PB83-115790

HEALTH HAZARDS IN A FOUNDRY.

BOOK I

PATTERN SHOP, CORE ROOM, MOLDING SHOP

AND

SANDHANDLING DEPARTMENT

Prepared by:

National Loss Control
Service Corporation

Long Grove, Illinois 60049

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Occupational health hazards in the pattern shops, core rooms, molding shops, and sand handling departments of foundries are reviewed. Specific health hazards are described along with methods of hazard detection and control. Problems caused by noise, solvent vapors, epoxy vapors, and dust in pattern shops, dusts, gases, vapors, noise, and noniodizing radiation in core rooms, gases, vapors, noise, and fumes in molding shops, and silica dust in sand handling departments are discussed. Remedial actions recommended include reporting of the problem and use of protective equipment such as face shields, goggles, ear plugs, gloves, and barrier cream. Also recommended are good housekeeping practices, regular medical examinations, and engineering controls. The authors emphasize cooperation between workers and management to ensure a safe factory environment.

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PATTERN SHOP, CORE ROOM, MOLDING SHOP,

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SAND HANDLING DEPARTMENT

SO YOU WORK IN A FOUNDRY --

Is it an easy job? Of course not. An important job? You bet.

Pick any item that people use and part of it is built with something produced in a foundry. Automobile engines, furnaces, washing machines, pipe and lots of things most of us can't do without. Without you, these things can't be built and life would be tough and uncomfortable for all of us. You're darned right your job is important!

PART I

This book is about the things in the Pattern Shop, Core Room, Molding Shop, and Sand Handling Department that may harm your health if you don't know what they are and how to watch out for them.

Today, management is responsible for providing a safe and healthful place for you to work. This responsibility is spelled out in the Occupational Safety and Health Administration (OSHA) Regulations. Businessmen, unions, people in government and workers in industry are working together and becoming aware of possible health hazards on the job.

So, what can you, as a foundry worker, do to get rid of health problems where you work?

FIRST - You should know what health problems may be in your area.

SECOND - You should know how to spot health hazards.

THIRD - You should know the right action to take when you think you have spotted a health problem.

REMEMBER!! Under the Occupational Health and Safety Act -- management must provide healthful working conditions and you should help management meet this responsibility. Because you work in the area where health problems may exist, you are in a better position to spot the hazards and report them to management. And it's your responsibility to follow proper procedures and wear protective equipment when required.

KNOW THE POSSIBLE HEALTH PROBLEMS IN YOUR AREA

Pattern Shop

The possible problems in the Pattern Shop are noise, solvent vapors, epoxy vapors, and dust.

Noise

The noise probably comes from the saws, planers, and other woodworking machines. Don't overlook noise from high-speed

fans, compressors, ventilation systems, conveyors, or other foundry equipment that may be located close to your area. (How to determine if a real Noise Hazard exists is discussed on Page 12.)

Solvents and Epoxy Vapors - You may be exposed to solvent vapors such as xylene, toluene, mineral spirits, and others that result from spray painting. You should also be aware of possible overexposures to epoxy vapors at glueing operations. (See Page 10 for more information.)

Dust - You may be exposed to wood and plastic dusts in the pattern shop. Excessive amounts in the air make working uncomfortable but they may not present a health problem.

The Pattern Shop in your foundry probably has fewer potential health problems than any other area.

Core Room

The possible exposures in the Core Room include: dusts, gases and vapors, noise, and Nonionizing Radiation.

Dust - Excessive dust exposures in the core area are primarily due to the automatic core molding operations. WATCH OUT for leaking conveyors and dust from other operations drifting or being vented through your area.

Gases and Vapors - Gases and vapors given off from core molding operations include isocyanates, formaldehyde, ammonia, phenol, carbon monoxide, and others. Isocyanates are used in making cores by the "cold box" method. If you become sensitized to isocyanates, you may get an illness similar to asthma, and additional exposures will make it worse. If isocyanates are used in your core making area, the potential exposures are not likely to be recognized by you. An industrial hygienist using special equipment will need to evaluate the air.

Other gases and vapors such as ammonia, formaldehyde and phenols are usually recognized by their odor or eye and nose irritations. These come from chemical reactions involving either the core baking or oven curing of resin-coated sands. For more information about these problems, see Page 9.

Noise - Excessive noise exposures may occur at automatic Core Molding operations. Watch out for noise from other foundry operations or equipment located near you. See Page 12 for information on noise hazards.

Radiation - Most core rooms cure their cores by baking the core in the box or in electric or gas fired core ovens. Some shops, however, use microwave ovens to cure the cores. Microwaves can cause burns and affect the eyes, ~~but the biggest problem is the~~ also they interfere with some heart pacemakers. These electronic pacemakers regulate the heart beat. It takes an expert

to measure the microwaves near the curing ovens.

Molding Shop

The hazards in the Molding Shop are dusts, fumes, gases, vapors, and noise, but as you'll see, the chance of being overexposed is low.

Dusts - Most of the foundry sand has either been through a sand washer (which will remove the small particles), or it has been wetted--tempered--in the mullers so that the small particles stick together to form larger particles. The component of the dust which causes lung disorders is called SILICA. In the next section of this manual we'll explain why certain contaminants are hazardous. For right now, the fact is that airborne foundry sand must contain very small particles and be dry and dusty for it to affect your lungs.

