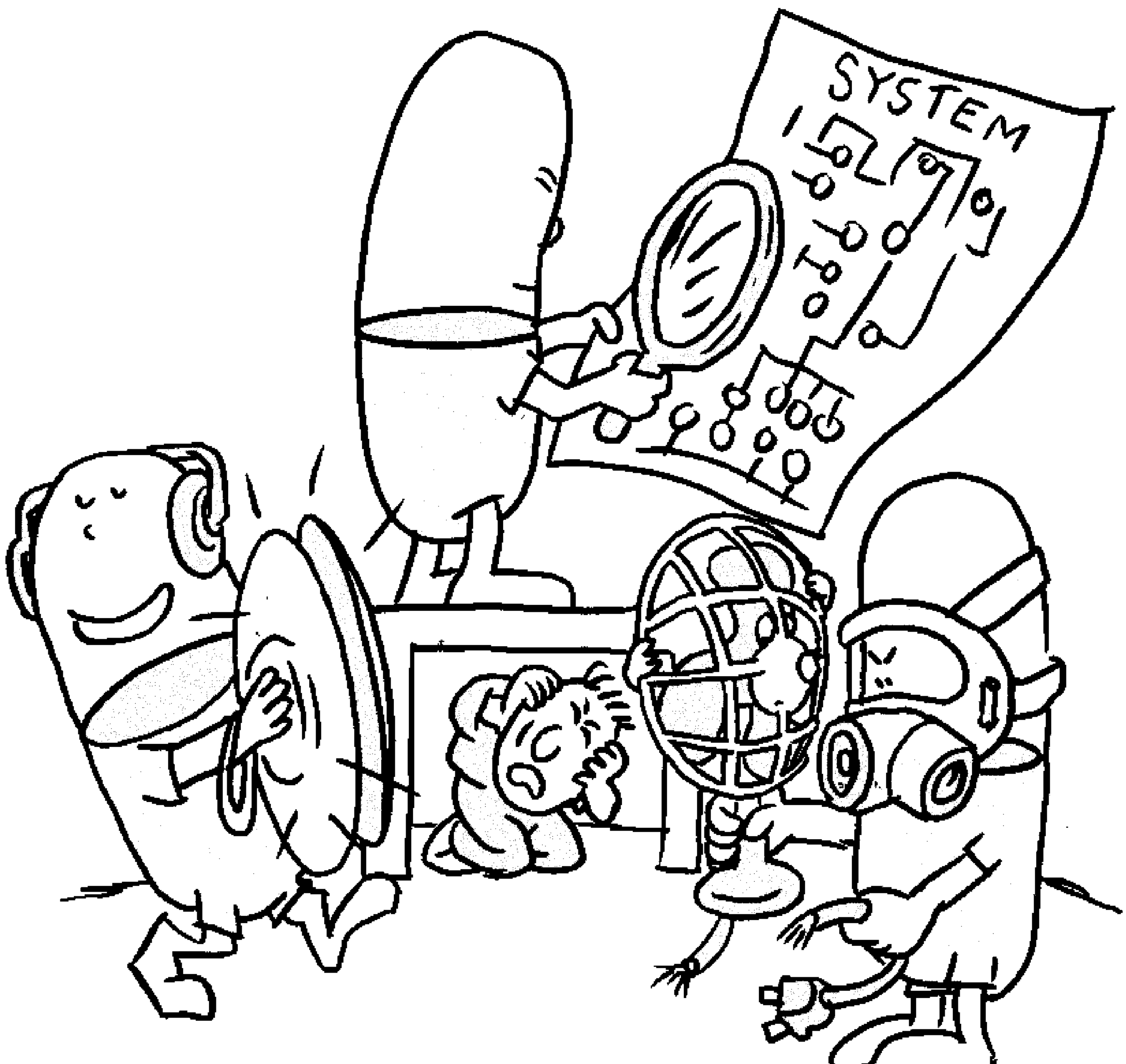
PACE/Labor Institute

Health and Safety Awareness Training



Merck-Medco Rx Edition

Written and Produced by
The Labor Institute
for the
Paper, Allied-Industrial, Chemical and Energy Workers International Union

PACE-Labor Institute

Health and Safety Awareness Training

for the Workers of

Merck-Medco Rx

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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 Doug Stephens at the PACE 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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Joint Mission Statement

PACE Health and Safety Awareness Training

The Merck-Medco Rx Services companies, the Paper, Allied-Industrial, Chemical and Energy Workers International Union, AFL-CIO, and its local unions, are mutually committed to assuring a safe and healthful workplace for our employees and members. We recognize that is only where a safe and secure work environment exists that employees can achieve their full career potential.

Employees can contribute substantially to achieving the goals of safety and health, but only if they have an awareness of recognized safety standards, and the ability to identify unsafe and unhealthy situations. Therefore, we believe that the education and training of each employee is a primary factor in achieving a safe and secure workplace. Such education and training should also enable employees to identify mechanisms to eliminate identified hazards. With such knowledge and information also comes the ability to interact with management and the Joint Health and Safety Committee that exists at each facility.

The training program presented in conjunction with this manual represents a significant step in meeting this joint commitment to workplace health and safety.

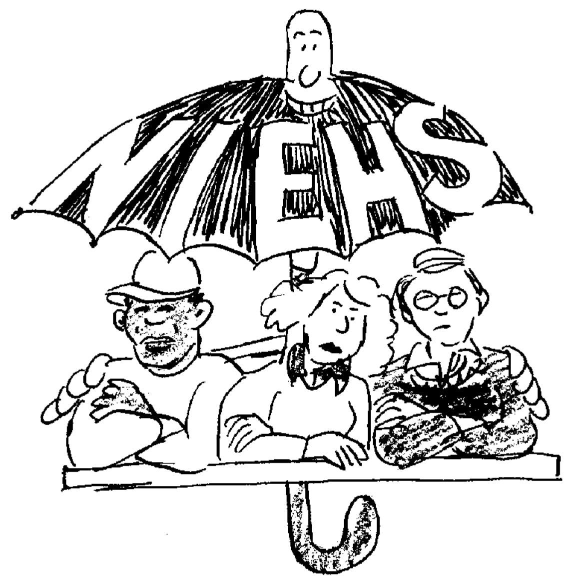
The training emphasizes the importance of identifying the root cause(s) of accidents with a systems-based approach. With this knowledge, each trained employee will be better able to provide input to his/her union and the management team as well at the Joint Health and Safety Committee. Your Joint Health and Safety Committee constitutes the most accessible and responsive vehicle for individual employees to communicate issues concerning workplace safety and health. By working with and through these committees, we can achieve results that would have been impossible if either management or the employees had worked alone.

We jointly hope that you benefit from the training program, and find it valuable in your every day work environment.

Introduction

Why Is This Training Taking Place?

The Oil, Chemical, and Atomic Workers Union, in cooperation with The Labor Institute of New York, recently 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.



The PACE Worker-Trainers

PACE has a long history 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 undermine 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 Oil, Chemical and Atomic 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 preferred.) Each activity has a **task**, or set of tasks, for the groups to work on. The idea is to work together in the group, not to compete. Very often there is not *one* right answer. The tasks require that the groups use their experience to tackle problems, and to 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 away from specific issues, 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 (SGAM) is based on the idea that every workshop is a place in which learning is shared. With SGAM, we learn not only from trainer to worker. Nor is SGAM simply an opportunity to sit around and talk over coffee. 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 from worker to worker. SGAM makes 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.

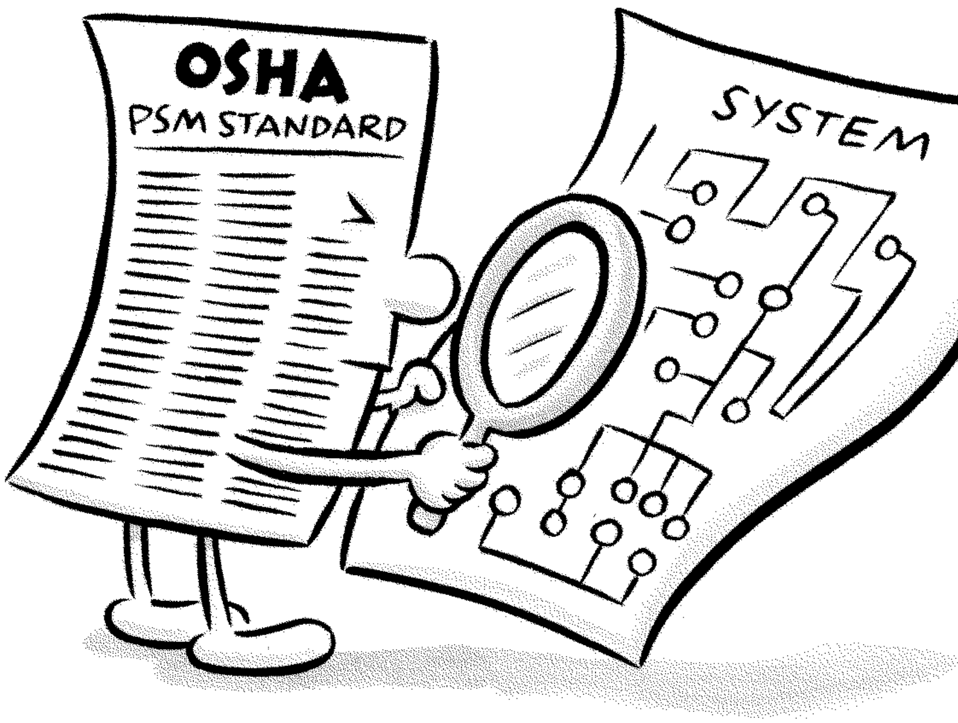
Worker to Trainer: Lecture-style training assumes that the trainer knows all the answers. SGAM is based on the understanding that trainers also have a lot to learn. Workers often will have as much, or more, collective knowledge as expert or teacher of a particular given subject. With SGAM we learn as much as possible from each other, the workshop participants, mainly during the report-backs. SGAM allows us to listen to those we are training, so we learn much more about the realities people face. Also, because our training method shows genuine respect for worker knowledge, it builds confidence among those we are training. Confidence is the key to adult learning.

Trainer to Worker: The traditional learning procedure of school also has its place in SGAM but not until the end. This is our chance to clear up confusion and make key points. By waiting until the summary section, we better understand what participants need to know.

Activity 1: Systems of Safety

Purpose

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



Task 1

Shortly after midnight on March 24, 1989, the tanker Exxon Valdez ran aground on Bligh Reef in Alaska spilling 11 million gallons of crude oil. Over 1,500 miles of shoreline were polluted by the spill. Responsibility for the incident was initially placed on the tanker captain who had been drinking earlier that evening. Captain Hazelwood was disciplined, sued and fired. Further investigation of the accident revealed the following facts:

a. The radar station in the city of Valdez, which was responsible for monitoring the locations of tanker traffic in the risky waters of Prince William Sound, had replaced its radar with much less powerful equipment. The location of tankers could not be monitored in the area of Bligh Reef.

b. Congressional approval of the Alaskan oil pipeline and tanker transport network included an agreement by the oil corporations to build and use double hulled tankers. This would significantly reduce the amount of oil released in an accident. The Exxon Valdez did not have a double hull.

c. Crew fatigue was typical on the tankers. In 1977, the average oil tanker operating out of Valdez had a crew of 40 people. By 1989, crew size had been cut in half. Crews routinely worked 12- to 14-hour shifts plus extensive amounts of overtime. The Exxon Valdez had arrived in port at 11 p.m. the night before. The crew was rushing to get the tanker loaded for departure the next evening.

d. State-of-the-art equipment for monitoring icebergs in shipping lanes was promised by the oil industry, but it was never installed. The Exxon Valdez was traveling outside of the normal sea lane in order to avoid icebergs that were thought to be in the area.

e. Although the Coast Guard at Valdez was assigned to conduct safety inspections of the tankers, they did not perform these inspections. Its staff had been cut by one-third.

f. Tanker crews relied on the Coast Guard to plot their location continually. Although the Coast Guard operating manual required this, the practice of tracking ships all the way out to Bligh

Reef had been discontinued. Tanker crews were never informed of the change.

g. Spill response teams and equipment were not readily available. This seriously impaired attempts to contain and recover the spilled oil.

1. Review the factsheets on pages 11 through 27 and in your groups list the systems of safety involved in each paragraph and the flaws in each system. Please be sure to pick a scribe at each table to record your response. You can list more than one system or flaw for each paragraph.

	Flaws	Systems
a.		
b.		
c.		
d.		
e.		
f.		
g.		

Sources: Fran Locher Freiman and Neil Schlager, *Failed Technology*, International Thomson Publishing; and Art Davidson, *In the Wake of the Exxon Valdez*, San Francisco: Sierra Club Books, 1990.

Task 2

1. In your groups, list three of the most important safety problems in your plants and then list which systems of safety need to be addressed in order to solve each problem.

Problem	Systems of Safety Involved
1.	1.
2.	2.
3.	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:

- Design & Engineering
- Mechanical Integrity
- Mitigation devices (i.e., relief valves)
- Warning devices (i.e., alarms)
- Training & Procedures
- 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 & procedures 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 Sons, 1983, p. 202.

2. OSHA and Systems of Safety

Although the Occupational Safety and Health Administration's (OSHA) Process Safety Management Standard (PSM) has yet to be applied to MMRx facilities, it provides an example of how systems of safety are used in other hazardous industries. For instance, the PSM Standard requires that, at a minimum, companies formally establish certain systems of safety and sub-systems. The chart below shows how some of OSHA's PSM requirements fit into a safety system framework.

Mechanical integrity system	Training and procedures system	Design, warning devices and mitigation systems
• Maintenance and inspection system • Sub-Contractors	• Operating procedures • Training • Hot work • Emergency planning and response	• Process safety information • Process hazard analysis • Management of change • Pre-startup safety review

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

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. **An effective investigation program focuses on examining all of the systems of safety involved in an incident in order to maximize prevention.**

3. The Mechanical Integrity System

Properly designed equipment can turn into unsafe junk if it is not appropriately maintained, inspected and repaired. **An effective mechanical integrity system should be evaluated by its performance in eliminating the use of breakdown maintenance.** The OSHA PSM Standard uses the term mechanical integrity to describe this safety system.

Important elements of the maintenance and inspection system include:

- safety and skills training for employees and sub-contractors 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 that are kept readily available;
- adequate staffing to eliminate work order and preventative 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 preventative maintenance.

4. The Training and Procedures System

The operation and maintenance of processes that are inherently dangerous 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 training and procedures system include:

- training and procedures 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;
- emergency response plan and training that are in place and are routinely practiced;
- training and procedures which identify all potential chemical 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;
- annunciator panels;
- community and neighboring plant alarm systems.

6. The Design System

Many important safety decisions are made long before new or revised systems and procedures are introduced into a facility. **A central purpose of the design safety system is to eliminate hazards through the selection of inherently safe or low-risk processes 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, 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 that a disaster will occur.

Important elements of the design safety system are:

- reducing the inventory of hazardous materials;
- safe-siting and spacing of equipment;
- 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:

- automatic fire systems (water and halon)
- mechanical ventilation
- automatic trip devices.

8. 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” encompasses 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, human factors must also constitute a major factor. Companies apply tight restrictions on the maximum safe process limits for the protection of piping and other hardware. Scheduling overtime and similar worker-related issues must receive even more consideration.

Source: Center for Chemical Process Safety, *Guidelines for Technical Management of Chemical Process Safety*, New York: American Institute of Chemical Engineers, 1989, pp. 99-103.

9. Systems of Safety and Sub-Systems (Examples)

Safety Systems	**Design & Engineering**	**Mechanical Integrity**	**Mitigation Devices**	**Warning Devices**	**Training & Procedures**	**Human Factors**
Type of Prevention	Primary	Secondary	Secondary	Secondary	Secondary	Secondary
Safety Sub-Systems	Codes, Standards Guidelines Process Hazards Analysis (PHA) and Management of Change (MOC) Safe Siting Chemical Substitution Communication Devices	Inspection Vibration Monitoring Preventive Maintenance Parts Quality Control Turn-around Frequency	Relief Valves Diking & Drainage Shutdowns & Isolation Devices Check Valves Fire Suppression Devices	Monitors Process Alarms Facility Alarms	Operating Manuals Process Safety Information Operating Procedures Permit Programs Emergency Response Planning & Training Pre-Startup Review Refresher Training As Low as Reasonably Achievable (ALARA) Information Resources Communications	Ergonomics Worker/ Equipment Interface Overtime Behavior Staffing Buddy System Workload Noise Temperature Ventilation Personal Protective Equipment Stress Illumination Shift Schedule

10. 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. Good design techniques 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	Mechanical Integrity Mitigation devices Warning devices Training & Procedures Human Factors

11. 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 with existing systems of safety.

The root causes of incidents are found in system failures such as faulty design or inadequate training which are responsible for unsafe acts and unsafe conditions.

Process safety management involves the use of systems to control hazards and reduce the number and seriousness of process related incidents and accidents.

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.

12. Proactive vs. Reactive Systems

Some 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”? Some corporate safety programs have been based on this reactive model.

The reactive safety model is the least effective method for preventing chemical releases and 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.

In contrast, effective systems of safety are based on the proactive identification and control of hazards before disasters and accidents take 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 preventative maintenance program.

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

13. Worker Involvement Creates Strong Systems of Safety

Joint Health and Safety Committees, such as those in place at Merck-Medco Rx Services sites, can be a positive force involved in creating or changing systems of safety. In addition to concentrating their activity on handling worker complaints and on promoting injury rate reduction goals, workers and their union representatives can be proactive in regard to 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.

14. Finding the Root Cause

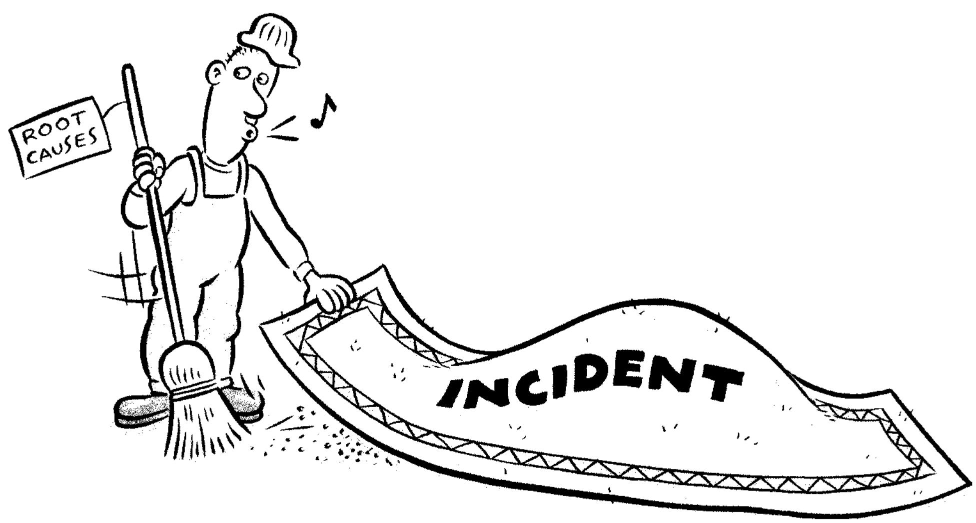
Safety professionals and government safety experts recognize the importance of identifying root causes and the prevention of accidents. For example, the Center for Chemical Process Safety defines "root causes" as:

> "**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.

15. Bad Decisions Today Can Cause Accidents Tomorrow

Root causes do not necessarily have immediate effects. It takes time for problems to take root. Decisions made without due consideration for future effects can be the root cause of current and future "accidents." Such decisions may include:

- cutbacks in preventative 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 preventative maintenance shutdowns
- the use of skeleton crews for maintenance and operations
- increased use of untrained subcontractors

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

16. What Are Root Causes?

The root causes of incidents are the prime factors that underlie the causal factors of an accident. Root causes are sometimes referred to as "basic" causes. There are almost always several root causes involved in an incident, accident or near-miss. For example, the root causes of an electrocution might include improperly designed or maintained equipment, poor lockout procedures or inadequate training. Root causes are always found in safety systems. Effective prevention of similar incidents requires changing safety systems.

Examples of Root Causes

- Poor design of process units and equipment
- Poor layout of control room indicators and controls
- Difficult access to equipment
- Unsafe siting and spacing of process units and equipment
- Lack of preventive maintenance or inspection
- Inadequate procedures or training for both normal and emergency situations
- Excessive overtime
- Inadequate staffing levels
- Human factors

Sources: Mine Safety and Health Administration, *Accident Prevention*, 1990, pp. 35-38; and Center for Chemical Process Safety, *Guidelines for Investigating Chemical Process Incidents*, New York: American Institute of Chemical Engineers, 1992, pp. 129-131.

Summary: Systems of Safety

1. Proactive systems of safety are the key to preventing disasters and injuries.

2. Major systems of safety include:

- design & engineering
- mechanical integrity
- mitigation devices
- warning devices
- training and procedures
- 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 pharmacy may have different structures and names for its systems of safety, but all of our pharmacies have systems of safety.

5. Active worker and union involvement in systems of safety is essential for these systems to be effective.

6. Understanding the hierarchy of systems of safety (design as the primary system) enables workers to become active participants in developing and implementing safe work practices ("training and procedures").

7. The most effective controls of health and safety hazards are those which are integrated or designed into the process such as engineering controls.

Evaluation Activity 1: Systems of Safety

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. Systems of Safety and Sub-Systems (Examples)
	2. OSHA and Systems of Safety		10. Getting to Prevention
	3. The Mechanical Integrity System		11. Systems vs. Symptoms
	4. The Training and Procedures System		12. Proactive vs. Reactive Systems
	5. The Warning System		13. Worker Involvement Creates Strong Systems of Safety
	6. The Design System		14. Finding the Root Cause
	7. The Mitigation System		15. Bad Decisions Today Can Cause Accidents Tomorrow
	8. Understanding Human Factors		16. What Are Root Causes?

continued

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?**

____

____

____

Activity 2: Getting to Recommendations

Purpose

To gain experience in making recommendations for correcting flawed systems of safety.

Task

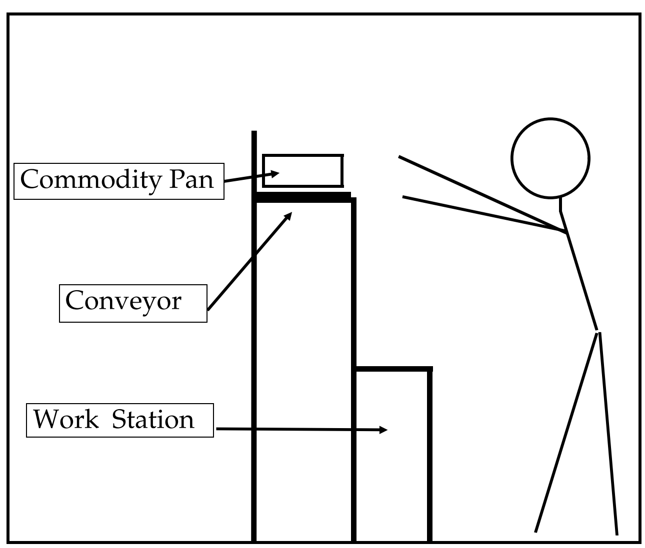
Please read the following scenario and look at the completed logic tree on the next page. Please refer to the factsheets on pages 34 through 41 and, in your groups, answer the questions which follow.

