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HEALTH AND SAFETY GUIDE
FOR HIGHWAY AND STREET CONSTRUCTION

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ABSTRACT

This health and safety guide provides information on Occupational Safety and Health Standards specific to Highway and Street Construction. Safe work practices, use of personal protective equipment, noise controls, traffic control, machine guarding and analysis of the workplace for illness and injury producing hazards are some of the subjects discussed. The occupational health section of the guide contains information on the toxic effects of chemicals, dusts, vapors, gases and fumes that workers may be exposed to and suggests methods for controlling them. The guide should be of particular benefit to the small to medium-sized employer who may not be able to afford the services of a health and safety consultant. It will assist the employer to establish an effective program for the recognition and control of hazards in the workplace. For additional information on Concrete Products Industries see NIOSH DHEW Publication No. NIOSH 75-163.

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INTRODUCTION

The Occupational Safety and Health Act of 1970 was passed "to assure safe and healthful working conditions for working men and women..." This Act established the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health, Education, and Welfare (DHEW) and the Occupational Safety and Health Administration (OSHA) in the Department of Labor (DOL). The Act provides for research, informational programs, education, and training in the field of occupational safety and health and authorizes the promulgation and enforcement of standards. As part of these activities, surveys have been made by NIOSH to determine the most common health and safety problems in small businesses. This guide was developed for distribution to the highway and street construction industry.

While the aim of this guide is to assist in providing a safe and healthful workplace by describing safe work practices and by helping to correct some of the more frequently encountered violations of the safety and health standards, it is not intended to provide total information in all areas of compliance.

Additional information can be found in the General Industry Standards (Code of Federal Regulations, Title 29, Part 1910 and Construction Safety and Health Regulations, Part 1926,), or can be obtained from your OSHA area office. The address and telephone number for your nearest area office are available by contacting the OSHA regional office listed in the back of this guide. In addition, some states, offer OSHA-funded consultation services.

Words such as "must," "shall," "required," and "necessary" appearing in this guide indicate requirements under Federal law. Procedures indicated by "should" or "suggested" are generally accepted good practices and recommendations.

In some states, the Federal government has delegated enforcement authority for occupational safety and health matters to the state government. Although state standards sometimes differ from Federal standards, they must always be at least as effective as the corresponding Federal standards.

HEALTH AND SAFETY GUIDELINES

GENERAL PHILOSOPHY REGARDING HEALTH AND SAFETY

Through the use of a health and safety program and through actively supported employee training, existing unsafe acts or conditions should become apparent. For many of these there may not be specific standards. Nevertheless, it is important to find a solution to these recognized problems.

HEALTH AND SAFETY PROGRAMS

Hazardous conditions or practices not covered by specific OSHA standards are covered under the general duty clause of the Act, which states: "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." The employer can meet this requirement with a health and safety program through which workplace hazards are recognized, evaluated, and controlled or eliminated. Such a program might include: conducting first aid courses and periodic safety meetings; developing chemical inventories; performing job hazard evaluations and safety analyses, ensuring the adequacy and use of local exhaust ventilation and personal protective equipment; and evaluating employee exposure through periodic air monitoring.

Many hazards can be identified by: performing inspections, interviewing employees for suggestions or complaints, investigating accidents promptly, reviewing injury and illness records, and using material from this guide and other sources to anticipate health and safety problems. The identification and evaluation of certain hazards, such as those caused by airborne chemicals, almost always requires an industrial hygiene survey.

An employee health protection form, such as the one reproduced in this guide, may be useful for identifying basic hazards. This form can be adapted to fit the needs of your program. Your NIOSH regional office or OSHA area or regional office can help you prepare it.

Although this guide describes many of the controls and work practices needed to eliminate workplace hazards, specific information on which controls are required and in what configuration (for example, controls to reduce noise or airborne chemical contamination) may require the services of safety consultants.

A practical but little known means of discussing remedies for workplace hazards with OSHA, without being subject to inspection, is for the employer to ask for an informal meeting with OSHA area office or regional office personnel off the plant premises; for example, in the OSHA office.

Periodic plant meetings and informal discussions can be held to review training programs, hazards, and injury and illness records. It may be advantageous to assign employer or employee groups responsibility for developing a safety and health program and putting it into effect. Regardless of the methods selected, the person(s) responsible for carrying out the program needs adequate authority and management support if the program is to be successful.

EMPLOYEE TRAINING

A safe operation depends on employees being aware of workplace hazards, as well as on activities being taken by management to reduce employee exposure. Training can play an important part in conveying safety related information to the employee. While training needs will vary according to the particulars of an operation, some suggestions are:

- *Impress upon the employee the need to avoid contamination of air, clothing, skin, or eyes with hazardous chemicals. Explaining the hazards may motivate workers to handle toxic materials in a safe manner.

- *Be sure all employees know when and how to maintain the proper personal protective equipment.

- *Develop and maintain a list of work practices to be observed as a part of standard and emergency procedures for each job category, and post it in the appropriate work areas.

- *Post appropriate warning signs and operating procedures wherever hazardous materials are handled or hazardous operations are performed.

- *Instruct employees in the use of portable fire extinguishers (refer to the fold-out chart in this book, and post it in a conspicuous place).

- *Have at least one employee on each job site trained in first aid, including cardiopulmonary resuscitation (CPR).

- *Be sure employees authorized to use either fixed or portable motorized equipment (including lift trucks) are thoroughly instructed in proper

operation, inspection, hazards, and in purposes served by machine guards.

*Encourage good industrial housekeeping to reduce accidents and to develop in employees a sense of pride in their surroundings. Responsibilities should be specifically assigned for clean-up and (where necessary) decontamination.

*Instruct employees in safe lifting practices. Such training can prevent many physical injuries. The chart titled "How to Lift Safely" can be removed from the back of this guide for posting.



OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

In the work environment, employees may be exposed to health hazards in a variety of forms--gases, dusts, mists, vapors, fumes, liquids, noise, heat, radiation, and cold. Chemical hazards often are not recognized because the particular formulations used are identified only by trade names. Many such formulations contain mixtures of several substances, which can make an evaluation of the product's hazard potential difficult. Note that exposure to certain hazardous substances, such as benzene or asbestos (alone or in mixtures), can cause cancer that does not show up until years later.

To identify occupational hazards, a materials analysis (product inventory) should be made that lists all materials entering the workplace. If the composition of a material cannot be readily determined, this information should be requested from the manufacturer or supplier. Many manufacturers provide Material Safety Data Sheets on request for their products. These sheets contain product information such as chemical identity, toxicity levels, physical characteristics, personal protective equipment requirements, emergency procedures, and known incompatibilities with other substances. From this materials analysis, applicable hazards may be determined and suitable controls prescribed. Also, these data sheets can be used effectively in training efforts. Assistance in this effort is available from NIOSH regional offices (see back pages).

A job analysis should also be performed that includes all chemicals used and all products and by-products formed in each specific operation. To aid in a job analysis, a sample employee chemical protection form is included in the back of this guide. When such an analysis is done, allied activities such as maintenance and service operations should be included. Some workplace hazards are not obvious. For example:

- *Welding or cutting performed around chlorinated materials may cause the formation of lethal gases (e.g., hydrogen chloride and possibly phosgene), as well as exposing workers to welding fumes and ultraviolet radiation.
- *Lift trucks that have internal combustion engines are sources of hazardous exhaust gases. These include carbon monoxide and oxides of nitrogen, which can build up to harmful concentrations (especially in enclosed areas). These exhaust gases should be included in the job analysis.

- *The mixing of certain cleaning agents can release poisonous gases (for example, when chlorine bleach and ammonia are mixed, poisonous chlorine gas is produced).
- *Organic solvents used to clean parts, assemblies, or machinery may produce elevated levels of harmful vapors.
- *Oil or kerosene sprays may create excessive hazardous concentrations of mists in the workplace atmosphere.

Job analysis, if properly performed, will also highlight unsafe work practices, improve procedures, expose unguarded components of machinery, etc. A complete job safety analysis is therefore an excellent training tool also.

Skin conditions such as chemical burns, skin rashes, and dermatitis are widespread in U.S. industries. The use of protective creams or lotions, proper protective clothing and equipment, and good personal hygiene on the job can prevent many common skin problems. More difficult skin problems may require enclosure of the offending process or substitution of a less irritating chemical.

AIR CONTAMINANTS

Various control methods can be used to prevent or reduce employee exposure to air contaminants.

- *Substitution--using less toxic materials.
- *Isolation--placing the hazardous process in an isolated area to reduce the number of persons exposed.
- *Administrative controls--limiting the total amount of time an individual is exposed to a hazard and rotating two or more workers each day.

- *Training and education of employees--informing employees what hazards they are exposed to and the ways to reduce or limit exposure (see "Employee Training").
- *Personal hygiene--emphasizing personal hygiene. Persons should wash their hands before eating. If cement, concrete, lime, acid, solvents, etc., get on the skin they should be washed off immediately. Employees should not be permitted to eat around toxic chemicals. Clothing should be changed and washed daily (separate from other family laundry) if it becomes contaminated with cement, concrete, lime, asphalt oil, solvents, etc.
- *Personal protective equipment--requiring the use of such items as respirators, hearing protection devices, protective clothing, and protective equipment (see "Personal Protective Equipment").
- *Ventilation--including either local exhaust ventilation, by which contamination is removed at the point of generation, or general mechanical ventilation (see "Occupational Health and Environmental Control").

GENERAL INFORMATION ON HIGHWAY AND STREET CONSTRUCTION

Occupational injuries still pose a major and continuing threat to the health and well being of American workers. In 1973, the highway and street construction industry ranked third in total number of fatalities according to statistics released by the U.S. Department of Labor. In 1974, this industry ranked fifth in total number of fatalities. However, a significant number of the fatalities were related to motor vehicle accidents. In terms of lost time injuries, this industry was listed 84th in a suggested ranking of 100 industries needing emphasis to effect a decrease in injury rates.

This Guide focuses on all highway and street construction (except elevated highways) including the construction of roads, streets, alleys, guardrails, sidewalks, parkways, parking areas, airports, bridge paths, and athletic fields. Highway and street construction is usually accomplished by general contracting firms. Road construction poses a greater variety of safety problems than do most other fields of heavy construction. The process of surfacing or resurfacing a roadway calls for a high degree of safety consciousness on the part of the work party as a whole. Some of the hazards associated with highway and street construction are:

- *The use of heavy mobile equipment such as earth-moving machinery, concrete and asphalt-paving equipment, and open highway vehicles.
- *The close proximity of moving streams of road traffic.
- *The use of hot asphalt for paving.

Additionally, maintenance of equipment at the construction site often dictates that temporary fuel storage areas and shop buildings need to be built. This means that some hazards common to general industry can exist at construction sites.

Also, workers are exposed to carbon monoxide gas from vehicles and welding operations, and to gaseous substances and particulates such as nitrogen dioxide, sulphur compounds, ozone, aldehydes, and various hydrocarbons from exposure to asphalt, cement fumes, and dust. Also, dermatitis is very common in cement workers.

During walk-around surveys of various highway and street construction sites, safety deficiencies noted were:

- *Workers operating earth-moving or material-handling equipment without using seatbelts where seatbelts were required.

- *Oxygen and acetylene bottles improperly stored or secured.
- *Excessive speed and reckless driving by operators of construction equipment and passing traffic.
- *Equipment being refueled by refuelers while engines of both vehicles were running. Also, refuelers not properly grounded or bonded.
- *Unguarded pulleys and gears on equipment.
- *Drivers of asphalt-hauling trucks remaining in vehicles while hot asphalt is being loaded into them.
- *Excessive dust around discharge chutes at mobile mixing plants.
- *Hardhats not being used, especially while working around mobile mixing plants.
- *Respiratory equipment not being used in dusty areas of mixing plants.
- *Electrical hazards such as ground prongs missing from power tools; ungrounded extension cords or electrical equipment; and frayed, damaged, or misused flexible cords.
- *Use of unsafe portable ladders or using portable ladders unsafely.
- *Storage of LPG (liquid propane gas) inside buildings.
- *Workers not using proper protective clothing and gloves.
- *Lack of hearing protection around high noise level equipment.

Although the above deficiencies cover some of the significant problem areas, the list is not considered complete. All of the applicable regulations contained in the OSHA Construction Safety and Health Regulations must be adhered to at highway and street construction sites. The "Frequently Violated Regulations" section in this Guide summarizes those standards which are most appropriate for the highway and street construction industry.

The following requirements or safe practices for highway and street construction job sites are worth emphasizing:

- *Workmen should not be allowed in front of a moving concrete (slip-form) paver as it consolidates, screens, and finishes the concrete.
- *Elevated platforms on concrete pavers must have the proper standard guardrails.
- *All power transmission apparatus and moving parts such as chain drives, revolving drums, and rotating shafts on concrete pavers and other equipment must be properly guarded.
- *The traffic pattern at a job site should be studied thoroughly and the proper traffic control measures such as signals, flagman, detours, etc., must be utilized.
- *Employees who are working with cements and are exposed to dusts must wear NIOSH-approved respirators.
- *Workmen who are exposed to solar radiation (sun) should wear the proper clothing to minimize skin exposure.
- *Rollers used to compact surfacing material present a unique hazard because of their size and the inability of the operator to see adequately while backing. Operators must exercise great care when rolling surfaces in the midst of a work party.
- *Trucks backing to unload asphalt or crushed stone are a particular source of danger, since the drivers vision is partially obscured. Audible alarms should be used to signal; in the absence of these alarms, short blasts on the horn or bell will suffice.
- *Workmen must remain clear of raised truck dump bodies to prevent injury in the event of a hydraulic lift failure.
- *All bulldozers, tractors, and similiar equipment must be equipped with substantial guards,

shields, canopies, and grilles to protect the operator from falling and flying objects.

*Crawlers and rubber-tired vehicles, self-propelled pneumatic-tired earthmovers, water-tank trucks and similar equipment must be equipped with steel canopies and safety belts to protect operators from the hazards of rollovers.

*All exhaust pipes on mobile equipment that are exposed and readily accessible to contact must be insulated or guarded. All engines must be enclosed or guarded to eliminate contact with the hot parts of such engines.

FREQUENTLY VIOLATED REGULATIONS

INTRODUCTION

This section is a review of OSHA regulations which are generally applicable to industrial conditions and operations. The important points of each standard are summarized and, where possible, are listed in the same sequence as the OSHA safety and health standards (29 CFR 1910 and 1926). Note that recognized hazards which are not yet covered by these regulations must still be controlled, even though there are no specific standards governing them. Also, while some of these standards may not apply to your particular operations, additional standards (depending on the specific processes and materials you use) may be applicable.

The control methods discussed in this section are only suggestions as to how hazards may be corrected. Further assistance may be obtained from your state occupational safety and health agency, NIOSH regional consultant, or OSHA area office. Consultation with OSHA compliance officers anywhere off your plant site, (including an OSHA office), or with NIOSH regional industrial hygienists on site or elsewhere, is encouraged and will not trigger a compliance inspection of your facility. The addresses and phone numbers for the OSHA and NIOSH regional offices are listed at the end of this booklet. In addition to the regional offices, OSHA maintains numerous local offices. For the location of the OSHA area office nearest you, contact your regional OSHA office. For detailed information on control of noise or air contaminant levels, machine guarding, etc.--where specific designs are sought--you may need the services of a professional consultant. In December 1977, the Occupational Safety and Health Administration proposed the elimination of a group of standards included under the General Industry

standards. These standards were to be removed because they were judged to contribute little to the health or safety of employees. Throughout this guide, the standards under consideration for elimination are indicated.

WALKING AND WORKING SURFACES

General Requirements

All work areas, passageways, storerooms, and service rooms must be kept clean, orderly, sanitary, and as dry as possible. All spills should be cleaned up promptly. Floors in work areas must be kept free of oil spills, scrap, chips, and other debris.

Areas which are constantly wet or often wet where employees must walk or work should have non-slip surfaces, mats, or trenches with covering grates.

Every floor, work area, and passageway must be maintained free from protruding nails, splinters, holes, and loose boards.

Portable Ladders

Portable ladders must be maintained in good condition at all times with tight joints, securely attached hardware and fittings, and freely operating movable parts. They should be kept coated with a suitable protective material if their construction or location makes them susceptible to decay. (OSHA may eliminate this requirement. Contact your OSHA area or regional office for more information.) Note that paint does NOT act as a suitable preservative for wooden ladders.

Ladders must be inspected frequently. Defective ladders must be tagged "Dangerous -- Do Not Use" and be removed from service for repair or destruction.

Ladders with broken or missing steps, rungs, or cleats, cracked or broken side rails, or other faulty parts must not be used.

Ladders should be stored where they will not be exposed to the elements; in addition, wood ladders should be stored where there is good ventilation. (This requirement may also be eliminated.)

Portable metal or conductive ladders must not be used near energized electrical lines or equipment. Metal ladders should be labeled with a warning against use near electrical wires or equipment.

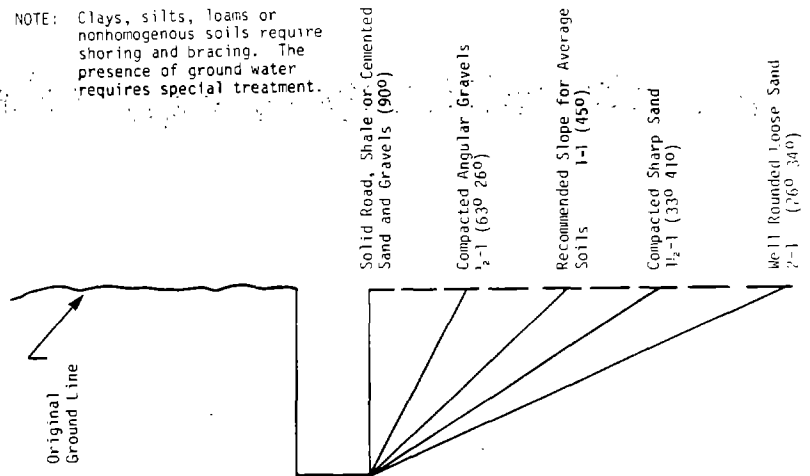
All ladders must be placed so that they have a secure footing. They may not be placed on boxes, barrels, boards, bricks, or other unstable bases to obtain additional height. Nonslip bases should be attached to the bottom of each ladder and maintained in good working condition.

Excavating and Trenching

Prior to any excavation, efforts must be made to determine if there are any underground utilities in the area, and they must be located and protected during any excavation operations. Utility companies and/or local regulatory agencies, as appropriate, must be contacted and appropriate permits or approvals obtained prior to excavation.

The walls and faces of excavations and trenches over 5 feet deep, where workers may be exposed to danger, must be guarded by a shoring system, sloping of the ground, or some other equivalent means. Trenches less than 5 feet deep with hazardous soil conditions also must be effectively protected. The information below may be used for sloping purposes.

NOTE: Clays, silts, loams or nonhomogenous soils require shoring and bracing. The presence of ground water requires special treatment.



APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS

Appropriate trench boxes and/or shields may be used in lieu of shoring or sloping.