Squeeze jolt molding doesn't produce much silica dust. But, if you are a sand slinger, you may be overexposed. Powdered mold release compounds may contain large amounts of silica and of small enough size to enter and be caught in your lungs.

Fumes - Your job won't produce fumes which affect your health but if you're near the pouring floor or furnace, you may have a metal fume exposure during melting and pouring operations (see Book II of this series).

Gases and Vapors - Your operation doesn't give off gas and vapors, but carbon monoxide gas and aldehyde vapor may drift into your work area.

Noise - Most of the hazardous noise is generated by the squeeze jolt molder and sand slinger. The only way to know if there is too much noise, is for your exposure to be checked by a person with noise measuring equipment.

Sand Handling Department

The most serious health hazard to rail car or truck unloaders, bin tenders, conveyor mechanics, sand washers, and muller operators is silica dust. You'll only be exposed to other health hazards if they drift over from other departments.

BE SURE TO SEE THE NEXT SECTION - PAGE 7 ON SILICA!!

PART II

HOW TO SPOT POTENTIAL HEALTH HAZARDS IN YOUR AREA!

This part of the book is designed to help you spot the things in your work area that might be harmful to your health.

NOTE: Once you have found what you believe to be a health problem, notify your foreman or union representative to see that a qualified person checks the problem.

HOW TO SPOT -

DUST HAZARDS

Foundry sand usually contains silica. When this silica dust gets in the air you breathe, it can cause a lung disease known as silicosis. This kind of disease usually takes 5 to 20 years of overexposure to develop. The silica dust particles that cause this disease are so small that you can't see them. The only way to be sure you don't have a high exposure to this dust is by having an industrial hygienist measure it. But, if you see a lot of airborne dust in your area, be suspicious, ask if it has been checked.

The symptoms of silicosis are not easily recognized. If you suspect you have been overexposed to silica dust, you should have a thorough examination by a physician. The examination should include a chest x-ray. If you have silicosis, continued exposure will make it worse.

Shakeout crews and grinders of new castings usually have the largest exposure to dust containing silica. But, workers at the following operations may also have high exposures:

Mullers - when mullers are not enclosed and exhaust ventilated.

Rail Car and Truck Unloading - if working downwind from the drop point of the sand.

Sand Bins - at conveyor drop points that are too high or not enclosed, causing dust to get into the air.

Molding - usually not from foundry sand (because it is usually damp at this point), but from some powdered mold release compounds.

Core Molding - from sand shooting out from mold boxes that do not close completely or are badly worn, and from overhead conveyors and leaking exhaust ducts and storage bins.

The clues that there may be too much silica dust in the air are:

1. Dust leaking from elevator enclosures.
2. Buildup of settled dust on window sills, rafters, and machinery.
3. Puffs of dust at conveyor drop points.
4. Dust blown out of shell core boxes.
5. Floor fans blowing dust into your face or away from the exhaust ventilation system.

6. Dust escaping the effect of the ventilation system.
7. Large amounts of black dust caught in your nose.
8. Open foundry sand mullers with no ventilation.
9. Lack of a daily housekeeping program.

VAPOR AND GAS HAZARDS

VAPOR

Solvents will evaporate to form vapors in the air. Solvents are taken into your body by breathing or by direct skin contact with the liquid; they can also be swallowed accidentally.

Unlike silica dust, which requires years of exposure to cause trouble, gases and solvent vapors are fast-acting. In high enough concentrations, the exposure can cause an effect in a few minutes; in lower concentrations, a few weeks may be required to cause an effect. Some solvents and solvent vapors you may be exposed to in the pattern shop and core room are:

toluene
xylene
mineral spirits
methyl ethyl ketone (MEK)
phenol
various alcohols

Exposure in high enough concentrations will cause problems to your nervous system, and you will notice symptoms such as:

dizziness
lightheadedness
headaches
nausea

and possible nose and throat irritation and congested tight chest. If you come into contact with the liquid solvents like toluene, xylene, MEK and phenol, they may cause skin problems (dermatitis), such as dry, cracked skin, redness or rashes.

EPOXY GLUES

Epoxies are called sensitizers. That is, the first dose may not affect you at all, but the next dose, a few days later, will cause an allergy-type reaction, either as asthma or dermatitis.

The odd thing about epoxies is that many workers are not bothered at all by them. It's like poison ivy - you and your buddy may walk through the same ivy patch - you break out, he doesn't.

NOTE: A heated automatic epoxy glueing operation produces more of these vapors than a manual cold glueing operation using epoxies.

GAS

Gases, like the vapors, are quick-acting. You may notice effects in a short time. Also, like solvent vapors, the concentration of gas must be high enough. Just because you smell the gas doesn't mean you will be affected.

Gases, like ammonia and the vapors of formaldehyde, are irritants, and are usually present near shell core machines or the ovens used to bake the oil cores. Ammonia has an odor that is very irritating to the nose, throat, and eyes. Formaldehyde has an odor too, but you'll notice its effects first by watery, burning eyes. Toluene diisocyanate (TDI) vapor given off at the cold box core molding is also a sensitizer like the epoxies, and may cause an asthma-type reaction.

Carbon monoxide gas is given off at core molding operations, and from gasoline or propane-operated industrial trucks. Breathing too much carbon monoxide gas will cause headaches, dizziness, lightheadedness, queasy stomach, and blurred vision. At higher concentrations, it can cause death.