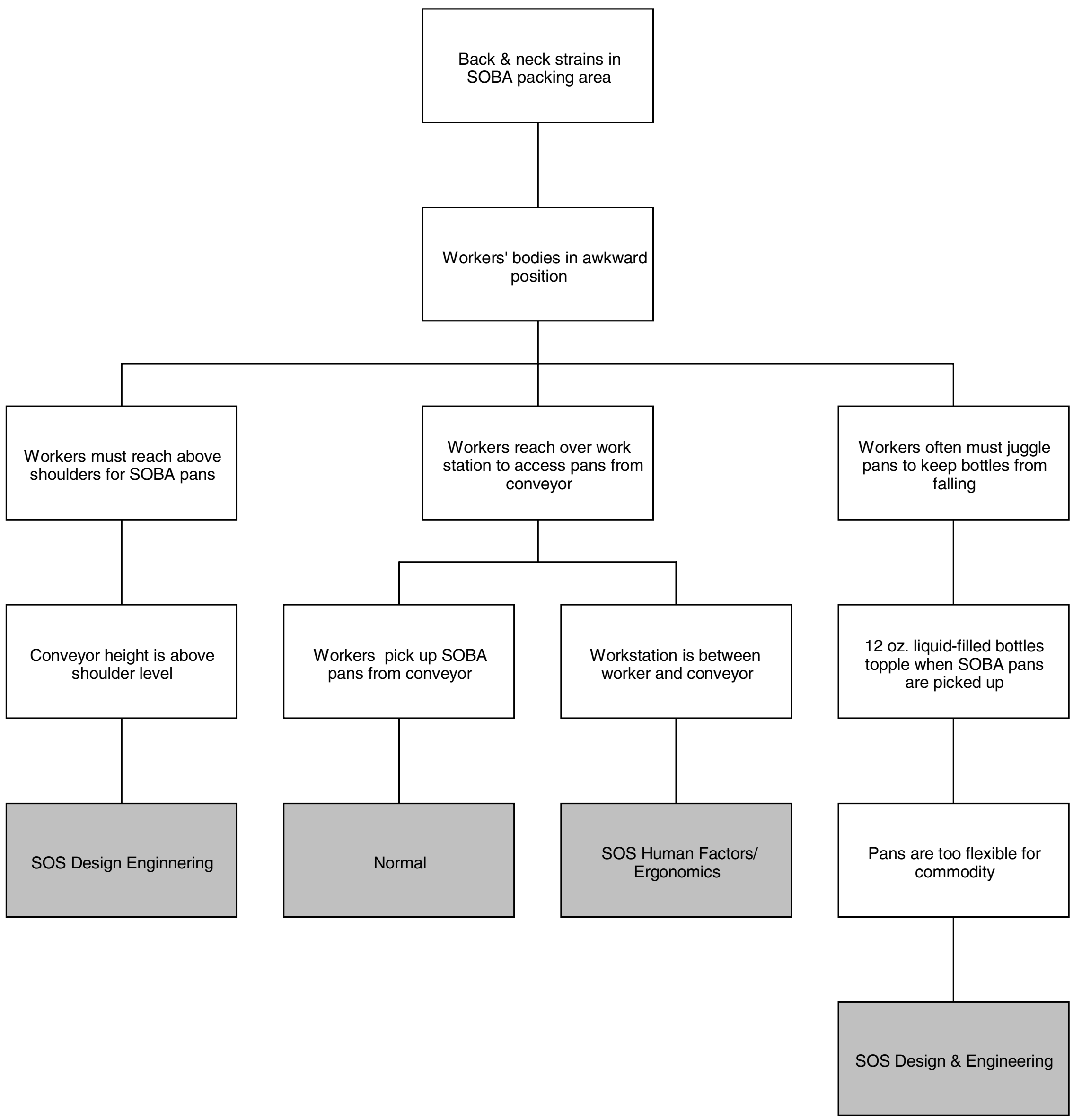
Scenario:
Review of reported employee injuries reflects an unusual number of back and neck strain injuries in the SOBA packing area.

An employee working in SOBA is required to retrieve pans filled with prescriptions ready for packaging. The Joint Health and Safety Committee has been asked to investigate and make recommendations regarding the cause of this pattern of injuries. The Committee has interviewed workers and conducted a walk-through inspection. The following facts are reported.

The SOBA workstation is directly in front of the conveyor belt, which delivers the prescriptions for packaging. Employees reach over the workstation to retrieve pans of prescriptions which may consist of bottles of various sizes including small tablet bottles and larger bottles up to 16 oz. The prescriptions sit in a lightweight plastic tote (pan) with a 1 ½-inch lip. The tote is not sturdy enough to hold the heavier bottles at one end and the lighter bottles at the other.

As employees reach across their workstation and above their shoulders to retrieve pans, the weight of the bottles sometimes cause the tote to flex and the bottles to topple. In the process of juggling the pan to keep the bottles from falling to the floor, the workers will inevitably place themselves in an awkward position resulting in strains to the back and neck.




Back & neck strains in SOBA packing area
Workers' bodies in awkward position
Workers must reach above shoulders for SOBA pans
Workers reach over work station to access pans from conveyor
Workers often must juggle pans to keep bottles from falling
Conveyor height is above shoulder level
Workers pick up SOBA pans from conveyor
Workstation is between worker and conveyor
12 oz. liquid-filled bottles topple when SOBA pans are picked up
SOS Design Enginnering
Normal
SOS Human Factors/ Ergonomics
Pans are too flexible for commodity
SOS Design & Engineering

Task *(continued)*

1. Read factsheet 1 and discuss the logic tree included with the scenario. Do you agree with the Systems of Safety the investigation arrived at? If not, what systems would you substitute or add? Why?

2. What recommendations would your group make to address the flawed systems of safety identified by the logic tree and by your own analysis? Please refer to factsheets pages 34 through 41.

Systems of Safety	Recommendations
1.	
2.	
3.	
4.	

3. Design a system for keeping track of your recommendations. (How would you follow their progress? Would you be responsible? How long would you allow for each recommendation to be completed? How should a negative response to one of your recommendations be handled? etc.)

1. The Logic Tree: a Tool to Identify Flawed Systems of Safety

A logic tree is a graphical way to analyze an incident in order to uncover its true root causes. Beginning with the event to be investigated (the Top Event), the facts leading up to the incident are broken down until a flaw in a system of safety is uncover.

Reading a Logic Tree

To read or follow through a logic tree, begin with the Top Event. We ask the question, "What facts caused or allowed the event to take place?"

For example, in the scenario we would ask, "What facts caused the back and neck strains?" We then insert facts that answer the question in a set in the line below. Looking at the logic tree, we find that our investigation revealed that the injuries were caused by the "workers' bodies being in awkward positions."

The process now repeats itself by asking, "What facts caused or allowed the workers' bodies to be in awkward positions?" This time, the investigation indicated three facts to be responsible. Each is listed separately on the next level and each becomes a new Top Event for further investigation.

The process continues until we reach one of four stopping points:

- A flawed System of Safety (SOS) – our prime objective;
- A case where we need more information to continue (NMI);
- A fact that is considered Normal (i.e., it was cold outside, it was raining, the operator was on the job, etc.);
- A fact that in Non-Correctable (i.e., the unit was running, the oil was hot, etc.).

2. The Do's and Don'ts of Writing Recommendations

Prevention of incidents and accidents requires that actual changes be made in the plant, not just on paper. A hard-hitting investigation can easily be wasted if you lob softballs in writing the recommendations. A major problem in writing investigation recommendations is the use of weak words such as "consider." These words make it easy to resolve recommendations for OSHA compliance on paper without changing anything in the plant.

The DON'Ts

- Do not make vague statements.
- Do not recommend discipline.

The DOs

- Address every root cause.
- Recommend changes in management safety systems, remembering that changes in design, engineering and chemicals provide the highest degree of prevention.
- State the specific actions to be taken.
- Make recommendations that are measurable and trackable.
- Include a timeline for completion of each recommendation.
- Ensure that each recommendation is assigned to an individual to oversee implementation.
- Not all of the recommendations will come directly from your logic tree. Some recommendations will flow from the general findings of the investigation.

Source: Center for Chemical Process Safety, *Guidelines for Investigating Chemical Process Incidents*, 1992, chap. 6.

3. Design Offers the Most Protection

Recommendations should be prioritized based on the reliability of the solution they provide. **The most desirable recommendations are those that will completely eliminate the source or cause of the hazard,** followed by those that will lessen its severity or likelihood.

Hazards might be eliminated by redesigning equipment, changing tools, installing ventilation, or adding machine guards. Hazards might be lessened by installing warning/mitigation systems, improving procedures, using personal protective equipment, and/or improving employee training.

In general, recommendations that can be applied to the job or process are better than those that are applied to individuals. Take, for example, an incident involving exposure to dust on a job process. A filtration or ventilation system (correction applied to the process) eliminates the hazard for everyone in the area, even visitors or unauthorized people who wander through. Requiring personal respirators (correction applied to the individual) affords protection for only those who wear them. Even then, the protection they provide to the individual is dependent upon several factors such as proper fit, experience and training.

Source: Job Hazard Analysis. OSHA Publication 3071, 1992 (Revised). ISBN 0-16-038038-3.

4. Tracking Recommendations

Once recommendations are made, it is important that their progress is tracked. This is most easily handled by placing one group such as the Joint Health & Safety Committee in charge of tracking progress.

A Recommendation Log can be a useful tool, especially if there are several recommendations to track. An example log is shown below.

JH&SC Recommendation Log

Project #	Recommendation	Assigned To:	Date Assigned	Projected Completion
Baker 1-3	Install ceiling dust collectors	J. Reynolds, Maint. Planner	6/10/98	9/10/98
Baker 1-7	Revise procedures to reflect newly installed equipment	S. Palmer, Production supervisor	6/10/98	6/17/98
Conveyor 08-1	Install guarding at east end of belt	B. Miller, Engineering	6/12/98	8/12/98
Warehouse 1-1	Repaint traffic markings on loading dock	T. Smith, General Services	6/16/98	6/30/98
Warehouse 1-2	Train forklift operators on DOT shipping regulations	D. Hendricks, Training Super.	6/16/98	6/30/98

Typically, the person assigned to the project is required to give a progress report to the committee monthly (or at shorter intervals if deemed necessary). If the recommendation is turned down or an alternative is sought, support and documentation for that decision must be presented to the committee.

5. The Study of Work

The term ergonomics has been thrown around our industry a lot lately, but what does it really mean? Basically, ergonomics is the science of fitting the job to the worker. More specifically, Industrial Ergonomics deals with interactions between people, machines, and the work environment. Ergonomics is the study of work-designing the job to fit people. Think about that for a minute. How many ways do you interact with machines and equipment on your job? Dozens? Hundreds?

Too often, workers are required to "fit the job." We are told to lift heavy loads, use awkward postures, do repetitive tasks and other factors that can lead to sprained muscles, inflamed tendons and damaged nerves.

By using ergonomic principles to properly design the work environment, we can do our jobs without disabling aches and pains.

Source: Marjorie Werrel and Zachary H. Koutsandreas, "Ergonomics: A Good Place to Start," *Occupational Hazards*, September 1997.

6. How to Select Ergonomic Controls

1. Identify the desired outcome:
What risk factors are you trying to reduce/eliminate?

2. List all possible controls:
There are usually several solutions to the same problem. Brainstorm and list all possible interventions. At this point, no idea is wrong. The list should be based on the results of your risk factor checklist.

3. Select controls for trial implementation:
Evaluate the ideas on your list to find those most effective and appropriate for your facility. You may even want to develop two lists, one for immediate but perhaps temporary action, another for a long-term approach to solving the problem.

Some factors to take into account:

- which risk factors will this control reduce or eliminate?
- will this control eliminate/reduce ergonomic risk factors for all effected employees?
- how long will it take to implement controls?
- is the control feasible from an engineering standpoint?
- how much will the control cost?
- how much is saved by eliminating these ergonomic-related injuries?
- how much training will be required after implementation?
- will the bargaining agreement be affected?
- what level of worker acceptance do you expect?

Source: *Ergonomics Awareness Training: Job Design with the Worker in Mind*, The Oil, Chemical and Atomic Workers International Union, 1995.

7. It All Adds Up

Most work injuries are classified as acute injuries – meaning they result from an incident which can be easily identified (i.e., a worker carries a heavy bucket which slips out of his hand and injures his toe).

But repetitive strain injuries are cumulative, occurring over a long period of time. This sometimes makes it difficult to uncover their real cause.

For example, a worker routinely carries a heavy bucket in her job as a sampler. Gradual damage to the tissues in her shoulder occur, but she hardly notices, except for some soreness. Finally at home one evening, she reaches for an object on the top shelf in her closet and has excruciating pain in her shoulder and immediate loss of motion.

<table>
<tr><th>Most Common Body Parts Affected:</th><th>Most Likely Caused By:</th></tr>
<tr><td>• Back
• Wrists
• Shoulders
• Elbows
• Neck
• Hands</td><td rowspan="3">• Fast work pace

• Repetition (performing the same task or movement over and over)

• Awkward or fixed posture (working in an awkward position such as reaching overhead or holding the same position for a long time)

• Forceful movements (pushing, pulling or heavy lifting)

• Vibration (often caused by tools)

• Working in cold temperatures

• Inadequate rest breaks</td></tr>
<tr><th>RSI Symptoms:</th></tr>
<tr><td>• Soreness
• Weakness
• Stiffness
• Tenderness
• Swelling
• A burning sensation
• Tingling
• Numbness
• Decreased coordination</td></tr>
</table>

8. Systems of Safety and Sub-Systems (Examples)

Safety Systems	**Design & Engineering**	**Mechanical Integrity**	**Mitigation Devices**	**Warning Devices**	**Training & Procedures**	**Human Factors**
Type of Prevention	Primary	Secondary	Secondary	Secondary	Secondary	Secondary
Safety Sub-Systems	Codes, Standards Guidelines Process Hazards Analysis (PHA) and Management of Change (MOC) Safe Siting Chemical Substitution Communication Devices	Inspection Vibration Monitoring Preventive Maintenance Parts Quality Control Turn-around Frequency	Relief Valves Diking & Drainage Shutdowns & Isolation Devices Check Valves Fire Suppression Devices	Monitors Process Alarms Facility Alarms	Operating Manuals Process Safety Information Operating Procedures Permit Programs Emergency Response Planning & Training Pre-Startup Review Refresher Training As Low as Reasonably Achievable (ALARA) Information Resources Communications	Ergonomics Worker/ Equipment Interface Overtime Behavior Staffing Buddy System Workload Noise Temperature Ventilation Personal Protective Equipment Stress Illumination Shift Schedule

Summary: Recommendations

1. Recommendations should address every root cause of an incident.

2. Make recommendations that are measurable and trackable.

3. Assign responsibility for recommendations to individuals and require periodic updates to be reported to the Joint Health & Safety Committee.

4. Recommendations that completely eliminate a hazard are the most powerful.

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 Logic Tree: a Tool to Identify Flawed Systems of Safety		5. The Study of Work
	2. The Do's and Don'ts of Writing Recommendations		6. How to Select Ergonomic Controls
	3. Design Offers the Most Protection		7. It All Adds Up
	4. Tracking Recommendations		8. Systems of Safety and Sub-Systems (Examples)

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point			
1.	2.	3.	4.

4. What would you suggest be done to improve this Activity?

____

____

____

Activity 3: Tackling Toxic Chemical Myths

Purpose

To help us see through the common myths about the health impact of toxic chemicals at the workplace.

Task 1

Assume you've been asked by the Joint Health & Safety Committee 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 45 through 56 and try to **refer to at least one factsheet** when you present your response.

Statement:

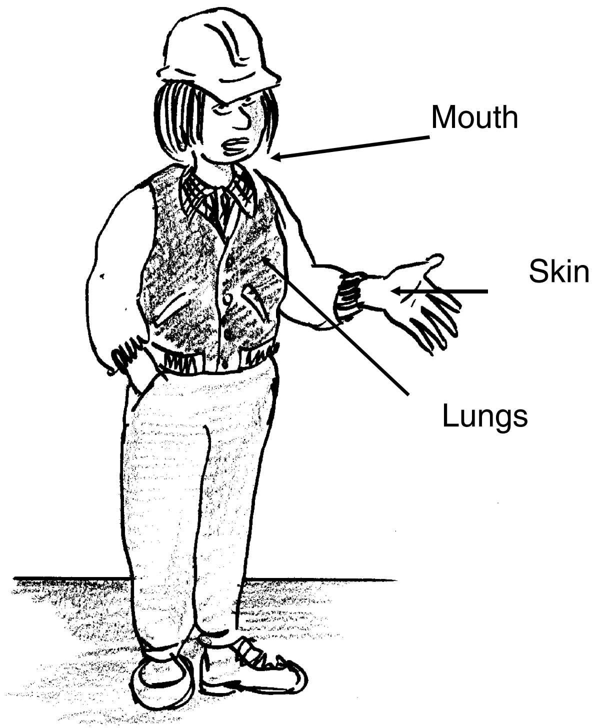
> "The danger of these chemicals is overstated. If you use your nose to warn you and don't breathe the stuff, it won't harm you. Of course, you must respect acids and avoid them. They can blow your lungs away.
>
> "I don't buy this panic about cancer. I know some people who got cancer but they never even worked with chemicals. I also know people who work with chemicals and haven't gotten cancer.
>
> "It's obvious that 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 three 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

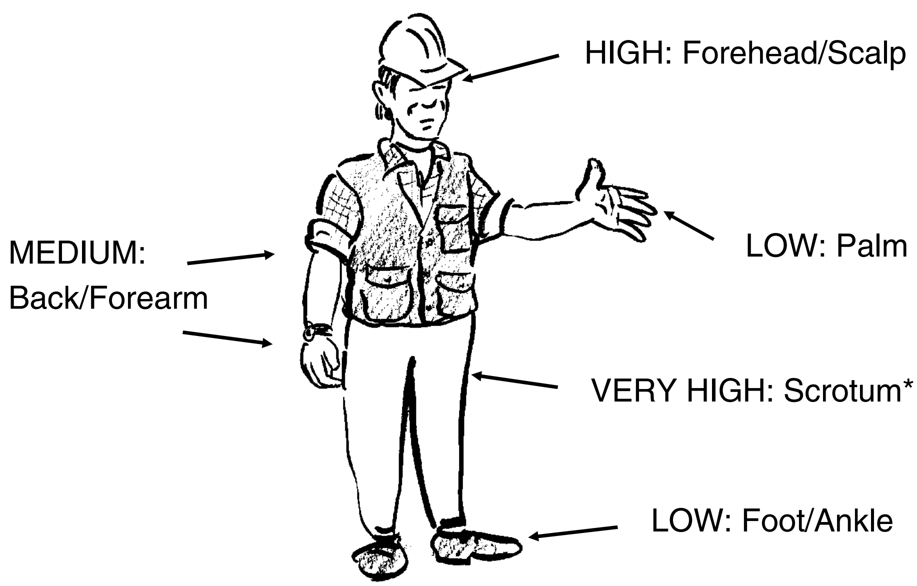


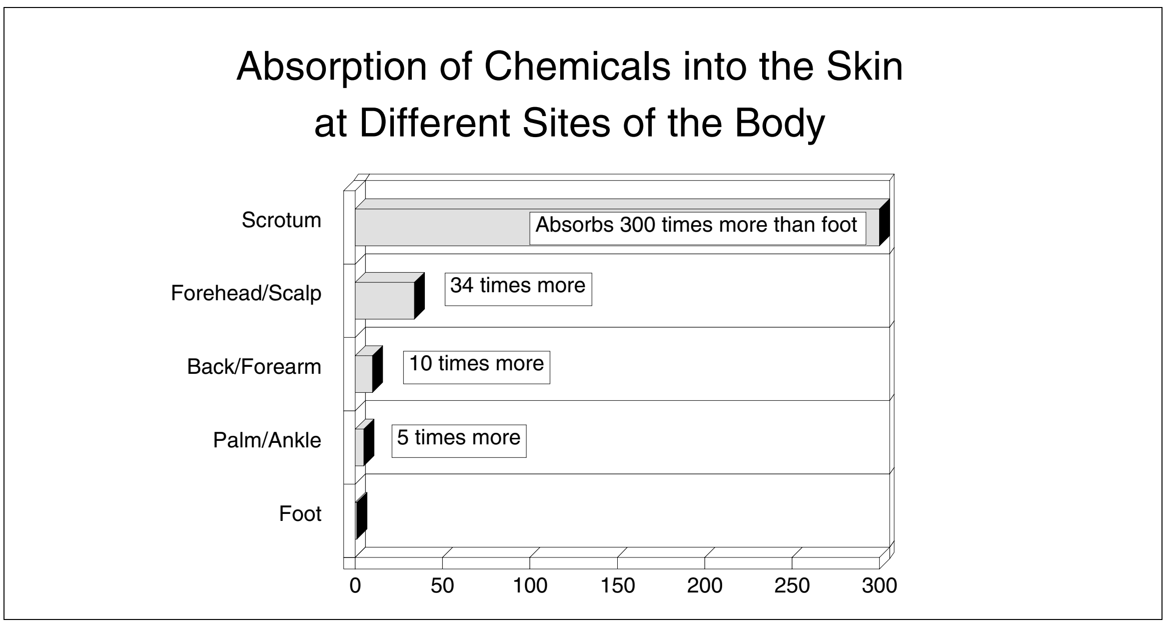
Direct Contact = Surface
Some chemicals burn or irritate the skin or eyes on contact, causing damage on the surface. Dermatitis (inflammation of the skin) and conjunctivitis (inflammation of the eye membrane) are two examples. Many acids – such as liquids or vapors – can burn the skin or eyes.

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.)





Source: E. Hodgson and P.E. Levi, *A Textbook of Modern Toxicology*, NewYork: Elsevier, 1987, pp. 34-35.
**For men (studies of female workers yet to be done).*

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, some dangerous chemicals are odorless, such as carbon monoxide. No one's 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. For example, if 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, the body must be exposed to a sufficient dose of the chemical.

"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.

The body can react to the dose of a toxic substance in two ways:

- The body may have a reaction to any dose, no matter how small. This type of response may occur with exposure to cancer-causing chemicals and cancer-causing physical agents, such as radiation.
- A certain level of dosage must be present before there is a bodily response. This type of response is found with most toxic chemicals (but not with 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 reaction has caused occupational fatalities.

5. The Short and Long of It

Disease can occur quickly after exposure to toxics, or it can take years to develop. The two words that describe this are **acute** and **chronic.**

Acute Effects
"Acute" 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 immediately.
- Caustic soda corrodes the skin. It burns. You know it immediately.
- Carbon monoxide binds up your red blood cells. It acts almost immediately, and if enough red blood cells are bound, you may die.

Chronic Effects
"Chronic" 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 both chronic and acute effects.
The differences are caused by the amount of the dose. High doses generally cause acute effects. Low doses absorbed 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 Known to Cause Cancer in Humans

Although we're 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 cause cancer in humans. In addition, 200 to 300 chemicals are suspected of causing cancer. (The list below includes only known human carcinogens.) Sadly, science found out about these carcinogens from workers who already experienced the terrible impact of these substances.