Tools, equipment, and excavated material must be kept 2 feet or more from the lip of the trench.

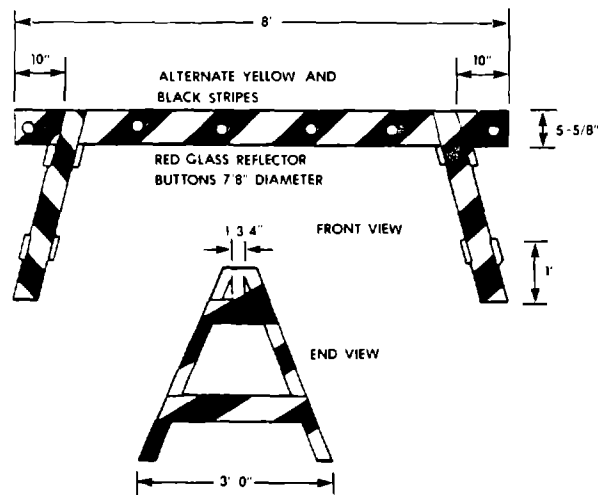
Daily inspections must be made of trenches and excavations by a competent person to assure adequate slopes, shoring, and bracing, and that there is no evidence of possible slides or cave-ins. More frequent inspections may be necessary as work progresses or after heavy rains.

Ladders or steps must be located so as to require no more than 25 feet of lateral travel in trenches 4 feet deep or more. Ladders should extend 3 feet above the surface of the trench.

Any runways and sidewalks must be kept free of debris and, if undermined, must be adequately shored to prevent a cave-in from any maximum loading.

Appropriate barricades and warning signs must be utilized to prevent employees and the general public from falling.

See "Information Sources" at the back of the book for additional material available concerning trenching and excavation.



Example of Acceptable Barricade

Employees must have proper personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet, and other parts of the body.

Employees shall not be permitted under loads handled by power shovels, derricks, or hoists.

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

Persons involved in the construction of highways and streets are not exposed to a great deal of chemicals or other toxic substances but they may possibly be exposed to some dusts, vapors, gases, or fumes. Since most of the construction is outdoors, the build-up of toxic substances in confined spaces is not normally a problem. However, the possibility of being exposed to dangerous levels of toxic substances does exist. Some of the more common exposures are: are:

Carbon Monoxide

Propane, diesel, and gasoline-powered equipment and some hot work operations such as welding, produce carbon monoxide. The employee's exposure to carbon monoxide may be excessive if such operations are conducted in low ceiling or confined areas. Also, it should be determined that there is an adequate amount of oxygen in any confined spaces. In the highway and street construction industry, the building of a highway takes a great deal of time and the work sites can be located away from major cities. Maintenance shops are usually constructed to handle repairs of equipment at the highway site. If motorized equipment is allowed to run at idle speeds in these shops, the exposures of employees to carbon monoxide may be excessive. Corrective action must be taken if exposures exceed the established standards. The installation of a mechanical ventilation system may be necessary to lower the carbon monoxide concentrations to a safe level.

Asphalt

Asphalt is a material derived from the refining of crude petroleum. The main constituents of asphalt are bitumens and small amounts of sulphur, oxygen, nitrogen, and trace amounts of other elements. The principal hazards are burns, and under unusual conditions, irritation of the skin and eyes by fumes from hot asphalt. These fumes can cause dermatitis and acne-like lesions on prolonged and repeated exposure. The greenish-yellow fumes given off by boiling asphalt may also cause photosensitization (sensitivity to light) and melanosis (a pigmentary affection of the skin marked by itching, reddening, scaling, and a spotty brown pigmentation). The type of asphalt used for paving of highways, airfields, streets, parking lots, and similar areas is asphalt cement which is a viscous material at normal temperatures. It must be heated to fluid consistency and mixed with various aggregates before it can be used for paving. Practically all of these mixtures are prepared in a mill and discharged directly into a truck. These haul trucks discharge the mix onto a surface for the paving operation. Usually smoke appears for a few seconds when the hot mix first hits the surface. The gaseous substances and particulates identified in the discharge of smoke are carbon monoxide, nitrogen dioxide, sulfur compounds, ozone, aldehydes, and various hydrocarbons. Although these substances are obnoxious and potentially toxic, they normally do not present a health hazard in the concentrations present during a typical street paving operation. However, employees and working conditions should be evaluated periodically since these substances are being generated.

Cement

Cement is a manufactured hydraulic bonding agent that is mixed with a coarse aggregate to form concrete. The basic raw materials of cement are lime, silica, alumina, iron ore, gypsum, and quartz (free silica) which are potentially hazardous to the respiratory tract. Quartz makes up only a small portion of cement and the worker's usual exposure to cement is the wet concrete mixture. Workers should avoid breathing cement dust. Exposure to this dust may produce cement dermatitis, which is usually due to primary irritations from alkaline, hygroscopic, and abrasive properties of cement. Chronic irritation of the eyes and nose may occur. Ethyl silicate is used as a hardener for water and weather resistant concrete. Route of entry into the body is through inhalation. It is a primary irritant to the eyes and nose. Fullface masks must be used in these areas.

Dermatitis

Concrete workers are very susceptible to dermatitis when working with wet lime and cement. The effect of lime or cement "burns" is the drying and subsequent cracking of the skin, which opens the way for infection. Quick lime actually burns when wet due to the high heat of hydration. Tools and equipment should be provided that will minimize the worker's contact with these materials. Insofar as possible, keep the exposed parts of the body away from direct contact with lime and cement. When working with these materials, wash the hands often and dry them thoroughly before returning to work. When the work is finished, wash hands thoroughly with soap and warm water, dry and rub in lanolin ointment. Ample washing facilities must be provided at the worksite. On concrete work, surface finishers must be provided with knee pads and gloves impervious to moisture.

Other concrete workers such as mudders should also be equipped with gloves and high topped rubber boots. Skin should be covered to minimize contact from splash and drying.

Solvents

Solvents are used in the highway and street construction industry to a minor degree. In maintenance shops, degreasing agents are common. Exposure to some of the more common organic solvents can result in dizziness, headaches, and sensations of drunkenness, as well as in affecting the eyes and respiratory tract. Also, organic solvents can defat the skin and cause dermatitis. The use of these solvents should be strictly monitored. Control measures such as mechanical ventilation may be needed. Also, if needed, the proper use of protective equipment such as gloves, goggles, face shields, aprons, and respirators should be strictly enforced. In the actual construction of concrete highways, a special machine is used to spray on a protective coating after the concrete has been laid. The coating is kept in a fluid state with the organic solvent toluene. As the coating is sprayed, toluene vapor becomes airborne. However, it is anticipated that since the operation is outdoors and sporadic, the concentrations of toluene should be maintained at a safe level. If conditions warrant it, however, the use of protective equipment such as respirators may be necessary.

Welding and Other Hot Work Operations

Fumes from welding and other hot work operations contain the metals being welded together (e.g., cadmium, zinc, lead, iron, and copper), the filler material, flux, and the coating on the welding rods. Such operations may also generate other gases (carbon

monoxide, arsine, ozone, etc.) at concentrations which may be hazardous to the health of workers. When extensive hot work operations (particularly in confined areas) are done, there could be an excessive exposure to these substances. Ventilation or respiratory protection may be needed for certain operations. Protection of the welder (eye protection) and for other employees (curtains, etc.) should be provided due to the ultraviolet light produced during such operations. Engineering controls such as local exhaust ventilation, if feasible, are required before resorting to personal protective equipment.

Radiation

The greatest source of "near" ultraviolet radiation on the surface of the earth is from solar radiation. Highway and street construction workers are routinely exposed to the sun. Many cases of skin cancer have been reported in people whose occupation required them to be exposed to the sun for long hours. The combined exposure of solar radiation and coal-tar may increase the incidence of skin cancer. In some highway or street construction, tar (a coal derivative) may be used in place of an asphalt product. Workers who find themselves exposed to solar radiation for long periods should wear the proper clothing for protection and use barrier creams.

Laser Equipment

Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment.

Areas in which lasers are used shall be posted with standard laser warning placards.

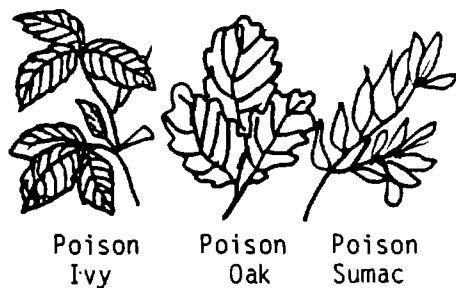
Heat and Cold

Provisions should be made to keep employees' body temperature within safe limits when they are exposed to extreme heat and cold. Such exposures can result in fatigue, discomfort, job inefficiency, sunburn, collapse, and other health problems. Cool drinking water must be readily available to employees working in excessive heat. Water loss through sweating is a problem among highway and street construction workers in hot weather.

Rodents, Snakes, Animals, Parasites, and Infectious Diseases

Some construction sites may present hazards which are not usually considered. Bites from rats, snakes, and other animals need medical treatment. Rabid animals pose a serious problem to persons who have been bitten. Cuts and abrasions can become infected, and parasitic bites (fleas, ticks, etc.) can result in an infectious disease such as Rocky Mountain spotted fever. During site clearing operations, workers must be protected against the hazards of irritant and toxic plants such as poison ivy, poison oak, and sumac. The employer must train his employees on the proper first aid treatment and preventive measures needed to prevent exposure to these types of hazards.

TOXIC PLANTS



OCCUPATIONAL NOISE EXPOSURE

The noise regulation is one of the most commonly violated standards. Excessive noise can cause permanent hearing damage. It is management's responsibility to make sure employees are not exposed to noise levels in excess of the OSHA noise standard.

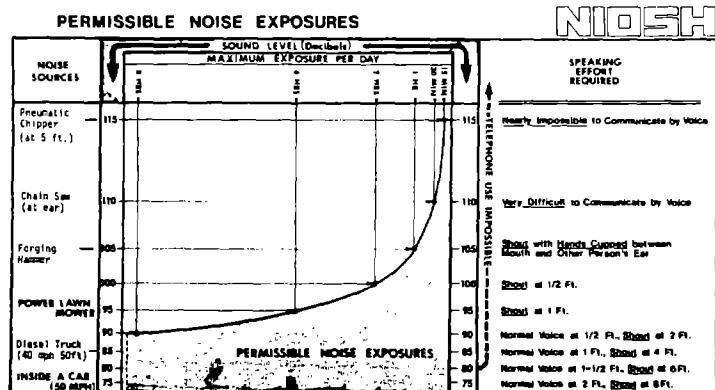
The current standard is a time-weighted average of 90 decibels A-scale (dBA) for an 8-hour exposure. Even at this noise level, hearing damage can be expected in some individuals. It is considered good practice to check the hearing every year by an audiometric test of all employees exposed to 85-90 dBA average for an 8-hour day. This testing may soon be required by law.

At noise levels averaging higher than 90 dBA over an 8-hour period, an effective hearing conservation program, including annual audiometric testing, must be administered. Engineering controls (such as enclosing noisy equipment) and/or administrative controls (such as limiting the duration of exposure) must be used where the 90 dBA level (8-hour time-weighted average) is exceeded.

If such control measures are not feasible, then effective personal protective equipment must be provided to employees and must be used. There are several types of personal hearing protection devices that can be used, including ear muffs and fitted ear plugs. Some devices are more effective than others, depending on the noise level, the frequency structure of the noise, and how well the device fits the ear. Devices that don't provide a good seal offer little hearing protection, and will not satisfy the regulations. In addition to being effective, ear protection must be reasonably comfortable to wear.

The accompanying chart is intended to give a rough indication of the intensity of noise levels from common workplace operations. If referral to the chart suggests that levels and duration of exposure in your operation requires corrective action, professional help should be sought to examine the situation. A noise survey by properly trained and equipped personnel should be made before engineering and administrative controls are put into effect to ensure that your hearing conservation program is adequate. See the back pages of this guide for information on free consultative services provided by OSHA contracts in several states. Note that the noise level chart cannot be used to rule out the possibility that specific noise levels might exceed the standard. It is intended instead to be a rough guide to typical noise levels and exposures permitted under the existing OSHA noise regulations.

As is emphasized above, determining whether a workplace complies with the noise standard requires measurement of the noise levels. Two types of measuring devices are available. A sound level meter measures the level of noise at any particular time. A personal dosimeter measures the average noise exposure of the employee wearing it over a period of time. Some instruments combine both measurement functions in one unit.



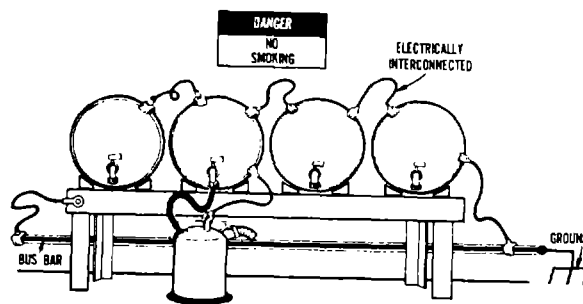
HAZARDOUS MATERIALS

Flammable and Combustible Liquids

Flammable and combustible liquids are categorized by their ease of ignition. Flammable liquids are more easily ignited than combustible ones. Examples of flammables are gasoline, acetone, and lacquer thinner; examples of combustibles are kerosene, fuel oil, and Stoddard solvent.

Connections on all drums and piped systems of flammable and combustible liquids must be vapor-tight, as well as liquid-tight.

When flammable liquids are transferred from one container to another (for example, from a bulk container to a portable container), the containers must be effectively bonded and grounded. It is recommended that containers be individually grounded to the bus bar to help assure that a proper ground is maintained at all times. Bonding and grounding prevent electrical discharge (sparks) arising from the accumulation of static charges during liquid transfer operations.



BONDING & GROUNDING

All spills of flammable and combustible liquids must be cleaned up promptly. Cleanup personnel must use appropriate personal protective equipment. If a major spill occurs, remove all ignition sources and ventilate the area. These liquids must never be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

Supplies of flammable and combustible liquids must be stored in approved, fire-resistant safety containers equipped with self-closing lids. Such containers can be purchased from an industrial supply house.

All flammable liquids removed from bulk storage or drums must be kept in closed safety containers.

Combustible waste material, such as oily shop rags and paint rags, must be stored in covered metal containers and be disposed of daily.

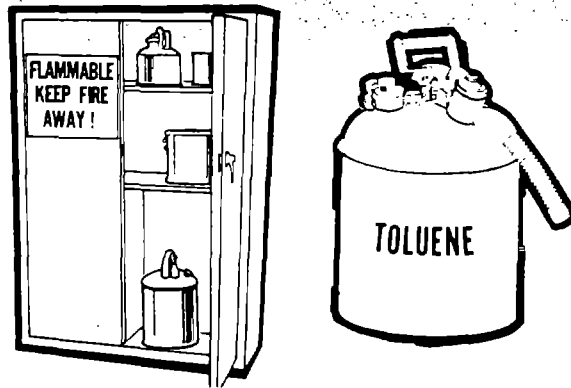
All storage areas must be posted as "NO SMOKING" areas. Portable and bulk containers of flammable or combustible liquids must be labeled with the required warning. Lime must not be stored where it will become moist, as there is danger of fire from damp slacked lime.

Storage Cabinets

Storage cabinets must be distinctly labeled "FLAMMABLE - KEEP FIRE AWAY".

Metal cabinets must be constructed of at least No. 18 gauge sheet iron, double-walled with a 1 1/2-inch air space and leakproof joints. Doors must have three-point locks and the sill must be at least 2 inches above the bottom of the cabinet.

Wooden cabinets must be constructed of at least 1-inch plywood. All joints must be rabbetted and fastened in two directions with flathead screws.



STORAGE CABINET AND SAFETY CAN

Inside Storage Areas

Each inside storage area must be prominently posted as a "NO SMOKING" area. Openings to other rooms or buildings must be provided with noncombustible, liquid tight raised sills or ramps at least 4 inches high. An open grated trench inside the room which drains to a safe location may be used as an alternative to a sill or ramp. General exhaust ventilation (either gravity or mechanical) which provides for a complete change of air within a room at least six times each hour is required. All lights, electrical equipment, and wiring must be of the type approved for hazardous locations (i.e., explosion-proof fixtures).

A fire extinguisher must be available (12B minimum) located within 10 feet of the door. An explanation of fire extinguisher codes is provided in material published by the National Fire Protection Association. The alphabetical code used above is explained on the fire extinguisher chart in the back of this guide.

Outside Storage Areas

If flammable and combustible liquids are stored outside, the storage area must be graded to divert spills away from buildings. The storage area must be posted as a "NO SMOKING" area, and must be kept free of weeds, debris, and other combustible material. There must be a fire extinguisher available at the storage area.

For construction areas: driveways between and around open area storage for combustible materials must be at least 15 feet wide; no combustible materials shall be stored outdoors within 10 feet of a building or structure; combustible materials must not be stacked more than 20 feet high and must be in stable piles.

Outdoor storage of containers (less than 60 gallons) must not exceed 1,100 gallons in any one pile or area; piles must be separated by 5 feet and not be nearer than 20 feet from a building. The storage area must be graded or diked in a manner to divert spills away from buildings or other exposures; and such areas must be free of weeds, debris, and other combustible materials not necessary to storage.

Liquified Petroleum Gas (LPG)

Each LPG system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type.

Every container and vaporizer must be provided with one or more approved safety relief valves or devices.

Filling of fuel containers for trucks or motor vehicles from bulk storage containers must not be done within 10 feet of a masonry-walled building, 25 feet of any other type construction, and within 25 feet of any building opening.

Aluminum piping or tubing shall not be used.

Containers, regulating equipment, manifolds, pipes, tubing, and hoses must be properly located or guarded to minimize exposure to high temperatures or physical damage. For example, heat sources can raise the temperature of the container by radiant heat absorption. This situation must be avoided.

Storage of LPG containers in buildings is prohibited.

Storage of containers outside of buildings shall be located away from buildings in accordance with the following:

Quantity of LPG Stored	Distance (Feet)
500 lbs. or less	0
501 - 6,000 lbs.	10
6,001 - 10,000 lbs.	20
Over 10,000 lbs.	25

Storage locations shall be provided with at least one approved portable fire extinguisher having a rating 20-B,C or greater.

PERSONAL PROTECTIVE EQUIPMENT

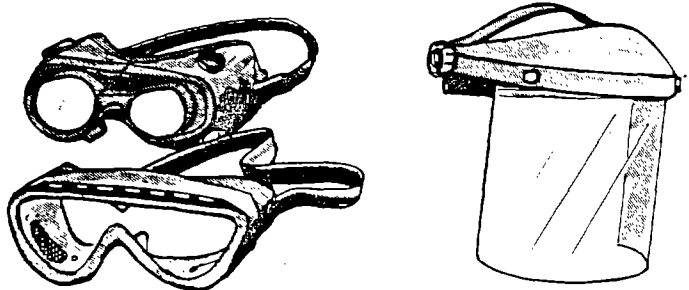
General

Employees must be adequately protected whenever harmful physical agents or toxic substances are present. Note that personal protective equipment may not be used as a substitute for feasible engineering or administrative controls. If such controls are not feasible, or while controls are being fabricated and installed, personal protective equipment is required. Personal protective equipment must be of safe design and construction for the work to be performed, and must be maintained in a sanitary and reliable condition.