So, the operations which will present a possible exposure to gases and vapors and the types of solvent vapors and gases are:

Spray Painting of Patterns:

- Mineral Spirits
- Toluene
- Xylene
- Naphtha
- MEK

Epoxy Glueing of Patterns

Shell Core Molding:

- Formaldehyde
- Ammonia
- Carbon Monoxide
- Phenol

Oil Core Baking:

Carbon Monoxide
Phenol

Cold Box Core Molding:

TDI Vapor
Dimethyl Ethyl Amine
Carbon Dioxide

To spot potential gas or vapor hazards, look for:

1. Open containers of solvents.
2. Spray painting outside of an exhaust-ventilated booth.
3. No spray booth filter replacement program.
4. Washing off dirt and grime from hands and skin with solvent.
5. Frequent dermatitis problems.
6. No local exhaust ventilation at automatic heated epoxy glueing operations.
7. No ventilation on shell core and cold box molding machines or on the core baking oven and run-out rack.
8. Shell or oil cores cooling in the workroom with no ventilation.
9. Clouds of smoke escaping exhaust hoods at core ovens or shell core machines.
10. Irritating odors.
11. Haze in the workroom getting worse as the shift progresses.

NOISE HAZARDS

Noise may become a problem if: **YOU CAN'T HEAR YOUR BUDDY TALKING IN A NORMAL VOICE AT AN ARM'S LENGTH**
and just like other hazards, you must be exposed to a certain

amount of loudness (loudness is measured in decibels) over a certain amount of time to have an effect. Too much noise over too long a time will cause a hearing loss. People will have to talk louder to you and you won't be able to understand every sound you hear! (The first sign of permanent hearing loss is you will not be able to hear as well for a time after leaving a noisy area. This is a temporary threshold shift.)

The operations which may generate too much noise are:

1. Saws, sanders, shapers, routers, and planers in the Pattern Shop.
2. Squeeze jolt molders, and compressed air used to blow off the pattern and mold in the Molding area.
3. Shell core molding, and cold box molding machines, pneumatic tampers in the Core Room.
4. Fans and collectors for the ventilation system and the air compressors.

RADIATION HAZARDS

Microwaves may be used to cure cores. Microwaves can heat up body tissue the same way it heats up sandwiches in your lunchroom! A guy wearing a pacemaker runs the risk of having the microwaves interfere with his heart beat; you may have noticed warning signs near the lunchroom microwave ovens.

X-rays may be used to inspect castings in the cleaning shop. X-rays can cause burns, eye problems, and other disorders if not properly controlled.

HEAT HAZARDS

Too much heat may cause illness known as heat cramps or heat prostration due to the loss of water from your body. This problem is increased in the summer months. The operation which presents this kind of exposure on your side of the foundry is the shell core molding operation, but this hazard is normally quite small.

You've done your part now in spotting what may be a health hazard by noticing symptoms of what might be overexposure in yourself, and by observing machines and equipment in the pattern shop, core room, molding and sand handling operations. The industrial hygienist can now provide the answer to the question, "Is there an unhealthy condition the foundry worker is exposed to?" He'll ask you and your co-workers to wear air sampling equipment. You've spotted the hazards, he will evaluate the hazards in a scientific manner. Cooperate with him; he has YOUR interests in mind.

PART III

ACTIONS YOU SHOULD TAKE IF YOU THINK A HEALTH HAZARD EXISTS IN YOUR AREA!

This book is written to help you spot exposures in your work area. This book can not tell you if your exposures are too high--only a qualified person with special training and instrumentation can determine that.

The Following are actions you should take:

1. REPORT YOUR PROBLEM!

   If you think that you have a health hazard in your area, it is in your best interest to report it to your foreman and/or union representative.

2. WEAR PROTECTIVE EQUIPMENT WHEN REQUIRED!

   Respirators - Sometimes respirators aren't comfortable, and they can be difficult to breathe through. But, they do protect your health, and it is YOUR RESPONSIBILITY to wear them:

   a. during brief exposures to high concentrations of contaminants when ventilation is not feasible.
   b. until effective engineering control--local exhaust ventilation--can be installed.

All approved respirators will have a NIOSH/MESA seal on the side of the box which explains what the respirator will filter out. Most respirators will only filter out specific chemicals and not all of the chemicals you are exposed to.

IF YOU ARE EXPOSED TO:	YOU SHOULD WEAR:
Dust	An approved dust respirator - Mechanical Filter.
Solvent Vapors	An approved organic solvent vapor respirator - Chemical Cartridge.
Dust and Solvent Vapors	An approved organic solvent vapor respirator (chemical cartridge) with a dust mechanical filter (prefilter).
Gases	A chemical cartridge or chemical canister respirator approved for the particular type of gas.

and, remember these things:

- The cartridges must be changed periodically, especially when you begin to taste or smell the vapor or gas, or have difficulty breathing through them.
- The respirators must be stored in a clean area.
- They must be disinfected regularly, especially when you have a cold.
- Respirators must fit properly. Beards and mustaches may make them leak.
- You must be trained in the proper use and care of the ~~devices.~~ respirator.

Gloves and Barrier Creams - These can be used to protect the skin from chemicals such as solvents and epoxies that can

cause dermatitis.

Face Shield and Goggles - These are used while grinding, sawing, sand slinging, and shakeout to keep particles from the eyes.

Ear Plugs or Muffs - These prevent hearing loss from high noise exposures.

