HYDROCARBONS AND ADDITIVES

USE: UNLEADED MOTOR FUEL

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

INGREDIENT	PERCENT	CAS NUMBER
GASOLINE	100.00	8006-61-9

For Mobil Use Only: MHC: 1* 1* 1* 1* 2*, MPPEC: C, REQ: US -
MARKETING

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

Prepared by: Mobil Oil Corporation
Environmental Health and Safety Department, Princeton, NJ



Material Safety Data Sheet

The Dow Chemical Company
Midland, Michigan 48674
Emergency 517-636-4400

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Page: 1

24-Hour Emergency Phone Number: 517-636-4400

Product: METHYLENE CHLORIDE, TECHNICAL

Product Code: 55590

Effective Date: 04/26/94 Date Printed: 01/06/95 MSD: 000009

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Methylene chloride CAS# 000075-09-2 99.9%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

* Colorless liquid. Ether-like odor. Harmful if inhaled. Can cause *
* death if too much is breathed. Contain liquid. Avoid ground and *
* water contamination. *
* EMERGENCY PHONE NUMBER: (U.S.) 517-636-4400 / IN CANADA SEE ABOVE *

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause pain, moderate eye irritation and slight corneal injury. Vapors may irritate eyes.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation, even a burn. Repeated contact may cause drying or flaking of skin. May cause more severe response if confined to skin. Extensive skin contact with methylene chloride, such as immersion, may cause an intense burning sensation followed by a cold, numb feeling which will subside after contact.

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 2****Product: METHYLENE CHLORIDE, TECHNICAL**

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SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts.

INGESTION: Single dose oral toxicity is low. If aspirated (liquid enters the lung), may be rapidly absorbed through the lungs and result in injury to other body systems.

INHALATION: In confined or poorly ventilated areas, vapors can readily accumulate and can cause unconsciousness and death. Minimal anesthetic or narcotic effects may be seen in the range of 500-1000 ppm methylene chloride. Progressively higher levels over 1000 ppm can cause dizziness, drunkenness; concentrations as low as 10,000 ppm can cause unconsciousness and death. These high levels may also cause cardiac arrhythmias (irregular heartbeats).

Excessive exposure may cause irritation to upper respiratory tract. Excessive exposure may cause carboxyhemoglobinemia, thereby impairing the blood's ability to transport oxygen.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Signs and symptoms of excessive exposure may be central nervous system effects. Excessive exposure may cause carboxyhemoglobinemia, thereby impairing the blood's ability to transport oxygen. Observations in animals include liver and kidney effects.

CANCER INFORMATION: For hazard communication purposes, under OSHA Standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by IARC and NTP. Methylene chloride has been shown to increase the rate of spontaneously occurring malignant tumors in the B6C3F1 mouse and benign tumors in laboratory rats. Other animal studies, as well as several human epidemiology studies, failed to show a tumorigenic response. Methylene chloride is not believed to pose a measurable carcinogenic risk to man when handled as recommended.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic

(Continued on page 3)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 3****Product: METHYLENE CHLORIDE, TECHNICAL****Product Code: 55590****Effective Date: 04/26/94****Date Printed: 01/06/95****MSD: 000009**

effects to the mother.

REPRODUCTIVE EFFECTS: In animal studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYES: Irrigate with flowing water immediately and continuously for 15 minutes. Consult medical personnel.

SKIN: Wash off in flowing water or shower.

INGESTION: Do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

NOTE TO PHYSICIAN: Because rapid absorption may occur through lungs if aspirated and cause systemic effects, the decision of whether to induce vomiting or not should be made by a physician. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach. Exposure may increase "myocardial irritability." Do not administer sympathomimetic drugs unless absolutely necessary. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient. Carboxyhemoglobinemia may aggravate any preexisting condition sensitive to a decrease in available oxygen, such as chronic lung disease, coronary artery disease or anemias.

5. FIRE FIGHTING MEASURES

FLASH POINT: None

METHOD USED: TOC, TCC, COC

AUTOIGNITION TEMPERATURE: 556 C or 1033 F

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 4****Product: METHYLENE CHLORIDE, TECHNICAL**

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FLAMMABLE LIMITS

LFL: 14% @ 25C

UFL: 22% @ 25C

HAZARDOUS COMBUSTION PRODUCTS: Open flames and welding arcs can cause thermal degradation with the evolution of hydrogen chloride and very small amounts of phosgene and chlorine.

EXTINGUISHING MEDIA: Water fog.

FIRE FIGHTING INSTRUCTIONS: Forms flammable vapor-air mixtures. Lower temperatures increase the difficulty of getting it to ignite.

PROTECTIVE EQUIPMENT FOR FIREFIGHTERS: Wear positive pressure breathing apparatus, and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Evacuate area. Wear appropriate respiratory protection. Avoid breathing vapors. Ventilate area. Follow confined space entry procedures.

PROTECT ENVIRONMENT: Contain liquid, transfer to closed metal containers. Avoid ground and water contamination.

CLEANUP: For small spills, mop up, wipe up or soak up immediately.

7. HANDLING AND STORAGE**SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:**

Exercise reasonable care and caution. Avoid breathing vapors. Store in cool place. Concentrated vapors of this product are heavier than air and will collect in low areas such as pits, degreasers, storage tanks, and other confined areas. Do not enter these areas where vapors of this product are suspected unless special breathing apparatus is used and an observer is present for assistance. The use of air for unloading product out of vessels or transport containers is not recommended.

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 5****Product: METHYLENE CHLORIDE, TECHNICAL**

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Cold cleaning operations using methylene chloride should be engineered to provide for confining solvent vapors, adequate ventilation and/or respiratory protection to reduce the potential for overexposure to vapors. Gloves or other protective equipment should be worn if skin contact is likely. Goggles should be worn if eye contact is possible.

The Consumer Products Safety Commission issued a Statement of Policy for household products containing methylene chloride. The policy statement establishes labeling guidelines for consumer products containing methylene chloride (including paint strippers, wood stains and varnishes, spray paints, adhesives and glues, and a number of other household products). The policy requires labels to include statements of principal hazard and indicate that the risk to the user is related to the level and duration of exposure. It appeared in the Federal Register, Vol. 52, No. 177, on Monday, September 14, 1987.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines. Lethal concentrations may exist in areas with poor ventilation.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use chemical goggles. If vapor exposure causes eye discomfort, use a full-face respirator.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as face-shield, gloves, boots, apron, or full-body suit will depend on operations. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required, use an approved air-purifying or positive-pressure supplied-air respirator depending on the potential airborne concentration. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved

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positive-pressure self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. In confined or poorly ventilated areas, use an approved positive-pressure supplied-air respirator.

EXPOSURE GUIDELINES: Methylene chloride: ACGIH TLV is 50 ppm, A2. OSHA PEL is 500 ppm TWA, 1000 ppm Ceiling, 2000 ppm Peak. PELs are in accord with those recommended by OSHA, as in the 1989 revision of PELs.

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 104F (39.8C)

VAP. PRESS: 355 mmHg @ 20C

VAP. DENSITY: 2.93

SOL. IN WATER: 2.0g/100g @ 25C

SP. GRAVITY: 1.320 @ 25/25C

APPEARANCE: Colorless liquid.

ODOR: Penetrating ether-like odor. Irritating at high concentrations.

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under normal conditions of use.

CONDITIONS TO AVOID: Avoid open flames, welding arcs, or other high temperature sources which induce thermal decomposition to irritating and corrosive HCL from solvent vapor. High energy ultra-violet sources such as welding arcs can cause degradation generating chlorine, hydrogen chloride and possible phosgene, and should be avoided.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, aluminum, possibly sodium, potassium, and finely divided magnesium, aluminum or zinc.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

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SKIN: The dermal LD50 has not been determined.

INGESTION: The oral LD50 for rats is in the range of 1500-2500 mg/kg.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): Negative or equivocal results have been obtained in mutagenicity tests with methylene chloride using mammalian cells or animals. This is consistent with the lack of interaction with DNA in rats and hamsters. Although results of Ames bacterial tests have generally been positive, overall the data suggest that genotoxic potential does not appear to be a significant factor in the toxicity of methylene chloride.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT AND PARTITIONING: Bioconcentration potential is low (BCF less than 100 or Log Kow less than 3). Log octanol/water partition coefficient (log Kow) is 1.25. Log air/water partition coefficient (log Kaw) is -0.94. Henry's Law Constant (H) is estimated to be 2.48 E-03 atm-m³/mol.

DEGRADATION & TRANSFORMATION: Material has shown potential to biodegrade: Attains aerobic degradation rate of 2.3 mg/h/g of activated sludge. Material has shown potential to biodegrade: Attains aerobic biodegradation in a variety of surface soils. Material has shown potential to biodegrade: Attains 86-92% conversion to CO₂ in anaerobic wastewater. Biodegradation rate may increase in soil and/or water with acclimation. Degradation is expected in the atmospheric environment within months to years.

ECOTOXICITY: Material is slightly toxic to aquatic organisms on an acute basis (LC50 between 10 and 100 mg/L in most sensitive species).

Acute LC50 for water flea (*Daphnia magna*) is 27-2270 mg/L.

Acute LC50 for sheepshead minnow (*Cyprinodon variegatus*) is 62-331 mg/L.

Acute LC50 for fathead minnow (*Pimephales promelas*) is

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193-330 mg/L.

Acute LC50 for bluegill (*Lepomis macrochirus*) is 224 mg/L.Acute LC50 for guppy (*poecilia reticulata*) is 294 mg/L.Acute LC50 for water flea (*Daphnia magna*) is 27-2270 mg/L.Acute LC50 for mysid (*Mysidopsis bahia*) is 256 mg/L.

Maximum acceptable toxicant concentration (MATC) is 108 mg/L.

Growth inhibition EC50 for green alga *Selenastrum capricornutum* is >662 mg/L.Algal growth inhibition EC50 for marine diatom *Skeletonema costatum* is >662 mg/L.**13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)**

DISPOSAL: Any disposal practice must be in compliance with all federal, state/provincial, and local laws and regulations. State/provincial and local requirements for waste disposal may be more restrictive or otherwise different from federal laws and regulations. Regulations may also vary in different locations. Chemical additions, processing, storage, or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate, or otherwise inappropriate. Waste characterization and disposal compliance are the responsibility solely of the party generating the waste or deciding to discard or dispose of the material. None of these waste management options should be considered 'arranging for disposal'.

Keep material in closed containers. Do not allow into any sewers, on the ground, or into any body of water. Do not landfill.

The preferred waste management option is to send to a properly licensed or permitted recycler, reclaimer, or incinerator. The same waste management options are recommended for use or contaminated material, although additional evaluation is required. Refer to 40 CFR Section 261, and/or any other appropriate federal, state, provincial, or local requirements for proper classification information.

As a service to its customers, The Dow Chemical Company can provide lists of companies which recycle, reprocess, or manage chemicals as well as lists of companies that recondition used

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 9****Product: METHYLENE CHLORIDE, TECHNICAL**

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drums. Telephone Dow's Customer Information Center at 517-832-1556 or 800-258-2436 (U.S.) for further details.
Contact The Dow Chemical Company for additional information.

14. TRANSPORT INFORMATION**CANADIAN TDG INFORMATION:**

For TDG regulatory information, if required, consult transportation regulations, product shipping papers, or your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

=====

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
DICHLOROMETHANE (METHYLENE CHLORIDE)	000075-09-2	99.9 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following

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REGULATORY INFORMATION (CONTINUED)

categories:

An immediate health hazard

A delayed health hazard

CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer. (See Section 6 of the MSDS for details on carcinogenicity.)

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
DICHLOROMETHANE (METHYLENE CHLORIDE)	000075-09-2	PA1 PA2 PA3 NJ2 NJ3

NJ2=New Jersey Environmental Hazardous Substance (present at greater than or equal to 1.0%).

NJ3=New Jersey Workplace Hazardous Substance (present at greater than or equal to 1.0%).

PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).

PA2=Pennsylvania Special Hazardous Substance (present at greater than or equal to 0.01%).

PA3=Pennsylvania Environmental Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

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REGULATORY INFORMATION (CONTINUED)

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Health 2
 Flammability 1
 Reactivity 0

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND):

This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases:

Category:

Chemical Name	CAS#	RQ	% in Product
Methylene chloride	000075-09-2	1000	99.9%

CANADIAN REGULATIONS

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

D1B - poisonous substance defined by TDG regulations
 D2A - possible, probable or known human carcinogen according to classifications by IARC or ACGIH
 D2B - eye or skin irritant
 Refer elsewhere in the MSDS for specific warnings and safe handling information. Refer to the employer's workplace education program.

CPR STATEMENT: This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 12****Product: METHYLENE CHLORIDE, TECHNICAL**

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REGULATORY INFORMATION (CONTINUED)

and the MSDS contains all the information required by the CPR.

HAZARDOUS PRODUCTS ACT INFORMATION: This product contains the following ingredients which are Controlled Products and/or on the Ingredient Disclosure List (Canadian HPA section 13 and 14):

COMPONENTS:	CAS #	AMOUNT (%w/w)
Methylene Chloride	CAS# 000075-09-2	99.9%

16. OTHER INFORMATION

Process water in contact with solvent and/or water separators of cleaning or distillation equipment should be treated as hazardous waste. Do not discharge water from water separators to drain.

MSDS STATUS: Revised sections 5, 6, 7, 8, 14, and 15.

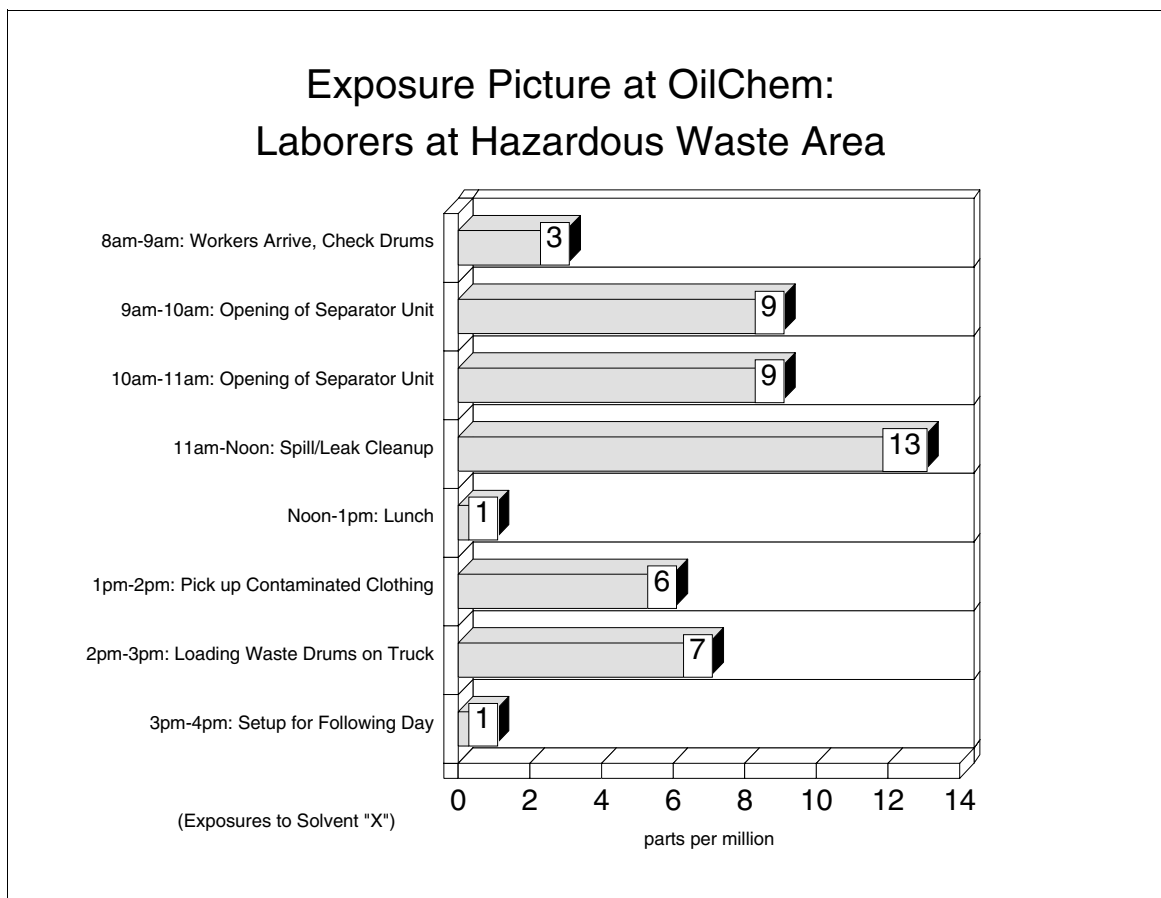
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The Information Herein Is Given In Good Faith, But No Warranty,
Express Or Implied, Is Made. Consult The Dow Chemical Company
For Further Information.

1. What You Get Is When You Test

The timing of air sampling is crucial to getting accurate results. To protect our health, we need to make certain that air samples are taken at **peak exposures and as averages for a full day's exposure**. This is often called typical and worst case monitoring.

Also, a sampling plan should take into account day-to-day variations in exposures at a given operation and between workers. To do this, it is usually necessary to collect several samples from each worker in a given area over several days. Single samples should be avoided.

Below is a chart that demonstrates the differences in peak, average and low points of exposure for OilChem chemical operators in the hazardous waste area.

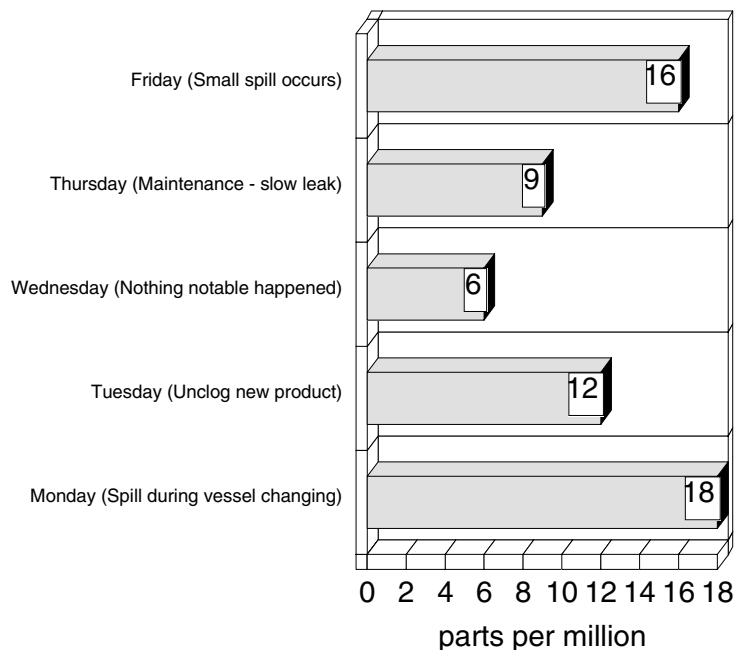


2. Exposure and Work Vary Day to Day

Many of our jobs and our exposures change not only by the hour, but also vary day to day. For example, our exposure might be high at the beginning of a week because that's when a new shipment of a chemical is put on line. It could be higher on a given day that we have to work, for example, on the valves of a toxic waste unit.

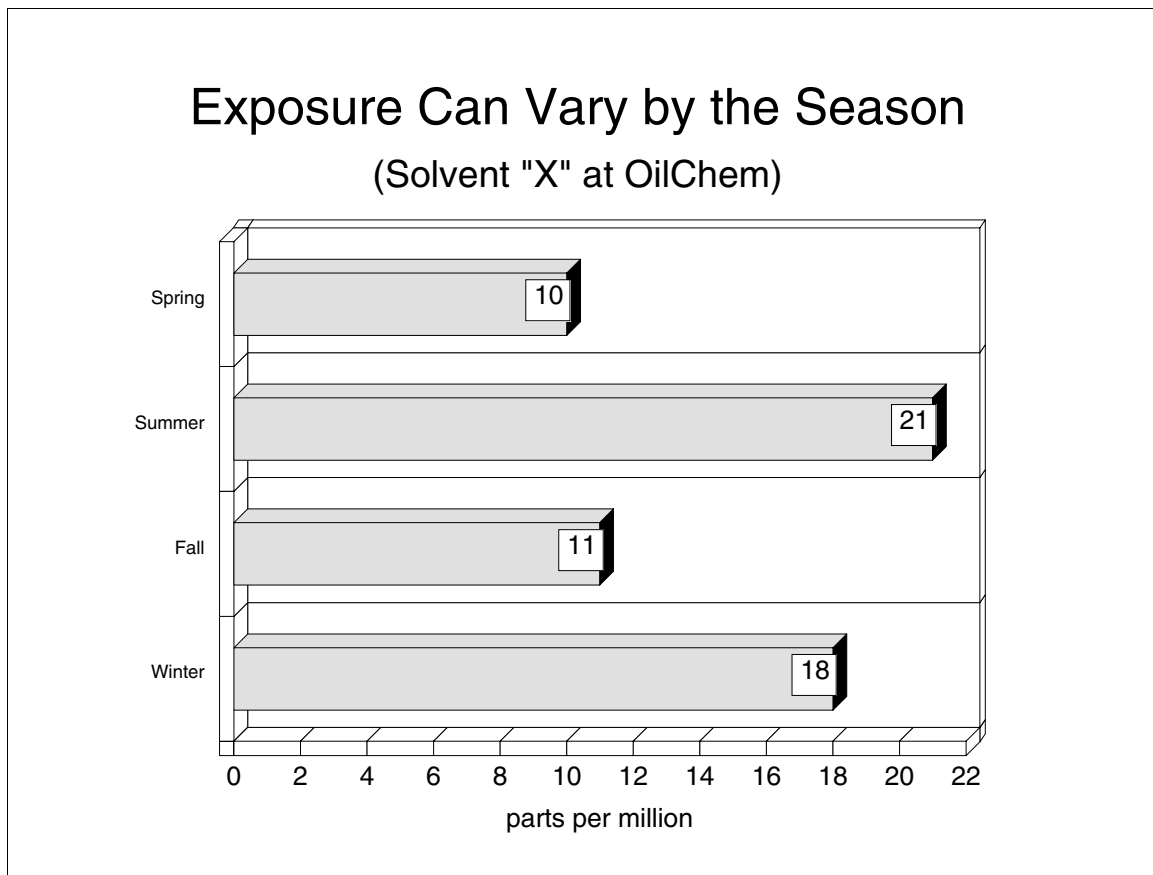
A sampling plan should take this variation into account. In order to get a "representative sample" – a true picture of worker exposures – the industrial hygienist must collect several samples from each worker in a given work area usually over several days. Typically these are collected for a full shift (8 hours) and adjustments should be made for overtime. (See the factsheet on page 184 for more on overtime.)

Exposure Can Vary by the Day
(Solvent "X" at OilChem)



3. Exposures Vary Season to Season

Exposures can also vary by the time of the year. For example, in the winter, work patterns may change calling for more indoor work with less fresh air, and therefore higher exposures. In some areas of the country, summer could mean strong inversions which could hold emissions closer to the ground causing increased exposures.

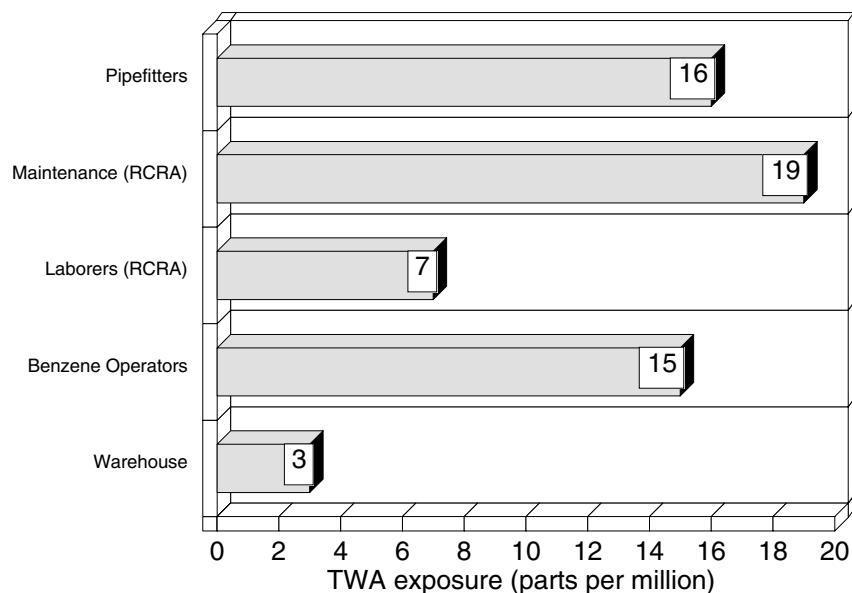


4. Exposures Vary by Type of Worker

It is true, of course, that different workers suffer different exposures to different chemicals. The drum handlers at the RCRA area of the plant may be more or less exposed than the maintenance workers who work on the equipment that separates the toxic wastes.

We need to be certain that the sampling is done either for all kinds of workers or for the workers we think are most exposed. Sampling is not useful if it is done on the workers which our survey suggests have the lowest exposures. In fact, you may want to have representative air sampling done for all workers; but remember, each job title and area has a unique and different exposure picture.

Were the Right Areas and Workers Tested?
(Solvent "X" at OilChem)



5. The More You Look, the More You See

Different monitoring devices have different error rates. Some are more accurate than others. In general, long-term sampling is more accurate than short-term, "grab" sampling. Detector tubes are used in short-term sampling methods and are the least accurate of all devices, with a 25 percent to 35 percent error rate.

Error Rates: "Grab" vs. Long-Term Samples

How you sample and how often you repeat that sample changes the error rate, up to a point. For example, the longer the sampling time, the more accurate are your results. Therefore, an 8-hour sample is more accurate than "instantaneous" or "grab" samples.

Repeating the sampling will also lower the error rate, although this error rate cannot be eliminated.

"Grab" Sampling: Includes detector tubes, direct reading and other short-term sampling devices. Laboratory analysis is not required for these samples since these sampling methods provide immediate exposure information.

For grab sampling you can improve the error rate by repeating the sampling technique four to seven times. But after the seventh time, there is no practical improvement in the error rate. It is similar to reaching the point of diminishing returns.

Long-term or Full-shift Sampling: Carried out for the length of a shift. Full-shift monitoring provides an exposure level which is an average of all exposures experienced during the shift. **Full-shift monitoring does not provide information on peak exposures.**

There are two types of full-shift monitoring:

- **Area Monitoring:** The equipment is left in one place. This method can be used to locate leaks and provides a rough idea of where highest exposures may be found. Area monitoring will not tell you your level of exposure.
- **Personal Monitoring:** The equipment is carried around by the worker. The pump is usually attached to the belt and the collection tube is near the worker's breathing zone. This provides information on an individual's exposure.

Long-term sampling is much more accurate than the direct reading, instantaneous method. However, it too has an error rate and repeated sampling can only improve this rate up to a point. For example, with full-shift sampling you can improve the error rate by repeating the sampling technique three to four times. However, after the fourth sampling there is no improvement in the error rate.

6. Chemical Mixtures: Too Much Exposure?

Exposure to a mixture of chemicals is different from an exposure to an individual chemical. **Even though your exposure might be below the OSHA standard for each chemical of the mixture, the combination of exposures might put you over the limit.**

If you are working with a mixture of chemicals, OSHA uses a special combined exposure calculation* when:

1. You are exposed to two or more chemicals which have adverse health effects on the *same* body organ or system.
– or –
2. You are working with two or more chemicals which have a *synergistic effect* – which means that the combined effect of the two chemicals is more harmful than either acting alone.

Here is an example of how the calculation works. Suppose you are exposed to the following mixture of chemicals with the following exposures: (Time-Weighted Average/8-hour day)

Benzene = .7 ppm	(OSHA PEL = 1 ppm)
Ethyl benzene = 60 ppm	(OSHA PEL = 100 ppm)
Xylene = 10 ppm	(OSHA PEL = 100 ppm)

Has there been an overexposure? ☐ No ☒ Yes

*OSHA *Field Operations Manual*, Change 12, September 21, 1987; Chapter 4-38, Paragraph E, Interpreting 1910.1000 b(2)i (regarding mixtures of air contaminants). Note: Application of mixture formula requires permission of OSHA Regional Administrator.

Here's why:

Each exposure is under the OSHA limit. But when you add up the percentages, it comes to over 100 percent which puts you over the combined limit:

Step 1: Find percentages for each chemical of the mixture.

The formula is: "Actual Exposure" divided by "OSHA Standard"

$$\text{Benzene} = 0.7 \text{ ppm} / 1 \text{ ppm} = 70\%$$

$$\text{Ethyl benzene} = 60 \text{ ppm} / 100 \text{ ppm} = 60\%$$

$$\text{Xylene} = 10 \text{ ppm} / 100 \text{ ppm} = 10\%$$

Step 2: Add up the percentages.

$$\text{Total for mixture} = (70\% + 60\% + 10\%) = 140\%$$

If the sum of the percentages is greater than 100 percent, an OSHA violation has occurred.

7. Overtime and Chemical Exposure

OSHA standards often offer us only the minimum in protection from toxic chemicals. At best they should be thought of as minimum standards. The exposure levels are often set with the assumption that you work eight hours and then have 16 hours away from the exposure so that your body can "clear out" or "detoxify" itself.

However, if you work a 10-hour or 12-hour day or longer, the OSHA limits no longer are adequate. They must be adjusted. Here's how that is done:

Suppose you are exposed to .8 ppm of benzene (OSHA PEL = 1 ppm) for eight hours. Your exposure is below the OSHA 8-hour TWA PEL. But if you work a 12-hour shift and your exposure is .8 ppm you are actually being overexposed. You are really above the limit.

Here's how the math works:

You multiply the TWA exposure by the number of hours and then divide the total by eight hours. You then can compare that number to the OSHA PEL.

$$\frac{(\text{Actual Exposure}) \times (\# \text{ of hours worked})}{8 \text{ hours}} = \text{Adjusted Exposure}$$

In our example, it works as follows:

$$\text{Step 1: } .8 \text{ ppm} \times 12 \text{ hours} = 9.6$$

$$\text{Step 2: } \frac{9.6}{8 \text{ hours}} = 1.2 \text{ ppm Adjusted Exposure}$$

Since 1.2 ppm is greater than the legal limit for eight hours of 1 ppm, the exposure is a violation of the OSHA law!

8. Three OSHA Standards: Time-Weighted Averages, Ceilings and Peaks

Sometimes, for the same chemical, OSHA will have three different exposure limits. For instance, if we look at benzene, OSHA really has three different standards. To look at each standard, refer to table below of potential exposures for four different workers.

Time	Worker 1	Worker 2	Worker 3	Worker 4
8 - 9 am	8 ppm	4 ppm	6 ppm	1.2 ppm
9 - 10	—	4	—	1.6
10 - 11	—	—	—	2.2
11 - 12	—	—	0.5	—
12 - 1 pm	—	—	0.5	—
1 - 2	—	—	—	2
2 - 3	—	—	—	—
3 - 4	—	—	1	1

1. Time-weighted Average (TWA)

For benzene, the TWA is 1 ppm, which means that OSHA believes that nearly all workers can be exposed up to 1 ppm continuously for eight hours a day, 40 hours per week, without suffering adverse health effects.

What this TWA really means is that your average hourly exposure to benzene must be no more than 1 ppm by the end of an 8-hour day. The way you figure out a time-weighted average in this case is to add up each worker's exposure and divide by eight:

Worker 1: 8 ppm divided by 8 hours = 1

Worker 2: (4 + 4) = 8 ppm divided by 8 hours = 1

Worker 3: (6 + .5 + .5 + 1) = 8 ppm divided by 8 hours = 1

Worker 4: (1.2 + 1.6 + 2.2 + 2 + 1) = 8 ppm divided by 8 hours = 1

So, as far as the benzene TWA goes for these four workers, they are all at the OSHA standard. So all is well? Not quite.

continued

8. (continued)

2. Ceiling Limit

There is a second standard for benzene known as the **ceiling limit**. During an eight-hour shift, a worker may be exposed to above 2.5 ppm once during the day for a maximum period of 10 minutes. This exposure must be compensated by exposures less than 1 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed the TWA of 1 ppm.

When we look back at our four workers we can see that **Worker 2 was over the 2.5 ceiling twice**. Therefore the company was in violation of the standard. The other three were ok. Well, not quite, because there is a third standard.

3. Peak Limits

Benzene has a third standard called a **peak** standard. This means that there is a certain level (5 ppm for benzene) which **cannot ever be exceeded for more than 10 minutes even if the TWA and ceiling standards are ok**.

When we look at **Worker 1** and **Worker 3**, we can see they were over-exposed according to the peak standard in the very first hour.

Sum Total

If the company over-exposes you in any of these three ways, they are in violation of the law. Here's the scorecard for our four workers. Only **Worker 4** is working according to **legal** conditions for benzene.

OSHA Standard	Worker 1	Worker 2	Worker 3	Worker 4
TWA	ok	ok	ok	ok
Ceiling	ok	violation	ok	ok
Peak	violation	ok	violation	ok
Total	violation	violation	violation	ok

Factsheet written by Jerry Roseman, Industrial Hygienist.

9. Different Types of Exposure Evaluation

Detector Tubes:

These are small, hand-held devices which draw air through a calibrated tube in which a color change indicates the amount of exposure in the air.

ADVANTAGES:

Gives an immediate indication of exposure.

DISADVANTAGES:

Highly inaccurate; doesn't yield "representative" 8-hour exposures. Only provides a "snapshot" of exposure.

Continuous Monitoring Systems:

These are systems set up to continuously monitor the air at selected sampling locations and to automatically record the values obtained.

ADVANTAGES:

Can warn of dangerous exposures and quickly detect leaks.

DISADVANTAGES:

Does not yield representative 8-hour time-weighted average (TWA) worker exposures.

Direct Reading Instruments:

These are often hand-held monitors that instantaneously record levels of oxygen, hydrogen sulfide gas, flammable vapors, etc.

ADVANTAGES:

Extremely useful for confined space entry to ensure a safe atmosphere, free of toxics and with sufficient oxygen.

DISADVANTAGES:

Not sensitive to all exposures and does not yield representative 8-hour TWA worker exposures.

Integrated Air Monitoring:

This involves the use of small personal sampling pumps, usually hooked onto a worker's belt, and the collection of a specific contaminant into a tube, filter or in a liquid which is located in the worker's "breathing zone." This type of sampling provides information on individual daily exposure and is the only method for reliably determining full-shift exposures.

ADVANTAGES:

Highly specific and yields 8-hour TWA exposures for analysis of actual worker exposures.

DISADVANTAGES:

Needs a qualified and experienced person to develop sampling strategy. A poor strategy would not detect ceiling or peak exposures.

10. Air Monitoring – Is It Adequate? Other Considerations

Air monitoring for chemical exposures is a complex process subject to many difficulties and errors. When done properly it can be extremely time consuming and expensive, so it is often done in a limited and inappropriate manner.

Air samples improperly collected and analyzed yield results that often indicate that no problem exists when, in fact, one does. In order to evaluate adequately any monitoring program, consider the following issues:

1. Does skin contact occur?

Remember that air samples only account for airborne exposures from a chemical. If the exposure also occurs through skin absorption, then take this into account.

Skin contact with a chemical can cause significant chemical exposures. For example, absorption of one drop of PCB fluid is equivalent to inhaling 7 mg/m^3 over an eight-hour period.* The OSHA limit for PCBs is $.5 \text{ mg/m}^3$, so one drop on your skin is 14 times the OSHA limit.

Skin absorption can occur in a number of ways:

Direct contact. The chemical comes in contact with the skin and is either absorbed into the blood stream or affects the skin directly.

Exists on walking and working surfaces. The chemical contaminates clothing, hands, cigarettes, food or can be carried home. Like direct contact, it is absorbed into the blood stream or causes skin problems.

*W. Nicholson, *Review of Human Health Effects and Carcinogenic Risk Potential of PCBs*, prepared for the Special Panel on Occupational Risk of Mortality from Cancer from Exposure to PCBs, 1987.

2. Did they sample for the right chemicals?

Although this is somewhat obvious, this is nonetheless a common problem with sampling strategies. Sampling is a very specific process. Make sure that they are sampling for the chemicals with which you are most concerned (e.g., chemicals which are highly hazardous) in locations where people are exposed, working conditions are poor, with a lot of chemical contact, or where there have been a lot of worker complaints.

Different chemicals must be collected in different ways (e.g., some are collected on filter paper, some on charcoal tubes, some in a liquid) and at different periods of time. Also, they must be analyzed in a lab differently.

3. Did the sampling consider the additive effects of chemicals?

If you are exposed to three separate chemicals with like health effects, then you must add their exposures together when considering if over-exposure is occurring. Their exposure should not be considered separately! (See the factsheet on pages 182 through 183 for more information.)

Summary: Monitoring the Monitors

Primary Issues

1. **All areas in which workers are exposed** need to be included in the survey.
2. The **chemicals of most concern** (i.e., most toxic, most used, most complaints received) must be evaluated.
3. Working conditions during the sampling should be:
 - Typical** (i.e., normal chemicals, conditions, workplace, ventilation and PPE use, etc.)
 - Worst case** (i.e., during the worst jobs, even if infrequent or during times when worst exposures are expected)
4. Most air samples collected should be **from the worker's breathing zone** – not of the general room air – and for the full shift of work (including overtime).
5. For OSHA, required time-weighted average samples must be collected **for the full work shift** (typically eight hours). (It pays to remind OSHA to adjust for overtime when they inspect.)
6. If there are short-term or peak exposures, then **special sampling** to evaluate these conditions needs to be conducted.
7. The possibility of **skin absorption and ingestion** (from chemical contamination of surfaces which come into contact with hands) must be evaluated.
8. If workers are **working overtime**, this must be considered when conducting sampling. Sampling results must be adjusted accordingly.
9. If exposures are to **chemical mixtures**, be sure that all components are sampled for or are otherwise factored into the evaluation.

10. Sampling should be done for **the same chemical, under fairly similar working conditions, but at varying times, shifts, etc.**, to ensure accuracy and representativeness.
11. To get an accurate and representative time-weighted average (TWA) for a particular chemical exposure, sampling must be done over a number of shifts, not just one or two.
12. There may be seasonal variations in exposures, so sampling should also be done at different times of the year in order to take this variation into account.
13. When conducting a survey, the company should monitor either the highest risk workers or all workers, but not just the workers with the lowest risk of exposure. Under the OSHA Access Standard 1910.20, **workers have a right to all monitoring data**. Request it routinely.
14. Evaluate whether or not **the exposure standards being used by the company are the strictest OSHA or NIOSH levels available**.

Secondary Issues – Accuracy

15. Are the people doing the sampling **trained, experienced and competent?**
16. **Is the correct sampling method being used** for a specific contaminant? NIOSH has standardized protocols for sample collection and analysis. If the wrong method is used, then the results will be inaccurate.
17. **All pumps must be checked and calibrated** for accuracy prior to and after sampling. Obtain records for this along with the name of the person conducting the sampling.
18. Make sure the union or the union representative has the right to observe the sampling.

Summary written by Jerry Roseman, Industrial Hygienist.

Activity 7: The Control of Toxic Hazards

Purpose

To develop our skills in evaluating whether or not the proper controls are in place to prevent serious exposure to toxic hazards in our plants and in our communities.



Task

Please read over the case study on the next page about a situation at OilChem. Then, in your groups, make an evaluation of the controls used and needed in this situation by answering the questions on page 196.

Controls at OilChem: A Hypothetical Case

As a member of the health and safety committee you have been asked by the hazardous waste handlers at OilChem to review the controls used in their situation. The following is how the work takes place:

First of all, the waste handlers go to the various units and fill up empty open-top drums (lids installed) with waste product from those units. In doing so, they move 55-gallon drums to the unit, open the trap at the bottom of the unit, take out the filter and wash it down over the sewer drain, attach a draft suction hose to the unit, and fill up their drums. In order to work with the filter the worker must reach down into the unit. In general, the fumes from the wastes are strong.

Next, they take the drums on a fork-lift truck and drive them to the storage area of the facility where they are stacked and removed from the facility by contractors.

As they work on a given unit, there are occasional spills when they connect and disconnect the hoses. When these minor spills occur, they simply put down some absorbent material and sweep up the substances and toss it all into a drum. It's basically a broom and shovel operation.

The only controls in place are the following:

- At the unit there is a draft hose suction ventilation system for the vessel, attached to a complete plant ventilation system, to suck up the vapors when they open the waste collecting portion of the unit. The hose opening is about three inches in diameter and hangs from the ceiling in the room. They use it by pulling the hose towards the vessel and placing it over the waste opening.*
- They have also been issued respirators to use when they are doing this task, but they seldom wear them because it's very hot in the area. Even when they do wear them, they get headaches.*
- They also wear gloves. But they only seem to work for about 20 minutes. Usually, everyone's hands get stained by the end of the day.*

In general, they are not the only ones who get headaches. The regular chemical operators have complained about similar problems.

continued

Task (continued)

Using the factsheets on pages 197 through 205 and your own experience, evaluate the controls in this situation by answering the following questions:

- 1. What controls that are in place do you feel are proper? Why?**
- 2. Which ones do you feel are inadequate? Why?**
- 3. What controls would you recommend be requested for this situation? (See the factsheets on pages 197 through 205.)**
- 4. Now switching to real life, what is the most important hazard in your facility that you feel needs improved controls, and what controls would you recommend?**

1. The Hierarchy of Controls

Choosing the Right Control

There is an order or priority when it comes to evaluating controls. The best controls are those that work at the source of the problem; the least desirable are those that control the exposure when it gets to the worker. The further from the source, the less desirable or effective is the control. The hierarchy is as follows:

BEST
At the source (example: substitution or total enclosure)
SECOND BEST
Along the path (example: local exhaust ventilation)
LEAST DESIRABLE
At the worker (example: respirators)

Every particular process must be evaluated individually to determine the optimal method of control. In some cases it will be necessary to combine a number of different methods to control successfully and completely a particular hazard or dangerous process.

It may also be necessary to **implement controls in several stages**, starting with those which can be put into place **quickly and provide interim protection while more extensive controls are planned and installed**.

The required control measures will, in part, depend on the form of the substance and the route by which it enters the body and by the possibility of major environmental contamination. Also, it is important that we understand the functioning, advantages and limitations of any control technology placed in the work area because this is what stands between us and a hazard.

2. What Is a Control?

A control is any device, procedure, piece of equipment, etc., that is used to keep vapors, fumes, dusts, etc., being generated by a work process, from getting into the air or onto the ground. The following is a list of the major controls used in the chemical industry **in order of priority – beginning with the best controls.** (We should always insist on the best controls, rather than settling for less adequate ones.)

1. Chemical Substitution

Whenever possible, the best solution to a hazardous chemical exposure is to remove it entirely from the workplace to prevent all exposure. This is often possible as demonstrated by the use of water-based paint instead of oil-based paints; and the use of insulation fluids other than those containing PCBs. Care must be taken to ensure that the substitute chemical is significantly safer than the original and that you are not just replacing one hazard with another.

2. Redesign (Change) the Process

In many cases the danger or exposure hazards associated with a job are inherent in the set-up of the job or the organization of the work process itself. The process design can often be changed, resulting in potentially dramatic improvements in health and safety, without using personal protective equipment (PPE) or even installing ventilation. In fact, management will often redesign a process for what they may consider reasons of efficiency and/or to accommodate new technologies. So they should also be expected to review and change the process design to minimize worker exposure.

3. Enclose the Process

If the removal of the hazard is not possible, then the process should be enclosed. This should be investigated prior to a management decision to use respirators to control exposure. (In fact, this "idea" is contained in the OSHA regulations.) Process enclosure keeps the contaminant out of the room air and effectively away from the worker. Plant areas which require only occasional attention can be very effectively controlled without interfering with operations. The

following are some examples of enclosures:

- At sampling ports
- At spill or screening points
- Sealing of ground-sewer connections
- Sight boxes, which enable you to see levels of materials inside vessels
- Pneumatic conveying of dusty materials
- Splash guards and hoods.

4. Mechanize the Process

Automating an operation, or phases of an operation, may be the best answer to a dangerous job. Of course management often wants to automate production processes to get rid of jobs. That is something the union must ensure doesn't happen if it pushes for process mechanization. This type of control is used widely in the chemical and nuclear industries. An example is pumps to handle solvents rather than manual measuring and dumping.

5. Isolate the Process

This can be done in one of three ways:

- Physically move the process, or otherwise physically separate it from other parts of the facility. This would limit the exposures to the process operators;
- Limit the time during which people are exposed. This is typically called an administrative control and involves rotating people through a hazardous process so that each person receives less exposure than before; and
- Restrict certain categories of workers from certain areas or processes. All of these solutions are limited – while they may limit the numbers of people exposed, they do nothing to lower the actual exposures. Further, they may be discriminatory and illegal.

continued

2. (continued)

6. Barriers and Diking of Hazardous Processes

This control is used where there are process or storage units which contain significant amounts of highly toxic materials and where a spill or leak could be potentially catastrophic in nature. Plant areas and processes, including storage tanks, should be evaluated for the potential to release chemicals into the environment (which also may be your own neighborhood or water supply). Containment barriers and collection systems should be designed and installed around these to prevent exposure. However, these will not reduce worker exposures.

7. Local Exhaust Ventilation

Toxic substances liberated into a work area from a process often can be effectively controlled by means of local exhaust ventilation applied at a point as close to the source of emission as possible and enclosing as much of the source of emission as possible. Ventilation design is of utmost importance in ensuring that the system functions effectively and removes contaminants. Major points to remember when looking at the local exhaust ventilation system:

- Is the opening of the ventilation system located right at the source of emission?
- Is there a hood or other component that encloses most or all of the emission source?
- **Is the ventilation system opening large enough, and is the air flow fast enough, actually to "capture" the chemical?**

8. General Ventilation

This is the type of ventilation that comes from having doors or windows open or having large ceiling or wall mounted exhaust fans, or having a ventilation system that circulates the air. This type of ventilation (also called dilution ventilation) is not applicable to the control of toxic materials because it does not stop them from being generated nor from getting into the room air. The main use for general ventilation is for office environments or in areas where toxic materials are not used. In these areas it is used to circulate fresh air and control temperature for comfort.

9. Housekeeping

There are major health and safety benefits to good housekeeping. Good housekeeping assists in keeping the work environment cleaner and prevents materials left on walking and working surfaces from getting into the air. Housekeeping depends on three basic things; (1) having adequate work time to allow for work area cleanup; (2) being provided with the proper equipment to conduct work area cleanup; and (3) using the proper equipment. For instance, for powdered materials, vacuum cleaners instead of brooms should be used to control dusting and the use of air hoses to blow dust off of surfaces should not be allowed. Other examples include:

- curbed cement pads under pumps
- water and steam connections provided for area wash-down
- provisions made for adequate flushing of lines and equipment when brought down for repair or turn-around
- prompt cleanup of spills
- laying down of drop cloths.

10. Routine and Preventive Maintenance

Because of the temperature, pressure and chemicals they handle and from normal wear, all machinery, equipment and tanks eventually are in need of repair. A routine and preventive maintenance program that is conducted before leaks, spills, or other breakdowns occur can stop potentially catastrophic situations from occurring. In particular, it is important to check valves, gaskets, welds and other equipment sites that are prone to damage and wear. This is a control that management often strongly resists (as with housekeeping) or severely limits in terms of time and manpower, but it can be an extremely important preventive control.

continued

2. *(continued)*

11. Special Work Methods

Wet methods can be used to reduce dusting when wettable material is handled and water does not interfere with the process. By keeping the material damp or by using fogging sprays at transfer points, very little material is released into the general air. Also, high-pressure water washing of the inside surfaces of vessels and tanks can be an effective control measure because it can reduce the amount of manual cleaning which exposes the worker.

Although wet methods can reduce large amounts of dust released into the air, they are not a cure-all. They are best used in combination with other methods of control like local exhaust ventilation.

Here are some examples of wet and special methods:

- powder wetting rooms
- addition of a slurry rather than a dry powder
- spent catalyst handling
- sand blasting
- water sprays around glands of pumps handling phenol
- hot washing of vessel holds
- addition of pellets, briquettes, or bagged material rather than a dry powder.

12. Respiratory Protection

This control is widely used in many workplaces; however, it is problematic for a number of reasons:

- It doesn't eliminate the exposure; instead it "encloses" the worker in an attempt to lower worker exposures;
- It is an extremely uncomfortable control and one which can fail to perform adequately for many reasons;
- It doesn't prevent skin contact and exposure;
- It doesn't protect against all contaminants.

When respirators are used as a control, it is important to note the following:

- Management must first install engineering controls if technically feasible;
- All workers must be medically evaluated and fit tested;
- Management must have written standard operating procedures governing the use of the equipment;
- Management must train all workers in the uses and limitations of the respiratory protection equipment and make sure there are enough respirators and parts to equip adequately all workers;
- Management must comply with all aspects of the OSHA Respiratory Protection Standard 29 CFR 1910.134.

3. Local Exhaust Ventilation

What is local exhaust ventilation (LEV) and how is it different from general ventilation?

Local exhaust ventilation systems consist of fans, hoods and air cleaners and are designed to remove toxic air contaminants from the workplace as close as possible to the source of their production.

Properly designed and maintained, they are almost as effective as controls at the source, and are the first line of defense when controls such as substitution are not possible.

General ventilation involves exhaust fans, or room air ducts that move or circulate the air. Their goal is to provide comfort, including adequate fresh air and temperature control. They are not designed to, nor can they, remove toxic chemicals.

Proper design requires that ventilation hoods:

- Enclose the process as much as possible;
- Be located very close to the source of contamination; and
- Be designed so that chemicals are not pulled through the worker's breathing zone.

Proper maintenance requires that adequate time and manpower be committed to the upkeep of these systems.

Capture Velocity vs. Face Velocity

Capture velocity is a measure of how much airflow exists at the **point at which the chemical is generated**. Face velocity is a measure of how much airflow exists **at the point of ventilation**. It is capture velocity that is important, although management often uses measures of face velocity to justify adequacy of ventilation.

Advantages of LEV

Local exhaust systems consist of more individual components, require more maintenance and involve higher operating expenses than do general exhaust systems. However, LEV is far superior to general ventilation. The advantages of LEV include:

- Almost complete capture and control of a contaminant at the source of exposure – provided the system is properly designed, functioning, and maintained.
- LEV is less costly than general ventilation systems because it "sucks" less air out of the workplace and requires less heated air to be put back in.
- LEV systems concentrate the contaminant at the point at which it is exhausted from the facility. This means lower costs to management for air pollution devices.
- LEV can be designed to capture dusts and other particles that might otherwise settle on walking/working surfaces. This way it reduces dust and lowers cleanup costs.

Summary: The Control of Toxic Hazards

1. There is a hierarchy of control both in a health-and-safety sense and in a legal sense (i.e., the OSHA law):

- The best control is **at the source** (substitution, enclosure, etc.);
- The next best control is **along the path** (i.e., ventilation, housekeeping, etc.); and
- The least effective control is **at the worker** (i.e., respirators and other personal protective equipment – PPE).

2. Respirators can only be used:

- If engineering controls are not technically feasible; or
- While engineering controls are being installed.

3. **Respirators are a dangerous and unsatisfactory control** because:

- They do not stop exposure but rely on a mask to prevent dangerous exposure;
- They are hot and uncomfortable to wear; and
- They have many other limitations. (See Activity 9: Respiratory Protection.)

4. Local exhaust ventilation is only effective when properly designed for the specific situation. An LEV system's effectiveness and safety is best measured by its captive velocity rating.

5. **Maintenance operations are crucial if prevention of major hazards is to occur.** The major issue here is negotiating manpower and time to do the job properly. Housekeeping is also a staffing and labor time issue.

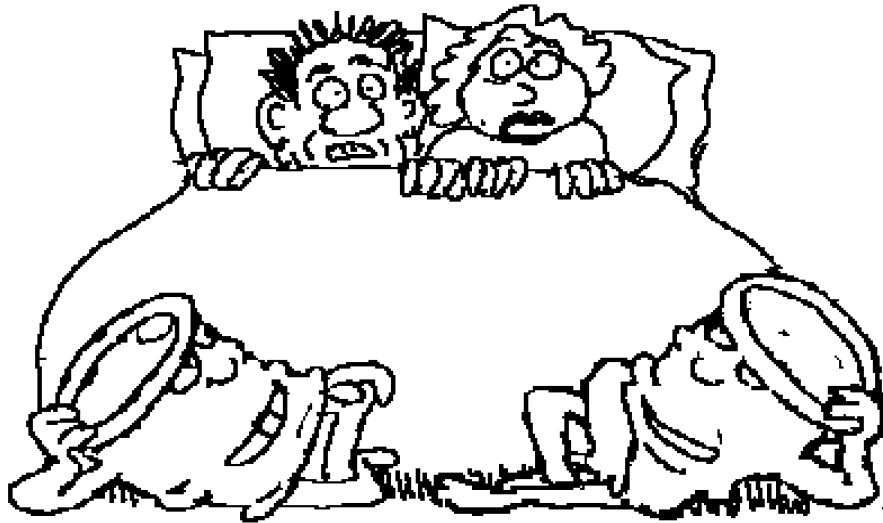
Summary written by Jerry Roseman, Industrial Hygienist.

Activity 8: Reproductive Hazards in the Workplace

Purpose

To provide an overview of reproductive problems that may result from chemical exposures.

To help figure out whether or not we are at risk on the job and what to do about it This activity has four tasks.



Task 1

Assume that you have been asked by the union to respond to a worker who made the statement below. In your groups, evaluate the statement and prepare a brief response for this worker. In doing so, please review the factsheets on pages 209 through 215 and try to **refer to at least one factsheet** when you present your group's response.

Statement:

"I'm concerned about all the substances we're working with at our facility. I'm especially concerned about the effect the substances may have on women, since women are more susceptible than men because of their reproductive system. I really don't think it's fair to expose these women to such a risk, and maybe we ought to look at keeping women away from these toxic substances."

1. What would you say to this worker?

1. Reproductive Risks: The Scope of the Problem

One of the 10 Leading Work-Related Diseases.

Reproductive dysfunction, whether in men or women, is one of the ten leading work-related diseases described by the National Institute for Occupational Safety and Health.

Only 6 Percent of All Chemicals Have Been Tested.

Only 6 percent of all chemicals in commercial use have been tested for reproductive risk, so the gap in knowledge is tremendous. Federal law does not require chemicals to be tested for reproductive effects. The result is that workers become guinea pigs.

At Least 7 Percent of All Children Born in the United States Each Year Suffer From Serious Birth Defects.

Over 200,000 children are affected annually. Right now, two-thirds of all birth defects are of unknown origin. We need to find out how much the workplace contributes to the incidence of birth defects.

Do Workplace Exposures Cause Genetic Diseases?

There are over 1,500 known genetic diseases, such as cystic fibrosis, muscular dystrophy, diabetes, hemophilia and Downs syndrome. These diseases can be passed on from generation to generation. What impact do workplace exposures have on the incidence of genetic diseases?

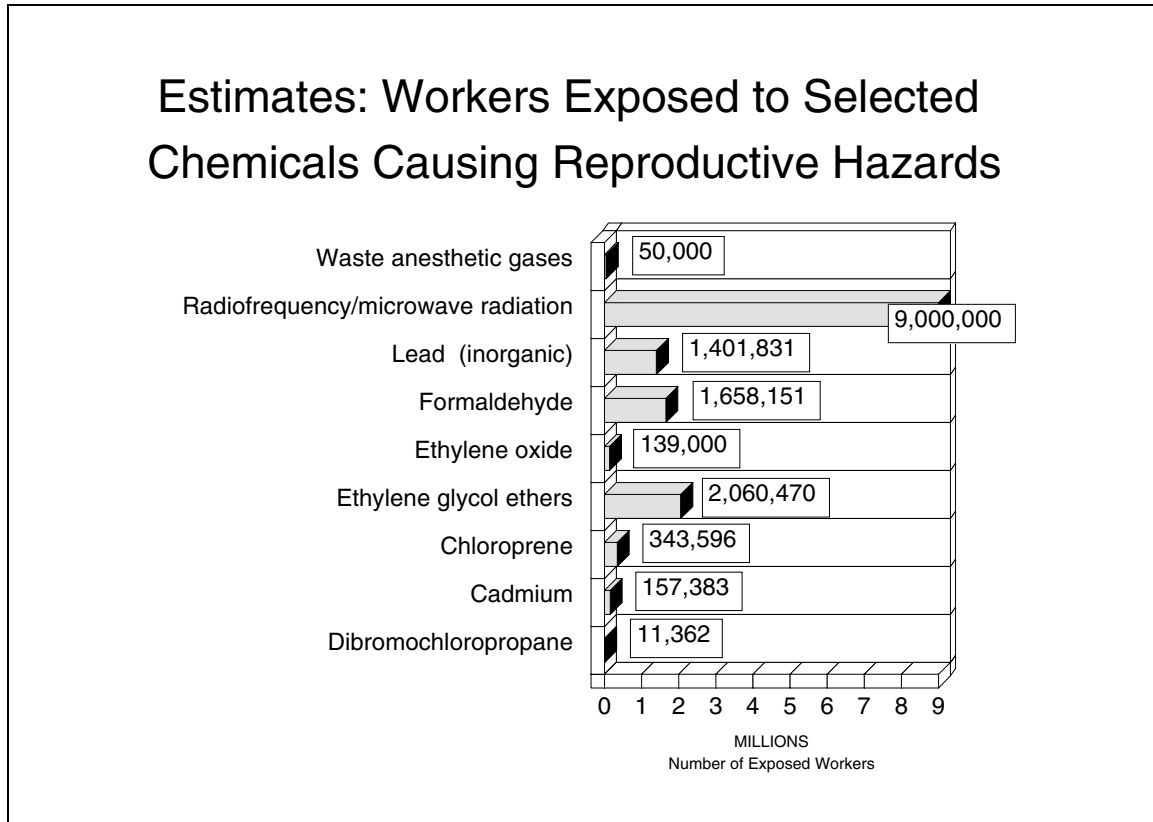
Male Sperm Count Is on the Decline.

Some experts say the sperm count of the average American man has declined dramatically in the last 30 years, a decline that may be influenced by the amazing rise of new toxic substances in the environment. Sperm counts influence one's ability to conceive children.

Source: National Institute for Occupational Safety and Health 1992 Projects.

2. How Many of Us Are at Risk

We are not the only ones that can suffer from toxic substances. Studies now show that some of the substances at work actually harm our reproductive systems and cause damage to the fetus.



Note: Examples of agents have been selected on the basis of positive animal and/or human data; inclusion or exclusion of agents does not constitute an evaluation of their potential reproductive toxicity in humans.

Source: *Morbidity and Mortality Weekly Report* 34, no. 35, Center for Disease Control, September 6, 1985.