Known Human Carcinogens

- Aflatoxins
- 4-Aminobiphenyl
- Analgesic Mixtures Containing Phenacetin
- Arsenic and Certain Arsenic Compounds
- Asbestos
- Azathioprine*
- Benzene
- Benzidine
- Bis (Chloromethyl) Ether and Technical Grade Chloromethyl Methyl Ether
- 1,4-Butanediol Dimethylsulfonate (Myleran)*
- Chlorambucil*
- 1-(2-Chloroethyl)-3-(4-Methylcyclohexyl)-1-Nitrosourea (MeCCNU)
- Chromium and certain Chromium Compounds
- Conjugated Estrogens*
- Cyclophosphamide*
- Diethylstilbestrol*
- Erionite
- Melphalan*
- Methoxsalen with Ultraviolet A Therapy (PUVA)*
- Mustard Gas
- 2-Naphthylamine
- Radon
- Thorium Dioxide
- Vinyl Chloride

Manufacturing Processes and Mixtures of Chemicals Known to Cause Cancer**

- Aluminum Production
- Auramine Manufacture
- Boot and Shoe Manufacture and Repair
- Certain Combined Chemotherapies for Lymphomas*
- Coke Oven Emissions
- Furniture Manufacture
- Hematite Underground Mining
- Isopropyl Alcohol Manufactured by the Strong Acid Process
- Nickel Refining
- Painter (occupational exposure)
- Rubber Manufacture (certain occupations)
- Soots, Tars, and Mineral Oils

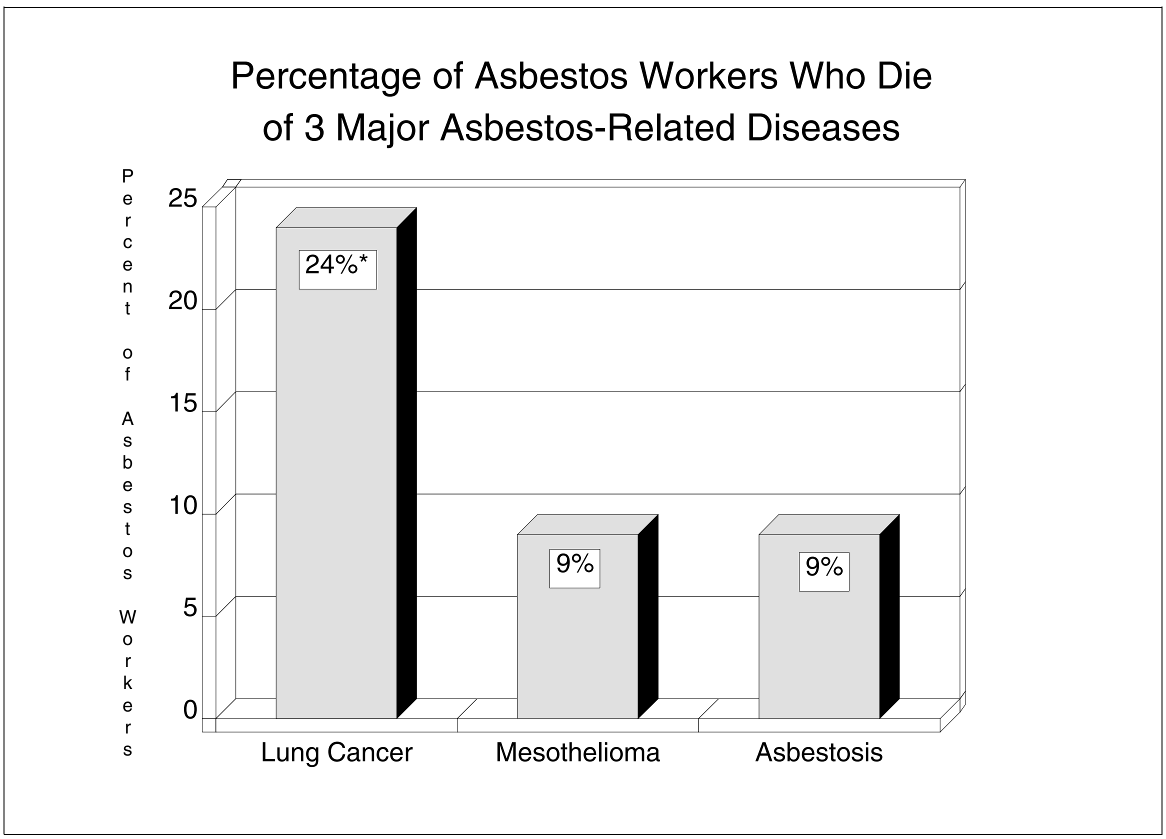
Source: U.S. Department of Health and Human Services, National Toxicology Program, *Seventh Annual Report on Carcinogens*, Research Triangle Park, NC: NTP, 1994.

*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 to be human carcinogens.

7. The Odds of Getting Disease

While humans are all pretty much the same, we're quite different as individuals. For example, if a large group is exposed to a large dose of a toxic chemical, not all of us will develop disease. We do know that such an exposure will cause some of us disease, but there's really no way of knowing who will become sick.

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 52). **But not all asbestos workers get these diseases.** The chart below shows the incidence of these diseases in asbestos workers between 1967 and 1986.



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

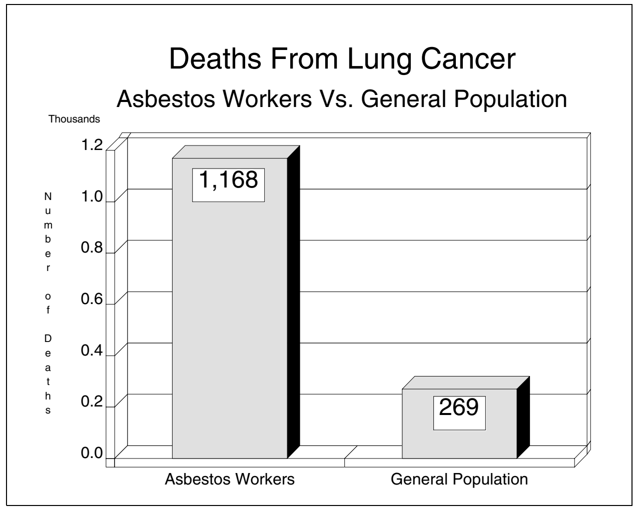
Source: I. J. Selikoff, "The Third Wave of Asbestos Disease: Exposure to Asbestos in Place, Public Health Control," *Annals of the New York Academy of Sciences*, vol. 643, 1991.

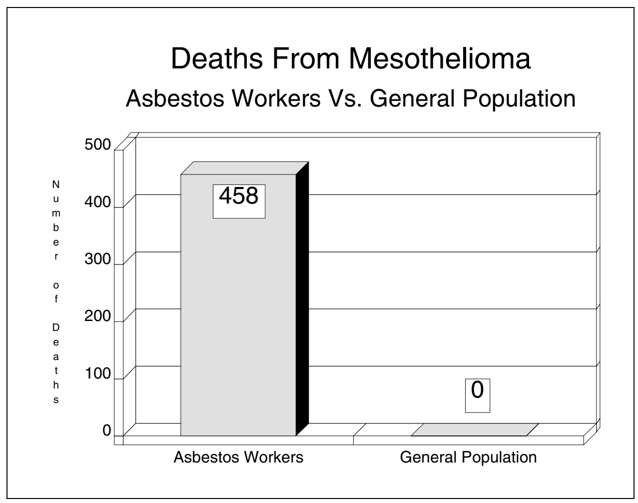
8. How Do We Know When a Toxic Substance Really Causes Human Disease?

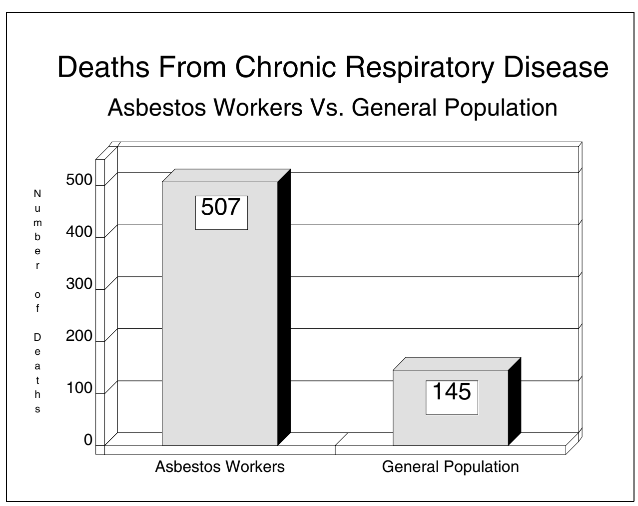
It is true that in most cases people who aren't exposed to workplace toxic chemicals develop the same kinds of cancers as workers who are exposed to carcinogens. But the numbers are very different. When we say something is a human carcinogen, we know that exposed workers suffer more cases of a particular kind of cancer than we would find in the population at large. In fact, this is how scientists "prove" that something is a human carcinogen. They study groups of **exposed** workers and groups of people **not exposed** but whose habits 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 studies this is called **epidemiology**.

These 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.

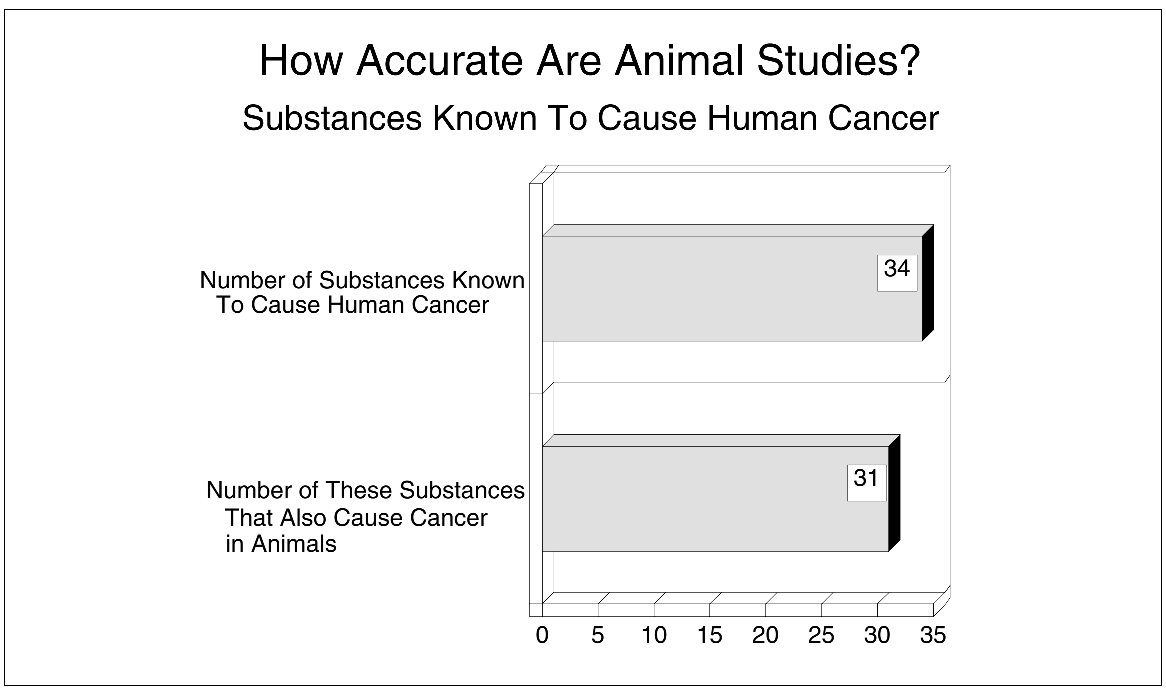






9. Do Animals Tell the Truth?

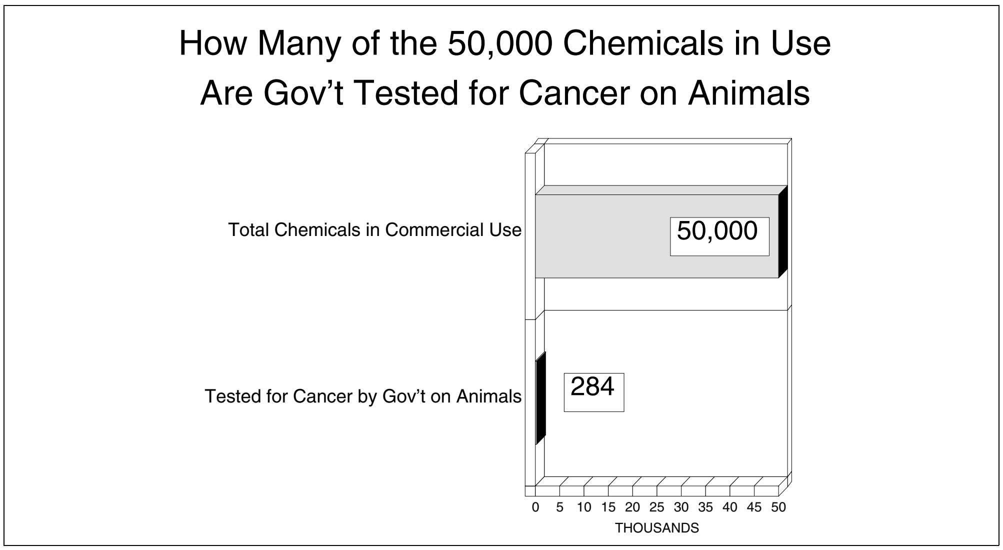
There are some pretty good indications that substances that cause cancer in animals cause cancer in people, too. From human studies, scientists have learned that 34 substances are now known to cause cancer. 31 of these also cause cancer in animals. The remaining three may also cause cancer in animals – adequate studies just haven't been done yet. (200 to 300 other chemicals are suspected to cause cancer in humans.) Animals are given large doses but only so that the cancer will appear more rapidly. Large doses in themselves don't cause cancer. For example, if an animal receives large doses of a safe substance, it won't contract cancer.

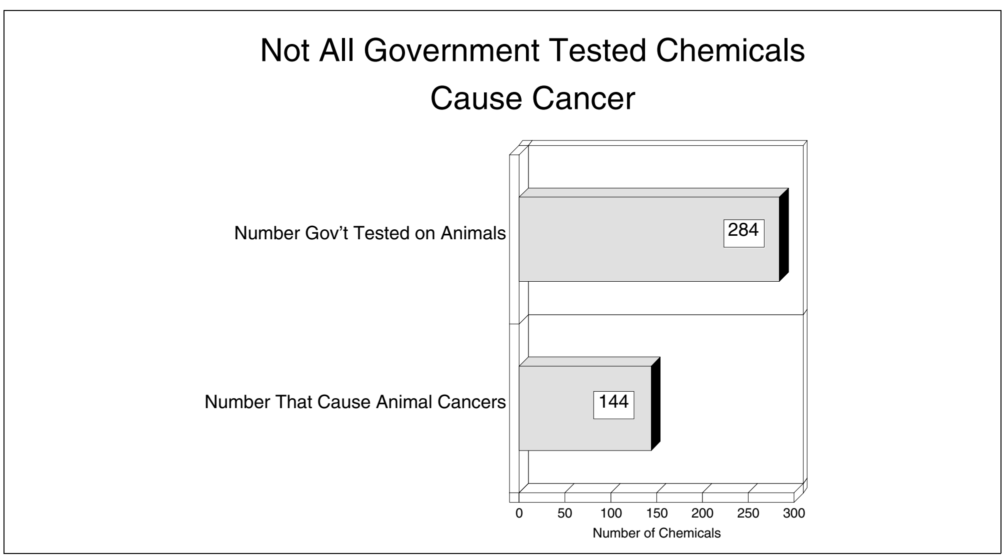


Source: David P. Rall, "Carcinogens and Human Health: Part 2," *Science*, January 4, 1991, p. 10.

10. What We Don't Know May Hurt Us

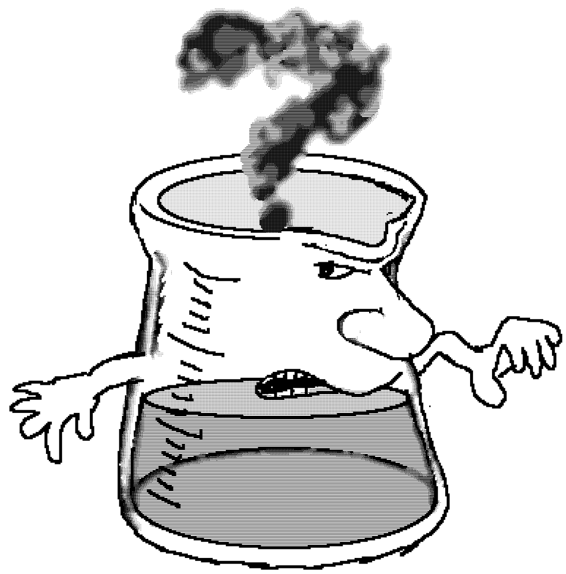
The vast majority of chemicals in use by humans have not even been tested on rats. The U.S. Congress's Office of Technology Assessment reviewed the evidence on identifying cancer-causing chemicals in 1987. **They found that of the more than 50,000 chemicals in commercial use, only 284 had been tested 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.**

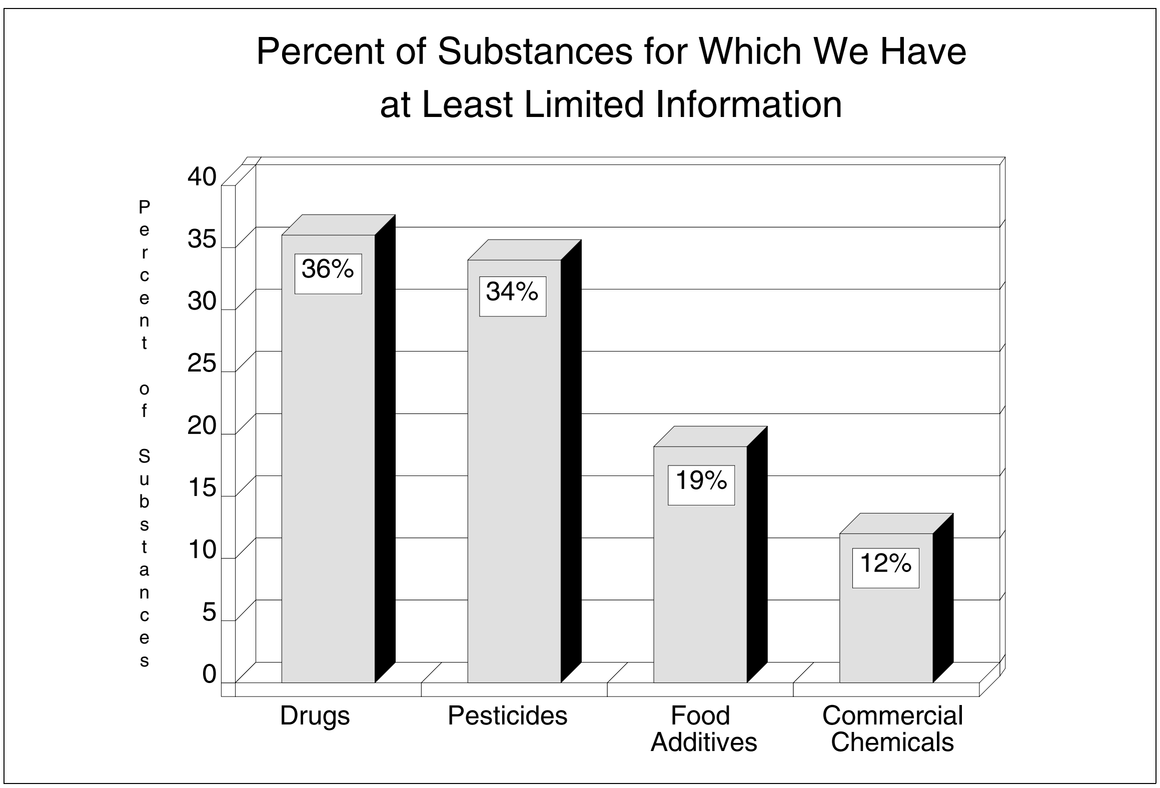




Source: U.S. Congress, Office of Technology Assessment, *Identifying and Regulating Carcinogens,* OTA-BP-H-42, Washington, DC: U.S. Government Printing Office, November 1987, p. 18.

Unfortunately, we produce chemicals first and ask questions later. The chart below shows that when it comes to health and safety, we only know about a relatively small number of chemicals. The chart refers to the percent of chemicals of different types about which science has any health and safety information at all.

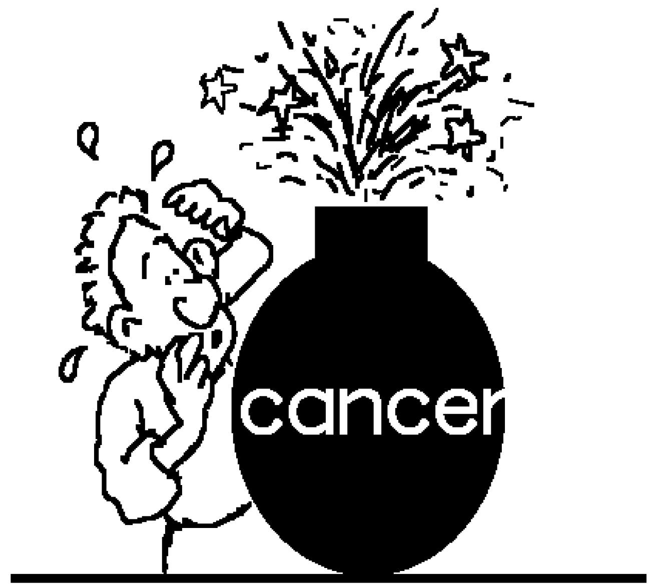


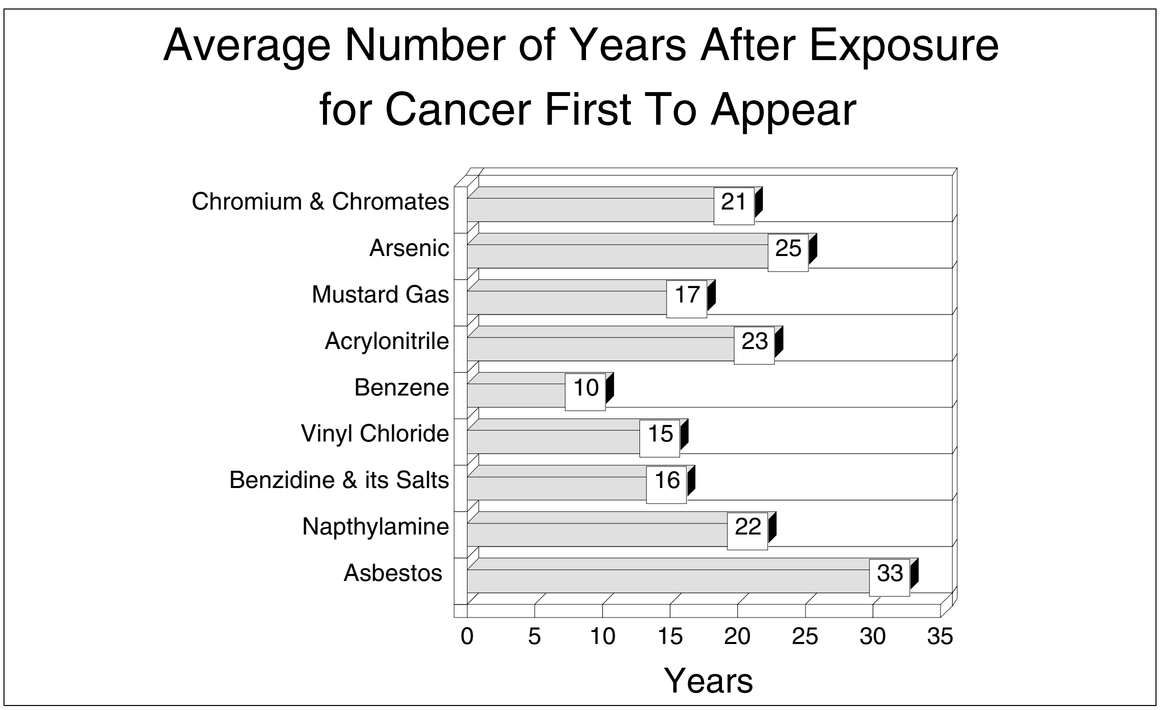


Source: *Toxicity Testing – Strategies to Determine Needs and Priorities*, National Research Council, 1984.

11. Exposure + Time = Cancer

It's a big mistake to believe that all is well if you've been exposed for many years and have no symptoms. The sad fact 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 develop it the very next year. The time cancer takes to show up is called the latency period. The chart below shows some of the latency periods for different carcinogens.





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

Task 2

In your groups, please evaluate the statement below and prepare a response. Again, review the factsheets on pages 59 through 63 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?

12. The Strengths and Limitations of Modern Medicine and Science

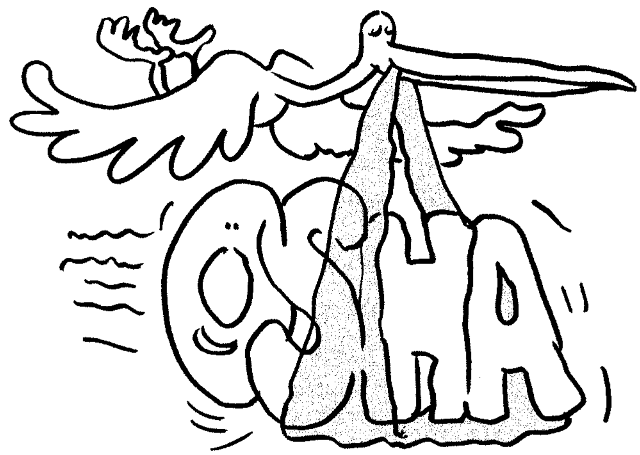
Modern medicine has the ability to detect some diseases early (see the list on the left, below) and to cure and control them. However, many serious occupational diseases cannot be treated at all (see list, right side). Even if tests are used to detect the disease early, by the time the disease shows up on the test, nothing can be done to reverse the disease. 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 usually *cannot* be reversed even when detected early
Bladder Cancer	Asbestosis
Colon Cancer	Lung Cancer
Asthma	Leukemia
Cotton Dust Disease	Silicosis

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.

13. 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). Although the word "government" is in the title, 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 the standards were challenged and removed in court in the basis that OSHA did not follow proper procedures. The standards currently in effect are from the 1968 ACGIH TLVs. These cover only approximately 425 substances of the tens of thousands in use 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.

14. 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 the case study below.

The Benzene Story

1974	When disturbing levels of leukemia appeared among Ohio tire builders who were 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 a 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.

