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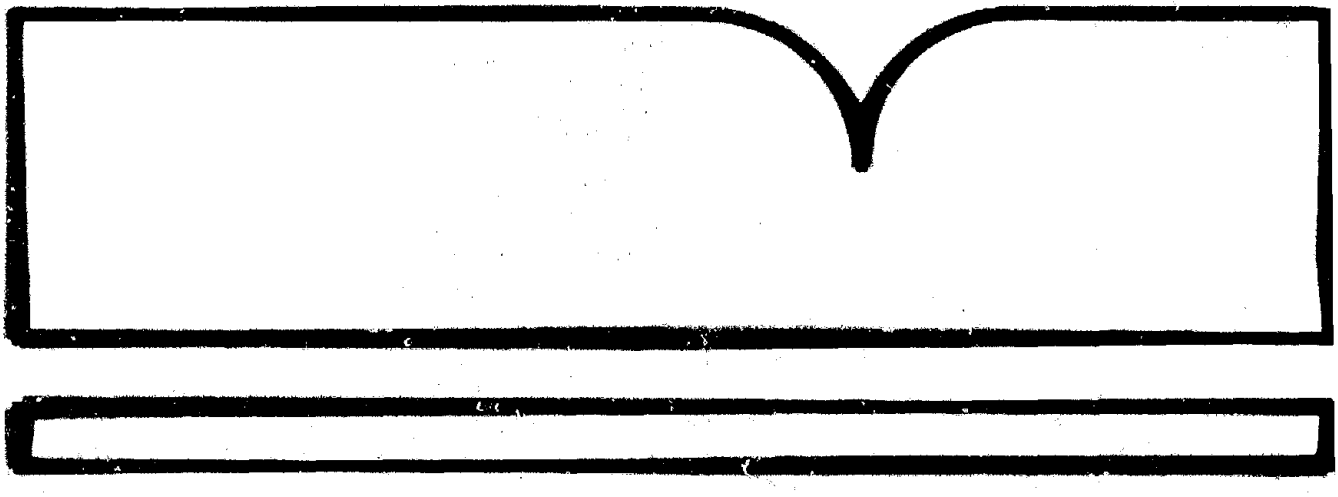
Health and Safety Guide for Oil and Gas Well Drilling and Servicing

(U.S.) National Inst. for Occupational Safety and Health, Cincinnati, OH

Aug 80



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The purpose of this guide is to assist in providing a safe and healthful workplace. It describes safe practices and points out some of the more frequently encountered violations of the health and safety standards as regards oil and gas well drilling and servicing. This book includes a section titled 'Health and Safety Guidelines', which includes the recommendations of good practices, and a section of 'Frequently Violated Regulations', which generally follows the order and content of the OSHA Standards. On the last few pages of this guide, addresses of NIOSH and OSHA regional offices are listed. Also included are addresses of other organizations which can provide assistance and information on occupational safety and health.

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NIOSH

Health and Safety Guide for OIL and GAS WELL DRILLING and SERVICING

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

Related publications are available from NIOSH:

How to Get Along With Your Solvent - Pub. No. 76-108
Spray Painting - Pub. No. 76-178
Working with Solvents - Pub. No. 77-139
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Single copies are available from:

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HEALTH AND SAFETY GUIDE FOR OIL AND GAS WELL DRILLING AND SERVICING

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Technical Services
September 1978
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CONTENTS

The Williams-Steiger Occupational Safety and Health Act of 1970 was passed into law "to assure safe and healthful working conditions for working men and women...". This Act established the National Institute for Occupational Safety and Health in the Department of Health, Education, and Welfare and the Occupational Safety and Health Administration in the Department of Labor. NIOSH is not responsible for the enforcement of Federal occupational health law. NIOSH provides research, information, and education programs and trains occupational health professionals. As part of these activities, surveys have been conducted to determine the most common health and safety problems faced by small businesses. This guide was developed for use in the oil and gas well drilling and servicing industry.

INTRODUCTION

Oil and gas well drilling and servicing contractors are usually safety-conscious, but as is true in many other industries, health hazards tend to be overlooked. The purpose of this guide is to assist in providing a safe *and* healthful workplace. It describes safe practices and points out some of the more frequently encountered violations of the health and safety standards.

This book includes a section titled "Health and Safety Guildelines", which includes the recommendations of good practices, and a section of "Frequently Violated Regulations", which generally follows the order and content of the OSHA Standards. On the last few pages of this guide, addresses of NIOSH and OSHA regional offices are listed. Also included are addresses of other organizations which can provide assistance and information on occupational safety and health. If you ask for help from either NIOSH or OSHA, this will not bring about an inspection of your workplace.

Although much of the material is based on Federal law, this guide does not provide complete compliance information. In addition, the Federal government has delegated enforcement of occupational safety and health standards to some state governments. State standards sometimes differ from Federal law, although they must be at least as effective as the Federal standards.

Words appearing in the text such as "must", "shall", "required", and "necessary" indicate requirements under Federal law. The words "should" and "suggested" identify generally accepted good practices.

