PART THREE
RESOURCES

1. Common Hazards

Safety Hazards

Health Hazards

Chemical Hazards

Indoor Air Quality

Safety Hazards

Safety hazards include machine guarding, mechanical power transmission systems, electrical safety, power and hand tools, working and walking surfaces, trip, slip and fall hazards, ladders, scaffolds, and other personal climbing and elevated support devices, lock-out and tag-out procedures, to name just some. Also, repetitive, awkward or heavy work is a widespread safety hazard.

HEIGHTS

Working at heights, especially of six feet or more, workers are at risk and need to be protected. The height could be on a roof, loading dock, catwalk, scaffold, ladder, stairs, or in a tree. Falls may result from many factors, including lack of handrails and guardrails, poorly constructed scaffolding, lack of fall protection equipment, slippery surfaces, and lack of safe ladders and footstools. Studies show that the use of handrails, guardrails, fall-arrest systems (like a lifeline to safely stop a fall), safety nets, covers, and travel restriction systems can prevent many deaths and injuries. Guardrails should be 42 inches high on top with a mid-rail. Toe-boards should be provided to prevent objects from being accidentally kicked off platforms onto workers below.

ELECTRICITY

Electrical exposure may occur when there is hard usage or poor maintenance of electrical equipment, or lack of understanding of the equipment and the way it operates. Oxygen-enriched atmospheres and water may contribute to hazardous conditions. Engineers, electricians, and other professionals are at high risk working with electricity directly, including working on overhead lines, cable harnesses, high voltage control panels, and circuit assemblies. Many others work with electricity indirectly and may also be exposed to electrical hazards.

Employers should provide workers with non-conductive protective clothing appropriate for the part of body to be protected. They need to ensure that live equipment is de-energized before work, stored electrical energy released, a lock and tag placed on each disconnecting means, and the effectiveness of these precautions verified. Employers must also ensure that all electrical equipment is properly installed, marked with a rating, its disconnecting means marked with the purpose and live parts guarded in approved enclosures with posted warnings. Employers must provide proper grounding and overcurrent

protection. In hazardous locations with potential ignitable, combustible atmospheres, all equipment must be intrinsically safe (incapable of igniting combustible vapors).

TRAFFIC ZONES

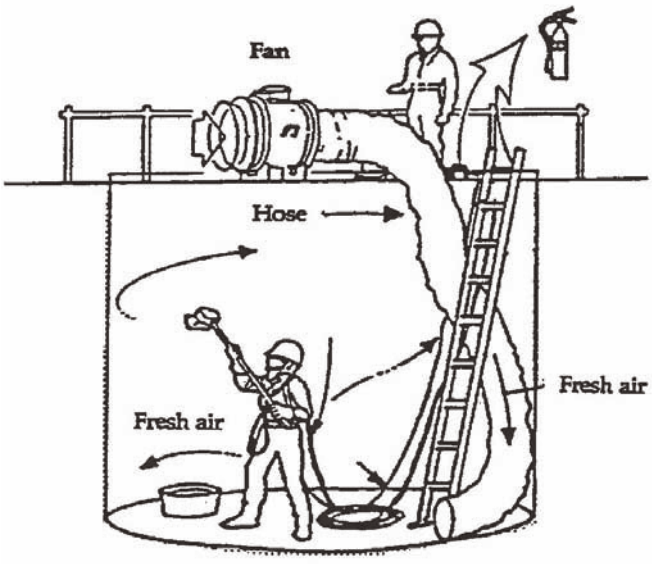
Many workers are killed or seriously hurt by vehicles while repairing roads or doing other work in traffic zones. This danger exists when traffic is not properly routed and/or adequate barriers are not placed between the workers and the traffic. Protection from traffic should be provided by work zones, signs, signals, lighting, flagging and barricades. All workers in traffic zones should wear reflective warning vests.