15. Safety and the ALARA Principle

The goal of health and safety programs should not be minimum compliance. For example, a good workplace safety committee does not settle for keeping exposures to harmful chemicals just a hair below the permissible exposure limits. An effective safety committee aims to reduce harmful exposures to the lowest possible level.

The question that comes up is "how far do we go to eliminate hazards?"

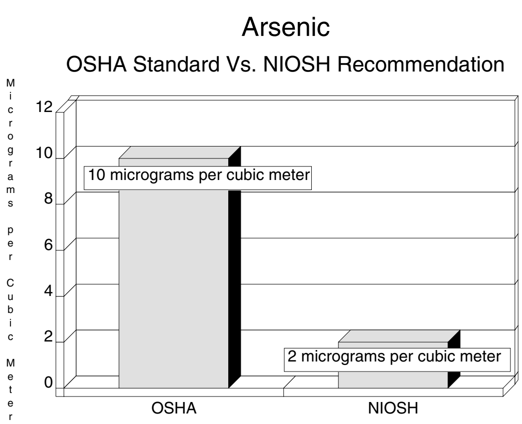
The U.S. Department of Energy (DOE) uses a principle for eliminating radiation exposure hazards called ALARA, as low as reasonably achievable. DOE policy states that compliance with minimum rules for radiation exposure is insufficient. The DOE mandates that workplaces are designed and operated in a manner that limits exposures to the lowest levels that are reasonably achievable. We should expect no less for our own facilities.

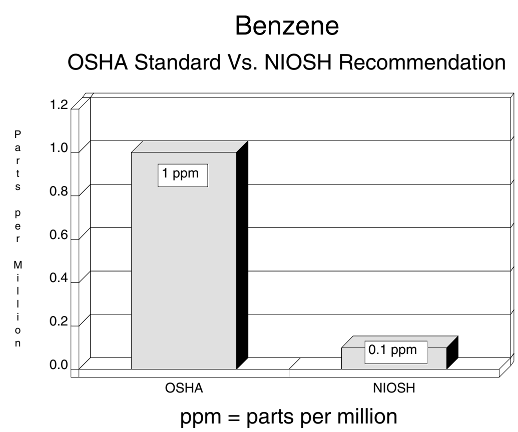
The ALARA principle is a good guideline for the PACE/MMRx safety teams to use when deciding how far to go to protect the health and safety of its employees. **The workplace should be designed as safe as reasonably achievable. For example, the installation of state-of-the-art pill dust collectors over the dispensing bakers can be an effective way of reducing exposures. It may cost more money, but this is a far more "reasonable" approach than to rely on mere compliance with minimum standards to protect workers' health and safety.**

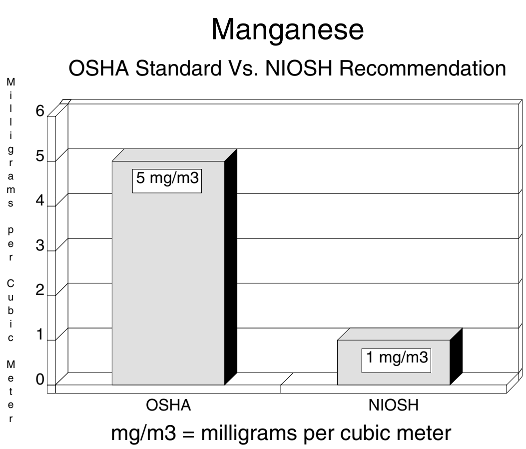
Source: U.S. Departament of Energy Order 5480.1

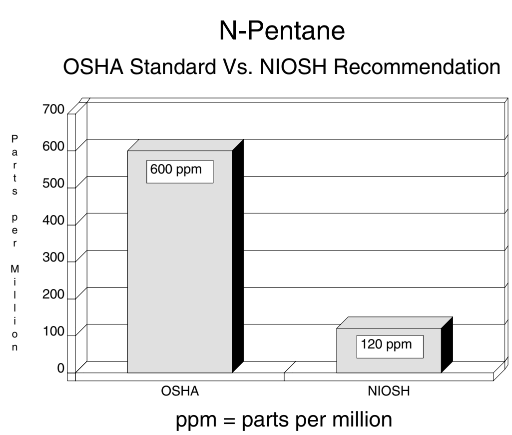
16. How and Why NIOSH and OSHA Differ

NIOSH (National Institute for Occupational Safety and Health) 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 within OSHA standards, we still may be receiving deadly exposures.**





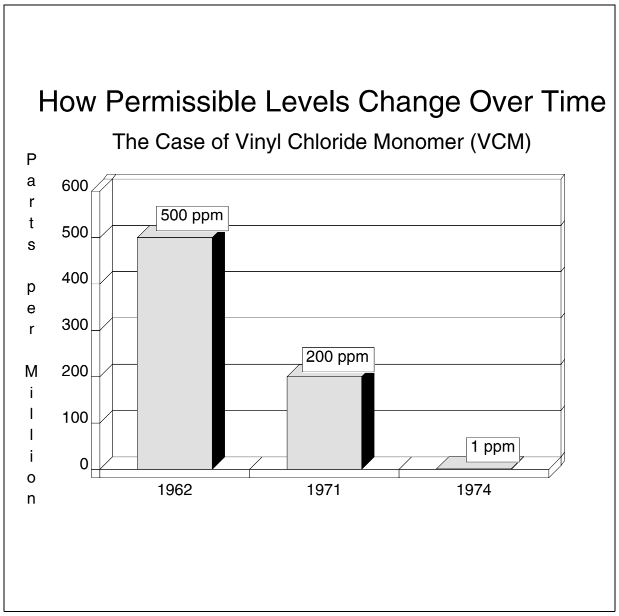




Source: U.S. Department of Health and Human Services, *NIOSH Pocket Guide to Chemical Hazards*, June 1990.

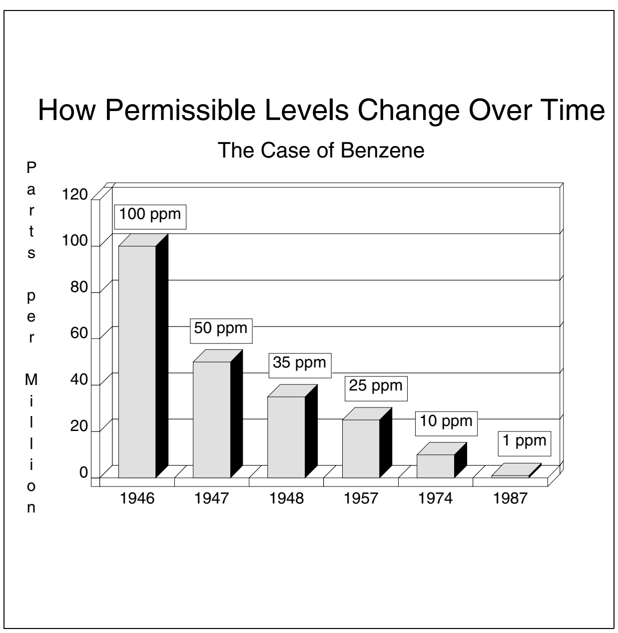
17. Safe Today, What About Tomorrow?

Unfortunately for us, **there is no proof that there are any safe levels of exposure to chemicals known to cause cancer.** The history of "safe levels" shows us that, as more scientific knowledge is gathered, **lower levels may be 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 showed that PVC hurt the liver, bones and kidneys. This 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. **Absorption through the skin is often ignored, but this can be a dangerous route of entry into the body.**

2. With many toxic chemicals, **disease only appears a long time after our exposure to them.** This latency period may give us a false sense of security when we work with very dangerous toxic chemicals.

3. It's true that not everyone who gets exposed to a toxic chemical becomes 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. Use of the **ALARA** principle is a good guideline for the Joint Health & Safety Committee. All health and safety risks should be kept **as low as reasonably achievable.**

5. **Not all chemicals cause cancer, neither in animals nor 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 about which chemicals might cause cancer in humans. **The alternative to animal studies is to wait until human exposure results in disease**. By that time, millions may have been exposed.

8. **Most carcinogens are not regulated properly.** The official OSHA standards do not universally protect us from getting cancer. In many cases the OSHA standard is too high to ensure adequate protection. **Even if your exposure level is below OSHA standards, you may still be exposed to very dangerous levels of cancer-causing chemicals.**

Source: This summary was written by Dr. Steven Markowitz, Mt. Sinai School of Medicine.

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		10. What We Don't Know May Hurt Us
	2. Absorption of Toxic Chemicals by Your Body		11. Exposure + Time = Cancer
	3. Your Nose Doesn't Always Know		12. The Strengths and Limitations of Modern Medicine and Science
	4. Dose and the Body's Response		13. How OSHA Health Standards Were Born
	5. The Short and Long of It		14. How OSHA Standards Are Changed
	6. Some of the Chemicals Known to Cause Cancer in Humans		15. Safety and the ALARA Principle
	7. The Odds of Getting Disease		16. How and Why NIOSH and OSHA Differ
	8. How Do We Know When a Toxic Substance Really Causes Human Disease?		17. Safe Today, What About Tomorrow?
	9. Do Animals Tell the Truth?		

continued

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?**

___

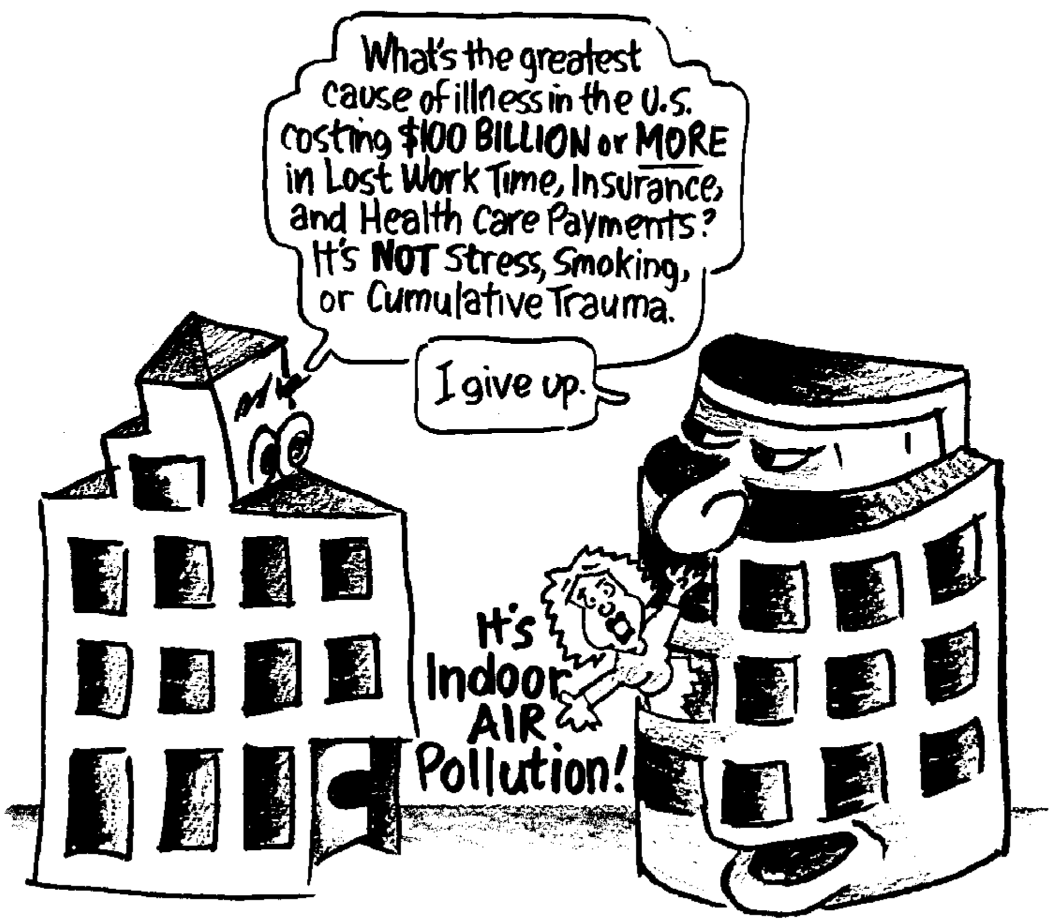
___

___

Activity 4: Indoor Air Quality Problems in Our Facilities*

Purpose

To explore the problems associated with indoor air, to discuss the range of strategic options for improving air quality in our facilities, and to develop a local plan of action. This activity has three tasks.



* This Activity was originally created with a grant from the New York State Department of Labor Occupational Safety and Health Training and Education Program.

Task 1

In your small group, please discuss the following questions. Jot down some notes on what you discuss. Select one person to present a brief summary of your discussion to the whole group.

What concerns do you and your co-workers have about the air quality in your facility?

1.

2.

3.

4.

5.

Task 2

Your group is asked by the Joint Health & Safety Committee to respond to the statement below made by a management consultant to PharmChem.

Statement:

> "Forgive me for differing with the common wisdom, but I just don't believe that indoor air is a serious health and safety issue. People just like to complain about life's minor ailments and they are looking to blame something or someone. It's okay to complain, but don't expect us to take it all that seriously. After all, what we have here is a clean, state-of-the-art prescription filling facility, not a chemical factory."

What's your response? Please review the factsheets on pages 68 through 81 and try to use at least one in your response.

1. The EPA Definition

The Environmental Protection Agency (EPA) is the federal government agency concerned with matters of the environment. It conducts research and development and advises the government on policy directions for the environment.

What is indoor air pollution?

Indoor air pollution has two terms associated with it: "sick building syndrome" (SBS) and "building-related illness" (BRI).

Sick building syndrome (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in the building, but no specific illness or cause can be identified. Complaints may be localized in a particular room or zone or may be widespread throughout the building. Most of the complainants report relief after leaving the building.

Symptoms of SBS include the following:

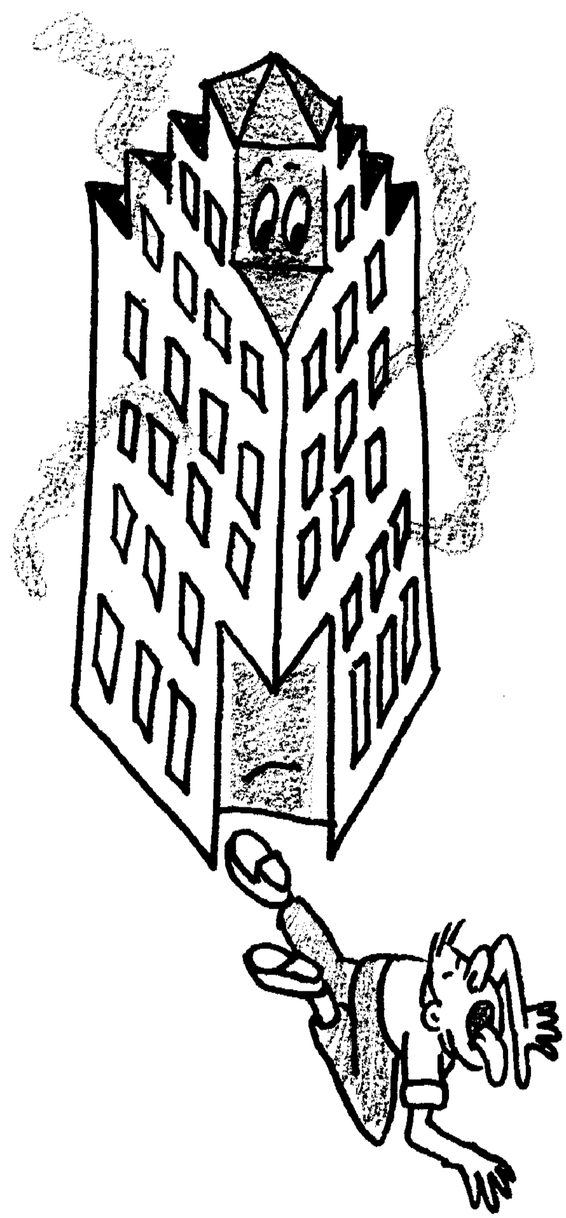
- headache
- eye, nose, or throat irritation
- dry cough
- dry or itchy skin
- dizziness and nausea
- difficulty in concentrating
- fatigue
- sensitivity to odors

Source: Environmental Protection Agency, "Sick Building Syndrome," *Indoor Air Facts No. 4* (revised), Washington, DC: EPA, April 1991.

Building-related illness (BRI) is the term used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. The symptoms can be clearly defined and have clearly identifiable causes. Complainants may require prolonged recovery times after leaving the building.

Symptoms of BRI include the following:

- cough
- chest tightness
- fever
- chills
- muscle aches



2. The ASHRAE Definition

ASHRAE is the American Society of Heating, Refrigeration and Air-conditioning Engineers, Inc. It is a technical society of some 50,000 members concerned with the technical means for conditioning the indoor air environment.

What is indoor air pollution?

Among the many environmental health issues* associated with indoor air quality is the sick building syndrome. The term "sick building" is used to describe a building in which a significant number **(more than 20 percent)** of building occupants report illness perceived as being building-related. This phenomenon – also known as "sick building syndrome" – is characterized by a range of symptoms including, but not limited to:

SBS Symptoms:

- eye, nose, and throat irritation
- dryness of mucous membranes and skin
- nose bleeds, skin rash
- mental fatigue, headache
- cough, wheezing
- hoarseness
- nausea, dizziness

*The other environmental health issues associated with indoor air quality are indoor combustion, volatile organic compounds (VOC), airborne allergens and pathogens, formaldehyde, radon, asbestos and carbon dioxide.

Source: Indoor Air Quality Position Statement, February 2, 1989, and the Indoor Air Quality Position Paper, August 11, 1987, of ASHRAE.

3. What Is the Difference Between SBS and BRI?

SBS (Sick Building Syndrome)

SBS is used to describe acute health and comfort effects experienced by workers in which no specific cause can be identified.

It is the common term for a condition characterized by headaches; eye, nose, throat and respiratory tract irritation; fatigue; coughing; nausea; dizziness; dermatitis; difficulty concentrating; and muscle pain. These symptoms diminish when the worker leaves the building.

BRI (Building-Related Illness)

BRI is the common name for infections or allergic responses (or poisonings) due to organisms (or chemicals) which grow or accumulate in buildings.

Building-related illnesses are distinguished from SBS by objective findings including hypersensitivity pneumonitis, asthma, and various infections. These are frequently related to humidification systems or other components of temperature control. BRI complaints occur in settings which also have high complaint rates consistent with SBS.

It may be possible that SBS is a precursor of BRI – this means that if SBS symptoms are not mitigated, the problems may continue to intensify until BRI occurs.

Sources: "Is Your Job Making You Sick?" a CLUW (Coalition of Labor Union Women) handbook on workplace hazards, 1991; "The Sick Building Syndrome: Where is the Epidemiologic Basis?" *American Journal of Public Health*, Vol. 80, No. 10, October 1990; James Woods, "Cost Avoidance and Productivity in Owning and Operating Buildings," in J. Cone, M.J. Hodgson, eds., *Problem Buildings: Building-Associated Illness and the Sick Building Syndrome*, pp. 753-755, Vol. 4 of *Occupational Medicine State of the Art Review 1989*.

4. What Are Some of the Sources of Indoor Air Pollution?

Poor indoor air quality can be traced to many sources, including equipment, furniture, carpeting and construction materials. Buildings are often designed or renovated without attention to ventilation, resulting in sealed windows, blocked vents, and a general lack of fresh air.

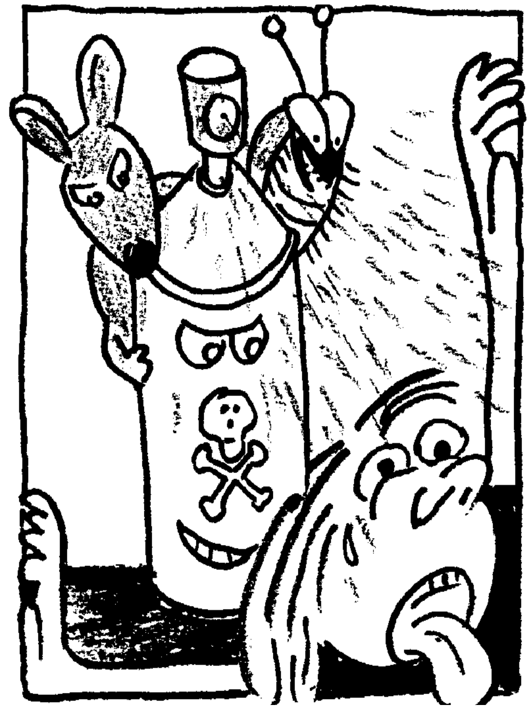
Office equipment such as the photocopier may give off ozone, which irritates the eyes and the respiratory tract, causes headaches, and has been shown to cause adverse genetic effects. Also, ink toner in photocopying machines may contain toxic substances and carcinogens.

Renovations and new furnishings may pollute indoor air. A variety of solvents are used in roofing, painting, and renovation work and can cause dry skin, respiratory irritation, headaches, fatigue and, with higher exposure, dizziness and nausea.

Formaldehyde, one of the most common pollutants in office buildings, may be found in furniture, new carpets, particle board, and plywood. These materials may emit formaldehyde which can cause irritation of the eyes and respiratory system. High doses may cause cancer.

Custodial and maintenance work involves the use of such chemicals as ammonia, solvents, paint strippers and cleansers which are associated with indoor air problems. These substances may cause respiratory irritation, chronic lung disease, and eye irritation. These chemicals can easily spread through the ventilation system, putting everyone in the area at risk.

Source: NYCOSH factsheet, “Indoor Air Pollution,” November 1990.



One particularly dangerous group of toxic substances is **pesticides.** These highly toxic substances can remain in the air long after being sprayed. Many are known to cause cancer and birth defects, to irritate the skin, eyes, and lungs, and to affect the nervous system (causing headaches, dizziness, nausea and muscle and nerve damage).

Dampness or standing water in the ventilation system can breed microorganisms (fungi, bacteria, or protozoa) which can be dispersed throughout the building. Microorganisms can cause allergic reactions, infections (like Legionnaire's Disease), and can contain chemicals which have been shown experimentally to affect the immune and cardiovascular systems. Dampness can also build up in carpets or within walls, causing similar problems.

Exhaust and cigarette smoke can pollute indoor air. Gasoline and diesel exhaust, containing carbon monoxide and cancer-causing substances, can enter buildings through improperly located air-intake vents or from loading docks. Carbon monoxide causes headaches, dizziness and nausea, and can be traced to many sources, including boiler gas and cigarette smoke.

5. Major Indoor Air Pollutants in Facilities: Health Effects and Sources

Contaminants	Health Effects	Sources
1. Combustion Processes Carbon monoxide Nitrogen oxide Particulate materials	Eye, throat and respiratory system irritations Fatigue Shortness of breath Headache Nausea At higher levels – death	Cigarette smoke Gas ranges Auto, truck, bus exhaust (operating in loading areas or adjacent to buildings)
2. Volatile Organic Compounds (VOCs)* Over 1,000 observed Two of the most common – benzene and chloroform – are carcinogenic Other examples: ethyl and methyl alcohol	Irritation of eyes and upper respiratory tract Some VOCs may be carcinogenic or have reproductive effects	Building materials Solvents (cleaners, glues, printing presses, copiers, white-out, rubber cement) Printed documents Vinyl Caulking Paints Adhesives Cosmetics Telephone cable Felt tip pens
3. Bioaerosols (Biological agents) Airborne matter of micro-biological origin from viruses, bacteria, fungal spores, protozoans, algae, pollen, mold and dust mites	**Three Types of Effects:** Infections: Viral and bacterial disease (like Legionnaire's Disease) Immunologic Reactions: Allergic rhinitis Asthma Humidifier fever (flu-like) Hypersensitivity pneu-monitis Skin reactions Reaction to Toxins: Microorganisms produce chemical toxins such as aflatoxin, penicillin, and trichothecenes. The effects of inhaling these potent substances are currently under study.	Humidifiers Flush toilets Ice machines Water accumulation in air conditioners Water towers Mildewed papers Infected individuals Water-logged carpets, walls and furniture

*Chemicals which turn to gas at room temperature.