3. Reproductive Hazards to Men and Women

Proven Reproductive Hazards (Based on Human Studies)
Anesthetic Gases: miscarriage, death of newborn Diethylstilbestrol (DES): cancer Hepatitis B: newborn hepatitis, liver cancer Lead: miscarriage, premature birth Organic Mercury: cerebral palsy, brain malformation Polychlorinated Biphenyls (PCBs): low birth weight Radiation: miscarriage, brain defects, skeletal defects
Suspected Reproductive Hazards (Based on Human Studies)
Carbon Monoxide: slowed growth Cytotoxic Drugs: miscarriage Ethylene Oxide: miscarriage Hexachlorophene: birth defects Organic Solvents: cleft palate, miscarriage, newborn infection, childhood cancer Physical Stress (including Heat): prematurity 2,4,5-trichlorophenol: miscarriage Vinyl Chloride: brain defects
Suspected Reproductive Hazards (Based on Animal Studies)
Acrylonitrile Arsenic Cadmium Dioxin Glycol Ethers Inorganic Mercury Organochlorine Pesticides Polybrominated Biphenyls (PBBs) Tellurium

Source: Linda Rosenstock and Mark R. Cullen, *Clinical Occupational Medicine*, W.B. Saunders Company, 1986.

4. Potential Adverse Effects of Job Exposures on Reproduction

Prior to Conception
<p>Menstrual disorders – women</p> <p>Interference with sexual functions – men</p> <p>Genetic damage in male and female germ cells can be passed on to the children and result in disease or birth defects</p> <p>Can also cause miscarriage or stillbirth</p>
At Conception
<p>Difficulties in conceiving a child (for example, by interference with the sperm's ability to fertilize the egg)</p>
During Pregnancy
<p>Miscarriage, stillbirth, cancer, disease, or birth defects as a result of substances crossing the mother's placenta and reaching the developing fetus (e.g., certain drugs, chemicals and viruses) or by direct action, such as radiation exposure</p>
On the Newborn
<p>Toxic effects on development of the baby as a result of substances transmitted in breast feeding</p>
On the Child
<p>Toxic effects on development of the child from exposure to substances inadvertently brought home on parents' work clothes</p>

Source: Andrea Hricko and Melanie Brunt, *Working for Your Life: A Women's Guide to Job Health Hazards* (joint publication of Labor Occupational Health Program and Public Citizen's Health Research Group, 1976).

5. What Harms Women Harms Men

PACE Members Are Guinea Pigs

Historically, PACE men have been physically affected by reproductive hazards, while women have been kept out of high-paying jobs on the basis of their reproductive capacity.

Yet, as far as we know right now, substances that affect the female reproductive system will also affect the male. The following summarizes some of the studies done to date:

Stage of Reproductive Cycle	Male	Female
Preventing Coitus	Changes in hormones, effects on nervous system or cancer of reproductive organs may cause impotency or lack of sexual desire.	
Pre-Conception	<p>There is scientific concern that death of sperm or genetic changes in sperm may cause sterility or mutations with the possible effect of:</p> <ul style="list-style-type: none"> •no conception •spontaneous abortions •stillbirths •abnormalities in immediate progeny or to future generations 	<p>There is also a concern that changes in hormones, changes to the eggs or cancer of reproductive organs may cause infertility or mutations with the result of:</p> <ul style="list-style-type: none"> •no conception •spontaneous abortions •stillbirths •abnormalities in immediate progeny or to future generations
Pregnancy	Some scientists believe that there is a possibility that toxic substances absorbed into the male body may contaminate seminal fluid and (through intercourse) uterine fluids which may be absorbed by the fertilized egg before attachment to the uterine wall and growth of placenta. This could result in spontaneous abortions.	It is also possible that toxic substances absorbed by the female body may contaminate uterine fluids with a lethal effect on young fertilized eggs. Toxic substances can also cross the placenta and cause spontaneous abortion, stillbirths, birth defects in the child or cancer.
Post-Pregnancy	Not applicable	Toxic substances absorbed by a nursing mother may contaminate her milk and cause various toxic effects in the newborn.

Source: Katherine Hunninen, M.S., *Environmental Toxins and Reproductive Systems Damage: Who's Liable?*, Memphis, Tennessee: Occupational Health Project, Midsouth Poison Center.

6. Reproductive Disorders: A Wide Range of Problems

The chemicals and compounds we work with can create a wide variety of reproductive problems. These include:

- reduced fertility,
- unsuccessful fertilization or implantation,
- an abnormal fetus,
- death of the fetus,
- structural and functional abnormalities in the newborn,
- spontaneous abortions (early and late),
- major and minor birth defects,
- perinatal death,
- low birth weight,
- altered sex ratio,
- developmental or behavioral disabilities, and
- transplacental exposure to carcinogen.

7. What We Know About Maternal and Paternal Exposures

Maternal Studies Show Rise in Spontaneous Abortions

Studies have shown increased rates of spontaneous abortions among female workers in:

- laboratory and chemical workers
- workers exposed to lead, ethylene oxide and anesthetic gases.

Paternal Studies Show Sperm Problems

More and more studies show that specific chemicals harm the ability of men to produce living sperm or enough sperm. The chemicals that have been proven to be harmful include:

- dibromochloropropane
- lead
- carbon disulfide
- anesthetic gases
- ionizing radiation
- toluediamine
- dinitrotoluene
- carbaryl and several other pesticides.

Task 2

Assume you are the Union's Health and Safety Committee dealing with the following situation:

Joanne is planning to have a baby. She works in a facility where she is exposed to glycol ethers used as solvents. Joanne has heard glycol ethers might be bad for her. She asked the company to transfer her to another job, but they refused. She comes to you, the Union Health and Safety Committee, for advice and help.

As a group, please answer the questions which follow.

1. According to the MSDS (see pages 217 through 224), what can you tell Joanne regarding glycol ethers (2-methoxyethanol) and reproductive risk?

2. According to the chemical lists and OSHA (see pages 225 through 229), what would you tell Joanne?



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SECTION I - PRODUCT IDENTIFICATION

Product Name: 2-Methoxyethanol
Common Synonyms: Ethylene Glycol Monomethyl Ether; Methyl Cellosolve; Methyl Glycol
Chemical Family: Ether Alcohols
Formula: $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$
Formula Wt.: 76.10
CAS No.: 109-86-4
NIOSH/RTECS No.: KL5775000
Product Use: Laboratory Reagent
Product Codes: P784

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
 3	 2	 2	 3
SEVERE	MODERATE	MODERATE	SEVERE

Laboratory Protective Equipment



U.S. Precautionary Labeling

DANGER!

COMBUSTIBLE. CAUSES IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. OVEREXPOSURE MAY CAUSE MALE OR FEMALE REPRODUCTIVE DISORDERS. EXCEPTIONAL HEALTH AND CONTACT HAZARDS. BEFORE USING, READ MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS MATERIAL.

Keep away from heat, sparks, flame. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide. In case of spill, soak

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PRECAUTIONARY LABELING (CONTINUED)

up with sand or earth. Flush spill area with water.

International Labeling

Flammable. Harmful by inhalation, in contact with skin and if swallowed.
 Irritating to respiratory system.
 Avoid contact with skin and eyes.

SAF-T-DATA* Storage Color Code: Red (flammable)

SECTION II - COMPONENTS

Component	CAS No.	Weight %	OSHA/PEL	ACGIH/TLV
2-Methoxyethanol	109-86-4	98-100	25 ppm	5 ppm

SECTION III - PHYSICAL DATA

Boiling Point: 124°C (255°F) (at 760 mm Hg)	Vapor Pressure (mmHg): 6.17 (20°C)
Melting Point: -85°C (-121°F) (at 760 mm Hg)	Vapor Density (air=1): 2.6
Specific Gravity: 0.97 (H ₂ O=1)	Evaporation Rate: 0.62 (Butyl Acetate = 1)
Solubility(H ₂ O): Complete (100%)	% Volatiles by Volume: 100 (21°C)
pH: N/A	
Odor Threshold (ppm): N/A	Physical State: Liquid
Coefficient Water/Oil Distribution: N/A	
Appearance & Odor: Clear, colorless liquid. Characteristic odor.	

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SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup): 38°C (102°F) NFPA 704M Rating: 2-2-0

Autoignition Temperature: 284°C (545°F)

Flammable Limits: Upper - 19.8 % Lower - 1.8 %

Fire Extinguishing Media

Use water spray, carbon dioxide, dry chemical or ordinary foam.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

Toxic Gases Produced

carbon monoxide, carbon dioxide

Explosion Data-Sensitivity to Mechanical Impact

None identified.

Explosion Data-Sensitivity to Static Discharge

None identified.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 16 mg/m³ (5 ppm)

The TLV listed denotes TLV (skin).

Short-Term Exposure Limit (STEL): Not Established

Permissible Exposure Limit (PEL): 80 mg/m³ (25 ppm)

PEL is for Methyl cellosolve (2-Methoxyethanol).

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

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Toxicity of components

Oral Rat LD ₅₀ for 2-Methoxyethanol	2460 mg/kg
Intraperitoneal Rat LD ₅₀ for 2-Methoxyethanol	2500 mg/kg
Skin Rabbit LD ₅₀ for 2-Methoxyethanol	1280 mg/kg
Inhalation-7Hr Mouse LC ₅₀ for 2-Methoxyethanol	1480 ppm
Carcinogenicity: NTP: No IARC: No Z List: No OSHA Reg: No	

Carcinogenicity

None identified.

Reproductive Effects

In tests with laboratory animals, exposure to 2-Methoxyethanol has resulted in an increase in birth defects, adverse effects on pregnancy, embryonic death, blood damage and damage to male reproductive organs. Acceptable maximum exposure limit for women of childbearing age = 2 ppm (8 Hr time-weighted average).

Effects of Overexposure

INHALATION: headache, nausea, vomiting, dizziness, drowsiness, irritation of upper respiratory tract, unconsciousness, may cause pulmonary edema

SKIN CONTACT: irritation, prolonged contact may cause dermatitis

EYE CONTACT: irritation

SKIN ABSORPTION: rapid absorption

INGESTION: headache, nausea, vomiting, dizziness, drowsiness, weakness, gastrointestinal irritation, unconsciousness

CHRONIC EFFECTS: central nervous system depression, damage to liver, kidneys, blood, testes

Target Organs

central nervous system, blood, eyes, skin, kidneys, reproductive system

Medical Conditions Generally Aggravated by Exposure

none identified

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

=====

Primary Routes of Entry

inhalation, ingestion, absorption, eye contact, skin contact

Emergency and First Aid Procedures

INGESTION: CALL A PHYSICIAN. If swallowed, if conscious, give large amounts of water. Induce vomiting.

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

EYE CONTACT: In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

SARA/TITLE III HAZARD CATEGORIES and LISTS

Acute: Yes Chronic: Yes Flammability: Yes Pressure: No Reactivity: No

Extremely Hazardous Substance: No

CERCLA Hazardous Substance: No

SARA 313 Toxic Chemicals: Yes Contains 2-Methoxyethanol

Generic Class: Generic Class Removed from CFR: 7/1/91

TSCA Inventory: Yes

State Lists: For products sold in the state of California, the state requires that we provide to users and their employees the following message: WARNING: THIS PRODUCT IS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

=====

SECTION VI - REACTIVITY DATA

=====

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, other sources of ignition

Incompatibles: strong oxidizing agents, strong bases, acid chlorides, acid anhydrides, caustics

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SECTION VI - REACTIVITY DATA (CONTINUED)

=====

Decomposition Products: carbon monoxide, carbon dioxide

=====

SECTION VII - SPILL & DISPOSAL PROCEDURES

=====

Steps to be Taken in the Event of a Spill or Discharge

Wear self-contained breathing apparatus and full protective clothing. Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker SOLUSORB^R solvent adsorbent is recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D001 (Ignitable Waste)

=====

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

=====

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 250 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, butyl rubber gloves are recommended.

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS

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SAF-T-DATA* Storage Color Code: Red (flammable)

Storage Requirements

Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area or cabinet.

=====

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

=====

Domestic (D.O.T.)

Proper Shipping Name: Ethylene glycol monomethyl ether
Hazard Class: 3
UN/NA: UN1188
Labels: 3 FLAMMABLE LIQUID
Regulatory References: 49CFR 172.101

Packaging Group: III

International (I.M.O.)

Proper Shipping Name: Ethylene glycol monomethyl ether
Hazard Class: 3.3
UN: UN1188
Labels: 3 FLAMMABLE LIQUID
Regulatory References: 49CFR PART 176; IMDG Code

I.M.O. Page: 3342
Packaging Group: III

AIR (I.C.A.O.)

Proper Shipping Name: Ethylene glycol monomethyl ether
Hazard Class: 3
UN: UN1188
Labels: 3 FLAMMABLE LIQUID
Regulatory References: 49CFR PART 175; ICAO=== We believe the transportation data and references contained herein to be factual and the opinion of qualified experts. The data is meant as a guide to the overall classification of the product and is not package size specific, nor should it be taken as a warranty or representation for which the company assumes legal responsibility.=== The information is offered solely for your consideration, investigation, and verification. Any use of the information must be determined by the user to be in accordance with applicable Federal, State, and Local laws and regulations. See shipper requirements 49CFR 171.2, Certification 172.204, and employee training 49 CFR 173.1(b).

Packaging Group: III

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

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U.S. Customs Harmonization Number: 29094200008

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NOTE: When handling liquid products, secondary protective containers must be used for carrying.

-N/A = Not Applicable, or not Available; -N/E = Not Established

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8. A Few *Known* Human Reproductive Toxic Substances

Substance	Effect*	Comments
Lead	Reduced sperm count; Spontaneous abortion; Low birth weight; Behavioral abnormalities	Some effects may occur at levels below those which cause other toxic effects
Antineoplastic drugs	Birth defects; Spontaneous abortion; Reduced sperm count	Effects may occur at levels below those which cause other toxic effects
Diethylstilbestrol (DES)	Cancer in children	No longer widely used; possible exposure in the pharmaceutical industry
Dibromochloropropane (DBCP)	Damages testes	Use is banned in the United States
Ethanol (alcohol)	Birth defects; Low birth weights; Behavioral abnormalities	Unlikely to occur through occupational inhalation exposures; significant risk through ingestion
Ionizing radiation	Birth defects; Spontaneous abortion; Low birth weight; Cancer in children; Reduced sperm count	Recommended dose limit to the fetus in occupationally exposed women is 0.5 rem during the entire pregnancy

*"Effect" refers to adverse reproductive effect that has been associated with this substance in human or animal studies. This does not mean that this effect will necessarily occur in response to exposure. Response depends on a number of factors, including dose, and the point in the reproductive process at which exposure occurs.

Source: Patricia Coyle, MPH, *Workplace Chemical Hazards and Reproductive Health*, California Department of Health, 1990.

9. A Few *Probable* Human Reproductive Toxic Substances

Reproductive effects may occur at lower exposure levels than other toxic effects, so that there may be no obvious symptoms to warn that workers' reproductive health is being harmed.

MSDSs usually do not list the "probable" or "possible" reproductive hazards of a toxic substance, and many times they fail to list the known hazards as well.

Please refer to "Activity 4: Tackling Toxic Chemical Myths" for routes of entry and absorption rates information.

Substance	Effect*
2-Methoxyethanol (glycol ether)	Birth defects (A) Reduced sperm count (A)
2-Ethoxyethanol (glycol ether)	Birth defects (A) Reduced sperm count (A/H)
Ethylene oxide	Toxic to sperm (A) Spontaneous abortion (A/H)
Nitrous oxide	Spontaneous abortion (A/H) Birth defects (A)
Cycloheximide	Birth defects (A) Damages testes (A) Toxic to sperm (A)
Mercury (inorganic)	Birth defects (A) Fetotoxicity (A) Menstrual irregularities (H)

A = evidence in animals

H = limited evidence in humans

*"Effect" refers to adverse reproductive effect that has been associated with this substance in human or animal studies. This does not mean that this effect will necessarily occur in response to exposure. Response depends on a number of factors, including dose, and the point in the reproductive process at which exposure occurs.

Source: Patricia Coyle, MPH, *Workplace Chemical Hazards and Reproductive Health*, California Department of Health, 1990.

10. A Few *Possible* Human Reproductive Toxic Substances

Substance	Effect*
Methyl ethyl ketone	Fetotoxicity (A)
Methanol	Birth defects at very high exposure levels (A)
Methylene chloride	Fetotoxicity (A)
Trichlorethane (TCA)	Fetotoxicity (A)
Perchloroethylene	Fetotoxicity (A)
Styrene	Death of the embryo (A)
Xylene	Fetotoxicity (A) Birth defects at levels toxic to mother (A)
Toluene	Fetotoxicity (A) Birth defects** (H)

A = evidence in animals

H = limited evidence in humans

*"Effect" refers to adverse reproductive effect that has been associated with this substance in human or animal studies. This does not mean that this effect will necessarily occur in response to exposure. Response depends on a number of factors, including dose, and the point in the reproductive process at which exposure occurs.

**Case reports in children of women who abused toluene (by sniffing glue) throughout pregnancy.

In animals (A), this does not occur at exposure levels near the Permissible Exposure Limit (PEL). However, because of the uncertainty inherent in animal testing, workplace exposures should be minimized.

Source: Patricia Coyle, MPH, *Workplace Chemical Hazards and Reproductive Health*, California Department of Health, 1990.

11. A Few Substances Which Are *Unlikely* To Harm Reproduction

Some chemicals are *not* likely to harm reproductive function because very little of the chemical is absorbed into the bloodstream. For example, strong irritants react with the first body tissue they contact, usually the eyes, nose, throat, or skin. Therefore, they are unlikely to affect other parts of the body, including the fetus. However, most of these substances can have other serious effects at the site of contact. A few chemicals which are believed to pose no danger to pregnancy or reproduction are listed below.

- ammonia
- chlorine
- hydrochloric acid
- nitric acid
- sulfuric acid
- sodium hydroxide
- potassium hydroxide
- sodium hypochlorite (bleach)
- fiber glass
- asbestos
- silica

12. OSHA Proposes Regulating Glycol Ethers

Washington (BNA) – The workplace exposure limits for four widely used industrial solvents would be reduced by up to 99 percent under a proposed rule to be published today by the Occupational Safety and Health Administration.

The proposed standard for four glycol ethers is designed to protect workers from hazards associated with human reproductive systems and fetal development as well as blood disorders, according to an OSHA statement issued March 22.

OSHA is proposing to reduce the permissible exposure limit for 2-Methoxyethanol and 2-Methoxyethanol acetate from 25 parts per million (ppm) to 0.1 ppm. The agency also would reduce the exposure limit for 2-Ethoxyethanol and 2-Ethoxyethanol acetate to 0.5 ppm. Current exposure limits for the latter substances are 200 ppm and 100 ppm, respectively. Those limits are for an average, eight-hour work day.

Other Requirements

In addition to the new eight-hour

exposure limits, OSHA is proposing 15-minute excursion limits that are five times higher than the work day limit and action levels that are one-half the full-day limit.

Employers would be required to initially monitor all exposed workers and conduct additional monitoring and medical surveillance for workers exposed at or above the action level or excursion limit, OSHA said.

Companies also would have to provide training for all exposed workers. Also included in the proposal are provisions covering personal protective equipment, hazard communication for employees, recordkeeping, and emergency response requirements.

Employers would have to reduce exposures to the proposed limits primarily through engineering controls to the extent that is feasible. OSHA estimates that about 2 percent of workers would be required to wear respirators because engineering controls would be infeasible in their workplaces.

Source: *Bureau of National Affairs*, March 23, 1993.

Task 3

Joanne's situation (as repeated below) poses important issues for the union concerning transfers and remediation of the problem. To better understand and clarify the problems, please review her situation and work as a group to answer the questions that follow. Please refer to the factsheets on pages 232 through 238.

Joanne is planning to have a baby. She works in a facility where she is exposed to glycol ethers used as solvents. Joanne has heard glycol ethers might be bad for her. She asked the company to transfer her to another job, but they refused. She comes to you, the Union Health and Safety Committee, for advice and help.

1. What are some steps that the union could take that might "convince" management to allow Joanne to transfer?
2. Assuming that Joanne was transferred, how can the union ensure that the rest of the workers in her former department are protected?

Task 4

Please look over the substance lists on pages 225 through 227 and answer the questions which follow.

- 1. Do you work with any substance that is a known, probable or possible reproductive toxic substance? If so, please list one.**
- 2. Please list three (3) things you would do at your workplace to protect yourself and your co-workers from the reproductive hazard you selected above.**

13. Supreme Court Bans "Fetal Protection" Policies: Johnson Controls

The Supreme Court ruled in March 1991 that **women don't have to choose between having a job and having children.**

In UAW vs. Johnson Controls, Inc., the court ruled that the company's "fetal protection" policy which excluded women from jobs involving lead exposure was illegal discrimination in violation of the Civil Rights Act of 1964 and the Pregnancy Discrimination Act of 1978.

While the decision gave women the same employment opportunities as men, **the court did not address the question of what to do about the reproductive hazard to protect all workers.**

Prior to that ruling, many companies, including many OCAW-represented facilities, had instituted exclusionary placement policies or "fetal protection" policies which excluded women of child-bearing potential from jobs that involved exposure to reproductive toxic substances.

At one OCAW-represented facility, American Cyanamid, in Willow Island, West Virginia, **five women had themselves sterilized in 1978 to keep their jobs** and comply with a company policy that barred women of child-bearing capacity from jobs involving lead exposure.

OCAW International believes that the Supreme Court ruling in Johnson Controls was a good one because **it outlawed policies that remove the worker rather than cleaning up the workplace.** OCAW believes that OSHA should adopt clear regulations that provide protection for men, women and the fetus exposed to reproductive hazards on the job.

14. Engineering Controls

If you identify a reproductive hazard at your workplace, action should be taken to reduce the hazard. **The most desirable action is to control exposures to the lowest achievable level for all workers.**

The surest way to prevent toxic substances from causing harm to workers or to a developing fetus is to minimize or prevent exposure. Limiting exposure at the source is the preferred way to protect workers. The types of engineering controls are listed below in order of effectiveness:

- **Substitution** is the use of a less hazardous substance. But before a substitute is chosen, its health and safety hazards must be carefully considered. For example, mineral spirits (Stoddard Solvent) and Freon dry cleaning fluids are less toxic than perchloroethylene; however, mineral spirits pose a greater fire hazard and Freons are a major cause of environmental air pollution.
- **Process or equipment enclosure** is the isolation of the source of exposure, often through automation. This can completely eliminate routine exposure of workers. For example, handling of radioactive materials is often done by mechanical arms or robots.
- **Local exhaust ventilation** is a hood or intake, at or over the source of exposure, which draws contaminated air from its source so that it cannot spread into the room and into a worker's breathing zone.
- **General or dilution ventilation** is continual replacement and circulation of fresh air sufficient to keep concentrations of toxic substances diluted below hazardous levels. However, concentrations will be highest near the source, and overexposure may occur in this area. If the dilution air is not well mixed with the room air, pockets of high concentrations may exist.

15. Personal Protective Equipment

The following devices **should be used only when engineering controls are not possible or are not sufficient to reduce exposure.**

Respirators

Respiratory protective equipment consists of devices that cover the mouth and nose to prevent substances in the air from being inhaled.

A respirator **is effective only when used as part of a comprehensive program established by the employer**, which includes measurement of concentrations of all hazardous substances, selection of the proper respirator, training the worker, maintenance, and replacement of parts when necessary.

A worker should not be assigned to tasks requiring use of a respirator unless it has been determined by a physician that he or she is physically able to perform the work while using the required respiratory equipment. If there is a change in health status, it is recommended that a physician be consulted about continued respirator use.

The use of a respirator **by a pregnant worker** must also be evaluated on a case-by-case basis. Most pregnant women can probably use a respirator without harm. However, certain complications of pregnancy, such as high blood pressure, may make it inadvisable for a woman to continue working at a job which requires the use of a respirator. As with all respirator use, use by a pregnant woman should be evaluated by a qualified occupational medicine physician, taking into account the exposure, the physical demands of the job, the type of respirator, and any complications of pregnancy.

Caution should be exercised in assigning any worker to tasks requiring the use of a respirator if a single overexposure could result in significant harm.

Protective Clothing

Protective clothing includes gloves, aprons, goggles, boots, face shields, and any other items worn as protection. It should be made of material designed to resist penetration by the particular substance being used. Such material is "impervious" to that substance. The manufacturer of the protective clothing usually can provide some information regarding the substances that are effectively blocked. All protective materials eventually become permeated with toxic substances and should be replaced frequently.

Safe Work Practices

Safe work practices can also reduce exposure to hazardous substances. Employers must instruct workers in general safe work practices and must provide specific instructions about hazards unique to a worker's job assignment. Some general recommendations for workers handling hazardous substances are:

- Store toxic substances in sealed containers when they are not in use;
- Avoid skin contact with toxic substances;
- Do not eat, drink, smoke, or apply make-up in work areas;
- If a toxic substance spills on you, change out of contaminated clothing right away and wash yourself with soap and water.

16. Pregnancy as Disability

The Pregnancy Discrimination Act, which amended Title VII of the Civil Rights Act of 1964, provides that unless pregnant workers differ from others in their ability or inability to work, they must be treated the same as other workers for all employment-related purposes. The law has been in effect since 1979.

What the law means is that, **for the purposes of granting disability benefits, pregnancy must be treated in exactly the same way as an illness.** If, as a result of pregnancy, there are medical indications (either maternal or fetal) which prevent a worker from carrying out her job assignment, she has rights. **She is entitled to the same benefits as a worker disabled for any other reason,** providing that she provide the same verification of disability that would be required for any other situation.

The law **offers no protection for a woman planning to have a child** who wants to transfer out of an area with reproductive toxic substances in order to protect her reproductive ability.

It does offer protection if a woman worker gets pregnant and her doctor forbids her to continue working in her present job because of a threat to the fetus from a reproductive toxic substance or a threat to her own health from the job. **In this case, the woman worker follows the same rules as prevail for any disability case.**

17. Medical Removal Protection

While unions must press for reproductive risk protection through OSHA, it is in the arenas of **collective bargaining**, education and public opinion where the pressure for protection must take place.

PACE and the entire labor movement are committed to the principle that companies must keep workers whole. This means in practice that if reproductive hazards are present in the workplace, the company must provide protection from those hazards to the employees.

Until exposures are reduced as low as achievable through engineering controls, work practices, monitoring, etc., an interim solution must be provided.

That interim solution **is to negotiate with the employer for medical removal protection or rate retention clauses in the contract.**

Rate retention clauses in the contract would allow anyone wanting to have a family and who is exposed to reproductive hazards on his or her job **to transfer to another position where there is no exposure.** That transfer would involve **no loss in pay, seniority or benefits** during that temporary period.

OSHA recognizes the need for such protection in some of its health standards. For instance, the benzene standard provides a medical removal protection clause for up to 18 months to someone whose blood tests results are abnormal. A reading of the preamble to the Benzene Standard lays the ground for extending this protection to people wanting to have families.

continued

17. (continued)

A sample rate retention clause would read as follows:

"The company agrees that any worker exposed to a reproductive hazard and wanting to parent a child may elect to transfer out of his or her current job to one involving no exposure to reproductive hazards. He or she shall continue to receive all pay, benefits, and seniority status as if the worker were still assigned to the previous job."

You can decide how long you want this protection provided. This could be 18 months or 24 months to be more protective.

Summary: Reproductive Hazards

1. Much is still **unknown** about the extent to which reproductive problems are caused by workplace hazards. There are some specific substances that are known from animal or human studies to affect the reproductive system. **Both men and women should avoid exposure.** However, workplace exposures are a **preventable** cause of reproductive damage.
2. The goal of employers should be to reduce exposures to the lowest possible levels in order to **protect all employees.**
3. Engineering controls **are the best means** for reducing exposure to reproductive toxic substances. **Personal protective equipment is unreliable** and should only be used for emergency spills.
4. MSDSs are often **not current**, so check other resources for information. A good resource is the OCAW Alice Hamilton Library.
5. The Supreme Court *Johnson Controls* decision made it **illegal to establish exclusionary placement policies for women workers.** As a result, we now have the dilemma that both men and women are exposed to reproductive risks equally and neither are guaranteed protection from this risk.
6. Pregnant workers **cannot be discriminated against** simply because they are pregnant. Moreover, the Supreme Court has ruled that if pregnancy leads to an inability to perform the job, then the employer must treat the pregnancy disability as it would any other disability.
7. The best solution for a workplace with reproductive hazards is to **negotiate with the company for a medical removal protection plan.** In this case, anyone planning to have a family, man or woman, may leave the job involving reproductive risk and transfer to one that involves no exposure without any loss in pay or seniority benefits.
8. The best long-term solution for reproductive hazards is to follow the same rule as prevails for cancer hazards – no exposure at all, through engineering controls, work practices, administrative controls, rigorous air monitoring, and medical surveillance.

Activity 9: Respiratory Protection

Purpose

To learn to evaluate the uses and limitations of respiratory protection; to understand OSHA's "Hierarchy of Controls" concept; and to gain familiarity with the OSHA respiratory protection standard.



Task 1

You are the union members of the health and safety committee. In response to your request, OSHA conducted an inspection of the Hazardous Waste Chemical Unit area. (There had been numerous complaints from workers in this area.) The results are summarized in the chart on the next page. The company has decided to use respirators to bring worker exposures below the OSHA permissible exposure limits (PELs) and has presented their approach at the health and safety committee meeting. They have made the following statement to you.

Statement

"As you have been informed, our company was cited by OSHA recently for exposures to hydrogen fluoride and methylene chloride that exceeded the government's exposure standards for these substances. The OSHA inspector found that the source of the methylene chloride was a broken vent in the solvent trap.

"All exposures occurred in the Chemical Waste Processing Unit (CWPU) where 50 employees work. To correct this situation and to meet our obligations under the law, we have purchased a respirator for each CWPU employee.

"Beginning next Monday, we will distribute an MSA half-face respirator, equipped with organic vapor cartridges, to each affected employee. These masks come in small, medium and large sizes. Each employee should let the safety officer know which mask you think will be most comfortable for your face. Also, each employee will be given two extra cartridges per week.

"As of Monday morning, any employee caught not wearing his/her mask will be disciplined. This is because of our own liability and is necessary for your own protection. We will also make available a full-face respirator (a few of these will be available), instead of the half-face respirator, for those who would like them. We expect that the union health and safety committee will help us explain this situation to the workers, and enforce these needed regulations."

Table of OSHA Sample Results (Hypothetical)

The table below shows the results of the OSHA inspection of the Hazardous Waste Chemical Unit of the OilChem facility.

Date	Job Title	Toxic	Sample Result	OSHA PEL
2/15/89	Operator	Hydrogen Fluoride	7ppm	3ppm
2/15/89	Operator	Methylene Chloride	690ppm	500ppm*
*ACGIH standard is 50 ppm. ACGIH suspects methylene chloride to be a human carcinogen.				

1. Based on your own experience, how would you recommend that the union respond to the OilChem respirator policy?

Task 2

The questions on the next page are a guide to the OSHA regulations on air-purifying respirators. They will assist you in preparing a union response to the OilChem respirator policy.

To answer these questions, you will need to refer to the factsheets on pages 271-279 and the MSDSs on pages 248-270. **(However, you will not have enough information to answer all of the questions. When you can't answer a question, put down what you need to know and go on to the next one.)** Use the score-card on the right side to keep track of your answers for each chemical in question. Please work on the questions as a group.

When you are finished with the worksheet, please answer the following question:

- 1. Based on your analysis of the OSHA respirator standard, what regulation is OilChem violating?**

Worksheet on OSHA Respirator Protocol for Air-Purifying Respirators

1. Are respirators being used either because no other technically feasible controls are available, or because engineering controls are in the process of being installed? (See the factsheet on page 271.)	Hydrogen Fluoride	Methylene Chloride
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No = OSHA violation	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>
2. Is the respirator being used because there is an <i>oxygen deficiency</i> in the area? (Air-purifying respirators are useless if there is not enough oxygen. A self-contained breathing apparatus would be required.)		
Yes = OSHA Violation	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>
3. Is the respirator being used to protect you from a known exposure in the air? (If it isn't airborne, or if we don't know what it is, you are not supposed to use an air-purifying respirator.)		
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No (you're not supposed to wear a respirator)	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>

continued

Task 2 *(continued)*

4. Can you *smell or feel* the toxic you're exposed to before it reaches a dangerous level? (If you can't, it means that if your respirator failed, you'd have no way of knowing it before the damage was already done to your health.) (See the factsheet on page 273.)

**Hydrogen
Fluoride**

**Methylene
Chloride**

Yes

☐
☐

No = OSHA Violation

☐
☐

Not enough information

☐
☐

5. Is the exposure such that there is an Immediate Danger to Life and Health (IDLH)? (This means very short or instantaneous exposure will cause death or permanent health damage.) (If the exposure is an IDLH, the law says that the only type of respirator protection permitted is a self-contained breathing apparatus.)
(See the factsheet on page 279.)

Yes = OSHA violation

☐
☐

No

☐
☐

Not enough information

☐
☐

6. Does the respirator in question have a Protection Factor (PF) that is *lawful* for the task? (See the factsheet on page 274.)

Yes

☐
☐

No = OSHA violation

☐
☐

Not enough information

☐
☐

7. Has the company provided correct respirator cartridges for chemicals in question? (See the factsheet on page 277.)	Hydrogen Fluoride	Methylene Chloride
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No = OSHA violation	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>
8. Have you been fit tested to be certain that the mask will <i>fit you properly</i> ? (See the factsheet on page 276.)		
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No = OSHA violation	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>
9. Have you been medically evaluated to be certain you can handle the physical stress of wearing a respirator for long periods of time?		
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No = OSHA violation	<input type="checkbox"/>	<input type="checkbox"/>
Not enough information	<input type="checkbox"/>	<input type="checkbox"/>



Du Pont Chemicals

4440CR



Revised 3-SEP-1993

Printed 28-OCT-1994

Hydrofluoric Acid - Anhydrous

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number	DU000021
CAS Number	7664-39-3
Formula	HF
CAS Name	HYDROFLUORIC ACID
Grade	TECHNICAL

Tradenames and Synonyms

HYDROGEN FLUORIDE
HF
AHF
CC0104

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information	1-800-441-9442
Transport Emergency	CHEMTREC: 1-800-424-9300
Medical Emergency	1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

**Components
Material****CAS Number %**

*HYDROGEN FLUORIDE	7664-39-3	100
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* Regulated as a Toxic Chemical under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

(Continued)

HAZARDS IDENTIFICATION

Potential Health Effects

Extremely hazardous liquid and vapor. Causes severe skin and eye irritation or burns, which may be delayed. Anhydrous HF causes immediate and serious burns on contact; concentrations less than 50% may not produce symptoms for 8 hours or longer. Wearing clothing contaminated with HF (such as shoes, gloves) may result in painful delayed effects. Inhalation overexposure may cause lung damage with pulmonary edema (fluid accumulation in the lungs).

HUMAN HEALTH EFFECTS:

Overexposure by eye or skin contact with the liquid may include severe eye and skin corrosion, excruciatingly painful, deep-seated and slow healing burns and ulcers. Causes immediate burns and rapid destruction of tissue accompanied by severe pain at concentrations about 50%; in 20% to 50% concentrations, the burns can be delayed 1-8 hours; in concentrations less than 20%, painful erythema may be delayed 24 hours; latent skin burns with necrosis can occur even at concentrations of 2%. The fluoride ion readily penetrates the skin and deep tissue causing destruction of soft tissue and decalcification of bone. Tissue destruction and neutralization of HF proceed for days.

Ingestion of the liquid may cause severe burns to the mouth and tissues of the upper gastrointestinal tract with severe pain, bleeding, vomiting, diarrhea, and collapse of blood pressure.

Overexposure by skin or eye contact with the vapors may cause skin irritation or corrosion with discomfort and rash; eye irritation with discomfort, tearing, or blurring of vision; or eye corrosion with corneal or conjunctival ulceration.

HF can be absorbed through the skin in toxic amounts.

Overexposure by inhalation can cause choking and coughing; severe eye, nose, and throat irritation followed, after an asymptomatic period of 1 to 2 days, by fever, chills, difficulty in breathing, cyanosis and pulmonary edema; hypocalcemia which leads to life-threatening cardiac arrhythmias; or kidney and liver damage. Overexposure by inhalation to concentrated hydrogen fluoride vapors can cause pulmonary edema and death within 2 to 3 hours. Prolonged overexposure to the vapors can cause fluorosis which may also result in weight loss, brittle bones, anemia, weakness and stiffness of joints, and discoloration of the teeth when exposures occur during tooth formation.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

(Continued)

FIRST AID MEASURES

First Aid

Speed in removing exposed personnel from contaminated area and in removing HF from skin or eyes is of primary importance. First aid must be started immediately, within seconds, in all cases of contact with hydrofluoric acid in any form. All potentially exposed personnel should be trained in first aid care for HF burns. First aid actions should be planned before beginning work with HF. Calcium gluconate gel should be readily accessible in areas where HF exposure potential exists.

Medical assistance should be obtained promptly for all affected persons. The doctor should be informed in detail of the accident.

HF differs from other acids in that the fluoride ion readily penetrates skin, causing destruction of deep tissue layers including bone. Unlike the action of other acids, which are rapidly neutralized, this process may continue for days.

SKIN CONTACT: IMMEDIATELY shower with large quantities of water, within seconds after contact or suspected contact, and completely remove all clothing while in the shower (remove goggles last). FLUSH SKIN THOROUGHLY WITH WATER FOR 5 MINUTES. Flushing with water thoroughly for 5 minutes is sufficient to effectively remove HF from skin. Additional flushing time is unnecessary and will delay further treatment.

Apply calcium gluconate (2.5%) gel at burn site or area of contamination by rubbing in continuously. Wear impervious gloves. Examination and treatment by a physician is recommended as quickly as feasible. It may be necessary to transport patient to nearest hospital emergency room. Remember that concentrated HF causes immediate pain, BUT DILUTE HF SOLUTIONS MAY NOT CAUSE REDNESS, BURNING OR PAIN UNTIL SEVERAL MINUTES OR EVEN HOURS HAVE ELAPSED.

EYE CONTACT: IMMEDIATELY flush eyes with large quantities of water for 5 MINUTES while holding the eyelids apart. Trained personnel should apply calcium gluconate 1% (no stronger) by continuous drip. THE EYES WILL REQUIRE FURTHER TREATMENT--SEE NOTES TO THE PHYSICIAN--"EYE CONTACT".

VAPOR INHALATION: IMMEDIATELY remove the patient to an uncontaminated atmosphere. Call a physician. Administer oxygen as soon as possible. Trained personnel should provide calcium gluconate, 2.5% solution, by nebulizer with patient in the sitting position. Keep patient warm.

INGESTION: DO NOT induce vomiting. Immediately drink water to dilute the acid, followed by milk of magnesia. Call a physician. Throat burns may cause severe swelling and require a tracheotomy (opening the windpipe). The patient

(Continued)

FIRST AID MEASURES (Continued)

should be admitted to the hospital and carefully attended.

MEDICAL SUPPLIES: The following materials have been found to be useful and effective in the treatment of hydrogen fluoride burns, and should be on hand at the First Aid Station:

- o Calcium gluconate gel-2.5%. This gel is prepared by mixing 3.5 grams of USP calcium gluconate powder with a 5-ounce tube of surgical water-soluble lubricant (e.g., K-Y Lubricating Jelly, Johnson & Johnson) or by mixing 1 standard ampule (10 mL, 10%) of USP calcium gluconate with 1-ounce of water-soluble lubricant. The shelf life of the gel has not been determined. Storage of gel has limitations and refrigeration may help.
- o Calcium gluconate 10% (standard ampules).
- o One percent calcium gluconate in normal, sterile saline solution. Make by mixing 1 standard ampule per 90 mL of saline solution.
- o 2.5 percent calcium gluconate in normal, sterile saline solution. Make by mixing 1 standard ampule per 30 mL of saline solution.
- o Milk of magnesia.
- o 99% pure USP medical oxygen with regulator and mask.
- o Impervious gloves.
- o Nebulizer.
- o Blanket.
- o Shower facilities.

NOTES TO PHYSICIAN

Choice of therapy following first aid measures is at the discretion of attending physician. Selection of the best treatment will depend on the following factors:

- o Concentration and temperature of the HF.
- o Degree and extent of the burn.
- o Duration of exposure.
- o Areas of the body affected.
- o Elapsed time since exposure.

(Continued)

FIRST AID MEASURES(Continued)

- o First aid measures taken before physician's arrival.
- o Age and clinical history of patient.
- o General condition of the patient.

The following methods, using materials listed under MEDICAL SUPPLIES, have been effective in treatment of HF burns. Methods are broken down by routes of exposure. Minor exposures are limited exposures to HF liquid and vapor. Major exposures are extensive exposures to HF liquid and vapor and all cases of combined routes of exposure, e.g., skin and inhalation exposures. Patients suffering suspected face or chest skin exposure should be assumed to have incurred inhalation exposure also.

In all cases of major exposure by HF, hypocalcemia may be present, therefore, calcium levels must be determined immediately upon arrival at the hospital. During hospitalization calcium levels should be monitored frequently. If possible, blood should be drawn for serum calcium in site medical facility and sent to the hospital with the patient.

Cardiac monitoring (EKG) is necessary (hypocalcemia causes prolonged Q-T interval and may cause cardiac rhythm abnormalities). Renal and liver function should be monitored.

In major inhalation exposure, pulmonary edema or edema of upper airway may occur. Blood gases should be monitored accordingly.

SKIN CONTACT: Topically applied Calcium Gluconate Gel (2.5%) must be rubbed into all burn areas continuously until pain has completely subsided, but not longer than 30 minutes. Calcium gluconate gel should not be used until after thorough and complete washing of the skin with water for 5 minutes. If pain continues for longer than 30 minutes, proceed with calcium gluconate topical injections. Care should be taken to see that the personnel who apply the gel, especially on the initial applications, wear impervious gloves to prevent skin contamination with HF and the development of hand burns.

Calcium Gluconate Topical Injections: When there is evidence of skin penetration as in second or third degree burns, a 5% calcium gluconate solution (standard ampule of 10% calcium gluconate for intravenous use must be diluted to 5% by mixing with an equal amount of normal sterile saline) may be injected by infiltrating the skin and subcutaneous tissues in the same manner as injection of any local anesthetic. Use stainless steel needles. Care should be taken to avoid overdosing with calcium. All skin which has

(Continued)

FIRST AID MEASURES(Continued)

been exposed should be infiltrated including up to 1/4 inch (6 mm) around area. This may prevent development of severe burns. Use of a local anesthetic is contraindicated since pain is indicative of response to treatment.

Burns around the fingernail may require splitting the nail from the distal end in order to relieve pain and facilitate draining.

In cases of overexposure due to HF, as in skin burns of greater than approximately 25 square inches (160 cm²) in area, hypocalcemia may be present. Therefore, systemic administration of calcium gluconate may be necessary. Frequent monitoring of serum calcium, cardiac, renal, and hepatic functions is necessary.

EYE CONTACT: Immediate rapid washing of the eyes with large quantities of water for 5 minutes should be followed by continuous drip of 1% calcium gluconate (no stronger) in normal, sterile saline. No oils or ointments should be used.

Inflammation may be decreased by the use of corticosteroid solutions for ophthalmic use. An eye specialist should be consulted immediately.

VAPOR INHALATION: Persons suspected of having had HF exposure by inhalation should immediately be given 100% oxygen by mask or catheter. As soon as possible (as precautionary treatment), they should be administered (in the sitting position and utilizing a nebulizer) 2.5% calcium gluconate solution by inhalation for 20 minutes. All those suspected of HF exposure and who experience signs and/or symptoms of respiratory irritation should be considered as strong candidates for admission to an intensive care unit for careful observation during the first 24-48 hours. Delayed pulmonary edema is likely in patients with burns of the skin of face or neck.

Patient should be carefully watched for edema of the upper airway with respiratory obstruction and the airway maintained by tracheotomy or endotracheal intubation if necessary. The administration of respiratory care should be very closely supervised and most likely includes continued administration of 2.5% calcium gluconate by inhalation. Toxicity from pulmonary absorption of fluoride ion may rapidly develop in the liver and kidneys and may require more energetic measures of control, up to and including hemodialysis, particularly if the blood urea nitrogen and potassium levels rise. Supportive care is necessary for all organ systems.

INGESTION: Refer to first aid measures as described. Gastric lavage with lime water or milk may be performed, but only by a physician. Treatment is the same as for ingestion of other strong acids.

(Continued)

FIRE FIGHTING MEASURES

Flammable Properties

Will not burn.

Fire and Explosion Hazards:

HF (particularly in dilute aqueous solutions) will attack most metals, releasing potentially explosive hydrogen gas. Follow appropriate National Fire Protection Association (NFPA) codes.

Extinguishing Media

Water Fog. Dry Chemical. CO2.

Fire Fighting Instructions

Keep upwind. If there is any possibility of direct contact, wear full acid suit with hood, boots and self-contained breathing apparatus. Do not get water into acid tanks - generates heat. Run-off from fire control may cause pollution; neutralize with lime.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Evacuate area and keep upwind until gas has dispersed. Enter contaminated area only with full protective equipment and self-contained breathing apparatus. Dike spill. Dilute with water fog (direct addition of water or alkali causes heat and violent spattering). Neutralize with lime. Do not flush to sewer. Comply with Federal, State, and local regulations on reporting releases.

DuPont Emergency Exposure Limits (EEL) are established to facilitate site or plant emergency evacuation, and specify airborne concentrations of brief durations which should not result in permanent adverse health effects or interfere with escape. EEL's are expressed as airborne concentration multiplied by time (C x T) for up to a maximum of 60 minutes and as a ceiling airborne concentration. These limits are used in conjunction with engineering controls/monitoring and as an aid in planning for episodic releases and spills. For more information on the applicability of EEL's, contact DuPont.

The DuPont Emergency Exposure Limit (EEL) for Hydrofluoric Acid is 200 ppm-min (for example, 40 ppm for 5 min; 20 ppm for 10 min; 6.7 ppm for 30 min; etc.) with a not-to-exceed ceiling of 100 ppm.

(Continued)

HANDLING AND STORAGE

Handling (Personnel)

Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

Keep containers closed.

Storage

Keep away from heat, sparks, and flame. Keep container tightly closed. Drainage facilities should be constructed for containment of small spills.

NOTE:

HF may react with steel, forming iron fluorides. During storage tank cleaning, iron fluoride particles may be released which, if inhaled, may cause lung damage. Iron fluoride scale reacts with water to produce HF, which may cause delayed burns when skin or eye contact occurs.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use only with ventilation sufficient to keep vapor concentrations below the exposure limit. Use forced draft ventilation and scrubbers for fume control.

Personal Protective Equipment

EYE/FACE PROTECTION

Wear chemical splash goggles. In addition, where the possibility exists for face contact due to splashing or spraying of the material, wear a full-length face shield/chemical splash goggle combination or an acid hood.

RESPIRATORS

If exposure limits may be exceeded, wear NIOSH/MSHA approved respiratory protection.

PROTECTIVE CLOTHING

Where there is potential for skin contact, have available and wear as appropriate: neoprene rubber gauntlet gloves, boots, and neoprene or vinyl jacket and pants. If there is any possibility of direct contact, wear a full acid suit of neoprene, vinyl, or other acid resistant material with hood, gloves, boots, and self-contained breathing apparatus. The highest degree of protection, used for large leaks or in an emergency situation, is provided by a fully encapsulating acid resistant suit (one piece construction) with an independent air supply.

Protective clothing and equipment should not be worn or

(Continued)

EXPOSURE CONTROLS/PERSONAL PROTECTION(Continued)

carried outside of the operating area. Wash protective clothing and equipment under a safety shower after exposure, or suspected exposure, to hydrofluoric acid.

Exposure Guidelines**Exposure Limits**

Hydrofluoric Acid - Anhydrous

PEL (OSHA)	3 ppm, 8 Hr. TWA, as F
TLV (ACGIH)	3 ppm, 2.6 mg/m ³ , Ceiling as F
AEL * (Du Pont)	3 ppm, 15 minute TWA

* AEL is Du Pont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES**Physical Data**

Boiling Point	19.5 C (67.1 F) @ 760 mm Hg
Vapor Pressure	775 mm Hg @ 20 C (68 F)
	1525 mm Hg @ 40 C (104 F)
Vapor Density	3.0 (Air = 1.0)
	at 25 deg C
Melting Point	-83.5 C (-118.3 F)
Evaporation Rate	(Butyl Acetate = 1)
	Greater than 1
Solubility in Water	100 WT%
pH	-2.0
	(2% Aqueous solution)
Odor	Acrid
Form	Clear, fuming liquid
Color	Colorless
Specific Gravity	~1 @ 0C (32F)

STABILITY AND REACTIVITY**Chemical Stability**

Stable, if stored in proper (steel) container.

Decomposition

Decomposition will not occur.

Other Hazards

Incompatibility : Reacts violently with water and alkaline solutions; with cyanides to give toxic hydrogen cyanide; with sulfides to give toxic hydrogen sulfide. Also corrodes glass and ceramics.

Polymerization : Non-hazardous endothermic polymerization may occur in the gaseous phase.

(Continued)

TOXICOLOGICAL INFORMATION**Animal Data**

Inhalation 1-hour LC50 : 2,300 ppm in rats
Skin absorption 1-2 minute ALD: 500 mg/kg in mice

The compound is corrosive to skin and eyes of animals and is extremely toxic by dermal exposure. Toxicity described in animals from exposure by inhalation includes an uptake of fluoride into bones and teeth that may cause disturbances in the calcification processes. Other effects of inhalation include edema, pulmonary congestion and hemorrhage; anemia; weight loss; and effects in the liver, lungs, and kidneys.

No carcinogenic effects were observed in guinea pigs exposed for 18 months to 0.2 ppm of HF. Embryotoxicity was observed in animals exposed by inhalation, but only at levels that were maternally toxic. Studies show that HF causes heritable genetic damage in insects. No acceptable animal test reports are available to define developmental or reproductive toxicity.

ECOLOGICAL INFORMATION**Ecotoxicological Information****Aquatic Toxicity**

No definitive information is available. The estimated 96-hour LC50 is 1-50 ppm.

DISPOSAL CONSIDERATIONS**Waste Disposal**

Comply with Federal, State, and local regulations. If approved, may be flushed to sewer to waste treatment plant, or transferred to a disposal contractor.

TRANSPORTATION INFORMATION**Shipping Information**

DOT	
Proper Shipping Name	HYDROGEN FLUORIDE, ANHYDROUS*
Hazard Class	CLASS 8 (CORROSIVE MATERIAL)
I.D. No. (UN/NA)	UN 1052
DOT Label(s)	CORROSIVE, POISON
Special Information	PACKAGING GROUP: PG I; POISON-INHALATION HAZ.; HAZARD ZONE C
DOT Placard	CORROSIVE, POISON

Reportable Quantity : 100 lbs/45.4 kg

*If shipped in quantities greater than 100 lbs., the Proper Shipping Name is RQ, HYDROGEN FLUORIDE, ANHYDROUS

(Continued)

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
 Chronic : Yes
 Fire : No
 Reactivity : Yes
 Pressure : No

LISTS:

SARA Extremely Hazardous Substance -Yes
 CERCLA Hazardous Material -Yes
 SARA Toxic Chemical -Yes

CANADIAN WHMIS CLASSIFICATIONS:

D-1A; E

Anhydrous hydrogen fluoride is specifically listed in Appendix A of CFR 1910.119. Use of anhydrous hydrogen fluoride may require compliance with 29CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals.

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating	
Health	4
Flammability	0
Reactivity	0

NPCA-HMIS Rating	
Health	3
Flammability	0
Reactivity	2

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

For further information, see DuPont's Hydrofluoric Acid "Data Sheet" and Properties, Uses, Storage, and Handling Bulletin.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS	DuPont Chemicals
Address	Engineering & Product Safety P. O. Box 80709, Chestnut Run Wilmington, DE 19880-0709
Telephone	302-999-4946

Indicates updated section.

End of MSDS



Material Safety Data Sheet

The Dow Chemical Company
Midland, Michigan 48674
Emergency 517-636-4400

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Page: 1

24-Hour Emergency Phone Number: 517-636-4400

Product: METHYLENE CHLORIDE, TECHNICAL

Product Code: 55590

Effective Date: 04/26/94 Date Printed: 01/06/95 MSD: 000009

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Methylene chloride CAS# 000075-09-2 99.9%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

* Colorless liquid. Ether-like odor. Harmful if inhaled. Can cause *
* death if too much is breathed. Contain liquid. Avoid ground and *
* water contamination. *
* EMERGENCY PHONE NUMBER: (U.S.) 517-636-4400 / IN CANADA SEE ABOVE *

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause pain, moderate eye irritation and slight corneal injury. Vapors may irritate eyes.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation, even a burn. Repeated contact may cause drying or flaking of skin. May cause more severe response if confined to skin. Extensive skin contact with methylene chloride, such as immersion, may cause an intense burning sensation followed by a cold, numb feeling which will subside after contact.

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M A T E R I A L S A F E T Y D A T A S H E E T

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SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts.

INGESTION: Single dose oral toxicity is low. If aspirated (liquid enters the lung), may be rapidly absorbed through the lungs and result in injury to other body systems.

INHALATION: In confined or poorly ventilated areas, vapors can readily accumulate and can cause unconsciousness and death. Minimal anesthetic or narcotic effects may be seen in the range of 500-1000 ppm methylene chloride. Progressively higher levels over 1000 ppm can cause dizziness, drunkenness; concentrations as low as 10,000 ppm can cause unconsciousness and death. These high levels may also cause cardiac arrhythmias (irregular heartbeats).

Excessive exposure may cause irritation to upper respiratory tract. Excessive exposure may cause carboxyhemoglobinemia, thereby impairing the blood's ability to transport oxygen.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Signs and symptoms of excessive exposure may be central nervous system effects. Excessive exposure may cause carboxyhemoglobinemia, thereby impairing the blood's ability to transport oxygen. Observations in animals include liver and kidney effects.

CANCER INFORMATION: For hazard communication purposes, under OSHA Standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by IARC and NTP. Methylene chloride has been shown to increase the rate of spontaneously occurring malignant tumors in the B6C3F1 mouse and benign tumors in laboratory rats. Other animal studies, as well as several human epidemiology studies, failed to show a tumorigenic response. Methylene chloride is not believed to pose a measurable carcinogenic risk to man when handled as recommended.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 3****Product: METHYLENE CHLORIDE, TECHNICAL**

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effects to the mother.

REPRODUCTIVE EFFECTS: In animal studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYES: Irrigate with flowing water immediately and continuously for 15 minutes. Consult medical personnel.

SKIN: Wash off in flowing water or shower.

INGESTION: Do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

NOTE TO PHYSICIAN: Because rapid absorption may occur through lungs if aspirated and cause systemic effects, the decision of whether to induce vomiting or not should be made by a physician. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach. Exposure may increase "myocardial irritability." Do not administer sympathomimetic drugs unless absolutely necessary. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient. Carboxyhemoglobinemia may aggravate any preexisting condition sensitive to a decrease in available oxygen, such as chronic lung disease, coronary artery disease or anemias.

5. FIRE FIGHTING MEASURES

FLASH POINT: None

METHOD USED: TOC, TCC, COC

AUTOIGNITION TEMPERATURE: 556 C or 1033 F

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FLAMMABLE LIMITS

LFL: 14% @ 25C

UFL: 22% @ 25C

HAZARDOUS COMBUSTION PRODUCTS: Open flames and welding arcs can cause thermal degradation with the evolution of hydrogen chloride and very small amounts of phosgene and chlorine.

EXTINGUISHING MEDIA: Water fog.

FIRE FIGHTING INSTRUCTIONS: Forms flammable vapor-air mixtures. Lower temperatures increase the difficulty of getting it to ignite.

PROTECTIVE EQUIPMENT FOR FIREFIGHTERS: Wear positive pressure breathing apparatus, and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Evacuate area. Wear appropriate respiratory protection. Avoid breathing vapors. Ventilate area. Follow confined space entry procedures.

PROTECT ENVIRONMENT: Contain liquid, transfer to closed metal containers. Avoid ground and water contamination.

CLEANUP: For small spills, mop up, wipe up or soak up immediately.

7. HANDLING AND STORAGE

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

Exercise reasonable care and caution. Avoid breathing vapors. Store in cool place. Concentrated vapors of this product are heavier than air and will collect in low areas such as pits, degreasers, storage tanks, and other confined areas. Do not enter these areas where vapors of this product are suspected unless special breathing apparatus is used and an observer is present for assistance. The use of air for unloading product out of vessels or transport containers is not recommended.

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Cold cleaning operations using methylene chloride should be engineered to provide for confining solvent vapors, adequate ventilation and/or respiratory protection to reduce the potential for overexposure to vapors. Gloves or other protective equipment should be worn if skin contact is likely. Goggles should be worn if eye contact is possible.

The Consumer Products Safety Commission issued a Statement of Policy for household products containing methylene chloride. The policy statement establishes labeling guidelines for consumer products containing methylene chloride (including paint strippers, wood stains and varnishes, spray paints, adhesives and glues, and a number of other household products). The policy requires labels to include statements of principal hazard and indicate that the risk to the user is related to the level and duration of exposure. It appeared in the Federal Register, Vol. 52, No. 177, on Monday, September 14, 1987.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines. Lethal concentrations may exist in areas with poor ventilation.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use chemical goggles. If vapor exposure causes eye discomfort, use a full-face respirator.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as face-shield, gloves, boots, apron, or full-body suit will depend on operations. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required, use an approved air-purifying or positive-pressure supplied-air respirator depending on the potential airborne concentration. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved

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positive-pressure self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. In confined or poorly ventilated areas, use an approved positive-pressure supplied-air respirator.

EXPOSURE GUIDELINES: Methylene chloride: ACGIH TLV is 50 ppm, A2. OSHA PEL is 500 ppm TWA, 1000 ppm Ceiling, 2000 ppm Peak. PELs are in accord with those recommended by OSHA, as in the 1989 revision of PELs.

9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 104F (39.8C)

VAP. PRESS: 355 mmHg @ 20C

VAP. DENSITY: 2.93

SOL. IN WATER: 2.0g/100g @ 25C

SP. GRAVITY: 1.320 @ 25/25C

APPEARANCE: Colorless liquid.

ODOR: Penetrating ether-like odor. Irritating at high concentrations.

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under normal conditions of use.

CONDITIONS TO AVOID: Avoid open flames, welding arcs, or other high temperature sources which induce thermal decomposition to irritating and corrosive HCL from solvent vapor. High energy ultra-violet sources such as welding arcs can cause degradation generating chlorine, hydrogen chloride and possible phosgene, and should be avoided.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, aluminum, possibly sodium, potassium, and finely divided magnesium, aluminum or zinc.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 7**

Product: METHYLENE CHLORIDE, TECHNICAL
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SKIN: The dermal LD50 has not been determined.

INGESTION: The oral LD50 for rats is in the range of 1500-2500 mg/kg.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): Negative or equivocal results have been obtained in mutagenicity tests with methylene chloride using mammalian cells or animals. This is consistent with the lack of interaction with DNA in rats and hamsters. Although results of Ames bacterial tests have generally been positive, overall the data suggest that genotoxic potential does not appear to be a significant factor in the toxicity of methylene chloride.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT AND PARTITIONING: Bioconcentration potential is low (BCF less than 100 or Log Kow less than 3). Log octanol/water partition coefficient (log Kow) is 1.25. Log air/water partition coefficient (log Kaw) is -0.94. Henry's Law Constant (H) is estimated to be 2.48 E-03 atm-m³/mol.