Eye and Face Protection

Eye and face protection are required where there is a possibility of injury from flying particles, chips, or sparks, or from splashes of liquids such as acids, caustics, concrete, asphalt, and organic solvents. For example, employees must wear protective equipment when they work with grinders, power drills, sanders, polishers, buffers, or with caustic or organic solvent degreasing or stripping baths.

Eye protection and face shields must be easy to clean and disinfect. If goggles must be worn by employees whose vision requires corrective lenses, the goggles must fit over the glasses. If necessary, the corrective lenses (with the temples removed) can be mounted behind the protective goggle lenses. Note that contact lenses can increase eye hazards, since chemicals that are splashed onto the eyes tend to seep under them and get trapped. In addition, soft contact lenses can absorb some vapors and gases.



EYE & FACE PROTECTION

Head Protection

A protective head covering (hard hat) is required in situations where workers may be struck in the head by falling objects or in areas with overhead

obstructions. Note that bump hats protect only against bumps, not against falling objects, and may not be substituted for hard hats where protection from falling objects is necessary. Hardhats must be worn when working at mobile mixing plants.

Foot Protection

Safety shoes are recommended to prevent injury to the feet from falling objects and other foot hazards. It is especially important that they be worn where heavy stock is handled. In such situations, metatarsal (instep) guards are available which attach to ordinary steel-toed safety shoes, increasing the protection. Safety shoes should also be used routinely by workers in parts handling, shipping, and receiving operations, and by other employees, as appropriate. Heavy duty work shoes should be worn while working around highway paving operations. Tennis shoes or soft shoes are forbidden. High topped rubber boots should be worn when working in wet concrete.

Gloves, Aprons, and Leggings

Aprons and leggings may be necessary for some operations (for example, welding), depending on the nature of the hazards involved. Gloves and arm protectors should be used to prevent laceration by objects with sharp edges, to prevent contact with chemicals, and to prevent burns. Obviously, one type of glove can't perform all these functions equally well. Workers handling hazardous chemicals, hot asphalt, and concrete need impervious gloves. Those handling sharp objects need heavy canvas or leather gloves, reinforced if necessary.

Hearing Protection

Noise levels in some areas may be above the 90 dBA limit. If administrative controls aren't feasible, or don't offer enough protection, or aren't desirable, engineering controls are necessary. While engineering controls are being fabricated for such areas, employees must be given and must wear fitted hearing protection devices (see "Occupational Health and Environmental Control").

Respiratory Protection

NIOSH-approved respirators must be provided by the employer when workplace air is contaminated with excessive quantities of harmful dusts, fumes, mists, gases, or vapors. Note that respirators may be used as a control only when engineering or administrative controls are not feasible, or while they are being implemented.

If respirators are used, a written respirator program must be established, including the following requirements:

- *The respirators selected for use must be designed to protect against the specific air contaminants to which the employees are exposed. The selection of an appropriate respirator also depends on the concentration of the air contaminant and the duration of exposure.
- *Written instructions covering the selection and use of respirators must be available.
- *Employees must be trained in the use and limitations of respirators as well as their proper fitting and maintenance.

*Respirators should be cleaned at the end of each use. They should be taken apart, washed, and dried; defective parts should be replaced.

*If a respirator is used by two or more people, it must be cleaned and disinfected after each use.

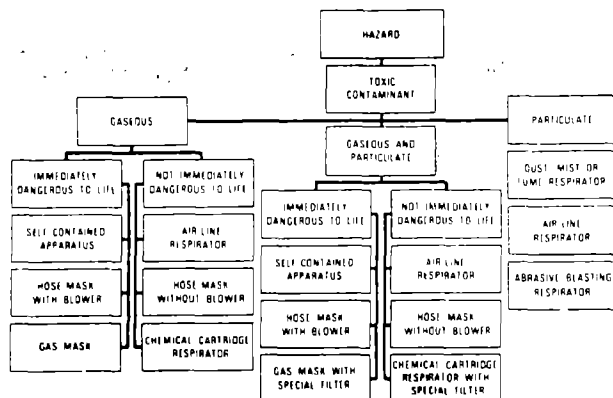
*When the respirator is worn, all straps must be properly adjusted.

*To ensure proper functioning of the respirator, a good face seal is necessary. Beards, long sideburns, and glasses may make it impossible to get a good seal.

*The cartridge or canister on the respirator must be replaced when it has been used for its specified lifetime (as determined by the number of hours or by the breakthrough indicator), when the employee can smell vapors in the mask, when breathing becomes difficult, or when the canister's or cartridge's storage life has expired--whichever occurs first.

*The accompanying diagram shows what type of respirator is appropriate once the physical form of an air contaminant is known. Also required for selection is a determination of whether there is sufficient oxygen (at least 19%) in the work area atmosphere.

RESPIRATOR CHART



Working Over or Near Water

Employees working over or near water, where there is a danger of drowning, must be provided with a U.S. Coast Guard-approved life jacket or buoyant work vests. Ring buoys with at least 90 feet of line shall be provided for emergency rescue operations. At least one lifesaving skiff must be immediately available at locations where employees are working over or adjacent to water.

GENERAL ENVIRONMENTAL CONTROLS

Sanitation at Construction Sites

*Portable containers used to dispense drinking water must be capable of being tightly closed, and equipped with a tap. Water must not be obtained by dipping into the container. Each container must be clearly marked as to its contents and not used for any other purpose.

*The community drinking cup is prohibited and single service cups (to be used only once) must

be supplied. Containers shall be provided for unused cups and also used cups.

*Outlets for non-potable water must be appropriately identified to indicate clearly that the water is unsafe for drinking, washing, or cooking purposes.

*At least one toilet must be provided for 20 employees or less; one toilet seat and one urinal per 40 employees; and one toilet seat and one urinal per 50 employees if more than 200 employees. This requirement is not applicable to mobile crews having readily available transportation nor to personnel at the place of business. Job sites not provided with a sanitary sewer may be provided (unless prohibited by local codes) with chemical recirculating and/or combustion toilets or privies if the use of the latter will not contaminate ground or surface water. Toilet rooms shall have a latch on the door and the door shall be self-closing. Adequate supplies (toilet paper, holder, etc.) must be available.

*Adequate washing facilities must be provided for employees engaged in operations involving harmful contaminants; washing facilities must be equipped to remove harmful substances. Such facilities must be in close proximity to the work site.

NOTE: The regulations on common drinking cups and the ratio of toilets to number of employees were being considered for elimination when this Guide went to press.

ASPHALT PAVING HAZARDS

The operation of asphalt paving equipment presents many associated hazards. When hot asphalt is applied to road surfaces its temperature exceeds 300 degrees Fahrenheit; consequently, the risk of burns is high. Asphalt causes severe burns because it sticks to the skin and is not readily removed. Employees working around tar pots and/or handling liquid asphalt must wear the following protective clothing to prevent skin contact with hot asphalt:

- Heavy duty work shoes,
- Long pants (without cuffs),
- Long sleeved shirt with cuffs buttoned,
- Gloves, and
- Face shield.

A supply of water for emergency first aid must be provided. Eyewash fountains, bottles, or other suitable devices with fresh potable water, should be available and inspected daily when eye or skin contact with asphalt is possible. Water in these containers should be changed daily. Emergency cold packs should also be available.

Dust created by the movement of material-hauling vehicles, public traffic, etc. must be controlled by using water sprays, spreading a dust retarding material, or other acceptable means.

Eating and smoking shall be prohibited in the immediate area of asphalt use or where asphalt fumes are present. Exposure to asphalt fumes can occur during the transport, storage, production, and handling or use of asphalt.

When asphalt is used in the open, as in paving, employees should station themselves on the windward side of any source of asphalt emissions, as far as it is possible. Sources of ignition, e.g., smoking or

open flames should not be allowed within 50 feet of asphalt kettles, pavers, or especially, spray rigs dispensing cut-back asphalt. Appropriate respiratory equipment must be used as needed.

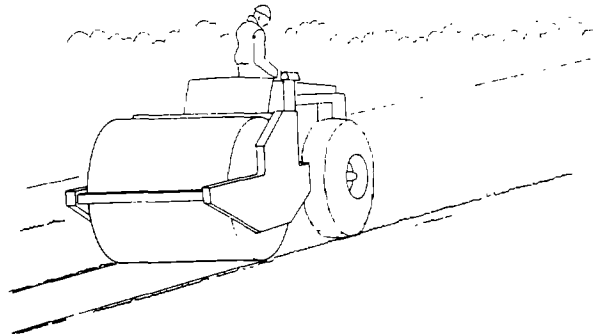
Asphalt Paving/Vehicle Operations

Drivers of all vehicles operating in and around the job sites must exercise due caution with respect to other vehicles and pedestrians. They should operate at a safe speed. When in the immediate vicinity of paving operations, all vehicles shall approach the paver slowly and with caution (See pages 56 thru 63 on heavy equipment). A guide must be used to direct the driver of trucks used to haul asphalt prior to backing up to a spreader or paver.

Only qualified and trained personnel will operate equipment.

Operators of mechanized paving equipment shall not mount or dismount on the traffic side of the equipment.

Operators of bidirectional, self-propelled compactors must be sure that the area to be compacted is free from vehicles, workers, and pedestrians before changing directions.



COMPACTOR

Equipment must be designed to protect personnel from normal machine operator hazards. All guards must be properly installed and maintained in good condition.

Asphalt paving machines must be equipped with the following minimum safety features:

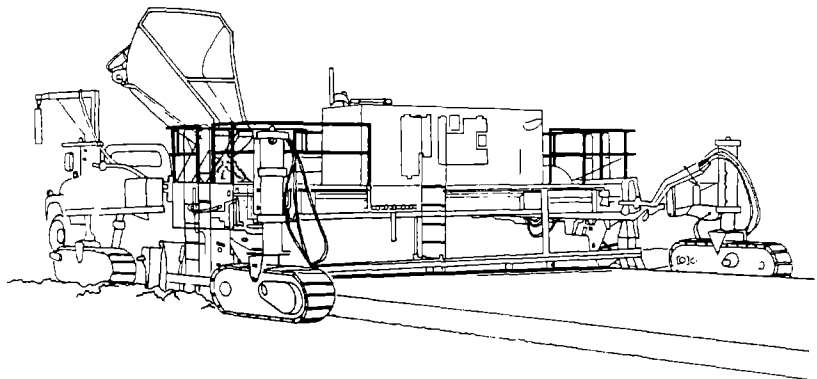
- *Material feeding auger and auger extensions that are guarded.

- *Material hopper wings that have warning signs citing the hazards.

- *Emergency switches or other devices for halting the machine that are accessible from the ground level on both sides of the paver.

- *Furthermore, the screed must be blocked or cribbed to prevent falling or shifting before employers are permitted to work under it.

- *Also, all machines must be shut down and the power locked out before vehicle maintenance work is performed or guards removed. Also, all guards must be replaced before any machine is returned to service.



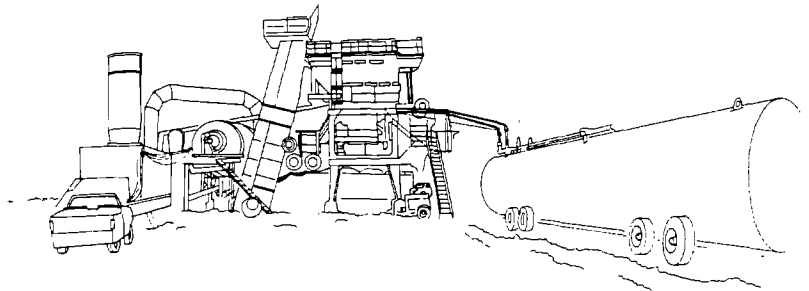
PAVING MACHINE

Properly illuminated signs and barricades for the information, protection, and safety of the traveling public must be provided and maintained in position to perform their intended purpose. (See page 99 thru 101 pertaining to signs and barricades).

MOBILE ASPHALT PLANTS

General

On larger paving jobs, such as the paving of interstate highways, it is desirable to erect mobile asphalt plants near the construction project. In selecting the plant site, consider such things as methods of material delivery that will be used, entrances to public highways, overhead electrical wires, and prevailing wind directions. Local, state, and Federal laws must be complied with when undergoing such an operation.



MOBILE ASPHALT PLANT

Perimeter fencing, posting, and night illumination may be necessary. Signs must be posted around the plant every 200 feet, reading: "DANGER - KEEP OUT".

Plant Operation

The following safety procedures must be complied with to ensure safe operations of mobile asphalt plants:

- *Personal protective equipment must be available for use as needed. Hardhats must be worn throughout the work area. Respiratory equipment must be used as needed.
- *The asphalt heater and aggregate dryer must always have sufficient capacity to avoid overloading.
- *Cranes must be of adequate capacity and in good mechanical condition. (See pages 65 thru 69 on safe operation of cranes).
- *Stockpiles of aggregate must be limited in height to secure against sliding.
- *If employees must enter railroad cars, bins, or silos, where aggregate is stored, they must wear a safety belt or harness properly secured. The workmen must work in pairs, with one man observing the operation from a safe location and tending the safety line. Safe means of access to bins or silos must be provided. Employees are forbidden from climbing on truss work.
- *Workmen must use cat-walks and never ride on conveyors. Safety trip cords must run the entire length of all conveyor systems and be located so that all employees working near them can reach the cord in an emergency.
- *Fire and explosion hazards are greatest in the areas of asphalt storage tanks and dryers. Automatic controls must be used to control these hazards.

*Maintain asphalt in storage tanks at constant temperatures well below the flash point of the material. Keep asphalt and hot oil lines in good condition. Clean up spills promptly to eliminate burn and slipping hazards. In no case shall anyone work under the asphalt weight pot.

*Fire extinguishers appropriate for the hazard must be conspicuously located about the plant and fully charged at all times.

Air Contaminants

Control of harmful dusts around a hot mix plant is a big problem. Standards required by Federal and state authorities are very stringent and should prevent the need for employees to wear respiratory equipment. However, there may be a few instances where plant operations may require the use of respirators. If the operation is not fully automated, requiring the need for a person to manually control the mixers and pugmill operation, this area (if not fully enclosed) may be dangerous. Employers must provide the respirators which are applicable and suitable for the purpose intended. Contact the local OSHA or NIOSH office if help is needed in the selection of proper respirators.

Proper mechanical ventilation equipment must be installed to remove excessive gases, smoke, etc.

Noise Hazards

The dryer area in the hot mix plant is the area most susceptible to excessive noise. On portable units, the dryer and the plant engine are sources of excessive noise. Appropriate ear protection must be used.

CONCRETE PAVING HAZARDS

The constant use of concrete equipment such as mixers and pavers on construction jobs, exposes workmen to hazards of many types. Each mixer and paver must be carefully positioned on the job to reduce any accident hazard. All gears, chains, and rollers of mixers must be guarded. If the mixer has a charging skip, the operator must ensure that workmen are out of danger before the skip is lowered. The skips on large mixers and pavers must be protected by guardrails. Signalmen must direct trucks backing into charge skips and must also signal equipment operators when to raise the skips. Only the operator will raise the skip on his machine and he shall not permit anyone to ride it. Pavers must be equipped with an automatic warning device which operates when the paver is moved ahead or the bucket is run out. When an operator leaves his paver or mixer, he must set the brakes and lower the skip to the ground. Wheel-mounted mixers must be blocked, especially when operated on a grade. When it is necessary to clean equipment drums, the engine must be stopped and the ignition locked. Material feeding augers and auger extensions must be guarded. Material hopper wings must have warning signs citing the hazards.

Emergency switches or other devices for halting the machine must be installed and accessible from ground level on both sides of the paver. The screed must be blocked or cribbed to prevent falling or shifting before employees are permitted to work under it.

Operators and others working around concrete mixers and pavers must wear dust respirators and clothing which covers as much of their skin as possible. Goggles must be worn when chipping hardened concrete from the machines.

To protect other workers, buckets on pavers that run out on a boom must be equipped with automatic warning

signals which must be sounded before the bucket moves.

Vibrators

Only workers in good health shall operate mechanical concrete vibrators.

Vibrators must not be lowered from one level to another by their air hoses or electric cables.

Sand Blasting

Workmen green cutting or wet sandblasting must wear protective head and face helmets equipped with safety glass lenses or fine-mesh screens.

Workmen sandblasting concrete must wear NIOSH-approved supplied air respirators and hoods. Other employees not engaged in the sandblasting operation must be kept out of the immediate area.

Concrete, Concrete Forms, and Shoring

All equipment and materials used in concrete construction shall meet the applicable requirements of ANSI A10.9-1970.

Reinforcing Steel

Employees working more than 6 feet above any adjacent working surface, or placing or tying reinforcing steel in walls, piers, columns, etc., must be provided with a safety belt or an equivalent device.

Employees shall not be allowed to work above vertically protruding reinforcing steel unless the hazard of impalement has been removed.

Reinforcing steel for vertical structures must be guyed and supported to prevent collapse.

Wire mesh rolls shall be secured at each end to prevent dangerous recoiling action.

Concrete Handling

Concrete mixers equipped with a 1 yard capacity or large loading skips must be equipped with a mechanical device to clear the skip of material.

Mixers with larger than 1 yard capacity must be equipped with protective guardrails on each side of the skip.

Powered and rotating-type concrete troweling machines that are manually guided must be equipped with automatic shut-off devices which activate when the operator removes his hands from the equipment handles.

Concrete buckets equipped with hydraulic or pneumatically operated gates must have positive safety devices designed to prevent aggregate or other loose material from accumulating on the top and sides of the bucket.

Employees must not ride on concrete buckets for any purpose or be under buckets suspended from cranes or cableways.

Tubular Welded Frame Shoring

Metal tubular frames used for shoring must not be loaded beyond safe working limits recommended by the manufacturer.

All locking devices on frames and braces must be in good working order and all components must be in good condition.

All baseplates, shoreheads, extension devices, or adjustment screws must be in firm contact with the footing sill and form.

Forms and Shoring

Formwork and shoring must be designed, erected, braced, and maintained to safely support all vertical and lateral loads that may be imposed during concrete placement.

Drawings and plans for all formwork and shoring, including jack layouts and working platforms, must be available at the jobsite.

Tube and Coupler Shoring

Couplers (clamps) must be made of a structural type metal (gray cast iron cannot be used) and shall not be used if they are broken or defective in any way.

All baseplates, shore heads, extension devices, or adjustment screws must be in firm contact with the footing sills and the form material and must be snug against the posts.

Removal of Forms and Shoring

Forms must not be removed prematurely. Concrete must be properly set. Job specifications and local building codes must be consulted before removing forms.

Concrete Placement

Buckets

A loaded bucket must not exceed the lifting capacity of a crane.

A safe platform (i.e., a nonslip surface with a standard railing, if above ground level) should be provided for employees to work from when manually pouring concrete from an open bucket.

An operable locking device must be used on bucket gates.