Contaminants	Health Effects	Sources
4. Formaldehyde A VOC, but gets special attention because it's so prevalent	**Low-Level Exposure:** Eye, nose, throat irritation Dermatitis **Long-Term Exposure:** Headache Dizziness Nausea Coughing Menstrual irregularities Recurring upper respiratory infections	Pressed wood products (plywood, chipboard) Insulation Combustion Textiles Furnishings Floor coverings Fabrics (permanent-press finish)
5. Radon A naturally occurring, odorless, tasteless radioactive gas	Lung cancer	Part of rocks and soil Found in building foundations and building materials (concrete blocks) Enters a building through cracks in sewer pipes and in concrete, wall/floor joints, hollow concrete block walls
6. Asbestos	Lung disease Lung cancer Mesothelioma	Asbestos insulation and fireproofing materials Floor tile

Sources: American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., "Indoor Air Quality Position Paper," August, 1987; Jeanne Stellman, PhD and Mary Sue Henifin, MPH, "Indoor Air Pollution," chapter in *Office Work Can Be Dangerous To Your Health*, New York: Pantheon Books, 1983; and Richard Laliberte, "Breathing Uneasy: The Truth About Sick Building Syndrome," *Health*, September 1990, pp. 63-82.

6. Sick Buildings: A Growing Epidemic?

Below are selected facts about the extent of the sick building problem.

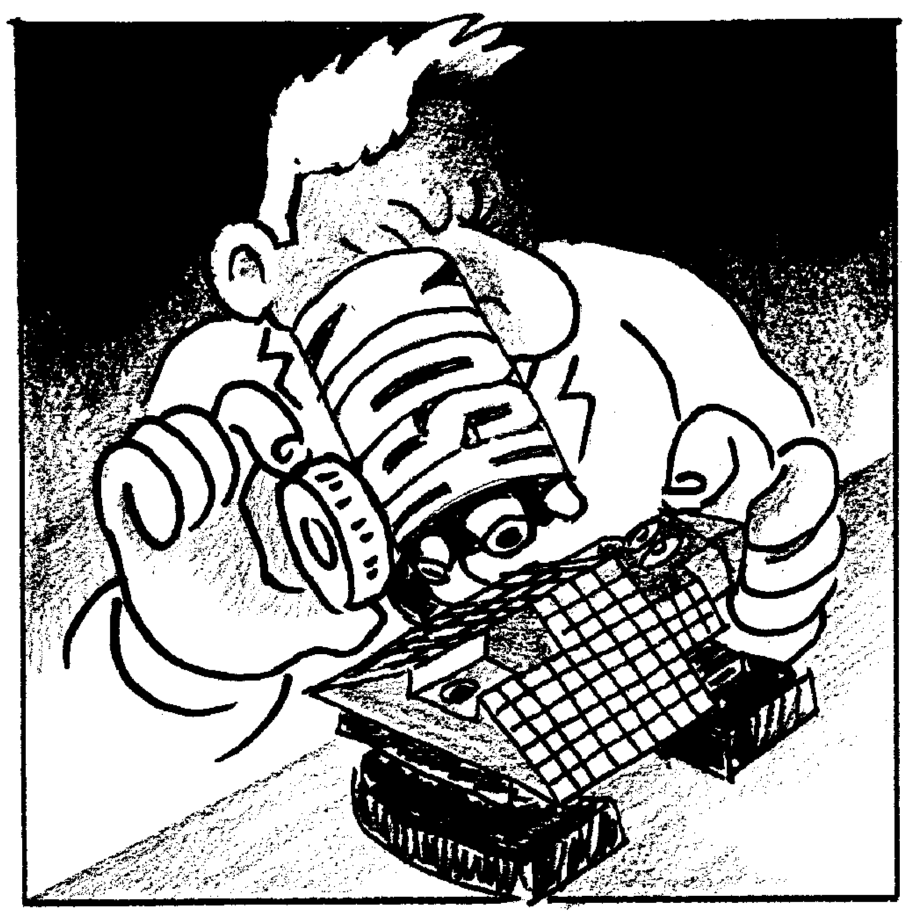
- The World Health Organization has estimated that as many as 30 percent of newly constructed and remodeled buildings may have problems associated with sick building syndrome (SBS), and that 10 to 30 percent of the occupants may be affected.
- Approximately 800,000 to 1.2 million commercial buildings in the U.S. have problems that are related to SBS or BRI (building related illness). This means that, assuming typical occupancy levels, approximately 30 to 70 million people are being exposed to potential building-related health problems. Of this group, approximately one-third might be expected to have symptoms associated with SBS and BRI, whereas the other 20 to 50 million might report symptoms associated only with SBS.
- Healthy Buildings International in Virginia estimates that up to one half of the offices and government buildings, hospitals and other major structures in the U.S. may have health problems associated with SBS.
- More than one half of the workplaces in the U.S. and in Europe are offices. This proportion and the size of the white collar workforce are expected to continue to grow.
- The Environmental Protection Agency ranks indoor air as the number four health risk in the U.S., and it is at the top of the list of environmental cancer risks.
- The *New England Journal of Medicine* reports that up to 60 percent of workers in surveys of buildings reported SBS symptoms. Ten to 25 percent reported SBS symptoms ocurred at least twice a week.

Sources: World Health Organization, "Indoor Air Quality Research," *EURO Reports and Studies,* Vol. 103, Copenhagen: WHO, 1986; James Woods, "Cost Avoidance and Productivity in Owning and Operating Buildings," in J. Cone, M.J. Hodgson, eds., *Problem Buildings: Building-Associated Illness and the Sick Building Syndrome*, Vol. 4 of *Occupational Medicine State of the Art Review, 1989*; Richard Laliberte, "Breathing Uneasy: The Truth About Sick-building Syndrome," *Health*, September 1990, p. 64; *Indoor Air Pollution*, May 1987; OSHA Compliance Advisor No. 151, March 12, 1990; Lani Sinclair, "Sick Building Syndrome: Air on the side of safety and health," *Safety & Health*, September 1996; and Drs. Dick Manzies and Jean Bourbeau, "Building-related Illnesses," *New England Journal of Medicine*, November 20, 1997.

7. NIOSH Finds Air Quality Problems Are Increasing

NIOSH, the National Institute for Occupational Safety and Health, conducts research, provides hazard evaluations and education and recommends standards to OSHA.

NIOSH has conducted approximately 450 field investigations of indoor air quality problems in many types of office buildings. The number of investigations has increased markedly since 1979 due to increased energy conservation measures and increased worker awareness of office environments. NIOSH now averages about two HHE (indoor air quality evaluations) requests per week.



continued

7. ***(continued)***

The following pie chart summarizes the results of the 450 evaluations.

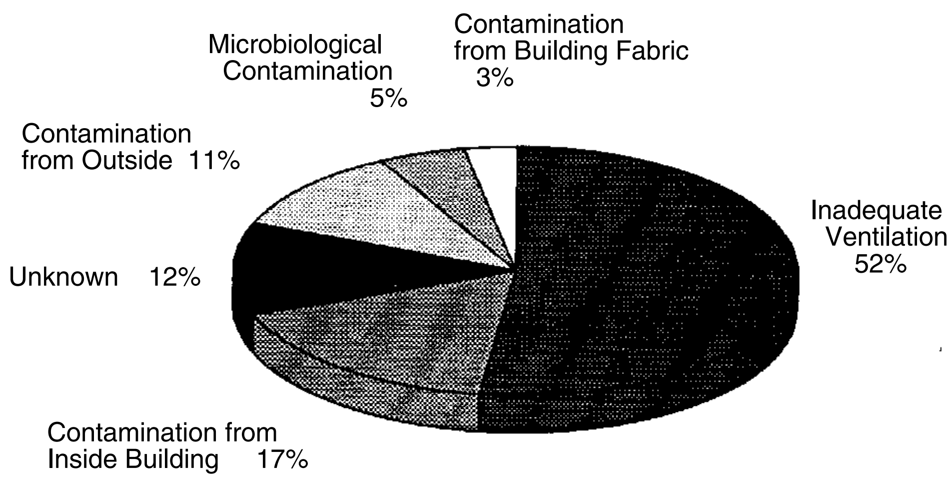
NIOSH provides some examples of the problems associated with each of the categories in the pie chart:

Inadequate Ventilation (52%)

The ventilation problems commonly encountered include: not enough fresh outdoor air supplied to the facility; poor air distribution and mixing which causes stratification, draftiness, and pressure differences between work areas; temperature and humidity extremes or fluctuations; and air filtration problems caused by improper maintenance or absence of maintenance to the system.

Inside Contamination (17%)

Copying machines are often found to be a significant source of indoor air problems. Examples include: methyl alcohol from duplicators; butyl methacrylate from signature machines; and ammonia and acetic acid from blueprint copiers. Other inside



Source: A 1988 NIOSH guidance document, Hazard Evaluations and Technical Assistance Branch, NIOSH, Cincinnati, Ohio 45226.

contamination problems include: exposures to pesticides, such as chlordane; dermatitis from boiler additives, such as diethyl ethanolamine; improperly diluted cleaning agents such as rug shampoo; tobacco smoke of all types.

Outside Contamination (11%)

These problems typically involve substances found outside buildings – vehicle exhaust, boiler gases, and previously exhausted air – which are drawn back into the building ventilation system. This is usually the result of improperly located exhaust and intake vents or periodic changes in wind conditions. Other outside contamination problems include contaminants from construction or renovation projects such as asphalt, solvents, and dusts.

Microbiological Contamination (5%)

Even though this is not a common cause of indoor air problems, it can result in a potentially severe health condition known as hypersensitivity pneumonitis. This respiratory problem can be caused by bacteria, fungi, protozoa, and microbial by-products. The contamination may result from water damage to carpets or furnishings or standing water in ventilation system components.

Building Material Contamination (3%)

Formaldehyde can off-gas (come off as a gas) from urea-formaldehyde foam insulation, particle board, plywood, and some glues and adhesives commonly used during construction. Other building fabric contamination problems include: dermatitis resulting from fibrous glass erosion in lined ventilating ducts; various organic solvents from glues and adhesives; and acetic acid used as a curing agent in silicone caulking.

8. Natural Ventilation: Healthier than Air-Conditioning

Six different studies examined the relationship between building ventilation and work-related symptoms. The studies compared the rate at which symptoms occur in naturally ventilated (with windows) and air-conditioned buildings. As the chart below shows, the chances that a worker will suffer from almost **each** symptom are greater in an air-conditioned environment. For example, the first line of the chart says that Study 1 found that office workers are 5.1 times more likely to experience lethargy in an air-conditioned building with no humidification than those who work in a building with natural ventilation.

Rate of Symptoms Compared to Naturally Ventilated Buildings: Selected Results of Six Studies*

Study	Symptoms	Air Conditioned, No Humidifier	Air Conditioned, Humidification
	Central Nervous System		
1	Lethargy	5.1 x higher	4.2 x higher
2	Lethargy	4.2 x higher	3.2 x higher
3	Headache	–	4.2 x higher
4	Lethargy	–	4.0 x higher
	Upper Respiratory		
1	Nose Symptoms	2.6 x higher	3.8 x higher
	Dry Throat/Blocked Nose	2.5 x higher	4.8 x higher
	Eye Symptoms	1.5 x higher	3.1 x higher
2	Throat Symptoms	2.5 x higher	2.4 x higher
	Eye	1.9 x higher	2.4 x higher
	Lower Respiratory		
1	Tight Chest	0.6 x higher	2.7 x higher
	Wheeze	0.0 x higher	1.7 x higher
3	Tight Chest	1.7 x higher	1.7 x higher
	Difficulty Breathing	2.1 x higher	2.1 x higher
	Flu-like Symptoms	2.1 x higher	2.1 x higher
	Skin		
1	Itching	1.0 x higher	1.9 x higher
2	Dry Skin	1.7 x higher	2.1 x higher
6	Dry Skin or Rash	–	2.5 x higher

* Each study did not examine all of the same symptoms. The chart on this page is not inclusive of all the results of each study. We chose a range of symptoms to provide an overview of the issue instead.

Source: Mark J. Mendell, MPH and Allan H. Smith, MD, PhD, "Consistent Pattern of Elevated Symptoms in Air-Conditioned Office Buildings: A Reanalysis of Epidemiologic Studies," *American Journal of Public Health*, Vol. 80, No. 10, October 1990.

9. Indoor Air Pollution Increases Economic Costs

- The Environmental Protection Agency (EPA) estimates that in the U.S. the medical costs of cancer cases associated with poor indoor air quality range from **$188 million to over $1.3 billion annually**.
- A study cited by the EPA found that poor indoor air quality results in 14 minutes lost for each eight-hour day. This adds up to **$41 billion in lost productivity annually**.
- The EPA also points out that poor indoor air quality results in actual damage to property (e.g. damage to metals, paints, textiles, paper and magnetic storage media – i.e. tapes).

Source: Lani Sinclair, "Sick Building Syndrome: Air on the side of safety and health," *Safety & Health*, September 1996.

Task 3: Local Plan of Action

Please look over the factsheets on pages 83 through 88 to assist you in developing a local plan of action. There is information about indoor air standards as well as examples which show what other unions have done to clean up their indoor air environments.

Your task, as a group, is to develop a local plan of action to begin tackling the problem of indoor air pollution in your facility. First read the examples in the factsheets, then discuss and list some possible approaches your union might take to solve the indoor air quality problem.

Local Plan of Action:

1.

2.

3.

4.

5.

10. OSHA Proposes Limited Standard

In March, 1994 OSHA released a proposed rule (1910.1033) aimed at regulating indoor air quality at non-industrial work sites. The rule covers offices, schools, health care facilities, and retail businesses. Some experts believe that the rule offers insufficient protection against environmental illnesses and sick building syndrome.

The proposed rule would require that employers:

- Develop and implement indoor air quality compliance plans, including inspections and maintenance of heating, ventilation and air-conditioning systems;
- Establish a written record of employees' complaints of building-related illness; and
- Maintain healthy indoor air during renovations.
- Require that workers be notified three days in advance if chemicals (such as pesticides and cleaning compounds) are to be used in their work area.

Also, there is a vague provision which requires that workers be notified three days in advance if chemicals (such as pesticides and cleaning compounds) are to be used in their work area.

Source: NYCAP News, Early Summer, 1994.

continued

10. ***(continued)***

OSHA's Industrial Standards Offer Little Protection

In 1971 OSHA established, for the first time, workplace exposure limits for certain chemicals. These limits are called Threshold Limit Values (TLVs). They represent the maximum exposure to a particular chemical that a worker can receive in a given period.

OSHA Standards: Protection for All Workers?

The OSHA standards were developed for workers in industrial settings who have frequent contact with hazardous chemicals and not for workers with indoor ari pollution problems. The concentrations of contaminants which result in symptoms are way below the standards set by industry. **In fact, some levels may be so low that they are not even detected by measuring equipment or by an industrial hygienist's monitoring devices.**

11. What Are the States Doing?

While OSHA standards apply to private sector workers nationwide, it is up to each state to issue standards to cover state and local government employees. For example, in 1981, New York passed the Public Employees Safety and Health (PESH) Act which extends OSHA coverage to New York State public sector workers. A similar standard in New Jersey, PEOSH, covers public employees. About half of all the states have similar standards for public employees.

Over the last 17 years, some 15 states have developed standards or codes regarding indoor air quality (IAQ).* Several of these states have only one or two standards which are limited to: disclosure of IAQ problems during residential real estate transactions; or are directed only at pesticide use, especially notification thereof, in schools and sports arenas; or are directed at the use of insulation – especially containing urea-formaldehyde.

A few of the states, including Maine (which has 10 statutes or codes enacted from 1977-1997), New Hampshire (with 7 statutes or codes), California (with 17), New Jersey (3), New York (3), Minnesota (6), Michigan (4), Florida (4), and Connecticut (4), have more general standards.

For example, New Hampshire requires all new state and public buildings to conform to standards not lower than those in the BOCA (Building Officials and Code Administrators International) Basic Building Code. It also prohibits the manufacture or sale of urea-formaldehyde, requires the state to investigate complaints of poor IAQ, requires the state to set and meet standards in state buildings, adopts ASHRAE ventilation standards, sets standards for noise, radon, carbon dioxide, asbestos, and formaldehyde, and prohibits aerial application of pesticides in many areas.

Minnesota, as another example, has had standards applying to urea folmaldehyde, particleboard and plywood as affects IAQ since 1980. In 1995, it required adoption and enforcement of rules and laws relating to IAQ and sports arenas, including zero emission ice resurfacing equipment. As of 1997, applicants for state school construction/renovation funding must include IAQ considerations and local school districts are required to have IAQ monitoring plans.

*The Environmental Law Institute in Washington, DC maintains a data base on what states are doing on indoor air quality in general and on lead paint, tobacco, asbestos, radon and local building codes directed at these issues [1616 P Street NW, Washington, DC 20036, 202/939-3802].

12. ASHRAE Recommendations Set the Standards

The American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) publishes a standard on indoor air quality. Their recommendations include the numbers of air exchanges required for adequate ventilation and ideal temperature ranges for facilities. However, their standards are not legally enforceable, unless incorporated into a law.

ASHRAE guidelines are widely used by NIOSH in their building evaluations, by various unions in their own inspections, and by occupational epidemiologists.

ASHRAE Standard 62 (see below) is the basis for almost all of the ventilation requirements contained in North American building codes and is also the basis for the few state laws that exist.

ASHRAE Standard 62-1989
Ventilation for Acceptable Indoor Air Quality

For all facility areas, whether or not smoking is permitted, fresh outdoor air should be adequately distributed during the entire time they are in use at a minimum rate of 20 cubic feet per minute (cfm) per person. The chart below suggests air requirements for specific areas.

ASHRAE Air Requirements for Offices (cfm/person*)	
Office spaces	20
Reception areas	15
Computer centers	20
Conference rooms	20
Smoking lounge	60
*Cubic feet per minute per person	

13. What Can Your Health & Safety Committee Do Now?

The following list represents suggestions made by many groups about what your committee can do to detect indoor air quality problems and solve them.

1. Conduct a survey of members. Look for problems typical of indoor air pollution, and check to see if those symptoms are linked to the job. Patterns such as time of day, week or season that people are most affected should also be noted. Use the results of the survey for further union organizing – forming a committee, filing petitions and grievances.

2. Inspect the building. Note recent changes in the facility, perhaps new furnishings, machines, or partitions, recent cleaning, heat on or off, smoking, dust from the ventilation system, or ceiling tiles missing or damaged. Investigate the building's ventilation system, if there is one. There should be both a supply and an exhaust vent in each room. Ask the building manager to show you where fresh air enters the building. Technical assistance is available from NYCOSH, the New York Committee on Occupational Safety and Health (212-627-3900), or from your union health and safety department.

3. Monitor the air. Bring in an independent industrial hygienist or NIOSH to check the air for contaminants or inadequate ventilation. You can check the effectiveness of the ventilation system by holding a tissue paper near the vents to see if they are working.

4. External sources. In the event the problem is not resolved through the efforts of the Safety Committee, such external sources as OSHA, NIOSH or State Agencies may provide assistance. Legislative action at the State or Federal level on indoor air pollution standards may also be pursued.

Sources: NYCOSH handout, "Indoor Air Pollution;" AFSCME factsheet, "How to Cure Indoor Air Pollution Problems;" CWA's factsheet, "Indoor Air Quality and the Workplace," #20; and comments made by Alice Freund, Industrial Hygienist, at Labor Institute Training Session in December 1991.

14. Concrete Remedies to Improve Indoor Air Quality

Unions or worker organizations may develop many recommendations. Here are some:

- Increase the air supply. Clean and maintain the ventilation system and open or unblock all sources of fresh air.
- Eliminate sources of contamination. Reduce the use of toxic substances in the building. Substitute less dangerous substances, such as solvent-free carpet adhesives.
- Clean and dry areas that are damp. Fungi and bacteria grow under such conditions and must be removed regularly.
- Isolate machines that release toxic fumes, such as photocopiers.
- Make sure hazardous work is done only on weekends and get management to inform the union before it is done.
- Ensure that people who work with hazardous substances are protected with adequate ventilation or protective equipment such as respirators.
- The OSHA Hazard Communication Standard requires management to provide you with information about all chemicals and compounds in use.
- Maintain temperature within the comfort zone of 68 to 78 degrees and humidity within 30 to 60 relative humidity.
- Ensure that all local exhaust systems pull polluted vapors away from people's breathing areas and that local systems do not compete with the primary ventilation system.
- Bring in a ventilation engineer to ensure that air movement is sufficient and to recommend remedies for any problem areas. A tool called a velometer measures air flow and can be used to calculate the amount of fresh air per person.

Sources: NYCOSH handout, "Indoor Air Pollution;" AFSCME factsheet, "How to Cure Indoor Air Pollution Problems;" CWA's factsheet, "Indoor Air Quality and the Workplace," #20; and comments made by Alice Freund, Industrial Hygienist, at Labor Institute Training Session in December 1991.

Summary: Indoor Air Quality

1. Two terms associated with indoor air pollution in facilities are "sick building syndrome" (SBS) and "building-related illness" (BRI). SBS is identified with symptoms such as headache; eye, nose, or throat irritation; fatigue; dry cough, dizziness and nausea; and sensitivity to odors – all of which appear to be linked to time spent in the building, but no specific illness or cause can be identified.

2. In BRI, building-related illness, symptoms of a diagnosable illness are identified and can be attributed directly to contaminants in the building air. Symptoms include cough, tightness in the chest, fever, aches and chills.

3. Indoor air quality is becoming a significant workplace issue. Approximately 30 to 70 million people who work in commercial buildings experience building-related health problems. The Environmental Protection Agency (EPA) ranks indoor air as the number two health risk in the country. Radon is listed as number one.

4. Studies have shown that workers are more likely to experience symptoms associated with sick building syndrome in "tight," air-conditioned buildings, compared with buildings in which the windows can be opened and closed.

5. Standard 62 of the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) , though not a law, is the basis for almost all of the ventilation requirements included in North American building codes. This standard states that fresh air in building areas should be distributed at a minimum rate of 20 cubic feet per minute per person.

6. The Health and Safety Committee can take a range of actions to address the problems of indoor air quality: conduct a survey of members, request an inspection of the building, bring in experts to monitor the air, file a complaint, and keep up with the status of legislation.

**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 EPA Definition		8. Studies Show that Natural Ventilation Is Healthier than Air-Conditioning
	2. The ASHRAE Definition		9. Indoor Air Pollution Increases Economic Costs
	3. What Is the Difference Between SBS and BRI?		10. OSHA Proposes Limited Standard
	4. What Are Some of the Sources of Indoor Air Pollution?		11. What Are the States Doing?
	5. Major Indoor Air Pollutants in Facilities: Health Effects and Sources		12. ASHRAE Recommendations Set the Standards
	6. Sick Buildings: A Growing Epidemic?		13. What Can Your Health & Safety Committee Do Now?
	7. NIOSH Finds Air Quality Problems Are Increasing		14. Concrete Remedies to Improve Indoor Air Quality

continued

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?

____

____

____

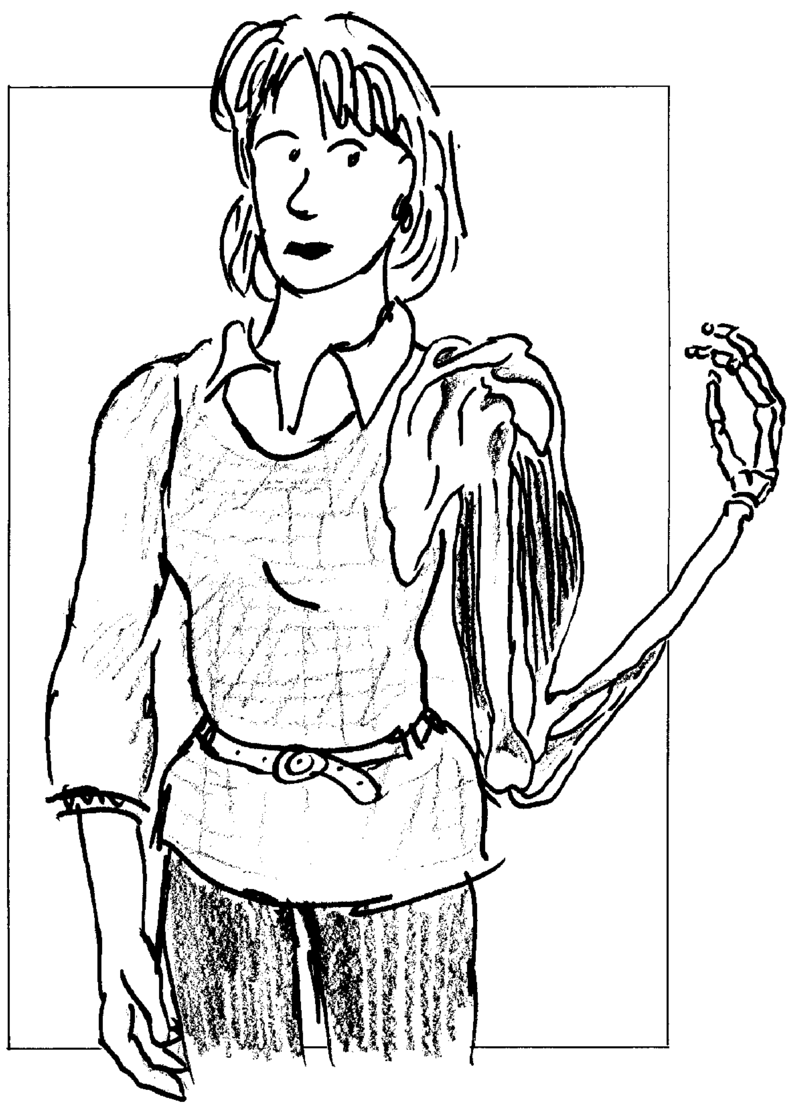
____

Activity 5: Repetitive Stress Injuries (RSIs)

Purpose

To become more familiar with symptoms and work situations that are linked to a group of illnesses or injuries called **repetitive stress injuries (RSI)** and to evaluate if we are victims of this occupational problem.