NOTE: Some workers say they can't hear warning bells or other workers when they are wearing hearing protection. You can actually hear better with hearing protection since most of the noise around you is masked out. You may find hearing protectors uncomfortable at first, but after a few days you will get used to them. You may then find the noise in the area to be uncomfortable when protectors are not worn.

REMEMBER

- Plugs must be properly fitted because one size does not fit everyone.
- Plugs should be washed frequently with warm, soapy water.
- Don't use plain cotton.
- Keep your ears clean.
- The side frames of glasses may prevent ear muffs from giving proper protection. You may have to get glasses with special side frames.

3. HOUSEKEEPING

Housekeeping in foundries is important! Dust that settles on the floor, pipes, rafters, and equipment, can be blown into the air by passing vehicles, drafts from open windows and doors, sweeping, fans, and other equipment. The better job YOU do of keeping this dust cleaned up, the better chance you will have of keeping the air you breathe safe.

Naturally, it's best to vacuum, but if you must sweep, do so carefully; don't blow off equipment with compressed air.

Other housekeeping YOU should be aware of include these:

a. Change filters on spray painting booths before they get caked up.
b. Don't leave solvents in open-top containers--use safety cans or lids.
c. Keep the door closed on all mullers.
d. Clean out the dust traps of ductwork.

4. MEDICAL EXAMINATIONS

In addition to your recognition of a hazard and the industrial hygiene studies, another way of determining exposure to excessive contaminants is through periodic medical examination - by your company doctor or your family physician.

A full-size chest x-ray every two to three years will show if silicosis is developing. Also, the doctor will probably ask you to take a breathing test. This will test how much air your lungs can hold. Remember, we said silicosis may cause shortness of breath.

Blood and/or urine tests measure your exposure to certain organic vapors such as phenol or to metal dusts like lead, especially if you work in a brass foundry.

If you work in noisy environments, a hearing test called an audiometric test may be given.

Don't be afraid of these examinations--they're meant to be an early warning for any possible health problems; a good preventive medical program.

5. ENGINEERING CONTROLS

Engineering controls include local exhaust ventilation systems, noise reduction devices (such as enclosures), vacuum systems, and special production equipment. The selection of these controls can only be made by management as a result of engineering plant studies.

REMEMBER -- YOUR input is important. There are many indications of a possible need for engineering controls or of present controls that don't appear to work properly. Ways to tell if ventilation is needed ~~include:~~ one needs improvement:

a. Eye, nose, and throat irritations.

b. Other symptoms you suspect may be caused by the health hazards.

c. Dusty atmosphere.

d. Dust settling over equipment.

e. Strong solvent vapor or gas odors.

WATCH OUT! Many solvent vapors and gases like carbon monoxide don't have an odor.

Indications of inadequate ventilation include:

a. All of the above.

b. Draft in doorways--not enough make-up air.

c. Dust not being drawn into hoods.

d. Poor location of vent hoods.

NOTE: The hood should be located so it will pull the air contaminant away from you.

e. Exhaust stack of the vent system located so that dirty air is returned to your work area through ventilators, heaters, doors, windows, or other openings.

f. Vent system in poor repair; leaking or clogged with dirt.

g. Local exhaust hoods not pulling as well as when initially installed.

DO'S AND DON'TS FOR A HEALTHY WORK ENVIRONMENT IN THE PATTERN SHOP, CORE ROOM, MOLDING SHOP, AND SAND HANDLING DEPARTMENT

THE DO'S!!

1. Make sure the ventilation system is turned on and operating. Things which may be wrong include:
   a. Motor is turning, but the belt to the fan is disconnected.
   b. Fan is reversed; air is blowing out from the hood, not in.
   c. Fans are blowing the contaminant away from the hood.
   d. Hood is too far from source of contaminant.
   e. Hoods and ducts are clogged, restricting air flow.
   f. Supply air duct is drawing contaminated air from the exhaust duct. Open windows can do the same thing.
2. Tell your supervisor of any irritation, discomfort, or rash you suspect may be caused by a foundry contaminant.
3. Dispense and store solvents in safety dispensing cans.
4. Keep the muller enclosure door shut when not adding ingredients.
5. Clean off ledges and machinery above your head. Vacuuming does a better job than sweeping.

6. Wear personal protective devices when needed -
   a. Dust respirators for silica dust.
   b. Chemical cartridge respirators for gases and organic solvents.
   c. Barrier creams and gloves - perhaps face shields and aprons when handling solvents or working with epoxy adhesives.
   d. Ear plugs or muffs for noise exposures.
   e. Face shields at sand slinging.
7. Eat only in designated areas.
8. See your doctor or the company doctor for periodic physical examinations and tests.
9. Discuss industrial hygiene hazards at your safety meetings and ways to correct them.
10. Clean up spills of solvents or chemicals quickly.

THE DON'TS!!

1. Don't spray paint outside the spray booth.
2. Don't use worn cold box or shell core boxes.
3. Don't dispense or store solvents in open containers.
4. Don't use solvents to clean hands.
5. Don't allow dust build-up in aisles, overhead structures, or on machinery.
6. Don't eat in areas having airborne contaminants.
7. Don't eat food in work area.
8. Don't overlook symptoms you suspect may be caused by health hazards.

9. Don't misuse personal protective equipment.

FIRST AID

In foundries, the word is FAST--FAST AID.