DEGRADATION & TRANSFORMATION: Material has shown potential to biodegrade: Attains aerobic degradation rate of 2.3 mg/h/g of activated sludge. Material has shown potential to biodegrade: Attains aerobic biodegradation in a variety of surface soils. Material has shown potential to biodegrade: Attains 86-92% conversion to CO₂ in anaerobic wastewater. Biodegradation rate may increase in soil and/or water with acclimation. Degradation is expected in the atmospheric environment within months to years.

ECOTOXICITY: Material is slightly toxic to aquatic organisms on an acute basis (LC50 between 10 and 100 mg/L in most sensitive species).

Acute LC50 for water flea (*Daphnia magna*) is 27-2270 mg/L.

Acute LC50 for sheepshead minnow (*Cyprinodon variegatus*) is 62-331 mg/L.

Acute LC50 for fathead minnow (*Pimephales promelas*) is

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193-330 mg/L.

Acute LC50 for bluegill (*Lepomis macrochirus*) is 224 mg/L.Acute LC50 for guppy (*poecilia reticulata*) is 294 mg/L.Acute LC50 for water flea (*Daphnia magna*) is 27-2270 mg/L.Acute LC50 for mysid (*Mysidopsis bahia*) is 256 mg/L.

Maximum acceptable toxicant concentration (MATC) is 108 mg/L.

Growth inhibition EC50 for green alga *Selenastrum capricornutum* is >662 mg/L.Algal growth inhibition EC50 for marine diatom *Skeletonema costatum* is >662 mg/L.**13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)**

DISPOSAL: Any disposal practice must be in compliance with all federal, state/provincial, and local laws and regulations. State/provincial and local requirements for waste disposal may be more restrictive or otherwise different from federal laws and regulations. Regulations may also vary in different locations. Chemical additions, processing, storage, or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate, or otherwise inappropriate. Waste characterization and disposal compliance are the responsibility solely of the party generating the waste or deciding to discard or dispose of the material. None of these waste management options should be considered 'arranging for disposal'.

Keep material in closed containers. Do not allow into any sewers, on the ground, or into any body of water. Do not landfill.

The preferred waste management option is to send to a properly licensed or permitted recycler, reclaimer, or incinerator. The same waste management options are recommended for use or contaminated material, although additional evaluation is required. Refer to 40 CFR Section 261, and/or any other appropriate federal, state, provincial, or local requirements for proper classification information.

As a service to its customers, The Dow Chemical Company can provide lists of companies which recycle, reprocess, or manage chemicals as well as lists of companies that recondition used

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 9****Product: METHYLENE CHLORIDE, TECHNICAL**

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drums. Telephone Dow's Customer Information Center at 517-832-1556 or 800-258-2436 (U.S.) for further details.
Contact The Dow Chemical Company for additional information.

14. TRANSPORT INFORMATION**CANADIAN TDG INFORMATION:**

For TDG regulatory information, if required, consult transportation regulations, product shipping papers, or your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

=====

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
DICHLOROMETHANE (METHYLENE CHLORIDE)	000075-09-2	99.9 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following

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REGULATORY INFORMATION (CONTINUED)

categories:

An immediate health hazard

A delayed health hazard

CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer. (See Section 6 of the MSDS for details on carcinogenicity.)

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
DICHLOROMETHANE (METHYLENE CHLORIDE)	000075-09-2	PA1 PA2 PA3 NJ2 NJ3

NJ2=New Jersey Environmental Hazardous Substance (present at greater than or equal to 1.0%).

NJ3=New Jersey Workplace Hazardous Substance (present at greater than or equal to 1.0%).

PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).

PA2=Pennsylvania Special Hazardous Substance (present at greater than or equal to 0.01%).

PA3=Pennsylvania Environmental Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

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REGULATORY INFORMATION (CONTINUED)

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Health	2
Flammability	1
Reactivity	0

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND):

This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases:

Category:

Chemical Name	CAS#	RQ	% in Product
Methylene chloride	000075-09-2	1000	99.9%

CANADIAN REGULATIONS

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

D1B - poisonous substance defined by TDG regulations

D2A - possible, probable or known human carcinogen according to classifications by IARC or ACGIH

D2B - eye or skin irritant

Refer elsewhere in the MSDS for specific warnings and safe handling information. Refer to the employer's workplace education program.

CPR STATEMENT: This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR)

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M A T E R I A L S A F E T Y D A T A S H E E T**PAGE: 12****Product: METHYLENE CHLORIDE, TECHNICAL**

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REGULATORY INFORMATION (CONTINUED)

and the MSDS contains all the information required by the CPR.

HAZARDOUS PRODUCTS ACT INFORMATION: This product contains the following ingredients which are Controlled Products and/or on the Ingredient Disclosure List (Canadian HPA section 13 and 14):

COMPONENTS:	CAS #	AMOUNT (%w/w)
Methylene Chloride	CAS# 000075-09-2	99.9%

16. OTHER INFORMATION

Process water in contact with solvent and/or water separators of cleaning or distillation equipment should be treated as hazardous waste. Do not discharge water from water separators to drain.

MSDS STATUS: Revised sections 5, 6, 7, 8, 14, and 15.

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The Information Herein Is Given In Good Faith, But No Warranty,
Express Or Implied, Is Made. Consult The Dow Chemical Company
For Further Information.

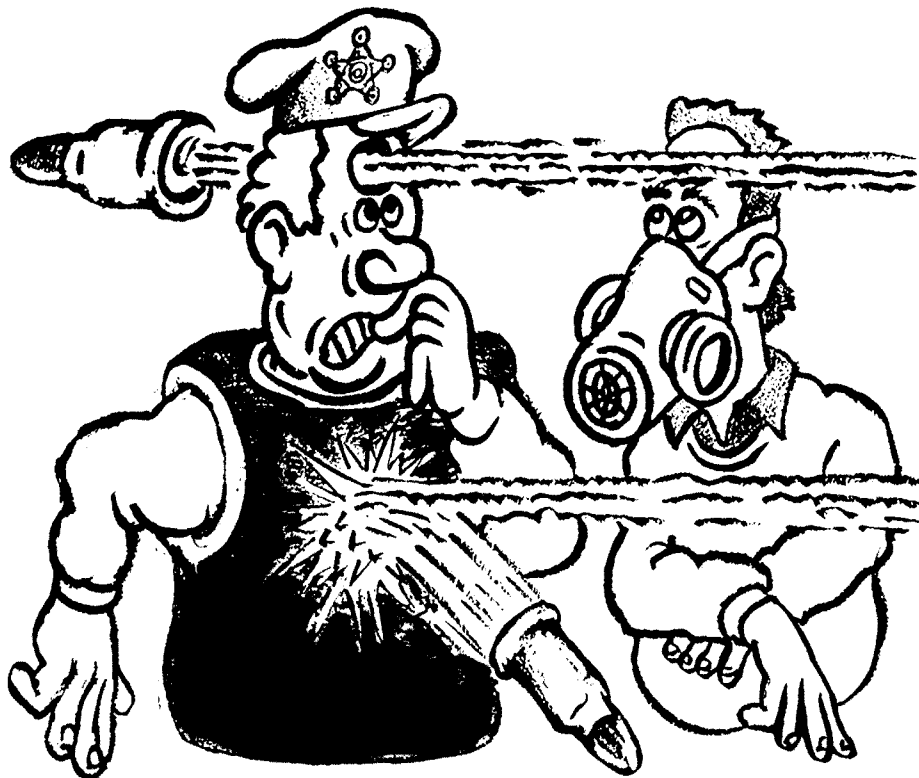
1. Respirators: A Last Ditch Control

Respirators are extremely limited as a control device. Their use must be carefully monitored. Here are some of the major problems.

Respirators . . .

- are hot and uncomfortable
- often fit poorly (allowing the toxic substance to get in)
- put extra stress on the heart and lungs
- limit conversation (and therefore safety)
- do not offer any protection whatsoever against many chemicals
- do not stop the toxic chemical from getting into the environment
- do not prevent skin exposure.
- also, half-face respirators don't prevent eye exposure.

continued



1. *(continued)*

In a sense, **wearing a respirator to stop a dangerous chemical exposure is like wearing a bulletproof vest to stop a bullet.** You are a lot safer if you stop the gun from firing than you are if you wear a vest for protection.

Here's what OSHA actually says in their Respiratory Protection Standard (29 CFR 1910.134):

"In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used."

For example, hydrogen fluoride will not only damage your lungs, it is also one of the most corrosive chemicals to the skin. (See the MSDS starting on page 248.) It is always better to prevent exposures than to rely on respirators.

2. How Do You Know if Your Respirator Works?

Every air-purifying respirator could fail. And **the only way you'll know if it's failing is if you can smell or feel the toxic chemical before it has already damaged you.** To make sure this happens, OSHA's respirator standard demands that respirators only be used if you can detect the substance at a level below the OSHA permissible level. Let's review how this would work for the two substances in our hypothetical example.

Toxic	Sample Result	OSHA PEL	Detectable Level
Hydrogen Fluoride	7.0 ppm	3.0 ppm	.04 ppm
Methylene Chloride	690.0 ppm	500.0 ppm*	200.0 ppm**

*ACGIH standard is 50 ppm TLV. ACGIH suspects methylene chloride to be a human carcinogen.

**Can adapt to odor with repeated exposure.

For methylene chloride we find that the detectable level is below the OSHA standard, but after repeated exposure our noses can adapt to the odor. This means that after a while we can't smell it at any level. The OSHA respirator standard says that when we can adapt to odors, it's unsafe to use an air-purifying respirator. (In other words, if the respirator failed, we would have no way of knowing it until too late.)

For **hydrogen fluoride**, we can see that the detectable level is well below the OSHA standard. This means that certain respirators may be permissible to use, as long as all the other parts of the standard are followed. (Remember, hydrogen fluoride will burn the skin and eyes.)

3. Protection Factors: Does Your Respirator Offer Enough Protection?

There are a number of different kinds of respirators. Each one is rated for the amount of protection it provides. This is called the **Protection Factor (PF)** and it is a property of the mask itself. A PF of 10 means that you are permitted to wear the particular respirator for levels of the chemical in the air that do not exceed the DOE-mandated OSHA Permissible Exposure Limit (PEL) by more than 10 times. The chart below shows the PF for different kinds of respirators.

Type of Respirator	Protection Factor	OCAW Leak Factor*	IDLH**	Low O ₂ [†]
Half-Face Air-Purifying Respirator	10	10%	N	N
Full-Face Air-Purifying Respirator	50	2%	N	N
Powered Air-Purifying Respirator	100	1%	N	N
Supplied-Air Respirator (Pressure Demand)	1000	0.1%	N	N
Self-Contained Breathing Apparatus (SCBA) (Pressure Demand) ^{††}	10,000	0.1%	Y	Y

* The OCAW leak factor is a measurement developed by OCAW Health and Safety staff to describe the percentage of unfiltered, contaminated air which will leak through the sides of the mask. For example, a half-face mask has a leak factor of 10 percent. If the contaminant level of the air you are breathing is 10 ppm, then the contamination level inside the mask would be 1 ppm (10 percent of 10 ppm is 1 ppm).

** IDLH – Permitted for use in Immediately Dangerous to Life or Health atmospheres (Yes or No).

[†] Low O₂ – Permitted for use in oxygen deficient atmospheres (Yes or No).

^{††} NFPA requirements have forced most people to use only pressure demand SCBAs. In fact, these are the only ones being made.

Here's an example of how the PF works:

Suppose the exposure involves chemical x . Assume this chemical has an OSHA Permissible Exposure Limit (PEL) of 1 ppm. **How high can the exposures be in your area for your particular respirator?**

The answer is easy to calculate. Just take the PF for the kind of mask you have and multiply it by the PEL. In this case, for a half-face with a PF of 10, multiply 10 times the PEL of 1 ppm and you get 10 ppm. This means if the exposure to chemical x in your area is 10 ppm or less, a half-face respirator will reduce your exposure to below 1 ppm if it is working properly. If it is more than 10 ppm, you need a better mask.

Conversely, you can tell what kind of exposure you will be receiving. If you know what the exposure level of chemical x is, just divide this by the PF, and this is your exposure **inside the mask!**

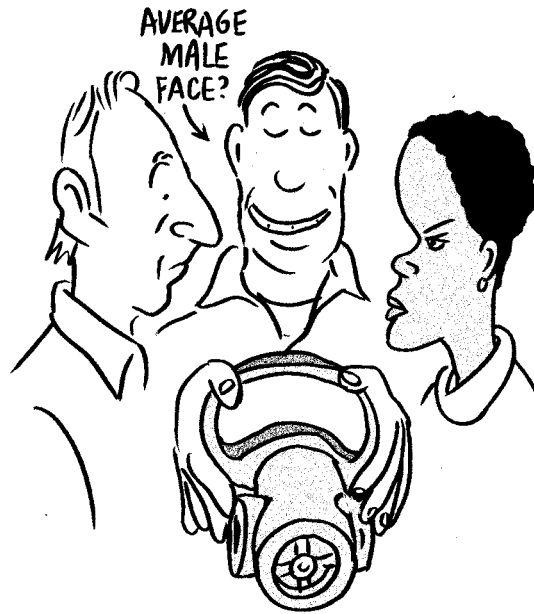
For example, if exposure monitoring in your area reveals a level for chemical x of 15 ppm, and you were wearing that same half-face respirator, your exposure inside the mask would be 1.5 ppm.

4. What Is Fit Testing?

It turns out that respirators are not made to fit every kind of face. As a result, OSHA mandates that the company make certain the respirators properly fit each of us.

Most respirators are made to fit the **average male face**. Fortunately, only half of us are males, and very few of us have average faces!

Scars, dentures, those high cheek bones, sexy beards, etc., can make it next to impossible to get a proper fit with a respirator. And remember, a **respirator is only as good as its ability to create a seal with the wearer's face**.



Fit testing involves giving a respirator to a worker and instructing him or her on how to wear the mask. The respirator must then be put on and adjusted so it is snug **but comfortable**. To achieve this, the company may have to provide you with a number of respirators made by a variety of manufacturers.

Now you are ready for a **qualitative fit test**. This involves having an irritant like smoke, that will cause coughing, or a chemical with a strong smell, like banana oil, sprayed all around the respirator while you wear it. If the respirator doesn't fit, you'll cough or smell bananas.

But remember, **even with a perfectly fit respirator, all it takes is one bump "up-side-the-head" and the seal can be disturbed, causing you to be exposed.**

5. Right Cartridge, Wrong Chemical?

Respirators come with different cartridges that filter out different toxic chemicals. No one has invented one that works with all substances. So we have to make certain that the cartridge we have will protect us from the chemicals we're exposed to. The chart below looks at what cartridges work with what chemicals.

Atmospheric Contaminants To Be Protected Against	Colors Assigned*
Acid gases	White
Hydrocyanic acid gas	White with 1/2" green stripe completely around the canister near the bottom
Chlorine gas	White with 1/2" yellow stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2" white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2" blue stripe completely around the canister near the bottom
Acid gases, organic vapors and ammonia gases	Brown
Radioactive materials, excepting tritium and noble gases	Purple (magenta)
Particulates (dusts, fumes, mists, fogs or smokes) in combination with any of the above gases or vapors	Canister color for contaminant, as designated above, with 1/2" gray stripe completely around the canister near the top
* Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.	
Note: Orange shall be used as a complete body, or stripe color, to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.	

6. Types of Respirators

1. Air-Purifying Respirators (APRs)

These are the **most commonly used and misused** respiratory protection devices. They involve the use of cartridges or canisters which contain either filters (to screen out dusts, fumes, or mists) or activated charcoal or other absorbent material (to screen out organic vapors, acids, gases, etc.) to reduce exposures of the wearer. These respirators come in two major varieties:

- negative-pressure types (either half-face or full-face) where air is not forced into the mask; and
- powered-air types where air is forced into the mask.

The *powered-air respirator is more protective and more comfortable* than the negative pressure type because it forces air to flow out, thereby helping to prevent inward leakage of contaminants. APRs generally leak at the seal between the face and the mask. That's why you need to be fit tested, preferably a quantitative fit test.

2. Supplied-Air Respirators

This respirator involves the wearing of a mask which is hooked up to a "fresh," uncontaminated, outside source of air by a hose. This fresh, unfiltered air (no cartridges or canisters are used) is forced into the face-piece. This type of equipment **offers more protection than the air-purifying respirators but can be cumbersome to wear.**

3. Self-Contained Breathing Apparatus (SCBA)

This is essentially like a supplied-air respirator but the fresh, uncontaminated source of air comes from a "bottle" or "tank" worn on the back. **This is the only type of respirator protection permitted for use in atmospheres that are immediately dangerous to life or health (IDLH).**

7. What Does IDLH Mean?

High concentrations of toxic chemicals, oxygen deficiency or enrichment are conditions which pose an immediate threat to life or health. These are known as IDLH conditions – **Immediately Dangerous to Life or Health**. Many chemicals have specific concentrations at which they become IDLH.

The purpose of establishing an IDLH concentration is to ensure that a worker can escape from an atmosphere if the respirator fails. The escape should not pose a risk to the worker's life or cause irreversible health effects (e.g., permanent lung damage caused by hydrogen fluoride or death from carbon monoxide poisoning).

Respirators and IDLH

For respirator selection purposes, IDLH means the highest concentration from which, in the event of respirator failure, a person could escape within 30 minutes without having their escape hindered (e.g., passing out) or suffering any irreversible health effects.

When working in an IDLH atmosphere, only highly reliable respirators providing maximum protection should be used. **This means a self-contained breathing apparatus (SCBA)** in the positive pressure mode or a positive pressure airline respirator with an auxiliary SCBA for escape.

What does OSHA say about IDLH conditions?

When reviewing a company's respirator program or investigating a complaint, OSHA uses the American National Standard Institute (ANSI) definition:

Immediately Dangerous to Life or Health: Any atmosphere that poses an immediate hazard to life or produces immediate irreversible effects on health. (ANSI Z 88.2, 1980)

continued

7. (continued)

Another definition of IDLH is found in the NIOSH respirator performance requirements:

"Immediately Dangerous to Life or Health" (IDLH) means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which *are likely to have adverse cumulative or delayed effects on health*.
[emphasis added] (Title 20, CFR, Part 11)

As you can see, OSHA only addresses acute (immediate) health hazards while the NIOSH definition encompasses acute and chronic (long-term) health effects. As a consequence, when dealing with a cancer-causing substance, OSHA does not consider it an IDLH situation, but NIOSH does. Some State OSHA Programs may use the NIOSH definition, so you might check to see if you have a State OSHA and find out which definition they enforce.

Summary: Respiratory Protection

1. **Respirators are a dangerous control technology.** Respirator use means that **management is admitting that a dangerous exposure is occurring and that they are going to continue to allow the exposure** and protect people by using respirators. You better hope they don't fail!

2. Respirator use is politically dangerous for a union. The problems respirators create for a union include:

- Violation of personal freedom with respect to facial hair;
- It is a hot and uncomfortable device; and
- Because it stresses the heart and lungs, all potential wearers must be medically evaluated for their fitness to wear the respirator. This type of situation may allow management to get rid of "unfit" workers.

3. Most respirator use is in violation of OSHA law. Respirators can only be used in compliance with the OSHA Respiratory Protection Standard 29 CFR 1910.134. This standard has many requirements, all of which must be implemented by an employer who wants to use respirators to control worker exposures.

Management almost never implements all pieces of the OSHA standard. They are, therefore, technically in noncompliance with the law. A detailed and specific knowledge of the standard by unionists can allow the union to fight effectively management's attempt to use respirators.

4. Respirators don't stop absorption through the skin. Many chemicals affect the skin directly. Others pass right through the skin to cause damage inside the body. Since respirators only limit what you are inhaling, **they are essentially useless where skin contact continues.**

5. Respirators are no good without "adequate warning properties." According to the law, respirators may only be worn as protection against chemicals that have "adequate warning properties." This means that should your respirator fail or leak, thereby allowing a chemical to penetrate into your breathing zone, you would be able to detect the substance (by odor, irritation of mouth or nose, etc.) at a level below the established OSHA level. **If the chemical does not have such warning properties, then the law says you are not permitted to wear a respirator. For example, carbon monoxide (CO) is colorless and odorless – it does not have adequate warning properties. If it leaked through the respirator and exceeded the OSHA level of 50 ppm you would never know it.**

Summary *(continued)*

6. Respirators should not be used as protection against cancer-causing agents **because there is no safe exposure level for these chemicals. Since respirators are not foolproof, there is no way to guarantee that no exposure will occur.**

7. All wearers of respirators must be "fit tested." All wearers of respirators must be "fit tested" for the specific respirator they will be given to ensure that it will not leak in the field.

Since every individual's facial shape is different, because many people have scars, or missing teeth, or wear dentures, and because respirators are designed for the average male worker's face, it is often difficult to be properly fitted.

Fit testing itself requires the wearer to put the respirator on and to have a test chemical (that can be easily detected if it penetrated the face-piece) sprayed around the seal of the respirator while the person moves his/her face, smiles, talks, etc. If he or she detects the chemical, then the mask doesn't fit. It is therefore clear that the management must have many different sizes and makes of respirators available in order to ensure that everyone can be properly and safely fit. Even with a respirator that fits, one hit to the head and it doesn't fit anymore.

8. Air-purifying respirators place a stress on the heart and lungs. Respirators place a stress on the heart and lungs by presenting a resistance to breathing (this is because air must pass through a filter of some type prior to entering the body). Because of this, each respirator wearer must be medically evaluated for his or her fitness to wear a respirator by having a physician check heart and lung function.

If a worker has medical problems wearing a typical negative-pressure cartridge respirator, there are alternatives. For example, a Power Air-Purifying Respirator (PAPR) is much less stressful to the heart and lungs. **(This medical fitness situation is extremely sticky from a labor viewpoint since it can be used by management to get rid of "unfit" workers – particularly those with seniority.)**

Summary written by Jerry Roseman, Industrial Hygienist.

Activity 10: Placing Medical Surveillance Under Surveillance

Purpose

To increase our confidence in evaluating company medical surveillance programs and tests conducted by doctors to protect our health.



Task 1

In your groups, read over the following medical surveillance report of the OilChem facility on page 285. Based on your own experiences with company doctors and medical programs, what questions do you think need to be asked about the OilChem medical surveillance program?

- 1. What questions should be asked about the OilChem report?**

OilChem

Executive Summary of Medical Surveillance Program of OilChem Prepared by Corporate Medical Examiners, Inc.

For the sixth consecutive year, Corporate Medical Examiners, Inc. (CME) has completed an annual medical surveillance program for participating employees at the OilChem facility. The purpose of this medical program was to promote employee health, to detect occupational health problems, and to maintain compliance with OSHA regulations. All employees were invited to take part in the testing. All employees completed a health questionnaire. Twenty-five percent of the production work force took advantage of the opportunity for testing. This year we made a special effort to reach anyone dealing with hazardous wastes. These employees underwent the following tests:

- Physical Examination
- Chest X-Ray (Read by Dr. Donald Killdare of California)
- Urinalysis
- Blood Chemistry Tests (cholesterol, calcium, liver function tests)
- Complete Blood Count

These tests were completed by qualified health professionals employed by CME, headed by Dr. James Brown.

Medical Resume for Doctor in Charge of OilChem Medical Surveillance James L. Brown, M.D.

Born:	January 13, 1932
College:	St. John's University
Medical School:	State University of New York, Downstate Medical School; graduated 1958
Residency Training:	1958-1962 (surgery), St. Mary's Medical Center, Akron, Ohio
Private practice:	1962 to present, Perth Amboy, New Jersey; many corporate clients including Anheuser-Busch, Witco, and Exxon
Attending:	Roosevelt Hospital, Metuchen, New Jersey
	Assistant Clinical Professor: J.F. Kennedy Medical School in New Brunswick, New Jersey
	Board-certified in surgery

Task 2: Checking the Checkers

Now that we've put together a list of questions about the OilChem medical surveillance program, let's look for some answers. The following set of questions go through some of the steps a worker-oriented occupational health specialist would follow to assess the program. Try to work through the answers in your groups. Assume that your own surveys of the workforce suggested that the main chemicals that concern workers at OilChem are benzene, hydrogen fluoride and asbestos. (See the MSDSs for benzene, hydrogen fluoride and asbestos on pages 288 through 305.)

1. Is the doctor specially trained to look at workers' diseases?

(See qualifications of OilChem doctor, previous page.)

a. Does he/she have formal training in occupational medicine?

(Is he/she Board-certified or Board-eligible* in occupational medicine?)

- ☐ **Yes**
- ☐ **No**
- ☐ **Not Enough Information**

b. Does he/she have extensive experience in diagnosing and treating occupational diseases?

- ☐ **Yes**
- ☐ **No**
- ☐ **Not Enough Information**

c. Does PACE International, or do other worker-oriented occupational health specialists, know and respect this doctor's work? (Please see the factsheet on pages 317 through 320 for recommended clinics.)

- ☐ **Yes**
- ☐ **No**
- ☐ **Not Enough Information**

(If any answer is "no," the workers may have serious problems that could go undetected.)

*Board-certified means certified by the American Board of Preventive Medicine in a particular area; in this example, occupational medicine. Board-eligible means that the doctor has met all the requirements, but has not yet been certified by the Board.

2. Is the physician reading the chest x-rays a qualified "B" reader?*

- ☐ Yes
- ☐ No
- ☐ Not Enough Information

3. Given the chemicals that workers are worried about, did the company program do the right tests to detect possible problems? (To determine the answer, review the chart on page 306 and compare it to the OilChem program.)

- ☐ Yes
- ☐ No
- ☐ Not Enough Information

4. Now let's go back to real life and consider your own company's medical surveillance program. What do you think the union should do about it? For example, do you believe that the union should bargain for the right to pick its own doctor and run the program at company expense?

5. What other recommendations would you make?

*A "B" reader has passed a special exam given by NIOSH. "B" readers are only necessary for reading x-rays of workers exposed to asbestos, silica, coal, cotton dust, beryllium, cobalt and selected other dusts. (See list of "B" readers, the factsheet beginning on page 309.)



MATERIAL SAFETY
DATA SHEET

BENZENE

MSDS NO: 02003201

MANUFACTURER/SUPPLIER:	EMERGENCY HEALTH INFORMATION: (800) 447-8735
Amoco Oil Company	EMERGENCY SPILL INFORMATION: (800) 424-9300
200 East Randolph Drive	CHEMTREC, U.S.A.
Chicago, Illinois 60601	OTHER PRODUCT SAFETY INFORMATION: (312) 856-3907

IMPORTANT COMPONENTS: Benzene (CAS 71-43-2), current OSHA PEL 1 ppm (8-hr. TWA),
5 ppm STEL (15 min.), ACGIH TLV 10 ppm (30 mg/m³).

WARNING STATEMENT: Danger! Extremely flammable! Can cause eye and skin irritation.
Causes headaches, dizziness, drowsiness, and nausea. Harmful or
fatal if swallowed and/or aspirated into the lungs. Danger.
Contains Benzene. Cancer hazard. Can cause blood disorders.
Harmful when absorbed through the skin.

HMIS/NFPA CODES: (HEALTH;2)(FLAMMABILITY;3)(REACTIVITY;0)

APPEARANCE AND ODOR: Colorless liquid, sweet odor.

HEALTH HAZARD INFORMATION

EYE

EFFECT: Can cause eye irritation.

FIRST AID: Flush eyes with plenty of water for at least 15 minutes, get medical
attention if irritation persists.

PROTECTION: Do not get in eyes. Wear eye protection.

SKIN

EFFECT: Can cause skin irritation. Can produce dermatitis upon prolonged or
repeated contact. Harmful when absorbed through skin.

FIRST AID: Wash exposed skin with soap and water. Remove contaminated clothing,
including shoes, and thoroughly clean and dry before reuse. Get medical
attention if irritation develops.

PROTECTION: Do not get on skin or clothing. Wear protective clothing and gloves.

INHALATION

EFFECT: Cancer hazard. Can cause blood disorders. Inhalation causes headache,
dizziness, drowsiness and nausea. See Toxicology Section.

FIRST AID: If adverse effects occur, remove to uncontaminated area. Give artificial
respiration if not breathing. Get prompt medical attention.

PROTECTION: Do not breathe mist or vapor. If ventilation is inadequate, use
supplied-air respirator approved by NIOSH/MSHA.

BENZENE
MSDS NO: 02003201

PAGE 02 OF 04

HEALTH HAZARD INFORMATION - CONTINUED

INGESTION

EFFECT: Harmful or fatal if aspirated into lungs. See Toxicology Section.

FIRST AID: If swallowed, do NOT induce vomiting. Get immediate medical attention.

FIRE AND EXPLOSION INFORMATION

FLASHPOINT: 12°F

AUTOIGNITION TEMPERATURE: 928°F

EXTINGUISHING MEDIA: Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, halogenated agents, foam, steam) or water fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable liquid. Vapor may explode if ignited in enclosed area.

PRECAUTIONS: Keep away from ignition sources (e.g., heat, sparks and open flames).
Keep container closed. Use with adequate ventilation.

FLAMMABLE LIMITS: 1.5-8.0% by volume.

REACTIVITY INFORMATION

DANGEROUS REACTIONS: None identified.

HAZARDOUS DECOMPOSITION: Incomplete burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

STABILITY: Stable.

CHEMICAL AND PHYSICAL PROPERTIES

BOILING POINT: 176°F

MELTING POINT: 42°F

SOLUBILITY IN WATER: Slight, 0.1 to 1.0%.

SPECIFIC GRAVITY (WATER = 1): 0.88

VAPOR PRESSURE: 74.6 mmHg @ 20°C

BENZENE
MSDS NO: 02003201

PAGE 03 OF 04

STORAGE AND ENVIRONMENTAL PROTECTION

STORAGE REQUIREMENTS: Store in flammable liquids storage area. Store away from heat, ignition sources, and open flame in accordance with applicable federal, state, or local regulations. Keep container closed. Outside storage is recommended.

SPILLS AND LEAKS: Remove or shut off all sources of ignition. Remove mechanically or contain on an absorbent material. Increase ventilation if possible. Water spray can be used to absorb vapors. Keep out of sewers and waterways.

WASTE DISPOSAL: Disposal must be in accordance with applicable federal, state, or local regulations. Enclosed-controlled incineration is recommended unless directed otherwise by applicable ordinances. Residues and spilled material are hazardous waste due to ignitability.

TOXICOLOGICAL INFORMATION

INHALATION: LC50 = 10,000 ppm (7 hours) (rats).

INGESTION: LD50 = 3.8 g/kg (rat).

Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, or excitation. Exposure to very high levels can result in unconsciousness and death.

Long-term overexposure to benzene has been associated with certain types of leukemia in humans and OSHA, IARC and NTP consider benzene a human carcinogen. Chronic exposures to benzene at levels of 100 ppm and below have been reported to cause adverse blood effects including anemia. Benzene exposure can occur by inhalation and absorption through the skin.

Inhalation and forced feeding studies of benzene in laboratory animals have produced a carcinogenic response in a variety of organs, including possibly leukemia, other adverse effects on the blood, chromosomal changes and some effects on the immune system. Exposure to benzene at levels up to 300 ppm did not produce birth defects in animal studies; however, exposure to the higher dosage levels (greater than 100 ppm) resulted in a reduction of body weight of the rat pups (fetotoxicity). Changes in the testes have been observed in mice exposed to benzene at 300 ppm, but reproductive performance was not altered in rats exposed to benzene at the same level.

Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Therefore, emptying the stomach should only be done under medical supervision.

REGULATORY INFORMATION

CERCLA REPORTABLE QUANTITY:

This product is reportable under 40 CFR Part 302.4 because it contains the following substance(s):

COMPONENT/CAS NUMBER	REPORTABLE QUANTITY (RQ)
Benzene (71-43-2)	10 lbs.

BENZENE
MSDS NO: 02003201

PAGE 04 OF 04

REGULATORY INFORMATION - CONTINUED

DOT SHIPPING DESCRIPTION: Benzene, 3, UN1114, 11, RQ.

OSHA HAZARD COMMUNICATION STANDARD: Flammable liquid. Carcinogen. Irritant. CNS effects. Target organ effects.

RCRA STATUS:

This product is not subject to the 40 CFR Part 268.30 land ban on the disposal of certain hazardous wastes.

SARA STATUS:

This product is regulated under the following section(s) of SARA Title III, 42 USC 9601. Spills or releases of the product may be reportable as determined by the information given below:

SECTIONS 311 AND 312 OF SARA AND 40 CFR PART 370:

This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d).

SECTION 313 OF SARA AND 40 CFR PART 372:

This product contains the following substance, which is on the Toxic Chemicals List in 40 CFR Part 372:

COMPONENT/CAS NUMBER	WEIGHT PERCENT
Benzene (71-43-2)	100

TSCA STATUS: All of the components of this product are listed on the TSCA Inventory.

ISSUE INFORMATION

BY:



G. I. Bresnick, Director
Product Stewardship & Toxicology

ISSUED: April 05, 1993
SUPERSEDES: March 09, 1992

This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in this data sheet which we received from sources outside our company. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either express or implied.



Du Pont Chemicals

4440CR



Revised 3-SEP-1993

Printed 28-OCT-1994

Hydrofluoric Acid - Anhydrous

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number	DU000021
CAS Number	7664-39-3
Formula	HF
CAS Name	HYDROFLUORIC ACID
Grade	TECHNICAL

Tradenames and Synonyms

HYDROGEN FLUORIDE
HF
AHF
CC0104

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information	1-800-441-9442
Transport Emergency	CHEMTREC: 1-800-424-9300
Medical Emergency	1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
*HYDROGEN FLUORIDE	7664-39-3	100

* Regulated as a Toxic Chemical under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

(Continued)

HAZARDS IDENTIFICATION

Potential Health Effects

Extremely hazardous liquid and vapor. Causes severe skin and eye irritation or burns, which may be delayed. Anhydrous HF causes immediate and serious burns on contact; concentrations less than 50% may not produce symptoms for 8 hours or longer. Wearing clothing contaminated with HF (such as shoes, gloves) may result in painful delayed effects. Inhalation overexposure may cause lung damage with pulmonary edema (fluid accumulation in the lungs).

HUMAN HEALTH EFFECTS:

Overexposure by eye or skin contact with the liquid may include severe eye and skin corrosion, excruciatingly painful, deep-seated and slow healing burns and ulcers. Causes immediate burns and rapid destruction of tissue accompanied by severe pain at concentrations about 50%; in 20% to 50% concentrations, the burns can be delayed 1-8 hours; in concentrations less than 20%, painful erythema may be delayed 24 hours; latent skin burns with necrosis can occur even at concentrations of 2%. The fluoride ion readily penetrates the skin and deep tissue causing destruction of soft tissue and decalcification of bone. Tissue destruction and neutralization of HF proceed for days.

Ingestion of the liquid may cause severe burns to the mouth and tissues of the upper gastrointestinal tract with severe pain, bleeding, vomiting, diarrhea, and collapse of blood pressure.

Overexposure by skin or eye contact with the vapors may cause skin irritation or corrosion with discomfort and rash; eye irritation with discomfort, tearing, or blurring of vision; or eye corrosion with corneal or conjunctival ulceration.

HF can be absorbed through the skin in toxic amounts.

Overexposure by inhalation can cause choking and coughing; severe eye, nose, and throat irritation followed, after an asymptomatic period of 1 to 2 days, by fever, chills, difficulty in breathing, cyanosis and pulmonary edema; hypocalcemia which leads to life-threatening cardiac arrhythmias; or kidney and liver damage. Overexposure by inhalation to concentrated hydrogen fluoride vapors can cause pulmonary edema and death within 2 to 3 hours. Prolonged overexposure to the vapors can cause fluorosis which may also result in weight loss, brittle bones, anemia, weakness and stiffness of joints, and discoloration of the teeth when exposures occur during tooth formation.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

(Continued)

FIRST AID MEASURES

First Aid

Speed in removing exposed personnel from contaminated area and in removing HF from skin or eyes is of primary importance. First aid must be started immediately, within seconds, in all cases of contact with hydrofluoric acid in any form. All potentially exposed personnel should be trained in first aid care for HF burns. First aid actions should be planned before beginning work with HF. Calcium gluconate gel should be readily accessible in areas where HF exposure potential exists.

Medical assistance should be obtained promptly for all affected persons. The doctor should be informed in detail of the accident.

HF differs from other acids in that the fluoride ion readily penetrates skin, causing destruction of deep tissue layers including bone. Unlike the action of other acids, which are rapidly neutralized, this process may continue for days.

SKIN CONTACT: IMMEDIATELY shower with large quantities of water, within seconds after contact or suspected contact, and completely remove all clothing while in the shower (remove goggles last). FLUSH SKIN THOROUGHLY WITH WATER FOR 5 MINUTES. Flushing with water thoroughly for 5 minutes is sufficient to effectively remove HF from skin. Additional flushing time is unnecessary and will delay further treatment.

Apply calcium gluconate (2.5%) gel at burn site or area of contamination by rubbing in continuously. Wear impervious gloves. Examination and treatment by a physician is recommended as quickly as feasible. It may be necessary to transport patient to nearest hospital emergency room. Remember that concentrated HF causes immediate pain, BUT DILUTE HF SOLUTIONS MAY NOT CAUSE REDNESS, BURNING OR PAIN UNTIL SEVERAL MINUTES OR EVEN HOURS HAVE ELAPSED.

EYE CONTACT: IMMEDIATELY flush eyes with large quantities of water for 5 MINUTES while holding the eyelids apart. Trained personnel should apply calcium gluconate 1% (no stronger) by continuous drip. THE EYES WILL REQUIRE FURTHER TREATMENT--SEE NOTES TO THE PHYSICIAN--"EYE CONTACT".

VAPOR INHALATION: IMMEDIATELY remove the patient to an uncontaminated atmosphere. Call a physician. Administer oxygen as soon as possible. Trained personnel should provide calcium gluconate, 2.5% solution, by nebulizer with patient in the sitting position. Keep patient warm.

INGESTION: DO NOT induce vomiting. Immediately drink water to dilute the acid, followed by milk of magnesia. Call a physician. Throat burns may cause severe swelling and require a tracheotomy (opening the windpipe). The patient

(Continued)

FIRST AID MEASURES(Continued)

should be admitted to the hospital and carefully attended.

MEDICAL SUPPLIES: The following materials have been found to be useful and effective in the treatment of hydrogen fluoride burns, and should be on hand at the First Aid Station:

- o Calcium gluconate gel-2.5%. This gel is prepared by mixing 3.5 grams of USP calcium gluconate powder with a 5-ounce tube of surgical water-soluble lubricant (e.g., K-Y Lubricating Jelly, Johnson & Johnson) or by mixing 1 standard ampule (10 mL, 10%) of USP calcium gluconate with 1-ounce of water-soluble lubricant. The shelf life of the gel has not been determined. Storage of gel has limitations and refrigeration may help.
- o Calcium gluconate 10% (standard ampules).
- o One percent calcium gluconate in normal, sterile saline solution. Make by mixing 1 standard ampule per 90 mL of saline solution.
- o 2.5 percent calcium gluconate in normal, sterile saline solution. Make by mixing 1 standard ampule per 30 mL of saline solution.
- o Milk of magnesia.
- o 99% pure USP medical oxygen with regulator and mask.
- o Impervious gloves.
- o Nebulizer.
- o Blanket.
- o Shower facilities.

NOTES TO PHYSICIAN

Choice of therapy following first aid measures is at the discretion of attending physician. Selection of the best treatment will depend on the following factors:

- o Concentration and temperature of the HF.
- o Degree and extent of the burn.
- o Duration of exposure.
- o Areas of the body affected.
- o Elapsed time since exposure.

(Continued)

FIRST AID MEASURES(Continued)

- o First aid measures taken before physician's arrival.
- o Age and clinical history of patient.
- o General condition of the patient.

The following methods, using materials listed under MEDICAL SUPPLIES, have been effective in treatment of HF burns. Methods are broken down by routes of exposure. Minor exposures are limited exposures to HF liquid and vapor. Major exposures are extensive exposures to HF liquid and vapor and all cases of combined routes of exposure, e.g., skin and inhalation exposures. Patients suffering suspected face or chest skin exposure should be assumed to have incurred inhalation exposure also.

In all cases of major exposure by HF, hypocalcemia may be present, therefore, calcium levels must be determined immediately upon arrival at the hospital. During hospitalization calcium levels should be monitored frequently. If possible, blood should be drawn for serum calcium in site medical facility and sent to the hospital with the patient.

Cardiac monitoring (EKG) is necessary (hypocalcemia causes prolonged Q-T interval and may cause cardiac rhythm abnormalities). Renal and liver function should be monitored.

In major inhalation exposure, pulmonary edema or edema of upper airway may occur. Blood gases should be monitored accordingly.

SKIN CONTACT: Topically applied Calcium Gluconate Gel (2.5%) must be rubbed into all burn areas continuously until pain has completely subsided, but not longer than 30 minutes. Calcium gluconate gel should not be used until after thorough and complete washing of the skin with water for 5 minutes. If pain continues for longer than 30 minutes, proceed with calcium gluconate topical injections. Care should be taken to see that the personnel who apply the gel, especially on the initial applications, wear impervious gloves to prevent skin contamination with HF and the development of hand burns.

Calcium Gluconate Topical Injections: When there is evidence of skin penetration as in second or third degree burns, a 5% calcium gluconate solution (standard ampule of 10% calcium gluconate for intravenous use must be diluted to 5% by mixing with an equal amount of normal sterile saline) may be injected by infiltrating the skin and subcutaneous tissues in the same manner as injection of any local anesthetic. Use stainless steel needles. Care should be taken to avoid overdosing with calcium. All skin which has

(Continued)

FIRST AID MEASURES(Continued)

been exposed should be infiltrated including up to 1/4 inch (6 mm) around area. This may prevent development of severe burns. Use of a local anesthetic is contraindicated since pain is indicative of response to treatment.

Burns around the fingernail may require splitting the nail from the distal end in order to relieve pain and facilitate draining.

In cases of overexposure due to HF, as in skin burns of greater than approximately 25 square inches (160 cm²) in area, hypocalcemia may be present. Therefore, systemic administration of calcium gluconate may be necessary. Frequent monitoring of serum calcium, cardiac, renal, and hepatic functions is necessary.

EYE CONTACT: Immediate rapid washing of the eyes with large quantities of water for 5 minutes should be followed by continuous drip of 1% calcium gluconate (no stronger) in normal, sterile saline. No oils or ointments should be used.

Inflammation may be decreased by the use of corticosteroid solutions for ophthalmic use. An eye specialist should be consulted immediately.

VAPOR INHALATION: Persons suspected of having had HF exposure by inhalation should immediately be given 100% oxygen by mask or catheter. As soon as possible (as precautionary treatment), they should be administered (in the sitting position and utilizing a nebulizer) 2.5% calcium gluconate solution by inhalation for 20 minutes. All those suspected of HF exposure and who experience signs and/or symptoms of respiratory irritation should be considered as strong candidates for admission to an intensive care unit for careful observation during the first 24-48 hours. Delayed pulmonary edema is likely in patients with burns of the skin of face or neck.

Patient should be carefully watched for edema of the upper airway with respiratory obstruction and the airway maintained by tracheotomy or endotracheal intubation if necessary. The administration of respiratory care should be very closely supervised and most likely includes continued administration of 2.5% calcium gluconate by inhalation. Toxicity from pulmonary absorption of fluoride ion may rapidly develop in the liver and kidneys and may require more energetic measures of control, up to and including hemodialysis, particularly if the blood urea nitrogen and potassium levels rise. Supportive care is necessary for all organ systems.

INGESTION: Refer to first aid measures as described. Gastric lavage with lime water or milk may be performed, but only by a physician. Treatment is the same as for ingestion of other strong acids.

(Continued)

FIRE FIGHTING MEASURES

Flammable Properties

Will not burn.

Fire and Explosion Hazards:

HF (particularly in dilute aqueous solutions) will attack most metals, releasing potentially explosive hydrogen gas. Follow appropriate National Fire Protection Association (NFPA) codes.

Extinguishing Media

Water Fog. Dry Chemical. CO2.

Fire Fighting Instructions

Keep upwind. If there is any possibility of direct contact, wear full acid suit with hood, boots and self-contained breathing apparatus. Do not get water into acid tanks - generates heat. Run-off from fire control may cause pollution; neutralize with lime.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Evacuate area and keep upwind until gas has dispersed. Enter contaminated area only with full protective equipment and self-contained breathing apparatus. Dike spill. Dilute with water fog (direct addition of water or alkali causes heat and violent spattering). Neutralize with lime. Do not flush to sewer. Comply with Federal, State, and local regulations on reporting releases.

DuPont Emergency Exposure Limits (EEL) are established to facilitate site or plant emergency evacuation, and specify airborne concentrations of brief durations which should not result in permanent adverse health effects or interfere with escape. EEL's are expressed as airborne concentration multiplied by time (CxT) for up to a maximum of 60 minutes and as a ceiling airborne concentration. These limits are used in conjunction with engineering controls/monitoring and as an aid in planning for episodic releases and spills. For more information on the applicability of EEL's, contact DuPont.

The DuPont Emergency Exposure Limit (EEL) for Hydrofluoric Acid is 200 ppm-min (for example, 40 ppm for 5 min; 20 ppm for 10 min; 6.7 ppm for 30 min; etc.) with a not-to-exceed ceiling of 100 ppm.

(Continued)

HANDLING AND STORAGE**Handling (Personnel)**

Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

Keep containers closed.

Storage

Keep away from heat, sparks, and flame. Keep container tightly closed. Drainage facilities should be constructed for containment of small spills.

NOTE:

HF may react with steel, forming iron fluorides. During storage tank cleaning, iron fluoride particles may be released which, if inhaled, may cause lung damage. Iron fluoride scale reacts with water to produce HF, which may cause delayed burns when skin or eye contact occurs.

EXPOSURE CONTROLS/PERSONAL PROTECTION**Engineering Controls**

Use only with ventilation sufficient to keep vapor concentrations below the exposure limit. Use forced draft ventilation and scrubbers for fume control.

Personal Protective Equipment**EYE/FACE PROTECTION**

Wear chemical splash goggles. In addition, where the possibility exists for face contact due to splashing or spraying of the material, wear a full-length face shield/chemical splash goggle combination or an acid hood.

RESPIRATORS

If exposure limits may be exceeded, wear NIOSH/MSHA approved respiratory protection.

PROTECTIVE CLOTHING

Where there is potential for skin contact, have available and wear as appropriate: neoprene rubber gauntlet gloves, boots, and neoprene or vinyl jacket and pants. If there is any possibility of direct contact, wear a full acid suit of neoprene, vinyl, or other acid resistant material with hood, gloves, boots, and self-contained breathing apparatus. The highest degree of protection, used for large leaks or in an emergency situation, is provided by a fully encapsulating acid resistant suit (one piece construction) with an independent air supply.

Protective clothing and equipment should not be worn or

(Continued)

EXPOSURE CONTROLS/PERSONAL PROTECTION(Continued)

carried outside of the operating area. Wash protective clothing and equipment under a safety shower after exposure, or suspected exposure, to hydrofluoric acid.

Exposure Guidelines**Exposure Limits**

Hydrofluoric Acid - Anhydrous

PEL (OSHA)	3 ppm, 8 Hr. TWA, as F
TLV (ACGIH)	3 ppm, 2.6 mg/m ³ , Ceiling as F
AEL * (Du Pont)	3 ppm, 15 minute TWA

* AEL is Du Pont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES**Physical Data**

Boiling Point	19.5 C (67.1 F) @ 760 mm Hg
Vapor Pressure	775 mm Hg @ 20 C (68 F)
	1525 mm Hg @ 40 C (104 F)
Vapor Density	3.0 (Air = 1.0)
	at 25 deg C
Melting Point	-83.5 C (-118.3 F)
Evaporation Rate	(Butyl Acetate = 1)
	Greater than 1
Solubility in Water	100 WT%
pH	-2.0
	(2% Aqueous solution)
Odor	Acrid
Form	Clear, fuming liquid
Color	Colorless
Specific Gravity	~1 @ 0C (32F)

STABILITY AND REACTIVITY**Chemical Stability**

Stable, if stored in proper (steel) container.

Decomposition

Decomposition will not occur.

Other Hazards

Incompatibility : Reacts violently with water and alkaline solutions; with cyanides to give toxic hydrogen cyanide; with sulfides to give toxic hydrogen sulfide. Also corrodes glass and ceramics.

Polymerization : Non-hazardous endothermic polymerization may occur in the gaseous phase.

(Continued)

TOXICOLOGICAL INFORMATION**Animal Data**

Inhalation 1-hour LC50 : 2,300 ppm in rats
Skin absorption 1-2 minute ALD: 500 mg/kg in mice

The compound is corrosive to skin and eyes of animals and is extremely toxic by dermal exposure. Toxicity described in animals from exposure by inhalation includes an uptake of fluoride into bones and teeth that may cause disturbances in the calcification processes. Other effects of inhalation include edema, pulmonary congestion and hemorrhage; anemia; weight loss; and effects in the liver, lungs, and kidneys.

No carcinogenic effects were observed in guinea pigs exposed for 18 months to 0.2 ppm of HF. Embryotoxicity was observed in animals exposed by inhalation, but only at levels that were maternally toxic. Studies show that HF causes heritable genetic damage in insects. No acceptable animal test reports are available to define developmental or reproductive toxicity.

ECOLOGICAL INFORMATION**Ecotoxicological Information****Aquatic Toxicity**

No definitive information is available. The estimated 96-hour LC50 is 1-50 ppm.

DISPOSAL CONSIDERATIONS**Waste Disposal**

Comply with Federal, State, and local regulations. If approved, may be flushed to sewer to waste treatment plant, or transferred to a disposal contractor.

TRANSPORTATION INFORMATION**Shipping Information**

DOT	
Proper Shipping Name	HYDROGEN FLUORIDE, ANHYDROUS*
Hazard Class	CLASS 8 (CORROSIVE MATERIAL)
I.D. No. (UN/NA)	UN 1052
DOT Label(s)	CORROSIVE, POISON
Special Information	PACKAGING GROUP: PG I; POISON-INHALATION HAZ.; HAZARD ZONE C
DOT Placard	CORROSIVE, POISON

Reportable Quantity : 100 lbs/45.4 kg

*If shipped in quantities greater than 100 lbs., the Proper Shipping Name is RQ, HYDROGEN FLUORIDE, ANHYDROUS

(Continued)

REGULATORY INFORMATION**U.S. Federal Regulations**

TSCA Inventory Status Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : Yes
Fire : No
Reactivity : Yes
Pressure : No

LISTS:

SARA Extremely Hazardous Substance -Yes
CERCLA Hazardous Material -Yes
SARA Toxic Chemical -Yes

CANADIAN WHMIS CLASSIFICATIONS:

D-1A; E

Anhydrous hydrogen fluoride is specifically listed in Appendix A of CFR 1910.119. Use of anhydrous hydrogen fluoride may require compliance with 29CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals.

OTHER INFORMATION**NFPA, NPCA-HMIS**

NFPA Rating
Health 4
Flammability 0
Reactivity 0

NPCA-HMIS Rating
Health 3
Flammability 0
Reactivity 2

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

For further information, see DuPont's Hydrofluoric Acid "Data Sheet" and Properties, Uses, Storage, and Handling Bulletin.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS DuPont Chemicals
Address Engineering & Product Safety
 P. O. Box 80709, Chestnut Run
 Wilmington, DE 19880-0709
Telephone 302-999-4946

Indicates updated section.

End of MSDS

M S D S

Canadian Centre for Occupational Health and Safety

IDENTIFICATION

RECORD NUMBER: 383321

LANGUAGE: ENGLISH

PRODUCT NAME(S): **chrysotile asbestos**

PRODUCT IDENTIFICATION DATA: CAS Registry Number: 1332-21-4
EPA Code Designation: A-152-4672

DATE OF MSDS: 1991-08-12

MANUFACTURER INFORMATION

MANUFACTURER: CASSIAR MINING

ADDRESS: 1130 Sherbrooke Street West
Suite 410
Montreal Quebec
Canada H3A 2M8

Telephone: 514-844-3956

Telex: 055-60565 (INSTAM)

Fax: 514-844-1381

Pavillon Marie-Victorin
Suite 336, Sherbrooke University
Sherbrooke Quebec
Canada J1K 2R1

Telephone: 819-821-7633

Telex: 058-36149 (BIBUNIV SHB)

Fax: 819-821-7824

MATERIAL SAFETY DATA SHEET

SECTION I - PRODUCT IDENTIFICATION

Name: chrysotile asbestos

Chemical family: fibrous hydrated silicates

Synonym: white asbestos

Formula: $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

M.W.: ca 283

CAS Registry Number: 1332-21-4

EPA Code Designation: A-152-4672

UN No.: 2590

SECTION II - HAZARDOUS INGREDIENTS

Chrysotile asbestos (90-95%)

TLV: 0.2-2.0 f/ml (see the countries regulations)

Magnetite, Fe₃O₄ (0.5-5%)

TLV: 5 mg/m³ (respirable)

SECTION III - PHYSICAL DATA

Physical state: solid

Appearance: white fibre

Odor: none

Specific gravity: 2.4-2.6

Solubility in water: insoluble

pH: ~10

Boiling point: not applicable

Melting point: will dehydrate above 580 deg C

Vapour pressure: not applicable

Evaporation rate: not applicable

Percent volatile: not applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flammability: non-flammable

Flash point: not applicable

Explosion sensitivity: no explosion hazard

Comburent: non-comburent

SECTION V - REACTIVITY DATA

Stability: very stable

Incompatibility (material to avoid): none

Hazardous decomposition: not applicable

Hazardous polymerisation: not applicable

SECTION VI - HEALTH HAZARD DATA

Route of entry: inhalation

Acute effects: no immediate reaction to overexposure.

Chronic effects: long term overexposure may cause asbestosis, lung cancer and mesothelioma of the pleura and peritoneum.

Toxic effects: listed as a carcinogen or potential carcinogen/NTP-OSHA-IARC.

Ingestion: not hazardous.

Eye contact: inert dust.

Skin contact: inert dust. It is not absorbed. Remove asbestos slivers.