FORKLIFTS AND TRUCKS

Workers can be injured or killed if a powered industrial forklift truck strikes a barrier, falls off a loading dock, or tips over. Workers may be struck by a truck or falling load, or injured while jumping off a tipping truck. They may fall off an elevated pallet or forklift tines. Ways to prevent these hazards include maintenance and daily inspections of trucks, especially brakes, horns, lights, back-up alarms, tire tread and pressure; safe operating procedures; operator training and licensing; operator seat belts; traffic management: speed limits, dome mirrors, stop signs, some aisles designated truck-only; lifting of persons only in lift cages; and restricting use during beginning and end of shift and breaks.

CONFINED SPACES

Many workplaces contain spaces that are considered "confined" because their configurations hinder the activities of workers who must enter, work in, and exit them. Examples of confined spaces include tanks, manholes, sewer digestors and silos, tunnels, pumping stations, and utility vaults.



There are many hazards in confined spaces. Workers can become unconscious and die from a lack of oxygen. At other times, there may be too much oxygen or other chemicals that can catch fire or explode.

Poisonous gases and vapors, such as hydrogen sulfide or carbon monoxide, may also build up. Confined spaces can also pose physical hazards. They can be very hot, cold, or noisy. Workers can slip on wet surfaces. Grain, sand or gravel can bury a worker.

Confined spaces need to be purged, flushed, and ventilated before entry. They often require other hazard prevention measures to be taken such as prohibiting unauthorized access; posted danger signs; written procedures to prepare, issue, use and cancel entry permits; appropriate testing prior to entry and continually during entry; an attendant stationed outside; and provision of harnesses, retrieval lines, and rescue personnel.

TRENCHING AND EXCAVATIONS

Working in an area that is dug up can be very dangerous. A trench is a space that is deeper than it is wide. An excavation is any depression formed by earth removal. The main danger in trenching and excavation is cave-ins. If a trench caves in, workers can be buried, crushed, drowned or suffocated. Any trench deeper than five feet needs protection such as soil testing, sloping, shoring, trench boxes, emergency rescue equipment, daily inspection by a competent person, and elimination of standing water.

MACHINES

Workers can get parts of their body caught in or struck by exposed moving parts if machines are not properly designed or guarded, or if they are not locked out when being repaired. Workers can also be struck by flying objects from grinders and other machines that do not have protective guards. All machines should have firmly secured guards that prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts, yet permit safe, comfortable, and relatively easy operation. Operating control panels and emergency shutdown mechanisms should be within easy reach of operators.

HAND AND POWER TOOLS

Tools can generate flying objects that may strike the eyes, face, or body. They are also sources of noise, vibration, and dust. Tools that use gasoline or propane fuel generate poisonous carbon monoxide gas and must be used with adequate ventilation. All tools should have a 3-wire grounding plug, regular inspection and maintenance to keep them sharp, clean, and lubricated, a ground-fault circuit interrupter, a positive "off-on" switch, and a constant-pressure switch that shuts off the power when released. Power-actuated tools should have a device to keep fasteners from being ejected unless the muzzle is against the work surface.

FIRE AND EXPLOSIONS

There are many ways fires can start in workplaces. Examples include sparking sources like welding and burning; ovens, boilers, fryers and other hot equipment; and flammable and combustible materials and waste. The most effective way to isolate flammable and corrosive hazards is to store them properly in approved safety storage cabinets. Minimum quantities should be stored to reduce the risk. The most serious hazards and incompatible materials need to be separated and isolated. Every workplace should have an evacuation plan for getting people out of a building in case of fire or explosion as well as an alarm or alert system to quickly inform employees of an emergency. Workers should be trained on what to do in case of an emergency. Every workplace must have enough exits suitably located to enable everyone to get out of the facility quickly. OSHA/NJPEOSH Standards require employers that expect workers to use firefighting equipment to give them appropriate equipment and train them to use the equipment safely.