If a solvent, acid, or resin gets into your eyes, send someone for medical help and immediately flush your eyes with clean water. Hold lids open with your fingers to make sure water washes away all of the chemicals.

Although always unexpected, foundry workers may suddenly become unconscious from extreme overexposure to solvent vapor, carbon monoxide gas, or extreme heat.

If you know how to give artificial respiration, you might revive someone who is unconscious and has stopped breathing. This could prevent death or brain damage.

KNOW WHO THE TRAINED FIRST AIDER IS ON YOUR SHIFT

NOTE: Make sure emergency telephone numbers are posted.

Emergency numbers should include:

Doctor
Ambulance
Hospital
Police Department
Fire Department

YOU'VE FINISHED READING THE BOOK--

Now, what are you going to do?

Getting rid of health problems in your foundry may be a tough job. But, for every health problem that exists in a foundry there is at least one way to control or eliminate it.

It isn't the health problems that are so difficult, it's the people problem. It takes people working together to solve health problems.

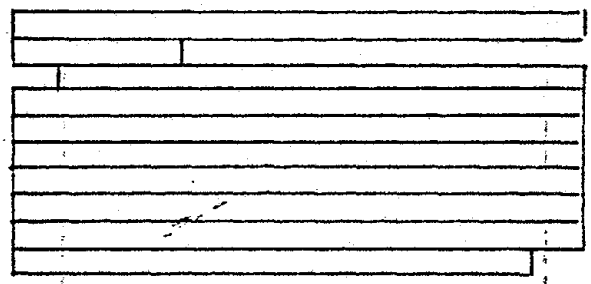
Someone must tell the company nurse or doctor where the health problems are, who may be exposed, and how to control them.

"ONE THING'S FOR SURE--THE BOOK CAN'T DO IT ALONE!"

See if you can't get the ball rolling. Be responsible--start caring--for your health and the health of your fellow workers.

SO YOU WORK in a FOUNDRY

PATTERN SHOP, CORE ROOM, MOLDING & HANDLING



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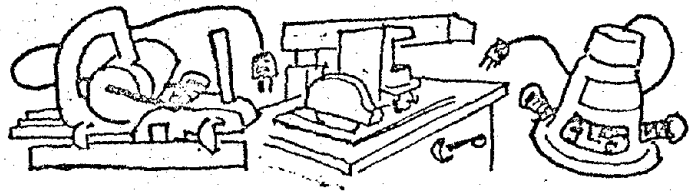

SAFETY-

DUST-

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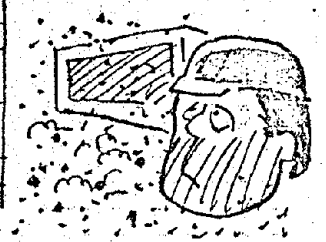
Life Building

DUST-



GASES-

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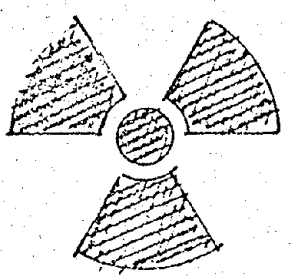
DUST-

SMOKE VARIOUS

RADIATION-



AIRBORNE SWAP!

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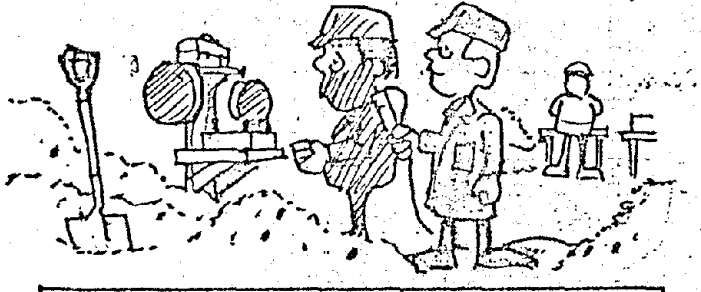

FUMES-

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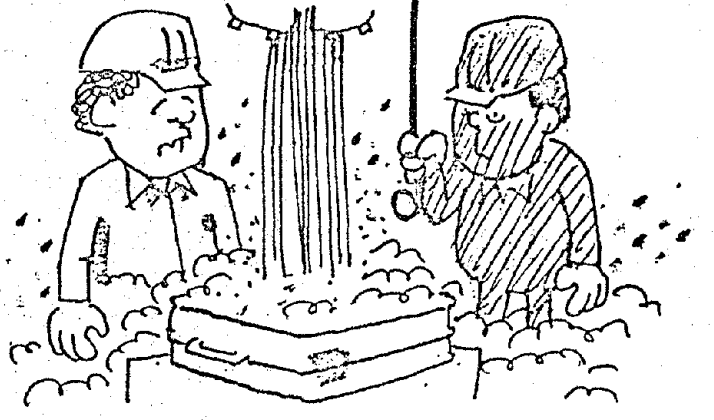

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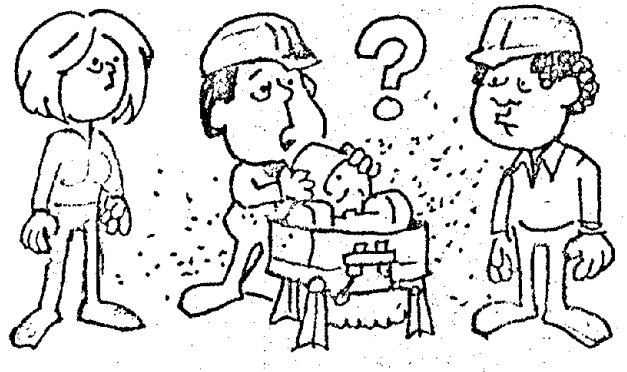