MSDS

Asbestos

Page 3

1. Medical Testing Worksheet

Toxics in Use	Body Parts Affected	Appropriate Tests
Benzene	Blood/Bone Marrow	Complete Blood Count
Hydrogen Fluoride	Skin	Physical Exam
	Lungs	Breathing Tests
	Kidneys	Kidney Function (Blood) Tests
Asbestos	Colon	Stool Test for Blood
	Lungs	Chest X-ray
		Physical Exam
		Breathing Test

2. Medical Testing Glossary

Part of Body Affected	Screening Test/Exam	Type of Specimen	Comments
Skin	Physical Exam	—	—
Nose, Mouth, Eyes, Mucous Membranes	Physical Exam, Medical History	—	—
Upper Respiratory Tract	Physical Exam, Medical History	—	—
Lungs (Lower Respiratory)	Physical Exam	—	—
	Chest X-Ray	—	Not useful for asthma, emphysema
	Pulmonary Function (Breathing) Tests	—	Not useful for lung cancer
Heart	Physical Exam	—	—
	Electrocardiogram	—	—
	Chest X-Ray	—	Not useful for heart attack, angina
Kidneys and Bladder	Kidney Function Tests	Blood	Not useful for infection
	Urinalysis	Urine	Not specific for cancer
	Urine Cytology (for cancer cells)	Urine	Only useful for cancer of bladder and kidney
	Cystoscopy (metal scope up urethra)	—	Useful for bladder cancer

continued

2. (continued)

Part of Body Affected	Screening Test/Exam	Type of Specimen	Comments
Liver	Liver Function Tests	Blood	Useful for hepatitis and inflammation
Intestines and Stomach	Sigmoidoscopy (metal tube in rectum to look around)	—	Useful for cancer, polyps, and chronic disorders
	Hemocult (to look for blood in stool)	Stool	Useful for early detection of colon cancer, polyps
Blood	Complete Blood Count	Blood	Useful for anemia, leukemia, infection
Thyroid	Physical Exam	—	Useful for nodules and cancer
	Thyroid Function Tests	Blood	Useful for too much or too little thyroid function
Nervous System	Neurological Exam (special physical exam)	—	—

3. List of Certified "B" Readers by State

Alabama

Adams, C. Raymond	Birmingham
Ballard, James Wayland	Birmingham
Branscomb, Ben V.	Birmingham
Goldstein, Allan R.	Birmingham
Hasson, Jack H.	Birmingham
Loveless, Scott B.	Birmingham
Nath, Hrudaya	Birmingham
Payne, Thomas Jefferson	Fairfield
Russakoff, A. David	Birmingham
Thomas, Robert H.	Birmingham
Tindol, Michael Bryan	Birmingham

Arizona

Berman, Phillip M.	Tucson
Collins, Joseph Michael	Scottsdale
Muhm, John Robert	Scottsdale
Standen, James R.	Tucson
Walgren, Harold N.	Litchfield Park

Arkansas

Schiefer, Mark	Heber Springs
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California

Balmes, John Randolph	San Francisco
Batra, Poonam	Los Angeles
Boatright, Carl H.	Los Angeles
Breyer, Donald A.	Oakland
Caplan, James Louis	Beverly Hills
Cassling, Robert J.	Burbank
Coleman, Robert M.	San Rafael
Cummins, Raymond Thomas	San Francisco
Custer, L. Evan	Berkeley
Drasin, Edward	Oakland
Dunn, Christopher Joseph	Redwood City
Epstein, Jacob Alan	Berkeley
Favelukes, Alex	San Diego
Feffer, Myra Lee	Los Angeles
Feigin, David S.	La Jolla
Fish, Jonathan Harold	Walnut Creek
Friedman, Sidney G.	Los Angeles
Gamsu, Gordon	San Francisco
Hamlett, Frank B.	San Diego
Harber, Philip L.	Los Angeles
Hinshaw, Horton Corwin	Tiburon
Kelly, Kevin M.	Pasadena
Lapp, Maurice M.	San Pablo
Lee, Charles Dudley	San Diego
Liston, Steven E.	Woodland
Litvak, Donald S.	Burbank
Livoni, John Peter	Sacramento

McCollom, Vance E.	Fairfield
McDonald, Charles C.	San Francisco
Meseroll, William Peter	Santa Rosa
Meyers, Gerald L.	Berkeley
Montgomery, Blaine L.	Rncho Pls Vrds
Moore, Elizabeth	Davis
Moscow, Norman P.	Berkeley
Nelson, Richard A.	Burlingame
Norton, Michael Peter	Sacramento
Patel, Girish	Bakersfield
Pfisterer, William F.	Brea
Powers, Daniel	Santa Monica
Preger, Leslie	San Francisco
Rawitch, Marvin A.	Tustin
Rhodes, Randall Earl	Travis AFB
Sakai, Hisaji Q.	Walnut Creek
Sargent, E Nicholas	Santa Rosa
Shah, Kashmira M.	Hemet
Shapiro, David Alan	Long Beach
Shrago, Gary	Piedmont
Silverbach, Spencer	Carmichael
Stein, Mark Geoffery	Santa Ana
Steinberg, Irwin	Los Angeles
Tao, Keith E.	Danville
Thomas, Ronnie D.	San Diego
Torrance, Daniel J.	Rncho Pls Vrds
Trefelner, Eric C.	Montara
Turner, Alan T.	Los Angeles

Colorado

Emmons, Lawrence Leroy	Aurora
Jobe, William L.	Englewood
Kreiss, Kathleen	Denver
Leever, John T. Do	Grand Junction
Oppenheimer, David A.	Boulder
Repsher, Lawrence Harvey	Wheat Ridge
Way, Deborah Elizabeth	Denver
Wilson, Robert Keith	Pueblo
Witwer, John P.	Evergreen

Connecticut

Bisceglia, Michael	Middletown
Crain, Michael	Middletown
Curtis, Anne McBride	New Haven
Kron, Elinor S.	West Hartford
Lund, David A.	New Britain
Moskowitz, Harold	West Hartford
Osborne, Raymond Lester	Hamden
Shaw, Coralie	Guilford

3. (continued)**Delaware**

Chao, Philip W.	Wilmington
Diznoff, S. Barry	Newark
Evantash, Alan B.	Wilmington
Fiss, Thomas W.	Wilmington
Hunt, Clifton Howard	Wilmington
Raisis, Irene P.	Greenville
Stein, Herman Joseph	Wilmington

District of Columbia

Buck, David Richard	Washington
Freedman, Matthew T.	Washington
Raizon, Arnold	Washington
Twible, Dana A.	Washington

Florida

Bauman, Shelly P.	Tampa
Bianco, Charles Carmine	Tallahassee
Brooker, Arthur Raymond Jr.	Tampa
Clark, Robert Alan	Tampa
Cole, William S.	Fort Myers
Drewry, Garth Richard	Brandon
Dubuisson, Robert Leonard	Panama City
Edelstein, Stephen Alan	Coral Springs
Feingold, Ilan A.	Coral Gables
Flynn, Michael Patrick	Brandon
Hannah, James Edward	Winter Park
Katz, Allan E.	St Petersburg
Klein, Gerald M.	Punta Gorda
Krainson, James Philip	Miami
Krawtz, Steven M.	Jacksonville
Mezey, Robert Joseph	Miami
Miller, Robert I.	Jacksonville
Myint, R. Than	Tampa
Otero, Raul R.	Tampa
Patel, Bharat U.	Tampa
Reed, Katherine	Tampa
Sheer, Allen L.	Tampa
Silbiger, Martin L.	Tampa
Sulzer, Jana L.	Tampa
Swerdlow, Trevor A.	Hollywood

Georgia

Anderson, Charles R.	Marietta
Barlow, Richard E.	Atlanta
Baron, Murray G.	Atlanta
Dunbar, Walter S.	Atlanta
Frolich, David Jay	Macon
Gilman, Murray J.	Atlanta
Haque, Abulkalam W.	Atlanta
Homlar, Marjorie L.	Atlanta
Jackson, Joseph G.	Macon
Jenkins, F. Hugh	Athens

Kallman, Douglas A.	Dunwoody
Lawrence, William Powell	Martinez
Mannino, David M.	Atlanta
Rogers, James V.	Stone Mountain
Sherrier, Robert H.	Marietta
Simmons, Richard Sanford	Lagrange
Strawn, Loy D.	Macon

Hawaii

Jobe, Virgil R.	Honolulu
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Illinois

Agee, Jeffrey H.	Decatur
Bauer, Richard Marcus	Highland Park
Borchart, Eugene Kent	Mt Prospect
Caligiuri, Philip A.	Burr Ridge
Demos, Terrence C.	Maywood
Fennessy, John J.	Chicago
Gilbert, Perry M.	Olympia Fields
Hales, James Darvin	Galesburg
Hessl, Stephen M.	Chicago
Hunter, David L.	Peoria
Kaplan, Robin	Chicago
Kennard, Donald R.	N Barrington
Lee, Grace H.	Glen Ellyn
Leef, Gerald S.	Hillside
Locke, G. Richard	Decatur
Main, David M.	Urbana
Mehta, Ajay C.	Elgin
Nelson, Boyd Eastham	Decatur
Papagiannopoulos, Steven	Naperville
Ragsdale, Edward F.	Alton
Schonfeld, Alvin J.	Chicago
Sider, Lee	Chicago
Singh, Bhurji N.	Morris
Sullivan, Kenneth P.	Elgin
Vyas, Mahendra I.	Metropolis
Vyborny, Carl J.	Lagrange
Wasserman, David	Chicago
Willams, Phillip K.	Springfield

Indiana

Cook, Thomas L.	Evansville
Gize, Raymond Walter	Ft Wayne
Lehmann, Juergen J.	Ft Wayne
McFall, Frederick T.	Indianapolis
McGraw, William Elmer	Indianapolis
McLaughlin, Gordon C.	Indianapolis
Miller, William J.	Lafayette
Roche, Francis Xavier	Merrillville
Sawlani, Tulsi C.	Valparaiso
Schultheis, Thomas E.	Evansville
Selby, Jeff W.	Evansville

Sellers, Ralph A.	Evansville
Semerdjian, Aram	Merrillville
Stafford, Jonathan Truesdale	Bloomington
Tarver, Robert D.	New Palestine
Zancanaro, Anthony V.	Indianapolis

Iowa

Hicklin, Gregory Alan	Urbandale
Makarewicz, Carl R.	Fort Madison
Tullo, Ralph J.	Muscataine

Kansas

Allen, Timothy Edward	Topeka
Allen, William Jr.	Great Bend
Allen, William R. Sr.	Kansas City
Borders, Jeffrey L.	Kansas City
Brooks, William H.	Overland Park
Cox, Glendon G.	Kansas City
Hart, Kelly Zack	Kansas City
Olomon, Caprice Michelle	Kansas City
Schworm, Curtis Paul	Kansas City

Kentucky

Baker, Glen R.	Corbin
Broudy, Bruce Charles	Lexington
Brown, Collins Dale	Paducah
Dineen, John Francis	Lexington
Haick, Edward M.	Louisville
Halbert, Dennis Herman	Pikeville
Harrison, John Morris	Lexington
Harty, Mary Louise	Louisville
Hashem, Abul	Whitesburg
Horowitz, Joel Adam	Louisville
Jarboe, Thomas M.	Lexington
Joyce, Betty W.	Louisville
Lieber, Arthur	Lexington
Marshall, Thomas R.	Fisherville
McLaughlin, Arthur J.	Louisville
Obryan, William Martin	Owensboro
Pope, Robert Neil	Owensboro
Poulos, Alex	Pikeville
Powell, Robert W.	Louisville
Skolnick, Judah L.	Louisville
Stemkowski, Paul E.	Ashland
Vaezy, Abdolazim	Corbin
Vuskovich, Matthew A.	Lexington
West, Larry K.	Pikeville
Westerfield, Byron T.	Lexington
Wicker, Mitchell	Hazard
Woodring, John Howell	Lexington

Louisiana

Cavin, Elwyn F.	Lake Charles
Gomes, Glenn M.	Baton Rouge

Hunter, David R.	New Orleans
Laborde, Jeffrey	Lafayette
Levy, Arthur E.	Marrero
Matthews, Charles C.	New Orleans
Morales, Robert James	New Orleans
Nussbaumer, David Paul	Baton Rouge
Prudhomme, Stephen C.	Baton Rouge
Sotile, Steven Charles	Baton Rouge

Maine

Isler, Robert J.	Falmouth
Kilgallen, John D.	Portland
Pitman, Jon Perley	Lewiston

Maryland

Benedikt, Richard A.	Silver Spring
Brown, Stephen Robinson	Severna Park
Eliasson, Orn	Baltimore
Gayler, Bob W.	Baltimore
Gelman, Russell	Baltimore
Golub, David D.	Baltimore
Gullickson, Gail Mary	Bethesda
Hagen, Harold Melton	Potomac
Harvey, Christopher M.	Lutherville
Hersh, Stephen Robert	College Park
Jackson, Francis D.	Cumberland
Khoury, Nagi Fouad	Baltimore
Kim, Myung Sup	Cumberland
Kim, Ryun Ho	Crownsville
Kim, Young Choo	Phoenix
Lesar, May Siang Lim	Bethesda
Mason, Andrew C.	Baltimore
Miller, Robert F.	Cumberland
Napoli, Louis Dominic	Potomac
Nissim, Jack E.	Baltimore
Pastakia, Behram	Bethesda
Sanders, Angelita D.	Columbia
Scott, Penelope Pate	Baltimore
Scott, William W.	Baltimore
Simmons, Julian T.	Baltimore
Siple, Donald J.	Baltimore
Stanfield, Ronald Jeffrey	Columbia
Templeton, Philip Anthony	Baltimore
Thomas, Sherida	Clinton
Wehunt, William D.	Rockville
Wheeler, Paul S.	Baltimore
Zimmons, Paul S.	Potomac

Massachusetts

Barrett, Peter J.	Hingham
Cloud, William Max	Springfield
Gale, Daniel R.	Needham
Gale, M. Elon	Needham
Greene, Reginald	Boston

3. (continued)

Llewellyn, Henry J.	Boston
McCloud, Theresa C.	Boston
Mittelholzer, Ernest M.	Holyoke
Oliver, L. Christine	Boston
Parker, Thomas H.	Springfield
Schwartz, Alan Marshall	Cohasset
Shapiro, Matthew	Boxborough
Shepard, Joanne O.	Boston

Michigan

Baker, David E.	Ann Arbor
Beute, Gordon H.	W Bloomfield
Breckenfeld, James Irving	Birmingham
Dibiase, Marco J.	Berrien Springs
Dimcheff, Donald G.	Ypsilanti
Drumm, John Kevin	Bloomfield Hill
Engel, Michael A.	Muskegon
Franzblau, Alfred	Ann Arbor
Guidot, Charles A.	Linwood
Kvale, Paul Arthur	Detroit
Manier, Stephen Michael	Escanaba
McCarroll Kathleen A.	Bloomfield Hill
Obrien, Kevin M.	Grosse Pte Farm
Osher, David Lawrence	Franklin
Pearlberg, Jay L.	Southfield
Pink, Rita J.	Pontiac
Rosenman, Kenneth D.	E Lansing
Sadik, Abdul Razzak	Madison Heights
Talbot, Joseph	Saginaw
Zeskind, H. Jay	W Bloomfield

Minnesota

Aughenbaugh, Gregory Lee	Rochester
Bjorgen, John Edward	Golden Valley
Boardman, William J.	Minneapolis
Brown, Larry Randolph	Rochester
Clark, Terrence Charles	Duluth
Cook, Anthony Michael	St Paul
Erwin, James Sheldon	Winona
Fiedler, Brian S.	St Paul
Flink, James Richard	St Paul
Gretsch, Gerald A.	North Oaks
Ketcham Douglas B.	Minneapolis
Kosel, Gary R.	Minneapolis
Moody, David L.	Minneapolis
Tashjian, Joseph Harry	Burnsville

Mississippi

Harrison, Robert Brent	Jackson
Kuebler, Richard S.	Ridgeland
Segarra, Jay T.	Ocean Springs

Missouri

Beal, Catherine E.	St Louis
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Beller, Thomas A.	Kansas City
Bramble, John Mark	Kansas City
Cusumano, Joseph Vincent	St Louis
Cyriac, George K.	Mexico
Hardy, Jeffery A.	St Louis
Johnson, Kevin T.	Bridgeton
Jones, Wendy R.	Springfield
Lang, John Joseph	St Louis
Sagel, Stuart Steven	St Louis
Solomon, Steven L.	Chesterfield
Speckman, Jerry	Kansas City
Sundaram, Murali	St Louis

Montana

Auerbach, Richard C.	Missoula
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Nebraska

Dobry, Charles A.	Omaha
Gurney, Jud W.	Omaha
Kujawa, Head Linda S.	Papillion
Stavas, Joseph Michael	Lincoln

Nevada

Steinberg, David L.	Las Vegas
Topper, Bruce M.	Las Vegas
Wiesner, J. Paul	Las Vegas

New Jersey

Altin, Robert S.	Browns Mills
Amorosa, Judith Korek	Somersville
Auerbach, Donald	Cherry Hill
Baker, Stephen R.	Newark
Berg, Roger A.	Short Hills
Chase, Paul J.	Cherry Hill
Daum, Susan M.	River Edge
Flicker, Stephanie	Browns Mills
Kipen, Howard Matthew	Basking Ridge
Kramer, Neil Robert	Cherry Hill
Leone, Armand F. Sr.	Franklin Lakes
Metzger, Rose Anne	Cherry Hill
Miller, Jeffrey A.	West Orange
Morley, Thomas F. D. O.	Laurel Springs
Moss, Edward G.	Cherry Hill
Platt, Marvin	Perth Amboy
Pope, Alan Raymond	Moorestown
Schaffer, Burton	Voorhees
Singer, Ellis P.	Plainfield
Timins, Julie K.	Morristown
Tiruvilumala, Parvathi	N Caldwell

New Mexico

Buchanan, William Y.	Albuquerque
Christensen, William I.	Albuquerque
Coultas, David Bruce	Albuquerque

James, David S.	Albuquerque
Rothstein, Martin Irwin	Albuquerque
Stevenson, James R.	Albuquerque

New York

Austin, John Holcombe	New York
Azimi, Farhad	Fayetteville
Black, Gerald A.	Fayetteville
Block, Brian	Lewiston
Bogart, Sydney David	Bayside
Buckwalter, Lawrence E.	Loudonville
Democker, John Carroll	Rochester
Fitzgerald, James B.	Orchard Park
Gerle, Richard D.	Syracuse
Germaine, Louis Mark	Scarsdale
Gottesman, Joseph J.	New York
Grosso Mario A.	Rochester
Guthikonda, Sudhir B.	Fulton
Harkin, Timothy Joseph	New York
Harris, Leon S.	West Nyack
Hendrick, William	Albany
Kennedy, John David	Rochester
Khan, Arfa	New Hyde Park
Killam, Donald A.	Guilderland
Lautin, Everett Marc	New York
Lautin, Robert	New York
Leblanc, Jude A.	Elmira
Lilis, Ruth	New York
Lincoln, A. James	Rochester
Maxfield, Roger A.	New York
Miller, Albert	Great Neck
Park, Jung Ja	Kenmore
Pinsky, Harry J.	Rochester
Price, William Henry	Lewiston
Reilly, Herbert F. Jr.	Scotia
Roche, Patricia Jean	Katonah
Salwen, Jay K.	Schenectady
Schechter, Sheldon	Brooklyn
Szeinuk, Jaime	Yonkers
Van Zandt, Theodore Fiske	Rochester
Vance, John W.	Buffalo
Velt, Paul Mark	Rochester
Wandtke, John C.	Rochester
Wood, Gary W.	Schenectady
Zehr, Ralph D.	Waverly
Zimmerman, Leonard	West Nyack

North Carolina

Adkins, Mark Allen	Kinston
Dula, Frederick M.	Salisbury
Eisenberg, Carl J.	Charlotte
Gerdes, Joseph John	Concord
Goodman, Philip Cary	Durham
Hayes, David Allen	Raleigh

Hoffman, Carl White	Lumberton
Newman, Edwin	Charlotte
Ragozzino, Mark William	Wilmington
Weaver, Michael David	Greenville

North Dakota

Meyer, Bradley N.	Bismarck
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Ohio

Adam, Wynn W.	Kettering
Corcoran, Helen L.	Cincinnati
Crass, Jeffrey Robert	Shaker Heights
Demarco, Victor Joseph	Beachwood
Fierra, Jeffrey James	Strongsville
Fisher, Stephen	Cleveland
Fox, Thomas Thurman	Dublin
Grael, George L.	Strongsville
Haas, Steven Douglas	Columbus
Hojat, Saied Mohamad Khalil	Gallipolis
Jacobs, George David	Oregon
Kattan, Kenneth R.	Cincinnati
King, Mary Anne	Lakewood
Lenhart, Richard Kenneth	Avon Lake
Lie, Sutek	Gates Mills
Lockey, James E.	Cincinnati
McFarland, Dan R.	Dublin
Meziane, Moulay	Cleveland
Nisenbaum, Josef	Dayton
Patterson, Richard	Bath
Radebaugh, David E.	Medina
Reinhardt, Nancy Sue	Kettering
Rubenstein, Eli	Cincinnati
Saks, John B.	Barberton
Shipley, Ralph Taylor	Cincinnati
Spitz, Harold B.	Cincinnati
Stafford, Patricia A.	Dublin
Subbiah, Balusamy	Gallipolis
Thompson, Jay S.	Bedford
Thorley, Lawrence G.	Amherst
Venizelos, Paul C.	Lakewood
Wiot, Jerome F.	Cincinnati
Wu, Tson Kuang	Oberlin

Oklahoma

Dunn, Charles Jackson	Oklahoma City
Dyer, Norris William	Tulsa
Eckman, Charles E.	Oklahoma City
Johnson, Thomas Harold	Oklahoma City

Oregon

Craven, Robert E.	Portland
Kocarnik, Daniel R.	Portland

3. (continued)

Pennsylvania

Ansley, Mark W.	Philadelphia
Aronchick, Judith M.	Merion
Babu, Vallabhaneni S.	Pittsburgh
Bennett, Michael Robert	Pittsburgh
Bresnitz, Eddy Armin	Bala Cynwyd
Brockmole, Dean Mark	Danphin
Ciotola, Joseph G.	Hazleton
Colella, Mark S.	Natrona Heights
Cynn, Won S.	Philadelphia
Dash, Nilima	Pittsburgh
Demarino, Georgine	Pittsburgh
Duncan, Carl Ronald	York
Dupont, Daniel C.	Ridley Park
Ehrlich, Irving	Wyomissing
Epstein, David M.	Pittsburgh
Epstein, Paul E.	Gladwyne
Fiehler, Paul C.	Pittsburgh
Fino, Gregory John	Pittsburgh
Freedman, Allan Perry	Philadelphia
Fuhrman, Carl Robert	Pittsburgh
Galgon, John P.	Allentown
Gardner, Morris	Allison Park
Gefter, Warren Bruce	Philadelphia
Goodman, George B.	Wexford
Haber, Arthur S.	Hazleton
Harding, John A.	Philadelphia
Herbick, William Thomas	Johnstown
Hoke, Hugh Holman	Lancaster
Holbert, Brenda L.	Pittsburgh
Holbert, John M.	Pittsburgh
Jagannath, Anand S.	Mechanicsburg
Johnson, Claude R.	Philadelphia
Kaplan, Lawrence M.	Reading
Kaplan, Peter Donald	Pittsburgh
Kettering, Donald Louis	Greensburg
Kibelstis, John A.	Allentown
King, Phillip Eugene	Johnstown
Kuhns, Karen F.	Pittsburgh
Laman, Paul David Jr.	Pittsburgh
Lapayowker, Marc S.	Abington
Laucks, Stanley Philip	York
Lepar, Edwin	Rydal
Levine, Richard B.	Elkins Park
Limberakis, Anthony John	Rydal
Lippman, Michael	Philadelphia
Lynn, Charles A.	Butler
Mathur, Kailash Nath	Pottsville
Mazzei, Joseph M.	Pittsburgh
McMahon, William Joseph	Washington
Mieckowski, Gregory C.	Kittanning
Miller, Wallace T. Jr.	Philadelphia
Miller, Wallace T. Sr.	Philadelphia

Mital, Nirmal	Johnstown
Mullin, Hugh J.	Holland
Nagle, Richard W.	Fairview
Naugle, Ingrid E.	Pittsburgh
Orr, Donald P.	Pittsburgh
Palmer, William E.	Johnstown
Patel, Arun R.	Altoona
Peacock, Joseph Ronald	West Chester
Pickerill, Robert G.	Johnstown
Prince, David	Bryn Mawr
Richterman, Ronald L.	Wilkes Barre
Robinson, James Alan	York
Rosner, William F.	Huntingdon Vly
Scott, John H.	Pittsburgh
Sherban, Paul R.	Lancaster
Shively, John G.	Pittsburgh
Simone, Frank J.	Indiana
Singh, Vijai Pal	Uniontown
Skeist, Barry Philip	Sayre
Smith, Henry K.	New Cumberland
Soble, Marc G.	York
Solic, John Joseph	State College
Spirn, Paul W.	Philadelphia
Steiner, Robert	Philadelphia
Sundheim, James Lang	Scranton
Thomeier, William C.	Canonsburg
Weinstein, Donald S.	Wynnewood
Wolfe, Patrick W.	Johnstown
Yeung, Horatio	Chadds Ford
Yoo, Ho Joon	Erie

Rhode Island

Ellin, Stephen R.	Warwick
Kern, David Grant	Pawtucket
Land, Richard E.	Providence

South Carolina

Greer, Charles Frederick	Charleston
Hanna, Jeffrey William	Greenville
Horton, Joseph	Charleston
Schabel, Stephen Irwin	Charleston
Tubbs, Charles Otis	Charleston

South Dakota

Henrickson, Lynn A.	Sioux Falls
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Tennessee

Duncan, Thomas R.	Columbia
Estes, Terrell C.	Bristol
Fulchiero, Randall M.	Bristol
Lucas, Phillip Howard	Memphis
Morrow, Sanford Hewitt III	Chattanooga
Pendergrass, Henry P.	Nashville

Sargent, Jeffery Dale	Bristol
Siner, John R.	Kingsport
Westerfield, Larry Haynes	Kingsport
Winer, Muram Helen T.	Memphis
Worrell, John Anthony	Nashville

Texas

Blakley, Gail	Houston
Bloom, Kim	Houston
Brannan, Harold Moulden	San Antonio
Cade, Samuel H.	Dallas
Cain, Harold D.	Austin
Cameron, Donald D.	Lubbock
Casar, Gregorio	Houston
Chalmers, John H. Jr.	Tyler
Clark, Mark C.	Austin
Conoley, Patrick M.	Houston
Cramer, Timothy J.	San Antonio
Delclos, George Luis	Houston
Garcia, Ramon Julio	Port Arthur
Goodrich, William A.	Baytown
Haysom, Howard Henry	Houston
Karnicki, Daniel C.	Beaumont
Manske, Arnold O.	Pt Arthur
Maza, Frank G.	Austin
Noss, Phyllis J.	Dallas
Padron, Gustavo M.	Nederland
Sheffield, Hugh C.	Nederland
Shepherd, James R.	Tyler
Sirota, Paul Gunnar	Houston
Smith, Arthur L.	Beaumont
Strollo, Diane Clare	San Antonio

Utah

Mann, Howard	Salt Lake City
Morrison, W. James	Salt Lake City

Vermont

Graham, William G. B.	Charlotte
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Virginia

Brandon, Brent D.	Natural Bridge
Castle, James R.	Roanoke
Cooper, Kevin Richard	Richmond
Deponte, Kathleen Ann	Norton
Derring, E. H.	Norfolk
Donlan, C. J.	Norfolk
Dunn, Neil F. S.	Newport News
Fairman, R. Paul	Richmond
Feldmann, William C.	Virginia Beach
Fine, Ronald	Great Falls
Fogel, William M.	Richmond
Forehand, John Randolph	Richlands
Foreman, David R.	Suffolk

Frey, Allen A.	Manakin-Sabot
Giessel, Glenn Matthew	Richmond
Henry, Daniel Anthony	Midlothian
Henwood, Wesley C.	Covington
Hippensteel, Kirk Edward	Roanoke
Jolles, Howard	Richmond
McGehee, Read Flournoy	Richmond
Navani, Shiv	Big Stone Gap
Paranthaman, Subramaniam	Appalachia
Proto, Anthony Vincent	Richmond
Ramakrishnan, M.	Big Stone Gap
Rivers, Cullen B.	Richmond
Robinette, Emory H.	Abingdon
Scutero, James V.	Portsmouth
Shaw, James O'neil	Newport News
Solack, George Andrew	McLean
Stewart, Bruce Neal	Salem
Stewart, Rhonda R.	Alexandria
Stitik, Frederick P.	Norfolk
Torrisi, Peter F.	Richmond
Wadsworth, James Douglas	Chester
Wheeler, William Francis	Norfolk
Zasada, Andrew P.	Suffolk

Washington

Casey, Kenneth Robert	Seattle
Godwin, J David	Seattle
Harvey-Smith, W.	Seattle
Kidd, Cloid R.	Seattle
Larson, Timothy L.	Seattle
Morishima, Michael Shoji	Seattle
Ostrow, Jonathan H.	Seattle
Smith, Dorsett D.	Everett
Takasugi, Julie Emiko	Seattle

West Virginia

Abdalla, Fouad H.	Elkins
Abrahams, Roger A.	Morgantown
Abramowitz, David	S Charleston
Ahmed, Afzal U.	Princeton
Alexander, Michael S.	Princeton
Altmeyer, Robert B.	Wheeling
Aycoth, Edward D.	Princeton
Bassali, Maurice A.	Beckley
Bellotte, John A.	Clarksburg
Binns, Carl Brooks	Scott Depot
Cappiello, Enrico John	Spanishburg
Cunanan, Roberto A.	Bridgeport
Dransfeld, Hans G.	Huntington
Francke, Paul	Charleston
Gaziano, Dominic J.	Charleston
Gogineni, Ravindra Kumar	Charleston
Goodwin, Andrew W. II	Bridgeport
Harron, Ray A.	Bridgeport

3. (continued)

Hayes, Thomas Morton	Charleston
Hetzer, Timothy B.	Morgantown
Hickey, Nancy M.	Lewisburg
Hodous, Thomas Knight	Morgantown
Hogan, Michael Thomas	Morgantown
Hurst, Janis L.	Fairmont
Jaworski, Andrzej J Acek	Morgantown
Kennard, John W.	Wheeling
Kinsella, Mario T.	Wheeling
Lapp, N. Leroy	Morgantown
Leef, Johnsey Lee	Charleston
McWhorter, Richard Ellison	Huntington
Morgan, Edwin James	Morgantown
Murthy, Narayan B.	New Martinsvill
Parker, John E.	Morgantown
Pathak, Kishor S.	Princeton
Ranavaya, Mohammed I.	Chapmanville
Rao, Laxminarayana C.	Bluefield
Renn, Joseph J.	Morgantown
Shah, Krishnajivan C.	Summersville
Smith, James T.	Charleston
Sparks, David Alan	Charleston
Tweel, Harry K.	Huntington
Wang, Mei Lin	Morgantown
Wershba, Martin S.	S Charleston
Younes, Maan	Williamson
Zaldivar, George Luis Leon	Charleston

Wisconsin

Alter, Albert J.	Madison
Anderson, Henry A.	Madison
Bates, Forrest Thomas	Neenah
Billings, Kenneth J.	Marshfield
Chabria, Prakash B.	Menomonee Falls
Clark, Kenneth E.	Kenosha
Collins, Jannette	Madison
Hinson, Robert E.	Milwaukee
Karnes, Mack A.	Caledonia
Kuhlman, Janet E.	Madison
Lindesmith, Larry A.	La Crosse
Lindgren, Richard D.	Madison
Luckey, William T.	Milwaukee
Pallin, John S.	Kenosha
Tolly, Thomas L.	Neenah
Vaisman, Uri	Neenah

International

Algranti, Eduardo	Sao Paulo, Brazil
Ameille, Jacques	Paris, France
Bertrand, Pierre	Montreal
Borgersen, Arne	Oslo, Norway
Brochard, Patrick	Creteil, France
Choudat, Dominique	Bois Colombes, France
Colman, Neil Cass	Montreal
Contreras, Gustavo R.	British Columbia
Eriksson, Jan R.	Oslo, Norway
Galiber, Angelo Keith	Christiansrnf, Norway
Hering, Kurt Georg	Germany
Letourneux, Marc	Caen, France
Morgan, William Keith C.	London, Ontario
Raffaelli, Claude Maurice	Flers, France
Rubin, Ami-hai Eliezer	Haifa, Israel
Zitting, Anders Johan	Helsinki, Finland

List of NIOSH Certified Roentgenographic Interpreting Physicians; B Readers by State; revised June 1995.

4. Occupational Health Clinics Throughout the U.S. and Canada

Alabama

University of Alabama at Birmingham
930 20th Street South
Birmingham, AL 35205
(205) 934-7303; Fax (205) 975-4377

California

Occupational & Environmental Health Clinic
University of California at San Francisco
1515 Scott Street
San Francisco, CA 94115
(415) 885-7770; Fax (415) 206-8949

Occupational & Environmental Health Clinic
University of California at Davis
ITEH
Davis, CA 95616
(916) 752-3317; Fax (916) 752-5300

Irvine Occupational Health Center
UC Irvine
19722 MacArthur Blvd
Irvine, CA 92717
(714) 824-8641; Fax (714) 824-2345

Colorado

Occ. and Env. Medicine Division
National Jewish Center for Immunology &
Respiratory Medicine
1400 Jackson Street
Denver, CO 80206
(303) 398-1520; Fax (303) 398-1452

Connecticut

Yale Occ./Env. Medicine Program
School of Medicine
135 College Street, 3rd Floor
New Haven, CT 06510
(203) 785-5885; Fax (203) 785-7391

University of Connecticut
Occupational Medicine Program
263 Farmington Ave.
Farmington, CT 06030
(203) 679-2893; Fax (203) 679-4587

Waterbury Occupational Health
140 Grandview Ave. Suite 101
Waterbury, CT 06708
(203) 573-8114; Fax (203) 755-3823

District of Columbia

Div. of Occ. & Env. Medicine
School of Medicine, GWU
2300 K Street, NW
Washington, DC 20037
(202) 994-1734; Fax (202) 994-0011

Georgia

Env. and Occ. Program—The Emory Clinic
Rollins School of Public Health—Emory U.
1518 Clifton Road
Atlanta, GA 30329
(404) 778-5978; Fax (404) 727-8744

Illinois

Occupational Medicine Clinic
Cook County Hospital
720 South Wolcott
Chicago, IL 60612
(312) 633-5310; Fax (312) 633-6442

University of Illinois Occ. Medicine Program
840 S. Wood
P.O. Box 6998 M/C 678
Chicago, IL 60612
(312) 996-1063; Fax (312) 996-1286

Iowa

Univ. of Iowa, Occupational Medicine Clinic
Dept. Internal Med.—College of Medicine
T304 GH 200 Hawkins Drive
Iowa City, IA 52242
(319) 356-8269; Fax (319) 356-6406

Kentucky

Univ. of Kentucky Occ. Medicine Program
Warren Wright Medical Plaza
800 Rose Street
Lexington, KY 40536-0084
(606) 257-5166; Fax (606) 258-1038

Louisiana

Ochsner Center for Occ. Health
1514 Jefferson Hwy
New Orleans, LA 70121
(504) 842-3955; Fax (504) 842-3977

4. (continued)

Maine

Center for Health Promotion
1600 Congress Street
Portland, ME 04102
(207) 774-7751; Fax (207) 828-5140

Maryland

Johns Hopkins University
Center for Occupational & Environmental
Health
5501 Hopkins Bayview Circle
Baltimore, MD 21224
(410) 550-2322; Fax (410) 550-3355

Occ. Health Project/School of Med.
Div. of Gen. Internal Med./Univ. of Md.
405 Redwood Street
Baltimore, MD 21202
(410) 706-7464; Fax (410) 706-4078

Massachusetts

Center for Occ. and Env. Medicine
Massachusetts Respiratory Hospital
2001 Washington Street
South Braintree, MA 02184
(617) 848-2600; Fax (617) 849-3290

Occupational Health Service
Dept. Family & Commun. Med. Univ. Mass.
55 Lake Avenue North
Worcester, MA 01655
(508) 856-2734; Fax (508) 856-1680

Occupational & Environmental Health Ctr.
Cambridge Hospital
1493 Cambridge Street
Cambridge, MA 02139
(617) 498-1580; Fax (617) 498-1671

Michigan

Michigan State University
Department of Medicine
117 West Fee
East Lansing, MI 48824-1316
(517) 353-1846; Fax (517) 432-3606

Div. of Occupational and Environmental
Medicine
Wayne State/Dept. of Family Medicine
4201 St. Antoine, Suite 4-J
Detroit, MI 48201
(313) 577-1420; Fax (313) 577-3070

Occupational Health Program
School of Public Health, U of M
1420 Washington Heights
Ann Arbor, MI 48109-2029
(313) 764-2594; Fax (313) 763-8095

Center for Occ. and Environmental Medicine
22255 Greenfield Rd. Suite 440
Southfield, MI 48075
(810) 559-6663; Fax (810) 559-8254

Occupational Health Service
Work and Health Institute
St. Lawrence Hospital
1210 W. Saginaw
Lansing, MI 48915
(517) 377-0309; Fax (517) 377-0310

Minnesota

Ramsey Clinic
Occ. & Env. Health & Occ. Med. Residency
Training
640 Jackson St.
St. Paul, MN 55101-2595
(612) 221-3771; Fax (612) 221-3874

Columbia Park Medical Group
6401 University Ave., NE #200
Fridley, MN 55432
(612) 572-5710; Fax (612) 571-3008

New Jersey

Env. and Occ. Health Clinical Center
Env. and Occ. Health Sciences Institute
P.O. Box 1179
Piscataway, NJ 08855-1179
(908) 932-0123; Fax (908) 932-0127

New Mexico

Presbyterian Occupational Medicine Clinic
6100 Pan American Freeway, Suite 210
Albuquerque, NM 87109
(505) 823-8450; Fax (505) 823-8484

New York

Eastern NY Occupational Health Program
1201 Troy Schenectady Road
Latham, NY 12110
(518) 783-1518; Fax (518) 783-1827

continued

4. (continued)

Mount Sinai
Irving J. Selikoff Occ. Health Cl. Ctr.
P.O. Box 1058 Gustave Levy Pl.
New York, NY 10029
(212) 241-6173; Fax (212) 996-0407

Center for Occupational & Environmental
Medicine
Health Sciences Center, Level 3-086
University at Stony Brook
Stony Brook, NY 11794
(516) 444-2167; Fax (516) 444-7525

Central NY Occ. Health Clinical Ctr.
6712 Brooklawn Parkway
Suite 204
Syracuse, NY 13211-2195
(315) 432-8899; Fax (315) 431-9528

HHC Bellevue Occ./Env. Medicine Clinic
Bellevue Hospital Room CD 352
1st Ave & 27th Street
New York, NY 10016
(212) 562-4572; Fax (212) 562-4574

Finger Lakes Occupational Health Services
601 Elmwood Avenue
Box EHSC
Rochester, NY 14642
(716) 275-1335; Fax (716) 256-2591

North Carolina

Div. of Occ. and Env. Medicine
Duke University Medical Center
Box 2914
Durham, NC 27710
(919) 286-3232; Fax (919) 286-1021

Ohio

WorkLink
Occupational & Environmental Health Clinic
2500 MetroHealth Drive
Cleveland, OH 44109-1998
(216) 778-8087; Fax (216) 778-8225

Center for Occupational Health
Holmes Hospital-Tate Wing
University of Cincinnati College of Medicine
Eden and Bethesda Ave.
Cincinnati, OH 45267-0182
(513) 558-1234; Fax (513) 558-1010

The U.S. clinics are members of the Association of Occupational and Environmental Clinics as of April 1995.

Summary: Medical Surveillance

1. Under the OSHA standard (1910.20), you as an individual are entitled to your individual test results. **The union is also entitled to the results without individual identities.**
2. Corporations have many programs relating to health and medicine, such as alcoholism programs and drug testing. But these are not occupational health surveillance programs. **An occupational health surveillance program is a program that tests for job exposures to toxic chemicals or conducts OSHA-mandated medical tests.**
3. Medical surveillance for work-related hazards is only useful to the extent that the medical tests are **the right ones to assess the possible health effects of the specific hazards that you face on your job.** For example, if you are exposed to lead, you should have a blood test, not a chest X-ray.
4. **You have the right and the obligation to your membership to make certain that the health care providers who implement the company program are competent to do the job.** Not every doctor has the experience and training to understand occupational medicine. A qualified "B" reader should read your X-rays, and a board-certified doctor for occupational medicine should be running the company program. We included a list of "B" readers, and a list of excellent clinics that can help you evaluate your doctors.
5. **You also have the skill to evaluate your medical surveillance program.** By looking at the MSDSs and the results of your surveys, you can make a list of the tests that should be done. If they are not being done, the program needs to be changed.

continued

Summary *(continued)*

6. If whatever program you have spots any kind of pattern of health problems, these problems should not be assumed to be caused by lifestyle factors like drinking or smoking. Any pattern of problems will need further analysis by a trained professional. **If you see such a pattern, call the PACE hot-line immediately, and/or contact any one of the recommended clinics on the list we have provided.**

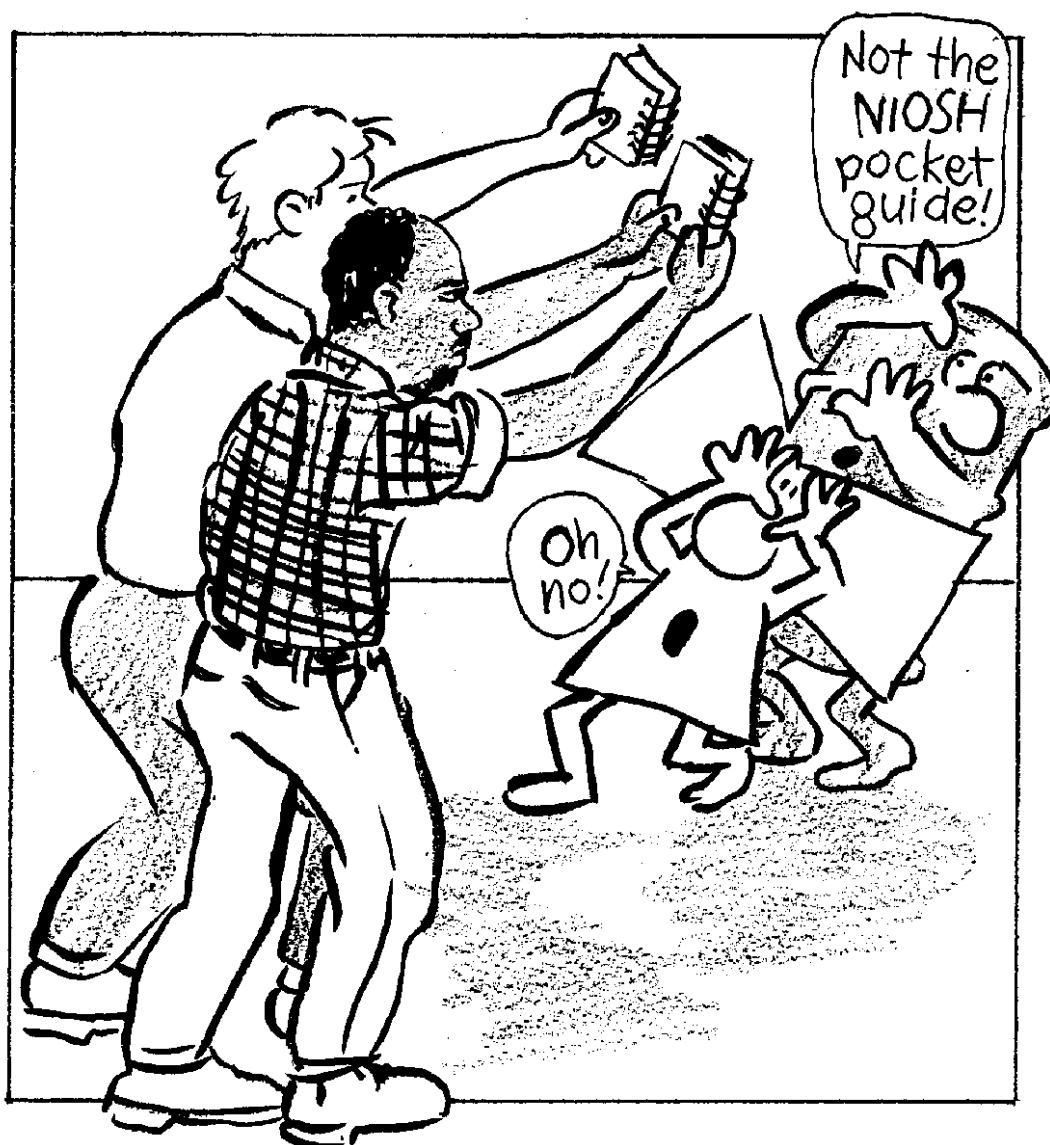
7. There are always potential conflicts of interest when a company directly provides a medical surveillance program, or directly hires doctors to do the job. **It would be far better if you could negotiate a program where the company would provide the funds and the union and management pick the medical provider.** In that way, you could insist that one of the qualified clinics perform the work.

Summary written by Dr. Steven Markowitz, MD, Mt. Sinai School of Medicine, New York, N.Y.

Activity 11: NIOSH Pocket Guide

Purpose

To familiarize ourselves with using the *NIOSH Pocket Guide to Chemical Hazards* and to compare health information on the MSDSs with that of the *Pocket Guide*. This activity has two tasks.



Task 1

Marty, a co-worker, has come to you because he is concerned with his exposure to a product he is working with, "Loctite Klean N' Prime." The fumes hurt his eyes and give him a headache. Marty complained to his supervisor Karen, but she told him that according to the MSDS, Klean N' Prime was safe if used as directed. The main ingredient of Klean N' Prime is 1,1,1-trichloroethane.

In your groups, use the *NIOSH Pocket Guide* and the MSDS on pages 328 through 330 to fill out the chart below. Please note that some chemicals may be listed by their synonym or trade name (see page 371 of the *Pocket Guide*). Please refer to the factsheets on pages 331 through 351 to help in answering the questions.

1. What are the short-term (acute) hazards ("symptoms" in the *Pocket Guide*) for exposure to 1,1,1-trichloroethane?

The MSDS says:	The <i>Pocket Guide</i> says:

2. What are the long-term (chronic) hazards ("target organs" in the *Pocket Guide*) for exposure to 1,1,1-trichloroethane?

The MSDS says:	The <i>Pocket Guide</i> says:

3. Referring to Factsheet 9 on page 342 and the *Pocket Guide*, find the IDLH for methyl chloroform. Do you think that being able to find the IDLH for a chemical is important? Why?

continued

Task 1 *(continued)*

4. Which reference guide (the MSDS or the *NIOSH Pocket Guide*) do you think is most useful to you? Would you recommend using just one or both? Please explain your answer.

5. What precautions would you advise Marty to take while working around Klean N' Prime? Please explain your answer.

Definitions of Terms Used in This Activity

The *NIOSH Pocket Guide to Chemical Hazards* uses abbreviations in all its listings. There is a comprehensive list of all abbreviations used at the beginning of the guide. There are a number of key concepts that should be discussed first. An understanding of these will allow the user of the guide to feel more comfortable with its format and content.

NIOSH – National Institute of Occupational Safety and Health. This is a group of scientists paid to perform research on exposure limits.

NIOSH RELs* – These are **recommended exposure limits** made by NIOSH. They are not law. This is the level that NIOSH states *should* not be exceeded.

OSHA – Occupational Safety and Health Administration. This is the government agency that sets and enforces the Occupational Safety and Health Act.

OSHA PELs* – These are the **permissible exposure limits** set by OSHA. They are law and **MUST** not be exceeded.

ACGIH – American Conference of Governmental Industrial Hygienists. This is another group of scientists and working professionals that recommend exposure limits.

ACGIH TLVs* – **Threshold Limit Values** set by the ACGIH. Like the NIOSH RELs, these values are not law.

Carcinogen – A cancer-causing substance.

IDLH – **Immediately Dangerous to Life or Health**. The current NIOSH definition for an IDLH exposure is a condition "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such environment."

LEL – **Lower Explosive Limit**. The minimum concentration of vapor in air below which propagation of a flame will not occur in the presence of an ignition source.

UEL – **Upper Explosive Limit**. The maximum concentration of a vapor in air above which propagation of a flame will not occur in the presence of an ignition source.

*The RELs and TLVs are presented as reference guides when evaluating exposure. The PELs set by OSHA are the levels that must be maintained by law. *It is always better to use the lowest limit for safety reasons.*



1001 TROUT BROOK CROSSING
ROCKY HILL, CT 06067-3910
EMERGENCY PHONE: (860) 571-5100

ISSUED 1/18/96
14:38:54
FAX: (860) 571-5465

MATERIAL SAFETY DATA SHEET

Page 1 of 3

I. PRODUCT IDENTIFICATION

Product Name: Loctite(R) Klean 'N Prime
Item No.: 02556
Part No.: 2556
Product Type: Aerosol Primer

II. COMPOSITION

Ingredients	CAS No.	%
ETHANE, 1,1,1-TRICHLORO-*	71-55-6	85-90
ISOPROPYL ALCOHOL	67-63-0	5-10
CARBON DIOXIDE	124-38-9	3-5
tert-BUTYL ALCOHOL*	75-65-0	1-3
N,N-Dialkyltoluidine	99-97-8	1-3
METHANE, DIMETHOXY-	109-87-5	1-3
2-Mercaptobenzothiazole*	149-30-4	1-3

* This component is listed as a SARA Section 313 Toxic Chemical.

III. CHEMICAL AND PHYSICAL PROPERTIES

Vapor Pressure: Approximately 100mm at 70°F
Vapor Density: Approximately 4.5
Solubility in Water: Slight
Specific Gravity: 1.3 at 70°F
Boiling Point: 170-180°F
Volatile Organic Compound (EPA Method 24) 4.1%; 53 grams per liter of base material
Evaporation Rate (Ether = 1) Not available
pH: Not applicable
Appearance: Yellow liquid
Odor: Sharp

IV. FLAMMABILITY AND EXPLOSIVE PROPERTIES

Flash Point: 147°F (Base only) Method: Tag Closed Cup
Estimated NFPA(R) Code:
Health Hazard: 2
Fire Hazard: 2
Reactivity Hazard: 0
Specific Hazard: Does not apply
Estimated HMIS(R) Code:
Health Hazard: 2
Flammability Hazard: 2
Reactivity Hazard: 0
Personal Protection: See Section X.
Explosive Limits:
(% by volume in air) Lower 7% 1,1,1-Trichloroethane
2.0% Isopropyl alcohol
1.2% N,N-Dialkyltoluidine
0.2 oz/cu ft. of air Mercaptobenzothiazole (dust)
2.4% t-Butyl alcohol
2.2% Dimethoxymethane
(% by volume in air) Upper 15% 1,1,1-Trichloroethane
12.7% at 200°F Isopropyl alcohol
7% N,N-Dialkyltoluidine
8% t-Butyl alcohol
13.1% Dimethoxymethane
Recommended
Extinguishing Agents: Carbon dioxide, Foam, Dry Chemical
Hazardous Products Formed by Fire or Thermal Decomp Toxic chlorides.
Unusual Fire or Explosion Hazards: Cans may rupture in fires.
Compressed Gases: Carbon dioxide
Pressure at Room Temp.: 50 psi

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MATERIAL SAFETY DATA SHEET Page 2 of 3

Product Name: Loctite(R) Klean 'N Prime
 Item No.: 02556

V. SPILL OR LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case of spill or leak: Remove sources of ignition. Allow to evaporate with good ventilation. Soak up residue with an inert absorbent. Store in a closed container until disposal.

Recommended methods of disposal: Follow EPA and local regulations for disposal of chlorinated hydrocarbons.

VI. STORAGE AND HANDLING PROCEDURES

Safe Storage: Store below 110°F.
 (Contact Loctite Customer Service 1-800-243-4874 for shelf life information)
 Handling: Avoid prolonged breathing of vapors. Keep away from eyes.

VII. SHIPPING REGULATIONS

DOT (49 CFR 172)
 Domestic Ground Transport
 Proper Shipping Name: Consumer Commodity
 Hazard Class or Division: ORM-D
 Identification Number: None
 Marine Pollutant: 1,1,1-Trichloroethane

IATA
 Proper Shipping Name: Aerosols, non-flammable, n.o.s. containing substance in Division 6.1, Packing Group III
 Class or Division: Class 2.2, Subsidiary Risk 6.1
 UN or ID Number: UN 1950

VIII. REACTIVITY DATA

Stability: Stable
 Hazardous Polymerization: Will not occur.
 Hazardous Decomposition Products (non-thermal): None
 Incompatibility: Solvent may react violently with aluminum on prolonged contact.

IX. EMERGENCY TREATMENT PROCEDURES

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.
 Inhalation: Remove to fresh air. If symptoms persist, obtain medical attention.
 Skin Contact: Flush with water.
 Eye Contact: Flush with water for at least 15 minutes. Obtain medical attention.

X. PERSONAL PROTECTION

Eyes: Safety glasses or goggles recommended
 Skin: Rubber or plastic gloves recommended
 Ventilation: Provide adequate local ventilation to maintain vapor concentration below TLV.

XI. HEALTH HAZARD DATA

Toxicity: Eye, skin, and inhalation irritant.
 Moderately toxic by ingestion.
 Estimated dermal LD more than 2000 mg/kg.

Primary Routes of Entry: Ingestion, inhalation eye and skin contact.

Signs and Symptoms of Exposure: Headache, nausea, dizziness. Narcosis at high concentration. Eye or skin irritation.

Existing Conditions Aggravated by Exposure: Isopropyl alcohol:
 Skin disorders, eye problems, respiratory problems
 1,1,1-Trichloroethane:
 CNS, liver, heart disease, alcoholism, skin dis-

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 MATERIAL SAFETY DATA SHEET Page 3 of 3

Product Name: Loctite(R) Klean 'N Prime
 Item No.: 02556

XI. HEALTH HAZARD DATA (continued)

orders, eye problems, respiratory problems.

Exposure Limits (TWA) Ingredients	ACGIH (TLV)	OSHA (PEL)	OTHER
ETHANE, 1,1,1-TRICHLORO-	350 ppm TWA 1910 mg/m3	350 ppm TWA 1900 mg/m3	None
ISOPROPYL ALCOHOL	400 ppm TWA 983 mg/m3	400 ppm TWA 980 mg/m3	None
CARBON DIOXIDE	5,000 ppm TWA 9,000 mg/M3	10,000 ppm TWA 18,000 mg/M3	None
tert-BUTYL ALCOHOL	100 ppm TWA 303 mg/m3	100 ppm TWA 300 mg/m3	None
METHANE, DIMETHOXY-	1000 ppm TWA 3110mg/M3	1000 ppm TWA 3100mg/M3	None
Exposure Limits (STEL) Ingredients	ACGIH (TLV)	OSHA (PEL)	
ETHANE, 1,1,1-TRICHLORO-	450 ppm 2460 mg/m3	450 ppm 2450 mg/m3	
ISOPROPYL ALCOHOL	500 ppm 1230 mg/m3	500 ppm 1225 mg/m3	
CARBON DIOXIDE	30,000 ppm 54,000 mg/M3	30,000 ppm 54,000 mg/M3	
tert-BUTYL ALCOHOL	None	150 ppm 450 mg/m3	

Ingredients for which no Exposure Limits have been established are not listed above.

Ingredients	Literature Referenced Target Organ and Other Health Effects	Carcinogen NTP IARC OSHA
ETHANE, 1,1,1-TRICHLORO-	CAR CNS IRR LIV	NO N/A NO
ISOPROPYL ALCOHOL	ALG CNS IRR	NO N/A NO
CARBON DIOXIDE	CNS DEV	NO NO NO
tert-BUTYL ALCOHOL	AC4 ALG CNS IRR	NO NO NO
N,N-Dialkyltoluidine	MUT	NO NO NO
METHANE, DIMETHOXY-	CNS IRR	NO NO NO
2-Mercaptobenzothiazole	ALG	NO NO NO

Abbreviations

N/A Not Applicable AC4 ACGIH-Unclassifiable as human carc.
 ALG Allergen CAR Cardiac
 CNS Central nervous system DEV Developmental
 IRR Irritant LIV Liver
 MUT Mutagen

XII. PREPARATION INFORMATION

Prepared By: Stephen Repetto
 Title: Research Chemist, Environmental Health & Safety
 Company: Loctite Corp., 1001 Tr Br Cr, Rocky Hill CT 06067
 (24hr.) Phone: (860) 571-5100
 Revision Date: January 03, 1995 Revision: 0011

1. Introduction to the *NIOSH Pocket Guide*

The *NIOSH Pocket Guide* is a useful tool for workers. It is a handy, easy to use field guide that can provide a lot of information in a short time. The guide provides references for certain chemicals on exposure limits, physical characteristics, personal protective equipment, and health effects.

While the *NIOSH Pocket Guide* will be helpful to workers they must realize its limitations. Namely, it is exactly as its name states, a guide. It does not contain every chemical that may be encountered on a site nor does it detail every situation that may arise with that chemical. The guide does not contain an analysis of all pertinent data. Common sense and caution should be exercised and more detailed reference sources used as warranted.

It is always a good idea to check at least two sources of information (such as an MSDS) to make sure you know the full picture.

2. Using the *NIOSH Pocket Guide*

The *Pocket Guide* can be used easily at the worksite. It is a compact practical guide. Used as a reference with MSDSs and other reference texts, it can be an important tool for workers.

The *NIOSH Pocket Guide* is set up in a logical manner. There is a short introduction, an explanation of NIOSH RELs, then a quick overview on how to use the guide, which contains tables explaining the abbreviations.

The next section is the chemical listings. The chemicals are listed on the even numbered pages and the information is read across to the odd numbered pages.

The end of the guide contains appendices that give information about NIOSH-identified occupational carcinogens, OSHA-regulated carcinogens, supplementary exposure limits, and substances with no PELs.

Finally there are two indexes, a Synonym and Trade Name index and a CAS Number index. Both of these are for easy cross referencing with the chemical name.

Each chemical listing can be broken down into six main categories:

- Identification
- Exposure Limits
- Properties
- Personal Protective Equipment
- Respiratory Protection
- Health Hazards

(Left-Hand Side)

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Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties		Incompatibilities and reactivities	Measurement method (See Table 1)
					MW, BP, SOL, FLP, IP, Sp, Gr, flammability	VP, FRZ UEL, LEL		
isoamyl alcohol (secondary) $(\text{CH}_3)_2\text{CHCH}_2(\text{OH})\text{CH}_3$ 528-75-4	3-Methyl-2-butanol, Secondary isoamyl alcohol	NIOSH 100 ppm (360 mg/m ³) ST 125 ppm (450 mg/m ³) OSHA† 100 ppm (360 mg/m ³)	500 ppm	Colorless liquid with a disagreeable odor.	MW: 88.2 BP: 234°F Sol: ? FLP(oc): 95°F IP: ?	VP: 1 mm FRZ: ? UEL: ? LEL: ?	Strong oxidizers	Char: 2-Propanol/ CS; GC/FID; III [#1402, Alcohols III]
1105 26	1 ppm = 3.67 mg/m ³				Sp Gr: 0.82 Class IC Flammable Liquid			
isobutane $\text{CH}_3\text{CH}(\text{CH}_3)_2$ 78-28-5 TZ4300000	2-Methylpropane [Note: Also see specific listing for n-Butane.]	NIOSH 800 ppm (1900 mg/m ³) OSHA† none	N.D.	Colorless gas with a gasoline-like or natural gas odor. [Note: Shipped as a liquefied compressed gas. A liquid below 11°F.]	MW: 58.1 BP: 11°F Sol: Slight FLP: NA (Gas) IP: 10.74 eV	VP(70°F): 3.1 atm FRZ: -255°F UEL: 8.4% LEL: 1.8%	Strong oxidizers (e.g., nitrates & perchlorates), chlorine, fluorine, (nickel carbonyl + oxygen)	None available
1011 22	1 ppm = 2.42 mg/m ³				RGasD: 2.06 Flammable Gas Class IA Flammable Liquid			
isobutyl acetate $\text{CH}_3\text{COOCH}_2\text{CH}(\text{CH}_3)_2$ 110-19-0 AI4025000	Isobutyl ester of acetic acid, 2-Methylpropyl acetate, 2-Methylpropyl ester of acetic acid, β-Methylpropyl ethanoate	NIOSH/OSHA 150 ppm (700 mg/m ³)	1300 ppm [LEL]	Colorless liquid with a fruity, floral odor.	MW: 116.2 BP: 243°F Sol: 77°F 0.6% FLP: 64°F IP: 9.97 eV	VP: 13 mm FRZ: -145°F UEL: 10.5% LEL: 1.3%	Nitrates, strong oxidizers, alkalis & acids	Char: CS; GC/FID; III [#1450, Esters I]
1213 26	1 ppm = 4.83 mg/m ³				Sp Gr: 0.87 Class IB Flammable Liquid			
isobutyl alcohol $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ 78-83-1 NP9625000	IBA, isobutanol, isopropylcarbinol, 2-Methyl-1-propanol	NIOSH 50 ppm (150 mg/m ³) OSHA† 100 ppm (300 mg/m ³)	1600 ppm	Colorless, oily liquid with a sweet, musty odor.	MW: 74.1 BP: 227°F Sol: 10% FLP: 82°F IP: 10.12 eV	VP: 9 mm FRZ: -162°F UEL(202°F): 100% LEL(123°F): 17%	Strong oxidizers	Char: 2-Propanol/ CS; GC/FID; III [#1401, Alcohols II]
1212 26	1 ppm = 3.08 mg/m ³				Sp Gr: 0.80			

(Right-Hand Side)

Personal protection and sanitation (See Table 3)		Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4)	Health hazards				
			Route	Symptoms (See Table 5)	First aid (See Table 6)	Target organs (See Table 5)	
Skin: Eyes: Wash skin: Remove: Change:	Prevent skin contact Prevent eye contact When contain When wet (flamm) N.R.	NIOSH/OSHA 500 ppm: SA:CF/CCRFOV/GMFOV/ PAPROV/SCBAF/SAF § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh ing Con	Irrit eyes, skin, nose, throat; head, dizz; cough, dysp, nau, vomit, diar; skin cracking; in animals: narco	Eye: Skin: Breath: Swallow:	Irrimmed Water flush prompt Resp support Medical attention immed	Eyes, skin, resp sys, CNS
[isoamyl alcohol (secondary)]							
Skin: Eyes: Wash skin: Remove: Change: Provide:	Frostbite Frostbite N.R. When wet (flamm) N.R. Frostbite	TBAL	Inh Con (liq)	Drow, narco, asphy; liq: frostbite	Eye: Skin: Breath:	Frostbite Frostbite Resp support	CNS
[isobutane]							
Skin: Eyes: Wash skin: Remove: Change:	Prevent skin contact Prevent eye contact When contain When wet (flamm) N.R.	NIOSH/OSHA 1300 ppm: SA:CF/CCRFOV/GMFOV/ PAPROV/SCBAF/SAF § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh ing Con	Irrit eyes, skin, upper resp sys; head, drow, anes; in animals: narco	Eye: Skin: Breath: Swallow:	Irrimmed Water flush prompt Resp support Medical attention immed	Skin, eyes, resp sys, CNS
[isobutyl acetate]							
Skin: Eyes: Wash skin: Remove: Change:	Prevent skin contact Prevent eye contact When contain When wet (flamm) N.R.	NIOSH 500 ppm: CCRFOV/SA* 1250 ppm: SA:CF/PAPROV* 1800 ppm: CCRFOV/GMFOV/ PAPRTOV/SCBAF/SAF § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh ing Con	Irrit eyes, throat; head, drow; skin cracking; in animals: narco	Eye: Skin: Breath: Swallow:	Irrimmed Water flush prompt Resp support Medical attention immed	Eyes, skin, resp sys, CNS
[isobutyl alcohol]							

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3. Identification: What's in a Name?