SLIPS/FALLS

Holes in floors and walls are a fall hazard unless properly guarded or covered. Bad housekeeping and poor drainage can make floors and other walking surfaces wet and slippery. Floors must be clear of ice, water, grease, debris, cords, lines, hoses and other obstructions. Loose or uneven flooring/carpeting needs to be repaired. Stairs need railings, non-slip treads, and uniform rise/tread dimensions, and should not be too steep.

ERGONOMIC HAZARDS

Ergonomic hazards refer to workplace conditions that can injure the muscles and bones and cause severe and debilitating symptoms including severe, chronic pain and numbness. Such injuries are among the most prevalent work-related medical problems. Examples include back strain and carpal tunnel syndrome, a condition affecting the hand and wrist. Ergonomic hazards include lifting heavy boxes, standing all day, vibration, repetitive motions, forceful movements, and awkward postures that arise from improper work methods and improperly designed workstations, tools, and equipment. Using a computer keyboard and mouse is a common repetitive motion hazard. Ergonomics is the science of fitting workplace conditions and job demands to the capabilities of workers.

Health Hazards

Health hazards include any working condition that can lead to disease, such as poor sanitation. Other health hazards are physical agents such as noise, vibration, radiation, and extremes in temperature and pressure. Health hazards also include biological hazards such as mold, bacteria, viruses, insects, plants, birds and animals. Working schedules different from the most common 9 to 5 pattern are also a potential health hazard, as are understaffing, excessive work load, fast work pace, long hours, shift work, production quotas, violent clients/patients, and harassment.

SANITATION

Sanitation problems include garbage, rodents, insects, unsafe water, too few toilets, poor toilet and washing facilities, and eating, drinking or storage of food in toilet rooms or contaminated areas. All restrooms should have hot and cold running water, soap, and hand towels. A clean lunchroom and separate storage for street and work clothing is desirable, especially in those workplaces using toxic substances. Proper storage and disposal of waste is essential as is safe drinking water. Pests should be controlled with least-toxic methods.

Biological Hazards: Sources of biological hazards include bacteria, viruses, mold, fungus, insects, plants, birds, animals, and humans. These sources can cause health effects ranging from skin irritation and rashes to allergies to infectious diseases like tuberculosis, influenza, hepatitis, and HIV/AIDS.

- ***Exposures to blood*** and other body fluids occur on many jobs. Health care workers, emergency response and public safety personnel, and other workers can be exposed to blood through needlestick injuries or contact of blood with skin or mucous membranes (mouth, eyes, and nose). The pathogens or disease-causing agents of primary concern are the human immunodeficiency virus (HIV/AIDS), hepatitis B virus (HBV), and hepatitis C virus (HCV).
- ***Exposures to airborne biohazards*** can lead to tuberculosis, influenza (flu), and colds.
- ***Mold or fungus*** may grow when any building material or furnishing is damp for more than 48 hours. Many types of mold exist and can be many different colors. Many buildings have experienced water damage due to roof or plumbing leaks, floods, and poor drainage of rainwater runoff or landscape

irrigation. Damp buildings support mold growth and other biological contaminants that may cause health problems for some workers. Molds can grow as long as organic material, air, and moisture are present. Mold growth is often visible. In some cases, however, indoor mold cannot be seen because it is on hidden surfaces such as the backside of drywall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads, or inside ventilation systems. Suspect hidden mold if an area smells moldy or if there has been water damage and occupants are reporting health problems.

Stressors/Work Design Hazards: These include understaffing, excessive work load, fast work pace, long hours, shift work, production quotas, violent clients/patients, and harassment.

- ***Violence on the job*** is a growing problem. In fact, homicides are the second-leading cause of workplace deaths. Workplace violence includes physical assault as well as near-misses, verbal abuse and sexual harassment. Workers in law enforcement, corrections, social services, health care, mental health and schools are most at risk. Homeless shelters, unemployment and public assistance offices, emergency rooms, and mental health clinics are more crowded than before. Staffing levels are not keeping up with increasing caseloads. Members of the public take out their frustration on workers when they face reduced benefits and longer waiting periods.