To understand how **ergonomics** (the study of work so that the job is made to fit people's bodies) can help protect us from RSIs.



Task

In your groups please read the statement below made by a worker at PharmChem and answer the questions that follow. In doing so, please review the factsheets on pages 94 through 107.

Statement:

> "Well, I hear they say there's a big new disease around here called Repetitive Stress Injuries. They say it comes from doing the same thing again and again. I don't buy it.
>
> "Work is all about doing the same things again and again. That's how they make money. That's how we get paid. That's why it's called work. Sure, we all get a little sore from doing repetitive jobs. I work a lot on a computer, and I know from personal experience that all I need is a little rest and the soreness in my wrists goes away.
>
> "There might be a few complainers around here who say it's a big problem. But I think the real problem is that people forget how to pace themselves. If we learn to work smart, we'll be fine."

1. What are your agreements and disagreements with this statement? (Please try to refer to at least one factsheet in making your points.)

2. What jobs or tasks do you believe are causing repetitive stress injuries at your site?

3. What do you think could be done to prevent these repetitive stress injuries at your facility?

1. What Are RSIs, CTDs and Ergonomics?

What are Cumulative Trauma Disorders (CTDs)?

A cumulative trauma disorder (CTD) is **damage to body tissue caused by repeated physical stresses.** The definition of CTD comes from the meaning of each word in the term.

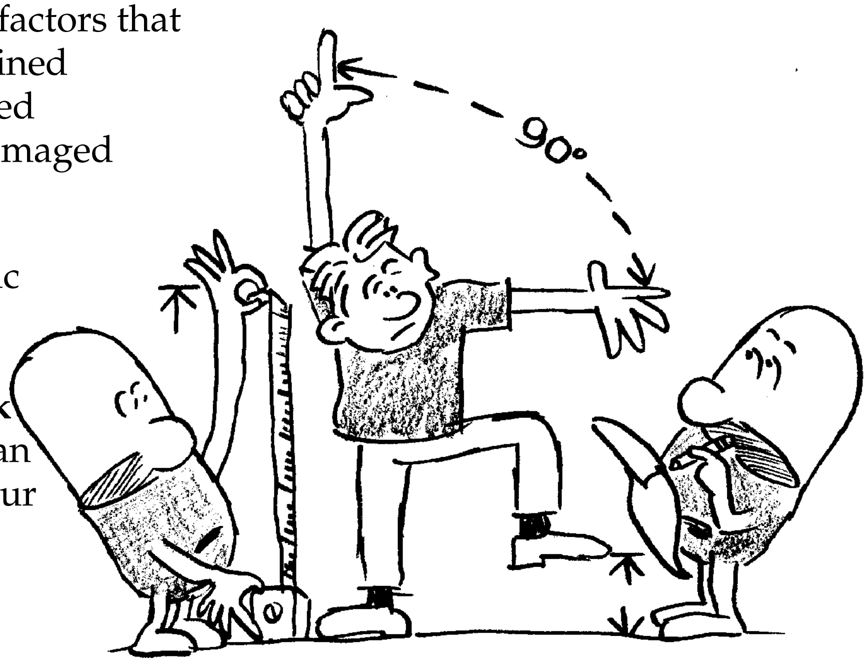
- **Cumulative:** building up or increasing over a long period of time.
- **Trauma:** the damage of body tissues by physical stress.
- **Disorder:** a condition that interferes with normal, healthy functioning of the body.

What are Repetitive Strain Injuries (RSIs)?

Repetitive Strain Injuries (RSIs) is a general term (like CTD) used to describe a **range of symptoms associated with repetitive motion work**. The term "RSI" is often used in the popular press like newspapers, while "CTD" is used more in the scientific magazines.

What is Ergonomics?

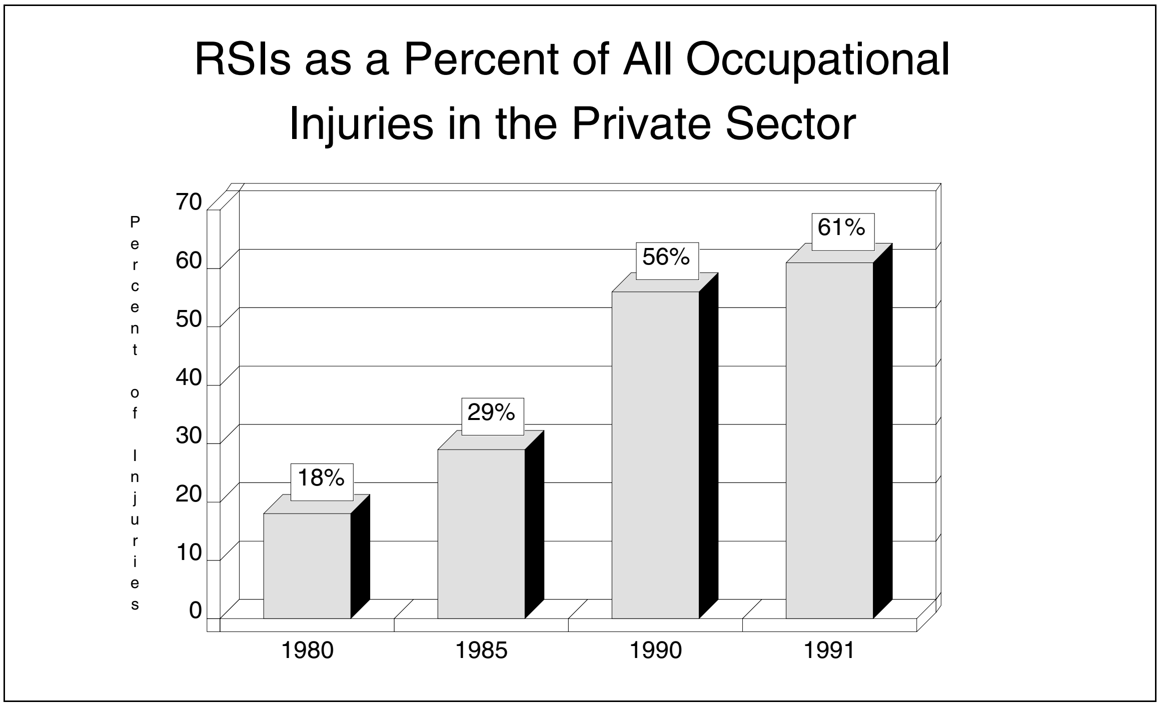
Ergonomics is the study of work – **designing the job to fit people**. Too often, workers are required to "fit the job." We are told to lift heavy loads, use awkward postures, do repetitive tasks and other factors that can lead to sprained muscles, inflamed tendons, and damaged nerves.



Using ergonomic principles **to properly design the work environment**, can allow us to do our jobs without disabling aches and pains.

2. How Big Is the Problem?

There is an increase of RSIs in the workplace. In 1980, RSIs accounted for 18 percent of all new cases of occupational injuries. By 1991, the share skyrocketed to 61 percent! That means that by 1991 there were 233,600 new cases of repetitive stress injuries reported nationally.



Source: U.S. Department of Labor, Bureau of Labor Statistics, *Occupational Illness in U.S. by Industry 1991*, Washington, DC: USGPO, May 1993.

3. Some Jobs that May Be Associated with RSIs

Type of Job	Disorder	Occupational Factors
Data Entry	Tension Neck Thoracic Outlet Wrist Tendinitis Epicondylitis	Prolonged restricted posture, forceful ulnar deviation and thumb pressure, repetitive wrist motion, forceful wrist extension and pronation.
Packing Bag Sealing Coding Mail Opening	Tendinitis of shoulder and wrist Tension Neck Carpal Tunnel DeQuervain's	Prolonged load on shoulders, repetitive wrist motions, overexertion, forceful ulnar deviation.
Opening Bottles/Safety Caps	Tendinitis of the wrist	Repetitive wrist motions.
Stockroom, Shipping	Thoracic Outlet Shoulder-tendinitis	Reaching overhead. Prolonged load on shoulder in unnatural position.

Source: Adapted from Vern Putz-Anderson, ed., *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs*, Philadelphia: Taylor & Francis, Inc., p. 22.

4. Canadian Telephone Operators: A Case Study in Pain

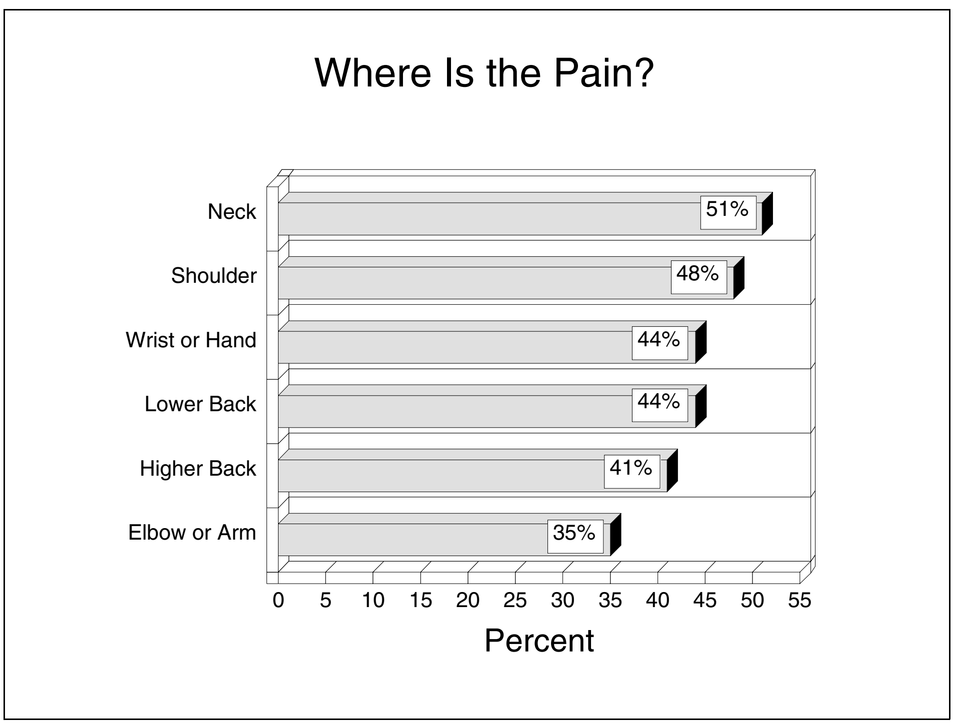
The following description was taken from a Canadian union's study of operators' tasks at Bell Canada. Operators sit or stand wired to a work station during their shift. They received two fifteen-minute breaks and a lunch break. Physical tasks included:

- Tilting head to scan Video Display Terminal (VDT)
- Tilting head to view keyboard
- Twisting head to view documents
- Reaching maneuvers
- Typing maneuvers (hunt-and-peck/touch-type)
- Movement of back and shoulders to properly see information on VDT and/or documents.

Each operator performed approximately 14,000 to 15,000 keystrokes per day.

Where It Hurts

Of the 1,309 workers who answered the survey, 1,018 (78 percent) reported pain, discomfort or fatigue. Here's where it hurt:



Three hundred sixty-eight operators reported specific diagnosed disease, which may have been work-related. They were:

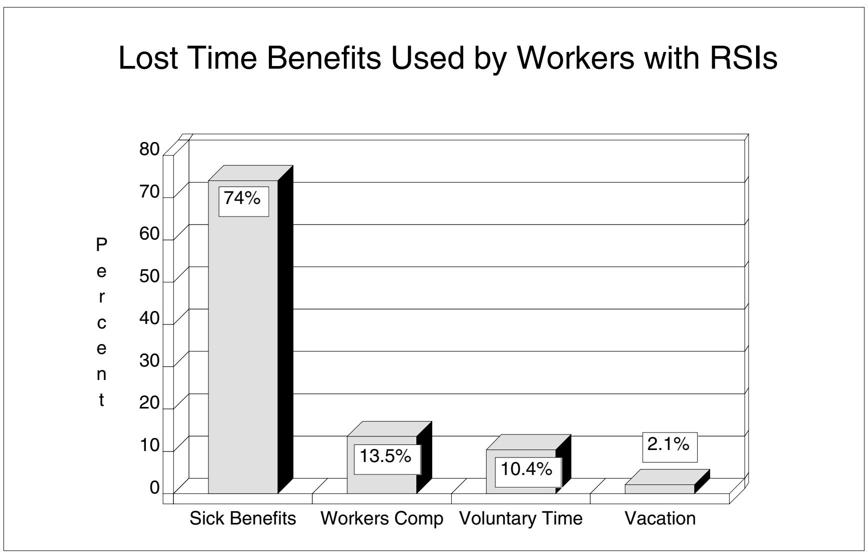
- Tendinitis (31.5%)
- Cervical strain (17.1%)
- Bursitis (16.3%)
- Degenerative changes in neck (14.4%)
- Carpal tunnel syndrome (13.0%)
- Epicondylitis (5.2%)
- Tenosynovitis (2.4%)

Source: Jacques Reid, Joel Carr, Michel Duplessis, *Repetitive Strain Injury Survey of Operators Services at Bell Canada: A Union Approach*, Communications, Energy and Paperworkers Union of Canada, November 1993.

5. Workers Don't Recognize That RSI May Be a Work-Related Disease

To cope with the pain, many operators had to stay home, but only 13.5 percent used their workers compensation benefits. The rest used up their sick benefits, vacation time and unpaid leave.

- Sick Benefits (74%)
- Workers' Compensation (13.5%)
- Voluntary time (no pay) (10.4%)
- Vacation (2.1%)



Work-related RSIs are legitimate occupational injuries and should be compensated (lost wages and loss of function) under the state's workers compensation laws. See your union representative for guidelines on the law in your state.

Source: Jacques Reid, Joel Carr, Michel Duplessis, *Repetitive Strain Injury Survey of Operators Services at Bell Canada: A Union Approach*, Communications, Energy and Paperworkers Union of Canada, November 1993.

6. The Three Stages of RSI Symptoms

RSI symptoms can range from mild aching to disabling pain. Symptoms often appear gradually and become more severe over time. Generally, symptoms progress through three stages.

Stage 1
At first, RSI symptoms appear during periods of activity. They disappear during periods of rest. Symptoms are relatively mild. Early symptoms of RSIs often are mistaken for muscle fatigue.

Stage 2
In Stage 2, symptoms are more persistent. They do not disappear completely during periods of rest. Increasingly severe symptoms may interfere with performance of usual work activities.

Stage 3
In Stage 3, symptoms are constant. Sleep often is disturbed. Severe pain, limited mobility, loss of sensation or muscle weakness make it impossible to perform most job tasks.

7. RSIs and Job Risk Factors

Job Risk Factors

- Repetitiveness
- Forcefulness
- Awkward Postures
- Mechanical Stress
- Vibration
- Exposure to Cold
- Poor Fitting Gloves
- Stress*

Repetitiveness + Forcefulness + Stress = Very High Risk

*Workplace stress, caused by such factors as increased boredom, fatigue, isolation and seemingly meaningless tasks, is now viewed, along with the well-known physical risk factors, as a root cause of RSIs.

Source: Jacques Reid, Joel Carr, Michel Duplessis, *Repetitive Strain Injury Survey of Operators Services at Bell Canada: A Union Approach*, Communications, Energy and Paperworkers Union of Canada, November 1993.

8. The Most Common RSIs

SYMPTOMS	CAUSES
CARPAL TUNNEL SYNDROME: Swelled tendons* in the carpal tunnel in the wrist pinch the nerve that allows hand grasp.	
Pain, numbness, tingling in thumb, index finger, middle finger, or arm; Wasting of muscles at base of thumb; Clumsiness of hands, difficulty grasping; Most noticeable at night or when awakening.	Working with wrists in bent position; Pinching or other forceful hand motion; Overuse of index finger; Circular twisting of wrists (wringing action); Tight or constant grip on tools.
DeQUERVAIN'S DISEASE: Lining of the tendons at the base of the thumb and side of the wrist becomes damaged.	
Sharp pain over front of wrist, forearm or thumb; Pain/discomfort when moving thumb.	Hand twisting while gripping (wringing action); Bending of the wrist toward pinkie, in combination with thumb movements (using scissors).
EPICONDYLITIS (TENNIS ELBOW): Swollen tendons in elbow.	
Pain over the elbow, usually outer side; Occasionally middle and ring fingers ache; Pain when grasping or lifting; Usually worse at night.	Using the arm for impact or jerky throwing motion; Rotating forearm while bending the wrist.
GANGLIONIC CYST: Tendon lining swells with fluid causing a bump from under the skin.	
A visible bump from under the skin (increases the risk of developing other RSIs).	Excessive bending of the wrist, or other joint.
RAYNAUD'S SYNDROME: Blood vessels in hand close.	
Hands become cold, numb, tingly, or blue; Unable to perform fine finger movements; Fingers become pale or white.	Cold temperature; Vibration; Forceful gripping.
TARSAL TUNNEL SYNDROME: Nerve disorder of foot and ankle, similar to Carpal Tunnel Syndrome.	

* Tendons are rope-like tissue that connect muscle to bone.

continued

8. *(continued)*

<table>
<tr><td>SYMPTOMS
Pain, numbness, tingling, in foot or leg;
Most noticeable in big toe and arch.</td><td>CAUSES
Repeated or constant ankle or foot movements.</td></tr>
<tr><td colspan="2">TENDINITIS: Swelling of tendons.</td></tr>
<tr><td>SYMPTOMS
Swelling;
Pain, burning sensation or dull ache over, or stemming from, affected area.</td><td>CAUSES
Repetitive bending of the fingers, wrists, or elbows;
Repeated or constant contact with tools, controls or handles;
Repeating new or unaccustomed exertions;
Vibration;
Acute trauma, such as a blunt blow.</td></tr>
<tr><td colspan="2">TENOSYNOVITIS: Swelling of tendon lining.</td></tr>
<tr><td>SYMPTOMS
Same as Tendinitis.</td><td>CAUSES
Same as Tendinitis.</td></tr>
<tr><td colspan="2">THORACIC OUTLET SYNDROME: Compression of nerves and blood vessels between neck and shoulder.</td></tr>
<tr><td>SYMPTOMS
Numbness or shooting pain in hand;
Arm “goes to sleep;”
Weakened pulse in wrist.</td><td>CAUSES
Reaching above the shoulder;
Reaching behind or below seat height;
Carrying loads on shoulder or sides of body;
Associated with vibration.</td></tr>
<tr><td colspan="2">TRIGGER FINGER: Tendinitis in a finger.</td></tr>
<tr><td>SYMPTOMS
On awakening, finger is flexed;
Pain when extending finger;
Clicking sensation in finger;
Finger loosens up during day.</td><td>CAUSES
Overuse of tools with handles.</td></tr>
</table>

9. Suggestions for Reducing Workstation Stress

The use of a comfortable well-designed chair is essential. It should have:

- A height adjustment so that your feet are comfortably placed (not dangling) and your knees are not too close to your chest.
- An adjustment for lower back support so that the natural curve of your back is maintained.
- Proper chair seat depth, which allows you to sit against the back of the chair with your lower back supported.
- A base with five legs instead of four, to keep from tipping as you move around on it.

The use of an adjustable commercial foot rest which will help keep your legs at a comfortable angle, thereby increasing blood flow to the legs and reducing stress.

Adjustable desks and/or keyboard trays. Both should be easily adjustable to a point where the elbows form a comfortable 90-degree angle, and the wrists are approximately lined up with your hands.

Wrist rests, which are padded platforms that fit in front of the keyboard to prevent the wrist from falling below the level of the key tops.

Monitor screen height should be adjustable so that the top of the screen is level with your eyes.

Source: Amy Roffmann New, "Is Your Office a Big Pain?" *Better Homes and Gardens*, September 1993.

10. Guidelines for Reducing Repetitive Motion

Reduce Repetitive Effort
Use mechanical assists or gravity to transfer parts rather than using the hands. Use power assists, tools or fixtures when forces are high to eliminate repetitive gripping actions.

Work Enlargement
Add different elements or steps to the job which do not require the same motions as the current work cycle demands.

For continuous, highly repetitive operations, design a five-minute break or another activity into each hour of work.

Job Rotation
Allow frequent rotation between jobs which use different postures and muscles until jobs can be redesigned to eliminate repetitive elements.

Alter Work Methods
For jobs requiring only one hand, organize the work station to allow alternate use of the hands.

In seated operations use foot pedals, where possible, for activating machinery or holding fixtures to reduce the load on the hands.

Adjust Work Pace
Allow frequent rest pauses or decrease production standards. Allow self-pacing rather than machine pacing.

11. Components of an Effective Ergonomic Program

What does it take to properly address ergonomic issues in your facility?

Training
All employees should have an understanding of ergonomic hazards and how to recognize and avoid them. In a truly participatory program, workers will be empowered to become the ergonomic inspectors for the plant.

Identification
A systematic process to identify jobs or tasks that may contain hidden ergonomic hazards.

Analysis
Once problem areas are discovered, careful analysis must be made to identify the risk factors that pose the hazard and their causes.

Control
Design and implement corrective measures to control the hazard.

Implement medical management – the use of health-care resources to prevent or manage RSIs.

Monitor
Follow up on any corrective change made. Is the change accomplishing what you intended? If the problem still exists, you may not have identified all the root causes.

Source: *Accident Prevention Manual for Business and Industry: Engineering and Technology*, 10th Edition, National Safety Council, 1992.

Summary: Repetitive Stress Injuries (RSIs)

1. Repetitive stress injuries (RSIs) **are a big problem**, accounting for over 60 percent of all reported illnesses in the private sector.

2. RSI symptoms can range from mild aching to disabling pain. Symptoms generally progress through three stages, becoming more severe. Early reporting of symptoms is critical for proper medical treatment.

3. The **major risk factors** for RSIs are repetitiveness, forceful exertions, awkward postures, force, and vibration.

4. **A job task analysis should be done** to determine if job conditions are contributing to or causing cumulative trauma disorders among workers. (The purpose of the analysis is the same as air monitoring to determine chemical exposure.)

5. A comprehensive RSI prevention program should include several parts, including **employee involvement, job analysis, hazard control, training, and appropriate medical management.**

6. **Union and employer involvement are important**, particularly so that all job hazards are identified and that recommended solutions will actually work to reduce RSIs.

Evaluation Activity 5: Repetitive Stress Injuries (RSIs)

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 RSIs, CTDs and Ergonomics?		7. RSIs and Job Risk Factors
	2. How Big Is the Problem?		8. The Most Common RSIs
	3. Some Jobs that May Be Associated with RSIs		9. Suggestion for Reducing Workstation Stress
	4. Canadian Telephone Operators: A Case Study in Pain		10. Guidelines for Reducing Repetitive Motion
	5. Workers Don't Recognize RSI May Be a Work-Related Disease		11. Components of an Effective Ergonomic Program
	6. The Three Stages of RSI Symptoms		

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?