Chemicals are known by many different names, symbols, and numbers. Often when someone goes on a worksite there are drums, boxes, tanks, etc. that are unlabeled or partially labeled. This presents a major problem for workers in determining how to proceed with the work and how to protect themselves. The first two columns of a listing in the *NIOSH Pocket Guide* are dedicated to the identification of the chemical.

The First Column

1. Chemical Name

This section lists the name of the chemical. The *NIOSH Pocket Guide* only lists 667 chemicals or substances. There are many more chemicals found in the workplace. Therefore you may not find the information you are looking for.

Check the spelling of the chemical you are looking up in the guide. Remember, a slightly different spelling can make worlds of difference in what you are dealing with. For example, **trichloroethylene** and **1,1,1-trichloroethane** are very close in spelling. However, one is a carcinogen and one is not.

You should also make sure that the numbers or letters before the name of the chemical match exactly with the one you are looking up. For example, **1,1,1-trichloroethane** (listed in the guide under methyl chloroform) is very close to **1,1,2-trichloroethane**. However, 1,1,2-trichloroethane is a carcinogen and 1,1,1-trichloroethane is *not*.

2. Chemical Structure/Formula

This section shows the chemical structure or formula for the chemical you are looking up. The only time that you will use this information is if a label or a marking on a container has both the name of the chemical and the formula. In this case it is good to check if the name of the chemical and the formula in the guide book match the information you have.

Caution: If they don't match you may have a completely different chemical.

3. Chemical Abstracts Service (CAS) registry number

This is a number that is unique to each chemical and will be helpful in searching for further information or for identification of the chemical. A list of CAS numbers is located in the back of the *Pocket Guide*, starting on page 386.

4. NIOSH Registry of Toxic Effects of Chemical Substances (RTECS) number

This number would be useful in obtaining additional toxicological data on a chemical.

5. DOT ID # and Guide #

The DOT ID number tells you whether the chemical is regulated or not. The guide number references information on how to stabilize an emergency situation. The DOT *Emergency Response Guidebook* is another good source of information. When possible it is always good to research a chemical in more than one reference guide. A list of DOT ID numbers is located in the back of the *Pocket Guide*, starting on page 394.

4. Looking Up Chemical Names in the *NIOSH Pocket Guide*

Chemicals are listed alphabetically in the *Pocket Guide*. Chemical names appear in the first column on the left hand side of the *Pocket Guide*. The information about one chemical extends all the way across the row from the left page to the right page.

Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties		Incompatibilities and reactivities	Measurement method (See Table 1)
					MW, BP, SOL FL.P, IP, Sp, Gr, Flammability	VP, FRZ UEL, LEL		
Titanium dioxide TiO ₂ 13463-67-7 XR2275000	Rutile, Titanium oxide, Titanium peroxide	NIOSH Ca See Appendix A OSHA† 15mg/m ³	Ca [5000 mg/m ³]	White, odorless powder.	MW: 79.9 BP: 4532-5432°F Sol: Insoluble FL.P: NA IP: NA Sp Gr: 4.26 Noncombustible Solid	VP: 0 mm (approx) MLT: 3326°F UEL: NA LEL: NA	None reported	Filter; Acid; AAS; II(3) [#S385]
o-Tolidine C ₁₀ H ₈ N ₂ 119-93-7 OD1225000	4,4'-Diamino-3,3'-dimethyl-biphenyl; Diaminodiphenyl; 3,3'-Dimethylbenzidine; 3,3'-Dimethyl-4,4'-diphenyl-diamine; 3,3'-Tolidine [CH ₃ (NH ₂)C ₆ H ₄ C ₆ H ₃ (NH ₂)CH ₃]	NIOSH Ca See Appendix A See Appendix C C 0.02 mg/m ³ [60-min] [skin] OSHA See Appendix C	Ca [N.D.]	White to reddish crystals or powder. [Note: Darkens on exposure to air. Often used in paste or wet cake form. Used as a basis for many dyes.]	MW: 212.3 BP: 572°F Sol: 0.1% FL.P: 7 IP: 7 Sp. Gr: 7 Combustible Solid	VP: ? MLT: 264°F UEL: ? LEL: ?	Strong oxidizers	Filter; water; HPLC/UV/D; III [#5013, Dyes]
Toluene C ₆ H ₅ CH ₃ 108-88-3 XS5250000 1294 27	Methyl benzene, Methyl benzol, Phenyl methane, Toluol 1 ppm = 3.83 mg/m ³	NIOSH 100 ppm (375 mg/m ³) ST 150 ppm (560 mg/m ³) OSHA† 200 ppm C 300 ppm 500 ppm (10-min max peak)	500 ppm Ca [N.D.]	Colorless liquid with a sweet, pungent, benzene-like odor.	MW: 92.1 BP: 232°F Sol(74°F): 0.07% FL.P: 40°F IP: 8.82 eV Sp. Gr: 0.87 Class IB Flammable Liquid	VP: 21 mm FRZ: -139°F UEL: 7.1% LEL: 1.1%	Strong oxidizers	Char; CS; GC/FID; III [#1500, Hydrocarbons]
Toluenediamine CH ₃ C ₆ H ₄ (NH ₂) ₂ 25378-45-8 95-80-7 (2,4-TDA) XS9445000 XS9625000 (2,4-TDA) 1709 53	Diaminotoluene, Methylphenylene diamine, TDA, Toluenediamine	NIOSH Ca (all isomers) See Appendix A OSHA none	Ca [N.D.]	Colorless to brown, needle-shaped crystals or powder. [Note: Tends to darken on storage & exposure to air. Properties given are for 2,4-TDA.]	MW: 122.2 BP: 556°F Sol: Soluble FL.P: 300°F IP: 7 Sp. Gr: 1.05 (Liquid at 212°F) Combustible Solid	VP(224°F): 1mm MLT: 210°F UEL: ? LEL: ?	None reported	Imp; Reagent; HPLC/UV/D; III [#5516]

Chemical name,
structure/formula
CAS and RTECS Nos.,
and DOT ID and
guide Nos.

Toluene

C₆H₅CH₃

108-88-3

XS5250000

DOT ID number → 1294 27

Guide number
from DOT
Guidebook

Chemical name

Structure/formula

CAS registry number*

RTECS number**

*Chemical Abstract Service.

**NIOSH's Registry of Toxic Effects of Chemical Substances.

Source: Adapted from the United Auto Workers, *Emergency Response Draft Workbook*, 1996.

5. One Chemical, Many Names

The Second Column

1. Synonyms and Trade Names

These may be helpful in identifying a chemical if the names on the labels are names that you are unfamiliar with. An example would be calling Hydrochloric Acid (HCl) by the more common name Muriatic Acid. This also helps with any regional peculiarities if you are working in another part of the country.

There is also a synonym and trade name index which cross references chemicals to the page they are listed on in the guide. This is helpful if you are looking for a chemical which is listed under another name. For example, **dichloromethane** is in the guide under the synonym name **Methylene chloride**. Another example is shown below:

- 2-butanone
- Methyl ethyl ketone
- MEK
- Methyl acetone
- CAS # 78-93-3

continued

5. (continued)

The Synonym Index starts on page 371 of the *Pocket Guide*. If you look up Methyl ethyl ketone in this index, this is what you will find:

SYNONYM AND TRADE NAME INDEX (Continued)	
380	Methyl azinphos, 22
	Methyl benzene, 310
	3-Methyl-2-butanol, 176
	3-Methyl-2-butanone, 212
	1-Methylbutyl acetate, 16
	Methyl butyl ketone, 164
	Methyl chlorobromide, 62
	Methylchloromethyl ether, 66
	Methyl cyanide, 4
	Methyl dinitrobenzene, 118
	Methylene dichloride, 208
	Methylene dimethyl ether, 198
	Methyl ethyl ketone, 36
	2-Methyl-5-hexanone, 212
	Methyl isobutenyl ketone, 194
	Methyl isobutyl ketone, 164
	4-Methyl-2-pentanone, 164
	4-Methyl phenol, 78
	1-Methyl-1-phenylethylene, 216
	Methyl phosphite, 320
	2-Methylpropane, 176
	2-Methyl-2-propanol, 40
	1-Methylpropyl acetate, 38
	Methyl propyl ketone, 244
	Methylstyrene, 332
	Methyl sulfate, 116
	Methyl systox®, 206
	Methyl tribromide, 34
	Mevinphos, 252
	MIBK, 164
	Mineral spirits, 286
	MiPK, 212
	MOCA, 206
	Monobromoethane, 200
	Monochloroethane, 134
	Monochloromethane, 202
	Monoethanolamine, 128
	Monoethylamine, 132
	Monomethylamine, 200
	Monomethylhydrazine, 210
	Monoxide, 54
	MPK, 244

The Synonym Index tells you to turn to page 36. If you look at page 36 in the *Pocket Guide*, you will see the MEK is actually listed under the name of 2-butanone.

2. Conversion Factors

The final listing in the second column is conversion factors which are provided for your convenience. This is usually a ppm (parts per million) to mg/m³ (milligrams per cubic meter) conversion factor. This may be useful if you are trying to compare an exposure level (found in your work area) which is expressed in ppm with an exposure limit (listed in the guide) which is expressed in mg/m³.

6. MSDSs Help Identify Hazardous Ingredients

There are thousands and thousands of chemicals in existence. In the *Pocket Guide*, chemicals are listed in alphabetical order by their chemical name, not brand name. The *Pocket Guide* does not list chemicals with more than one ingredient. It only lists single chemicals.

For example, if you work with a cutting fluid called "Magic Lube," you won't find it under "m" in the *Pocket Guide*. One way to identify the hazardous ingredient is to get the MSDS for the product. Look up the hazardous ingredients, then look for those chemicals in the *Pocket Guide*.

From the MSDS for Magic Lube:

SECTION II: HAZARDOUS INGREDIENTS						
CAS Registry Number	% Weight	Chemical Names	Table Z-1-A			Carcinogen
			TWA mg/M ₃	STEL mg/M ₃	Ceiling mg/M ₃	
141-43-5	0-10%	Ethanolamine	6	15	–	No
471-90-44	0-5%	s-Triazine-1,3,5-Triethanol	– Not established –			No
6474-25-25	0-7%	Mineral Oil, Petroleum distillates	5	–	–	No

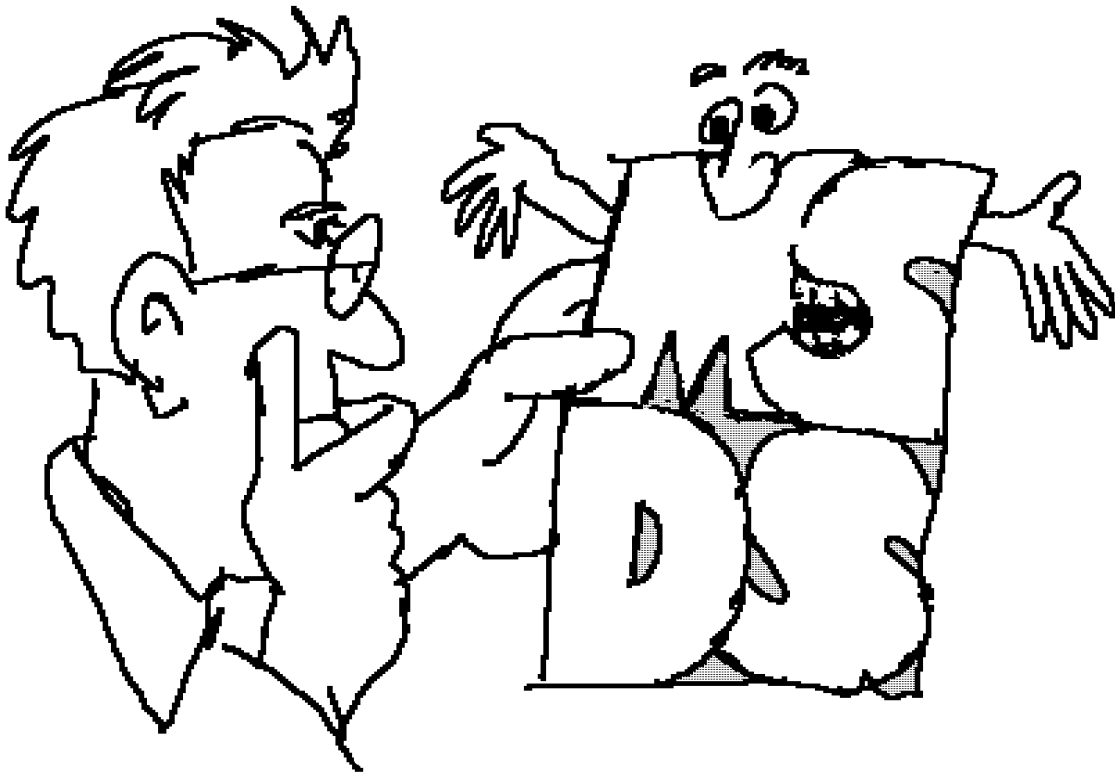
The main ingredient is ethanolamine (10%), so look this up in the *Pocket Guide* under "e."

Source: Adapted from the United Auto Workers, *Emergency Response Draft Workbook*, 1996.

7. The Problems With MSDSs

Employers are required by OSHA, and by many state laws, to provide Material Safety Data Sheets (MSDSs). The MSDS is prepared by the product's manufacturer and provides basic information on the chemical's physical properties and related health effects. The MSDS gives guidance on using, storing and handling substances safely on the job and in emergencies such as fires and spills. But these sheets have problems. Here's how the American Lung Association puts it:

"Unfortunately, information presented on an MSDS may be incomplete or inaccurate. This is particularly true for information on health effects that workers may experience from low-level chemical exposure over a long period of time."



8. CAS Numbers

Using the CAS number is another way to find a chemical. CAS stands for Chemical Abstracts Service. Each chemical is given a unique CAS number. The chemical may have many names, but it has only one CAS number.

The CAS Number Index starts on page 386 in the *Pocket Guide*. If you look up CAS # 78-98-3, the number for MEK, here's what you will see:

CAS NUMBER INDEX (Continued)

75-86-5: 4	78-82-0: 178	83-79-4: 274	92-87-5: 26
75-99-0: 100	78-83-1: 176	84-15-1: 296	92-93-3: 226
76-01-7: 242	78-87-5: 268	84-66-2: 108	92-94-4: 298
76-03-9: 314	78-92-2: 40	84-74-2: 94	93-76-5: 292
76-06-2: 66	78-93-3: 36	85-00-7: 122	94-36-0: 26
76-11-9: 298	79-00-5: 314	85-44-9: 256	94-75-7: 88
76-12-0: 298	79-01-6: 316	86-50-0: 22	95-13-6: 170
76-13-1: 316	79-04-9: 60	86-88-4: 20	95-47-6: 334
76-14-2: 102	79-06-1: 6	87-68-3: 158	95-48-7: 78
76-15-3: 66	79-09-4: 266	87-86-5: 242	95-49-8: 68
76-22-2: 48	79-10-7: 8	88-72-2: 232	95-50-1: 96
76-38-0: 196	79-20-9: 196	88-89-1: 258	95-53-4: 312
76-44-8: 156	79-24-3: 228	89-72-5: 42	95-63-6: 320
77-47-4: 158	79-27-6: 6	90-04-0: 18	95-80-7: 310
77-73-6: 102	79-34-5: 300	91-20-3: 220	96-12-8: 92
77-78-1: 116	79-41-4: 194	91-59-8: 222	96-18-4: 316
78-00-2: 302	79-44-7: 112	91-94-1: 96	96-22-0: 106
78-10-4: 142	79-46-9: 230	92-06-8: 296	96-33-3: 198
78-30-8: 322	80-62-6: 214	92-52-4: 120	96-45-7: 138
78-34-2: 120	81-81-2: 334	92-67-1: 14	96-69-5: 306
78-59-1: 178	83-26-1: 258	92-84-2: 248	97-77-8: 122

The index tells you to turn to page 36 of the *Pocket Guide*.

Source: Adapted from the United Auto Workers, *Emergency Response Draft Workbook*, 1996.

9. What's a Safe Level? Exposure Limits

The third column in the *NIOSH Pocket Guide* lists **exposure limits**. Exposure limits are based on the idea that a worker can be exposed to some amount of a chemical without being harmed by it. There is some threshold amount that a worker's body can tolerate. Lots of people don't agree with this idea, especially when it comes to cancer-causing chemicals. (See the next few pages for information on problems with exposure limits.)

It's easy to get confused when talking about exposure limits. There are many different types of exposure limits, levels set by different agencies, and lots of short-cut names. Here are the ones you will see in the *Pocket Guide* and on MSDSs.

1. Short- and Long-Term Exposure Limits

An exposure limit is the highest amount of a chemical that you can work in without harm. Exposure limits are expressed as concentrations: parts per million (ppm), milligrams per cubic meter (mg/m^3), and sometimes micrograms per cubic meter (mcg/m^3 or m/μ^3). For example, 50 ppm of diesel exhaust means that there are 50 parts of diesel exhaust for every 1 million parts of air.

- **Time-Weighted Average (TWA)** is related to long-term exposure. The theory is that a worker will not get sick if he or she works at or below this level for a long time. A "long time" usually means 8 hours per day, 5 days per week for your whole working life. These are averages, which means that your exposure can be higher than this limit for part of the day, as long as it is also lower for part of the day.
- **Short-Term Exposure Limit (STEL or ST)** is the amount you can be exposed to a substance for no more 15 minutes. This is also an average. Short-term limits are higher than 8- or 10-hour exposure limits.
- **Ceiling Limit (C)**. Never exceed this amount at any point during the work day. Ceiling limits are set for some chemicals that are fast-acting.

2. IDLH

Immediately Dangerous to Life or Health (IDLH). The current NIOSH definition for an IDLH exposure is a condition "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such environment."

As a safety margin, the Standards Completion Program IDLH values were based on the effects that might occur as a consequence of a 30-minute exposure. However, the 30-minute period was *not* meant to imply that workers should stay in the work environment any longer than necessary. In fact, *every effort should be made to exit immediately!*

3. Ca

This designation appears for all substances that NIOSH considers to be potential human carcinogens. It should be noted that, in theory, there is no safe level of exposure to a carcinogen. When OSHA lists a PEL for a chemical listed as a carcinogen, there is no guarantee that you will not get cancer. For this reason, when possible, exposures to carcinogens should be avoided completely.

Note: Potential human carcinogens will also be bracketed by [carc] listed under the Symptom column of the *Pocket Guide*. **Important:** While OSHA PELs are law, you should strive to meet the most restrictive of the three exposure limits for maximum safety of site personnel.

4. OSHA†

The substances for which OSHA PELs were vacated on June 30, 1993 are indicated by the symbol "†" following OSHA in this column. Previous values are listed in Appendix G, starting on page 355 of the *Pocket Guide*.

OSHA believes the 1989 PELs are more protective and encourages employers to continue compliance efforts to meet these levels, particularly where engineering and work practice controls have already been implemented. OSHA always encourages employers to go beyond the minimum protection afforded by the standard.*

*Question and answer document concerning PEL decision. Interpretation Standard: 20 CFR 1910.1000, March 30, 1993.

10. Physical Properties

This main section contains four columns that will provide the site worker with some very valuable information. They are physical description, chemical and physical properties (two columns) and incompatibilities and reactivities.

Physical Description

This is the first column in this heading and gives the guide user a short description of the chemical and idea of the odor emitted. Possible problems may occur if you rely completely on this information:

- Mixtures of chemicals may change both physical appearance and odor.
- Smell and appearance can both be very subjective. Different people can perceive the same thing differently. Remember, don't rely on your sense of smell to detect the presence of a hazardous chemical.
- Chemical appearance and odor may change over time.

Chemical and Physical Properties

These two columns describe the chemical and physical properties of the listed chemical. They offer a wealth of knowledge to both the site worker and chemists analyzing any samples. Some of the important properties with regards to health and safety listed in this section include:

- Flash Point
- Vapor Pressure
- Upper Explosive Limit
- Lower Explosive Limit

11. Respiratory Protection

In this section of the guide, types of respiratory protection required for different concentrations of a given material are listed. The concentration, usually expressed in ppm or mg/m^3 , is the **maximum use concentration (MUC)** for the respirator listed.

For example, the guide recommends a **Dust / Mist (DM)** filter for concentrations up to $12.5 \text{ mg}/\text{m}^3$ and **Supplied Air Respirator (pressure demand or positive pressure type) (SAR: PD,PP)** for concentrations not exceeding $500 \text{ mg}/\text{m}^3$.

The guide can be useful for decision-making with regard to respirator selection. However, it does take a little time to sort out all of the different acronyms. It is also important to remember that these are recommendations for what respirator to use up to a maximum concentration. If you are near the **maximum use concentration (MUC)** for a respirator you should be using a better respirator or should NOT be working in the area.

You should also keep in mind that these respirators are listed based on the concentration of one chemical. If you are working with more than one chemical or radionuclides, you can NOT simply go by this quick reference guide.

In any situation where you are using respirators you must have a respirator program in place.

For further description of what is required in a respirator program and additional information on different types of respirators, see Activity 9: Respiratory Protection.

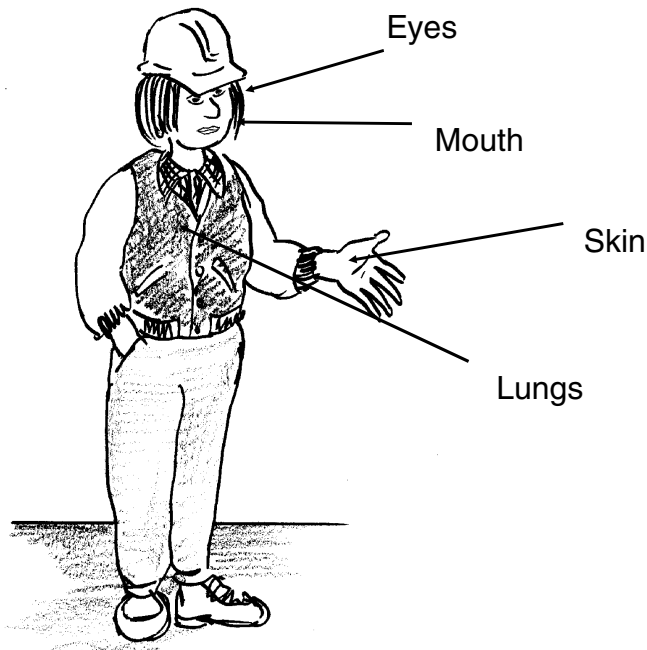
12. Health Hazards

The health hazards section of the chemical listing contains five columns of information that is both informative and useful – routes of entry, symptoms, first aid (two columns) and target organs.

Routes of Entry

The four basic ways toxics enter your body are:

- **Direct Contact:** on the skin or eyes
- **Absorption:** through the skin
- **Ingestion:** through the mouth with food, etc.
- **Inhalation:** through the lungs

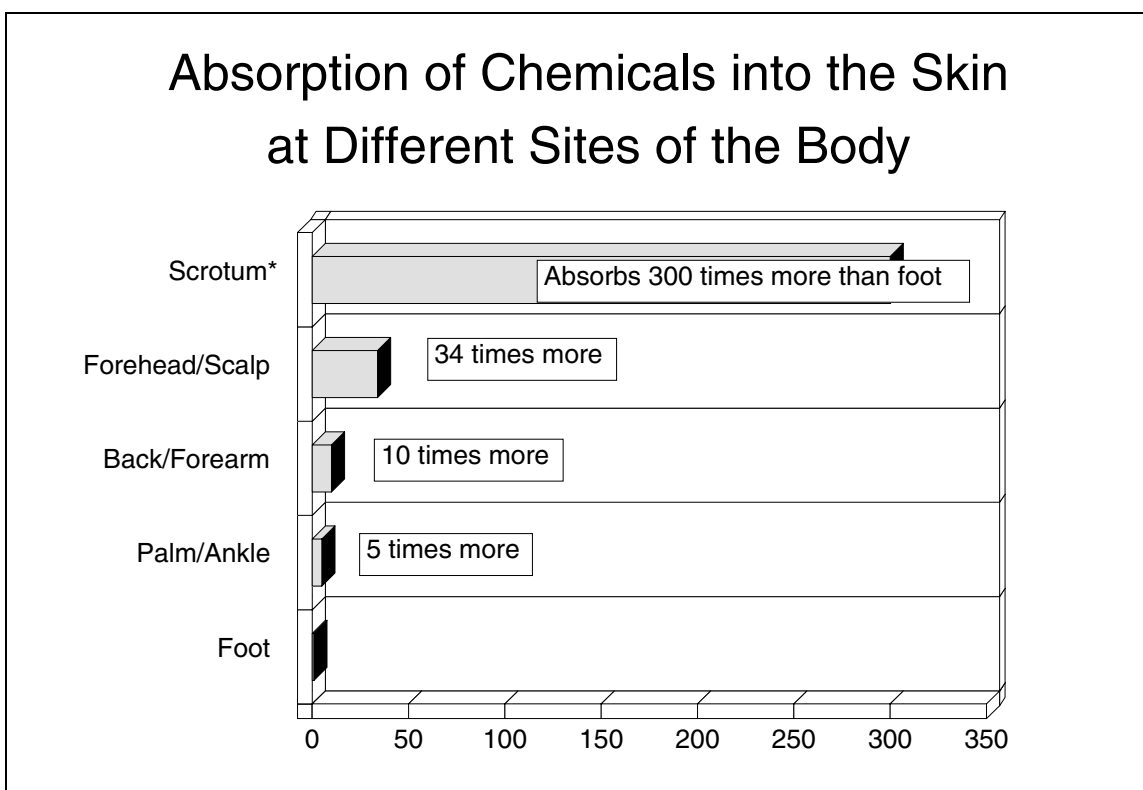


Direct Contact = Surface

Some chemicals burn or irritate the skin or eyes on contact, causing damage on the surface. Dermatitis (inflammation of the skin) and conjunctivitis (inflammation of the eye membrane) are two examples. Many acids – as liquids or vapors – can burn the skin or eyes.

Absorption = Penetration

Some chemicals can pass right through the skin undetected and enter the bloodstream. They are carried throughout the body, causing harm. Broken skin or puncture wounds greatly increase the rate at which chemicals are absorbed. Examples include many solvents and pesticides. Watch out for both toxic liquids and vapors.

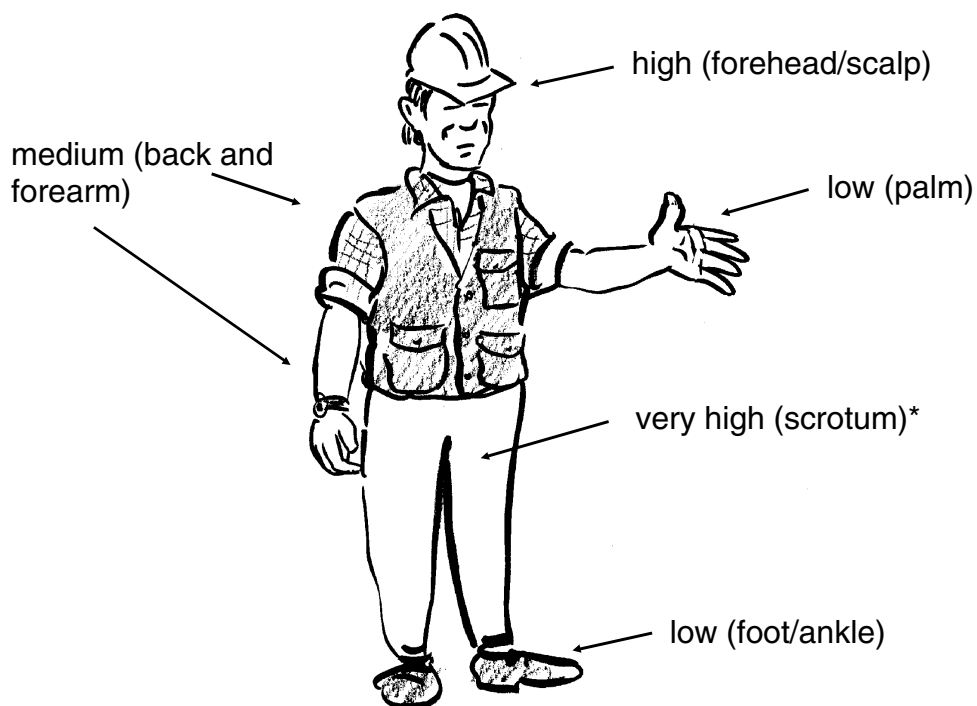


Source: E. Hodgson and P.E. Levi, *A Textbook of Modern Toxicology*, New York: Elsevier, 1987, pp. 34-35.

*For men (studies of female workers yet to be done).

13. Absorption of Toxic Chemicals by Your Body

Toxics can enter and harm your body even if you don't breathe them in. They can enter your system by being absorbed through the skin or by being ingested with your food and drink. In fact, as the chart below shows, when it comes to absorption through the skin, different parts of your body absorb chemicals at very different rates. (Wash your hands **BEFORE** using the bathroom.)



Symptoms and Target Organs

The two columns labeled "Symptoms" and "Target Organs" let you know what to look for in the case of exposure and what bodily systems will be affected by the chemical. Explanations of abbreviations are in Table 5 at the beginning of the guide.

First Aid

The last column, "First Aid," is a quick reference for first aid to be administered in the event of an accident. For more information, Material Safety Data Sheets should be referenced.

* For men (studies of female workers yet to be done).

14. Finding Health Information in the *NIOSH Pocket Guide*

Health information is listed on the far right-hand side of the *Pocket Guide*. For now, focus on these columns only. The terms and abbreviations used in these columns are explained in Tables 5 and 6 in the *Pocket Guide*.

Personal protection and sanitation (See Table 3)		Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4)	Route	Symptoms (See Table 5)	Health hazards		Target organs (See Table 5)
					First aid (See Table 6)		
Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: Daily		NIOSH § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: HIEF/SCBAE	Inh	Lung fib; [carc]	Breath: Resp support		Resp sys [in animals: lung tumors]
[Titanium dioxide]							
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam/Daily Remove: When wet or contam Change: Daily Provide: Eyewash, Quick drench		NIOSH § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/HIE/SCBAE	Inh Abs Ing Con	Irrit eyes, nose; in animals: liver, kidney damage; [carc]	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed		Eyes, resp sys, liver, kidneys [in animals: liver, bladder & mammary gland tumors]
[o-Toluidine]							
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet (flam) Change: N.R.		NIOSH 500 ppm: CCROV/PAPROV/GMFOV/ SA/SCBAF § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Irrit eyes, nose; ftg, weak, conf, euph, dizz, head; dilated pupils, lac; ner; musc: ftg, insom; pares; dem: liver, kidney damage	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed		Eyes, skin, resp sys, CNS, liver, kidneys
[Toluene]							
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam/Daily Remove: When wet or contam Change: Daily Provide: Eyewash, Quick drench		NIOSH § SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Irrit eyes, skin, nose, throat; dem; ataxia, lacar, nausea, vomit, convuls, resp depress; methemo, cyan, head, ftg, dizz, bluish skin; liver inj; [carc]	Eye: Irr immed Skin: Water flush immed Breath: Resp support Swallow: Medical attention immed		Eyes, skin, resp sys, blood, CVS, liver, CNS [in animals: liver, skin & mammary gland tumors]
[Toluenediamine]							

Explained in Table 5 of the *Pocket Guide*, on pages xxix-xxxii.

↓

Explained in Table 6 on pages xxxiii-xxxvi.

↘

Health hazards

↙

Route	Symptoms (See Table 5)	First Aid (See Table 6)	Target Organs (See Table 5)
Inh Abs Ing Con	Irrit eyes, nose; ftg, weak conf, euph, dizz, head; dilated pupils, lac; ner, musc ftg, insom; pares; dem; liver, kidney damage	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed	Eyes, skin, resp sys, CNS, liver, kidneys

Inh = Inhalation (breathing)
Abs = Skin absorption
Ing = Ingestion (swallowing)
Con = Skin and eye contact

Source: Adapted from the United Auto Workers, *Emergency Response Draft Workbook*, 1996.

15. What Does "Euph" Mean?

One thing that makes the *Pocket Guide* hard to use is all of the abbreviations and technical terms. Here are some of the abbreviations used in the *Pocket Guide* and their meanings.

Symptoms

Abbreviation	Stands for	Means
anor	anorexia	no appetite
arrhy	arrhythmia	irregular heartbeat
ataxia	ataxia	not coordinated
[carc]	carcinogen	causes cancer
cyan	cyanosis	blue lips – not enough oxygen
der	dermatitis	flaky, dry, red skin
dysp	dyspnea	trouble breathing
eryt	erythema	red skin
equi	equilibrium	lose sense of balance
euph	euphoria	feeling "high"
halu	hallucinations	seeing things that aren't there
hema	hematuria	blood in urine
hemog	hemoglobinuria	blood in urine (any word with "hem" has to do with blood)
inco	incoordination	clumsy
lac	lacrimation	watery eyes
lass	lassitude	no energy
narco	narcosis	feeling sleepy, slow, in a stupor
pares	paresthesia	tingling, shooting pains in arms/legs
pulm edema	pulmonary edema	build up of fluid in lungs, "drowning" in your own fluids
sens	sensitization	become allergic
som	somnolence	sleepy
terato	teratogenic	causes birth defects
vert	vertigo	loss of balance

Target Organs

Abbreviation	Stands for	Means
CNS	central nervous system	brain and spinal cord
CVS	cardio-vascular system	heart, veins, arteries and blood
GI tract	gastro-intestinal tract	mouth, stomach and intestines
Hemato sys	hematopoietic system	blood-making system, includes bone marrow
PNS	peripheral nervous system	nerves (other than the brain)
Resp Sys	respiratory system	nose, throat, bronchia, lungs

To look up the meaning of other terms used in the *Pocket Guide*, ask for a medical dictionary in your local library.

Source: Clayton L. Thomas, MD, MPH, ed., *Taber's Cyclopedic Medical Dictionary*, 16th edition, Philadelphia: F.A. Davis, 1989.

Task 2

Scenario

Your team, the health and safety committee for your site, is touring the warehouse area of your plant. During the tour, several drums are discovered in an old shed adjacent to the warehouse. Some of the drums are unlabeled and some are labeled phosphoric acid. Discussion with some old timers reveals that the shed used to be used as a staging area for shipping waste chemicals slated for disposal, and the unlabeled drums most likely contain caustic soda.

The plant manager wants the drums removed and the shed cleaned up. Your committee has been asked to do a safety review of the area prior to cleanup to identify any hazards.

Working in your group, please refer to the factsheets on pages 353 through 360 and to the *NIOSH Pocket Guide* and answer the following question.

1. Are there any precautions that you would recommend be taken while removing the drums? Please explain your answer and refer to a factsheet and/or the *Pocket Guide* during your report back.

16. Flashpoint

Flashpoint (FP) is the temperature to which you must heat a liquid chemical so that it gives off enough vapor to catch on fire in the presence of an ignition source (e.g., spark or match) and oxygen. The lower the flashpoint, the greater the hazard.

Flashpoint less than 100° F =	High Fire Risk (Flammable)
Flashpoint between 100° F and 200° F =	Moderate Risk (Combustible)
Flashpoint greater than 200° F =	Low Fire Risk (Combustible)

Here is an example:

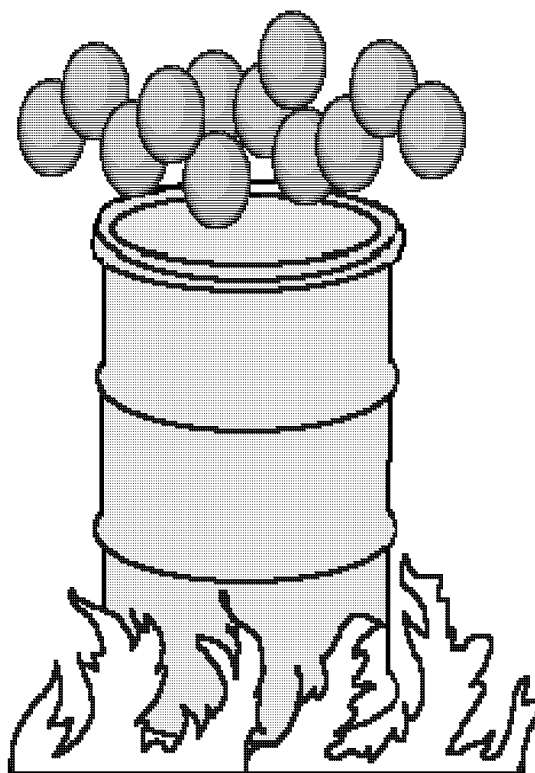
Benzene (a liquid at normal room temperature) has a FP of 12° F. This means that if a drum of liquid benzene is heated or is warmer than 12° F (which is obviously the case in a work area), it will give off enough vapor that a fire could be caused by a spark, a lit match or some other ignition source.

In general, any time you have a chemical whose flashpoint is less than the temperature surrounding it, you have reason to worry.

Another example:

Once the temperature of liquid toluene exceeds 81° F, there will be enough vapor about the liquid to ignite. This means that if workplace temperatures climb above 81° F, and there is liquid toluene around, there will be enough vapor to catch fire if there is a spark, flame or other ignition source.

In a practical sense, whenever you work with a chemical whose flashpoint is less than room temperature (i.e., less than 65° F), there is a real fire hazard.

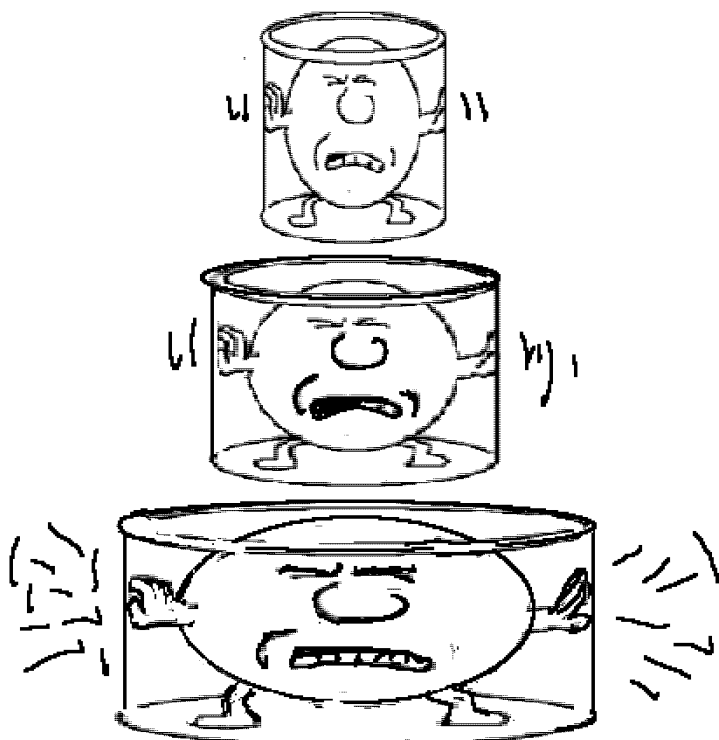


17. Vapor Pressure

Vapor pressure is a measure of how much vapor is given off by a chemical at a given temperature. Chemicals with high vapor pressure readings are more likely to contaminate the air than are chemicals with low vapor pressure readings. The vapor pressure of a chemical rises when it is heated.

It is referred to as a vapor pressure because it is measured by seeing how "hard" the vapor of a material "pushes" against the sides of a closed container. If the liquid is heated, the vapor pressure will rise. Vapor pressure is measured in millimeters of mercury (mmHg) at a certain temperature.

Chemicals whose vapor pressure is less than one (1) at room temperature are not likely to pose airborne vapor hazards. Chemicals whose vapor pressures exceed fifty (50) or so at room temperature are more likely to present airborne exposure hazards.



The practical significance of this measure is:

If a chemical has a high vapor pressure, more of it will be in the air than a chemical with a low vapor pressure. Given two liquids with the same toxicity rating, the most hazardous one will be the one with the higher vapor pressure.

Vapor pressure can also warn us about the possibility of explosions. High vapor pressure chemicals in sealed containers can explode if, for instance, there is a fire nearby or temperatures rise.

Liquids with a high vapor pressure may be particularly hazardous if you are working in an enclosed or confined area, especially if the liquid is flammable.

This chart can tell you, for example, that:

If both acetone and sulfuric acid were released during an accident, you would expect to find more acetone in the air than sulfuric acid.

High Vapor Pressure	
Acetone	266 mm
Benzene	75 mm
Moderate Vapor Pressure	
Ethylene glycol diethyl ether	9.4 mm
Methyl cellosolve	6.2 mm
Low Vapor Pressure	
PCBs	.001 mm
Sulfuric acid	.001 mm

18. The Ups and Downs of Flammability Limits

All fires and most explosions are chemical reactions. (Note that some explosions are not due to chemical reactions.) For the reaction to occur, certain conditions must be met, such as an ignition source, fuel and oxygen (or other oxidizing agents).

The fuel and oxygen need to be mixed in certain proportions for the reaction to be able to start. These are commonly referred to as the lower flammability limit (LFL) and the upper flammability limit (UFL). Often these same limits are called lower and upper explosive limits (LEL and UEL).

The LFL and UFL are defined as percentages of the substance to air. For example, 92 octane gasoline will be able to ignite if the gasoline is between 1.4% gas to air (LFL) and 7.6% gas to air (UFL). If the mixture is too lean (below 1.4%), the gas/air mixture will not burn; and if the mixture is too rich (higher than 7.6%), the mixture will not burn.

Never work in any atmosphere that is above 10 percent of the LFL or the LEL (ANSI Z117.1 1989). For example, 92 octane gasoline would reach its 10% LFL @ .14% gas to air.*

It is never safe to work in atmospheres that are too rich to burn. Many workers have died and suffered burns when working in atmospheres they were told were "too rich" to burn. That's because the oxygen content is not controllable in work areas (this includes confined spaces, ditches, pump pits, etc.), and the edge of the work area will always have a zone in the flammability range. See the chart on the next page.

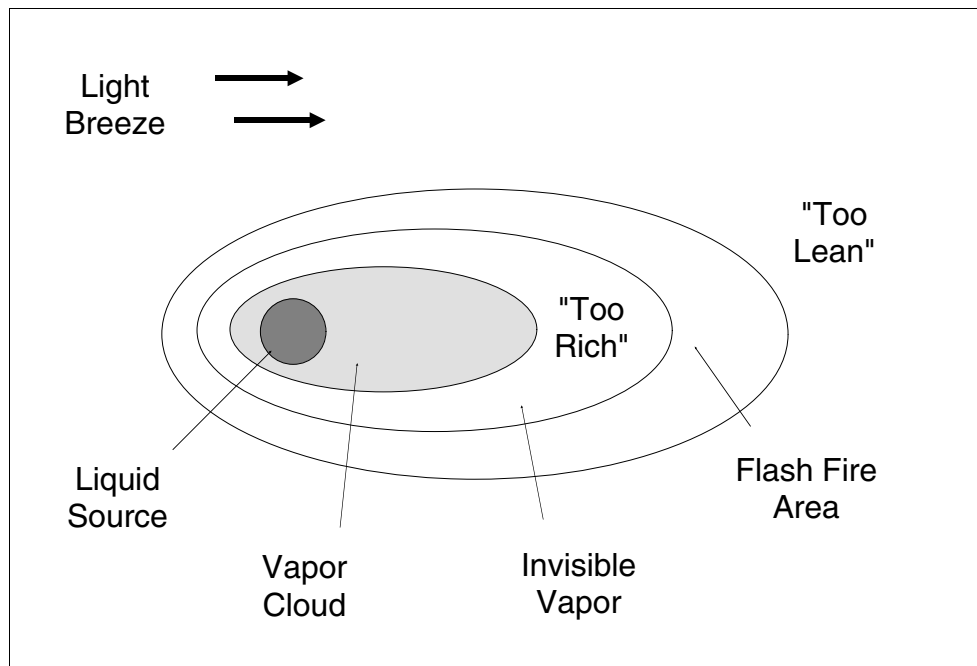
*Note: The 10 percent guideline does not protect you from the toxics in the material. For example, gasoline, which averages 4 percent benzene, would at 10 percent LEL expose you to 56 times the PEL for benzene.

Too Rich = Too Dangerous

Grayco Booster Plant

Pampa, Texas; March 7, 1991

Three workers were badly burned when working on a compressor using a "rich" method. The Booster plant was handling unrefined gasoline when two of several compressors failed. No nitrogen was provided for purging purposes at this remote facility, so gasoline was used to purge the compressor in order to make the air too rich to burn. Unfortunately, the gasoline vapor close to the compressor picked up enough oxygen to be in the flammability range. Sure enough, it found an ignition source and exploded, badly burning the workers.



19. Incompatibilities and Reactivities

The fourth column in the main category of properties is one of great practical value to the waste site worker. Called "Incompatibilities and Reactivities" it will allow the worker to determine:

- chemicals that may be stored together
- types of containers required
- storage facilities

Remember: This is only a guide. Not every incompatibility may be listed.

20. The Fearsome Incompatibles

Keep These . . .		Away From These . . .		Or You May Get These
Acids	+	Bases	→	Heat Violent Reaction
Acids or Bases	+	Reactive Metals (Aluminum, Beryllium, Calcium, Lithium, Potassium, Magnesium, Sodium, Zinc Powder) Metal Hydrides	→	Fire Explosion Hydrogen Gas
Water or Alcohols	+	Concentrated Acids or Bases Calcium, Lithium, Potassium Metal Hydrides Other Water Reactive Waste	→	Heat Fire Explosion Flammable and Toxic Gases
Reactive Organic Compounds or Solvents (Alcohols, Aldehydes, Nitrated Hydrocarbons)	+	Concentrated Acids or Bases Reactive Metals and Metal Hydrides	→	Fire Explosion
Cyanide or Sulfide Solutions	+	Acids	→	Toxic Hydrogen Cyanide Sulfide Gas
Strong Oxidizers (Chlorates, Chlorine, Chlorites, Chromic Acid, Hypochlorites, Nitrates, Perchlorates, Permanganates, Peroxides)	+	Organic Acids Concentrated Mineral Acids Reactive Metals Metal Hydrides Reactive Organic Compounds or Solvents Flammable or Combustible Waste	→	Fire Explosion

21. Personal Protective Equipment (PPE)

There are two columns pertaining to PPE. They give the reader a quick reference guide to recommended PPE. They do not cover everything:

- Proper glove selection is not covered, so another reference source must be used when selecting gloves for the job.
- Material for the clothing is not covered, again necessitating another source of information.

The first column is entitled "Personal Protection and Sanitation." Here you are given recommendations on:

- **CLOTHING**, which only states clothing should be worn to prevent certain situations.
- **GOGGLES**, again telling you goggles should be worn to prevent situations.
- When to **WASH, CHANGE** clothing, and **REMOVE** clothing.
- What equipment should be **PROVIDED** at the site for emergencies.

All abbreviations are explained in detail in Table 3 at the beginning of the guide.

The *NIOSH Pocket Guide* should not be your only reference for selecting protective clothing for a job. Your site-specific health and safety plan should contain much more specific information regarding the hazards found at the site.

Summary: NIOSH Pocket Guide

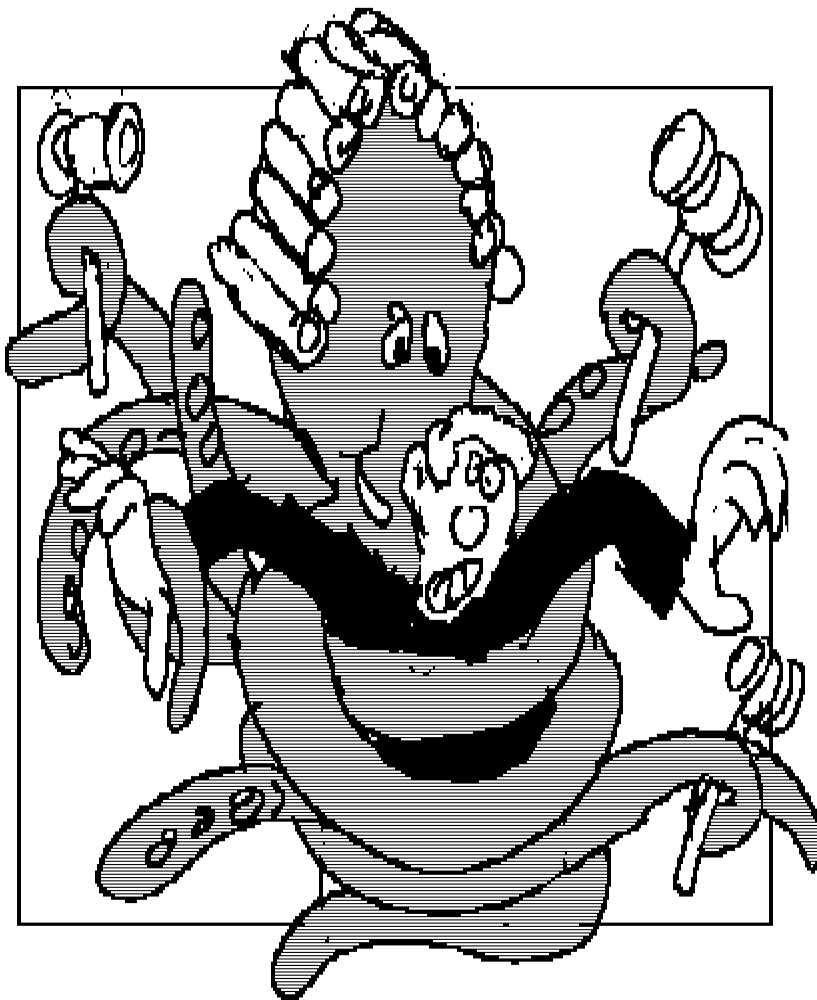
1. It is a good field reference but should be used only as a guide.
2. Use other sources, such as MSDSs, as additional references.
3. Always remember that, when in doubt, use the safest means possible.
4. The guide does not include all chemicals or all information on a chemical.
5. It does not take into account any aging or mixing of chemicals that may have occurred before you entered the site.
6. Although a court decision rolled back the more protective PELs, OSHA believes the majority of employers will continue to adhere to the higher levels of protections.

Activity 12: The Legal Octopus

Purpose

To familiarize ourselves with the laws and regulations governing hazardous materials and health and safety.

To improve our skills in learning how to enforce the law, in order to protect ourselves, our co-workers and the community.



Task

Attached are a series of case studies for your groups to discuss and consider. Please read over each one carefully and decide what your legal rights are and what you think should be done. The factsheets on pages 373 through 400 detail the laws and regulations that might apply. (You will probably only have time to do one or two of the case studies. So the workshop should decide in advance which topics to work on.)

Case 1: Big Mike's Headache

You are a member of the health and safety committee. A hazardous waste worker named Big Mike, from OilChem, came to you asking for advice on the following situation:

Big Mike is an operator on the waste separator unit which handles the waste product for the entire facility. About once every other day Big Mike must open the unit and remove several filters that become clogged with residues of waste. Almost every time Big Mike handles this task, he gets severe headaches and nearly passes out. Other workers who do similar processes also feel some of his symptoms but not as severely. Big Mike has complained several times to supervision, which has told him that the monitoring results and medical surveillance program for the area show no violations of OSHA law and no health problems. They also issued him a respirator, which he wears, but he says it doesn't help.

Big Mike is convinced that he is being exposed to some kind of deadly chemical. He's tried to transfer out of the department, but because of layoffs there are no jobs to go to. He's filed grievances but they have not been settled. Big Mike is getting desperate. He says that he's had enough, and that he's going to refuse to do that portion of the job because it is an extreme hazard and a threat to his life. He has told this to his supervisor, and the supervisor said that if he doesn't do the work he will be immediately suspended.

Big Mike is coming to you to get your backing for his refusal of hazardous work.

continued

Case 1 (*continued*)

1. What are his rights? (See the factsheets on pages 379 through 382.)

2. What should he and the union do?

Case 2: Punish the Spiller

Your company has a set of policies which fine and suspend operators who are involved with spills. As a result of this policy, workers do everything they can to cover up a spill so that no one will notice it.

For example, one benzene operator had a spill which at first was contained in the containment area around his operation. Rather than report the spill and get suspended, the worker tried to hook up a hose to get the benzene back into the main vessel. In trying to pull off this maneuver, the benzene escaped from his protection vessel and got into the sewer system and spread through the entire facility. Almost every worker could smell it as it went by. Needless to say, the worker got suspended. He was also fined \$1,000.

More recently, an operator with a 10-year perfect record was forced to work 14-hour shifts, five days in a row. On the fifth day the operator left a valve open when she shouldn't have and about 50 gallons of product poured out all over the unit. Because of her exemplary record, the company only suspended her for five days without pay.

The workers in the facility are extremely angry with this company policy. They've come to the health and safety committee and demanded that the union get the company to get rid of those rules.

1. What rights do the workers and union have to alter this situation?

2. What should they do?

Case 3: RCRA Not OSHA?

Your health and safety committee is receiving complaints from the workers in the hazardous waste unit about possible exposures to asbestos which is peeling off the pipes at the unit.

You have asked the company for permission for the health and safety committee to inspect the area on behalf of these workers. You have also requested that a union industrial hygienist be allowed to inspect. In addition, you have requested MSDSs for all the substances at the waste unit.

The company refused the request for the following reasons:

- All of their air monitoring and medical surveillance programs show that there are no health and safety problems in this area.
- Because of the confidentiality of the doctor-patient relationship, they are not in a position to share the data with the union.
- Because these workers work in the RCRA waste area of the facility, the normal OSHA rules do not apply (so says the company). Therefore, the company is under no obligation to provide the health and safety committee with access.
- Because of trade secrets they are not at liberty to provide access to the MSDSs.

1. What are the union's rights in this situation? (See the factsheets on pages 383 through 388.)

2. What should they do?

Case 4: The Privacy Act

The union health and safety committee of OilChem has discovered several cases of a rare cancer caused by a chemical at work called ortho-toludine. The union asked the company for the names and addresses of all the retirees so that the union could inform them of the potential exposure they may have received from this substance.

OilChem refused the request on the grounds that they could not release such information because of the federal Privacy Act.

1. What are the union's rights?

2. What should they do?

Case 5: Subcontracting

Over the past 10 years, OilChem has greatly increased the number of subcontractors at the facility from about 20 to over 60. During the same period, the bargaining unit has been cut nearly in half through attrition. The subcontractors are largely involved in maintenance of the facility and now are almost in total charge of the waste handling processes.

As a member of the health and safety committee, you are very concerned about the health and safety training of the subcontractors. In your opinion, they are prone to take short-cuts on repair, and work excessively long shifts (sometimes up to 20 hours at a time). You have spoken to several of these workers and they seem to have no idea what chemicals are around them. It is clear to you that they have had little or no health and safety training.

You can't prove it for certain, but you suspect that the rise of accidents at OilChem over the past few years is related to increased use of these subcontractors. Each day you are growing more certain that these subcontractors add up to an accident waiting to happen. You have tried again and again to address the issue in collective bargaining, but the company has refused to budge.

**1. What laws might you be able to use to correct this situation?
(See the factsheet beginning on page 393.)**

2. What, if anything, should you do about it?

Case 6: Compulsory Overtime

Overtime (compulsory and voluntary) is running wild at OilChem. The average overtime per week is 10 hours. It is not unusual for bargaining unit members to be forced to work 12 to 14 hours a day. It is even worse with the subcontractors. In order for them to get overtime pay they have to get up to 40 hours. So, many of the crews try to get in the 40 hours in two or three days in a row. Some workers even work 20- to 22-hour shifts.

To make matters worse, most OilChem union members desperately desire as much overtime as they can get. As a member of the health and safety committee you are concerned about the way overtime impacts health and safety.

1. Is overtime really a health and safety issue? What are your reasons?

2. What should you do about the situation? Do we have any legal remedies?

Case 7: Community Right To Know

You and the union are concerned that OilChem is not handling hazardous waste properly, and that there is just too much compulsory overtime and use of subcontractors. You've brought these issues up time and again in bargaining, but the company has refused to make any major changes.

Recently, the community has become much more agitated about the petrochemical and chemical facilities in your area. In fact, a few months back another facility up the road had a major release, forcing 4,000 people to flee their homes. (Fortunately, no one was injured.)

You have come across a new piece of legislation that gives the community specific rights to find out about your facility. (See the factsheet beginning on page 389 on Community Right-To-Know.)

Your union executive board has asked you to research this law and make a report to them on what it is and how the union should use it.

1. What provisions of this law, if any, might be of use to the union in its effort to protect the membership's and the community's health and safety?

2. In real life, do you think PACE locals should use this law? Why? How? Do you think the membership would want the union to get involved with this?

1. Taming the Legal Octopus

For a local union trying to control toxic exposures in the facility, the laws and regulations governing toxic wastes and worker health and safety can be overwhelming. Indeed, it can be a real legal octopus. The problems tackled in this workbook give you a feel for the stakes at hand – people’s jobs when they refuse to perform hazardous work; people’s health when they are carelessly exposed to hazardous chemicals.

Using these laws to your advantage is not always easy. You must be organized, savvy and persistent, pressing the company as well as the government to fulfill their legal responsibilities. Bringing in a government agency to solve a health and safety problem should be your last resort. If you can resolve a problem through direct negotiation with management, do so. In general, this will be the fastest as well as easiest route and one in which you will have the most control over the outcome.

If, after weighing all the options, you decide to bring in a government agency, here are some tips which may help you to be more effective in your efforts.

1. Build a strong foundation for your case.

- A. This means gathering information, *in writing*, which documents the existence and seriousness of your health and safety problem. Keep a log of workers’ complaints and symptoms related to this particular problem. For a safety hazard, keep track of accidents and/or near misses. Collect technical information on the hazard: company Standard Operating Procedures (SOPs), MSDSs, labels and technical research (government, scientific or technical references). If you have a safety committee or a group of concerned workers, you can divide up these tasks. You can also go to the International Health and Safety Department for technical support.
- B. Document your attempts to press management to correct the problem. Keep track of meetings, discussions, grievances, etc. This should be in writing.

continued

1. (continued)

2. Know what problem you want to correct and have a timetable.

Once you have identified and researched the problem, the next step is to decide how to correct it. This should be an outline of demands to the company – e.g., bringing in the union or an independent industrial hygienist to evaluate the problem, installation of a new ventilation system, or specific training for workers. You should also have an idea of a fair and realistic timetable. In formulating these demands, you should involve the members. You can also get some help on the technical part from the International Health and Safety Department. These demands and timetable are also important if you are forced to bring in a government agency. They give the government inspector a strong message that you are knowledgeable, that you know what you want, and that you are expecting a fair and thorough evaluation of your case and rapid correction of the problem.

3. Involve the membership and keep them informed.

Legal proceedings tend to tie you up. Don't forget to involve the membership from start to finish. It is your base of support. Get them involved in the fight. Use them for advice and direction. Always keep them informed (e.g., through leaflets, formal and informal meetings, and one-on-one's). By involving people, you also will be able to gauge how far people are willing to go to correct the problem.