Buckets may not be transported over the heads of persons working below.

A communication system, which could be vocal or visual, should be set up before transfer of concrete beams.

Powered trucks used to transport buckets must have a horn and back up alarms. Special mirrors to help eliminate blind spots are also helpful in preventing accidents.

Personnel

It is unsafe for persons to ride buckets. Personal protective equipment such as safety glasses, rubber boots, and gloves must be worn when washing out buckets.

Ready Mix Trucks

When loading concrete on a slope, the wheels of the ready-mix truck should be chocked and the brakes set. Backing lanes must be free of equipment, material, and workers. The movement of personnel and equipment should be routed so as to avoid crossing the truck lane.

Metal Fabrication

General Requirements

The dangers involved in working in and around a metal fabrication area must be emphasized. For information about this topic, the reader is referred to the sections on "Portable Hand Tools", "Welding, Cutting, and Brazing", and "Machinery and Machine Guarding" sections of this guide.

Considerations During Tensioning

Tensioning requires great care by all who are involved. Written procedures should be established which identify associated hazards.

Stressing beds should be laid out so that employees will pass the ends of the beds as little as possible. Since it may be impossible to eliminate all traffic around the beds, shields should be installed at the ends of the beds to stop flying strands and strand chucks resulting from strand breakage.

Another important consideration is the handling and storage of stressing materials (strands, bars, tendons, etc.). Procedures should be implemented which will prevent cutting, pinching, or burning of these materials in transportation and storage.

Before each tensioning operation, the cutoff valves and level of hydraulic fluid should be checked to make sure the equipment is functioning properly.

Acids

Various types of acids, such as hydrochloric or muriatic acid, are commonly used in the concrete industry. They can be handled safely if the proper

procedures and personal protective devices are used.

Acids should be stored away from combustible materials in airtight, properly labelled containers; out of aisleways and heavy traffic areas.

Some acids splatter or emit vapors when mixed with water. Splatter can cause acid burns on the skin, in the eyes, or on clothing. To reduce splatter, employees must be instructed in proper mixing procedures. One important instruction: always add acid to the water; never add water to the acid.

Before handling, all containers must be inspected for damage, leaks, bulging, and loose plugs.

Goggles or a face shield (or both), head protection, acid proof, full-gauntlet gloves, an apron, and acid-proof boots may be necessary when handling acids. Sleeves and pant legs should always be worn outside of gloves and boots.

A deluge shower or other facilities for rapidly flushing the entire body should be in the immediate vicinity. An eye-wash fountain or hose must be available and operating properly.

Asbestos

Asbestos is sometimes added to concrete for acid-resistance or other properties. Asbestos dust when inhaled can cause serious bodily harm and incurable disease (pulmonary fibrosis and cancer).

The following procedures are important:

*Asbestos dust producing procedures must be isolated and the dust should be vented away from employees.

*Asbestos should be wetted before handling to reduce airborne fibers.

*Asbestos waste and debris should be collected in impermeable bags and containers.

*Bags of asbestos and asbestos-bearing materials must be labelled.

*A respirator approved for the purpose is usually required when handling asbestos. (Replaceable cartridge respirators, a single-use mask, a self-contained breathing apparatus, or a supplied air device are suitable for this purpose.)

*Clothes should be vacuumed after work periods and placed in a designated container. Separate change rooms must be used if employees are exposed to air concentrations in excess of the OSHA standard.

*Smoking should be controlled. Asbestos workers who smoke while working run a greater risk of respiratory disease than non-smoking workers.

*Regular physical examinations should be provided for all employees handling asbestos.

*Where asbestos is used, cleaning must be done by vacuuming.

MOBILE CONCRETE MIXING PLANTS

General

Sometimes it is feasible to erect mobile concrete mixing plants near the construction site. Certain safety criteria should be used for the selection of these sites. (See page 40 for examples).

Material Batching and Mixing

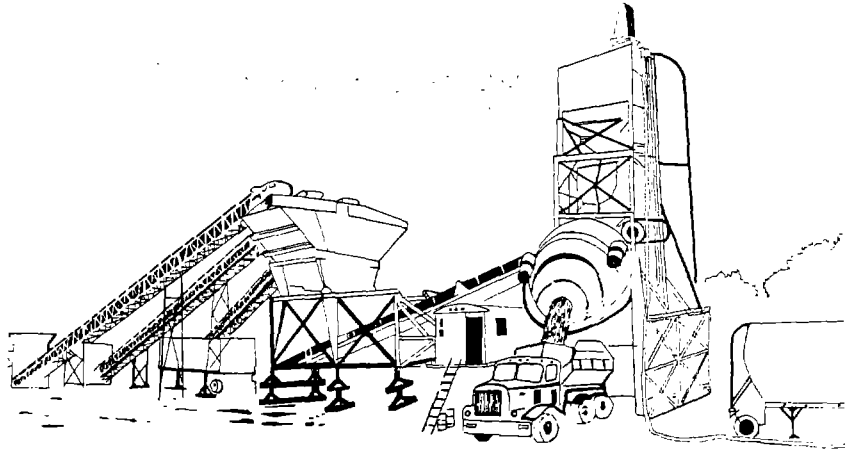
Activities in the batching and mixing areas can present health as well as safety hazards. Of particular importance, is the potential for respiratory, eye, and skin irritation. Dust (especially cement dust) is always present and easily inhaled. Inhalation of cement dust can cause irritation as well as acute and chronic disorders of the respiratory system.

Sand, gravel, and cement are ever present sources of eye and skin irritation. Also, exposure to additives used in batching, such as accelerators, water reducing agents, anti-freeze, and other air contaminants, must be minimized. Generally, flushing the skin or eyes with water is the first step to alleviating discomfort following accidental exposure.

Wet concrete is toxic, abrasive, and caustic. Because of the danger of splatter to the eyes (or face), and skin, protection should be provided. Goggles (or face masks), gloves, hardhats, and rubber shoes, are examples of protective clothing and equipment which should be provided.

Silos can pose a serious safety hazard. Access to the tops of silos must be by ladder or crossover walkways and never by riding on conveyors. Open top silos require guarding. Materials often become bonded in wet or freezing weather and "hang up". When this situation occurs, the material may often be manually loosened. Persons can accidentally fall into a silo under such circumstances. If the silo is filled with cement, which reacts like quicksand, a person can sink below the surface very quickly. Safety belts and lifelines are needed where there is danger of falling into silos. A line tender should be posted at the top of the silos to observe the worker, tend his line, and help in case of an emergency.

MOBILE CONCRETE MIXING PLANT



Air Contaminants

The dustiest areas of a concrete paving operation are normally in the batching and mixing areas and where workers are cutting cured concrete.

Employee exposure to air contaminants must be controlled as completely as possible by the use of engineering controls or by limiting the time of exposure. If these controls fail to produce satisfactory results, personal protective equipment or other protective measures must be utilized to control employee exposures. (A single-use dust mask or a unit with replaceable filters or cartridges made for this purpose, is suitable.)

Good housekeeping will help reduce the dust problem by reducing the potential for resuspension. However, a technique, such as vacuuming, should be used that will not itself create a dust problem.

TEMPORARY HEATING DEVICES

Temporary heaters include all heating devices used on a construction job to control temperature conditions and provide for personal comfort during cold weather. (See examples listed on page 56)

Improperly installed and controlled heating devices have caused loss of life and serious property loss on construction sites from fire, asphyxiation, and explosion.

Common fire causes are: placement of heating devices or vent pipes too close to combustibles, lack of insulation for combustible bases, use of fuels that produce high flames or sparks.

The presence of carbon monoxide is an inherent danger. Prolonged exposure can result in death; there is no color or odor to provide a warning that carbon monoxide is present. Adequate ventilation is essential to eliminate this exposure.

The use of liquified petroleum gas presents special fire and explosion hazards. Persons responsible for handling LPG should be familiar with the properties of this gas and with safety requirements for storage of containers and the operation of heating devices. NFPA #58, prepared by the National Fire Protection Association, and applicable to the storage and handling of LPG gases, should be followed. A copy of this standard can be obtained at a nominal cost from the following address:

National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02210

Temporary heating devices should not be installed or used by anyone on the job until authorized by the job superintendent.

One or more attendants should be assigned to check on the proper operation of temporary heating units at all hours while they are in use.

Wood, wood by-products, and similar fuels that produce sparks and flame that cannot be contained should not be used as fuel.

Use only approved containers for fuel storage.

Adequate fire extinguishers should be provided.

At least 2 1/2 feet of clearance should be maintained in a horizontal direction and 6 feet of clearance from overheads that contain combustible material.

All heating units should be well constructed and provided with stable footing. Fireproof materials should be placed under the base. A minimum of 4 inches of clearance space should be maintained between the salamander base and the fireproof material.

When tarpaulins or canvas coverings are used near salamanders, at least 10 feet of clearance should be maintained and these materials should be securely fastened.

Heating devices used in confined or unventilated spaces must be properly vented to the outside.

Kerosene, gasoline, oil, or gas fired units should be shut down and cooled prior to refueling or moving them.

Improvised drums or empty paint containers should not be used as salamanders.

Spark arresting screens should be utilized on coal and coke burning salamander units.

Liquid fuel should be provided with a manual shutoff system on the fuel flow line. The valve should be located at a safe distance from the unit.

All fuel tanks should be properly secured so that they cannot be knocked over.

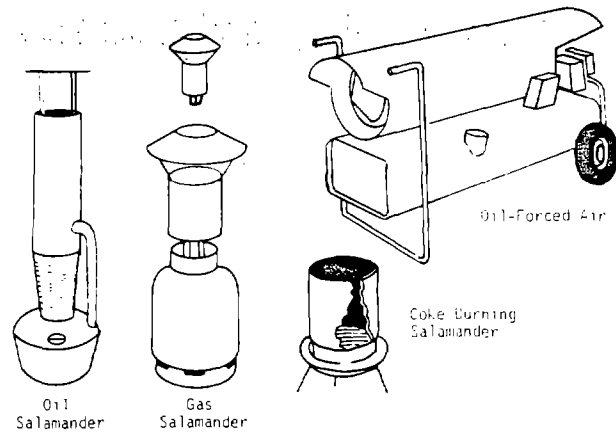
Daily checks should be made of the excess flow valve, regulator, hose, and connections on all LPG units to ascertain that no leaks are present and that the unit is safe for its intended use.

Open flame heating units should not be used in a shaft or tunnel.

LPG gas cylinders and fuel tanks should be stored away from all combustibles out of doors. A cap should be provided to protect valves on LPG cylinders in storage.

Solid fuel salamanders are prohibited in buildings and on scaffolds.

Cold Weather Protection



HEAVY EARTH MOVING AND HANDLING EQUIPMENT

Applied to:

- Scrapers
- Loaders
- Crawler or wheel tractors
- Bulldozers
- Off-highway trucks
- Graders
- Agricultural and industrial trucks

General Safety Rules

Hard hats should be worn by operators at all times; this includes while on the work site as well as at the controls of a piece of equipment.

Operators should always check to make certain that other workers are in the clear before starting the machine.

Employees should not jump on or off machines in motion.

Before repairs are made on earthmoving equipment, the operator should make certain that the motor is not running. Motors of all equipment should be stopped before refueling is done.

If possible, equipment should be driven entirely off the road at night. Where any portion of the machine projects into the road, it should be adequately marked with red lights, flashers, or flares; red flags should be used in daytime.

Unauthorized riding on equipment should be prohibited.

The operator should never leave his machine on an inclined surface or on loose material with the motor idling, as vibrations could put the machine in motion.

All haulage vehicles, whose pay load is loaded by means of cranes, power shovels, loaders, etc., must have a cab shield or canopy.

Trucks regularly used for transporting personnel must be provided with side and end protection and safe seating to prevent falls. Workers are prohibited from riding on running boards, fenders, bumpers, or atop cabs.

Drivers must not remain inside the vehicle while it is being loaded by cranes, etc.

Parking

Barricades, lights, and reflectors to identify the location of the equipment shall be provided for equipment left unattended at night, adjacent to highways or construction areas where work is in

progress. Parked equipment shall have the brake set and, when on an incline, shall have the wheels chocked.

Access Roadways and Grades

All access roadways and grades shall be constructed and maintained to accommodate the movement of equipment and vehicles safely, and every emergency access ramp shall be constructed to restrain and control runaway vehicles.

Seat Belts

Seat belts meeting requirements set forth by the Society of Automotive Engineers (SAE) for construction equipment must be provided for all equipment covered by this section except:

Equipment designed for stand-up operation.
Equipment which does not have rollover protection.

Brakes

Equipment shall have a service braking system capable of stopping and holding the equipment fully loaded.

Fenders

Pneumatic-tired earth-moving haulage equipment (trucks, scrapers, tractors, and trailing units) whose maximum speed exceeds 15 miles per hour, shall be equipped with fenders unless a waiver is granted.

Audio Alarms

A horn, distinguishable from the surrounding noise level, shall be provided and operated as needed on

all bi-directional machines such as rollers, compacters, front-end loaders, bulldozers, etc.

A reverse signal alarm or a signalman shall be provided for all earth moving or compacting equipment which has an obstructed view to the rear.

Scissor Point Guards

Scissor points on front-end loaders shall be guarded when they constitute a hazard to the operator.

Rollover Protection

Rollover protection (ROP) shall be provided for the following types of equipment:

- Rubber-tired self-propelled scrapers.
- Rubber-tired front-end loaders.
- Rubber-tired dozers.
- Wheel-type agricultural and industrial tractors.
- Crawler tractors.
- Crawler-type loaders or motor graders.

Rollover protective structures (ROPS) and supporting attachments shall meet the minimum performance criteria detailed in CFR 1926 paragraphs 1001 and 1002 (as applicable), or shall be designed, fabricated, and installed in a manner which will support (based on the ultimate strength of the metal) at least 2 times the weight of the prime mover applied at the point of impact.

- a. The design shall provide a vertical clearance of at least 52 inches from the work deck to the ROPS at the point of ingress or egress.
- b. ROPS, removed for any reason, shall be remounted

with equal quality, or better quality bolts or welding as required for the original mounting.

c. Labeling

Each ROPS shall have the following information permanently affixed to the structure:

Manufacturer or fabricator's name and address.
ROPS' model number (if any).
Machine make, model, or series number that the structure is designed to fit.

In addition, all rider-operated equipment used in site clearing operations shall be equipped with an overhead and rear canopy guard meeting the following requirements:

*The overhead covering on the canopy structure shall not be less than 1/8-inch steel plate or 1/4-inch woven wire mesh with openings no greater than 1-inch, or equivalent.

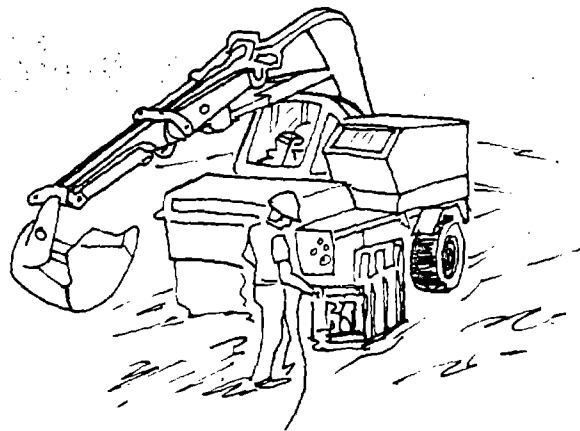
*The openings in the rear of the canopy structure shall be covered with no less than 1/4-inch woven wire mesh with openings no greater than 1 inch.

Glass

Cab glass shall be safety glass that introduces no visible distortion affecting the safe operation of any machine.

Tire Rack

A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rungs or similar devices.



SAFETY TIRE CAGE

Bulldozers and Tractors

Before starting down a hill, the blade should be lowered to secure a load of earth in front of it and the load should be maintained all the way down the hill. If the load is lost, the blade should not be jammed into the ground as this might cause overturning. The dozer blade must never be used as a brake on downgrades.

Filling operations can be very dangerous. The material should be pushed over the edge only as far as is necessary. This could prevent the possible overturning of the machine. It is recommended that a spotter or curb block be used when possible.

When coupling a tractor to other equipment, workers should stand clear of the space between the units. The machine should be stopped, the transmission placed in neutral, and the brakes set before a person is allowed to couple the equipment.

At the end of a work shift, or when leaving the

machine, the power should be shut off, the brakes set, the blade landed, and the shift lever placed in neutral.

Scrapers

When going downhill, the operator should not shift the machine out of gear because increased speed may make control of equipment difficult. He should leave the machine in gear and use his brakes and the braking action of the motor to control speed. If the brakes will not hold the load, the operator should drop or drag the bowl or make an emergency stop. Avoid sharp downhill turns.

The scraper or dozer bowl should always be blocked up when blades are being replaced. After the scraper is lifted to the desired height, blocks should be placed under the bottom near the ground plates. Apron arms are raised to extreme heights, and a block is placed under each arm, allowing the apron to drop enough to wedge each block firmly in place.

To prevent the scraper from slipping off the edge of a fill, keep the center of the fill low and the outside edges high.

Motor Graders

Back sloping on steep, high embankments is tricky and often dangerous. Generally, when graders operate on slopes greater than one on one, the operator runs the risk of tipping over.

When operating a grader slowly on highways, be sure a red flag projects above the left rear wheel, or a flashing red light is used to warn other vehicles. The "slow moving vehicle" emblem should be properly displayed. Where blading against traffic is

necessary, be sure that such devices as flags and barricades are in place or that a flagman is used to warn traffic.

To avoid overturning, the blade should be extended when scraping shoulders, and the graders should be operated off the shoulder.

Shovels, Clamshells, Loaders

All workers should be clear of the bucket swing and the cab rotation. Never swing the bucket or clamshell over other workers.

When soil is soft, make sure the equipment is on solid foundation, such as mats or heavy planking, with outriggers fully extended before starting to operate.

Before operating on a bank next to an excavation, a check should be made with the superintendent or engineer to determine whether shoring or bracing is necessary.

Never operate closer than 10 feet from overhead electric lines (or whatever distance local, state, or Federal codes require).

No one should be permitted in the cab with the operator.

Make sure the bucket (or clamshell) is kept on the ground, or on blocking when not being operated. Never leave the cab while master clutch is engaged.

MATERIALS HANDLING AND STORAGE

General

Materials should be segregated as to kind, size, and length, and placed in neat, orderly piles that are safe from falling. Collect and dispose of all scrap promptly.

Lifting

In spite of the increased use of machinery and equipment in construction, most of the materials are handled manually at some point. Each worker should be instructed by his supervisor in the proper method of lifting heavy objects. (See Chart on Lifting in back of Guide.)

Sacked Materials

Sacked materials, such as cement and lime, should be carefully piled when placed in storage and should be carefully removed so as to keep the piles in a stable condition.

Lime, when exposed to dampness or water, forms slaked lime and may cause serious burns. It should, therefore, be stored in a dry place (preferably above ground) and should never be stored in a general warehouse, but always in a separate building at a safe distance from other buildings. Men handling sacked cement and lime must wear goggles, gloves, clothing made of durable materials with a snug-fitting neck, wrist and ankle bonds, and should be encouraged to use a protective cream on exposed skin surfaces.