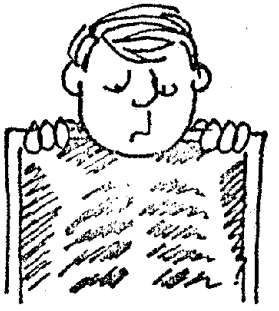

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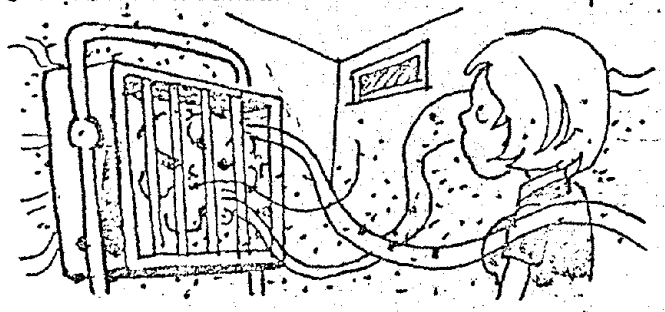

VAPOR HAZARDS

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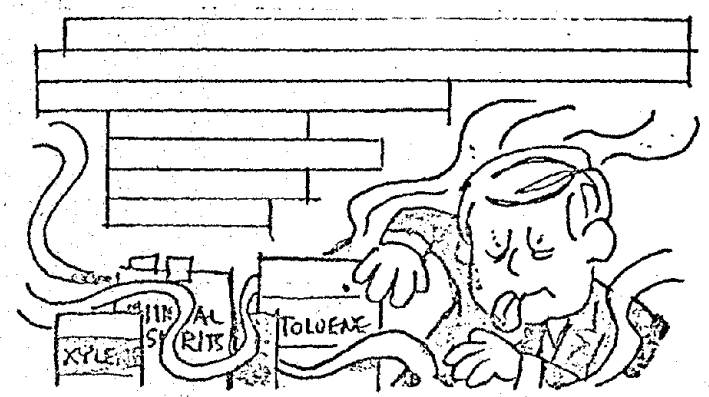

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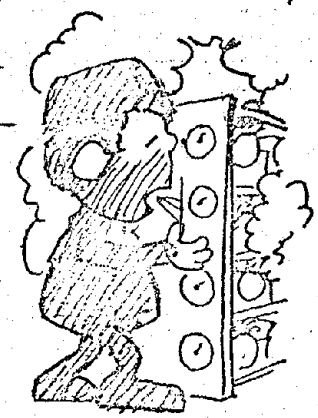
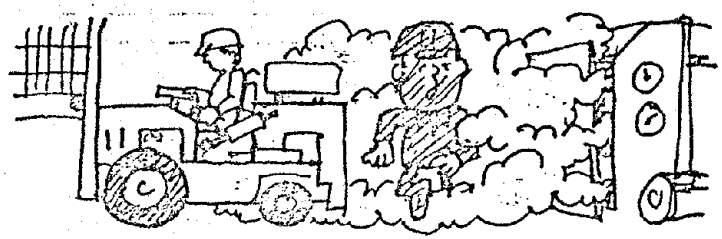
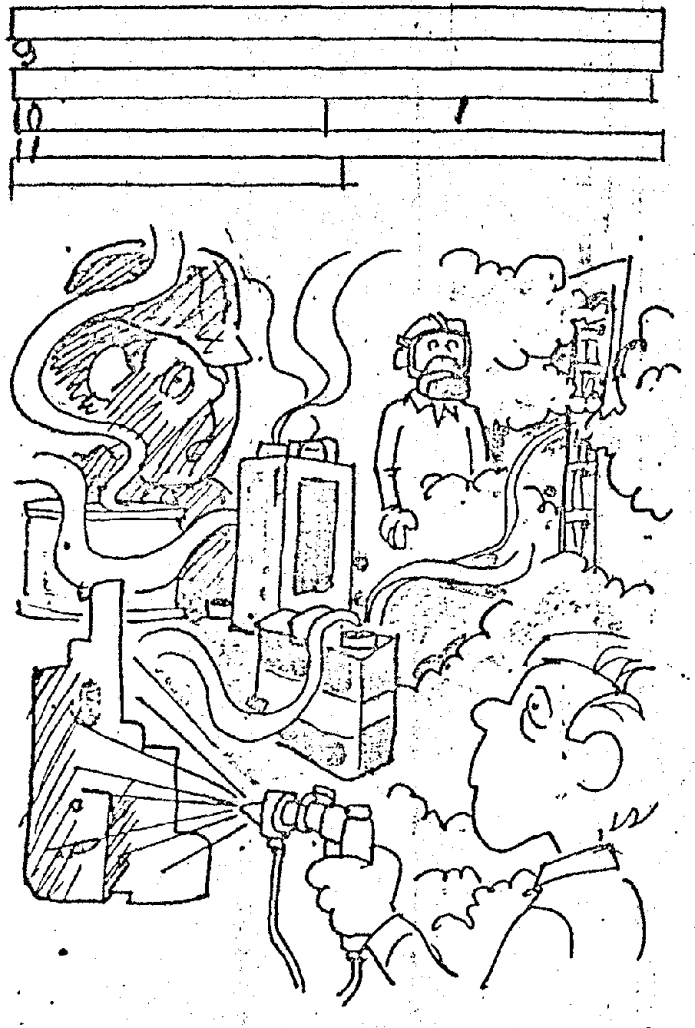