4. Decide which government agency to call in.

Because there are so many to choose from (OSHA, RCRA, SARA, NLRB, etc.), you have to decide which is the best legal avenue to resolve your problem. The first step is to become more knowledgeable. Begin by reading some basic information on each of the laws (factsheets or booklets from government, union or COSH groups). Also talk to some health and safety people to identify which government agency has a record of rigorous enforcement of your problem.

Once you have narrowed it down to one or two government agencies, you should call the regional or area office of the agency

which would be in charge of the inspection. Find out first-hand the proper procedure for processing a complaint, how long it will take to respond, type of documentation they are looking for and regulations which might apply to your problem. Ask questions about pertinent standards – what constitutes a violation and requires corrective actions.

These questions are important because they give you an idea of your odds of winning if you bring in an outside agency to resolve a problem. If there is no standard pertaining to your problem or if it is unlikely that there is a violation of the law, don't call them in. Try another strategy. For example, use the documentation you have collected (NIOSH recommendations, scientific or engineering literature, company SOPs) and mount a campaign with the rank and file.

An important point to remember is that sometimes the threat of government intervention is a more powerful weapon than the actual fact of intervention. However, if you make the threat, be prepared to use it.

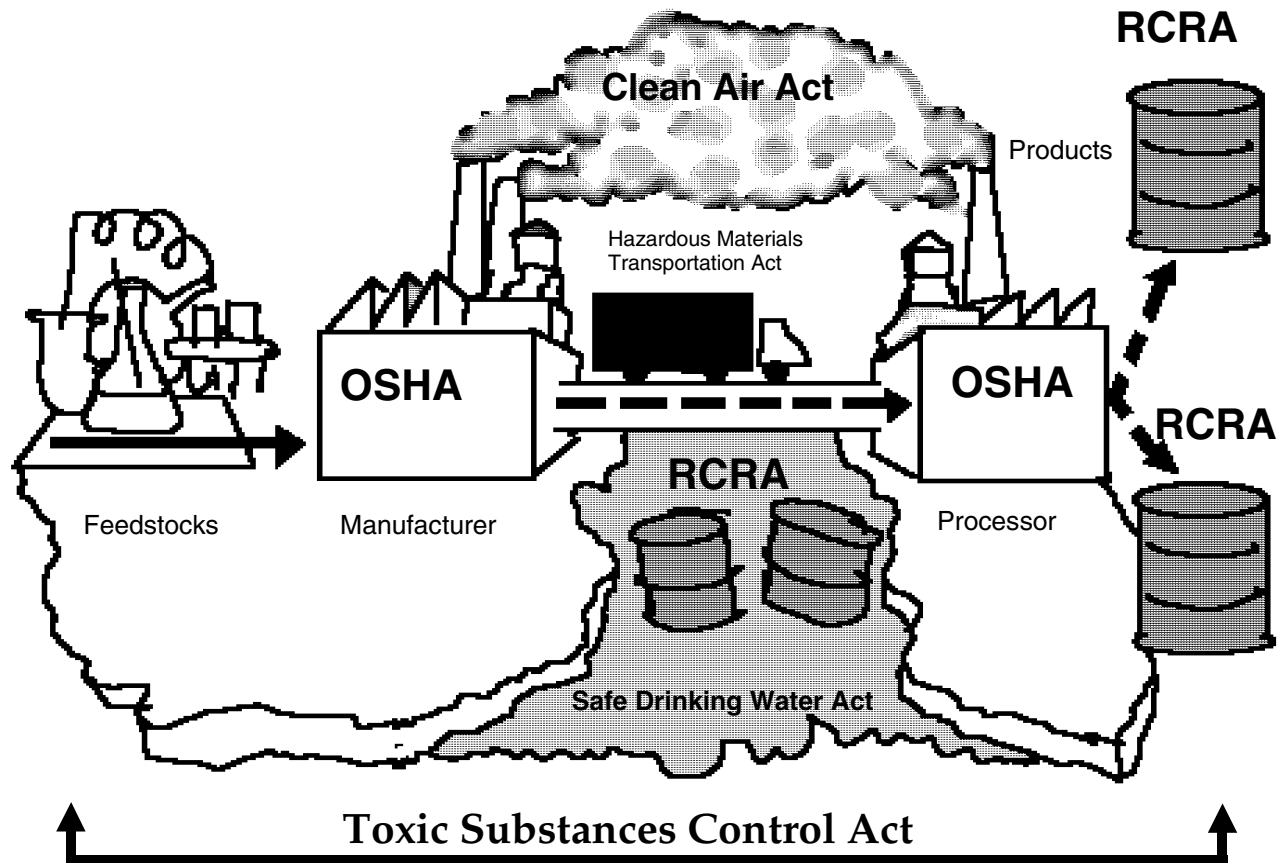
5. Persistent Follow-up.

Aggressive and persistent follow-up is one of the most important things you will have to do once you call in the government. Make sure you are notified of all formal and informal meetings that the government has with the company regarding your case. Be persistent because there are likely to be a lot of delays. Keep the rank and file informed about what is going on.

Last Point.

Health and safety problems do not occur in a vacuum. When you are deciding on a strategy, consider your past history with the company. How have they responded to other health and safety problems in the past? How have they responded to general labor relations problems? If you have been stonewalled in the past, don't expect anything different for this problem. If relations have been good, try your hardest to resolve the problem without bringing in the government. You will have more control over the outcome and will help to build the union in the process.

2. A Few of the Laws Affecting Toxics



3. Basic Health and Safety Rights

After years of hard fighting, the labor movement has achieved certain basic rights (in the law and in our contracts) for workers and unions when it comes to health and safety. Those basic rights are listed below. The factsheets which follow elaborate on a few of them.

- The right to a workplace free of recognized health and safety hazards. (OSHA)
- The right to establish a union health and safety committee with total facility access and investigative authority, including release time. (contract language)
- The right to any and all health and safety information, including monitoring and medical surveillance information, to allow the union to carry out its duty of fair representation. (OSHA and NLRB)
- The right to bring outside experts into the facility to conduct inspections and evaluations. (NLRB, contract language)
- The right to file OSHA complaints and have OSHA inspections. (OSHA)
- The right to refuse unsafe work (under limited conditions). (OSHA, contract language and NLRB)

4. Right to a Health and Safety Committee

OSHA does not give you the right to a health and safety committee with release time. But OCAW locals have won this right in collective bargaining. Ideal contract language should include:

- The right to organize a union health and safety committee.
- The right to investigate accidents immediately.
- The right to request an industrial hygiene survey of the workplace by a neutral consultant.
- The right to statistical data on employee medical examinations.
- The right to "rate retention" if people are forced to change jobs for medical reasons.
- The right to health and safety training by the International Union at company expense.
- The right to refuse unsafe work.
- The right to shut down unsafe operations.



5. On the Right To Refuse Unsafe Work

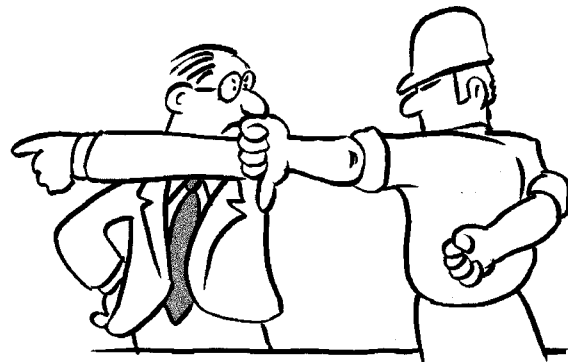
Organized workers have the right to refuse unsafe work under the National Labor Relations Act (NLRA), and all workers have that right under OSHA. But in both cases the right is a conditional one. Before refusing to do a job, a worker must be sure that the required conditions listed below are satisfied:

- Under OSHA, the worker must have a reasonable belief, based on what he or she knew at the time of refusing, that there was a real danger of serious physical injury, even if it is later found that there was no immediate danger.
- The danger was so great that the worker could not wait for an OSHA inspector before refusing to do the job.

It helps the case if the employee has volunteered to do another "safe" job in the interim. The worker should stay near the job site unless ordered to leave by the employer. Also, an OSHA inspection should be immediately requested at the time the job is refused.

What if you get fired?

If the employer fires the worker or initiates disciplinary action because of the refusal, employees must file an 11(c) discrimination complaint with OSHA within 30 days.



In theory, the 11(c) clause protects workers against retaliation for exercising their safety and health rights. In practice, though, it simply doesn't work. Workers who file an 11(c) complaint must depend upon the federal government to investigate and prosecute their case in federal district court. The process can take months to years, and according to a 1989 study by the GAO, less than 20 percent of these cases are resolved or prosecuted. An analysis of 11(c) complaints in New York City revealed that not one case out of 51 filed by workers in 1991 was settled in favor of the worker.

continued

5. *(continued)*

What about "Concerted Action"?

The rules of the National Labor Relations Board (NLRB) protect the right to take "concerted action" such as refusing to work to protest unsafe conditions.

"Concerted action" means that two or more workers or an individual act in order to protect other workers, even though the others may disagree with the action.

Under Section 502 of the NLRA, workers can only refuse to work if the conditions are "abnormally dangerous." As with OSHA, this does not mean that the worker has to be correct about the degree of danger. But at the time of refusal, there must have been evidence which would have made other "reasonable" people believe there was a danger.

But the Board has rarely upheld this right. In fact, in the 40-plus years since the passage of Section 502, the Board has found "abnormally dangerous" working conditions in only six contested cases.

In each of these cases the workers had to objectively prove that "tangible and immediate physical dangers" existed at the worksite. Also, the dangers had to be "substantially greater than those presented by normally existing conditions" to justify stopping work – a heavy burden indeed.

Caution.

Caution is the watchword for refusing unsafe work. It could take a long time for you to win your rights. Success is not guaranteed. PACE recommends that employees punished or fined for refusing an unsafe job **file a grievance**, as well as complaints, with both OSHA and the NLRB.

Source: *OCAW Reporter*, July-August, 1987; and TNS, Inc. and OCAW, 309 NLRB.

6. Contract Language on the Right To Refuse Hazardous Work

Union Co-Chair Has a Clear Right To Shut Down Job

A joint hazard prevention committee will be established for the purpose of analyzing and correcting unsafe and unhealthful working conditions inside the plant. The union co-chairperson of the committee and the management co-chairperson of the committee will have the right, either together or separately, to shut down any operation that he/she believes presents an imminent danger to the health and safety of an employee or presents a danger to the outside environment. (United Auto Workers Local 726 and Harvard Industries, October, 1991)

The Job Is Shut Down Until Determined To Be Safe

No employee shall be required to work on a job or machine while its safety is being questioned by any three (3) members of the health, safety and absentee committee and during such time he shall receive full wages at his regular rate of pay if transferred to a lower rated job. (Local 825 of the International Chemical Workers Union, Totowa, 1991)

Worker Has Clear Right To Stop Work

If an employee or group of employees shall believe that there exists an unsafe or unhealthful condition beyond the normal hazards inherent in the operation, he shall notify his foreman of such danger and of the facts relating thereto. Thereafter, he shall have the right, subject to reasonable steps for protecting other employees and the equipment from injury, to relief from duty on the job in respect of which he has complained, without loss of his right to return to such job. (United Steelworkers of America, AFL-CIO-CLC, Local Union No. 5298, 1986)

continued

6. (continued)

Issue Goes Immediately to Final Step in Grievance Procedure

If the existence of an alleged unsafe condition shall be disputed, the Grievance Committee, the Safety Director and the Foreman shall immediately investigate such alleged unsafe condition and determine whether it exists. If they shall not agree, and if such Grievance Committee is of the opinion that such alleged unsafe condition exists, the employee shall have the right to present a grievance in writing for immediate handling in the third step of the grievance procedure . . . , and arbitration, if necessary, to determine whether such employee was justified in leaving the job because of the existence of such an unsafe condition. (United Steelworkers of America, AFL-CIO-CLC, Local Union No. 5298, 1986)

Employees Have the Right Not To Commence the Assignment

Should there be a disagreement on the application of these [safety] rules, employees must specifically state their concerns about the [safety] rules application. The immediate supervisor will discuss the specific concerns responsibly to reach a consensus, if possible. If no resolution is found, the employee or employees who dispute the application will have the right to not commence the assignment without fear of retribution or retaliation. The next level of supervision is then contacted to mediate or resolve the concern. If the employee or employees still disagree with the provided protection, they have a no-fault right to refuse to participate in the assignment. (Pennsylvania Federation of the Brotherhood of Maintenance of Way Employees, 1993)

Sources: *Workplace Health and Safety: A Guide to Collective Bargaining*, Labor Occupational Health Program, Berkeley, California, 1980.

7. How To Request Medical and MSDS Information

(This letter should be submitted on the union local's letterhead. Send certified mail, return receipt requested.)

Date:

Dear _____:

In order to appropriately represent our members, this local union requests that the following information be provided to us.

A. Pursuant to OSHA Regulation 29 CFR 1910.20, Access to Employee Exposure and Medical Records (effective August 21, 1980):

1. All employee exposure records, including all workplace monitoring and biological monitoring results. Note that this includes a request for all results covering chemicals or compounds, noise, heat, cold, vibration, pressure, and radiation exposure;
2. Any analysis using these exposure records;
3. Any analysis using employee medical records; and
4. Copies of all Material Safety Data Sheets.

This information must be provided within fifteen days at no cost.

B. Pursuant to OSHA Regulation 29 CFR 1904.7, Access to Records, Log and Summary of Occupational Injuries and Illnesses (effective July 21, 1978):

1. The log and summary of occupational injuries and illnesses for the last 5 years.

C. Pursuant to OSHA Standard 29 CFR 1910.1200, Hazard Communication (fully effective May 25, 1986):

1. The entire written hazard communication program, including the list of hazardous substances and explanation of how you will inform employees of the hazards of unlabeled pipes and non-routine tasks;
2. An explanation of how MSDSs will be readily accessible to employees;
3. If you do not have MSDSs for all hazardous substances at this facility, please provide copies of documentation indicating that you are attempting to obtain MSDSs from your suppliers; and
4. An explanation of how the training requirements of this standard will be met by May 25, 1986.

Consider this letter a standing request for updated and/or new information pursuant to the above regulations.

A designated representative of this local union is prepared to meet with you if you have any questions concerning this request.

Sincerely,

8. The Duty of Fair Representation

Under the National Labor Relations Act and National Labor Relations Board rulings, the employer is required to bargain in good faith with the union. The union is required to provide non-discriminatory representation to all employees in the bargaining unit. This obligation on us is called "the duty of fair representation." In order to carry out our duty of fair representation, the union may request information from the employer to assist in contract administration, to frame collective bargaining proposals or to otherwise assist the union in understanding and representing the membership in appropriate subject matters of bargaining.

Under well-established principles of labor law, the employer is required to provide the union, upon request, information available to the employer relating to wages, hours and other conditions of employment. Health and safety on the job is definitely a condition of employment. The NLRB has made that clear:

"Few matters can be of greater legitimate concern to individuals in the workplace, and thus to the bargaining agent representing them, than exposure to conditions potentially threatening their health, well-being or their very lives."

3M., 109, LRRM 1345 (261 NLRB No.2); Colgate-Palmolive Co., 109 LRRM 1352 (261 NLRB No. 7). (Both are OCAW cases which the NLRB decided on April 9, 1982. On June 30, 1983, the U.S. Circuit Court of Appeals for D.C. upheld the NLRB decision.)

This means the union has a right to any and all information the company has concerning the health and safety of our members.

To help us get this information, the International Union has created a "Representational Letter" (see next page) that your locals can use to get all the information we are entitled to. (For more information on the specifics of this letter's use, see the *OCAW Health and Safety Policy Manual*, Chapter 3.)

9. PACE Representational Letter

Suggested Letter To Request Health and Safety Information

(This letter should be submitted on the union local's letterhead. Send certified mail, return receipt requested.)

Date:

Dear _____:

This local union requests the company to submit the following information in order that it may properly carry out its representational responsibilities under the collective bargaining agreement:

1. The illness and death statistics, and basic data from which these were calculated, on all past and present employees.
2. A list of all toxic substances and/or harmful physical agents by chemical name, correlated with company code names and/or trade names, that employees are exposed to, or potentially exposed to.
3. Material Safety Data Sheets (MSDSs) on all toxic substances that employees are exposed to, or potentially exposed to.
4. The results and analyses of all biological monitoring data on employees obtained to evaluate exposures, or potential exposures, to toxic substances and/or harmful physical agents; a statement of the purpose of any such monitoring and the biological indicators (i.e., blood, urine, etc.) being analyzed.
5. The results of toxicological laboratory investigations (if any) concerned with toxic substances and/or harmful physical agents that employees are exposed to, or potentially exposed to. This should include results available to the company through "in-house" investigations or undertaken through an outside agency or contractor.
6. All health-related information derived from any insurance program or health-related information concerning occupational diseases, and accident data related to worker's compensation claims, for those employees covered under the collective bargaining agreement. It is agreed that any personal identifiers which would reveal the identity of any individual employee may be removed from any medically confidential data requested here.
7. The OSHA Log of Occupational Injuries and Illnesses (OSHA Form 200) and the OSHA Supplementary Record of Occupational Injuries and Illnesses (OSHA Form 101).
8. All industrial hygiene monitoring data for toxic substances and/or harmful

continued

9. (continued)

physical agents that employees are currently exposed to, or potentially exposed to; all results of historical monitoring data from past industrial hygiene surveys, including a list of all toxic substances or harmful physical agents which have been monitored in the past; any analysis, or use, of these industrial hygiene monitoring results.

9. Description of the engineering control program(s) the company has in place to prevent exposure to toxic substances and/or harmful physical agents (i.e., ventilation, noise control, heat control, etc., systems). Name the toxic substances and/or harmful physical agents which are subject to engineering controls, administrative controls or personal protective equipment.
10. Description of your hearing conservation program, if any, including a description of any periodic audiometric examination, noise level surveys and engineering control measures, which are in effect.
11. Description of the uses of radiation sources, if any, noting source type and activity if isotopes are used. Note machine sources of radiation. Indicate the radiation protection program in effect. List the incidents which require notification to state and federal agencies. Describe monitoring.
12. We also wish to have copies of EPA Form R (required under SARA Title III), and the RCRA permit for the Hazardous Waste Site.

Please be assured that this local union requests the above information for the sole purpose of pursuing its representational responsibilities under the collective bargaining agreement.

We will accept photostats of insurance carriers' reports, payroll records or any other written form convenient to the company to supply this information. The order in which the above questions have been asked is not to indicate their priority or to in any way describe the format under which the company chooses to answer this request.

We would appreciate receiving this data and information, or any part thereof which is readily available, as quickly as possible, as we may desire to propose steps to be instituted in order to protect the health and lives of the bargaining unit personnel. However, partial response to this request in no way relieves the obligation to provide all data and information requested herein. This is an on-going request for any new information.

Yours truly,
(signed by local union officer
or group chairman)

10. Right to Exposure and Medical Records

Under OSHA 1910.20, every employee has a right to a copy of his or her own medical record maintained by the company.

The individual worker also has the right to sign a release authorizing the medical record to be turned over to a physician of choice. PACE does not encourage wholesale solicitation of individual medical records by entire bargaining units or locals. Rather, it is often more useful to make selective use of the Standard when a particular health problem has surfaced within a particular group.

Please do not request individual medical records of a group without first consulting the International Union's Health and Safety Department in Denver.

However, make your members aware that they have the right to request their own record for their own use and viewing.

11. Right to a Union Industrial Hygienist Inspection

Through a series of court cases, it has now been established that the union does indeed have the right to have a union-designated industrial hygienist inspect a facility. Here are some main points to remember in claiming this right:

- Use existing contract language if you have it. It can help you avoid the time-consuming process of going to the NLRB.
- Make your request in writing.
- The employer must give the union's person access. They can't get off the hook by just discussing your request with the union. But the employer can insist that the inspection take place for a reasonable period at a reasonable time.
- If OSHA, or any other agency, has conducted an inspection, you still have a right to a union inspection.

Source: Scott Tobey, Labor Program Services, Michigan State University.



12. The Emergency Planning and Community Right-To-Know Act of 1986:

Title III of the Superfund Amendments and Reauthorization Act (SARA)

Establishment of Local Emergency Planning Committees

Every local community with toxic facilities was to have a local emergency planning committee (LEPC) **by August 1987** appointed by the governor's State Emergency Response Commission (SERC). (Few had the broad representation required by the law by that date – see next page on representation requirements.)

By October 17, 1988, each LEPC was to have developed an emergency response plan to deal with potential toxic accidents in their communities. The plan must do the following:

- Identify facilities in the community where chemicals are used.
- Identify transportation routes for extremely hazardous substances used in, or passing through, the community.
- Establish emergency response procedures to be followed within industrial facilities and in the community.
- Name a community emergency coordinator and facility coordinators to implement the community's plan.
- Issue emergency telephone numbers, emergency assistance locations, and other notification procedures.
- Establish ways to determine the occurrence of a hazardous chemical release and the probable affected area and population.
- Describe local and industrial emergency equipment and facilities available for use during a chemical emergency and identify the persons and agencies responsible for putting them into action.
- Develop evacuation plans for the community.
- Develop a training program and schedule for local emergency response personnel.
- Organize emergency response plan exercises in the community to practice emergency response procedures.

continued

12. *(continued)*

Who Gets on the Local Committee

The law requires "at a minimum" members from each of the following groups or organizations:

- elected officials;
- law enforcement, civil defense, firefighting, first aid, health, local environmental, hospital, and transportation personnel;
- broadcast and print media;
- community groups; and
- owners and operators of facilities subject to Title III.

What the Title III Law Requires of the Toxics Industry

- Section 312 calls for **full disclosure of the names and health hazards of chemicals** at major industrial facilities across the country. (Exclusions for trade secrets' protection only cover a narrow range of information that must be withheld in order to protect corporate innovations.)
- Section 312 requires that companies **disclose the average amounts and location of these toxic substances** to help local officials adequately plan for emergency situations.
- Section 313 requires that those manufacturing firms handling large quantities of toxic chemicals report to the public the **annual amounts of those chemicals being emitted into the air, water, and soil**. (For the first time, this will provide information on how much exposure there is on a routine basis.)
- Section 303 (d) says that upon request from an LEPC, the owner or operator of any toxic facility subject to the emergency planning provisions of the act must promptly provide information to the committee **"necessary for developing and implementing the emergency plan."** This means that the emergency committees can obtain all the information they need for emergency situations, not just the information specifically required under the act. This provision closes the loopholes.

An Example of How Section 303 (d) Might Work

(by former Congressman Florio)

"Suppose a local emergency committee is trying to assess and plan for the toxic risks of a complex chemical plant in its neighborhood. The committee has received a list of the toxic chemicals at the plant, the average amounts handled, and the annual estimates of emissions, all required to be reported under the Act. But, as many of you know, chemical plants handle their chemicals in a variety of ways. Sometimes these substances are stored under intense pressure or at high temperatures. The risks are very different depending on the manner of use and storage of these toxic substances.

"Consequently, the local committee will likely want to conduct a complete hazard assessment of the facility to determine, in a more exact way, the true risks from the plant. Using Section 303 (d), the local committee can receive the facility's own hazard assessment, if any, which would provide the company's own projections for air releases, water releases or explosions under a variety of conditions. In addition, if one chemical is of particular concern because of its immediate toxic effects, such as MIC, the local committee can obtain detailed information on the precise uses, storage conditions, and likely community risks of this chemical.

"With the added information available under Section 303 (d), the Right-To-Know Act offers local officials the opportunity to turn the spotlight on all of the activities of the local facility, not just those aspects the local plant may be willing to divulge."

continued

12. *(continued)*

How Unions Can Get Involved in Title III

Worker organizations **are not mandated by law to be included on an LEPC**. But a good case could be made that unions, at the very least, are a "community group." Often LEPCs are inactive or dominated by corporations.

Also, any member of the community has the right to obtain chemical information including material safety data sheets (MSDSs) and chemical inventory forms. In addition, the public has the right to comment on revisions to the facility each year, and the right to information on toxic chemical emissions collected by the EPA. If any of this information is denied, **you have the right to sue** any or all of the following: the EPA, your state Emergency Response Commission, the Governor, or owner/operator of a facility, depending on the type of information you are seeking. Once you make a request, the owner of the facility is obligated to provide the local committee with the requested information.

The Definition of "Hazardous Materials"

As used in Title III, the term hazardous materials refers generally to substances transported, used, and stored at petroleum refineries and natural gas facilities; hazardous chemicals such as PCBs and trichloroethylene (used in dry cleaning establishments); acutely toxic chemicals whose effects are immediate; and fumes and dust from such metals as arsenic, lead, and cadmium.

The Definition of "Extremely Hazardous Substances"

In Title III, this specifically refers to those chemicals that, particularly in gaseous form, could cause serious health effects following short-term exposure from accidental releases (for example, chlorine, ammonia, sulfuric acid, and methyl isocyanate (MIC)). The EPA has developed a list of 406 "extremely hazardous substances."

13. Violating RCRA Training Requirements

Colorado Concrete Company Convicted of Knowing Endangerment of Employees

Denver (By a BNA Staff Correspondent) – A federal jury found a concrete company guilty December 21, 1987, of knowingly endangering three employees, in the first such conviction under criminal provisions of the Resource Conservation and Recovery Act.

In *U.S. v. Protex Industries Inc.* (no. 87-CR-115), Protex Industries Inc., a Denver firm that manufactures curing compounds, grouts, and epoxies used in concrete construction, and recycles 55-gallon drums of chemicals, also was found guilty of conspiring to treat, store, and dispose of hazardous waste without a permit.

The government charged that Protex knowingly violated RCRA provisions by failing to provide training and proper protective equipment to employees in the drum recycling facility, exposing them to an "increased risk" of cancer.

Sentencing for Protex was scheduled for January 29. According to a Justice Department statement announcing the verdict, Protex could face fines of up to \$1 million on each of the knowing- endangerment counts.

Protex purchased used drums, some of which had contained paints, solvents, and pesticides, washed the drums, then filled them with its own products. According to the government's case, employees were not instructed on how to identify toxic chemicals, or how to handle drums still

containing them.

At the trial, the government presented evidence that barrels with contents still inside were emptied into a 4,500- gallon underground storage tank. Some drums were then placed in a reject pile while others were processed through the drum-wash facility.

Workers Face Increased Cancer Risk

Workers testified that drums which they thought contained water were dumped onto the ground without any tests being conducted to identify the contents, according to Assistant U.S. Attorney Kenneth Fimberg. This practice, he said, resulted in "routine" dumping of toxic substances.

Fimberg said barrel workers testified that a tank that contained wash-water from the drum recycling operation was emptied into the local sewer system, and that workers entered the tank to remove sludge by shoveling it into five-gallon pails, which were then placed in trash dumpsters.

According to medical testimony, the workers had an "increased risk" of developing cancer, and two of the employees suffered from "psycho-organic syndrome" as a result of solvent exposure. Symptoms of the syndrome include dizziness, headaches, memory impairment, loss of initiative, and nervousness.

The defense, led by Denver attorney

continued

13. *(continued)*

David Palmer, sought to show that Protex attempted to comply with the requirements of RCRA, but that it was given no assistance by state and federal authorities.

The defense also tried to show that state and federal inspections of the site detected chemicals that may have migrated to the Protex site from neighboring industrial facilities.

Possible Million-Dollar Fines

Palmer told BNA that the verdict was a "bitter pill" to accept. "We thought our case had gone well," he said.

Fimberg told BNA the government sought to show Protex was guilty of "criminal recklessness, that the company just did not keep itself informed of its obligations, and to the extent that it did know, it did not take the steps necessary" to comply with RCRA.

"We believe that [this]...important guilty verdict will have a major beneficial impact in persuading those who are responsible for hazardous wastes to obey fully the law," Acting Assistant Attorney General Roger J. Marzulla of the Justice Department's Land and Natural Resources Division said.

Protex General Manager Donald Wilson faces a separate trial on the charges. A second company official, Comptroller Charles Hyatt, pled guilty to violation of the Clean Water Act by discharging hazardous waste into a waterway and to making a false statement concerning hazardous waste storage.

Source: *The BNA Occupational Health and Safety Reporter*, January 13, 1988.

14. New Jersey's Conscientious Employee Protection Act

New Jersey significantly expanded the protection of employees from wrongful discharge when the Conscientious Employee Protection Act [N.J.S.A. 34:19-1, et seq.] became law on September 5, 1986. This law is principally intended to protect "whistle-blowers" who reveal an employer's conduct to public entities. It also protects employees who never go public, but who are the victims of retaliation from employers who are upset by their efforts to ensure employer compliance with law and public policy. In effect, it should give greater ability to workers who attempt to enforce workplace regulations on their own, without awaiting action from frequently slow-acting public agencies.

The key provision of the Act is Section 3, which defines **unlawful employer conduct** as follows:

An employer shall not take any retaliatory action against an employee because the employee does any of the following:

- Discloses, or threatens to disclose to a supervisor or to a public body an activity, policy or practice of the employer that the employee reasonably believes is in violation of a law or a rule or regulation promulgated pursuant to law;
- Provides information to, or testifies before, any public body conducting an investigation, hearing or inquiry into any violation of law, or a rule or regulation promulgated pursuant to law by the employer; or
- Objects to, or refuses to participate in any activity, policy or practice which the employee reasonably believes:
 - is in violation of a law, or a rule or regulation promulgated pursuant to law;
 - is fraudulent or criminal; or
 - is incompatible with a clear mandate of public policy concerning the public health, safety or welfare.

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14. *(continued)*

The coverage of this section is extremely broad, as the Act's definition of "employer" includes all public and private employers [N.J.S.A. 34:19-2a] and its definition of a "retaliatory action" goes beyond termination, suspension and demotion to include any "adverse employment action taken against an employee in terms and conditions of employment." [N.J.S.A. 34:19-2e]

In the absence of an emergency, an employee must notify his or her employer in writing of any alleged violations, and give the employer an opportunity to correct the problem, before blowing the whistle in public. In the absence of such notice, the Act provides no protection. [N.J.S.A. 34:19-4]

An employee who prevails in a suit under this Act can obtain reinstatement with full back pay, an injunction against further violations of the Act, an award of attorney's fees and costs, and, in an appropriate case, punitive damages. In addition, the Court can impose a civil fine upon the employer. [N.J.S.A. 34:19-5] An employee who brings a suit "without basis in law or fact," however, can be forced to pay the employer's attorneys fees and costs. [N.J.S.A. 34:19-6]

The Act requires employers to post notices "of its employees' protections and obligations under this act," which notices must include the name of the appropriate person designated by management to receive written notices of allegedly improper employer activity. [N.J.S.A. 34:19-7]

Source: Memo to the New Jersey Industrial Union Council, by Sidney Reitman and Bennet D. Zurofsky of Reitman, Parsonnet, Maisel & Duggan Law Offices, Newark, New Jersey.

15. Federal Environmental Statutes

The Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act covers waste management – it does not apply to storage or use of hazardous materials or products unless a hazardous waste is generated. It applies to all industries which generate, transport, store, treat or dispose of hazardous waste (over one hundred kg./mo. or one kg./mo. of acutely hazardous wastes).

RCRA includes federal identification of hazardous wastes; a manifest system for tracing wastes from generator, to transporter, to treatment, storage, or disposal facility; federal minimum standards for hazardous waste treatment, storage, and disposal; and state implementation of hazardous waste management programs at least equivalent to the federal program.

Generators of wastes must keep records and report to the EPA or an administering state agency; assure that all hazardous waste is designated for treatment, storage, or disposal in permitted facilities, and deliver wastes in correctly labeled proper containers.

The transporter of hazardous wastes must record and report on wastes transported, accept only properly labeled and contained wastes, comply with the system designating waste for treatment, etc., and transport only to the permitted facility.

Facilities must have permits for treatment, storage or disposal of wastes (including such onsite activities). Permits indicate compliance with EPA standards for location, design, construction, operation, maintenance, preparedness and prevention, contingency plans and emergency procedures, closure and post-closure measures, and financial responsibility.

Groundwater protection is covered by RCRA, including cleanup when a hazardous substance is detected beyond the facility boundary.

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Clean Water Act (CWA)

The Clean Water Act declares that any "discharge" of a "pollutant" by a "point source" to "waters of the United States" is illegal without a discharge permit issued by either the federal Environmental Protection Agency or a state that has been delegated authority to administer the permit program. Some 40 states are currently administering discharge permits.

The Act covers the addition of any substance (including heat) to a water body (artificial or natural) by a pipe, ditch, or other discrete conveyance (i.e., a confined runoff). Facility site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage may also be included at the discretion of the permitting authority.

- Discharges are subject to the best current technology available.
- Standards are set according to process and product on a national level and individually for companies not fitting neatly into an industrial category.
- Standards for very polluted or very clean waterways may be more stringent than other technology-based standards.
- Industry is required to "self-monitor" discharges and report all violations to the permitting authority.
- Facility inspections are possible – sometimes requiring a search warrant.
- Enforcement of the CWA is through strict penalties for violations of monitoring and reporting requirements.
- Strict liability is enforceable by the EPA through administrative compliance orders, administrative fines, civil suits, and criminal actions.
- When neither the EPA nor a permitting agency take enforcement action against a violator, any citizen may sue a violator in federal court.

The Clean Air Act (CAA)

In November 1990, the first major revision of the nation's 1977 Clean Air Act was signed into law. The CAA has provisions addressed at:

- Cutting back on destruction of the ozone layer through phase-out of chlorofluorocarbons and carbon tetrachloride by the year 2000, methyl chloroform by 2002, and hydrochlorofluorocarbons by 2030, and through new rules covering recycling and disposal of ozone-depleting chemicals.
- Cutting emissions from motor vehicles, including reductions in tailpipe emissions of hydrocarbons and nitrogen oxides in all new cars by 1996; installation of long-lasting pollution control equipment in new cars by 1998; requirements of car manufacturers to produce experimental fleets meeting stricter standards by 1996; and requirements of oil companies to produce cleaner fuels by 1992.
- Urban smog reductions through attaining standards to cut ozone pollution and controls on sources of large amounts of smog emissions.
- Controls on sulfur dioxide and nitrogen oxide emissions to curb acid rain through cuts in smokestack emissions.
- Tighter controls on toxic air pollutants including a listing of 189 toxic pollutants and 250 categories of hazardous pollutants for which the EPA is to develop standards; installation of pollution control equipment by polluters by 2003; new standards for exposure of communities; and establishment of a new agency to investigate chemical accidents.

The new law also establishes a small fund to aid workers displaced by the new regulations, although this amounts to a minor extension of unemployment insurance.

The 1990 Clean Air Act has been criticized both for costs to industry and the fact that it is full of loopholes and delays in meeting new standards and, in some instances, effectively lowers standards from earlier reliance based on public health standards to those developed by industry. In addition, reliance on the EPA to establish and enforce standards does not bode well for the environment.

Sources: "The Clean Air Act: Immediate Costs, Long-Term Gains," *The New York Times*, October 23, 1990 and Richard Grossman as cited in *Global Warming Watch*, October 1990/January 1991.

continued

15. *(continued)*

The Toxic Substances Control Act (TSCA)

The Toxic Substances Control Act empowers the EPA to require testing of new and existing chemicals that are potentially toxic, and to prohibit or condition the manufacture, distribution and usage of a chemical which poses an unreasonable risk to health or the environment.

TSCA requires "premanufacture notice" to EPA by anyone intending to import, manufacture or process a new chemical or to introduce a significant new use of an existing chemical.

Information must be provided on the nature of the chemical, including structure, trade name, amounts to be produced, and intended uses; the production process, including number of workers and type of exposure, location of facility and environmental release data; and known effects.

The EPA may regulate or prohibit manufacture of the chemical within 180 days of notification, or may require further testing of health and environmental effects.

For existing chemicals, TSCA requires monitoring and reporting on chemicals on the Interagency Testing Committee's (ITCs) lists of potentially dangerous chemicals.

Manufacturers and some processors must report significant adverse health or environmental reactions to EPA. EPA has the power to order companies to submit health and safety studies in their possession. EPA may limit production, use and disposal of chemicals indicated harmful in such a report.

Summary: The Legal Octopus

1. Bringing in a government agency to solve a health and safety problem should be your **last resort**. If you can solve a problem through **direct negotiation** with management, do so. In general, this will be the fastest and easiest route. It is also the one in which you will have the most control over the outcome.
2. There are numerous laws and regulations governing hazardous materials and worker health and safety. Some are federal, some are state, and all are **constantly changing** (new standards, new legal decisions). Therefore, if you plan to use them, it pays to try to keep up to date.
3. Keep in mind that of all the legal avenues available, **the OSHA Law and your union contract are your most effective weapons** in your fight to clean up your workplace.
4. **If after researching the law you find that there is no standard** pertaining to your problem, or if it is unlikely the inspector will find a violation of the law, **don't call the government agency in**. Try another strategy.
5. If you decide to bring in a government agency like OSHA, it is important to **build a strong foundation** for your case. This means gathering information, *in writing*, which documents the existence and seriousness of your health and safety problem. Also keep track, *in writing*, of your attempts to press management to correct the problem.
6. Remember that **OSHA standards are minimum standards**, similar to the minimum wage. Few of us would be happy with only the minimum wage; we always fight for better. Working conditions are no different. Never be content with simply meeting OSHA standards. If recommended standards exist that are superior (for example, from NIOSH) try to use them as a basis to fight for improved conditions in your workplace.

continued

Summary *(continued)*

7. Under the National Labor Relations Act (NLRA), **your employer has a duty to bargain with you and to provide information on "wages, hours and working conditions."** This includes hazards in the workplace.

8. **Don't act alone.** For best results, file OSHA, RCRA and NLRB complaints through the local union and the International Health and Safety Department. The government agency is likely to be more responsive.

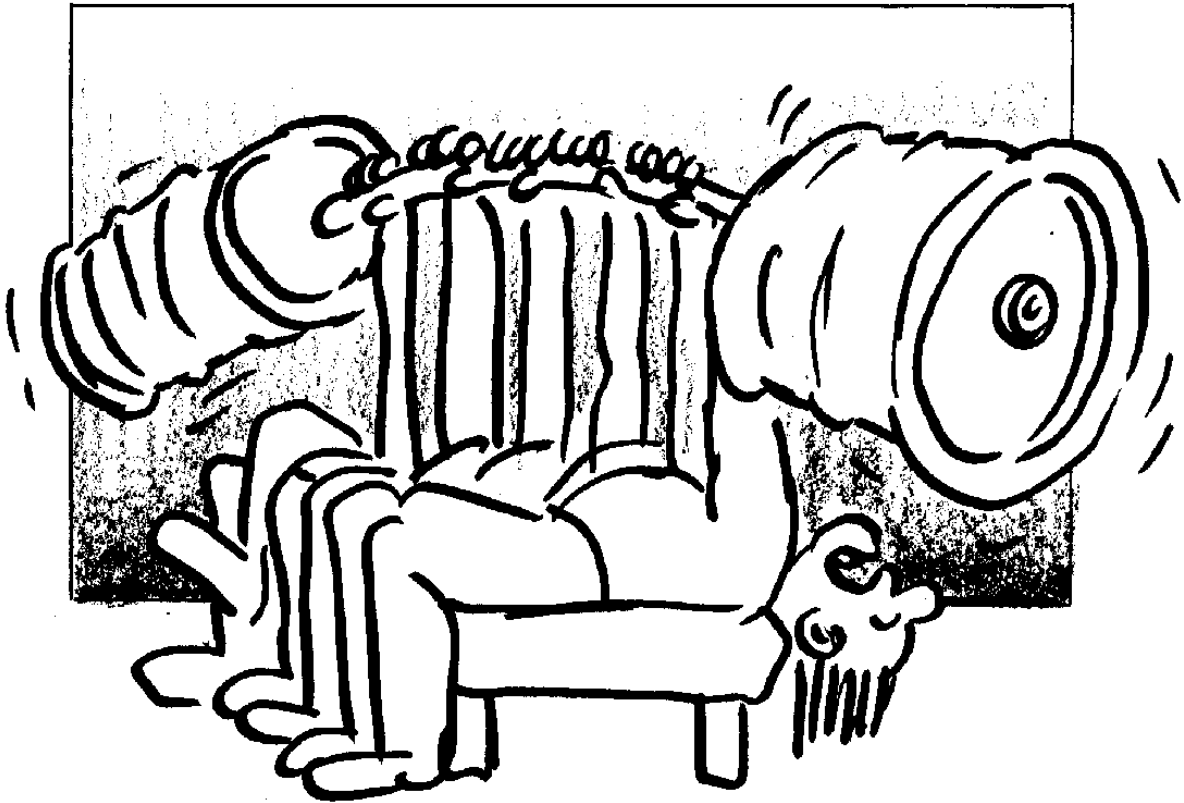
9. **Legal proceedings tend to tie you up.** Don't forget to involve the membership from start to finish. It is your base of support. Get them involved in the fight. Use them for advice and direction. Always keep them informed (e.g., through leaflets, formal and informal meetings and one-on-one's). By involving people, you will also be able to gauge how far people are willing to go to correct a problem.

10. Health and safety problems do not occur in a vacuum. When you are deciding on a strategy, consider your past history with the company. How have they responded to other health and safety problems in the past? What about general labor relations problems? If you have been stonewalled in the past, don't expect anything different for this problem. **If relations have been good, try your hardest to resolve the problem without bringing in an outside agency.** You will have more control over the outcome while building the union in the process.

Activity 13: Strengthening the Health and Safety Committee

Purpose

To gain an understanding of how to make joint labor-management health and safety committees more effective.



Task

Please read the scenario below. Your small group is the health and safety committee at OilChem. In your group, make a list of recommendations for the newly organized local union leadership.

The OilChem facility across town was recently organized by the 250 production and maintenance workers. The facility is the recipient of all of OilChem's liquid hazardous waste nationally. OilChem has 15 facilities in the United States. The facility uses a natural-gas-fired kiln to burn the waste.

The new local has asked your local leadership for advice and recommendations on how to set up a safety and health committee. Your local president delegated you and the committee to help set up the new safety and health committee.

Please review the factsheets on pages 405 through 419 and make a list of recommendations and actions for the new local's health and safety committee.

List of Recommendations:

1. Safety Committee Structure

The best safety committee structure is a joint labor-management committee. These committees may be formally spelled out in the contract or may be established by years of "past practice." Either way, the company acknowledges the union's role in dealing with workplace health and safety problems. The joint committee also gives the union a formal "window" to discuss the workers' concerns.

To be effective, the following are required:

- The committee needs to consist of equal numbers of labor and management.
- The chairperson needs to rotate on a regular schedule.
- There needs to be a mechanism for the union to check and double-check the minutes to ensure that they accurately reflect the meeting.
- And the union members need to be picked by the union, not by the company.

The union members of the joint committee need to meet among themselves, to discuss problems and strategies, to educate themselves, and to prepare for the joint committee meetings.

The union members of the safety committee need to keep in communication with the local officers and stewards.

Effective committees meet on a regular basis. These can be weekly, monthly, or whatever, but they should be regular.

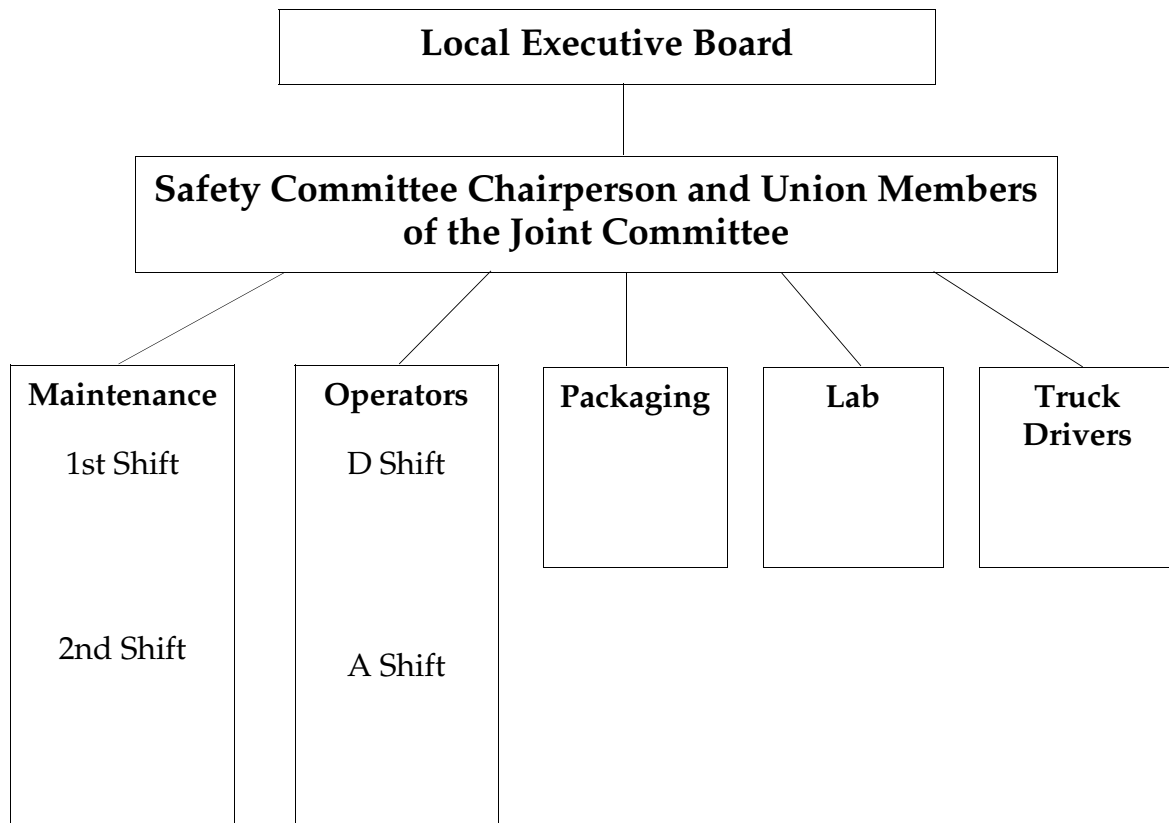
If a local union can't get the company to agree to a joint health and safety committee, the local needs to form a committee of its own. As you'll see later in this section, there are plenty of activities the union can undertake on its own.

2. Eyes, Ears and Voices

Because the joint labor-management committee should be relatively small, let's say three members of labor and three members of management, the union will need a union committee structure that is representative of the facility. **The union committee should have representatives from all major departments, shifts, and work groups.**

A committee of two or three members will not be able to represent adequately a large facility. This is not a new problem. The local president or group chairperson has stewards throughout the facility to help enforce the contract. This structure can be adapted for the safety committee. The local union can appoint **safety stewards** to function as the eyes, ears and voice of the union's safety committee.

A Proposed Facility Structure:



3. No Free Lunch

The local union will need to invest in its safety committee if it is to function properly. Investment can be money and time, but most importantly the local union will need to back up the union safety committee. **Health and safety concerns will at times need the full backing and moral support of the local union.**

Investment in the committee is essential to the education of the safety committee. Simply put, information is power. An informed safety committee will be able to fulfill its role better in the joint labor-management committee. Health and safety concepts, the legal duties under the National Labor Relations Board (NLRB), and OSHA standards are areas of expertise that the local union will need to educate the members of the union's safety committee about. Knowledge invested in the union's safety committee will reap rewards in the form of a safer and healthier place of work.

Some ideas for investment:

- Use collective bargaining to have the union safety committee chairperson be paid up to 40 hours per week by the company to do health and safety activities.
- Send committee persons to classes given in local area colleges and technical colleges.
- Use the Alice Hamilton Library (OCAW Headquarters).
- Join a COSH group (see Appendix for list of COSH groups).
- Build a local union health and safety library (the International Union has a list of recommended books, and see the Appendix).
- Work with management to have access to their materials.
- Subscribe to safety magazines and/or newsletters.

4. Common Pitfalls

Safety committees often fail or are steered into pitfalls. These are called pitfalls because they drain a committee of its energy and make workers in the facility see it as a waste of time.

1. The List-Making Process

This is also called the **broken ladder committee**. If a committee's meetings usually deal with lists of maintenance jobs (repairs, etc.) and a discussion of which ones were completed and arguments over the ones that were not done, that committee is probably not doing much more than keeping the maintenance department busy. Repairs are important, but they should be done routinely, not saved for committee meetings. The joint committee meetings are times to discuss problems, company policies, accidents and near misses; to review industrial hygiene data, test results and investment in equipment; not to list repairs.

2. The Company-Dominated Committee

If the local has a joint labor-management committee, then it should be truly "joint" and cooperative, not dominated by one side. If the company's side always sets the agenda, always chairs the meetings, and always makes the recommendations, then the committee will lose its effectiveness. There must be involvement on the part of the workers beyond just listening and receiving the company's opinion.

3. The Joint Committee and the Management Committee

Often there are two health and safety committees at work. One with no power and one that really makes all the decisions. The joint labor-management committee negotiated in the collective bargaining agreement is powerless. Behind the scene, management dominates and controls their own safety committee that makes all the important decisions. This management-only committee reviews the recommendations and the information that engineering and the company's health and safety department has uncovered. The union safety chairperson is not invited, and usually no bargaining unit workers are involved. The joint labor-management committee is just "window dressing" while the company does its work behind closed doors.

To be effective, the joint committee has to involve the workforce. That means rotating chairpersons between labor and management, allowing the union input on all discussions, allowing the union to have their issues put on the agenda, allowing for review and joint control over the minutes of the meeting, and allowing enough time for all problems to be discussed.

5. Road Map for Health and Safety Committees

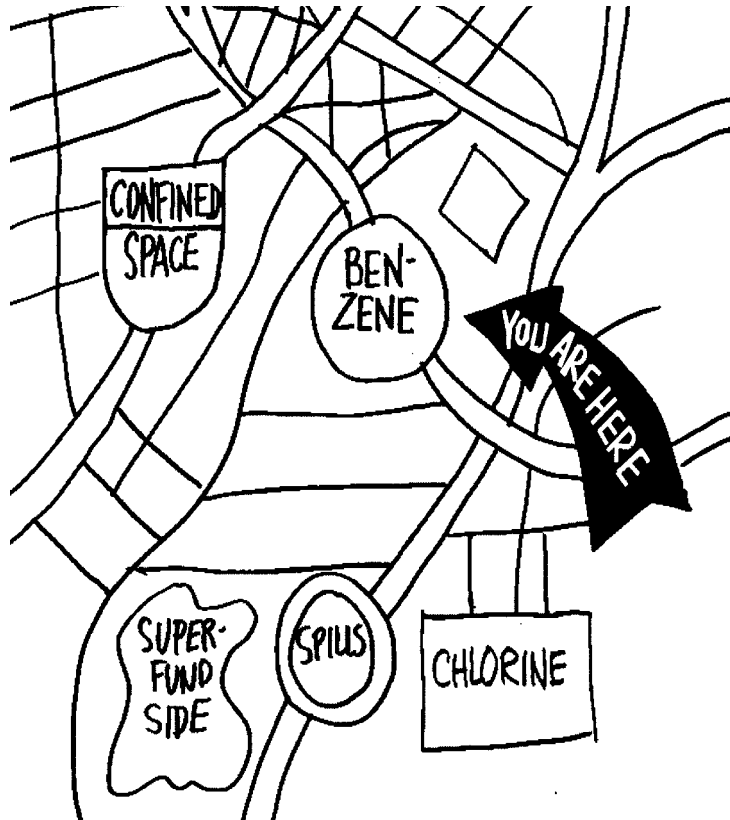
An effective health and safety committee's primary purpose is to improve the work environment. To accomplish this, the committee will need to think of this activity as an on-going process. There are several elements to this process.

1. Reach out to the membership.

The committee needs to represent the membership. This can only be done through actively seeking their input and concerns.

2. Develop a list of health and safety problems.

The committee will need to have an "overview" of the membership's concerns. This is best accomplished through putting down on paper the concerns of the membership.



3. Select priority concerns.

This may be one of the most difficult tasks facing a safety and health committee. Issues that the membership is concerned with may not be the same issues the health and safety committee would tackle first. For instance, the committee may be very interested in benzene exposures, but the membership may be interested in an improved lock-out/tag-out procedure. The membership's concerns should be placed first.

4. Deal with the priority issues first.

The union's safety committee persons need credibility to be effective – credibility in the eyes of the membership and management. The health and safety committee will need to build, or earn this credibility from the membership. Earn it by dealing with the members' concerns. Credibility from management will come later.

5. Win some changes.

A health and safety committee should attempt to solve small or easy problems first before they attempt to make major changes. From the concerns of the members, address the ones that you feel will be solved easily. Build your committee on small incremental changes to begin with. It is essential that the safety committee have the backing of the membership. To have credibility with the membership, the cancer concern from benzene exposure may have to wait for the committee to "deliver" an improved lock-out/tag-out procedure.

6. Build toward larger and more comprehensive changes.

From small beginnings, tougher issues can be solved. As the committee gains credibility with the membership, its credibility will grow from management's point of view. This enhanced credibility will allow the committee to tackle more difficult issues, such as the reduction of exposure to benzene and other cancer-causing substances.

6. Understanding Levels of Activity

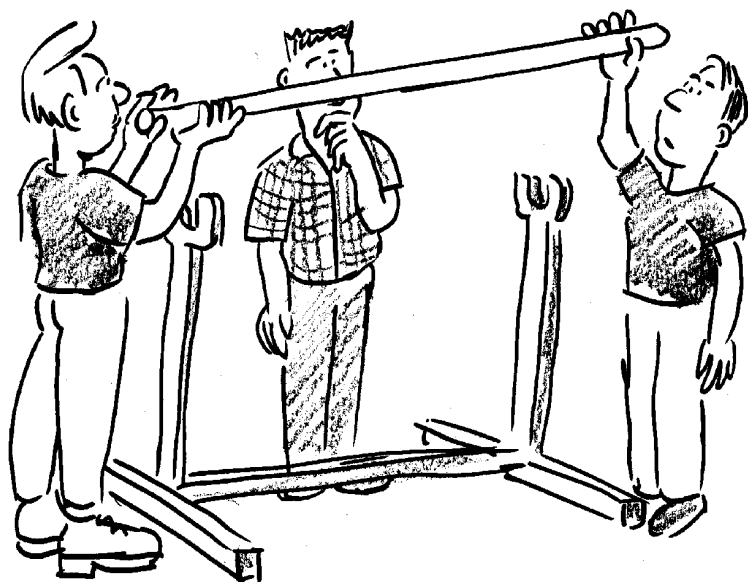
In order to solve problems on the job, we need all the help we can get from fellow workers. But not everyone will make the same commitment.

- The individual worker who cannot commit him or herself in a big way, may be willing to help out in some small task.
- A work group that has no experience sticking together to affect improvements in the health and safety of the facility may not be ready to tackle a major issue with dramatic action. But they may be willing to work together in a smaller way to solve a safety concern that bothers all of them.

The point is that there are many **levels of activity** and there are many different ways for people to participate in solving problems around the facility.

The job of a health and safety committee is to find the tasks and activities suited to the present situation and to increase the level of activity as the work group's experience, knowledge and commitment grows.

Start with issues and goals that the work group feels comfortable with.



7. Health and Safety Problem Solving

Step 1. Small group discussions.

There is no substitute for getting people together either at lunch, at someone's home, or at a special meeting to have a free and open discussion about the health and safety problems we face.

It is very important to get everyone's ideas out and to get everyone involved in giving the health and safety committee direction.

Step 2. Selecting a problem to face first.

You can't solve everything at once. The committee needs to pick one or two problems to concentrate on. Two key points are to:

- pick a problem the membership is concerned about, and
- start small or with an issue you can solve.

Deal with the membership's concerns, not your own or others' agenda.

Step 3. Developing a plan of action.

This can be simple or more complicated. Sometimes just bringing a safety matter to management's attention will do the trick. For some issues the committee will have to relay the members' concern, document the problem, show how it can be solved, and bring in experts to back up the committee's recommendations to resolve the concern.

Once in awhile, the committee will need to use legal routes to alleviate health and safety concerns (this should be a last resort).

Here it's important to keep the membership informed and to involve as many people as possible. Don't be afraid to share responsibility.

Step 4. Evaluating your activity on a regular basis.

A health and safety committee will only learn by doing and then discussing what worked, what didn't work and why.

8. Tips on Small Group Meetings at Work

- Choose a comfortable, convenient social setting – lunch time, after work, etc.
- Let people know why you want to meet. Let them know you need their input. Remind them of the time and place.
- Have an agenda – a plan for your meeting. This can be a simple note to yourself jotted down on paper.
- Organize the meeting so that there is "give and take" – two-way communication. You may have information to share, but make sure part of the meeting is to get feedback from the members.
- When starting the meeting, explain what the meeting is about, briefly and clearly.
- Make sure everybody knows everybody. Don't assume that they do. Go around and have everyone introduce themselves, where they work, and something about the health or safety issue you want to discuss.
- Make sure the discussion moves around and includes everyone. Ask each person what they think about the issue.
- When the meeting is over, sum up and review the main points. Agree on what follow-up plans are needed and how they will be carried out.

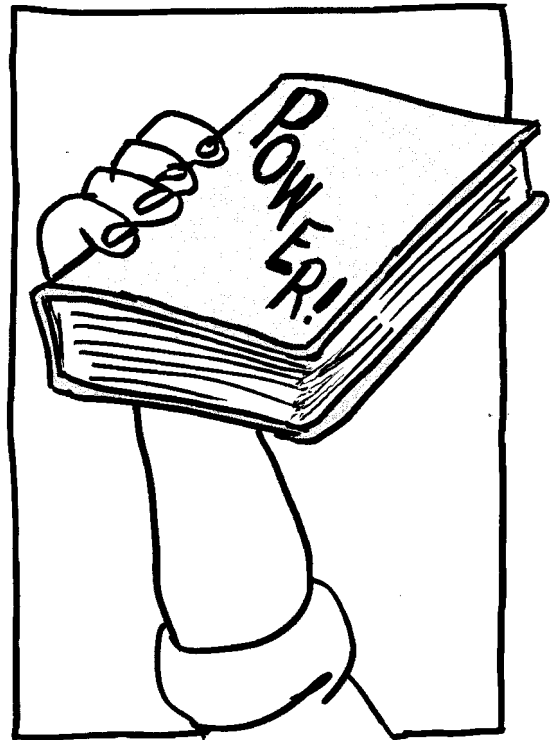


9. Information Is Power

Health and safety committees need to be informed to be able to function. Knowledge of the laws, health effects, and consensus standards relating to exposure, chemicals or compounds, and health and safety (for example, the American National Standards Institute (ANSI) or American Conference of Governmental Industrial Hygienists (ACGIH)), will give credibility to the committee. Often this involves having access to resources to help in finding and interpreting the information.

Listed below are some examples of information resources.

- Alice Hamilton Library (OCAW Headquarters)
- International Union's Health and Safety Department
- COSH groups (see Appendix for list of COSH groups)
- Poison Centers
- National Institute of Occupational Safety and Health (NIOSH: 1-800-35NIOSH)
- OSHA (see phone book for your area office or refer to Appendix for list of OSHA Area Offices)
- Company work rules and policies, such as those regarding confined space entry, etc.
- OSHA's General Industry Standards
- Local universities with a public health department



Know your collective bargaining agreement, and laws governing them, and keep your own notes at all meetings.