Employees should be instructed that personal cleanliness is one of the best preventives against cement dermatitis, and employees should be furnished with suitable washing facilities including hand cream or lanolin ointment for protection.

Mobile Cranes, Derricks, and Slings

The safe operation of cranes, hoists, and other hoisting mechanisms covers a broad field of requirements but, in particular, selection and training of operators, and equipment maintenance are of the utmost importance. Only trained and qualified persons should be permitted to operate this type of equipment.

All equipment used for hoisting should be inspected daily, before CONTROLS AND/OR PROTECTIVE CLOTHING AND EQUIPMENT REQUIRED cables, sheaves, pulleys, boom, and boom stops on a regular basis.

Workmen must not be permitted to adjust, lubricate, or repair any mechanism with moving parts until stopped. Any guards that must be removed to adjust, oil, etc., should be promptly replaced.

When working near power lines, the installation of a safety guard is recommended. It should never be assumed that a power line taken out of service is harmless.

Hoists

Although the information provided in this section on hoists pertains specifically to cranes, these requirements should be applied to all hoisting equipment.

The rated load must be legibly marked on each side of the hoist. Employees should be made aware of the weight of the load.

The hoist must be equipped with a self-setting brake, applied to the motor shaft or some part of the gear train.

For powered hoists, holding brakes must be applied automatically when the power is off.

Hooks, chains, and all functional operating mechanisms must be visually inspected daily for any indication of damage and wear; monthly records must also be maintained.

Loads must not be carried over the heads of people.

The operator must not leave the position at the controls while the load is suspended.

The operator must test the brakes each time a near-capacity load is handled. This test is done by raising the load a few inches and applying the brakes.

The hoist rope or chain must be free from kinks or twists and not be wrapped around the load.

Overhead protective coverings must be provided on the top of the hoist cage or platform.

Rigging Equipment

The following requirements apply when rigging equipment is used:

- *Hooks must have no cracks or other deformations.

- *The rated capacity of the hook must be equal to that of the chain.

- *It is not permitted to use job or shop hooks or makeshift fasteners constructed from bolts, rods, etc.

- *Wire rope slings, including end connections, may not have excessive wear, broken wires, kinks, or twists.

*Rigging equipment must be removed from the immediate work area when not in use.

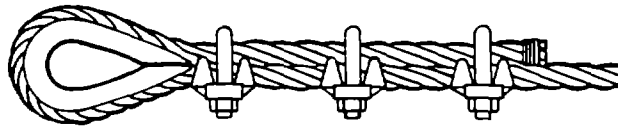
*Rigging equipment for material handling must be inspected visually every day for unusual wear and serviceability. A monthly, itemized, inspection report must be written for all lifting equipment.

*Protruding ends of strands in splices on slings and bridles of wire rope must be covered or blunted.

*It is not permitted to tie or secure wire rope with knots.

*An eye splice made in any wire rope may not have less than 3 full tucks.

*When used for eye splices, the "U" bolt must be applied so that the "U" section is in contact with the dead end of the wire rope.



"U" BOLT

Manila rope must be used in accordance with manufacturer's recommendations. Knots may not be used in place of splices.

Synthetic webbing (nylon, polyester, and polypropylene) and other slings must be marked to show:

- *The name or trademark of manufacturer;
- *rated capacities for the type of hitch (the

rated capacity must not be exceeded); and
*the type of material.

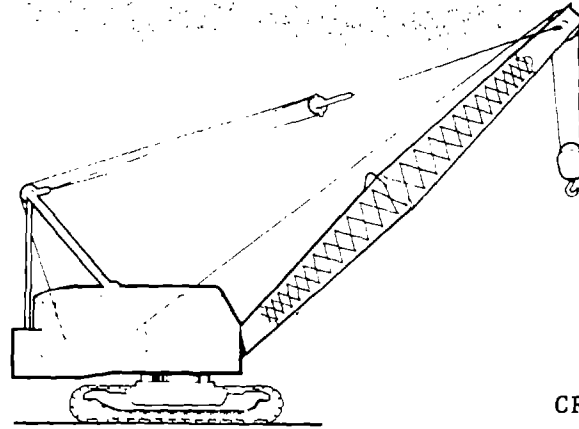
Slings

Each day before use, the sling and all fastenings and attachments must be inspected by a competent person designated by the employer. A thorough inspection and record of alloy steel chain slings must be made at regular intervals not to exceed 12 months. Each new, repaired, or reconditioned alloy steel chain sling must be proof tested before use, and a certificate of the proof test must be kept.

Whenever a sling is used, the following safe practices must be observed:

- *Slings that are damaged or defective must not be used.
- *Slings must not be shortened with knots, bolts, or other makeshift devices.
- *Sling legs must not be kinked.
- *Slings must be securely attached to the load and must not be loaded in excess of their rated capacities.
- *Slings must be padded or protected from the sharp edges of the load.
- *Suspended loads must be kept clear of all obstructions and all employees must be kept clear of loads about to be lifted or already suspended.
- *Shock loading is prohibited.
- *A sling must not be pulled from under a load

while the load is resting on the sling.



CRANES

Crawler, Locomotive, and Truck Cranes

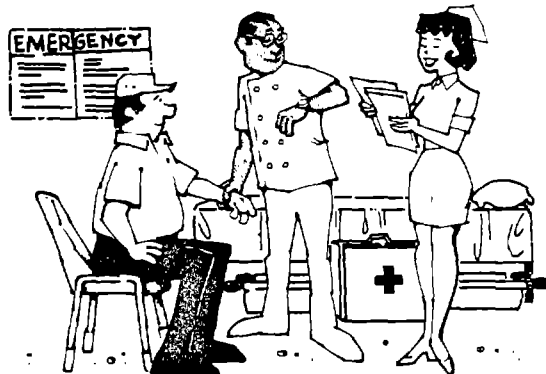
OSHA requirements for crawler, locomotive, and truck cranes also include:

- *A substantial and durable rating chart with clearly legible letters and figures must be provided with each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at his control station.
- *A carbon dioxide, dry chemical, or equivalent fire extinguisher must be kept in the cab or vicinity of the crane.
- *The minimum clearance between cranes and powerlines must be 10 feet except where the powerlines have been de-energized and visibly grounded at the point of work, or where separate insulating barriers have been erected.
- *Any overhead wire must be considered to be an energized line until the electrical utility

authorities indicate that it is not an energized line.

MEDICAL AND FIRST AID

The employer interested in maintaining production, preventing loss of work time, and encouraging efficient work performance and good morale in employees should adopt procedures for employee health maintenance. A good practice is to require medical examinations before job placement to ensure that the capabilities of the prospective employees are compatible with the demands of the specific job. Periodic health evaluations for hazardous jobs and early treatment of any illness or injury should also be encouraged. Medical personnel must be readily available by phone or on-site for advice and consultation.



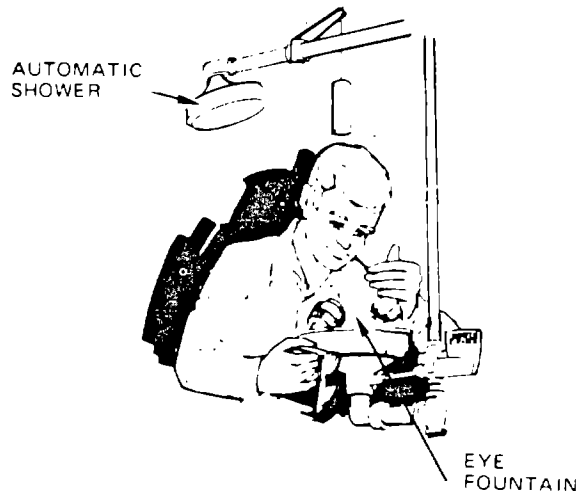
Emergency phone numbers must be posted near telephones. The Emergency Information Chart (printed inside the back cover of this Guide) may be helpful. Stretchers and blankets should be available for immediate transportation of ill or injured employees.

At least one and preferably more employees on each shift must be trained in first aid. Local health

departments, the American Red Cross, the U.S. Bureau of Mines, some insurance carriers, many local safety councils, and other organizations have training programs that will satisfy OSHA first aid requirements.

First aid supplies approved by a consulting physician must be readily available. The supplies should be in sanitary containers with individually sealed, sterile packages for material such as gauze, bandages, and dressings. Other items often needed are adhesive tape, triangular bandages (to be used as slings), inflatable plastic splints, scissors, and a mild soap for cleansing of wounds or cuts.

Suitable facilities for quick drenching or flushing of the eyes and body must be provided within work areas where a person may be exposed to corrosive materials, such as acids or caustics.



EMERGENCY SHOWER AND EYE WASH

FIRE PROTECTION

Portable Fire Extinguishers must:

- *Be kept fully charged and in their designated places.
- *Be located along normal paths of travel.
- *Not be obstructed or obscured from view.
- *Not be mounted higher than 5 feet (to the top of the extinguisher) if 40 pounds or less, or 3 feet if heavier. (OSHA may eliminate this requirement. Check with your OSHA area or regional office for more information.)
- *Be inspected by management or a designated employee at least monthly to ensure that they:
 - *are in their designated places,
 - *have not been tampered with or actuated, and
 - *do not have corrosion or other impairments.
- *Be inspected at least yearly and recharged or repaired to ensure operability and safety. A tag must be attached to show the maintenance or recharge date and signature or initials of the person performing the service. (OSHA may eliminate this requirement. Check with your OSHA area or regional office for more information.)
- *Be hydrostatically tested. The extinguisher sales representative usually will perform this service at appropriate intervals.

*Be selected on the basis of type of hazard, degree of hazard, and area to be protected.

A chart showing fire extinguishers by class and how to use them is located in the back of this booklet.

Construction Sites--General

The employer is responsible for establishing an adequate fire protection program covering all phases of construction and/or demolition work. Effective fire fighting equipment must be promptly available to meet all fire hazards.

Fire fighting equipment must be conspicuously located, inspected monthly, appropriately maintained, and readily accessible; it must be promptly replaced if found defective. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited. Appropriate fire extinguishers must be readily available for hot work operations such as welding. The employer is responsible for having a system to warn employees of a fire and for having means available (phone number posted) to promptly obtain the services of the local fire department. Smoking is prohibited in areas of potential fire hazards, and "NO SMOKING" signs must be conspicuously posted.

Only approved containers and portable tanks should be used to store flammable and combustible liquids; and such liquids must not be stored in or around exit routes such as stairways and exits. At least one approved fire extinguisher must be located within 10 feet of any room or inside storage area used to store such liquids. Furthermore, an approved fire extinguisher must not be more than 75 feet from any outside storage area.

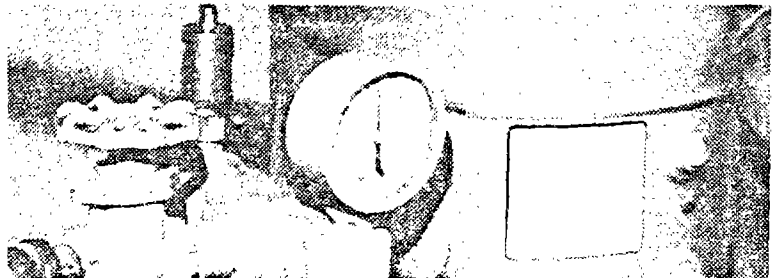
COMPRESSED AIR EQUIPMENT

Employees should be familiar with instructions for operating and maintaining air compressors.

New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (A.S.M.E.) Boiler and Pressure Vessel Code, section VIII. The A.S.M.E. Code requires this information to be permanently stamped on the air tank.

The drain valve on the air tank should be opened frequently to prevent excessive accumulation of liquid.

Air tanks must be protected by adequate safety-relief valve(s). The valves must be tested at regular intervals to be sure that they are in good operating condition.



The pressure controller and guage must be maintained in good operating condition.

There must be no valves between the air tank and safety valve.

MACHINE GUARDING

General Requirements for Guarding

One or more methods of machine guarding must be provided to protect the operator and other employees from hazards such as those created at the point of operation, in-running nip points, rotating parts, flying chips, and sparks. All such hazards located 7 feet or less above the ground, floor, or working platform, must be guarded to prevent accidental contact. Guards must be attached to the machine if possible and secured elsewhere if attachment to the machine is not possible. The guard must not offer an accident hazard in itself. Machines designed for fixed locations must be securely anchored to prevent "walking" or tipping.

A booklet entitled "The Principles and Techniques of Mechanical Guarding", OSHA 2057, can be obtained by writing to OSHA regional offices listed in the back of this Guide. Many equipment representatives can assist in obtaining the necessary protective devices.

Some common methods of guarding a hazard or hazardous machine operations are:

- * Enclosing the operation (preferred),
- * Interlocking devices,
- * Moving barriers,
- * Removal devices,
- * Remote control, and
- * Electronic safety devices.

Certain guarding methods are preferable to others. The type of operation, the size or shape of stock, the method of handling, the physical layout, the type of material, and the production requirements or limitations are important considerations. Certain

flexibility in operations may also determine the practicability of the method to be used. As a general rule, however, power transmission apparatus can be protected by fixed enclosure guards.

The following pages contain examples of specific equipment that must be guarded. This listing is not intended to include all equipment that may require guarding.

Rotating, reciprocating, and transverse motions create hazards in two general areas: at the point of operation where work is being done, and at the point where power or motion is being transmitted from one part of a mechanical linkage to another. Even smooth, slowly rotating shafts can grip clothing or hair, and through mere skin contact, force an arm or hand into a dangerous position.

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, rotating bar stock, lead screws, and horizontal or vertical shaftings are typical examples of common rotating mechanisms which are hazardous. The danger increases when bolts, oil cups, nicks, abrasions, and projecting keys or screw threads are exposed when rotating.

In-Running Nip Points

In-running nip points are a special danger existing only through the action of rotating objects. Whenever machine parts rotate toward each other, or where one rotates toward a stationary object, an in-running nip point is formed. Objects or parts of the body may be drawn into this nip point and be bruised or crushed.

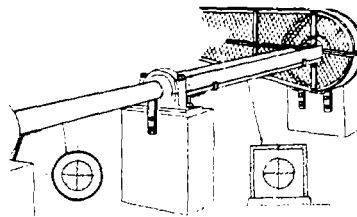
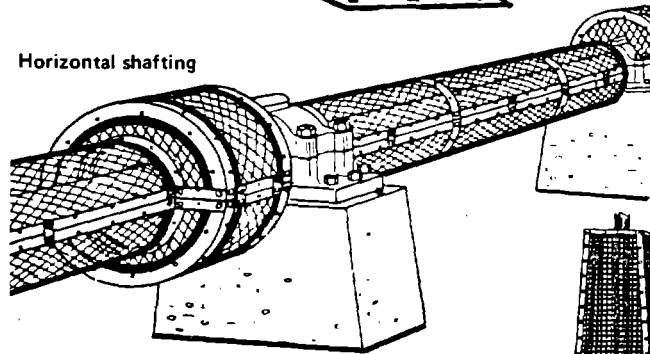
GUARDING ROTATING MOTION BY ENCLOSURE GUARDS



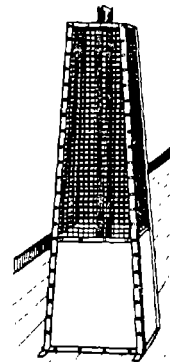
Horizontal shafting



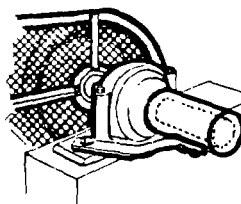
Horizontal shafting



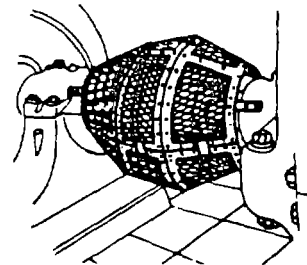
Horizontal shafting and belt and pulley



Vertical shafting

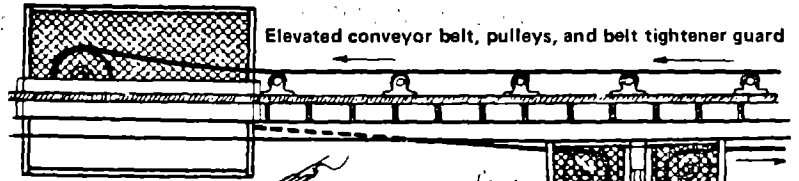


Sleeve for shaft end



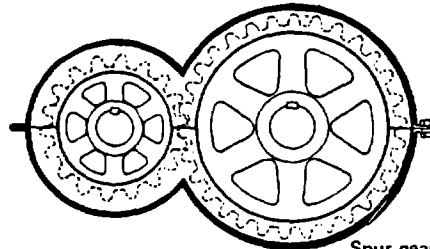
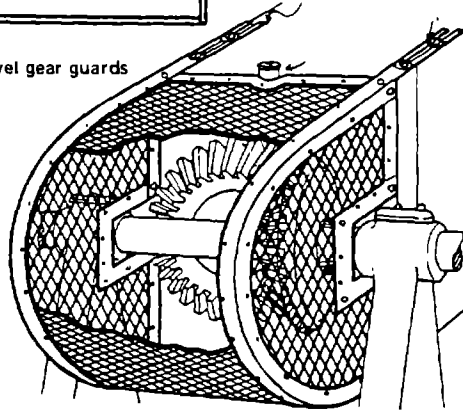
Coupling

ILLUSTRATIONS SHOWING GUARDS FOR POWER TRANSMISSION EQUIPMENT



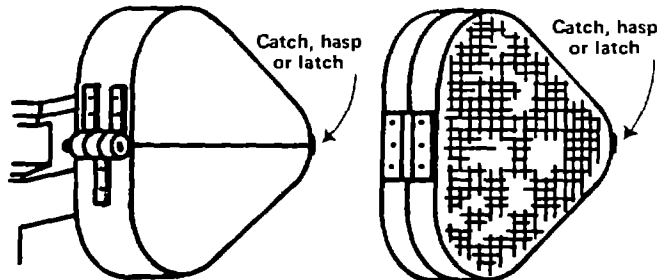
Elevated conveyor belt, pulleys, and belt tightener guard

Bevel gear guards

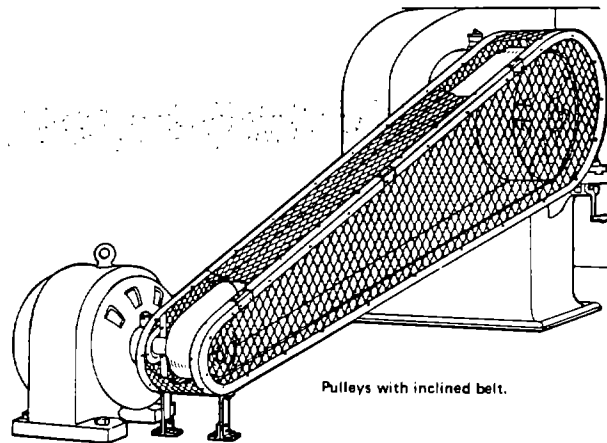


Spur gear guards

Totally enclosed guard. Split and hinged for either top or side opening



Belt and pulley guards



Grinders

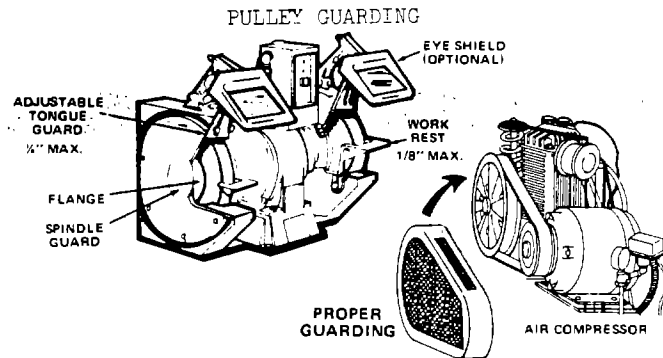
Wheel safety guards must cover the spindle end, nut, and flange projections. Three-fourths of the area of the entire wheel should be guarded. Visors and other accessory equipment are not considered to be machine guards unless they are as strong as the guard itself.