____

____

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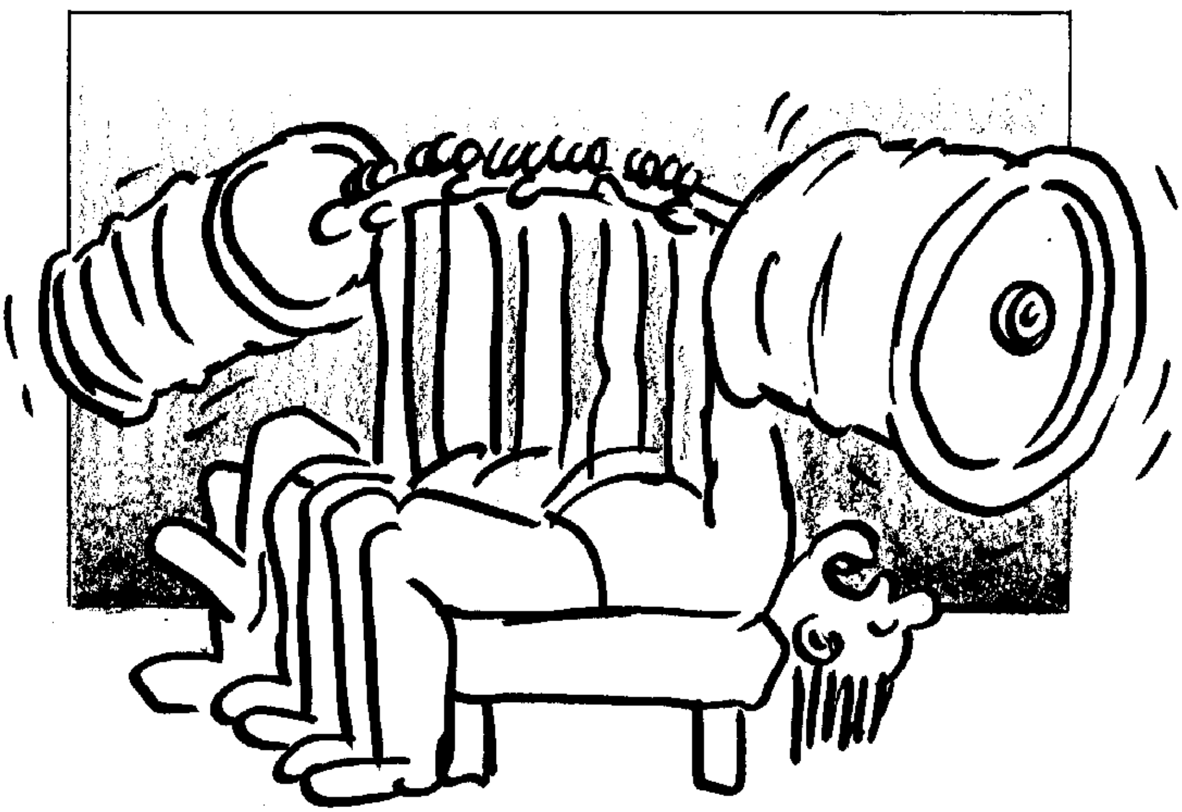
Activity 6: Strengthening the Health and Safety Committee

Purpose

To understand how joint labor-management health and safety committees become more effective.



Task

Please read the scenario below. Your small group is the joint health and safety committee at PharmChem. In your group, make a list of recommendations for the newly organized local union leadership.

The PharmChem facility across town was recently organized by the 250 production and maintenance workers. The facility is the recipient of all of PharmChem's liquid hazardous waste nationally. PharmChem 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 health and safety committee. Your local president delegated you and the committee to help set up the new health and safety committee.

Please review the factsheets on pages 111 through 124 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.
- The union needs to have a mechanism to check and double-check the minutes to ensure that they accurately reflect the meeting.
- The union members need to be picked by the union, not by the company.

The union members of the joint committee should meet 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 communicate routinely with the local officers and stewards.

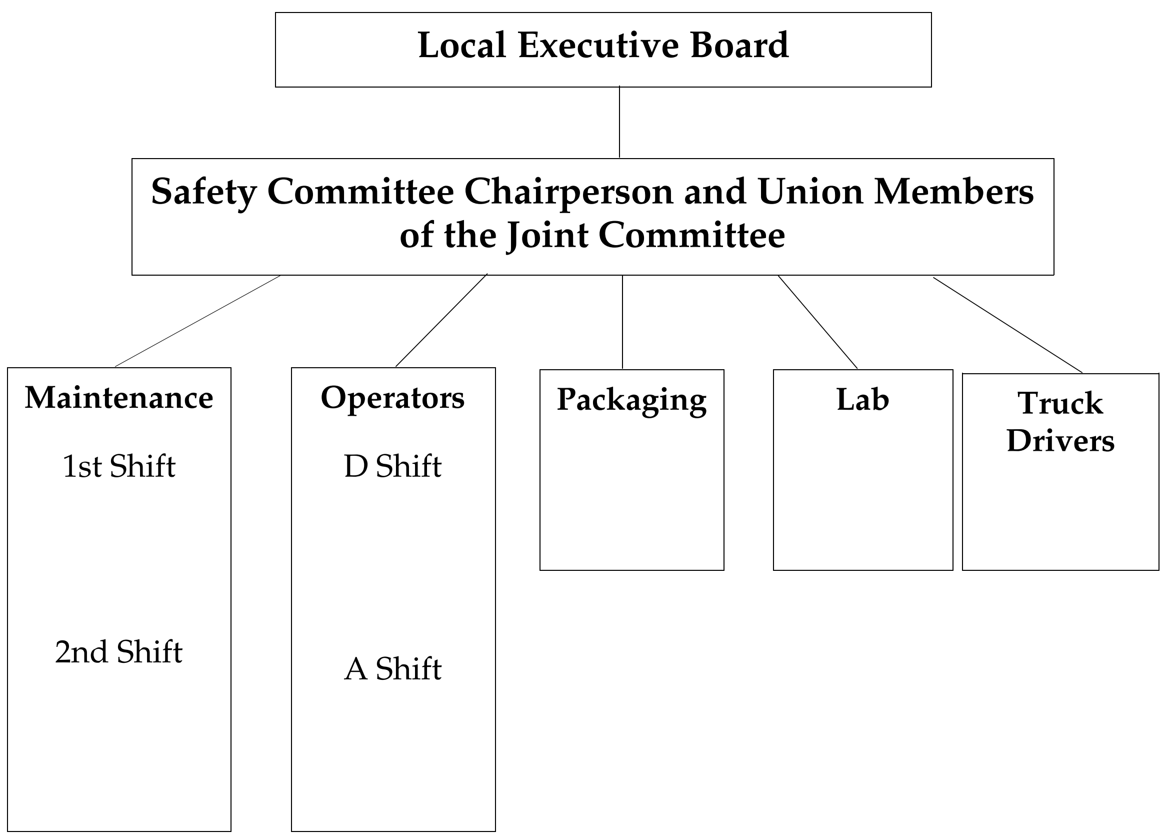
Effective committees meet on a regular basis. The meetings can be weekly, monthly, or less or more often, but they should be regular.

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 adequately represent 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 it's most important that the local union support the decisions and concerns of the union safety committee. **At times, health and safety concerns will 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 can fulfill its role better in the joint labor-management committee. The local union will need to educate the members of the union's safety committee about areas of expertise, for example, health and safety concepts, legal duties under the National Labor Relations Board (NLRB), and OSHA standards. Knowledge invested in the union's safety committee will reap rewards in the form of a safer and healthier workplace.

Some ideas for investment:

- Through collective bargaining, arrange for a union safety committee chairperson to have sufficient time for health and safety activites.
- Send committee persons to classes given in local area colleges and technical colleges.
- Use the Alice Hamilton Library (PACE Headquarters).
- Join a COSH group (see Appendix pages 3 and 4 for a list of COSH groups).
- Build a local union health and safety library (the International Union has a list of recommended books. Also see the Appendix for such a list.).
- 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 think of the committee 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 discussions or arguments over which were completed and which were not, 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. The purpose of the committee meeting is **not** to list repairs.

2. The Company-Dominated Committee

If the local has a joint labor-management committee, 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, the committee will lose its effectiveness. Workers must be involved beyond just listening and receiving the company's opinion.

3. An Effective Joint Committee

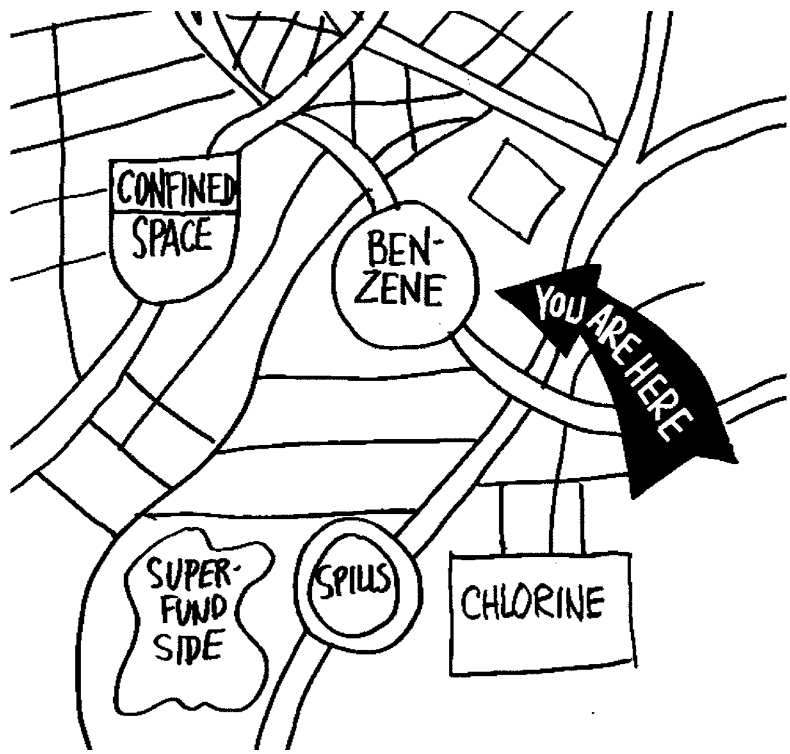
To be effective, the joint committee has to involve the workforce. That means rotating chairpersons between labor and management, allowing the union to have input on all discussions, allowing the union to have their issues placed on the agenda, allowing for review and joint control over the minutes of the meeting, and allowing enough time for all problems to be discussed.

5. Road Map for Health & Safety Committees

The primary purpose of an effective health and safety committee is to improve the work environment. To accomplish this, the committee will need to think of this activity as an ongoing 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 by 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 by putting the members' concerns down on paper.

3. Select priority concerns.

This can be one of the most difficult tasks facing a safety and health committee. Membership may not be concerned with the same issues that the health and safety committee would tackle first. For instance, the committee might be very interested in benzene exposures, while the membership is interested in an improved lock-out/tag-out procedure. The membership's concerns should be placed first.

continued

5. ***(continued)***

4. Deal with the priority issues first.

The union's safety committee persons need to be credible in the eyes of the membership and management to be effective. The health and safety committee will need to build, or earn, this credibility from the membership 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

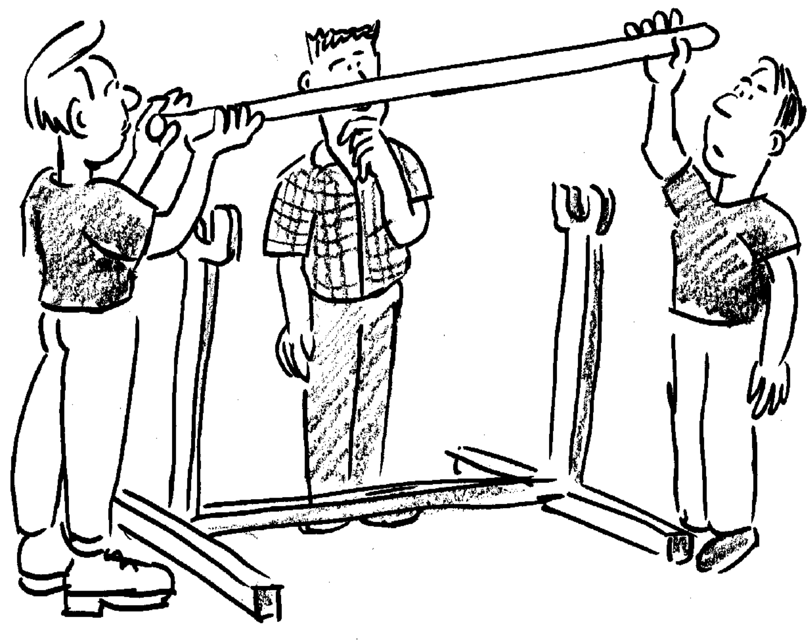
In order to solve problems on the job, we need all the help we can get from fellow workers. However, everyone will not make the same commitment.

- 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 with 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, 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 grow.

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. Select a problem to face first.
You can't solve every problem at once. The committee needs to concentrate on one or two problems. 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' agendas.

Step 3. Develop 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.

Once in a while, 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.

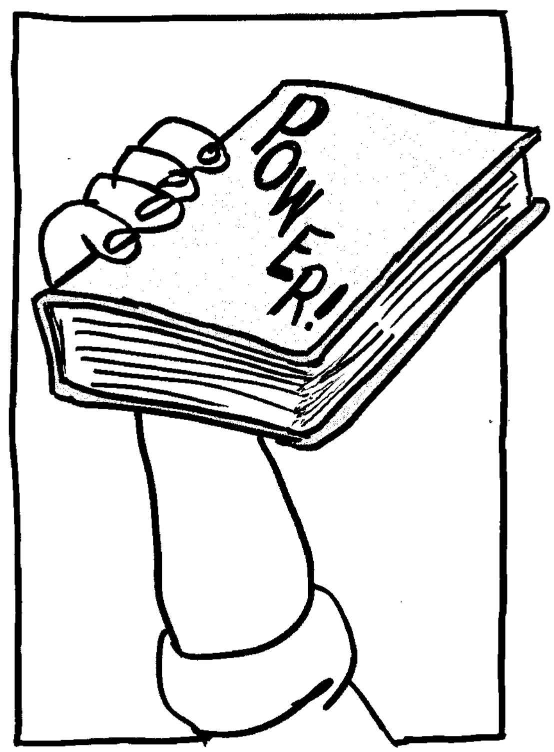
Step 4. Evaluate your activity on a regular basis.
A health and safety committee will only learn by doing and then discussing what worked, what didn't, and why.

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 devoted to getting 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 follow-up plans and how to carry them out.

9. Information Is Power

Health and safety committees need to be informed in order 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 (PACE Headquarters)
- International Union's Health and Safety Department
- COSH groups (see Appendix page 3 and 4 for a list of COSH groups)
- Poison Centers
- National Institute of Occupational Safety and Health (1-800-35NIOSH)
- OSHA (see your phone book for your area office or refer to the 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. An effective committee will only be limited by its imagination and energy, and will most likely come up with activities not listed in this manual. In this section, we'll briefly discuss 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 for 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 who work in the facility. This requires communication and education.

All workers should be educated about the hazards of the job. 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

continued

10. *(continued)*

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 regularly updated list, and that all information about the dangers of the substances is available to the committee and to 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 to 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 ensure 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 constantly propose 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 indicating a health hazard.

Noise levels should be monitored and recorded so that noisy areas can be pinpointed and dealt with. If the company monitors for hazardous substances, the committee should get the results and discuss them.

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 "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 educational 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.

continued

10. ***(continued)***

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

A. Organization

1. A health and safety committee must be rooted on the shop floor. A series of **safety stewards** should feed information to the union members on the joint committee. The system should be broad enough to be representative of your facility. Each facility is different, and you need to custom-craft your organization.

2. A window of communication with management is important. 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.

B . Functions

1. It is important to choose a realistic issue as the “foot in the door” to build more effective committees.

2. Information is power. This information comes from the membership, the International Union, company safety professionals, company policies, etc.

3. If there are minutes, a mechanism should be in place to develop the minutes, their content, and their distribution.

4. Try to solve problems at the lowest possible level through the safety stewards, just as you would grievances. If they cannot be solved there, go to the joint committee.

C. Road Map for Health & Safety Committees

1. Reach out to the membership.

2. Develop a list of health and safety concerns.

3. Select priorities that reflect the membership’s concerns.

4. Deal with priority items first.

5. Make smaller, easier changes first.

6. Build toward larger and more comprehensive changes.

Evaluation Activity 6: Strengthening the Health & Safety Committee

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 & Safety Committees		10. Health & Safety Committee Activities

3. Which summary point do you feel is most important? Please circle one number.

Most Important Summary Point						
A1.	A2.	A3.	B1.	B2.	B3.	B4.
C1.	C2.	C3.	C4.	C5.	C6.	

4. What would you suggest be done to improve this Activity?

___

___

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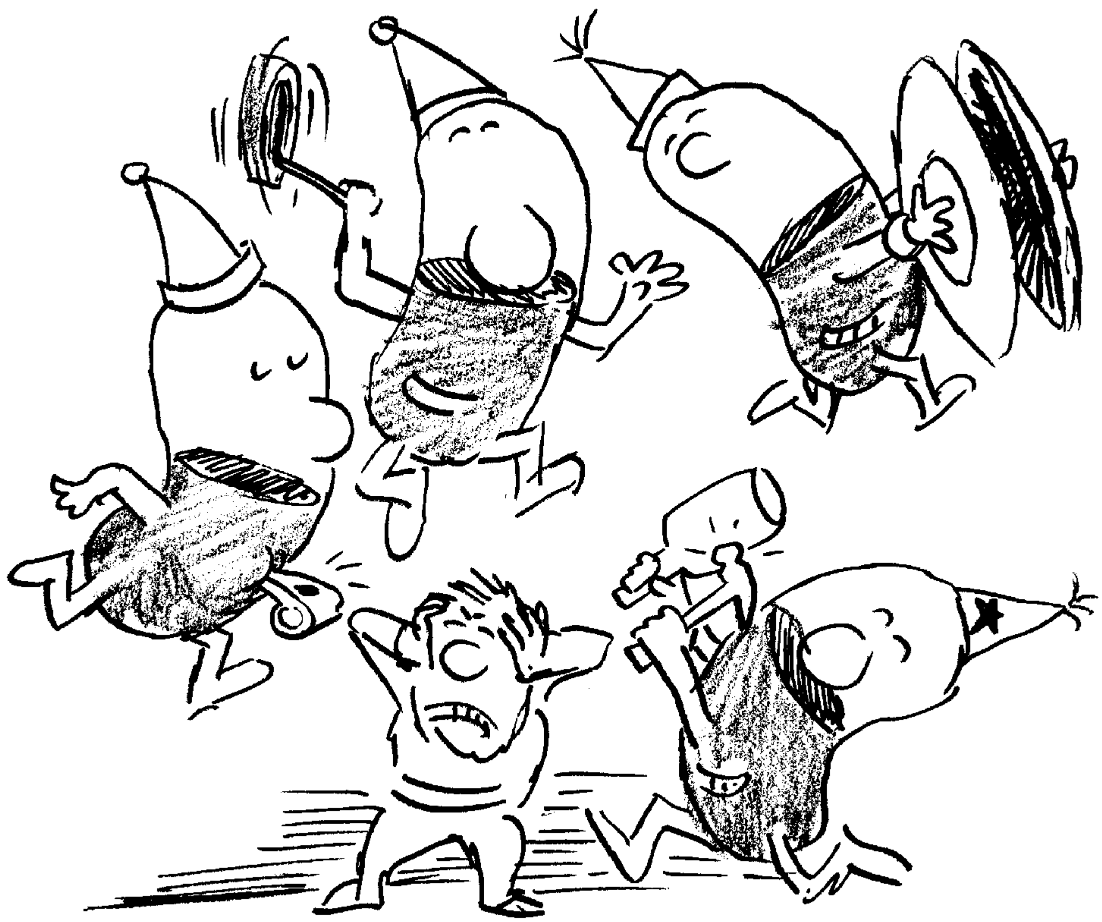
Activity 7: The Hazards of Noise Exposure

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 PharmChem to respond to a worker who made the following statement. In doing so, please review the factsheets on pages 129 through 138. 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?

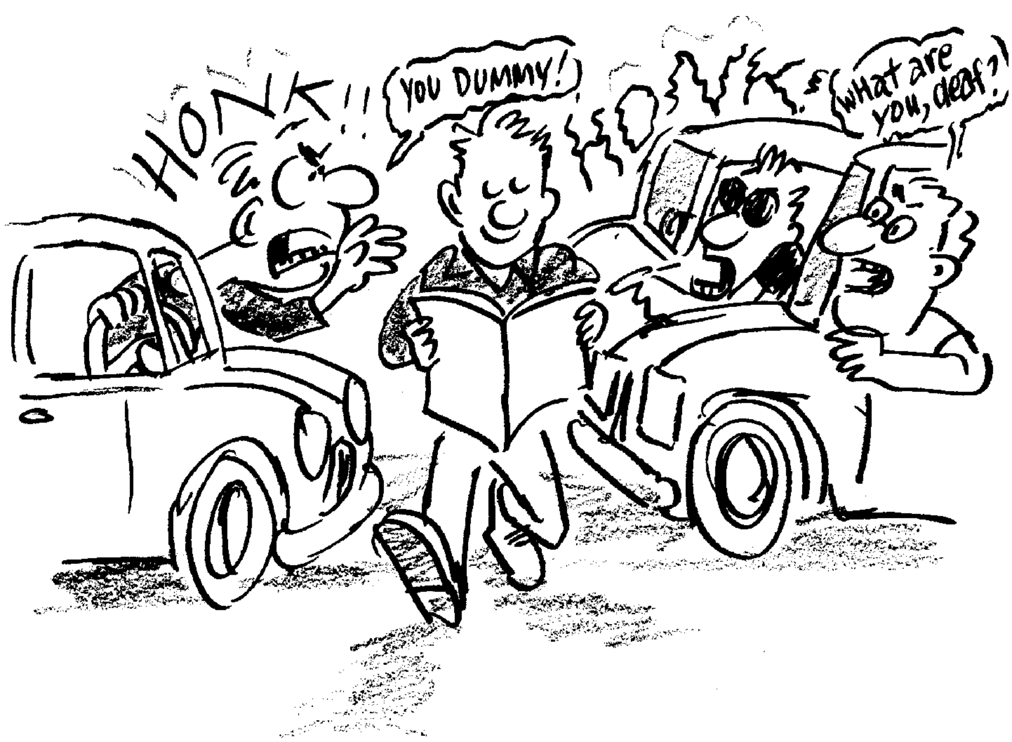
1. How To Tell If There Is a Noise Problem at Work

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

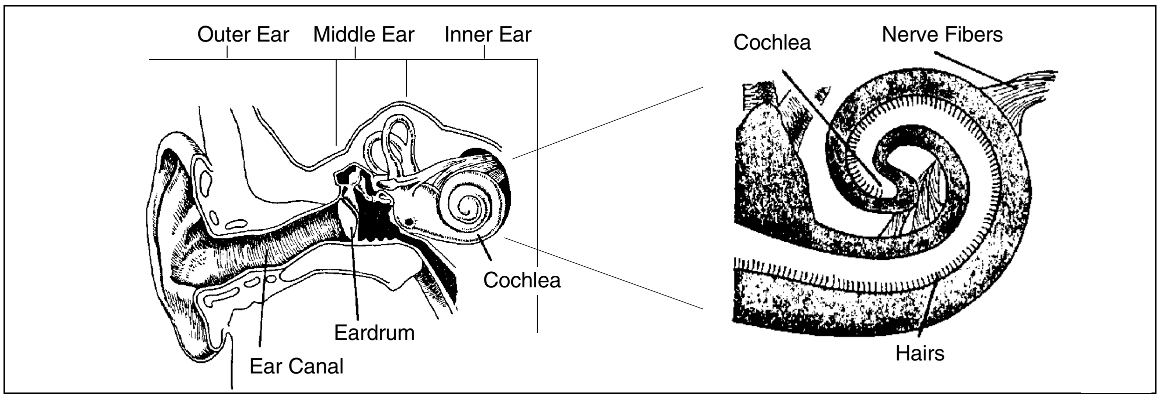
- Failure to catch words or phrases.
- Shouting or raising the voice without realizing it.
- Ringing in the ears known as tinnitus.