10. Health and Safety Committee Activities

There is no set list of activities for a good health and safety committee. A really effective committee will be limited only by its imagination and energy, and will most likely come up with activities not listed in this manual. In this section, we'll discuss briefly some activities that can be part of a committee's "active" approach to health and safety problems.

1. Get information from the workers.

The surest way to involve the whole local, and to earn their respect, is to ask their help. Let them tell you what the health and safety problems are. This can be done quite easily with a simple survey form, and it gives the committee plenty of information.

2. Communicate and educate.

In order to get good results from a health and safety program, the committee needs to have the support of the people working in the facility. This requires communication and education.

All workers should be educated about the hazards of the job they work on. More than that, the committee should establish a continuous education program to inform everyone about workplace hazards.

Communication is essential if the committee wants all workers to think about health and safety and to be aware that the committee is doing its job. Some ways to communicate about health and safety items are:

- Reports at union meetings
- Leaflets or bulletins passed out to all workers
- Posters on the bulletin board
- Classes conducted by outside health and safety experts, open to all workers
- A health and safety newsletter, or article in the union's newsletter

3. Keep lists of hazardous substances.

Every union has the right to a list of all hazardous substances at use in the workplace. Make sure the committee has a list that is regularly updated, and that all information about the dangers of the substances are known to the committee, as well as the workers.

A good activity for committee meetings might be to set aside some time each month to go over two or three hazardous substances in detail, and discuss ways to limit the exposure to these substances.

4. Review new machines and work procedures, and propose changes.

The committee should review new machinery to insure it's properly guarded, isn't excessively noisy, and meets accepted standards. Sometimes these reviews can spot hazardous conditions before the machinery goes into operation, and thus prevent injuries.

Any good committee will be constantly proposing changes in work procedures, based on workers' complaints, or new information received, or, unfortunately, after an injury has already occurred. These changes may be anything: a request for a new roof on a loading dock, the removal of a dangerous solvent, the installation of better ventilation, etc. When these changes require the company to spend money, there's usually reluctance to make the change.

But if the committee has done its homework (educated the members, listed the benefits of the change, listed the dangers of the present conditions), its chances for success are increased.

5. Keep records.

The committee will need facts to make changes. It's crucial that the committee have data about workers' injuries and illnesses. Many times, a series of illnesses will be the only clue that there is a health hazard present.

continued

10. *(continued)*

Records should also be kept of noise monitoring, so noisy areas can be pinpointed and dealt with. If the company monitors for hazardous substances, the committee should get and discuss these results.

The committee does not want to get bogged down in accident numbers and government reporting forms. But a smart committee will understand that it needs information in order to get a clear picture of the health and safety situation in the facility.

6. Keep posted on legal issues.

Every committee should have one or two persons designated as its "legal experts."

Laws dealing with occupational safety and health are constantly changing and many times state laws differ from federal laws. When new laws are passed, such as the "Right To Know" law, the committee should discuss how it will be implemented.

When the government changes its rules on certain substances, like banning the use of carbon tetrachloride, or changing the noise standard, the committee should discuss how these changes will be implemented in the workplace.

7. Maintain a library or resource center.

Since information is so crucial to making changes, a good committee will build up a library of books, films, pamphlets, etc. that it can use.

These can be used as a reference to seek information about hazardous substances, or as an education tool to get information to the workers involved.

The PACE health and safety department can help a local build a library by suggesting titles and good publications. Just ask for our help.

8. Investigate accidents.

Obviously, changes should be made *before* an accident happens, but a thorough investigation after the fact can at least determine the cause of an accident and prevent it from happening again.

9. Conduct inspections.

This might be done on a departmental basis, or on a facility-wide basis. For the inspections to be worthwhile, they should be complete, should involve both union and company committee members, and questions should be asked of the workers in the areas being inspected.

As you can see, there's really no limit to the topics a good committee can tackle.

Summary: Health and Safety Committee

Organization

1. A health and safety committee needs to be rooted on the shop floor. There needs to be a series of **safety stewards** to feed information to the union members on the joint committee. The system needs to be broad enough to be representative of your facility. Each facility is different, and you need to custom craft your organization.
2. There needs to be a window of communication with management. This is the joint labor-management committee.

3. Local unions need to invest in the health and safety committees – for example, through seminars, classes and company-paid lost-time.

Functions

4. It is important to choose a realistic issue as the "foot in the door" to build more effective committees.
5. Information is power. You get this information from the membership, the International Union, company safety professionals, company policies, etc.
6. If there are minutes, there needs to be a mechanism to have input into how the minutes are developed, what is in them, and their distribution.
7. Try to solve problems at the lowest possible level through the safety stewards, just as you would grievances. If they cannot be solved there, they go to the joint committee.

Road Map for Health and Safety Committees

8. Reach out to the membership.
9. Develop a list of health and safety concerns.
10. Select priorities that reflect the membership's concerns.
11. Deal with priority items first.
12. Make smaller, easier changes first.
13. Build toward larger and more comprehensive changes.

Activity 14: Evaluating Emergency Response Plans

Purpose

To understand the basic elements of an effective emergency response program and apply them to your facility. This activity has three tasks.



Task 1 – Part A

Any one of us could very well be the first to spot a potential emergency at our facility. Clearly, we all must know what to do to protect ourselves and our co-workers in times of emergency.

On the next page is a list of eight procedures (listed alphabetically) that are typical actions or procedures to take when there is an emergency.

These eight procedures are summarized on a **set of eight cards** that your trainer will pass out to your small group. The cards list the actions that you would take as the first person who identifies that an emergency situation exists.

On the following pages are three emergency scenarios. Your trainer will assign one to your group. Please read over the scenario. Then arrange the cards in the order of the steps you would take to respond to the emergency: what would you do first, second, third, etc.

To replicate some of the confusion of an emergency situation, your group will only have **one minute** to arrange the cards.

Task 1 – Part B

Now, review the factsheets on pages 427 through 433 and see if you change your mind.

Eight Emergency Response Actions (listed alphabetically)

ALERT . . .

others nearby. Tell a nearby co-worker or anyone else nearby that there's a problem; get help.

CONTROL . . .

the hazard. Control or contain any spill or leak of hazardous material that is part of the incident.

CRITIQUE . . .

the responses to determine how to improve procedures for the next time.

DECONTAMINATE . . .

the injured. Wash or rinse the contamination off the injured person.

EVACUATE . . .

Make sure all unnecessary and uninvolved personnel are cleared from the problem area.

NOTIFY . . .

government agencies (Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Department of Transportation (DOT), state offices of emergency services, etc.). Make a phone call to the appropriate government agency to let them know an incident has occurred.

RESCUE . . .

the injured. If safe to do so, get qualified rescue people in there and get the downed person out (so they can be medically attended to).

SIZE UP . . .

the situation. Take time to think through the situation as you see it and decide on what you will do.

Scenario 1

At OilChem Company, an operator was making his 2 a.m. rounds, checking the unit for any problems that could not be detected by the operators in the control room.

He noticed that a pressure relief valve on one of the 1,800-pound reactors was relieving to the flare. A check of the gauges revealed the reactor to be grossly over pressured, indicating the reactor was in a very serious condition.

He tried to contact the control room on his radio. No one answered. Then he tried the unit telephone, but there was still no answer, so he hurried to the control room.

When he reached the entrance, he noticed a hydrogen sulfide (H₂S) odor. He looked through the window and saw all the operators, including the shift foreman, on the control room floor.

All of the unit emergency alarms are inside the control room. The unit has many hazardous hydrocarbons and chemicals including chlorine and H₂S.

What should he do?

As a group, please arrange the cards in order of the first step he should take, the second step, and so on.

Scenario 2

A one-ton cylinder of chlorine located near the cooling tower of OilChem Company has become overheated, causing a fusible plug to release the contents.

A yellow-green vapor cloud has drifted over the hazardous waste unit and is moving toward other units.

One worker is down in the area of the cloud. You are the first person to discover this situation.

What should you do?

As a group, please arrange the cards in order of the first step you should take, the second step, and so on.

Scenario 3

You are working in a remote area of the plant to clean up an old drum storage area. You are using a fork lift to move the drums.

You are dressed in personal protective equipment: a full-face air-purifying respirator with HEPA/OV (high efficiency particulate air/organic vapor) cartridges, work coveralls, boots and gloves.

Your co-worker, Bill, is on the ground in front of you moving drums out of a six-foot deep trench to an adjacent area where you can pick them up, using the forklift. Bill is wearing a splash suit with an airline respirator.

Suddenly you notice a drum falling back into the trench, knocking Bill out cold. The drum hits the ground and ruptures and a dark liquid begins pouring out.

What should you do?

As a group, please arrange the cards in order of the first step you should take, the second step, and so on.

1. The Types of Emergencies at Oil and Chemical Facilities

Fires and explosions are probably our top concerns because they have the potential to escalate rapidly from small to extremely large and serious emergencies. That's why firefighters and e-squad members are so important.

But our facilities must also be prepared for other kinds of emergencies. The facility's emergency action plan should have detailed response procedures for all emergencies that the employer may reasonably expect in the workplace. Often two or more factors come together to create an emergency situation. For example, a leak of a highly flammable vapor may ignite and cause a fire and explosion.

Below is a partial list of emergencies based on workers' experiences. Feel free to use your own experience to add to it. You can then use it as a checklist to evaluate the completeness of your facility's plan.

Fires, spills, explosions reaction of incompatible materials	Personal exposure chemical radiation
Releases toxic vapors radioactive materials	Personal injury physical injury heat stress heart attack
Equipment failures pressurized vessels alarms monitors PPE	Extreme weather heavy rain lightning extreme heat or cold
Power failure loss of plant utility	Natural disasters earthquakes, floods, hurricanes, tornadoes

Warning: This training does not qualify you for any level of emergency response activity. To be qualified to respond to an emergency, you are required to complete a specified amount of highly specialized training.

2. Emergency Response Planning: What's Required?

All employers must develop and implement emergency response plans at workplaces where there is the potential for a hazardous chemical release or major emergency. (This includes all contractors and subcontractors.)

Virtually every PACE-represented facility must have a plan. Facilities with special permits from EPA (such as a permit to treat, store, or dispose of hazardous waste or to clean up old waste areas) require additional emergency response planning.

The new OSHA Hazardous Waste Operations and Emergency Response Standard requires employers to develop and implement an emergency response plan which:

- Includes a written plan, covering specific procedures listed on the next few pages;
- Must be available for inspection and copying by all employees;
- Must be **rehearsed regularly** as a part of the overall training program for site operations;
- Must be compatible with and part of the local or regional government's emergency response plan (as required by state and federal EPA community emergency response planning laws);
- Must include an alarm system at the site to notify employees of emergency situations; and which
- Must be reviewed and updated to include new information.

For more information, see OSHA Standard 1910.120(q) and 1910.38. If you work in a RCRA treatment, storage or disposal (TSD) area, see 1910.120(p)(8).

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3. Alert, Think, Then Act: Emergency Response Procedures

All of the eight steps listed in Task 1 do not always apply in every emergency situation. However, when the situation involves an injured person, **the following five procedures always apply**, and should be done in the following order:

1. Alert others nearby.

This is always the first action to take. Notify others that an emergency is taking place so that on-site and off-site help can be called immediately.



2. Size up the situation.

Before you make any move, think first – **do not become a casualty yourself**. Consider your options: evacuation, rescue, hazard control, etc.

3. Rescue the injured.

Your first priority is to **protect your health and safety; then assist or obtain assistance for the injured**. In almost all situations you will need the help of others, specialized equipment, and proper personal protective equipment before any rescue can be attempted.



continued

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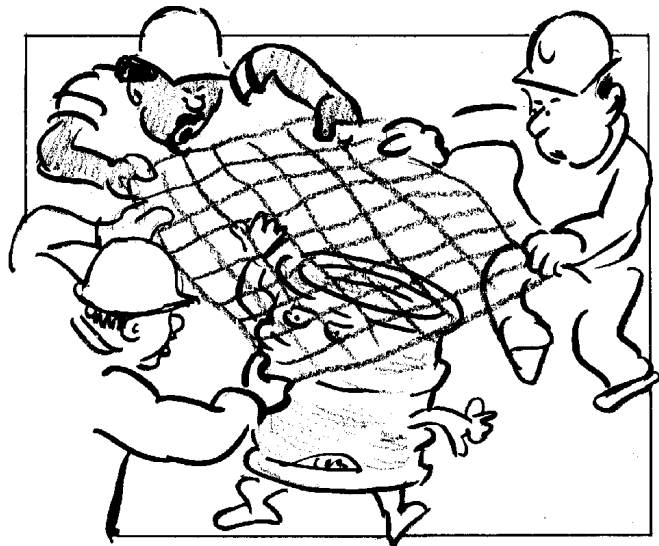
3. *(continued)*

Decontamination of the person is a case-specific decision depending on how toxic the chemical is and how life-threatening the situation is.

Whenever handling an injured and contaminated person, be sure that emergency medical, ambulance and hospital personnel are kept informed. Some states and communities have laws or policies prohibiting transportation of a contaminated person who has not been decontaminated.

4. **Control the hazard.**

The next priority is to contain or control the hazard. In most cases, this **should be done by the emergency response team** because they have the training, experience and equipment to do the job safely. Prompt equipment shutdown or isolation are steps trained personnel may take to minimize the hazards.



Protecting life and the environment is a higher priority than saving the facility.

5. **As a follow-up, critique your response.**

After an incident, always critique the responses to identify ways to improve response procedures for the next time. This should include the need for more training, drills, equipment or modification of the emergency response plan.

Finally, companies are required to notify government agencies immediately following a significant chemical release.

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4. Setting Priorities: Life Comes First

Getting Our Priorities Straight

Emergency responders should act to protect:

1. Human Life and Safety,
2. Environment,
3. Equipment,
4. Property.

Life Comes First

The first priority of responders is to **protect human life and rescue the injured where possible.**

Sounds easy, right? Unfortunately, it's not easy to live by this simple rule during an emergency because of the following:



continued

Warning: This training does not qualify you for any level of emergency response activity. To be qualified to respond to an emergency, you are required to complete a specified amount of highly specialized training.

4. *(continued)*

1. **Companies train us incorrectly.**

Many companies train their employees that their first priority during an emergency is to protect the plant equipment, resulting in our members being injured or killed.

- At the Union Oil refinery in Lemont, Illinois, where a 1984 fire killed 17 workers, all operators were instructed to remain at their posts in case of a fire until a fire crew arrived.
- Thirteen firefighters from Kingman, Arizona were killed when a railcar in a remote rural area exploded; they needlessly risked their lives – to save a railcar!

2. **We try a rescue when we shouldn't.**

Our human nature is such that we can't stand to watch a fellow worker go down and not jump in and try a rescue. Unfortunately, in our dangerous chemical facilities this instinct will almost always kill us.

- According to a NIOSH study of confined spaces fatalities, over 60 percent of all fatalities were **would-be rescuers becoming casualties because they jumped in to rescue a co-worker.**

It's hard, but we need to learn to think before we jump in. Sometimes "protecting life first" means your own. This is done by isolating the area and **keeping everyone out until people with proper training and protective equipment arrive.**

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Protecting the Environment

Sometimes emergency response actions taken to contain a spill or fire can result in widespread environmental contamination.

- In November 1987, firefighters sprayed water on a pesticide warehouse fire in Basel, Switzerland. The contaminated water ran into the nearby Rhine River, contaminating a major drinking water source to four nations.

When dealing with hazardous substances, **minimizing the contamination and adverse effects to the environment** – air emissions, leaks to bodies of water, leaks into flood control or sewer lines – **is a higher priority than putting out a fire to save a facility.**

Protecting Equipment and Property

Only when life and the environment are protected, should we move to protect equipment, buildings and structures.

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Task 2

Our facilities by law **must** have a comprehensive program to deal with all of the different potential emergencies that could occur:

- fires,
- explosions,
- spills,
- vapor releases,
- chemical overexposure or medical emergencies, and
- "acts of nature" (earthquakes, floods, hurricanes, etc.).

By using the questionnaire on the following pages, we can evaluate our companies' emergency response plans and procedures. The questionnaire is based on OSHA requirements and what officials have identified as the most important elements of an effective emergency response program.

As a group, please complete the questionnaire on pages 435 through 437.

Emergency Response Questionnaire

1. Have you ever seen your facility's emergency response plan?
 - ☐ Yes.
 - ☐ No.
2. Has the company explained the written plan in detail to you?
 - ☐ The company has explained the plan in detail to everyone, including me.
 - ☐ The company has gone over the plan with a few bargaining unit members.
 - ☐ The company has never gone over the written plan with us.
3. Does your facility have an emergency response Hazmat team?
 - ☐ Yes.
 - ☐ No.
 - ☐ Not sure.
4. Does your facility have awareness level training?
 - ☐ Yes.
 - ☐ No.
 - ☐ Not sure.
5. Does your facility have operations level trained personnel?
 - ☐ Yes.
 - ☐ No.
 - ☐ Not sure.
6. Do you feel that the Hazmat team is carefully trained?
 - ☐ Our team is carefully trained again and again.
 - ☐ Our team is trained, but they could stand a lot more training.
 - ☐ Our team is untrained.
 - ☐ Not sure.

continued

Questionnaire *(continued)*

7. Does your facility have: (check all that apply)

- ☐ Table top drills.
- ☐ Announced drills.
- ☐ Unannounced drills.

8. Does your facility have good communication links to the response team, complete with backup communication systems?

- ☐ We have an excellent communications system and procedure.
- ☐ Our communications system is ok but not great.
- ☐ Our communications system is poor.
- ☐ Not sure.

9. What is the alarm system in your facility? Please explain the number of different alarms and how they sound.

10. Do you believe the workers in your facility are really aware of what the chemicals could do to them in an emergency situation?

- ☐ Very aware.
- ☐ Somewhat aware.
- ☐ Not too aware.
- ☐ Don't know.

11. Do workers know the basics – such as how to use the alarm system and which way to go or run, depending on the wind and the plant layout, in case of emergency?

- ☐ We all know.
- ☐ Some of us know.
- ☐ Few of us know.
- ☐ Can't tell you for certain.

12. Could the following type of problem occur during an emergency in your facility?

"One part of the plan called for team members to use absorbent material stored on a dedicated electric-powered cart. But the night shift had been using the cart, without permission, to transfer materials from one building to another and had not been diligent about recharging the battery. When the emergency team member arrived at the cart to drive it to the spill, the battery was dead." ("Responding Properly to Hazardous Waste Spills," *Chemical Engineering*, January 1988.)

- ☐ Something like that could definitely happen in our facility.
- ☐ Something like that might happen in our facility.
- ☐ No way could that happen to us.

13. After each spill or release does the company carefully investigate each situation and make changes in the procedure or the emergency response?

- ☐ Yes, they investigate and make changes to prevent the spill.
- ☐ Yes, they investigate but don't make many changes.
- ☐ They don't even investigate.

14. Does the Health and Safety Committee have the right to investigate?

- ☐ Yes.
- ☐ No.
- ☐ Not sure.

Task 3

As a group, use your questionnaires and the factsheets on pages 439 through 444 to make a list of the most common problems we face when it comes to emergency response.

If you were asked to make three major recommendations to improve your facility's emergency response plan, what would they be?

5. Checking the Written Plan

If you are a member of the joint health and safety committee, the emergency response team or the fire brigade team, you have a special interest in reviewing the facility's emergency response plan to make sure that it is complete and accurately reflects reality. If implemented as written, will it work? Will it protect the workforce? Is the company taking all the necessary steps to prevent emergencies?

Employers must prepare a written emergency response plan which includes:

- Pre-emergency planning and coordination with outside agencies;
- Job descriptions, lines of authority, and communication methods for those people responsible for emergency response;
- How to recognize and prevent emergencies;
- Procedures for alerting all workers in an emergency;
- Evacuation routes and procedures, including procedures to account for everyone after an emergency evacuation is complete;
- Safe distances and places of refuge;
- Methods for providing emergency medical treatment and first aid;
- Decontamination procedures;
- Site security and control;
- Personal protective equipment and emergency equipment;
- Evaluation and follow-up for response actions;
- Site topography, layout and prevailing weather conditions; and
- Procedures for reporting incidents to local, state, and federal agencies.

Warning: This training does not qualify you for any level of emergency response activity. To be qualified to respond to an emergency, you are required to complete a specified amount of highly specialized training.

6. What Should the Training Cover?

OSHA requires emergency training for everyone in the facility. People or teams with special emergency response duties must receive additional training. The training should cover the topics listed below, and be site-specific. Only those with special training, such as members of the emergency response or "Hazmat" team should attempt to control or stop a hazardous spill or release.

All site workers ("non-responders") should have enough training to:

- Recognize that an emergency exists.
- Understand communications and alarm systems and instructions on how to call in the emergency response team.
- Understand their role in an emergency: what to do, what not to do. (Do not attempt to control emergency situations for which you are not trained.)
- Understand evacuation procedures and routes, depending on the type of emergency.
- Understand operation shutdown procedures.
- Have practice drills using the emergency response team.

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Members of the emergency response team should have the training to:

- Know the contents of the emergency response plan.
- Know the standard operating procedures (SOPs) the employer has established for the job.
- Know the selection and use of personal protective equipment to be worn.
- Know the procedures for handling all potential kinds of emergency incidents.
- Know how to recognize health and safety hazards and implement methods to minimize hazards.
- Know how to coordinate with other employees to minimize risks.
- Know the appropriate response to overexposure from health hazards or injury to yourself or others.
- Know how to recognize symptoms of overexposure.

Members of the emergency response team should also receive annual training, with your employer determining that you have been trained to a "level of competency," as defined by the employer in writing (subject to OSHA review).

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7. Spill Prevention, Control and Countermeasures

Everyone needs to be involved every day to prevent spills and releases. This may involve noticing that the operations are not running "right." It also means that a good, solid preventive maintenance program is adhered to. As the old saying goes, an ounce of prevention is better than a pound of cure.

Even the best-run technological facilities have unintended interactions that may lead to unwanted spills and releases. What is your responsibility in these situations?



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Five Types of Responders

First Responder, Awareness Level. These individuals are likely to witness or discover a spill or release. Their responsibility is to notify or initiate the emergency response plan. They must receive awareness training annually.

First Responder, Operations Level. These individuals are the initial responders who act in a defensive fashion without actually trying to stop the leak. Their function is to attempt to contain a release from a "safe distance," keep it from spreading and prevent exposures. They need at least eight hours of training to be operations level responders.

Hazardous Materials Technician. These individuals respond to a release to "stop the release." They must have a minimum of 24 hours of training before they can attempt to stop a release.

Hazardous Materials Specialist. These individuals provide support to the hazardous materials technicians. This includes a more specific knowledge of various substances that may be released. They also act as the site liaison. They must have 24 hours of training equal to the Hazardous Materials Technician.

On-Scene Incident Commander. These individuals, also known as plant emergency directors, assume control of the incident scene and manage emergency response and recovery activities. Incident command training includes at least 24 hours of training and demonstrated competency.

Most workers fall into the First Responder Awareness Level and First Responder Operations Level categories. The emergency response plan should tell you exactly what type of responder you are.

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8. More on Training

How good is your training?

Since a quick, informed response is essential when there is an emergency, it is important that people receive training that:

- Is related directly to site-specific, anticipated situations;
- Is brief and repeated often;
- Is realistic and practical;
- Provides an opportunity for special skills to be practiced regularly;
- Features drills frequently (for example, site-specific mock rescue operations);
- Makes sure that training records are maintained.

When should training be done?

The emergency response training program should be provided:

- When the Emergency Response Plan is first developed;
- For all new employees;
- Whenever new processes, equipment or materials are brought in;
- When practice drills show that worker performance needs improving;
- At least annually.

Source: U.S. Department of Health and Human Services, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, OSHA/NIOSH/EPA/USCG, 1985.

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Summary: Emergency Response Plans

1. The priorities to follow during an emergency should always be in the following order:

- Life (minimize death, injury, disability)
- Environment (protect and minimize the impact of a release)
- Equipment and Property.

Don't risk your life or the lives of others (who may then have to attempt to rescue you) to save equipment or property.

We need to know the limits of our role. **Our first priority is to protect ourselves and others from being injured.** If we don't have thorough training and the right equipment, **we shouldn't try to be heros.** Instead, we need to **call in the emergency response team.**

2. Employers **must** develop and implement emergency response plans, clearly describing response procedures for different types of emergencies and the various roles and responsibilities of different people or teams in the facility.

All workers must be informed about the plan – how it works, what their role is in an emergency, such as how to recognize an emergency situation, communication and alarm systems, how to notify and call in the emergency response team, emergency shutdown procedures, head count procedures, etc. It must include procedures to account for everyone after emergency evacuation is completed.

3. Union members have the right to read and inspect the plan. The union members and the joint health and safety committee should review the plan to make sure it will effectively protect the members if there is an emergency, and that the company is taking the necessary steps to prevent emergencies. **We should also be involved in post-emergency investigation and evaluation so any problems are corrected.**

continued

Summary *(continued)*

4. Members of the emergency response team **must receive special annual training, with practice or simulated drills.** The right personal protective equipment must be available (SCBAs, chemical protective clothing, etc.) so we can wear the right PPE for the particular chemical exposure.

5. The emergency response plan at our facilities must be compatible with our local community emergency response plan. We can participate in local emergency response planning committees to make sure local fire, professional "Hazmat" teams and emergency medical services agencies **have the information needed** to plan and prepare for emergencies at our facility. Practice drills should involve these community "mutual aid" agencies.

Activity 15: Relating to the Community

Purpose

To develop a basic strategy and approach for relating to the community on the issues of toxic waste.



Task 1

To sharpen our skills, we would like for you to put yourselves in the position of the union executive board at OilChem. An accident has occurred which caused a plume of hydrogen fluoride to pass through the community, forcing 4,000 residents to evacuate. They are very concerned and have called a town meeting which will include various national environmental types who have come to town to help mobilize support for tougher controls on OilChem. The community group has asked a representative from the union local to come speak to the meeting and address the press. At least one member of the executive board is extremely concerned about how the union should relate to the community. He makes the following statement. Your group task is to evaluate this statement and make a recommendation to the union.

Statement

"Brothers and sisters, we are in a mess. Many of you believe we should be allies with the environmentalists. I believe that will be a disaster.

"Outside trouble-makers will stir up things, and the press will publish every word. I say we shouldn't get involved. What we say may be used against us and our company.

"All we should say is, 'Our company is always trying to prevent accidents.' We must remind people how much OilChem means to our community's economy and that our jobs depend on this company. We won't allow outsiders to shut them down.

"We need to tell the media to look at all the plants around the area and not just pick on us. We have a lot to lose and the members will be angry if we knock the company that feeds them."

1. What do you think is right with this statement?
2. What do you think is wrong with this statement?
3. How would you recommend that the union handle this situation?

Task 2

You have been invited to attend the community meeting. In your groups, prepare a no more than five-minute talk to give to that meeting. Select one member of your group to give the presentation to the workshop as a whole.

Task 3 (*where applicable*)

From time to time, we may have with us representatives from some of the leading environmental groups in the area. To increase our understanding of these groups we will have them rotate from table to table so that you can interview them and find out if and how locals in your area can work with these groups. In doing so, we hope you will be able to establish the kinds of contacts and obtain the kinds of information that could help you prevent toxic waste problems in your areas.

On the next few pages is a questionnaire you can use to help you record information about each environmental group you talk to. This information is for you to keep, so that you'll be able to recall how this group could be most helpful to you in your area.

continued

Task 3 *(continued)*

Environmental Group Survey

1. Name of person interviewed:

2. Organization:

3. Address:

4. Telephone:

5. When was it founded?

6. How many staff members does it have?

7. What are its primary goals?

8. What are its major projects?

9. How are the organization's policies decided?

10. How is the organization funded?

11. What are its major successes?

12. What are its major failures?

13. Have they ever worked with PACE locals, or other locals of toxic workers, in the past? On what projects? How did it go?

14. Have they ever been involved in a worker/environmental struggle where the workers were worried about losing their jobs? If so, how did they deal with the jobs issue?

15. Would they like to work directly with PACE locals? On what issues? In what ways?

continued

Task 3 *(continued)*

16. What basic resources or skills do they have that could be of use to PACE locals in your area?

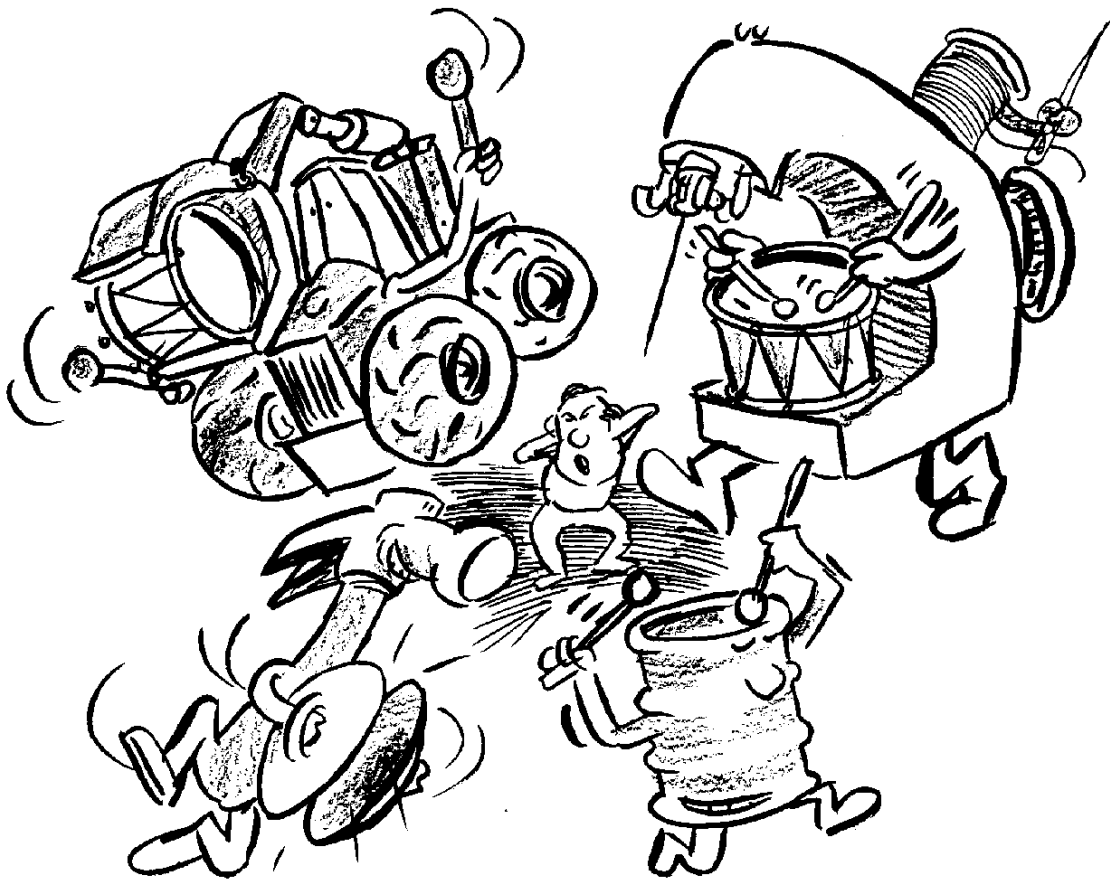
17. What groups or individuals would they recommend you work with in your area?

18. Evaluation: Is this the kind of organization you think the union should or shouldn't work with? Please explain your reasons.

Activity 16: The Hazards of Noise Exposure

Purpose

To raise our awareness of the negative effects of noise, the OSHA Noise Standard (1910.95) and its limitations, and other solutions to the problem. This activity has two tasks.



Task 1

Assume your group has been asked by the union health and safety committee at OilChem to respond to a worker who made the following statement. In doing so, please review the factsheets on pages 457 through 466. Try to refer to at least one factsheet in making your response.

Statement

"I know a lot of people are worried about the noise around here, but I just don't see what all the fuss is about. Sure my ears ring a little after work, but after a couple of hours I'm fine. I hate to say it, but we have a lot of complainers around here. Lots of people are uptight and need to learn how to modify their lifestyle to relax. Anyway, many of us have bigger problems to worry about. My doctor is more worried about my tendency for high blood pressure than he is about my ears."

1. How would you respond?

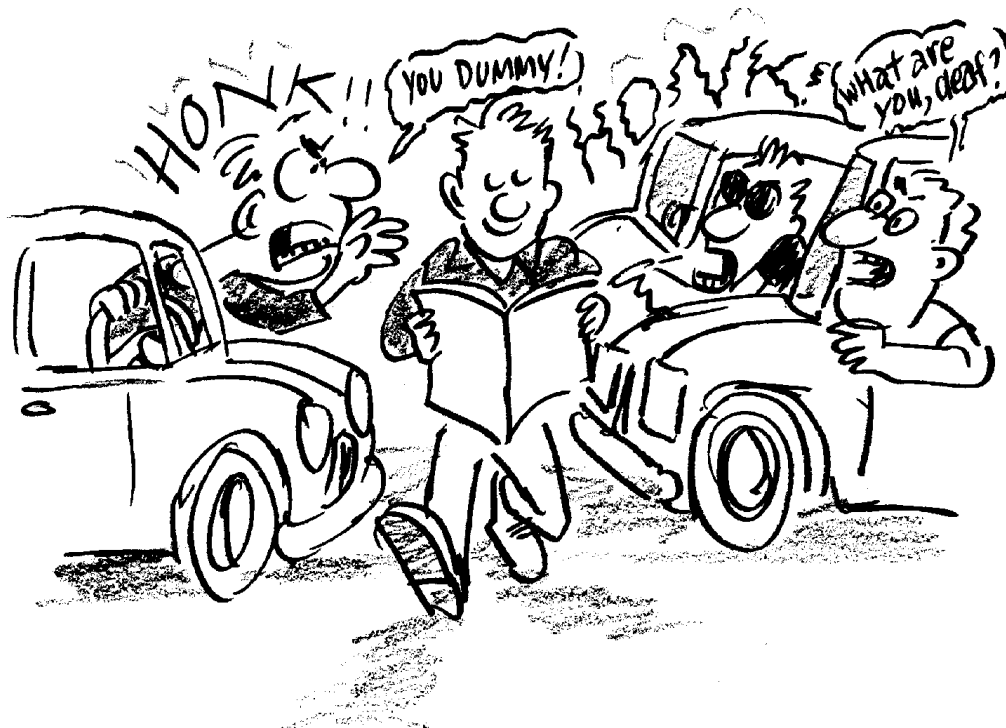
1. How To Tell If There Is a Noise Problem at Work

Some common indications of overexposure to noise at work are:

- Difficulty hearing normal speech in the work area.
- The need to shout to make ourselves heard more than an arm's length away.
- Ringing in the ears after leaving the work area.
- After leaving work, dulled or muffled hearing that disappears after 14 hours. (It's hard to hear normal conversation, TV, radio, etc.)
- Headaches, dizziness or other health conditions related to stress (for example, high blood pressure, fatigue, etc.).
- Co-workers who are hard of hearing.

If you suspect that there is a noise problem, demand that management conduct a noise survey. It's your legal right.

Sources: Labor Occupational Health Program, University of California at Berkeley, *Noise... A Hazard, Not Just a Nuisance*, Berkeley: University of California, 1990; and *Federal Register*, 46 FR 4078, January 16, 1981.



2. Early Warning Signs of Hearing Loss

First Warning

The first warning sign of hearing loss is often the inability to hear high frequency sounds. The loss usually appears first and most severely around 4,000 Hz, the approximate frequency of a birdsong or a voice on the telephone.

Damage Spreads

Continued exposure to excessive noise causes the damage to spread to the frequency range between 500 Hz and 6,000 Hz, causing loss of sensitivity.

Damage in the high frequency area results in a person having difficulties in the perception of speech. Most of the sound energy of speech is in the vowel sounds (which are low frequency sounds), but consonants (which are high frequency sounds) help make speech understandable. A sound like the letter "s" will not be heard, but a low frequency sound like the letter "o" will be heard. The more damage that occurs in the high range, the less able a person will be to hear the consonant sounds in speech.

At first, there is trouble hearing plurals. Words may sound like grunts, and distinguishing between simple words like fifteen and sixteen may prove difficult. Finally, you won't be able to understand what people are saying even though you can hear that they are talking.

Other Signs

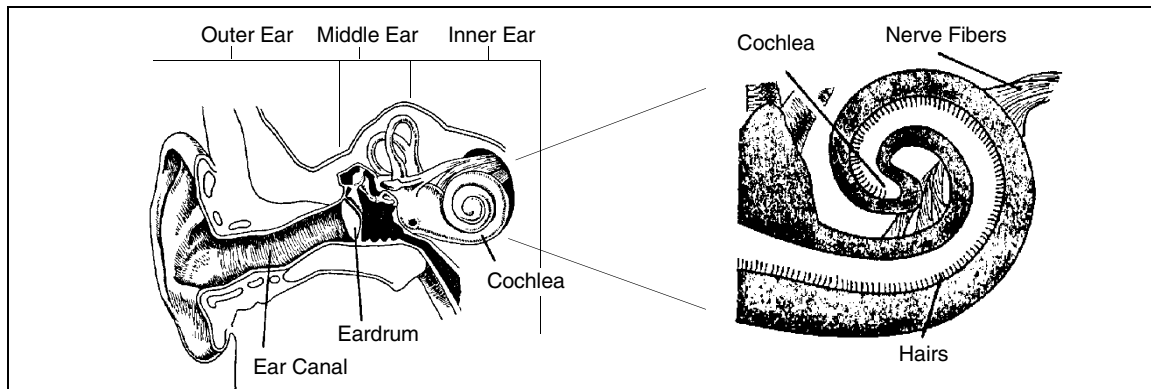
- Failure to catch words or phrases.
- Shouting or raising the voice without realizing it.
- Ringing in the ears known as tinnitus.

Sources: United Auto Workers, *Noise Control*, Detroit: UAW, 1978; Coastal Video Communications Corporation, *Hearing Protection: A Sound Practice*, Virginia Beach: CVC, 1992; *Federal Register*, 46 FR 4078, January 16, 1981; State of California, Department of Industrial Relations, *Noise Control*, CAL/OSHA Communications, June 1985.

3. Noise Damages the Ear and Hearing

Exposure to excessive noise can damage the ear and destroy the ability to hear.

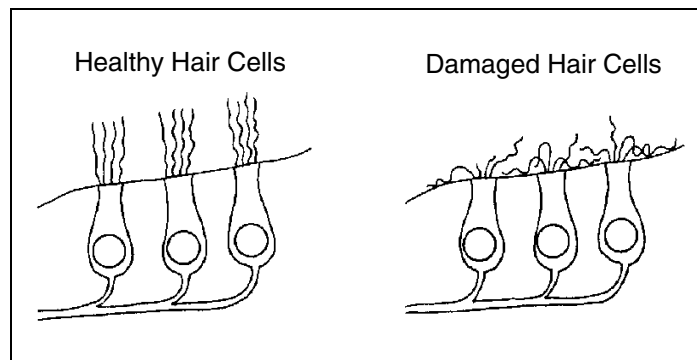
When sound vibrations hit the outer ear, the eardrum itself begins to vibrate. A series of bones transmit the vibrations to an organ in the inner ear called the cochlea. The cochlea has thousands of tiny hair cells which change the vibrations into nerve impulses which are sent to the brain and the rest of the body.



Too much noise will wear out the hair cells. Photographs taken through an electron microscope show the hair cells broken, bent out of shape, and completely missing as a result of noise.

If the exposure to excessive noise is stopped in time, the hair cells can bounce back.

If there is continual exposure to excessive noise, the hair cells will be permanently damaged. The result is loss of hearing.



Source: U.S. Department of Labor, *Noise Control; A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980; United Auto Workers, *Noise Control*, Detroit: UAW, 1978; and Coastal Video Communications Corporation, *Hearing Protection: A Sound Practice*, Virginia Beach: CVC, 1992.

4. Noise-Induced Stress

Fight or Flight

Fight-or-flight is a particular reaction to frightening or stressful circumstances. A good example is a close brush with a life-threatening accident. One response we all have is the fight-or-flight reaction. The human body reacts to such a threat by preparing either to flee or to fight in the following ways.

- Adrenalin and other hormones are released,
- Blood pressure rises,
- Heart rate increases, and
- Muscles constrict throughout the body.

Once the danger passes, and if we are still alive and well, the body goes back to normal.

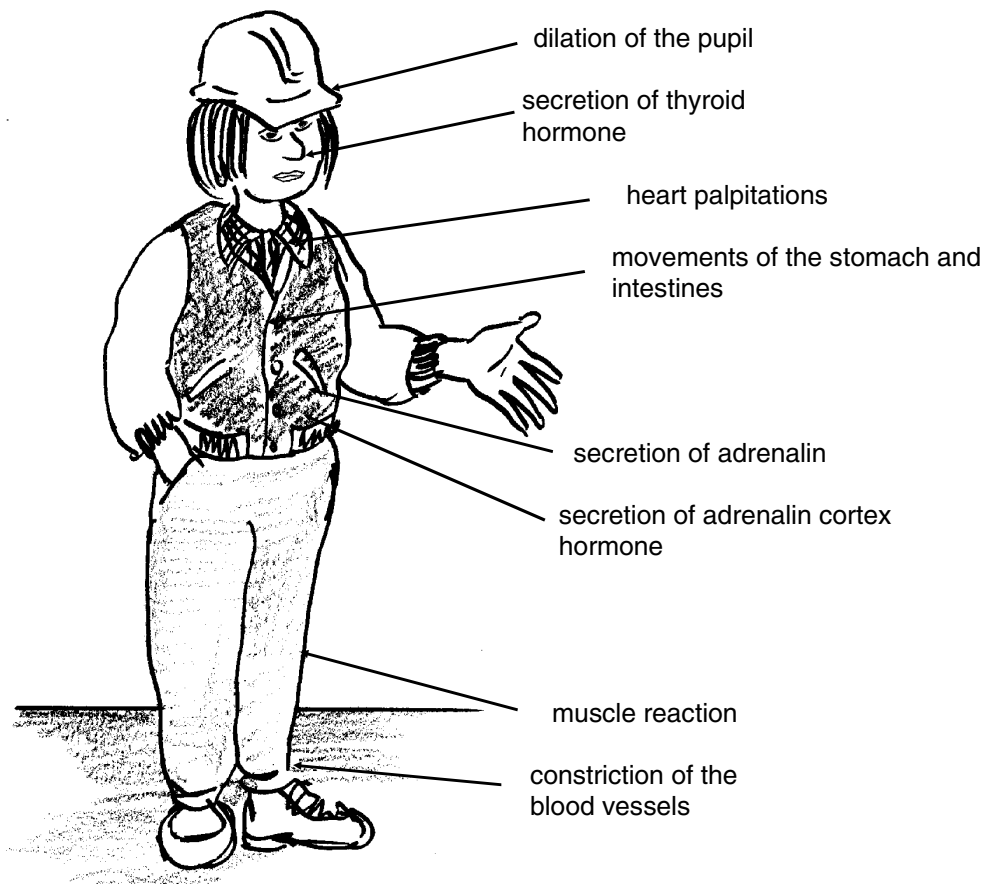
Excessive Noise Triggers Fight-or-Flight Reactions

Our bodies are **not** designed to withstand continued fight-or-flight reactions. Such continued stress actually begins to wear us out. According to OSHA and a variety of studies, workers who are constantly exposed to high levels of noise suffer a continual fight-or-flight-type reaction that puts them into a stress response every day.



That kind of continual stress means trouble for our bodies. As OSHA states:

"Laboratory and field studies implicate noise as a causative factor in stress-related illnesses, such as **hypertension, ulcers and neurological disorders.**"*



The diagram above summarizes the variety of ways that excessive noise affects our bodies, in addition to hearing damage.

Sources: U.S. Department of Labor, *Noise Control; A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980; *Federal Register*, 46 FR 4078, January 16, 1981; and Australian Council of Trade Unions, "Guidelines for the Control of Noise at Work," *Health and Safety Bulletin* (of the ACTU), September 1983.

**Federal Register*, 46 FR 4078, January 16, 1981.

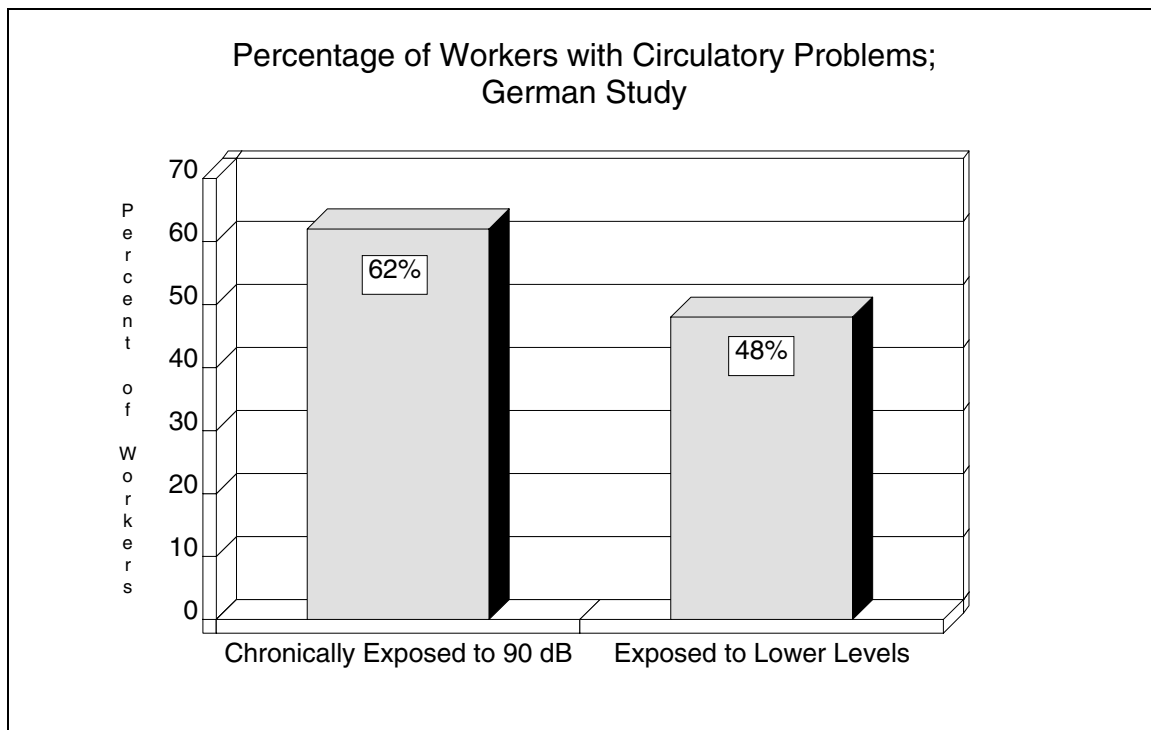
5. Noise-Induced Stress = Bad News for Heart and Circulation

Numerous studies point to the dangerous effects of noise-induced stress on the heart and the circulatory system.

OSHA cites specific studies of workers that demonstrate "significant differences in the number of cardiovascular and circulation disorders as well as other health problems."

What the studies do is compare one group of workers who are in high noise areas to similar workers (the control group) who work in lower noise areas.

The chart below summarizes the result of an often-cited German study of steel and iron workers. According to the study, 62 percent of the workers continually exposed to 90 decibels (dB) noise suffered circulatory problems, compared to 48 percent of the workers in lower noise areas.



Source: *Federal Register*, 46 FR 4078, January 16, 1981.

6. Additional Harmful Impacts of Noise

NIOSH Studies Show Variety of Harmful Effects

The National Institute of Occupational Safety and Health (NIOSH) conducted many studies on the impact of noise. In addition to cardiovascular effects, the NIOSH studies found evidence of the following disorders:

- digestive
- respiratory
- allergenic
- musculo-skeleton

"Over a period of 5 years, the number of diagnosed disorders in every category was significantly higher for workers exposed to high noise levels than it was for those exposed to lower noise levels."*

Australian Union Study Shows Additional Harm

- **Ulcers:** Increases the secretion of acid in the stomach as well as steroids that diminish the resistance of the stomach lining to the acid. This may lead to ulcers.
- **Liver Damage:** Changes in liver metabolism which can diminish the liver's ability to detoxify cancer-causing substances that get into the body. This may increase the risk of developing cancer.
- **Birth Defects:** Animal studies demonstrate an association between noise exposure and reduced fetal weight and increased incidence of malformation of offspring.

**Federal Register*, 46 FR 4078, January 16, 1981.

Sources: *Federal Register*, 46 FR 4078, January 16, 1981; and Australian Council of Trade Unions, "Guidelines for the Control of Noise at Work," *Health and Safety Bulletin* (of the ACTU), September 1983.

7. Chemicals and Pharmacological Agents Can Harm Hearing Too

According to studies by the Environmental Protection Agency (EPA) certain substances can actually injure the inner ear leading to deafness. These include:

- carbon monoxide
- carbon disulfide
- trichloroethylene

The drug streptomycin also has a well-known side effect that harms hearing.

Synergistic Effects: Two Kinds of Noise = Bigger Problem

When two problems combine to form a problem that is bigger or different from the sum of the two original problems, a synergistic effect is at work. This is what happened in a study reported by OSHA when two kinds of noise combined.

- OSHA reported that the impulsive noise (like a punch press) combined with a continuous noise (like a vent fan), producing a synergistic effect. The sum of the combined effect problem was greater than the sum of the two noises taken individually. According to OSHA, "hearing loss was exacerbated" and considerably more damage was found than would be expected from just continuous noise.
- Noise and heat are suspected to have a synergistic effect, according to the Australian Council of Trade Unions.
- Noise and vibration can also have a damaging effect on hearing, which is greater than the sum of their individual effects.

Sources: Australian Council of Trade Unions, "Guidelines for the Control of Noise at Work," *Health and Safety Bulletin* (of the ACTU), September 1983; and *Federal Register*, 46 FR 4078, January 16, 1983.

8. Even Low Levels of Noise May Be Hazardous

Studies have shown other possible effects of noise.

- Diminished ability to perform intellectual tasks when noise level reaches **80 dB**.
- Increased blood pressure and respiration and diminished mental capacity at noise levels of **60 or 70 dB**.
- Fatigue and annoyance at low levels and difficulties in maintaining equilibrium or balance.
- Evidence that even sounds which cannot be heard (ultrasound) can, under certain conditions, be hazardous to workers' health.
- High frequency, intermittent, unexpected or uncontrollable noise below the action levels (85 dB and 90 dB) may affect job performance.
- Noise has a cumulative effect especially for workers who are exposed to noise during non-working hours. Workers who live in urban settings or near airports, highways or industrial facilities may be stressed 24 hours a day.

Sources: *Federal Register*, 46 FR 4078, January 16, 1981; National Institute of Occupational Safety and Health, "Noise as an Occupational Hazard: Effects on Performance Level and Health, A Survey of Findings in the European Literature," *Government Reports, Announcements and Index*, Issue 2, 1986; and Australian Council of Trade Unions, "Guidelines for the Control of Noise at Work," *Health and Safety Bulletin* (of the ACTU), September 1983.

9. Noise and Physical Safety

There is yet another reason why it is better to control noise problems at the source, through engineering controls. If the facility is noisy or if we are wearing personal protective equipment (PPE), such as ear plugs and ear muffs, we have limited hearing or no hearing at all. And if we are working without our full hearing, the odds of an accident happening increase.

It is not difficult to imagine large and small accidents that can occur from the inability to use our sense of hearing, due to working in a noisy environment and wearing hearing protection devices. For example, a collision or accident could occur if someone doesn't hear the call to get out of the way. In crowded facilities we could find ourselves bumping into each other or tripping because we couldn't hear a warning.

Danger from Moving Equipment

This is obviously a major problem when working around vehicles of any kind. For example, a study of fatalities in the railroad industry showed that most workers who died were unaware of the approach of the trains or equipment that struck them. The study pointed out that "many of these workers . . . were under exposure to a high level of noise."*

Danger from Failure To Hear Warnings

Several other studies, as reported by OSHA and the *Journal of Occupational Medicine*, similarly found that workers in high noise areas have trouble with warning signals. "Many workers reported concerns that they would not hear warning signals or hear vital sounds signaling danger, or the malfunction of equipment."**

*Federal Register, 46 FR 4078, January 16, 1981.

**K. Riko and P.W. Alberti, "Hearing Protectors: A Review of Recent Observations," *Journal of Occupational Medicine*, Vol. 25, No. 7, July 1983.

Sources: Australian Council of Trade Unions, "Guidelines for the Control of Noise at Work," *Health and Safety Bulletin* (of the ACTU), September 1983; and U.S. Department of Labor, *Noise Control: A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980.

Task 2

Assume your group has been asked by the union health and safety committee to analyze and respond to the following report issued by management concerning the noise issue at OilChem. In doing so, please review the factsheets on pages 468 through 480 and answer the questions which follow below.

OilChem Report on Noise

"As a result of the concerns of our workers regarding noise levels here, we have checked and rechecked the noise levels at this facility. The results show that there has been a slight rise in the time-weighted decibel level from 84 dB to 87 dB. By law, OilChem is not required to reduce these levels. However, out of concern for our workers, we will issue each of you a set of ear plugs or ear muffs. Also, the company will provide a hearing test, free of charge, to anyone who wants one. We are doing our part; now you need to do yours. It's up to you to wear your personal protective equipment for your ears."

- 1. What are your agreements with this report?**

- 2. What are your disagreements?**

- 3. In your opinion, what should the union ask the company to do about the noise situation at OilChem?**

10. How Loud Is Loud?

Decibels (dB) measure the loudness of the noise. This measure is based on a mathematical shorthand, using multiplication rather than addition. This shorthand scale is used because of the tremendous range in power between quiet sound and noisy sound. **When decibels go up by 3, loudness doubles.** For example, 93 dB is twice as loud as 90 dB and 90 dB is 10 times louder than 80 dB.

Noise is a form of energy which can also be measured in watts. A very soft whisper generates about one billionth of a watt (0.000,000,001 watt) of sound power. A jet engine can produce one hundred thousand watts (100,000 watts) of sound power.

Noise Levels		
Noise Source	Sound Power in Decibels	Sound Power in Watts
Jet engine	140	100,000
Riveting on steel tank	130	10,000
Cutting machine; hardened tools	120	1,000
Pneumatic hammer	110	100
Pneumatic drill	100	10
Shouting to be heard a few feet away	90 80 70	1 0.1 0.01
Voice, normal conversation	60 50 40	0.001 0.0001 0.00001
Very soft whisper	30 20 10	0.000001 0.0000001 0.00000001
Threshold of hearing	0	0.000000001

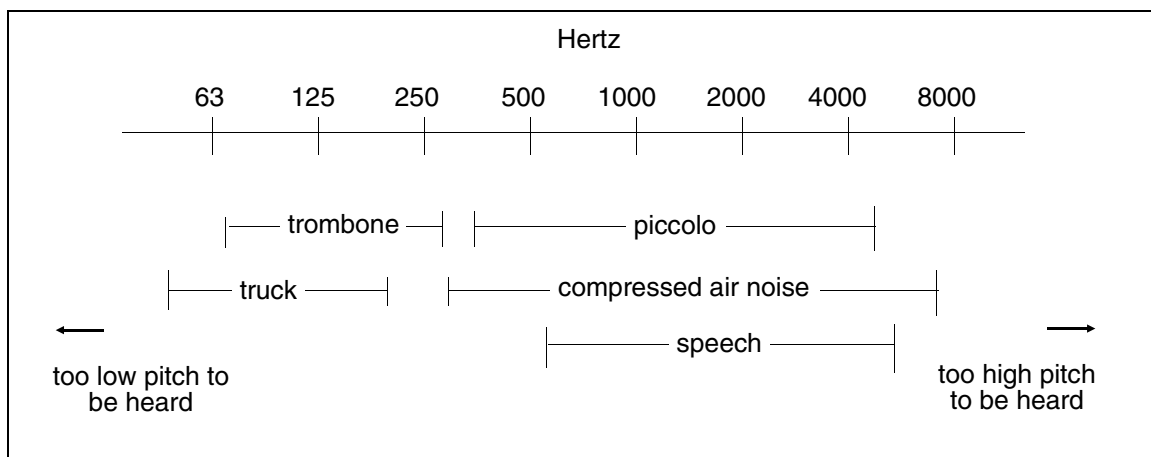
The critical decibel range where painless hearing damage can occur is between the 85 dB to 125 dB exposure levels.

Sources: U.S. Department of Labor, *Noise Control: A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980; United Auto Workers, *Noise Control: A Workers Manual*, Detroit: UAW, August 1978; Coastal Video Communications Corporation, *Hearing Protection: A Sound Practice*, Virginia Beach: CVC, 1992.

11. What's High, What's Low

In addition to knowing how loud noise is, it is important in controlling noise to know the frequency (or pitch) of noise. The disturbing effects of noise depend both on the loudness (intensity) and the pitch of the tones. Higher frequency noise is generally more annoying than low frequency noise. Also, single frequencies (pure tones) can be somewhat more harmful to hearing than broad band noise.

Frequency is measured in hertz (Hz). The higher the number of hertz, the higher the frequency. An example of a high frequency noise is a compressed air jet in a plant. A low frequency example is a large truck rumbling by.



At the same intensity, the noise from the truck is less disturbing than the noise from the compressed air jet because the truck noise is at a lower frequency.

Frequency is measured both when analyzing the noise of a machine and when measuring hearing loss. Noise causes hearing to be lost first in the upper frequencies, especially around 4000 Hz.

Sources: *Noise Control: A Workers Manual*, United Auto Workers International Union, UAW Social Security Department, Melvin A. Glasser, Director, August 1978; *Noise Control: A Guide for Workers and Employers*, U.S. Department of Labor, OSHA 3084, 1980.

12. OSHA's 1910.95: One Standard; Two Action Levels

OSHA's Occupational Noise Exposure Standard is broken down into two parts. Each section has a different "action level." An action level is a measurement of noise that triggers some required action on the part of the employer.

Part 1: 1910.95 (a) and (b)

The action level for this part is 90 decibels (dB) over a time-weighted average (A), sometimes written as 90 dB(A).

Part 2: 1910.95 (c) through (p) – OSHA's Hearing Conservation Program

The action level for this section is 85 dB(A).

Source: *Federal Register*, 46 FR 9739, March 8, 1983 and 46 FR 4078, January 16, 1981.

13. OSHA Part 1: The 90 dB Action Level

Under the Occupational Safety and Health Act, **every employer is legally responsible for providing a workplace free of hazards such as excessive noise.**

Under OSHA regulation 1910.95, employers are required to limit workers' noise exposure to 90 decibels averaged (dB(A)) over an eight-hour period. The chart below shows that there are shorter time limits for higher noise levels.

Noise Exposure Limits Set by OSHA 1910.95	
Hours of Exposure	Sound Level dB(A)
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115

Impulse and Impact Noise

Impulse and impact noise exposure should never exceed 140 dB at any time. Examples of impulse and impact noises are the sharp outbursts of noise produced by noisy punch presses or pneumatic tools.