Work or tool rests must be of strong construction and must be adjustable to compensate for wheel wear. Work rests must be kept closely adjusted to prevent the work from becoming jammed between the wheel and the work rest. The maximum clearance allowed is 1/8-inch.

Tongue guards (upper peripheral guards) must be constructed so that they adjust to the wheel as it wears down. A maximum clearance of 1/4-inch is allowed between the wheel and the tongue guard.

Goggles or a face shield must be worn by grinder operators.

Eye shields should be installed and used.



Cutting Actions

Cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that the material removed is in the form of chips. The danger of cutting action exists at the movable cutting edge of the machine as it approaches or comes in contact with the material being cut.

Typical examples of cutting action are band and circular saws, and grinders.

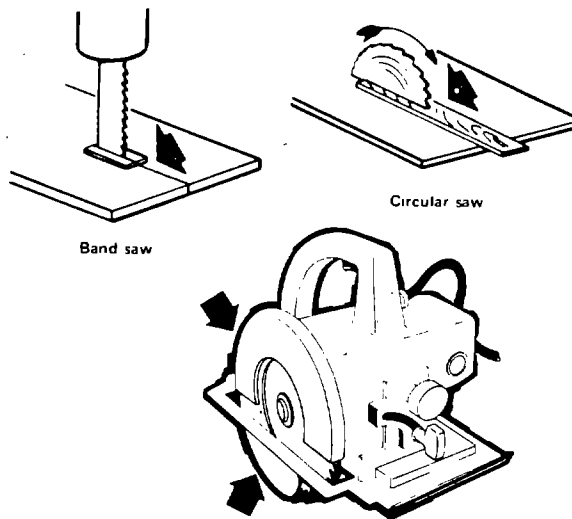


Table Saws

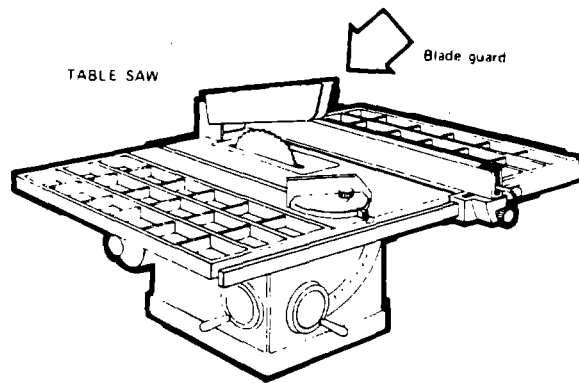
Table saws must be provided with a hood that covers the saw at all times.

Many times when rabbeting and dadoing, the standard hood guard may be impractical. In this case, an effective guarding procedure can be effected by the use of a jig to hold the work, thereby keeping the hands away from the blade.

Table saws used for ripping must be equipped with an anti-kickback device and spreader.

The exposed part of the saw underneath the table must be guarded.

When ripping short stock, the use of a "pusher" stick should be required.



Radial Saws

Radial saws must be provided with:

*An upper hood to enclose the top portion of the blade down to a point that will include the end

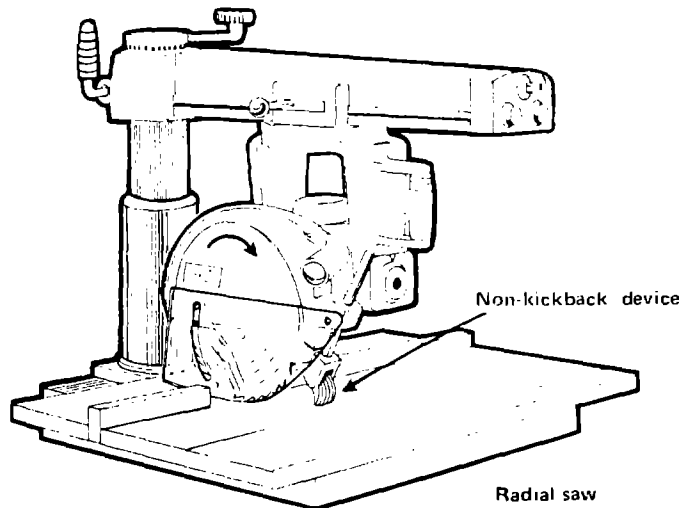
of the saw arbor. The sides of the lower, exposed portion of the blade must be guarded to the full diameter of the blade by a device that automatically adjusts to the thickness of the stock being cut.

- *Non-kickback dogs on both sides of the saw designed to provide adequate holding power for all thicknesses of materials being cut, if used for ripping.

- *An adjustable stop, limiting forward travel of the blade beyond the distance necessary to complete the cut in repetitive operations.

- *A head which automatically returns to starting position.

- *Marking on the hood showing the direction of saw rotation. In addition, a permanent label must be affixed to the rear of the guard reading: "DANGER. DO NOT RIP OR PLOUGH FROM THIS END."



Air Compressors

Air compressors must have their flywheel and drive fully enclosed.

Fans

If cooling fans are located within 7 feet of the floor, they must be guarded with a grill or mesh, limiting openings to not more than 1/2-inch (least dimension).

HAND TOOLS AND PORTABLE POWER TOOLS

The following are general requirements governing the use of hand tools:

- *Each employer is responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees.
- *Hammers with broken or cracked handles, chisels and punches with mushroomed heads, wrenches with sprung jaws, or bent or broken wrenches should not be used.
- *Most hand-held electrical tools must be equipped with a "dead man" or "quick release" control, so that the power is shut off automatically whenever the operator releases the control.
- *Portable circular saws must be equipped with guards above and below the base plate or shoe. The lower guard must retract when the blade is

in use, and automatically return to the guarding position when the tool is withdrawn from the work.

*All hand-held portable electrical equipment must have its frame grounded, or be double-insulated and identified as such.



*All tools must be used with appropriate shields, guards, and attachments that are in accordance with recommendations by the manufacturers. Employees must be trained concerning the use of power tools and safety requirements.

*Electrical lighting or power tools, supplied by temporary power circuits on construction sites, shall have ground fault circuit interrupter protection in the temporary power circuit.

*The rated load of all jacks must be permanently marked on the jack.

*Jacks must be inspected at least every six months.

*Jacks must be appropriately blocked or cribbed when necessary to provide a firm foundation.

*Pneumatic power tools must be positively secured to the hose to prevent the tool from becoming disconnected; also a tool retainer must be used on tools to prevent attachments from being expelled.

*Nailers, staplers, and similar equipment with an auto-feed device should have a muzzle to prevent the tool from ejecting material unless the muzzle is in contact with work surface.

Pneumatic Tools

A variety of tools, including hammers, drills, saws, tampers, paving-breakers, and vibrators are powered by compressed air, usually provided by a compressor near the worksite. Generally the same precautions regarding the use and care of electric and gasoline engine-driven equipment should be followed for pneumatic tools.

Fire precautions should be observed in connection with the operation of compressors.

Air-supply lines should be protected from damage by vehicles, inspected regularly, and maintained in good condition. Air-supply lines carried overhead or vertically should be supported with a messenger cable, or other proper support. Noise levels from pneumatic impact tools should be determined to see if protective hearing devices for workers are necessary.

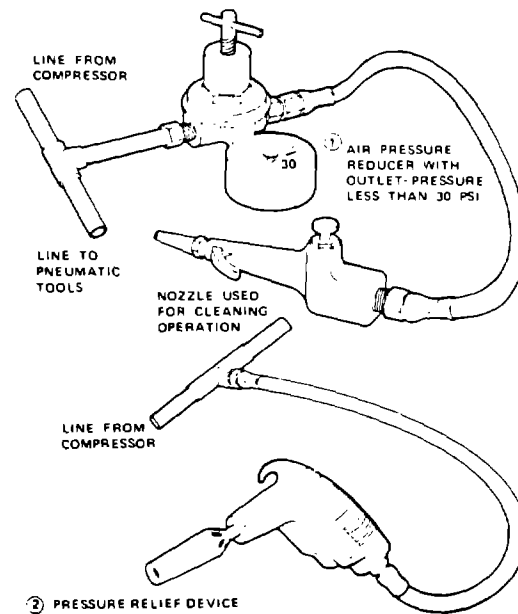
Also, operators of pneumatic tools are subjected to the hazards of flying pieces of rock. Operators and other workers in the area must wear safety goggles, hard hats, and other applicable safety equipment.

Handling of heavy jackhammers can cause fatigue and possible strains. Jackhammer handles should be

provided with heavy rubber grips to reduce vibration and fatigue, and operators should wear safety shoes to reduce the possibility of injury.

COMPRESSED AIR

Beware of compressed air, it can be dangerous. Alternate methods of cleaning surfaces should be sought, but compressed air may be used if no alternate method of cleaning surfaces is acceptable. Compressed air should never be used to blow debris from a person. The downstream pressure of compressed air must remain at a pressure level below 30 psi whenever the nozzle is dead-ended, and then use it only when effective chip guarding and personal protective equipment are used. Two acceptable methods of meeting the 30 psi requirement are illustrated below.



WELDING AND CUTTING

General

Management must establish areas and procedures for welding and cutting. Preferably, cutting or welding should be done in an area with no surrounding combustible materials. If combustibles in the immediate vicinity are unavoidable, guards must be used to protect the fire hazards from heat and sparks. Suitable fire extinguishing equipment (pails of water, buckets of sand, hoses, or portable extinguishers) must be maintained for instant use.

Torch cutters and welders must be suitably trained in the safe operation of their equipment. Printed rules and instructions covering the operation of equipment supplied by the manufacturers must be strictly enforced.

No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks, or other containers until they have been thoroughly cleaned. The employee must make absolutely certain that these containers have no flammable materials present or any substances such as greases, tars, acids, or other materials which, when subjected to heat, might produce flammable or toxic vapors.



The atmosphere in the welding area must be free of flammable gases, liquids, and vapors.

Specially tinted goggles or other suitable eye protection (helmets, hand shields) must be used during cutting operations.

Workers adjacent to the welding areas must be protected from ultraviolet rays by noncombustible or flameproof screens or shields, or must be required to wear appropriate goggles.

Employees exposed to hazards created by cutting and welding must be protected by personal protective equipment. For example:

- *Flameproof gauntlet gloves (except when engaged in light work) should be worn. (OSHA may eliminate this and the following two requirements: contact your area or regional office for more information.)
- *Flameproof aprons (leather for example) may be desirable for protection against sparks and radiant heat.
- *Fire resistant leggings or high boots should be worn.

The potential health hazard to a welder or cutter from gases or metal fumes depends on the toxicity of the materials involved (types of metals, fluxes, coatings, etc.), duration, location, and ventilation.

There are specific requirements concerning ventilation and respirators when welding or cutting on the following:

- a. stainless steel, lead, zinc, or cadmium.
- b. metals coated with lead or mercury containing materials such as paint.

- c. fluxes or other materials containing fluorides.

The table below summarizes these requirements:

REQUIREMENTS FOR VENTILATION AND RESPIRATORS WHEN
WELDING OR CUTTING

SUMMARY OF VENTILATION REQUIREMENTS FOR WELDING
AND CUTTING

Welding or Cutting on Materials Containing or Coated with:	Location of Operation		
	Confined Spaces	Indoors	Outdoors
Lead	A or B	A	C
Zinc	A or B	A	
Cadmium*	A or B	A or B	C
Beryllium*	A and B	A and B	A and B
Fluorine*	A or B	A or B	C
Mercury*	A or B	A or B	C
Stainless Steels	A	A	A

A = Mechanical local exhaust by means of hoods or booths with sufficient airflow to maintain a velocity away from the worker of at least 100 linear feet per minute.

B = NIOSH approved respiratory protective equipment, or equivalent.

C = NIOSH approved respiratory protective equipment, or equivalent.

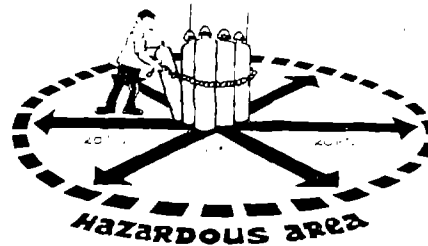
*Unless atmospheric tests under the most adverse conditions have established that the workers' exposures are within acceptable concentrations defined by 1910.1000.

Mechanical ventilation must be provided when welding or cutting is done on metals not covered in the table when:

- a. there is less than 10,000 cubic feet of volume per welder.
- b. the ceiling is less than 16 feet high.
- c. when working in confined spaces.

Such mechanical ventilation must be at the minimum rate of 2,000 cubic feet per minute per welder, unless hoods or booths are provided with sufficient airflow to maintain a velocity away from the worker of at least 100 linear feet per minute. Alternatively NIOSH-approved supplied-air respirators must be used.

COMPRESSED GAS



Gas Welding

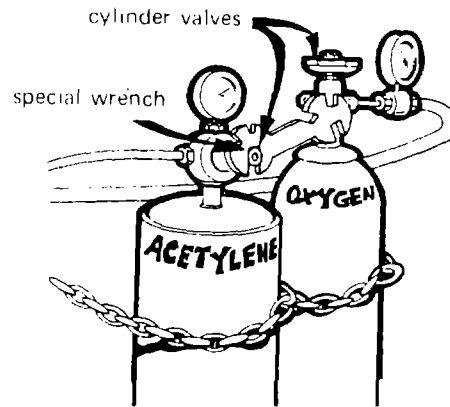
For gas welding operations, it is required that:

- *All cylinders are away from radiators and other sources of heat.
- *All cylinders stored inside buildings are located in a well-protected, well-ventilated, dry location at least 20 feet from highly combustible materials and away from elevators, stairs, or gangways. They are not to be kept in unventilated enclosures such as lockers and cupboards.

*Valve protection caps are utilized where the cylinder is designed to accept a cap except when cylinders are in use or connected for use.



*Stored oxygen cylinders are separated from stored fuel gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet, or by a noncombustible barrier at least 5 feet high and having a one-half hour fire resistance rating. Cylinders, cylinder caps, valve couplings, regulators, hoses, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves.



CYLINDER WRENCH

*All cylinder valves must be closed when work is finished. Where a special wrench is required, it must be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of an emergency. In the case of manifolded or coupled cylinders, at least one such wrench shall always be available for immediate use.

*All cylinders must be legibly marked to identify contents.

*No cylinder should be permitted to stand alone without being secured with lashings or chains to prevent it from toppling over.

*Acetylene must not be utilized at a pressure in excess of 15 psi gauge (or 30 psi absolute). Above this pressure acetylene may become unstable.

*Indoor storage of fuel gas is limited to a total capacity of 2,000 cubic feet or 300 pounds of liquified petroleum gas.

*Hoses showing leaks, burns, or worn places which render them unfit for service must be replaced or repaired.

Electric Arc Welding

If the welding machine is wet, it must be thoroughly dried and tested before it is used again.

Coiled welding cables are to be spread out; the ground lead must be firmly attached to the work.

Cables must be inspected for damage such as loss of insulation, and be repaired immediately.

Ground and electrode cables may be joined together only with connectors specifically designed for that purpose.

Cables with splices within 10 feet of the operator may not be used; neither may the operator coil cables around his body.

Welding helmets or hand shields must be worn by the operator. Persons near the operation must wear eye protection.

Shields must protect others in the vicinity from arc welding rays.

Arc welders should wear clean, fire-resistant gloves and clothing with collars and sleeves buttoned.

Electrode holders which are not in use must be placed in a safe place, for example, away from conducting objects.

THE NATIONAL ELECTRICAL CODE (NEC)

Electrical Requirements

More fires are caused by electrical malfunction than any other cause, and standards pertaining to electrical equipment and use in all industries have been cited as violations more frequently than any others.

The National Electrical Code, NFPA 70-1971; ANSI C1-1971 has been adopted as a national consensus standard by OSHA (refer to "Information Sources"). The purpose of the NEC is the practical safeguarding of persons and buildings and their contents from hazards arising from the use of electricity. The

code contains basic minimum provisions considered necessary for safety. The electrician should be familiar with these requirements.

Each disconnecting means (e.g., circuit breaker or fuse boxes) must be legibly marked to indicate its purpose unless its purpose is evident.

Frames of electrical motors, regardless of voltage, must be grounded.

Exposed noncurrent-carrying metal parts of fixed equipment that may become energized under abnormal conditions must be grounded under any of the following circumstances:

- *in wet or damp locations,
- *if in electrical contact with metal,
- *if operated in excess of 150 volts to ground, or
- *when in a hazardous location.

Exposed noncurrent-carrying metal parts of the following plug-connected equipment which may possibly to become energized, must be grounded or double-insulated and distinctly marked:

- *portable, hand-held motor-operated tools,
- *appliances, or
- *any equipment operated in excess of 150 volts to ground.

Outlets, switches, junction boxes, etc., must be covered.

Vibrators

The handles of all electric hand vibrators must be of nonconductive material.

A safety-relief valve must be installed at the source of pressure on all air-operated vibrators.

Employees using electric vibrators should wear rubber gloves and rubber boots; the vibrators must also be grounded.

Employees using any internal vibrator must wear eye protection.

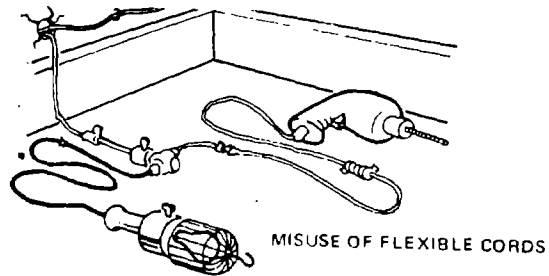
External vibration causes a noise hazard (see "Occupational Noise Exposure" section).

Flexible cords may not be:

- *used as a substitute for fixed wiring, wiring,
- *run through holes in walls, ceilings, or floors,
- *run through doors, windows, etc., or
- *attached to building surfaces.

Flexible cords must be:

- *continuous lengths without splices or taps,
- *fastened so that there is no pull on joints or terminal screws, and
- *replaced when frayed or insulation has deteriorated.