2
5
4
5
6
7
8



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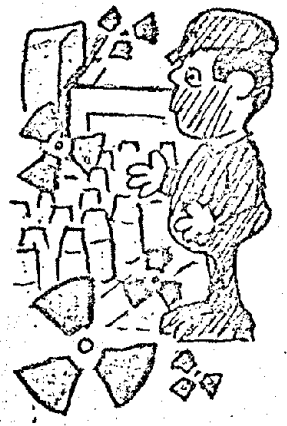
RADIATION HAZARDS



HEAT HAZARDS

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Part 3

ACTIONS YOU SHOULD TAKE IF YOU THINK A HEALTH HAZARD EXISTS IN YOUR AREA

1. REPORT YOUR PROBLEM

2. WEAR PROTECTIVE EQUIPMENT WHEN REQUIRED

4.

5.

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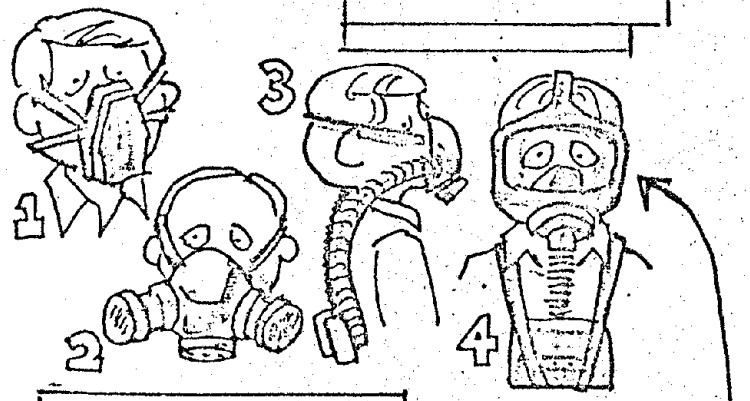
1.
2.
3.
4.



1.
2.
3.

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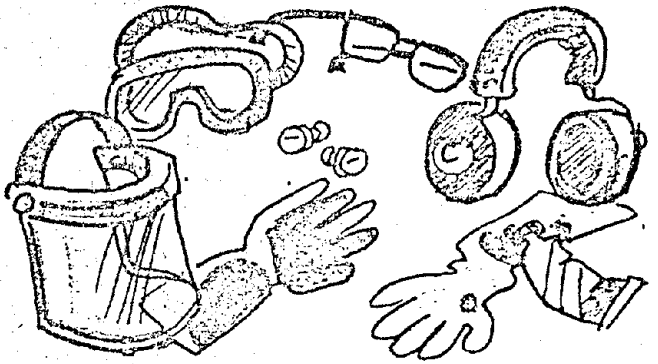
4.
5.



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The man looks scared to death!

What about "spooky eyes"

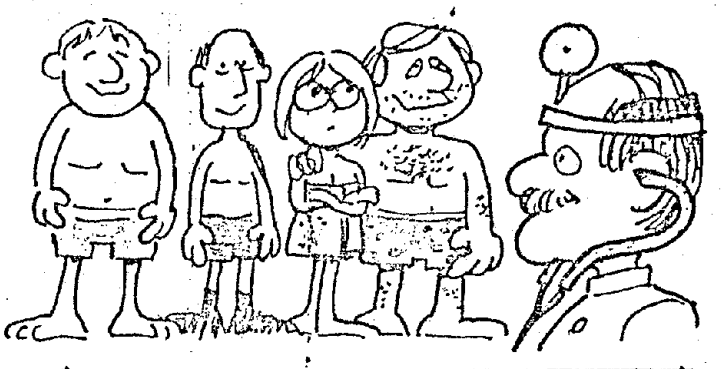
35

1.
2.
3.
4.

II HOUSEKEEPING

A
B
C

IV MEDICAL EXAMINATIONS



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V. ENGINEERING CONTROLS

A.
B.
C.
D.

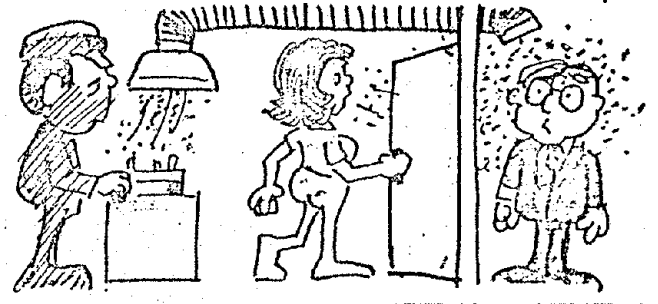
A.
B.
C.
D.

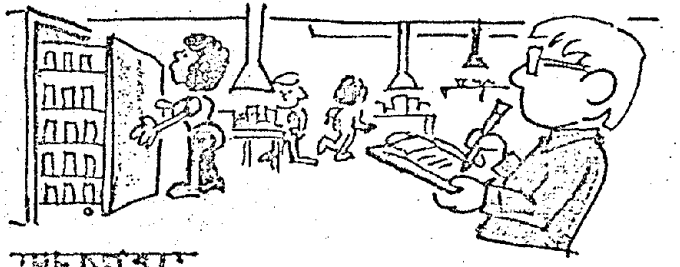
NOTES:

E.