Source: U.S. Department of Labor, *Noise Control: A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980.

continued

13. (continued)

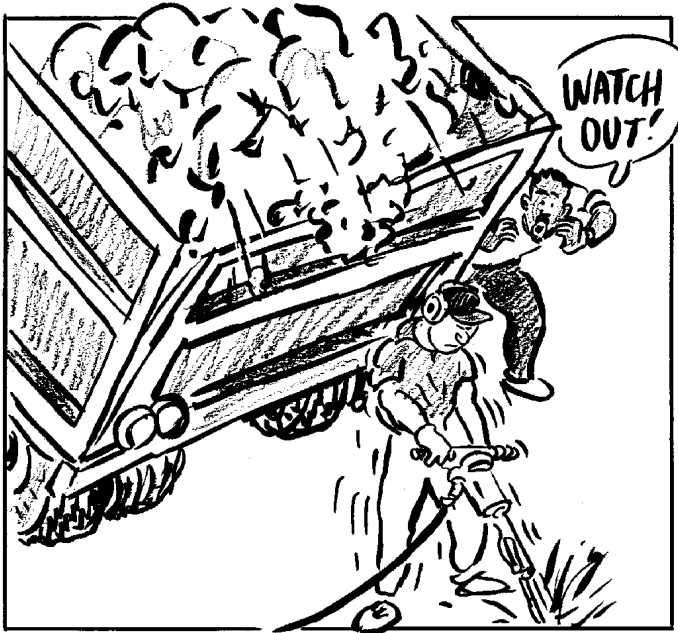
OSHA Requires Engineering Controls

According to OSHA, if noise exposure rises above the levels set forth in Standard 1910.95, the employer must use "engineering controls" (changes in the physical work environment such as sound dampening measures on noisy machines) or "administrative controls" (such as limits on the individual employee's exposure time) in order to comply with the law.

"If such controls fail to reduce sound levels within the prescribed levels then personal protective equipment [ear plugs, ear muffs] shall be provided and used to reduce sound levels within the OSHA prescribed levels." *[Brackets added]*

OSHA Discourages Personal Protective Equipment

OSHA **does not** recommend the use of personal protective devices as a permanent solution because



- they may cause infection or discomfort,
- they may not work effectively due to poor fit, and
- they may make conversation more difficult, which can contribute to accidents.

Source: U.S. Department of Labor, *Noise Control: A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980.

14. OSHA Part 2: The 85 dB Action Level (Hearing Conservation Program)

Monitoring Is Required

The employer must monitor facility noise levels to identify work areas where workers are exposed to **85 dB or more** during an eight-hour shift (TWA).

Area monitoring, in which one sample of the entire work area is tested, is allowed (not individual worker's exposure as was first proposed by OSHA). **Workers should ensure that any area monitoring is truly representative of the noise exposure in the area they are working in.** OSHA says the employer must provide employees and employee representatives with an opportunity to observe the monitoring and they must be notified of the results of the test.

If the area monitoring indicates that any employee's exposure may equal or exceed an eight-hour TWA (the action level) of 85 dB, the employer must develop and implement a Hearing Conservation Program.

Requirements of a Hearing Conservation Program

- If the eight-hour exposure is found to be between 85 dB and 90 dB, then the employer must provide **comfortable and effective** personal protective equipment to all affected employees.
- The employer also must provide a free annual hearing test for all workers exposed to noise levels of 85 dB or more.
- The testing program must be administered by a professional audiologist or physician.
- An initial (baseline) hearing test (audiogram) must be provided for all exposed workers. The test is designed to measure a person's ability to hear noise at different frequencies and sound levels. It indicates whether a worker is losing his or her ability to hear. The initial audiogram is the reference hearing test against which future tests will be compared.

continued

14. (continued)

- Newly hired workers must be tested six months after they start work. Where a mobile testing service is used, however, the employer may take up to a year. These workers must wear hearing protection after six months or until tested. The mobile testing exception is a concession by OSHA to minimize expenses of the services to the employer.
- To ensure accuracy, the hearing exam should be given only after a worker has had at least 14 hours of quiet time.

Annual hearing tests must be compared with the previous one to determine if there has been a hearing loss of 10 dB or more at 2,000, 3,000 and 4,000 Hz frequency in either ear. Any employee identified as having a hearing loss must be notified in 21 days and be provided with **comfortable and effective** hearing protection which OSHA requires them to wear.

Workers must be trained annually in the use of hearing protection, the advantages and disadvantages of the various types and their fitting and care. They must also be trained in the adverse effects of noise on both hearing and physical health.

OSHA requires that all records of employees' hearing tests be maintained for the length of employment and that area noise survey records be kept for two years. Employees have a right to their records.

Sources: *Federal Register*, 46 FR 9738, March 8, 1983; National Institute of Occupational Safety and Health, *A Practical Guide to Effective Hearing Conservation Programs in the Workplace*, September 1990; remarks by Gerard F. Scannell, Assistant Secretary of Labor for Occupational Safety and Health Administration before the 38th Annual Institute in Occupational Hearing Loss, University of Maine, July 10, 1990; United Steel Workers of America, *Noise and Its Effects*, Pittsburgh: USWA, September 1985; and Rhode Island Committee on Occupational Safety and Health (RICOSH) factsheet.

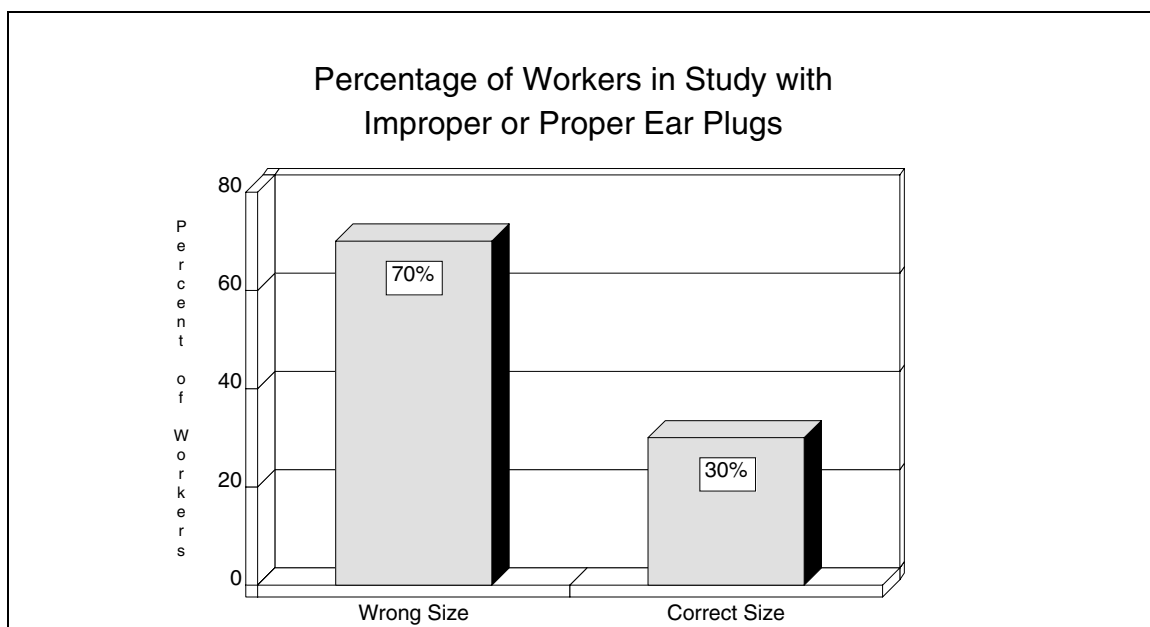
15. Poor-Fitting Ear Plugs Provide Little Protection

Noise-induced deafness has been the top industrial disease in Singapore for the last five years. It accounted for 78 percent of all occupational diseases in 1989.

A study of 317 exposed workers found that 70 percent had ear canals which were too large for the ear plug they were using. **Employers often provided medium-sized ear plugs without checking, on the presumption that it was the size that would fit most people.**

The effectiveness of ear plugs is partly dependent on the fit of ear plugs in the ear canal. If the ear plug is too tight, it is uncomfortable. If it is too loose, it does not provide an effective seal against the noise.

A difference of only 0.5 mm (millimeters) between the measured ear dimensions and the ear plug size can have a significant effect on the sound pressure level in the ear canal. Also, it may be necessary to provide a differently-sized plug for each ear due to anatomical variation (size) between the two ears.



Source: K. Riko and P.W. Alberti, "Hearing Protection: A Review of Recent Observations," *Journal of Occupational Medicine*, Vol. 25, No. 7, July, 1983; *Occupational Health and Safety*, May 1993.

16. Ear Plug Protection Factors Are Overstated

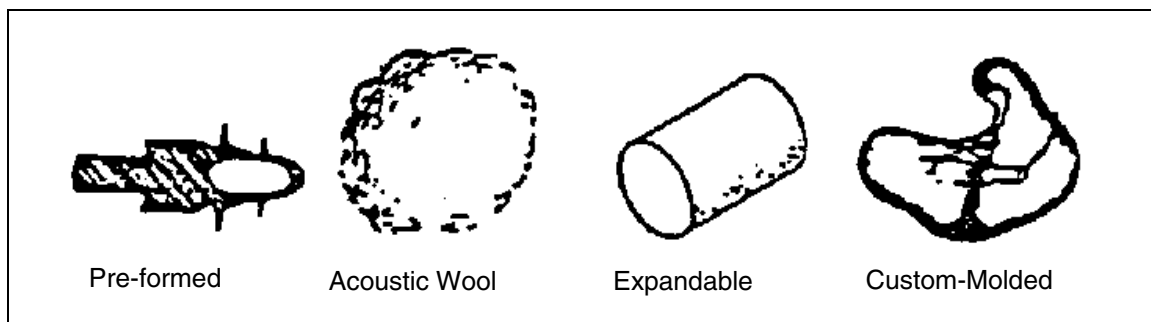
OSHA's Noise Standard 1910.95 requires workers exposed to certain high levels of noise to wear hearing protection. Ear plugs of various types are probably the most widely used hearing protective devices in U.S. industry.

A NIOSH (National Institute for Occupational Safety and Health) study shows that as actually worn in the facility, ear plugs **are less than half as effective** as their manufacturers claim in protecting workers' hearing. The study also reveals some significant differences between types of ear plugs.

In 15 different facilities, 420 workers had their hearing tested while wearing one of the four different types of ear plugs. The results were compared with the ear plug manufacturers' claims. None of the plugs provided the claimed percentage of effectiveness.

Amount of Protection in dB		
Type	The manufacturers claim their earplugs provide this much decibel reduction but the NIOSH study found they only provide this much decibel reduction.
Pre-formed plastic	29	7
Acoustic wool	26	10
Expandable foam	36	20
Custom-molded	20	14

For example, the little pre-formed plastic plugs, which are widely used, gave relatively little protection. Wads of acoustic wool inserted into the ear canals provide more protection.



Sources: *Federal Register*, 46 FR 4078, January 16, 1981; and David Kotelchuck, "Earplugs Anyone?" *U.E. News*, February 6, 1984.

17. Ear Muffs: Over-Rated and Uncomfortable

In a study conducted in Canada, scientists found that ear muff manufacturers, as do ear plug manufacturers, dangerously overstate the protection factor of their product.

Ear Muffs Offer Less Protection

In fact, ear muffs may provide less protection than ear plugs. In Sweden, a select group of shipyard workers were tested. Each had worked in a similar high noise environment for five to ten years and had used either ear muffs or ear plugs for protection. The study showed that there was a greater hearing impairment among the workers who used ear muffs than those who used plugs, even though the "attenuation" factor (noise reduction factor) was higher for ear muffs than for the plugs.

Ear Muffs Are Uncomfortable as Well

A German study compared various hearing protection devices (ear plugs, ear muffs) to determine which were the most comfortable to wear.

Significant differences were found in the degree of comfort between the devices tested. Plastic plugs were rated over ear muffs as being more comfortable to wear, therefore providing the best protection between the two for long-term use.

Some possible reasons for the lack of protection and comfort provided by ear muffs are attributed to:

- Certain head shapes which cannot be fitted by any available muff;
- The seals being broken by eyeglasses, side burns or hair;
- Improper fitting;
- Working loose over time; and
- Wearing out.

Sources: K. Riko and P.W. Alberti, "Hearing Protectors: A Review of Recent Observations," *Journal of Occupational Medicine*, Vol. 25, No. 7, July 1983; G. Schultz, et al., "Comparative Studies of the Noise Reducing Capability and the Wearing Comfort of Hearing Protection in the Workplace," *Zeitschrift für die Gesamte Hygiene und Ihre Grenzgebiete*, Vol. 29, No. 2, 1983; and Scand Audiol, *The Difference in Protection Efficiency Between Ear Plugs and Ear Muffs: An Investigation Performed at a Workplace*, Coden: SNADA, 1980.

18. Controlling Noise at Its Source

Experts agree (and OSHA mandates at 90 dB) that the best way to protect workers from damaging sound is to control noise at its sources.

The most effective controls are engineering controls which, if introduced at the time a building or piece of machinery is being designed or installed, are the least expensive alternatives ($\frac{1}{5}$ to almost $\frac{1}{2}$ of the investment that would be required to retrofit later).

Existing equipment and structures can also be adapted so as to limit harmful noise.

Engineering controls include:

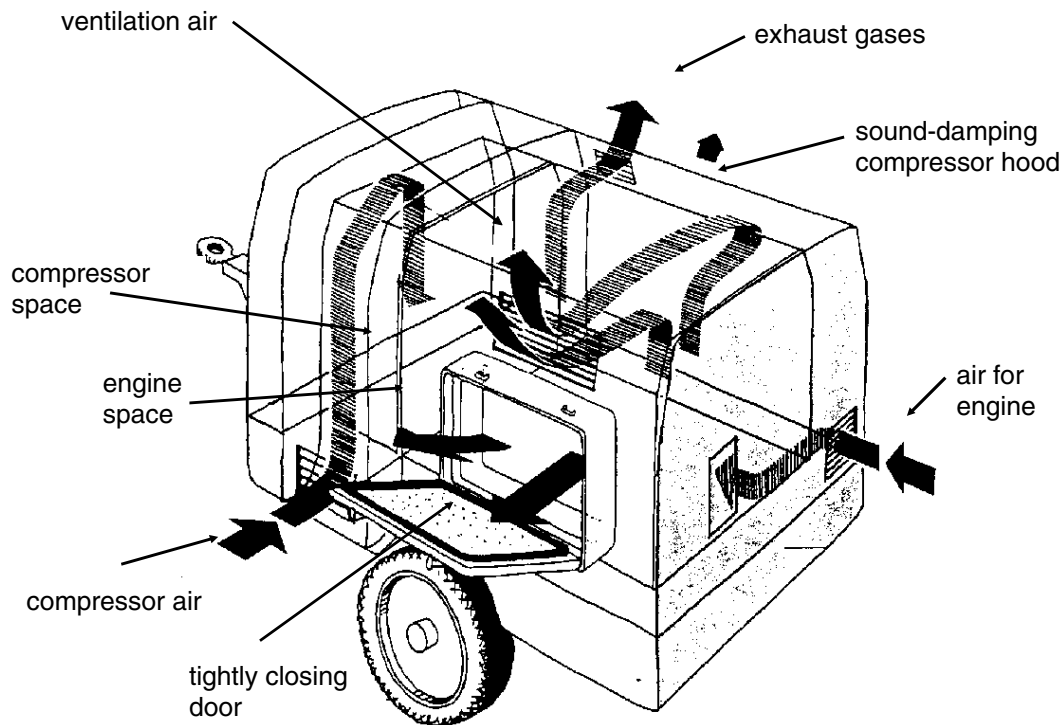
- barriers,
- damping,
- isolation,
- muffling,
- noise absorption,
- variations in force, pressure or driving speed as well as other solutions.

Examples

- Sound absorbing ceiling and wall coverings in noisy areas, such as heavy equipment cabs or buildings, where workers must spend time.
- Mufflers for the air outlets of pneumatic valves.
- Enclosures for especially noisy machine parts in a sound absorbent structure.
- Mufflers for intakes of air compressors.
- Dual flow mouthpieces for compressed air cleaning tools.

Example

Compressors, and the diesel engines inside them, both may produce strong, low frequency noise, even if they are provided with effective mufflers at the intake and exhaust.



Control Measure

A complete enclosure of damped material lined with sound absorbent will help. The air and exhaust gases must pass through mufflers which are partly made of channels with sound-absorbing walls. Doors for inspection must close tightly.

Sources: U.S. Department of Labor, *Noise Control: A Guide for Workers and Employers*, Washington, DC: OSHA 3048, 1980; Occupational Safety and Health Administration, *Controlling Noise at Its Source Can Help Protect Workers' Hearing*, OSHA, June 1987; State of California, Department of Industrial Relations, *Noise Control*, CAL/OSHA Communications, June 1985; and United Auto Workers, *Noise Control: A Workers Manual*, Detroit: UAW, August 1978.

19. OSHA's 90 dB Action Level Is Not the Safest Standard

Many experts believe that OSHA's 90 dB action level is not strict enough and have proposed a lower standard.

The Environmental Protection Agency

The Environmental Protection Agency (EPA) has identified **75 dB** as a safe action level for workplace exposure to hazardous noise.

The Council of European Communities

The European Commission is proposing to the Council an action level of **80 dB**, reversing the current dangerous 90 dB(A) level.

The United Auto Workers

The United Auto Workers (UAW) has lobbied for an **85 dB** action level, calling it a feasible standard.

Sources: London Hazards Center, *Protecting the Community: A Workers Guide to Health and Safety in Europe*, London: LHC, 1992; and United Auto Workers, *Noise Control: A Workers Manual*, Detroit: UAW, 1978.

Summary: Noise Exposure

1. Workers have a legal right to a safe work environment free of the hazards of dangerous noise exposure. Employers are required to monitor exposure levels if a noise hazard is suspected to exist.
2. Excessive levels of hazardous noise can cause physical damage to the inner ear which is irreversible, resulting in hearing loss.
3. An early sign of hearing loss is the inability to understand normal speech.
4. Noise can cause a severe stress reaction (fight or flight) in our bodies which can lead to serious health problems such as heart disease and high blood pressure. Some low level noise may also be harmful.
5. Some chemicals and pharmacological agents, as well as heat, vibration and different types of noise, can combine (synergistically) to cause a more serious threat to our hearing and health.
6. Ninety dB is ten times louder than 80 dB. Ninety-three dB is twice as loud as 90 dB.
7. OSHA requires that engineering controls or administrative controls be installed at the "90 dB(A) action level."
8. OSHA requires that a hearing conservation program be instituted at the "85 dB(A) action level."

continued

Summary *(continued)*

9. Hearing protectors' (ear plugs, muffs) safety factors are dangerously overstated by their manufacturers. Ear plugs and muffs should be the last line of defense against the hazards of noise.
10. Many experts believe that OSHA's 90 dB(A) action level is too high and recommend lower levels.
11. An active Worker Health and Safety Committee is the best way to insure and secure protective measures against the hazards of noise exposure.

Activity 17: Evaluating the Workshop

Purpose

To evaluate the PACE Worker-to-Worker health and safety training workshop that we have just completed and to spend some time talking about where we go from here.

Task

Working together with the other members of your group, answer the following questions.

- 1. In your group, make a list describing the most important things you learned during this workshop.**

- 2. Given your own experience and the things you have learned in this workshop, what are the health and safety problems at your worksite that need to be addressed right away? (Use an additional sheet if necessary.)**

continued

Task *(continued)*

3. How would you rate the workbook's readability?

☐ Too hard

☐ Just right

☐ Too easy

4. What health and safety topics would you like to learn more about?

5. Of all the activities, which was your favorite? Why?

Appendix

References and Resources

COSH Groups	A-2
OSHA Offices	A-4
NIOSH Offices	A-9
Labor Education Centers	A-11
Union Health and Safety Library	A-13
Glossary of Terms	A-17

COSH Groups

(No health and safety activist should be without one.)

Alaska

Alaska Health Project
218 East 4th Avenue
90 Anchorage, AK 99501
Tel: (907) 276-2864
Fax: (907) 279-3089

California

Worksafe/Francis Schrieberg
c/o San Francisco Labor Council
1188 Franklin St. Suite 203
San Francisco, CA 94109
Tel: (415) 433-5077
Fax: (510) 835-4913

LACOSH (Los Angeles COSH)
5855 Venice Blvd.
Los Angeles, CA 90019
Tel: (213) 931-9000
Fax: (213) 931-2255

SA-COSH (Sacramento COSH)
c/o Fire Fighters, Local 522
3101 Stockton Boulevard
Sacramento, CA 95820
Tel: (916) 442-4390
Fax: (916) 446-3057

SCCOSH (Santa Clara COSH)
760 North 1st Street
San Jose, CA 95112
Tel: (408) 998-4050
Fax: (408) 998-4051

Connecticut

ConnectiCOSH (Connecticut)
77 Huyshoup Ave., 2nd Floor
Hartford, CT 06106
Tel: (203) 549-1877
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Alice Hamilton Occupational Health
Center
410 Seventh Street, S.E.
Washington, DC 20003
Tel: (DC) (202) 543-0005
Tel: (MD) (301) 731-8530
Fax: (DC) (202) 543-1327
Fax: (MD) (301) 731-4142

Illinois

CACOSH (Chicago Area)
c/o Mike Ross, UIC School of Public
Health
Great Lakes Center, M/C-922
2121 West Taylor Street
Chicago, IL 60612-7260
Tel: (312) 996-2747
Fax: (312) 413-7369

Maine

Maine Labor Group on Health
Box V
71 State Street
Augusta, ME 04330
Tel: (207) 622-7823
Fax: (207) 622-3483

Massachusetts

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555 Amory Street
Boston, MA 02130
Tel: (617) 524-6686
Fax: (617) 524-3508

Western MassCOSH
458 Bridge Street
Springfield, MA 01103
Tel: (413) 731-0760
Fax: (413) 732-1881
Masscosh@external.umass.edu
(Francesca Rheanon)

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SEMCOSH (Southeast Michigan)
1550 Howard Street
Detroit, MI 48216
Tel: (313) 961-3345
Fax: (313) 961-3588

Minnesota

MN-COSH
c/o Lyle Krych
5013 Girard Avenue North
Minneapolis, MN 55430
Tel: (612) 572-6997
Fax: (612) 572-9826

New Hampshire

NHCOSH
110 Sheep Davis Road
Pembroke, NH 03275
Tel: (603) 226-0516
Fax: (603) 225-1956

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ALCOSH (Allegheny COSH)
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Jamestown, NY 14701
Tel: (716) 448-0720
Fax: (716) 487-0968
alcosh@netsync.net

CNYCOSH (Central New York)
615 W. Genessee Street
Syracuse, NY 13204
Tel: (315) 471-6187
Fax: (315) 471-6193
eameltz@mailboxsy.edu

ENYCOSH (Eastern New York)
c/o Larry Rafferty
121 Erie Blvd.
Schenectady, NY 12305
Tel: (518) 372-4308
Fax: (518) 393-3040

NYCOSH (New York)
275 Seventh Avenue, 8th Floor
New York, NY 10001
Tel: (212) 627-3900
Fax: (212) 627-9812
(914) 939-5612 (Lower Hudson)
(516) 273-1234 (Long Island)
71112.1020@compuserve.com

ROCOSH (Rochester COSH)
46 Prince Street
Rochester, NY 14607
Tel: (716) 244-0420
Fax: (716) 244-0956
SPULA@DBI.cc
Rochester.edu

WNYCOSH (Western New York
COSH)
2495 Main Street, Suite 438
Buffalo, NY 14214
Tel: (716) 833-5416
Fax: (716) 833-7507

North Carolina

NCOSH (North Carolina COSH)
P.O. Box 2514
Durham, NC 27715
Tel: (919) 286-9249
Fax: (919) 286-4857
HN2100@Handsnet.org

Oregon

c/o Dick Edgington
ICWU-Portland
7440 SW 87 Street
Portland, OR 07223
Tel: (503) 244-8429 - No Fax

Pennsylvania

PhilaPOSH (Philadelphia
Project OSH)
3001 Walnut Street, 5th Floor
Philadelphia, PA 19104
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Fax: (215) 386-3529

Rhode Island

RICOSH (Rhode Island COSH)
741 Westminster Street
Providence, RI 02903
Tel: (401) 751-2015
Fax: (401) 751-7520

Texas

TexCOSH (Texas COSH)
c/o Karyl Dunson
5735 Regina
Beaumont, TX 77706
Tel: (409) 898-1427 - No Fax

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WashCOSH
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Seattle, WA 98108
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Wisconsin

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WOSH (Windsor OSH)
547 Victoria Avenue
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COSH-Related Groups**California**

Labor Occupational Health Program
University of California
2515 Channing Way
Berkeley, CA 94720
Tel: (510) 642-5507
Fax: (510) 643-5698

District of Columbia

Workers Institute for Occupational
Safety and Health
1126 16th Street, NW, Room 403
Washington, DC 20036
Tel: (202) 887-1980
Fax: (202) 887-0191

Louisiana

Labor Studies Program/LA Watch
Institute of Human Relations
Loyola University, Box 12
New Orleans, LA 70118
Tel: (504) 861-5830
Fax: (504) 861-5833

Massachusetts

Center for New Office Technology
1 Summer Street
Somerville, MA 02143
Tel: (617) 776-2777

Michigan

Michigan Right-to-Act Campaign
Ecology Center for Ann Arbor
417 Detroit Street
Ann Arbor, MI 48104
Tel: (313) 761-3186
Fax: (313) 663-2414

New Jersey

New Jersey Work Environment
Council
452 East Third Street
Moorestown, NJ 08057
Tel: (609) 866-9405
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New York

Midstate Central Labor Coalition
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Ithaca, NY 14850
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71112.503@compuserve.com

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Greater Cincinnati Occupational
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Institute of Labor Studies
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SC, TN)**

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Fax: (334) 441-6396

US Department of Labor-OSHA
Jacaranda Executive Court
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(305) 424-0242
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US Department of Labor-OSHA
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US Department of Labor-OSHA
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US Department of Labor-OSHA
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US Department of Labor-OSHA
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US Department of Labor-OSHA
Century Station Federal Bldg
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US Department of Labor-OSHA
Strom Thurmond Federal Building
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US Department of Labor-OSHA
Green Hills Office Park
2002 Richard Jones Road
Nashville, TN 37215-2869
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Des Plaines, IL 60018
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Federal Office Building, Rm. 620
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234 N. Summit Street, Room 734
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Madison, WI 53716
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US Department of Labor-OSHA
310 West Wisconsin Ave, Room 1180
Milwaukee, WI 53203
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Region VI (AR, LA, NM, OK, TX)

Regional Office

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525 Griffin Street, Room 602
Dallas, TX 75202
(214) 767-4731

District Office

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4171 North Mesa Street, Rm C119
El Paso, TX 79902
(915) 236-3220

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Hoover Annex, Suite 200
Baton Rouge, LA 70806
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(713) 286-0583

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350 North Sam Houston Pkwy
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(713) 591-2438

US Department of Labor-OSHA
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Lubbock, TX 79401
(806) 743-7681

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8600 Farley, Suite 105
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US Department of Labor-OSHA
Overland-Wolf Bldg., Room 100
6910 Pacific Street
Omaha, NE 68106
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Region VIII (CO, MT, ND, SD, UT, WY)

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*7(c)(1) Programs

**18(b) Programs

OSHA Offices *(continued)*

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Department of Employment
Herschler Bldg, 2nd Floor East
122 West 25th Street
Cheyenne, WY 82002
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Region IX

(CA, AZ, NV, HI, American Samoa, Guam, Trust Territory of the Pacific Islands)

Regional Office

US Department of Labor-OSHA
71 Stevenson Street, Suite 420
San Francisco, CA 94105
(415) 744-6670
Fax: (415) 744-7114
Federal Compliance (800) 475-4020
Federal Technical Assistance (800) 475-4019
Publication Request (800) 475-4022

District Offices

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105 El Camino Blvd, 1st Floor
Sacramento, CA 95815
(916) 978-5641

US Department of Labor-OSHA
5675 Ruffin Road, Suite 330
San Diego, CA 92123
(619) 557-2909

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3221 North 16th Street, Suite 100
Phoenix, AZ 85016
(602) 640-2007
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US Department of Labor-OSHA
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5675 Ruffin Road, Suite 330
San Diego, CA 92123
(619) 557-2909
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US Department of Labor-OSHA
300 Ala Moana Blvd., Suite 5122
Honolulu, HI 96850
(808) 541-2685
Fax: (808) 541-3456

US Department of Labor-OSHA
705 North Plaza, Room 204
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Carson City, NV 89701
(702) 885-6963
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(AK, ID, OR, WA)

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US Department of Labor-OSHA
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553-5930
Fax: (206) 553-6499

Area Offices

US Department of Labor-OSHA
301 W. Northern Lights Blvd.,
Room 407
Anchorage, AK 99503
(907) 271-5152
Fax: (907) 271-4238

US Department of Labor-OSHA
3050 N. Lakeharbor Lane, Suite 134
Boise, ID 83703
(208) 334-1867
Fax: (208) 334-9407

US Department of Labor-OSHA
1220 Southwest Third, Room 640
Portland, OR 97204
(503) 326-2251
Fax: (503) 326-3574

US Department of Labor-OSHA
505-106th Avenue NE, Suite 302
Bellevue, WA 98004
(206) 553-7520
Fax: (206) 553-0106

***Both 7(c)(1) Programs and 18(b) Programs

NIOSH Educational Resource Centers

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4676 Columbia Parkway
Cincinnati, OH 45226
(800) 35-NIOSH

NIOSH Educational Resource Centers

Deep South Center for Occupational Health and Safety

Univ. of Alabama at Birmingham
School of Public Health
Birmingham, AL 35294-2010
(205) 934-7178; fax (205) 975-7179
pubn011@uabdpdpo.dpo.uab.edu

Northern California Educational Resource Center

Univ. of California-RFS
1301 S. 46th Street, Bldg 102
Richmond, CA 94804
(510) 231-5645; fax (510) 231-5648
baplog@UCLINK.BERKELEY.EDU

Southern California Educational Resource Center

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Institute of Safety & Systems Mgt.
Professional Programs, Room 102
Los Angeles, CA 90089-0021
(213) 740-3995; fax (213) 740-8789

University of Cincinnati

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Illinois Educational Resource Center

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University of Illinois at Chicago
School of Public Health
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lnickels@tiger.uic.edu

Johns Hopkins Educational Resource Center

Environmental Health Sciences
615 North Wolfe Street, Room 6001
Baltimore, MD 21205
(410) 955-0423; fax (410) 955-9334
CARUTHE@JHU.EDU

Michigan Educational Resource Center

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1205 Beal, 176 IOE Bldg
Ann Arbor, MI 48109-2117
(313) 763-0567; fax (313) 764-3451
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Texas Educational Resource Center

Southwest Center for Occupational and
Environmental Health/School
of Public Health
University of Texas Health
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P.O. Box 20186, RAS W1026
Houston, TX 77225-0186
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University of Washington
Seattle, WA 98195
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jschwert@dehpost.sphcm.washington.edu

Labor Education Centers

Labor Education Centers at several universities provide occupational safety and health programs as part of their Worker Extension Schools. These programs provide both outreach and on-campus training.

University of Alabama, Birmingham
Center for Labor Education and Research
School of Business
University Station
Birmingham, AL 35294
(205) 934-2101

University of California, Berkeley⁺
Labor Occupational Health Program
Institute of Industrial Relations
2521 Channing Way
Berkeley, CA 94720
(415) 642-5507

University of California, Los Angeles
Center for Labor Research and Education
Institute of Industrial Relations
Los Angeles, CA 90024
(213) 825-3537

University of Connecticut⁺
Labor Education Center
Storrs, CT 06268
(203) 486-3417

University of Hawaii
Center for Labor Education and Research
1420A Lower Campus Rd., Bldg. 3
Honolulu, HI 96822
(808) 948-7145

Indiana University
Division of Labor Studies
312 North Park
Bloomington, IN 47401
(812) 337-9082

University of Illinois
Institute of Labor and Industrial Relations
504 East Armory
Champaign, IL 61820
(217) 333-0980

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Chicago Labor Education Program
1315 SEO Building
P.O. Box 4348
Chicago, IL 60680
(312) 996-2623

University of Kentucky
Center for Labor Education and Research
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(606) 258-4811

University of Maine, Orono
Bureau of Labor Education
218 College Avenue
Orono, ME 04473
(207) 581-7032

Michigan State University
Labor Program Service
School of Labor and Industrial Relations
South Kedzie Hall
East Lansing, MI 48824
(517) 355-5070, 355-2214

University of Michigan
Institute of Labor and Industrial Relations
401 Fourth Street
Ann Arbor, MI 48103
(313) 763-1187

University of Minnesota
Labor Education Service, IRC
447 BA Tower
271 19th Avenue South
Minneapolis, MN 55455
(612) 373-3662, 4110, 5380, 5306

Cornell University⁺
New York State School of Industrial
and Labor Relations
Division of Extension and Public Service
Ithaca, NY 14850
(607) 256-3281

⁺ Universities with extensive programs in occupational health.

Labor Education Centers (continued)

Metropolitan District Staff:

**New York State School of Industrial
and Labor Relations**

7 East 42nd Street
New York, NY 10017
(212) 697-2247

Western District Staff:

**New York State School of Industrial
and Labor Relations**

120 Delaware Ave., Rm. 225
Buffalo, NY 14202
(716) 842-4270

Ohio State University⁺

Labor Education and Research Center
1810 College Road
Columbus, OH 43210
(614) 422-8157

University of Oregon

Labor Education and Research
Center
Eugene, OR 97403
(503) 686-5054

University of Wisconsin Extension⁺

School for Workers
1 South Park Street, #701
Madison, WI 53705
(608) 262-2111

Pacific Northwest Labor College⁺

Flavia Hall
Maryhurst, OR 97036
(503) 245-1315

**Rutgers University, The State University of
New Jersey**

Labor Education Center
Institute of Management and Labor Relations
University Extension Division
Ryders Lane & Clifton Ave.
New Brunswick, NJ 08903
(201) 932-9502

Antioch

AFL-CIO Labor Studies Center
10000 New Hampshire Ave.
Silver Spring, MD 20903
(301) 431-6400

The Basics for a Union Health and Safety Library

Toxic Chemicals and Occupational Health

Work Is Dangerous to Your Health, Jean Stellman and Susan Daum, New York: Vintage Books, 1973. A must for every safety and health committee. Provides interesting and readable explanations of occupational disease, stress, noise and a range of problems related to toxics in the workplace. Also contains non-technical references to hundreds of chemicals used in the workplace. Available at bookstores. (Note: A new edition is being reissued soon.)

Chemical Hazards of the Workplace, third edition, edited by Nick H. Proctor, et al., Philadelphia: J. B. Lippincott Co., 1991. A handy reference guide to chemical exposures at work. (666 pages, \$79, ACGIH, (513) 742-2020.)

Encyclopedia of Occupational Health and Safety, third edition, vols. I and II, Geneva: International Labor Organization, 1988. Comprehensive reference books. (3,714 pages, \$240, ACGIH, (513) 742-2020.)

Occupational Health: Recognizing and Preventing Work-Related Disease, third edition, edited by Barry S. Levy and David H. Wegman, Boston: Little, Brown and Co., 1995. A good textbook on occupational health designed for medical students but useful for others involved in workplace safety and health. (772 pages, \$44.)

Protecting Workers Lives: A Safety and Health Guide for Unions, Chicago: National Safety Council, 1983. Provides a history of organized labor efforts in safety and health, discusses hazard recognition and controls, workplace inspections and collective bargaining for safety and health. (National Safety Council (800) 621-7619.)

Death on the Job, Daniel M. Berman, New York: Monthly Review Press, 1978. A "must read" for workers concerned with safety and health. A very compelling presentation about workers' compensation, corporate control of information, "the body count" and organizing activities by labor and coalition groups. (260 pages.)

Fear at Work: Job Blackmail, Labor and the Environment, Richard Kazis and Richard Grossman, Philadelphia: New Society Publishers, 1991.

Union Health and Safety Library (*continued*)

Ventilation: A Practical Guide, Nancy Clark, et al., New York: Center for Occupational Hazards, 1984. This guide contains step-by-step procedures for designing and building a ventilation system. It includes information on hoods, ducts, fans and air cleaners. Presents typical design specifications for five standard types of ventilation systems. Although written with small shops in mind, it is an easy-to-understand guide on ventilation. (117 pages, \$12.95 plus \$2.00 p&h, Center for Safety in the Arts, (212) 287-6220.)

Cancer and Work

Cancer and the Worker, Phyllis Lehmann, New York: New York Academy of Sciences. A pro-worker, easy-to-read booklet on workplace cancer.

The Politics of Cancer, Samuel S. Epstein, San Francisco: Sierra Club Books, 1978. A compelling book on workplace and environmental cancer. Presents case studies of the workplace, consumer products and the general environment; discusses the impact of cancer and prevention.

Reproductive Hazards at Work

Pregnant and Working: What Are Your Rights? New York: New York Committee for Occupational Safety and Health – NYCOSH, 1986.

Double Exposure: Women's Health Hazards on the Job and at Home, edited by Wendy Chavkin, New York: Monthly Review Press, 1984. Collection of articles on women, their work and hazards faced on the job. Includes a section on work and reproduction, hazards at home and women organizing around environmental issues. Available from NYCOSH. (262 pages.)

Women's Work, Women's Health: Myths and Realities, Jean Stellman, New York: Pantheon Books, 1977. Contains useful information on women's job health hazards. Available at bookstores or from NYCOSH.

Working for Your Life: A Women's Guide to Job Health Hazards, Andrea Hricko and Melanie Brunt, Berkeley: Labor Occupational Health Program – LOHP, 1976. Contains useful information on reproductive hazards to men and women; easy-to-read; focuses on high risk industries for reproductive hazards. Available from LOHP or NYCOSH.

OSHA Publications

OSHA has a wide variety of booklets, posters, videos and standards. Many are available for free, others must be purchased from the Government Printing Office or other supplier. The best way to learn about OSHA publications is to obtain the free booklet ***OSHA Publications and Audiovisual Programs*** (OSHA 2019), 1994. To order, write to OSHA Publications, 200 Constitution Avenue, N.W., Room N3101, Washington, DC 20277-2975, tel: (202) 219-8151, fax: (202) 219-9266.

OSHA now charges for complete sets of their standards. Your local may be able, however, to obtain free copies by contacting your U.S. Senator or Representative or the OSHA Labor Liaison in your OSHA Regional Office. Ask for Title 29 Code of Federal Regulations for General Industry and Construction Industry. If you have a computer with a CD-ROM, a good buy is the OSHA CD of all regulations, selected documents, and other technical information. The CD is available from the Government Printing Office, (202) 783-3228, for \$88 per year, \$28 quarterly (no. 729-13-00000-5).

Some recommended free OSHA Publications:

Employee Workplace Rights (OSHA 3021) explains employee workplace rights under OSHA, including right to know, access to exposure and medical records, inspections and confidentiality.

OSHA Inspections (OSHA 2098) provides information on inspection priorities, the review and inspection process, inspection results and the review and appeals procedure.

Personal Protective Equipment (OSHA 3077) discusses the types of equipment most commonly used for protection of the head, eyes, ears, torso, arms, hands and feet. Also discusses the inspection and maintenance of equipment.

Chemical Hazard Communication (OSHA 3084) outlines the requirement of the HAZCOM standard, such as written programs, labels and other forms of warning, employee information and training and material safety data sheets.

Union Health and Safety Library (*continued*)

NIOSH Publications

NIOSH has a toll free number (800-35-NIOSH) for ordering publications, making requests for information and other purposes. This is a voice-mail system but NIOSH representatives are available Monday-Friday, 1-4 pm.

NIOSH will fax or mail you a list of their publications. They no longer publish a publications catalog. You can fax publication orders to (513) 533-8573 or mail to NIOSH Publications, Mail Stop C-13, 4676 Columbia Parkway, Cincinnati, OH 45226.

Pocket Guide to Chemical Hazards, 1994 edition. A compact guide, the *Pocket Guide* is updated annually, providing basic information on specific chemicals for which there are federal regulations. The guide lists chemical names and synonyms, permissible exposure limits, signs and symptoms of exposure, monitoring procedures and requirements for personal protective equipment. A quick reference guide and a must for any safety committee. Single copies are available while supplies last.

NIOSH publishes *Criteria Documents* on specific industrial hazards and control technologies available in different industries. OSHA uses these technical documents in developing standards. Criteria documents detail health effects, recommended exposure limits, workplace controls and personal protective equipment, including respirators. In general, NIOSH recommendations are more stringent than OSHA's. The documents can provide you with useful information in your effort to upgrade safety and health protection at your company. Call NIOSH Publications at (800) 35-NIOSH.

Glossary of Health and Safety Terms

Acute Effect—A harmful effect upon the human body following a short exposure to a dangerous substance or material. An acute reaction or illness occurs immediately after exposure or over a short term (usually less than 24 hours).

Carcinogens—Substances or agents that can cause cancer when people are exposed to them.

Caustic—A corrosive chemical with a high pH (basic or alkaline).

Ceiling limit—The maximum concentration of a chemical, dust or physical agent that is allowed at any time under federal standards.

Central nervous system (CNS)—Body system made up of the brain and spinal cord.

Chemical name—The correct name that fully defines the chemical composition of a substance. "Benzene" and "3,3-dimethoxy benzidine" are chemical names; "Magic Solve" and "Red ECBS" are trade names. The generic name is frequently referred to as the exact description, but it actually refers to categories such as metals or solvents.

Chromosome—Part of the cell's genetic material. Damage to chromosomes can cause harmful changes to an individual's body and may also result in birth defects.

Chronic effect—An adverse effect upon the human body which develops from a long-term or frequent exposure to a harmful substance such as a carcinogen. Chronic effects or diseases may not show up for years after exposure.

Combustible—Any material, chemical, or structure that can burn. A combustible liquid is defined as having a flash point above 100° F. (See also **flammable**.)

Concentration—The amount of a chemical, dust or other substance in a given amount of air. Example: 50 micrograms of lead in one cubic meter of air (50 µg/m³) is a concentration.

Contaminant—Poison, toxic substance – anything that makes air or water dirty or unfit for human consumption.

Contact dermatitis—Dermatitis of the skin due to direct contact with irritating substance. (See **dermatitis**.)

Corrosive—A substance that can wear or eat away another substance. Corrosive chemicals, such as strong acids, alkalis and caustics, can cause burns and irritation when in contact with human skin.

Dermatitis—Inflammation of the skin, such as redness, rash, dry or cracking skin, blisters, swelling, or pain. May result from exposure to toxic or abrasive substances.

Dust—Airborne solid particles that are created by work processes, such as grinding.

Engineering controls—Prevention of worker exposure to contaminants by work process changes or ventilation, rather than by requiring workers to wear protective equipment. OSHA regulations require that exposure to airborne contaminants be reduced wherever possible by engineering controls rather than by the use of respirators.

Exhaust ventilation—Removes air contaminants from workplace air by sucking them away from the breathing zones of workers by means of hoods, canopies or ducts. Exhaust ventilation is the most efficient means of controlling air contaminants because it moves smaller air volumes with less heat loss (in winter) than general exhaust ventilation.

Explosive level—The concentrations of gas in air which can explode. It is usually expressed as a range between a "lower explosive level" (LEL) and an "upper explosive level" (UEL). It is commonly measured by an explosimeter which reads out the concentration of a possible dangerous gas in percent per volume of air.

Exposure—When a worker takes in a toxic substance by inhalation, ingestion, skin absorption or other means, he or she is exposed to that substance. Exposure is measured over time and in amounts (dose).

Flammable—Can easily be set on fire with a spark or flame. Inflammable means the same thing. (See **combustible**.)

Lower explosive (flammable) limit—The lowest concentration of a combustible or flammable gas or vapor in air that will produce a flash of fire. Mixtures below this concentration are too "lean" to burn.

Upper explosive (flammable) limit—The highest concentration of a combustible or flammable gas or vapor in air that will produce a flash of fire. Mixtures above this concentration are too "rich" to burn.

Fume—Small solid particles that become airborne when a solid material is heated or burned. Example: Welding on lead solder creates lead fumes.

Gas—A chemical that is normally airborne at room temperature, rather than solid or liquid. Examples: Carbon monoxide, hydrogen sulfide.

General ventilation—Lessens airborne contamination by diluting workplace air by ceiling or window fans.

Generic name—The correct name for a whole group or class of substances which have similar characteristics.

Hazard abatement—The process of controlling and eliminating hazards.

Health hazard—Any type of job-related noise, dust, gas, toxic chemical, substance or dangerous working condition which could cause an accident, injury, disease or death to workers.

Industrial hygiene—The technical specialty concerned with the recognition, evaluation and elimination of workplace hazards. Industrial hygienists study ventilation techniques and other engineering controls, as well as methods for determining the identity and concentration of chemical, physical and radiation hazards.

Inflammable—Means the same thing as flammable: a material that can burn easily.

Inflammation—A condition of the body or portion of the body characterized by swelling, redness, pain and heat.

Inhalation—The process of breathing something into the lungs.

Ingestion—The process of taking a substance through the mouth.

Local effect—Means that the action of the chemical takes place at the point of contact, such as dermatitis caused by skin contact with solvents. (Compare with systemic effect.)

Mg/m³—Milligrams per cubic meter of air. A unit for measuring the amount of a chemical or substance in the air.

µg/m³—Micrograms per cubic meter of air; 100 micrograms equal one milligram.

Mist—Airborne liquid droplets that are created by a gas going into the liquid state or by a liquid being splashed, foaming or atomized. Examples: oil mist from cutting, grinding or from pressure; paint mists from spraying.

Mucous membrane—The moist, soft lining of the nose, mouth and eyes.

Mutagen—A chemical or other substance capable of causing a mutation. (See below.)

Mutation—A change (usually harmful) in the genetic material of a cell. When it occurs in the sperm or egg, the mutation can be passed on to future generations.

PEL—Permissible exposure limit; the numerical level of a chemical or substance above which a worker cannot legally be exposed under the Occupational Safety and Health Act (OSHA). The limit reflects an average exposure over an 8-hour work day, 40-hour week, that a worker can get without experiencing any harmful health effects. Example: the PEL for lead exposure is 50 µg/m³ for a 40-hour week. Unfortunately, PELs may not always be completely protective.

Personal protective equipment (PPE)—Devices worn by workers to protect them against work-related hazards such as air contaminants, falling materials and noise. While it is important to wear such equipment when required, it should be remembered that these devices usually only provide minimal protection to workers and should only have to be worn when all other efforts have been initiated to correct an unsafe working environment. Examples of personal protective equipment include hard hats, ear plugs, respirators and steel-toe work shoes.

PPM—Abbreviation for parts per million; the ratio of the amount of a substance to the amount of air or water. One part benzene vapor per million parts of air is 1 ppm.

Sensitizer—A substance that causes an individual to react when subsequently exposed to the same or other irritant, as in a skin reaction or allergy.

Short-term exposure limit (STEL)—The maximum average concentration of a chemical allowed for a continuous 15-minute period. Usually only four short exposures a day are permitted, each at least 50 minutes apart. Only some chemicals have STELs.

Solvent—A substance (liquid) capable of dissolving another.

Synergistic—Two or more agents that act together to produce a total effect greater than the sum of the separate effects.

Systemic effect—A chemical's effect on the body that takes place somewhere other than point of contact. For example, some pesticides are absorbed through the skin (point of contact), but affect the nervous system (site of action).

Teratogen—Substances or agents that cause birth defects or other abnormalities in offspring.

Threshold limit value (TLV)—Exposure limits for chemicals recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), which sometimes differ from OSHA's PELs. ACGIH's TLVs are not legally enforceable.

Time-weighted average (TWA)—A method used to calculate the average concentration of a chemical over an 8-hour day, 40-hour week.

Toxic—Poisonous; capable of causing any sort of injury to the body. This includes noise, radiation, heat, cold, along with chemical and mineral substances.

Trade name—Any arbitrary name a company chooses to use for a chemical or product for advertising reasons or in order to keep secret the ingredients. "Formacil" or "Methotrexate" are trade names. (See Generic Names and Chemical Names.)

Vapor—The gas formed above a liquid as it evaporates.

Ventilation—A duct-and-fan system that takes fumes or dust in the air out of the work area, thereby reducing a worker's exposure. The most effective type of ventilation is local exhaust ventilation, placed close to the source of airborne fumes or dust and drawing it away from the worker.

Volatile—Tendency for a liquid to evaporate or vaporize rapidly. A volatile liquid has a high vapor pressure and may be readily inhaled.

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1. How important is this Activity for the workers at your facility?
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the one factsheet you feel is the most important.

	1. How Many OCAW Members Work in Toxic Jobs?		10. How Much Will It Cost To Clean Up Known Superfund Sites?
	2. How Many Different Federal Regulations Affect Our Facilities?		11. Toxic Chemical Incidents on the Rise?
	3. Are Our Kinds of Jobs Growing or Declining?		12. Toxic Torts on the Rise?
	4. Are Regulations Harming Profits and Jobs?		13. Recent Court Cases and Fines Involving Toxics
	5. Sometimes Corporations Cry Wolf – All the Way to the Bank		14. Can This Training Help Save Our Jobs and Our Lives?
	6. Profits and Jobs in Our Largest Corporations		15. Lack of Experience = Injuries
	7. What Kinds of Jobs Are Growing in Our Economy?		16. Why PACE Wants This Kind of Training
	8. How Much Cancer Is Caused by Workplace Exposures?		17. Job Loss Could Lead to More Releases and Regulations
	9. Are Cancer Rates Higher in Your Community?		

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point		
1.	2.	3.

4. What would you suggest be done to improve this Activity?

1. How important is this Activity for the workers at your facility?

Please circle one number.

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

2. Please put an "X" by the one factsheet you feel is the most important.

	1. What Are Systems of Safety?		9. Getting to Prevention
	2. OSHA and Systems of Safety		10. Systems vs. Symptoms
	3. The Maintenance and Inspection System		11. Proactive vs. Reactive Systems
	4. The Procedures and Training System		12. Worker Involvement Creates Strong Systems of Safety
	5. The Warning System		13. Finding the Root Cause
	6. The Design System		14. Profit-Driven Decisions Can Cause Accidents
	7. The Mitigation System		15. Is Human Error the Root Cause?
	8. Treating Workers as Good as the Pipe: Understanding Human Factors		

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point		
1.	2.	3.
4.	5.	

4. What would you suggest be done to improve this Activity?

Evaluation

Activity 3: Assessing Our Workplace Hazards

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. Assessing the Hazards at Work		3. Ranking and Making Priorities: The Organizing Side
	2. Making Priorities: The Technical Side		

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	

- 4. What would you suggest be done to improve this Activity?**

1. How important is this Activity for the workers at your facility?
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the one factsheet you feel is the most important.

1. How Hazardous Materials and Other Toxic Chemicals Enter Your Body	12. Smoking and Drinking Are Addictions That Kill
2. Absorption of Toxic Chemicals by Your Body	13. Making a Killing
3. Your Nose Doesn't Always Know	14. Smoking and Toxics: A Dangerous Combination
4. Dose and the Body's Response	15. Fighting Through the Smoke-Screen
5. The Short and Long of It	16. The Strengths and Limitations of Modern Medicine and Science
6. Some of the Chemicals That Are Known To Cause Cancer in Humans	17. How OSHA Health Standards Were Born
7. The Odds of Getting Disease	18. How OSHA Standards Are Changed
8. How Do We Know When a Toxic Substance Really Causes Human Disease?	19. OSHA Tries to Adopt New and Improved Standards – Still Little Protection
9. Do Animals Tell the Truth?	20. How and Why NIOSH and OSHA Differ
10. What We Don't Know May Hurt Us	21. Safe Today; A Killer Tomorrow
11. The Toxic Time Bomb	

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	8.

4. What would you suggest be done to improve this Activity?

1. How important is this Activity for the workers at your facility?**Please circle one number.**

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

2. Please put an "X" by the one factsheet you feel is the most important.

	1. The Problems With MSDSs		5. Flashpoint
	2. What's in an MSDS?		6. Some Other Basic Chemical Terms: pH and Oxidizer
	3. Vapor Pressure		7. The Ups and Downs of Flammability Limits
	4. Vapor Density		8. The Fearsome Incompatibles

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	8.

4. What would you suggest be done to improve this Activity?

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. What You Get Is When You Test		6. Chemical Mixtures: Too Much Exposure?
	2. Exposure and Work Vary Day to Day		7. Overtime and Chemical Exposure
	3. Exposures Vary Season to Season		8. Three OSHA Standards: Time-Weighted Averages, Ceilings and Peaks
	4. Exposures Vary by Type of Worker		9. Different Types of Exposure Evaluation
	5. The More You Look, the More You See		10. Air Monitoring – Is It Adequate? Other Considerations

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point								
1.	2.	3.	4.	5.	6.	7.	8.	9.
10.	11.	12.	13.	14.	15.	16.	17.	18.

- 4. What would you suggest be done to improve this Activity?**

Evaluation

Activity 7: The Control of Toxic Hazards

- 1. How important is this Activity for the workers at your facility?
Please circle one number.**

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. The Hierarchy of Controls		3. Local Exhaust Ventilation
	2. What Is a Control?		

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point		
1.	2.	3.
4.	5.	

- 4. What would you suggest be done to improve this Activity?**

1. How important is this Activity for the workers at your facility?
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the one factsheet you feel is the most important.

1. Reproductive Risks: The Scope of the Problem	10. A Few <i>Possible</i> Human Reproductive Toxic Substances
2. How Many of Us Are at Risk	11. A Few Substances Which Are <i>Unlikely</i> To Harm Reproduction
3. Reproductive Hazards to Men and Women	12. OSHA Proposes Regulating Glycol Ethers
4. Potential Adverse Effects of Job Exposures on Reproduction	13. Supreme Court Bans "Fetal Protection" Policies: Johnson Controls
5. What Harms Women Harms Men	14. Engineering Controls
6. Reproductive Disorders: A Wide Range of Problems	15. Personal Protective Equipment
7. What We Know About Maternal and Paternal Exposures	16. Pregnancy as Disability
8. A Few <i>Known</i> Human Reproductive Toxic Substances	17. Medical Removal Protection
9. A Few <i>Probable</i> Human Reproductive Toxic Substances	

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	8.

4. What would you suggest be done to improve this Activity?

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. Respirators: A Last Ditch Control		5. Right Cartridge, Wrong Chemical?
	2. How Do You Know if Your Respirator Works?		6. Types of Respirators
	3. Protection Factors: Does Your Respirator Offer Enough Protection?		7. What Does IDLH Mean?
	4. What Is Fit Testing?		

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	8.

- 4. What would you suggest be done to improve this Activity?**

Evaluation

Activity 10: Placing Medical Surveillance Under Surveillance

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. Medical Testing Worksheet		3. List of Certified "B" Readers by State
	2. Medical Testing Glossary		4. Occupational Health Clinics Throughout the U.S. and Canada

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point			
1.	2.	3.	4.
5.	6.	7.	

- 4. What would you suggest be done to improve this Activity?**

1. How important is this Activity for the workers at your facility?
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the one factsheet you feel is the most important.

1. Introduction to the NIOSH Pocket Guide	12. Health Hazards
2. Using the NIOSH Pocket Guide	13. Absorption of Toxic Chemicals by Your Body
3. Identification: What's in a Name?	14. Finding Health Information in the NIOSH Pocket Guide
4. Looking Up Chemical Names in the NIOSH Pocket Guide	15. What Does "Euph" Mean?
5. One Chemical, Many Names	16. Flashpoint
6. MSDSs Help Identify Hazardous Ingredients	17. Vapor Pressure
7. The Problems With MSDSs	18. The Ups and Downs of Flammability Limits
8. CAS Numbers	19. Incompatibilities and Reactivities
9. What's a Safe Level? Exposure Limits	20. The Fearsome Incompatibles
10. Physical Properties	21. Personal Protective Equipment (PPE)
11. Respiratory Protection	

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point		
1.	2.	3.
4.	5.	6.

4. What would you suggest be done to improve this Activity?

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. Taming the Legal Octopus		9. PACE Representational Letter
	2. A Few of the Laws Affecting Toxics		10. Right to Exposure and Medical Records
	3. Basic Health and Safety Rights		11. Right to a Union Industrial Hygienist Inspection
	4. Right to a Health and Safety Committee		12. The Emergency Planning and Community Right-To-Know Act of 1986
	5. On the Right To Refuse Unsafe Work		13. Violating RCRA Training Requirements
	6. Contract Language on the Right To Refuse Hazardous Work		14. New Jersey's Conscientious Employee Protection Act
	7. How To Request Medical and MSDS Information		15. Federal Environmental Statutes
	8. The Duty of Fair Representation		

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point				
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

- 4. What would you suggest be done to improve this Activity?**

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

- 2. Please put an "X" by the one factsheet you feel is the most important.**

	1. Safety Committee Structure		6. Understanding Levels of Activity
	2. Eyes, Ears and Voices		7. Health and Safety Problem Solving
	3. No Free Lunch		8. Tips on Small Group Meetings at Work
	4. Common Pitfalls		9. Information Is Power
	5. Road Map for Health and Safety Committees		10. Health and Safety Committee Activities

- 3. Which summary point do you feel is most important? Please circle one number.**

Most Important Summary Point						
1.	2.	3.	4.	5.	6.	7.
8.	9.	10.	11.	12.	13.	

- 4. What would you suggest be done to improve this Activity?**

1. How important is this Activity for the workers at your facility?**Please circle one number.**

Activity Is Not Important			Activity Is Very Important		
1	2	3	4	5	

2. Please put an "X" by the one factsheet you feel is the most important.

	1. The Types of Emergencies at Oil and Chemical Facilities		5. Checking the Written Plan
	2. Emergency Response Planning: What's Required?		6. What Should the Training Cover?
	3. Alert, Think, Then Act: Emergency Response Procedures		7. Spill Prevention, Control and Countermeasures
	4. Setting Priorities: Life Comes First		8. More on Training

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point		
1.	2.	3.
4.	5.	

4. What would you suggest be done to improve this Activity?

Evaluation

Activity 15: Relating to the Community

- 1. How important is this Activity for the workers at your facility?**
Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

- 2. What would you suggest be done to improve this Activity?**

1. How important is this Activity for the workers at your facility?**Please circle one number.**

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Please put an "X" by the one factsheet you feel is the most important.

1. How To Tell If There Is a Noise Problem at Work	11. What's High, What's Low
2. Early Warning Signs of Hearing Loss	12. OSHA's 1910.95: One Standard; Two Action Levels
3. Noise Damages the Ear and Hearing	13. OSHA Part 1: The 90 dB Action Level
4. Noise-Induced Stress	14. OSHA Part 2: The 85 dB Action Level
5. Noise-Induced Stress = Bad News for Heart and Circulation	15. Poor-Fitting Ear Plugs Provide Little Protection
6. Additional Harmful Impacts of Noise	16. Ear Plug Protection Factors Are Overstated
7. Chemicals and Pharmacological Agents Can Harm Hearing Too	17. Ear Muffs: Over-Rated and Uncomfortable
8. Even Low Levels of Noise May Be Hazardous	18. Controlling Noise at Its Source
9. Noise and Physical Safety	19. OSHA's 90 dB Action Level Is Not the Safest Standard
10. How Loud Is Loud?	

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point					
1.	2.	3.	4.	5.	6.
7.	8.	9.	10.	11.	

4. What would you suggest be done to improve this Activity?