The National Institute for Occupational Safety and Health (NIOSH) says that conditions increasing a worker's risk of assault include:

- Working with the public.
- Working alone.
- Handling money.
- Coming in contact with people (patients, clients) who may be violent.
- Inexperience.

Physical Agents: Physical "agents" include sources of energy that may cause injury or disease. Examples include noise, vibration, radiation, poor lighting and extremes in temperature and pressure.

- ***Noise exposure*** may cause a temporary, partial loss of hearing (ears may feel stuffed up) or a temporary ringing in the ears (tinnitus). These short-term problems usually go away within minutes or hours after leaving the noise. However, repeated exposures to loud noise can lead to permanent, incurable hearing loss or tinnitus. It is also hard to understand speech in noisy situations, which creates a safety hazard. Even low noise levels, when encountered throughout the work day, can create stress. Workers exposed to noise should be provided with earplugs and muffs, hearing tests, and quiet rooms for breaks. The employer should arrange for measurement of noise levels, enclosure of noisy machines, and sound dampening with absorbent materials.

- ***Vibration*** exposure is a danger for workers who come in contact with vibrating machinery or equipment. When a worker operates hand-held equipment, such as a chain saw or jackhammer, vibration affects hands and arms. When a worker sits or stands on a vibrating floor or seat, the exposure affects almost the entire body. The risk of injury depends on the intensity and frequency of the vibration, the duration (years) of exposure and the part of the body which receives the vibration energy.
- ***Non-ionizing radiation*** is found in a wide range of occupational settings and can pose a considerable health risk to potentially exposed workers if not properly managed by protective glasses and clothing, limiting exposure time, increasing the distance from the source, and shielding the source. Non-ionizing radiation includes ultraviolet (UV), visible light, infrared (IR), microwave (MW), radio frequency (RF), and extremely low frequency (ELF). Lasers commonly operate in the UV, visible, and IR frequencies.
- ***Ionizing radiation*** can be found in many workplaces, including health care facilities, research institutions, nuclear reactors and their support facilities, and other manufacturing settings. These radiation sources can pose a serious health risk if not properly managed by limiting exposure time, increasing the distance from the source, shielding, and measuring exposure levels with film badges or dosimetry. Ionizing radiation includes X-rays and radioisotopes like uranium that are radioactive and give off radiation when the nucleus breaks down or disintegrates. The three possible kinds of radiation generated by radioactive materials or sources are alpha particles, beta particles and gamma-rays.
- ***Excessive Cold*** is a risk in operations involving low air temperatures, high air movement; wetness or sweating; exposed fingers, cheeks, nose, ears, uncovered head; clothing or shoes that restrict circulation; low activity level; contact with cold objects; and being tired, hungry or thirsty. Readings of temperature and air movement should be taken in all cold work areas at the start, middle, and end of each shift, at least every four hours. Excessive cold exposure can result in frost bite, hypothermia, swollen and tender feet (immersion foot) and chilblains - red, swollen skin, usually on hands and feet, that feels hot, tender, and itchy after cold exposure.
- ***Excessive Heat*** is a risk in operations involving high air temperatures, especially above 95 degrees Fahrenheit; radiant heat sources such as boilers, ovens, furnaces, hot asphalt; high humidity, direct physical contact with hot objects, or hard physical work. Additional risk factors are workers not being given time to gradually get used to the heat and lack of drinking water, fans, reflective shields, heat-protective gloves and clothing, and cooling vests. Readings of temperature and humidity should be taken in all hot work areas at the start, middle, and end of each shift, at least every four hours. Excessive heat can result in heat rash, dehydration, heat cramps, heat exhaustion, and heat stroke.

- ***Lighting.*** Whether in industrial or office settings, proper lighting makes all work tasks easier. Appropriate lighting, without glare or shadows, can reduce eye fatigue and headaches. It highlights moving machinery and other safety hazards. It also reduces the chance of accidents and injuries from "momentary blindness" while the eyes adjust to brighter or darker surroundings. Improper lighting can often be a problem associated with poor maintenance.