Damp or Wet Locations

A switch or circuit breaker in a wet location or outside of a building must be enclosed in a weatherproof enclosure.

In damp or wet locations, cabinets and cutout boxes of the surface type must be weatherproof and so placed or equipped as to prevent moisture or water from entering and accumulating within the cabinet or cutout box. They must also be mounted so there is at least a 1/4-inch of air space between the enclosure and the wall or another supporting surface. It is recommended that boxes of nonconductive material be used with nonmetallic-sheathed cable.

In locations where walls are frequently washed or where there are surfaces of absorbent materials such as damp paper or wood, the entire wiring system, including all boxes, fittings, conduits, and cables must be mounted so that there is at least a 1/4-inch air space between it and the wall or supporting surface.

Temporary Lights

Exposed bulbs on temporary lights and sockets shall be guarded to prevent accidental contact except if deeply recessed in the reflector or otherwise inaccessible.

Temporary lights shall not be suspended by their electrical cords unless they are designed for that use.

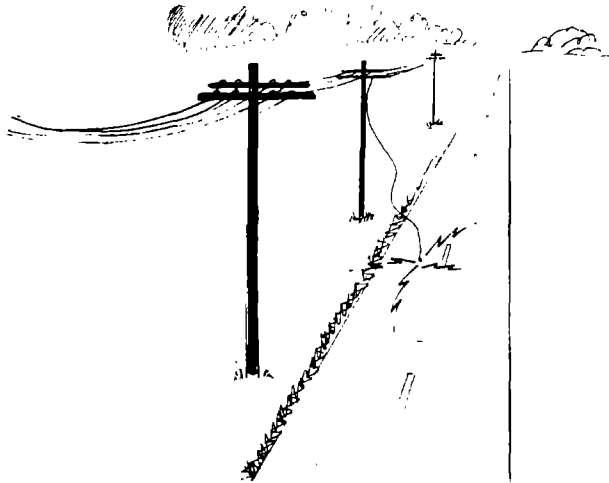
Arcing Parts

Parts of electrical equipment which in ordinary operation produce arcs, sparks, etc., must be

enclosed unless they are separated and isolated from all combustible materials.

Electrical Equipment

All electrical wires should be treated as live wires. Dangling wires should not be touched and should be reported immediately to the supervisor.



If it is necessary to use an extension cord in a damp place or on bare ground, one with an insulated handle should be used and touching metal parts of the lamp or its connections must be avoided. Also, when working with electric portable tools in damp places, the insulation on the extension cords should be checked.

Before using an electric hand tool, the worker should inspect the wiring to be sure that the tool is equipped with a ground wire or a three-prong plug.

Workers should not leave the cords of portable

electric tools where equipment can run over them, or where they can cause tripping hazards.

When necessary to suspend portable power tools, they should be hung from some stable object by means of a rope or similar support of adequate strength.

High-Voltage Lines

No part of a lifting device (particularly the boom), or its load should be permitted to come within 10 feet of any live electrical power line.

High-voltage power lines (440 volts or higher) must have a vertical clearance of not less than 25 feet where they cross highways, service roads, or areas traveled by trucks, cranes, shovels, or other equipment. Detours should be provided if possible.

Road clearance should conform to requirements of State Highway Departments. The minimum clearance in such areas should be conspicuously posted.

Blasting under or near high-voltage lines also constitutes a hazard and should be given thorough consideration on pre-blast surveys.

BLASTING AND THE USE OF EXPLOSIVES

The transportation, storage, handling, and use of explosives are subject to numerous Federal, state, and local laws and regulations, which should be consulted before any action is taken. The handling and use of explosive compounds and accessory devices should be further governed by the instructions of the manufacturers. For additional information see U.S.

Department of Transportation, 49 CFR, Chapter 1, CFR 1926 and 26 CFR 181. General safe practices that should be followed are:

- *Only authorized and qualified persons shall be allowed to handle and use explosives.

- *No person shall smoke, carry matches or other flame producing devices, nor shall firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives.

- *All explosives must be accounted for at all times. Explosives not being used must be stored in a locked, approved magazine facility required under the applicable provisions of the Internal Revenue Service regulations contained in 26 CFR 181, Commerce in Explosives.

- *State and Federal regulations pertaining to transportation of explosives must be strictly followed.

- *The employer must post all required areas and vehicles with appropriate signs. (Reference ANSI D6.1-1971)

- *Necessary guards or flagmen must be safely stationed on highways during blasting to control highway traffic.

HIGHWAY TRAFFIC SIGNS, FLAGMEN AND BARRICADES

Traffic Signs

Construction areas must be posted with legible traffic signs at points of hazard. (Examples are listed in ANSI D6.1-1971.)

All traffic control signs or devices used for protection of construction workers must conform to ANSI D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways, and state and local regulations.

All signs intended to be used during hours of darkness must be reflectorized or illuminated. Torches or lanterns are for warning or guidance, and must not be used for sign illumination.

Signs must be placed in positions where they will convey their messages most effectively. Placement must therefore be accommodated to highway design and alignment.

Signs must be so placed that the driver will have adequate time for response.

As a general rule signs must be located on the right-side of the street or roadway.

Flagmen

When construction is of such a nature that signs, signals, or barricades don't provide adequate protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls shall be provided.

Flagmen stations must be located far enough in advance of the work site so that approaching traffic will have sufficient distance to reduce speed before entering the project. This distance is related to approach speed and physical conditions at the site; however, 200 to 300 feet is desirable. In urban areas the distance necessarily must be decreased. Flagmen shall be provided with, and shall wear, a red or orange vest. The vest shall be reflectorized material if worn at night.

Barricades

A means of obstruction to deter the passage of persons or vehicles shall provide protection on or adjacent to a highway or street.

For further information see:

"Manual on Uniform Traffic Control Devices for Street and Highways," ANSI D6.1-1971.

"Highway and Street Construction," Associated General Contractors of America Accident Prevention Manual.

RECORDKEEPING REQUIREMENTS

OSHA requires that records be kept of factual information about illnesses and accidents. Employers can use these records for evaluating the success of their safety and health activities and for identifying high risk areas of their businesses in need of attention. Employers must report within 48 hours to OSHA (or a state agency in states which have operational safety and health plans) any incident or accident which results in hospitalization of five or more employees or in a fatality.

Employers with 11 or more employees at any time during the preceding calendar year are required to complete OSHA Forms 101 and 200 (the replacement for OSHA Forms 100 and 102) or an equivalent log. The following cases must be recorded on the OSHA Form 200 (Log of Occupational Injuries and Illnesses): every death, every illness, and any injury which results in loss of consciousness, loss of time, restriction of work or motion, temporary or permanent transfer to another job, or medical treatment other than first

aid. Illnesses and injuries are classified as to whether they result in lost workdays, restriction of duties, or "light duty", or lost time.

A supplementary record must be completed for each recordable case. OSHA Form 101 may be used; a state workers' compensation report or other form is acceptable if it contains information equivalent to that provided on the OSHA 101. Forms 101 and 200 must be kept current to within six work days after the employer has been notified of a recordable accident or injury case.

An annual summary, OSHA Form 200, must be posted during the entire month of February in a place where all employees are likely to see it. Both forms (101 and 200) must be retained for five years, excluding the calendar year of occurrence.

A booklet, "Recordkeeping Requirements Under the Williams-Steiger Occupational Safety and Health Act of 1970", provides a supply of forms and more detailed information. It is available from OSHA regional or area offices or from the regional offices of the Bureau of Labor Statistics (see back pages).

Employers are also required to maintain accurate records of certain toxic or harmful physical agents which must be monitored or measured and must promptly advise employees of any excessive exposures and the corrective action taken. In certain cases, physical examinations and testing are required. Examples of these agents are asbestos and ionizing radiation. Any OSHA office can supply a list of these hazardous substances and explain what records are required.

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job safety and health protection

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers through the promotion of safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers:

Each employer shall furnish to each of his employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to his employees, and shall comply with occupational safety and health standards issued under the Act.

Employees:

Each employee shall comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to his own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards and its Compliance Safety and Health Officers conduct on-site inspections to insure compliance with the Act.

Inspection:

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a responsible number of employees concerning safety and health conditions in the workplace.

Complaint:

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will without request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or otherwise exercising their rights under the Act.

An employee who believes he has been discriminated against may file a complaint with the nearest OSHA office within 30 days of the alleged discrimination.

Citation:

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

Proposed Penalty:

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than \$10,000 or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity:

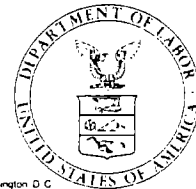
While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce injuries and illnesses arising out of employment.

More Information:

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional Area Office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.



Washington, D.C.
1974
OSHA 2203

Peter J. Brennan
Secretary of Labor

U. S. Department of Labor

Occupational Safety and Health Administration

OSHA 2203-101-100

Employers must post one of the full size versions (10x16) of this type of OSHA poster or a state-approved poster where required.

CHECKLISTS

Since safe conditions depend on vigilance for possible hazards and immediate remedial action, periodic inspections are one of the most important aspects of a successful safety and health program.

Management will find a checklist, such as the one presented on the following pages, helpful in performing a self-inspection of its facility. Because businesses vary, it is best that each business develop a customized list from the information in this booklet and a walk-through inspection.

Using this checklist, the manager, supervisor, or employee representative makes periodic inspections (preferably at least once each month) to identify problem areas so that corrective action may be taken.

Reference made in the "Checklist" subtitles refers to appropriate sections of "General Industry Standards, Title 29, Code of Federal Regulations, Part 1926 and 1910."



WALKING AND WORKING SURFACES,
AISLES AND FLOOR (29 CFR 1910.22)

Are all places of employment kept clean and orderly?

Are floors, aisles, and passageways kept clean and dry; and all spills cleaned up immediately?

Are floor holes, such as drains, covered?

Are permanent aisles appropriately marked?

Are wet surface areas covered with nonslip materials?

STORAGE LOFTS, SECOND FLOORS, ETC.
(29 CFR 1910.22, .23)

Are there signs present showing floor load capacity?

Are platforms, storage lofts, balconies, etc., that are more than 4 feet above the floor, protected with standard guardrails?

Are all platforms, lofts, and balconies (where people or machinery could be exposed to falling objects) guarded with standard 4-inch toeboards?

Are bridges provided over conveying devices?

STAIRS (29 CFR 1910.24)

Are there standard stair rails or handrails on all stairways having four or more risers?

Are all stairways at least 22 inches wide?

Do stairs have at least a 7 foot overhead clearance?

Do stairs angle no more than 50 and no less than 30 degrees?

LADDERS (29 CFR 1910.25, .26, .27)

Have defective ladders (e.g., broken rungs, side rails, etc.) been tagged as "DANGEROUS, DO NOT USE" and removed from service for repair or destruction?

Is it prohibited to use the top of an ordinary portable ladder as a step?

Do fixed ladders have at least 3 1/2 feet of extension at the top of the landing?

Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7 inches or more?

Do all fixed ladders have a preferred pitch of 75 to 90 degrees?

Do fixed ladders longer than 20 feet have cages or ladder safety devices?

Do fixed ladders longer than 30 feet have landing platforms?

EXCAVATING - TRENCHING (29 CFR 1926.650-.652)

Prior to excavation, has a check been made to determine whether underground installations (i.e., sewer, telephone, water, fuel, electric lines, etc.) will be encountered?

Are the walls and faces of all excavations in which men are exposed to danger from moving ground, guarded by a shoring system, sloping of the ground, or some equivalent means?

Are excavations inspected by a competent person after every rainstorm or other hazard-increasing occurrence?

Is excavated or other material stored at least 2 feet from the edge of excavation?

Do trenches more than 5 feet deep have ladders or steps located within 25 feet of employees?

EGRESS (29 CFR 1910.36-.38)

Are all exits marked with an exit sign and illuminated by a reliable light source?

Is the lettering at least 6 inches high with the principal letter strokes at least 3/4 of an inch wide?

Is the direction to exits, when not immediately apparent, marked with visible signs?

Are doors or other passageways that are neither exits nor access to an exit, and located where they may be mistaken for exits, appropriately marked such as, "NOT AN EXIT" or "TO BASEMENT"?

Are exit doors side-hinged?

Are all doors that must be passed through to reach an exit, or way to an exit, always free to access with no possibility of a person being locked inside?

Are all exit routes always kept free of obstructions?

OCCUPATIONAL HEALTH AND
ENVIRONMENTAL CONTROL (29 CFR
1910.94, .1000)

Is management aware of the hazards caused by various chemicals being stored?

Is employee exposure to these chemicals kept within the acceptable levels?

Are all containers, such as vats and storage tanks, labeled as to their contents?

Are employees required to wear personal protective equipment when handling hazardous materials (gloves, eye protection, respirators, etc.)?

Are eye-wash fountains and safety showers provided in areas where chemicals such as caustics are used?

If internal combustion engines are used, is carbon monoxide kept within acceptable levels?

Is employee exposure to welding fumes controlled by ventilation, use of respirators, limited exposure time, or other means?

Is vacuuming rather than blowing or sweeping dust used wherever possible?

Are grinders, saws, and other machines that produce respirable dusts vented to an industrial collector or central system?

Is adequate ventilation provided to minimize exposure to wood dust?

Are all local exhaust ventilation systems operating properly?

Are ducts plugged?

Are belts slipping?

Is there proper air flow and volume?

Do radio-frequency energy devices have effective electrical interlocks and shields?

Have measurements been made to determine any radio-frequency energy leakage?

OCCUPATIONAL NOISE EXPOSURE (29 CFR 1910.95)

If a noise problem is suspected, have noise levels been measured?

If a noise problem exists, have plans to reduce noise levels by engineering methods been made (e.g., enclosure, maintenance, different methods of processing)?

If engineering controls cannot reduce the noise to safe levels:

- *Have administrative controls, such as limiting worker exposure in a given area, been started?

- *Are affected employees given

annual audiometric tests, if necessary?

*Do all employees in high-noise areas wear proper hearing protection?

*Are annual noise surveys made to reevaluate the problem?

HAZARDOUS MATERIALS, FLAMMABLE AND
COMBUSTIBLE LIQUIDS (29 CFR
1910.106)

Are all connections vapor- and liquid-tight on drums and combustible liquid piping?

Are flammable liquids kept in closed containers when not in use (e.g., parts cleaning tanks and pans)?

Are all spills of flammable or combustible liquids cleaned up promptly?

Is combustible waste material (oily rags, etc.) stored in covered metal receptacles and disposed of daily?

Are bulk drums of flammable liquids grounded and bonded to containers during dispensing?

Are gasoline and other flammable liquids stored in approved containers?

Do storage rooms for flammable and

combustible liquids have mechanical or gravity ventilation (at least six air changes per hour)?

Are storage cabinets for flammable liquids labeled "FLAMMABLE--KEEP FIRE AWAY"?

Is there never more than 1 day's supply of flammable liquids outside of approved storage cabinets or rooms?

Are LP gas storage tanks guarded to prevent damage from vehicles?

Are "NO SMOKING" signs posted on LPG gas tanks?

TEMPORARY HEATING DEVICES (29 CFR 1926.154)

Is sufficient ventilation provided? Especially in confined areas?

Are heaters placed within safe distances from combustible materials as defined in CFR 1926.154?

Are solid fuel heaters and oil-fired salamanders prohibited in buildings and on scaffolds?

Are heaters securely anchored so they will not fall over?

Are the provisions of the National Fire Protection Association (NFPA) #58 followed?

Are one or more attendants assigned to check on the proper operation of the unit?

PERSONAL PROTECTIVE EQUIPMENT (29 CFR 1910.132-.137)

Are employee-owned personal protective equipment, such as gloves, hard hats, knee pads, protective shoes, etc., adequate and properly maintained?

Do employees wear required personal protective equipment (gloves, eye protection, respirators, etc.) when handling hazardous materials?

Are ear plugs or muffs provided and worn during noisy conditions?

Are hard hats or safety shoes available where falling objects could be a hazard?

RESPIRATORY PROTECTION DEVICES (29 CFR 1910.134)

Are respirators provided and worn during dusty operations, spraying, etc.?

Is the proper respirator in use for the hazards present? (For example, dust masks do not protect against solvent vapors.)

Are written standard operating procedures available to the employee for the selection and use

of respirators?

Is the employee-user instructed and trained in the proper use of respirators?

Are respirators cleaned and disinfected after use?

Are respirators stored in a convenient, clean, and sanitary location?

Are routinely used respirators inspected during cleaning?

GENERAL ENVIRONMENTAL CONTROLS SANITATION (29 CFR 1910.141-.149)

Are restrooms and washrooms kept clean and sanitary?

Are covered receptacles for waste food kept in clean and sanitary condition?

- Is all water provided for drinking, washing, and cooking suitable for drinking?

Are all outlets for water not suitable for drinking clearly posted as "UNSAFE FOR DRINKING, WASHING, OR COOKING"?

Are employees prohibited from eating in areas where toxic materials are present?

Is pest and rodent control exercised where needed?

If employees are permitted to eat on the premises, are they provided with a suitable space for that purpose?

MEDICAL AND FIRST AID (29 CFR 1910.151)

Is at least one employee on each shift currently qualified to render first aid in the absence of a nearby clinic or hospital? (Some states require first aid trained persons regardless of nearby clinics or hospitals.)

Are means provided for quick drenching or flushing of the eyes and body in areas where corrosive materials are used?

Is there a first aid kit easily accessible to the work area, with supplies readily available, inspected, and replenished?

Have first aid supplies been approved by a consulting physician, indicating that they are adequate?

Are medical personnel readily available for advice and consultation on matters of employee health?

Are emergency phone numbers posted?

FIRE PROTECTION (29 CFR 1910.156-157)

Are extinguishers selected for the types of combustibles and flammables in the areas where they are to be used?

- | | |
|----------|--|
| Class A. | Ordinary
combustible
material fires |
| Class B. | Flammable-liquid,
or grease fires |
| Class C. | Energized-
electrical-
equipment fires |

Are extinguishers fully charged and in designated places?

Are extinguishers located along normal paths of travel?

Are extinguisher locations free from obstruction or blockage?

Are extinguishers mounted properly?

Have all extinguishers been serviced, maintained, and tagged at intervals not exceeding one year?

Are all extinguishers checked (by management or designated employees) monthly to see if they are in place and fully charged?

Have extinguishers been

hydrostatically tested according to schedules set for the type of extinguisher?

COMPRESSED AIR (29 CFR 1910.169)

Are pulleys and belts on compressors and motors completely guarded?

Are flexible cords or plugs on electric motors periodically checked and replaced if in a deteriorated condition?

Do the relief valves operate properly?

Are air tanks drained regularly?

Is the pressure-relief device and gauge in good operating condition?

Is air pressure reduced to less than 30 psi when the nozzle used for cleaning is dead-ended?

Have employees been instructed that the use of compressed air to blow debris from clothing or body is prohibited because the debris can enter the body and cause serious harm?

MATERIAL HANDLING AND STORAGE (29 CFR 1910.176-.181)

Is there safe clearance for

equipment through aisles and doors?

Are materials stored and stacked properly?

Are storage areas free from tripping hazards?