F.

G.
H.
I.





THE BASIS:

1.

A.

B.

C.

D.
E.
F.
G.

2.
3.
4.
5.
6.
A.
B.
C.
D.
E.

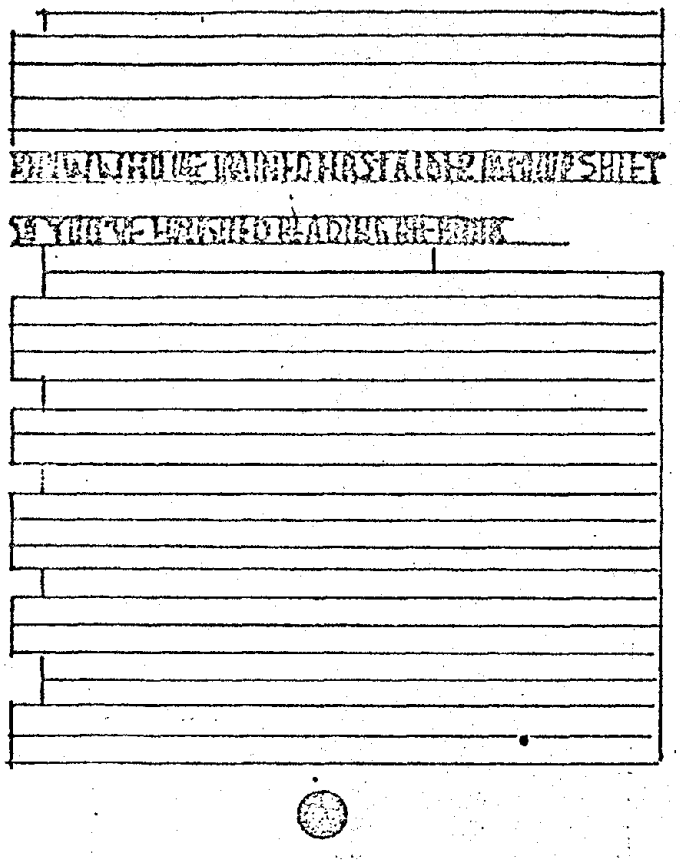
This is no way to properly clean a respirator!

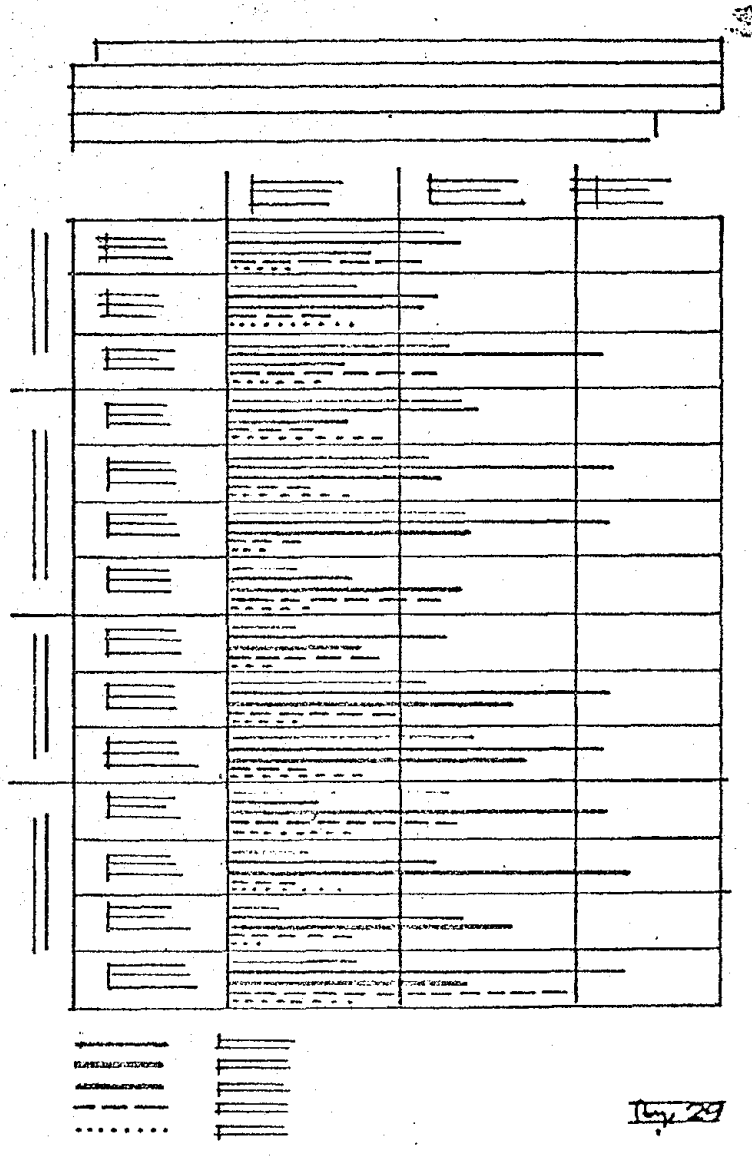
7.
8.
9.
10.

THE DON'TS!!

1.
2.

3.
4.
5.
6.
7.
8.





IN CASE OF EMERGENCY