Chemical Hazards

Of the six to seven million chemical substances known in industry and scientific research, close to 70,000 are produced for regular use. Of this number, several thousand are produced in substantial quantities for industrial use. Solvents, lead, asbestos, silica, latex, formaldehyde, cleaning chemicals, metal dust, metalworking fluids, diesel exhaust, and copier and printer fumes are all examples of chemical hazards. Some can be seen as dust in the air and some can be smelled as vapors or gases. Others can be harmful without any odor or visible sign. Too often workers get used to chemical smells and cannot detect them even at high levels. Some chemicals are also safety hazards because they are flammable or explosive, or react dangerously with other chemicals.

ROUTES OF ENTRY

Breathing contaminated air is the most common way that chemicals enter the body. Some chemicals, when contacted, can seep through the skin. Less commonly, chemicals may be eaten if the hands, face, food or cigarettes are contaminated. The eyes may also be a route of entry. Usually, however, only very small quantities of workplace chemicals enter through the mouth or the eyes. Rarely, a chemical is injected through the skin by a sharp object such as a needle or broken glass.

HEALTH EFFECTS

In addition to serious and immediate health problems, chemicals can cause a new health problem or make old problems worse. People with existing lung problems, for example, are most at risk from substances that cause lung problems.

Most chemicals can cause both immediate effects (acute) and those that show up years later (chronic). Acute health effects may be temporary, such as skin irritation, headaches or nausea, or they may be permanent, such as blindness, scars from acid burns, mental impairment, etc. Chronic health effects include cancer and damage to major systems of the body. For example, solvents can cause acute irritation of the eyes, nose and throat, dizziness, drowsiness, nausea and vomiting. Solvents also cause chronic damage to the liver, kidneys, and brain – and many cause cancer.

FORMS OF TOXIC MATERIALS

Toxic materials can take the form of solids, liquids, gases, vapors, dusts, fumes, fibers and mists. How a substance gets into the body and what damage it causes depends on the form or the physical properties of the substance.

A toxic material may take different forms under varying conditions and each form may present a different type of hazard. For example, lead solder in solid form is not hazardous because it is not likely to enter the body. Soldering, however, turns the lead into a liquid, which may spill or come into contact with skin. When the spilled liquid becomes solid again, it may be in the form of small particles (dust) that may be inhaled or ingested and absorbed. If lead is heated to a very high temperature such as when it is welded, a fume may be created; a fume consists of very small particles that are extremely hazardous as they are easily inhaled and absorbed. It is thus important to know what form or forms a given substance takes in the workplace. A description of each of the forms follows.

Solid: A solid is a material that retains its form, like stone. Most solids are generally not hazardous since they are not likely to be absorbed into the body, unless present as small particles such as dust.

Liquid: A liquid is a material that flows freely, like water. Many hazardous substances such as solvents are in liquid form at normal temperatures. Some liquids can damage the skin. Some pass through the skin and enter the body and may or may not cause skin damage. Liquids may also evaporate (give off vapors), forming gases which can be inhaled. Mercury is a metal that is liquid at room temperature.

Gas: A gas consists of individual chemical molecules dispersed in air, like oxygen, at normal temperature and pressure. Some gases are flammable, explosive, and/or toxic. Examples of gases are formaldehyde, chlorine, ammonia and Freon refrigerants. The presence of a gas may be difficult to detect if it has no color or odor, and does not cause immediate irritation. Such gases, like carbon monoxide, may still be very hazardous.

Vapor: A vapor is the gas form of a substance that is primarily a liquid at normal pressure and temperature. Most organic solvents evaporate and produce vapors. Vapors can be inhaled into the lungs, and in some cases may irritate the eyes, skin or respiratory tract. Some are flammable, explosive and/or toxic. The term vapor pressure or evaporation rate is used to indicate the tendency for different liquids to evaporate.