Are storage racks inspected periodically for cracks, weaknesses, or indentations?

Are material safety data sheets available in case of exposure to toxic materials?

Have personnel been trained on clean-up procedures involving toxic materials?

CRANES (29 CFR 1926.550, 29 CFR 1910.179, .180)

Are only designated qualified employees permitted to operate cranes?

Is the rated load of each crane plainly marked?

Are loads carried over the heads of people?

Does the operator test the brakes each time a near capacity load is handled?

Is a fire extinguisher kept in the cab or vicinity of the crane?

Are hooks, ropes, brakes, and all functional operating mechanisms inspected daily for indication of damage and wear, and written monthly records signed and dated?

Is the hoist rope wrapped around the load?

Are proper hand signals being used?

Is hoisting, lowering, or traveling done while someone is on the load or hook?

Are crawler and locomotive cranes a minimum of 10 feet away from electrical power lines?

SLINGS (29 CFR 1910.184)

Are proper procedures followed whenever slings are used?

MOTORIZED VEHICLE OPERATIONS (29 CFR 1926.600-606)

EQUIPMENT

Are vehicles left unattended at night adjacent to highways equipped with appropriate lights or reflectors to identify the location of the vehicle?

Are approved safety tire racks or cages used when inflating, mounting, or dismounting tires

installed on split rims or rims equipped with locking rungs or similar devices?

Are parking brakes applied when vehicles are parked?

Are wheels checked when parked on inclines?

Is safety glass installed on all vehicles and is glass free from distortions?

Are vehicles equipped with the proper safety equipment as required by CFR 1926.601 and CFR 1926.602?

GENERAL SAFETY RULES

Are only certified operators permitted to operate equipment?

Do all operators wear hardhats?

Are operators prohibited from jumping on or off machines while in motion?

Are motors turned off when making repairs or refueling?

Are workers prohibited from riding on running boards, fenders, bumpers, or atop cabs?

Are drivers prohibited from remaining inside vehicles while it is being loaded by cranes, etc.?

ROLLOVER PROTECTIVE STRUCTURES
(ROPS) (29 CFR 1926.1000-1003)

Are vehicles equipped with the proper rollover protective structures as required by CFR 1926.1000?

Are vehicles in compliance with testing criteria as required by CFR 1926.1001, 1002, and 1003?

Does each ROPS have the manufacturer or fabricator's name and address, ROPS' model number (if any) and machine make, model, or series number that the structure is assigned to fit, permanently affixed to the structure?

MACHINERY AND MACHINE GUARDING (29
CFR 1910.212)

Are belts, pulleys, and rotating shafts (air compressor, saws, etc.) properly guarded?

Are chains, sprockets, and gears properly guarded?

Are all in-going nip points properly guarded?

Are rotating parts (lubrication fittings, etc.) recessed or covered with collars?

Are all pieces of equipment with an electric motor or any electrical

connection effectively grounded?

Are sprockets and V-belt drives that are within reach of platforms and passageways or less than 7 feet from the floor completely enclosed?

Are fans less than 7 feet above the floor protected with a guard having openings 1/2-inch or less?

ABRASIVE WHEEL MACHINERY (Grinders)
(29 CFR 1910.215)

Is the work rest used and kept adjusted to within 1/8-inch of the wheel?

Is the adjustable tongue on the top side of the grinder used and kept adjusted to within 1/4-inch of the wheel?

Do side guards cover the spindle, nut, and flange, and 75% of the wheel diameter?

Are bench and pedestal grinders permanently mounted?

Are goggles or face shields always worn when grinding?

JACKS (29 CFR 1910.244)

Are jacks checked periodically to see if they are still in good condition?

Are loads on jacks cribbed,
blocked, or secured at once?

HAND AND PORTABLE POWER TOOLS (29
CFR 1910.242.244) (29 CFR 1926.300-
305)

Are tools and equipment (both
company and employee-owned) in good
condition?

Have mushroomed heads on chisels,
punches, etc., been reconditioned
or replaced if necessary?

Have broken hammer handles been
replaced?

Have worn or bent wrenches been
replaced?

Are electric tools grounded or
double insulated?

Do power-activated tools have
required safeguards and are they
operated only by trained personnel?

Have deteriorated air hoses been
replaced?

Are portable abrasive wheels
appropriately guarded?

Have employees been made aware of
the hazards caused by faulty or
improperly used hand tools?

SAWS (29 CFR 1910.213)

Are there proper guards on all saws?

Is the lower portion of the blade on radial arm saws guarded?

Are there devices used to automatically return the swing saw or radial saw back to its original position?

Are saws used for ripping equipped with anti-kickback devices and spreaders?

Does every machine have a master switch to keep it inoperative during repairs or adjustments?

Is the exposed part of the saw underneath the table properly guarded?

Are blades on bandsaws properly enclosed and guarded?

WELDING, CUTTING, AND BRAZING (29 CFR 1910.252)

Are fuel gas cylinders and oxygen cylinders separated by 20 feet or a barrier 5 feet high having a 1/2-hour fire resistance rating?

Are cylinders secured and stored where they cannot be knocked over?

Are cylinder protective caps in place except when the cylinder is in use?

Are compressed gas cylinders kept away from sources of heat, elevators, stairs, or gangways?

Are only trained employees, who are judged competent by the employer, allowed to use oxygen or fuel gas equipment?

Do all cylinders (except those with fixed hand wheels) have nonadjustable wrenches, keys, or handles in place on valve stems while cylinders are in use?

Is welding always conducted at a safe distance from flammable liquids or dusty areas?

Are all compressed gas cylinders legibly marked for identifying the content?

Are the valves shut off when the cylinder is not in use?

Are flash shields provided to protect nearby workers from the welding flash?

Is there a fire extinguisher nearby?

Do the electrical leads not contain a splice within 10 feet of the electrode holder?

Is the arc welding equipment in good repair?

Is appropriate protective clothing worn?

Is the proper shade of lens used for the welding being done?

Are the welders protected from excessive amounts of welding fumes by the use of ventilation, respirators, etc.?

NATIONAL ELECTRICAL CODE,
ELECTRICAL WIRING (29 CFR 1910.309)

Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced?

Are junction boxes, outlets, switches, and fittings covered?

Does all equipment connected by cords and plugs have grounded connections?

Are electrical appliances such as vacuums, blowers, and vending machines grounded?

Are all portable electrical hand tools grounded unless doubly insulated?

Are breaker switches identified as to their use?

Are flexible cords and cables run only in appropriate places (not through holes in walls or ceilings, or through doorways or windows, or attached to building surfaces)?

Are flexible cords and cables free from splices or taps?

Are all conduit connections intact?

Do all extension cords being used have a ground wire?

Do all extension cords being used have appropriate wiring to carry the current being drawn?

Are multiple plug adapters not used?

In wet locations, is the electrical equipment properly protected?

Are flexible cords and cables substituted for fixed wiring?

Are flexible cords and cables fastened so that there is no direct pull on joints or terminal screws?

Are tag-outs or lock-outs used when working on equipment?

BLASTING AND THE USE OF EXPLOSIVES

Do only authorized and qualified persons handle explosives?

Is transportation and storage of explosives and blasting agents according to standards?

Is the area to be blasted properly posted and monitored?

SIGNS, FLAGMEN, AND BARRICADES

Are safety and directional signs posted where required?

Are flagmen/barricades used where required?

Are signs and flagmen procedures in compliance with ANSI Code D6.1-1971?

Are flagmen provided with and required to wear red or orange warning garments?

RECORDKEEPING (29 CFR 904.2-.8, 29 CFR 1903.2)

Is employee poster (OSHA or equivalent state poster) prominently displayed?

Have occupational injuries or illnesses, except minor injuries requiring only first aid, been recorded on OSHA Form Nos. 101 and 200, or equivalent?

Has a summary of all occupational injuries and illnesses been compiled at the conclusion of each calendar year and been recorded on OSHA Form No. 200, and was it posted during the month of February?

Have all OSHA records been retained for a period of five years, excluding the current year?

EMPLOYEE CHEMICAL PROTECTION CHART (JOB ANALYSIS)

Employees, first-line supervisors, and others need to know what hazards are presented by workplace chemicals, and what protective measures are required to guard against overexposure. The accompanying chart is suggested as a format for analyzing the specific chemical hazards employees face. Column headings are explained in the sections below.

Item

If the contents of chemical products are not listed by technical chemical names, those names should be requested from the supplier (for example, by requesting Material Safety Data Sheets). Both common and technical names should be included in the job analysis. Note that regulations being drafted when this Guide went to press are expected to improve the usefulness both of chemical labeling and of Material Safety Data Sheets. Assistance in identifying chemical components can also be obtained by contacting NIOSH (see back pages).

Use

Indicating the use for each chemical product helps employees who handle several chemicals to determine what type of personal protective equipment is required. Frequently, employees may recognize the chemical by its use far more readily than by its technical name. This information should also be valuable for supervisors.

Form(s) Found; Route(s) of Exposure

Selection of appropriate engineering and administrative controls, and personal protective equipment and clothing depends on the physical forms of the substance present in the workplace--dust, liquid, vapor, fume, gas, etc. The forms in which a chemical is present in a particular application plus the nature of the required handling together determine the routes of exposure--skin, inhalation, eye contact, or swallowing.

Controls and/or Protective Clothing and Equipment Required

Controls are recorded in this column so that in those situations where controls are necessary, supervisors and employees will be aware of what they are, and will take action if such controls require repair, adjustment, or routine maintenance.

To determine the adequacy of engineering or administrative controls, and of personal protective equipment or clothing, the concentration of an air contaminant may have to be measured. Similarly, in the case of a highly toxic chemical that is readily absorbed by skin, swipe samples from contaminated surfaces may be necessary.

Periodic measurement of the amount appearing in workers' blood can sometimes be used as a periodic check to assure that the protective equipment and work practices used are adequate.

Possible Results of Overexposure

This column is for the health effects of the hazard presented by overexposure (or by any exposure where a

chemical is cancer-causing), as well as the basic symptoms of overexposure, if known. This information should be available from the supplier. If not, contact NIOSH (see back pages).

Effects due to short-term overexposure and those due to long-term overexposure should be separately identified. This should encourage the use of required protective equipment and the adoption of necessary work practices.

The following pages list NIOSH regional and OSHA regional and area offices which can provide information on requirements of the Occupational Safety and Health Act; answer questions on standards interpretations, and particular hazards; and provide voluntary compliance information, copies of the OSHA Standards and of the OSHA Act, Employee Rights Posting Notice, and publications.

INFORMATION SOURCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1430 Broadway
New York, New York 10018

A10.9	Concrete Construction and Masonry Work
A10.10	Safety Requirements for Temporary Space Heating Devices and Equipment Used in Construction Industry
A10.17	Safe Operating for Asphalt Pavement Construction
A12.1	Floor and Wall Openings
A14.1	Portable Wood Ladders
A54.1	Carbon Dioxide Extinguishing Systems
A58.1	Minimum Design Load
A64.1	Fixed Stairs
B15.1	Mechanical Power Transmission
B30	Cranes and Hoist
C1	National Electrical Code
D6.1	Manual on Uniform Control Devices
Z4.1	Sanitation in Places of Employment
Z49.1	Welding and Cutting

Z87.1	Eye and Face Protection
Z88.1,88.2	Respiratory Protection
Z89.1	Safety Requirements for Industrial Head Protection
Z112.1	Portable Fire Extinguishers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
 470 Atlantic Avenue
 Boston, Massachusetts 02210.

NFPA-10-1970	Installation of Portable Fire Extinguishers
NFPA-13A-1971	Sprinkler Systems, Maintenance
NFPA-17-1969	Dry Chemical Extinguishing Systems
NFPA-70-1971	National Electrical Code
NFPA-101-1970	Life Safety Code

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago, Illinois 60611

NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH (NIOSH)
4676 Columbia Parkway
Cincinnati, Ohio 45226

List of Criteria Documents

List of Technical Publications

NIOSH 75-119 Certified Personal Protective
Equipment

Training Division Course Schedule NIOSH and OSHA
Regional Directors (see listing in back of this
book)

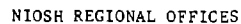
Trade associations, state and local governmental
agencies, and insurance companies can also provide
useful information. The Small Business
Administration will provide information concerning
procedures for securing economic assistance for
compliance with the OSHA Standards (if needed).

OSHA 2085 Excavation and Trenching Operations

OSHA 2086 Excavation, Trenching, and
Backfilling

OSHA 2089 Trenching - and Excavating - A
Checklist

The following pages list NIOSH and OSHA regional offices. Either of these facilities serving the state can provide information on the Occupational Safety and Health Act including questions on standards interpretations, voluntary compliance information, copies of the OSHA Standards, OSH Act, Employee Rights Posting Notice, and other OSHA publications.



DHEW, Region X
1321 Second Ave., Mail Stop 502
Seattle, Washington 98101
206/442-0530

OSHA REGIONAL OFFICES

Region I

U.S. Department of Labor
Occupational Safety and Health Administration
JFK Building, Room 1804
Boston, Massachusetts 02203 Telephone: 617/223-6712/3

Region II

U.S. Department of Labor
Occupational Safety and Health Administration
1515 Broadway (1 Astor Plaza), Room 3445
New York, New York 10036 Telephone: 212/971-5941/2

Region III

U.S. Department of Labor
Occupational Safety and Health Administration
15220 Gateway Center, 3535 Market Street
Philadelphia, Pennsylvania 19104 Telephone: 215/596-1201

Region IV

U.S. Department of Labor
Occupational Safety and Health Administration
1375 Peachtree Street, N.E., Suite 587
Atlanta, Georgia 30309 Telephone: 404/526-3573/4 or 2281/2

Region V

U.S. Department of Labor
Occupational Safety and Health Administration
230 S. Dearborn, 32nd Floor
Chicago, Illinois 60604 Telephone: 312/353-4716/7

Region VI

U.S. Department of Labor
Occupational Safety and Health Administration
555 Griffin Square Building, Room 602
Dallas, Texas 75202 Telephone: 214/749-2477/8/9 or 2567

Region VII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 3000, 911 Walnut Street
Kansas City, Missouri 64106 Telephone: 816/374-5861

Region VIII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 15010, 1961 Stout Street
Denver, Colorado 80202 Telephone: 303/837-3883

Region IX

U.S. Department of Labor
Occupational Safety and Health Administration
9470 Federal Building, 450 Golden Gate Avenue
Post Office Box 36017
San Francisco, California 94102 Telephone: 415/556-0584

Region X

U.S. Department of Labor
Occupational Safety and Health Administration
6048 Federal Office Building, 909 First Avenue
Seattle, Washington 98174 Telephone: 206/442-5930

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NOTICE:

Prices of Government publications are subject to change without notice. Prices charged on your order may differ from prices printed in the publications.

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Superintendent of Documents
Washington, D.C. 20402

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Discount	
Refund	

KIND OF FIRE

DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .

↓

... THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS

→



CLASS A FIRES

USE THESE EXTINGUISHERS

- ORDINARY COMBUSTIBLES
- WOOD
 - PAPER
 - CLOTH
 - ETC.



CLASS B FIRES

USE THESE EXTINGUISHERS

- FLAMMABLE LIQUIDS, GREASE
- GASOLINE
 - PAINTS
 - OILS, ETC.



CLASS C FIRES

USE THESE EXTINGUISHERS

- ELECTRICAL EQUIPMENT
- MOTORS
 - SWITCHES
 - ETC.



APPROVED TYPE OF EXTINGUISHER

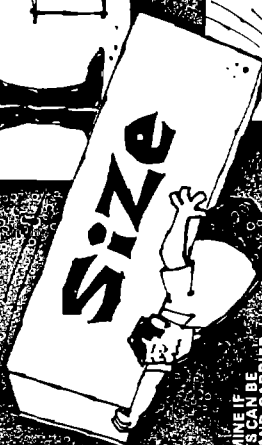
MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT

FOAM Solution of Aluminum Sulphate and Bicar- bonate of Soda	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	SODA ACID Bicarbonate of Soda Solution and Sul- phuric Acid	PUMP TANK Plain Water	GAS CART- RIDGE Water Ex- pelled by Carbon Dioxide Gas	MULTI- PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL

HOW TO LIFT SAFELY

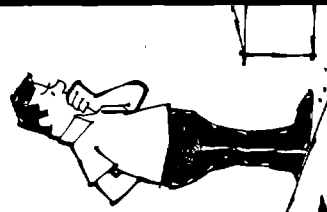
The following safe practices should be observed in order to avoid injury.

The factors that contribute to safe lifting are...

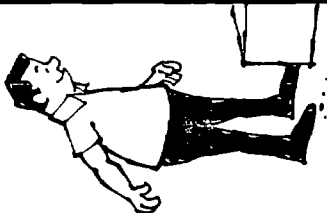


DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY

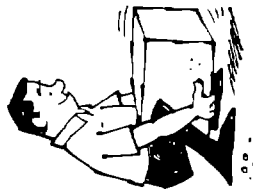
1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.



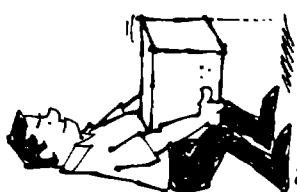
2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.



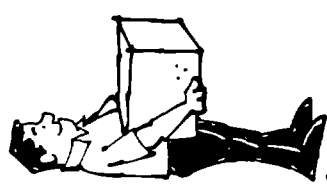
3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles...



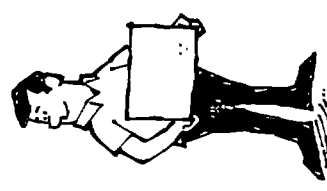
4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.



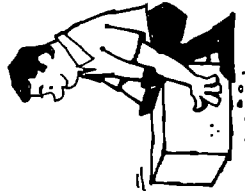
5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.



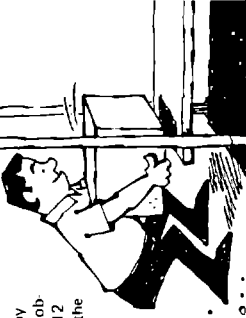
6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.



7. Setting the load down, is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.



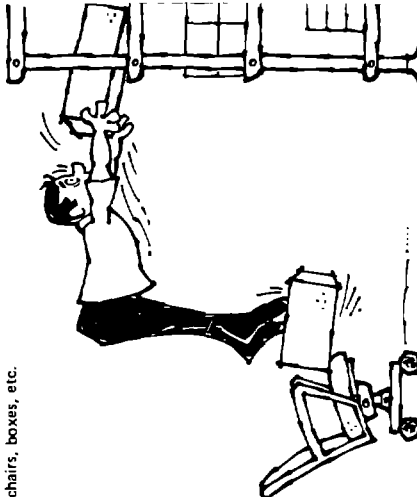
Avoid strain by storing heavy objects at least 12 inches above the floor.



Avoid awkward positions or twisting movements while lifting.



Over-reaching and stretching to reach overhead objects may result in strains or falls. Use a ladder instead of chairs, boxes, etc.



When lifting and carrying with another person—teamwork is important. The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.



Stack material in such a manner as to permit full view while carrying.