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

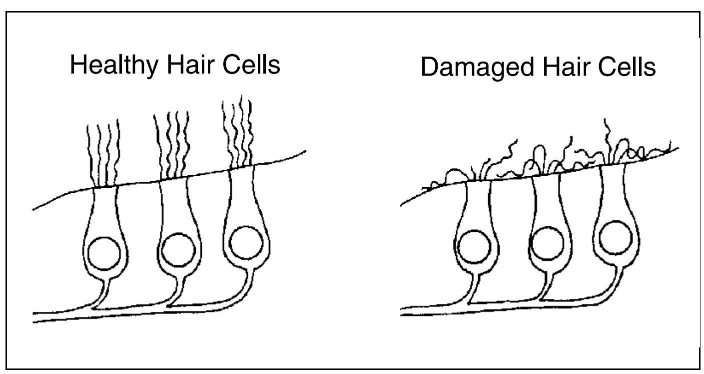
Exposure to excessive noise can damage the ear and destroy the ability to hear.

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.



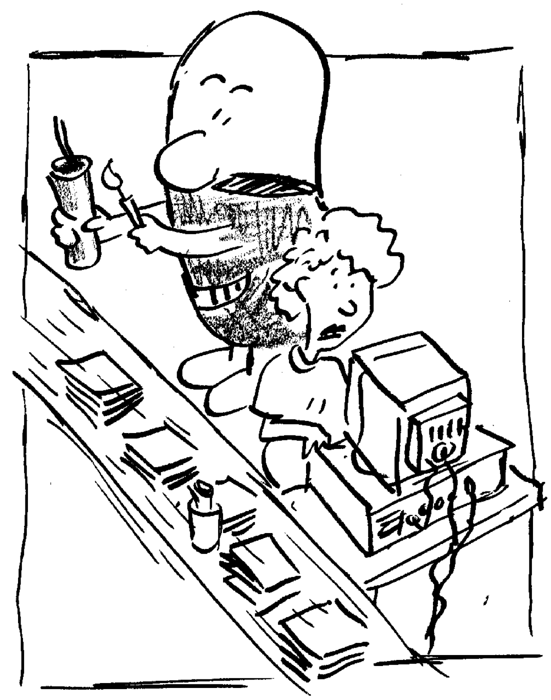
If there is continual exposure to excessive noise, the hair cells will be permanently damaged. The result is loss of hearing.

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.

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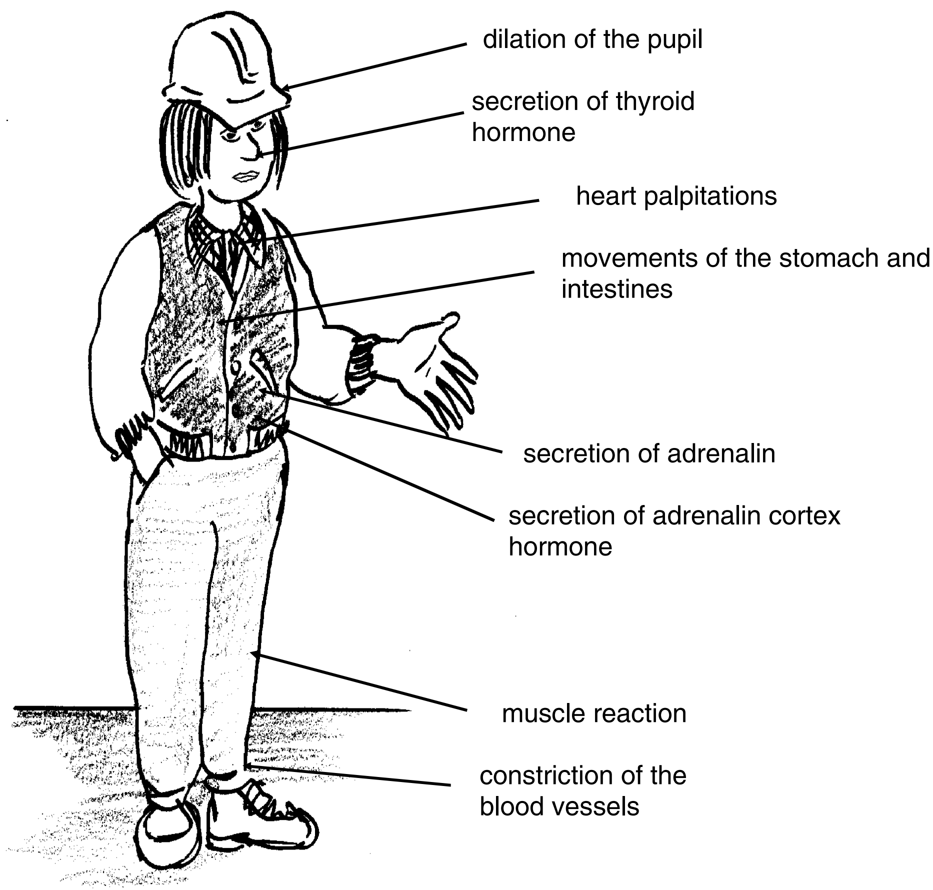
That kind of continual stress means trouble for our bodies. As OSHA states:

> "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.

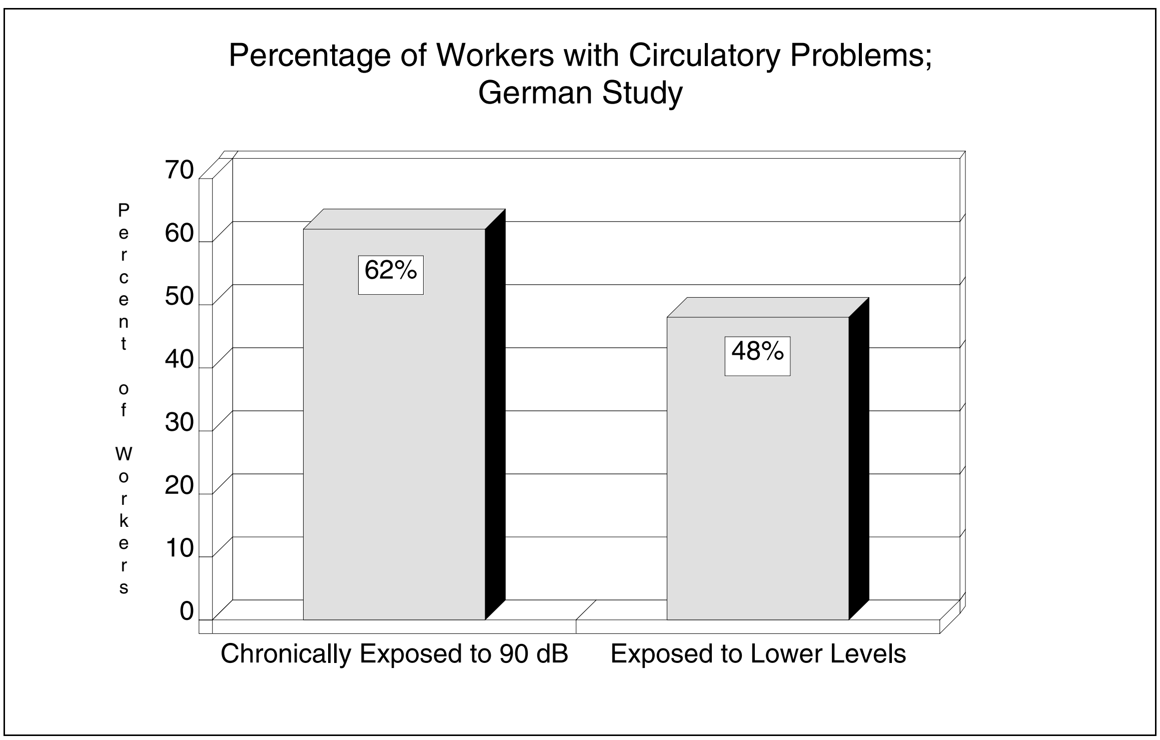
5. Noise-Induced Stress = Bad News for Heart and Circulation

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 PharmChem. In doing so please review the factsheets on pages 140 through 152 and answer the questions which follow below.

PharmChem 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, PharmChem 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 PharmChem?

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

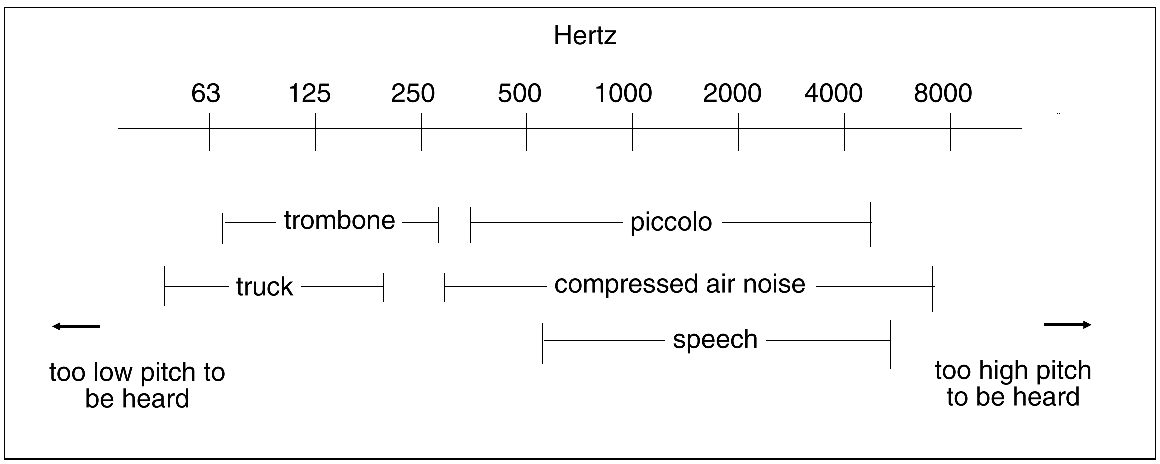
The critical decibel range where painless hearing damage can occur is between the 85 dB to 125 dB exposure levels.

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.

OSHA Requires Engineering Controls

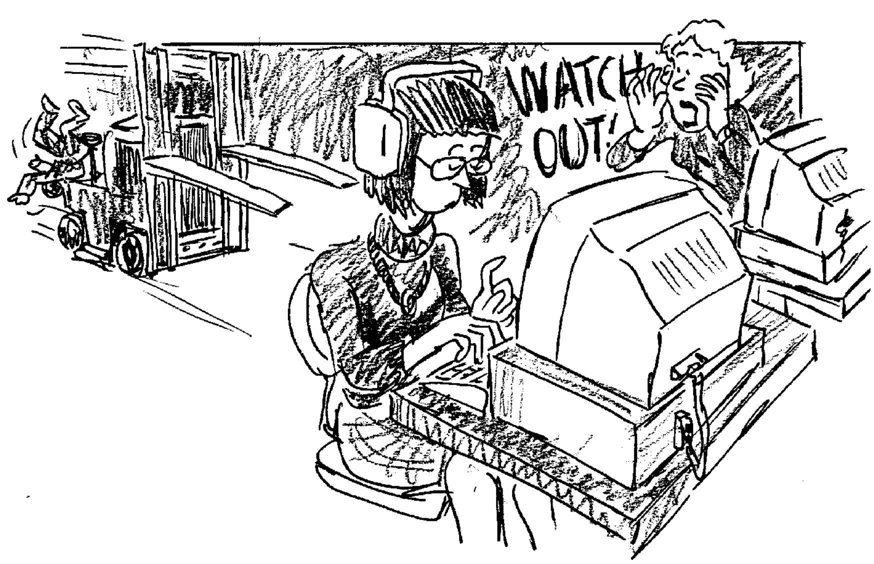
According to OSHA, if noise exposure rises above the levels set forth in Standard 1910.95, the employer must use "engineering controls" (changes in the physical work environment such as sound dampening measures on noisy machines) or "administrative controls" (such as limits on the individual employee's 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.

- 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.

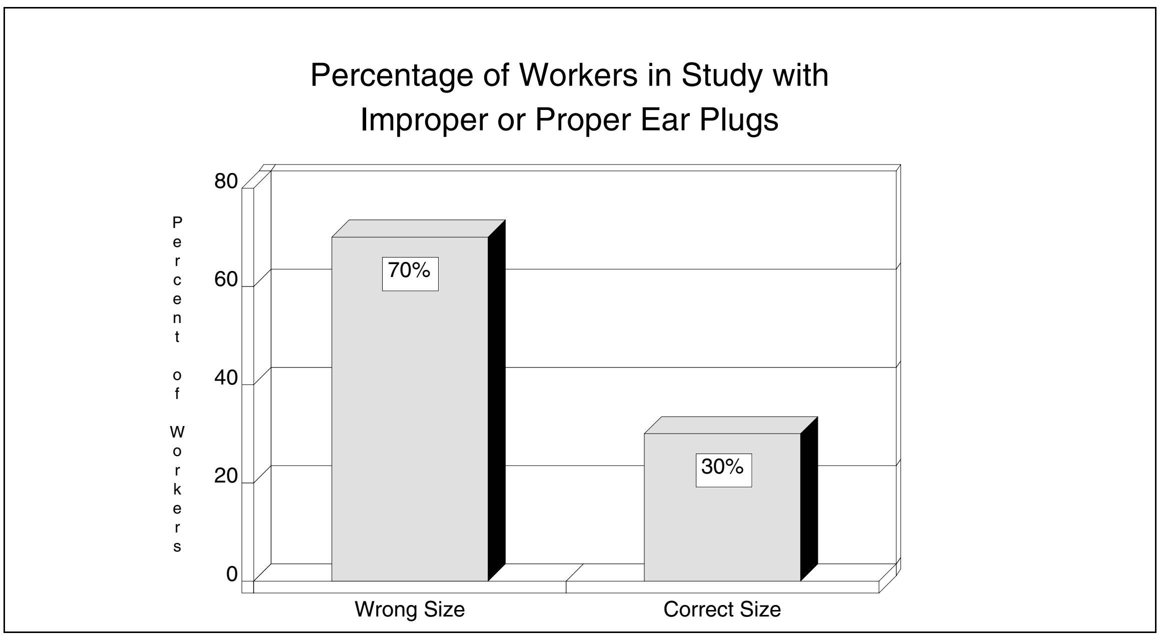
15. Poor-Fitting Ear Plugs Provide Little Protection

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.

Pre-formed   Acoustic Wool   Expandable   Custom-Molded

Sources: *The 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 fur 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 source.

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 (1⁄5 to almost ½ 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.

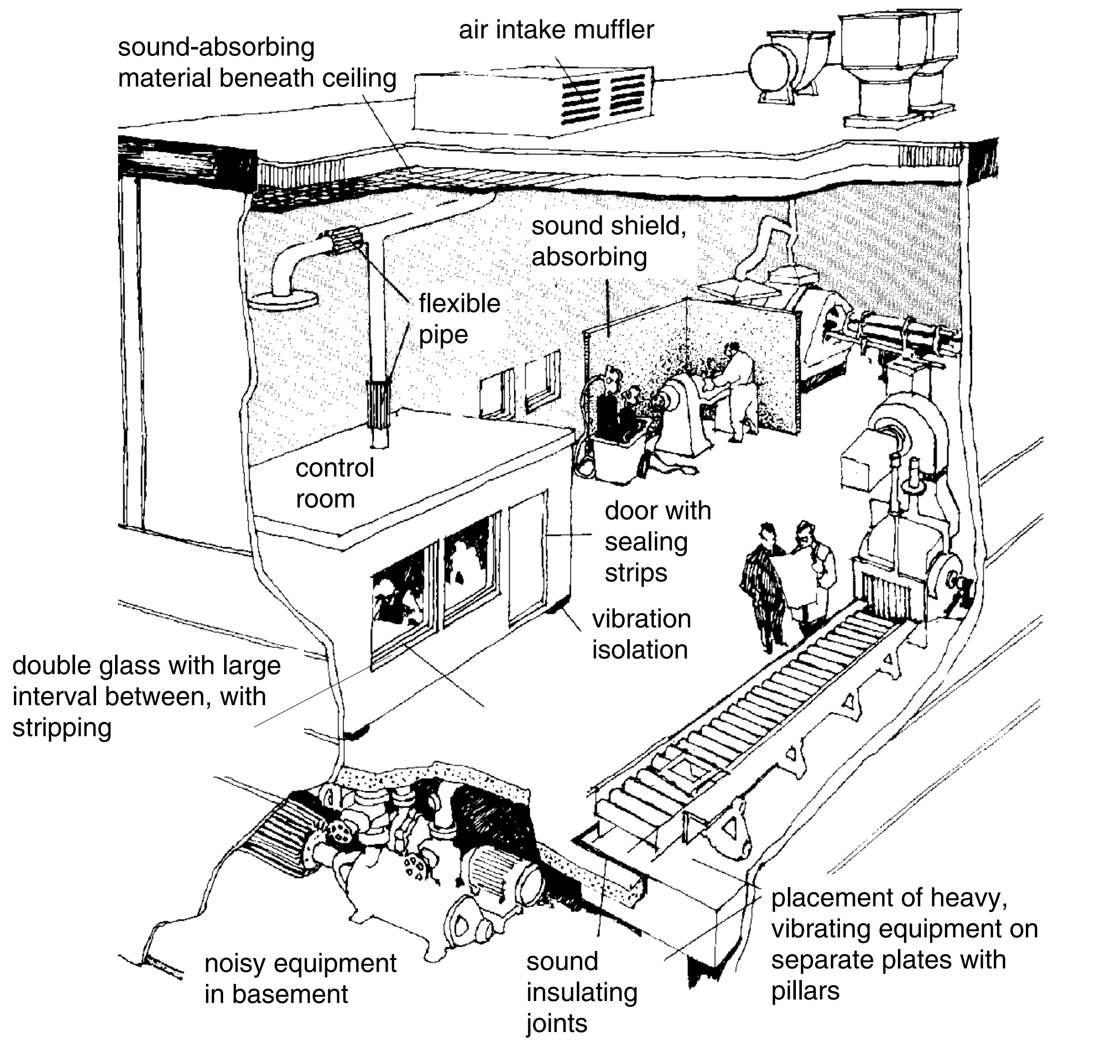
Examples

- Sound absorbing ceiling and wall coverings in noisy areas where workers must spend time.
- Replacement of metal parts with quieter plastic parts.
- Enclosure of especially noisy machine parts in a sound-absorbent structure.
- Design of ventilation ducts with fan inlet mufflers and other mufflers to prevent noise transfer in the ducts.
- Reduction of the dropping height of goods being collected in bins and boxes.
- Selection of belt conveyers which generally are quieter than roller conveyers.

continued

18. *(continued)*

Examples of Engineering Controls



Source: 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.

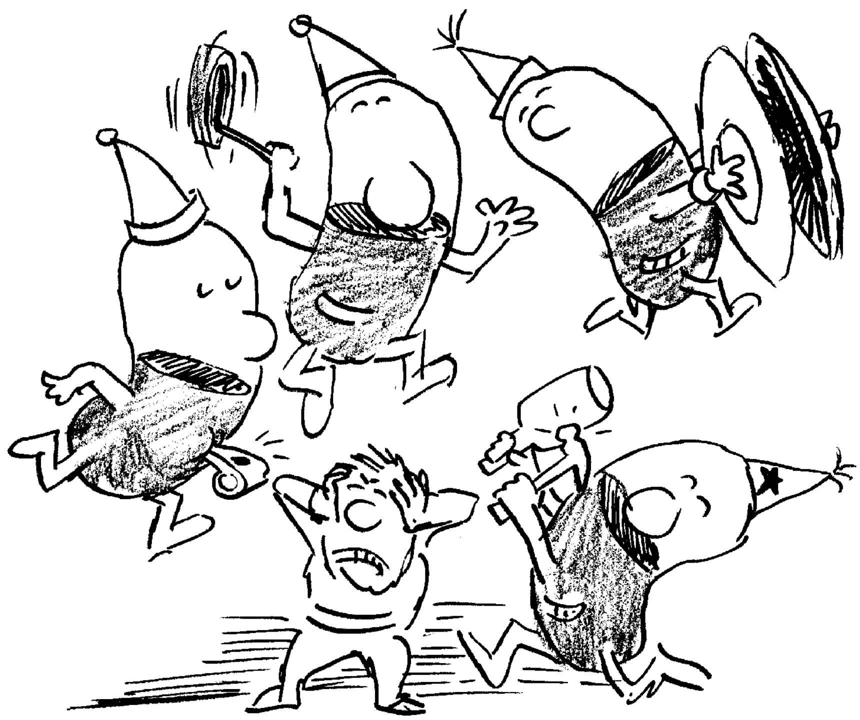
7. OSHA requires that engineering controls or administrative controls be installed at the "90 dB(A) action level."

8. OSHA requires that a hearing conservation program be instituted at the "85 dB(A) action level."

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.



Evaluation Activity 7: The Hazards of Noise Exposure

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's 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: Overated 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?		

continued

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?**

____

____

____

____

Activity 8: Evaluating the Workshop

Purpose

To evaluate the OCAW 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.)

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

References and Resources

COSH Groups*

(No health and safety activist should be without one.)

Alaska

Alaska Health Project
1818 W. Northern Lights Blvd., Ste. 103
Anchorage, AK 99517
(907) 276-2864/Fax: (907) 279-3039

California

San Francisco Labor Council
Fran Schrieberg-c/o Worksafe
660 Howard Street, 3rd Floor
San Francisco, CA 94105
(415) 543-2699/Fax: (415) 433-5077

LACOSH (Los Angeles COSH)
5855 Venice Blvd.
Los Angeles, CA 90019
(213) 931-9000/Fax: (213) 931-2255

SACOSH (Sacramento COSH)
c/o Fire Fighters, Local 522
3101 Stockton Boulevard
Sacramento, CA 95820
(916) 442-4390/Fax: (916) 446-3057

SCCOSH (Santa Clara COSH)
760 North 1st Street
San Jose, CA 95112
(408) 998-4050/Fax: (418) 998-4051

Connecticut

ConnectiCOSH (Connecticut COSH)
32 Grand Street
Hartford, CT 06106
(203) 549-1877/Fax: (203) 728-0287

District of Columbia

Alice Hamilton Occupational Health Center
410 Seventh Street, S.E.
Washington, DC 20003
(202) 543-0005 (DC)/(301) 731-8530 (MD)
Fax: (202) 546-2331/(301) 731-4142

Illinois

CACOSH (Chicago COSH)
37 South Ashland
Chicago, IL 60607
(312) 666-1611/Fax: (312) 243-0492

Maine

Maine Labor Group on Health, Inc.
Box V
Augusta, ME 04330
(207) 622-7823/Fax: (207) 622-3483

Massachusetts

MassCOSH (Massachusetts COSH)
555 Amory Street
Boston, MA 02130
(617) 524-6686/Fax: (617) 524-3508

Western MassCOSH
458 Bridge Street
Springfield, MA 01103
(413) 731-0750/Fax: (413) 732-1881

Michigan

SEMCOSH (Southeast Michigan COSH)
2727 Second Street
Detroit, MI 48206
(313) 961-3345/Fax: (313) 961-3588

Minnesota

MN-COSH
c/o Lyle Krych M330
FMC Corp. Naval System Division
4800 East River Road
Minneapolis, MN 5421
(612) 572-6997/Fax: (612) 572-9826

New Hampshire

NHCOSH
c/o NH AFL-CIO
110 Sheep Davis Road
Pembroke, NH 03275
(603) 226-0516/Fax: (613) 225-7294

New York

ALCOSH (Allegheny COSH)
100 E. Second Street
Jamestown, NY 14701
(716) 488-0720

* As of 1994

continued

COSH Groups *(continued)*

New York *(continued)*

CNYCOSH (Central New York COSH)
615 W. Genessee Street
Syracuse, NY 13204
(315) 471-6187/Fax: (315) 422-6514
Director: Gordon Darrow
Areas of particular interest or expertise:
Workers' compensation.

ENYCOSH (Eastern New York COSH)
c/o Larry Rafferty
121 Erie Blvd.
Schenectady, NY 12305
(518) 374-4308/Fax: (518) 393-3040

NYCOSH (New York COSH)
275 Seventh Avenue, 8th Floor
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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^{o} 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 ug/m^3) 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.

Glossary

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.

Glossary

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/M^3 - Milligrams per cubic meter of air. A unit for measuring the amount of a chemical or substance in the air.

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 ug/m^3 for a 40-hour week. Unfortunately, PELs may not always be completely protective.

Personal Protective Equipment - 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.

Glossary

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.)

Ug/m^3 - Micrograms per cubic meter of air; 100 micrograms equal one milligram.

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.