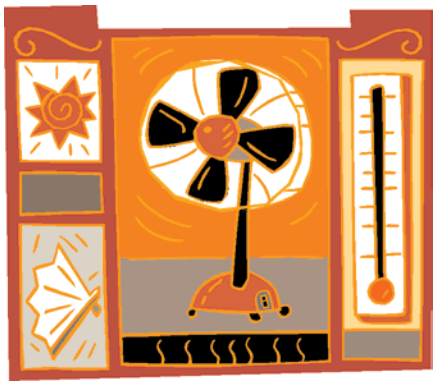
Dust: A dust consists of small solid particles in the air. Dusts may be created when solids are pulverized or ground, or when powder (settled dust) becomes airborne. For example, silica dust is created when concrete is cut. Dusts may be hazardous because they can be inhaled into the respiratory tract. Larger particles of dust are usually trapped in the nose and windpipe where they can be expelled, but smaller particles can reach and may damage the lungs. Some, like lead dust, may then enter the bloodstream through the lungs. Some organic dusts, such as grain dust, may explode when they reach high concentrations in the air.

Fume: A fume consists of very small, fine solid particles in the air which form when solid chemicals are heated to very high temperatures, evaporate to vapor, and finally become solid again. The welding or brazing of metal, for example, produces metal fumes. Asphalt also fumes when heated. Fumes are hazardous because they are easily inhaled. Many metal fumes can cause an illness called metal fume fever, consisting of fever, chills and aches like the "flu." Inhalation of other metal fumes, such as lead, can cause poisoning without causing metal fume fever.

Fiber: A fiber is a solid particle whose length is at least three times its width. The degree of hazard depends upon the size of the fiber. Smaller fibers such as asbestos can lodge in the lungs and cause serious harm. Larger fibers are trapped in the respiratory tract and are expelled without reaching the lung. Examples of fibers are fibrous glass and asbestos.

Mist: A mist consists of liquid particles of various sizes which are produced by agitation or spraying of liquids. Mists can be hazardous when they are inhaled or sprayed on the skin. The spraying of pesticides and the machining of metals using metal working fluids are two situations where mists are commonly produced.

Indoor Air Quality (IAQ)



Exposure to indoor air pollutants has increased due to many factors, including:

- Construction of tightly-sealed buildings, some lacking windows that open.
- Reduced ventilation to save energy. More air is re-circulated within the building, resulting in the buildup of contaminants in the building air.
- Use of synthetic building materials and furnishings that give off toxic substances.
- Increased use of chemically-formulated housekeeping supplies.
- Routine application of chemical pesticides.
- Cutbacks in personnel, resulting in inadequate maintenance of ventilation systems.
- Increased use of flat roofs prone to standing water and leakage.
- Deferred maintenance of roofs and plumbing, resulting in water leakage and mold growth.

Symptoms associated with poor IAQ may include eye, nose, throat, and upper respiratory irritation, chills, fever, cough, chest tightness, congestion, sneezing, runny nose, muscle aches, and pneumonia. Typically, workers notice that these symptoms appear and worsen at work and become less severe outside of work. Illnesses associated with IAQ problems include asthma, hypersensitivity pneumonitis, multiple chemical sensitivity, and Legionnaires' disease.

WHAT IS GOOD INDOOR AIR QUALITY?

Good Indoor Air Quality (IAQ) includes:

- Adequate outdoor air supply and distribution.
- Absence of pollutants in the air.
- Acceptable temperature and humidity.

Temperatures should be in the range of 72.5 to 80 degrees Fahrenheit in summer and 68 to 76 degrees Fahrenheit in winter with fluctuations of less than 2 degrees per hour. Humidity should be in the range of 30 to 60 percent. Outdoor air supply should be 15 to 20 cubic feet per minute per person (cfm/person). Carbon dioxide levels above 800 parts per million parts of air (ppm) indicate a lack of outdoor air supply.