HEALTH AND SAFETY GUIDELINES

HEALTH AND SAFETY PROGRAM

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 and job hazard evaluations; 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, by interviewing employees for suggestions or complaints, by promptly investigating accidents, by reviewing injury and illness records, and by using material from this guide and other sources to anticipate health and safety problems. Typical examples of hazards are improper use of the cat head, spinning chains, wet or slippery walking surfaces, unguarded chains and sprockets, electrical hazards, improper lifting, and air contaminants, The "Checklist" in the back of this guide is of particular importance in identifying hazards. You should customize it to fit the needs of your program.

Although this guide describes many of the controls and work practices needed to eliminate common hazards, specific information on which controls are required and in what configuration (for example, controls to reduce noise around the compound, mud pumps, and rig motors) may require the services of consultants.

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

Management leadership—from the contractor, toolpusher, and driller—is necessary for the acceptance of the health and safety program. The driller who deals directly with the workers (roughnecks) must be responsible for implementing the program. Because workers cannot take an interest in a program they know nothing about, regular meetings should be held to discuss safety promotion, potential hazards, and injury and illness records. The roughnecks will be more likely to follow safe work practices if they are aware that the contractor himself is interested in, and practices, safety.

EMPLOYEE TRAINING

Safe oil and gas well drilling and servicing depends largely upon the knowledge and training of the contractor, toolpushers, drillers, and roughnecks. All persons working around a drilling or servicing rig should be properly informed and aware of potential health and safety hazards. Training needs will vary according to the complexity of the operation.

Impress upon employees the need for constant awareness of their surroundings—even during automatic operations. This should include a "good housekeeping" awareness, which can reduce accidents and create a sense of pride for your employees in their workplace. (Good housekeeping is the rule on drilling rigs. Well servicing rigs are not as clean and orderly, probably because they are moved on and off location more often than drilling rigs.) Warning signs and operating procedures should be posted where they are appropriate (near rotating machinery, for instance). Check points should be included as part of both standard and emergency procedures.

Lifting objects the wrong way often causes back injuries or hernias. These are especially common injuries among drillers and roughnecks. Instruction in safe lifting practices can prevent many of these injuries. The "How to Lift Safely" chart in the back of the book can be used for instruction and then posted where all employees can refer to it.

Another fold-out chart included with this book provides information on the use of portable fire extinguishers. All employees should know how to use such equipment. The chart can be used to train those who don't, and then may be posted in the workplace.

One or more persons trained in first aid must be at work on each shift. A vehicle should also be available at all times to transport ill or injured employees to the hospital or doctor.

Employees who use motorized equipment, such as winch trucks, must be trained in the operation and potential hazards of the equipment. Only employees who have such training and who are authorized by management should use the equipment.

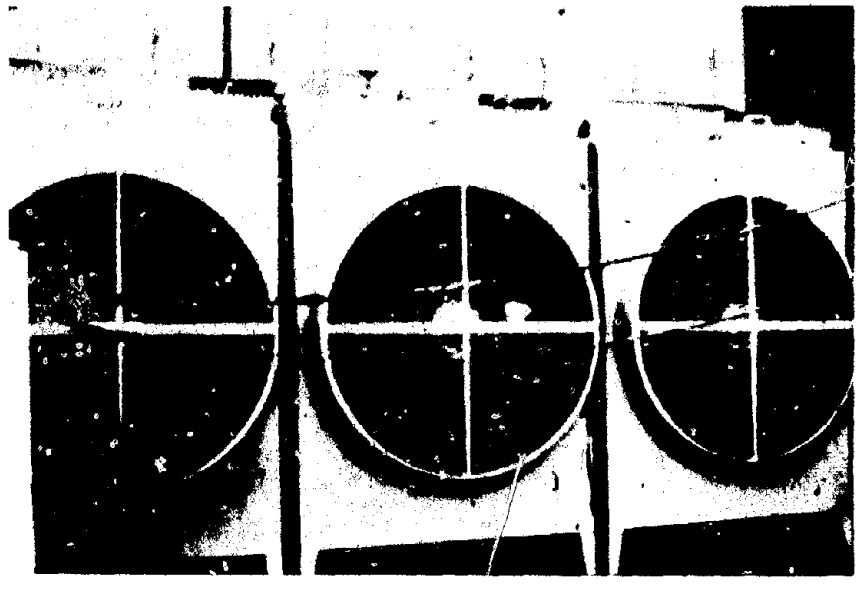
All employees should be taught the correct way to use all the equipment on a drilling rig and well servicing unit—such as the cat head, rig climbers, slips, tongs, and elevators. This training should emphasize the function of the machine guards and the protection the guards provide.

All employees should know when and how to use personal protective equipment. All workers should wear hard hats and gloves before leaving the change house (doghouse). Hearing protection is required in many areas, but in some cases may itself be a hazard. Because subtle changes in engine sound or other sounds and rhythms may be an early indication of a gas leak or blowout, engineering controls are preferable in controlling excess noise exposure.

MACHINE GUARDING

Machine guarding is extremely important in protecting the employee. In fact, it could be said that the degree to which machines are guarded in the workplace is a reflection of management's interest in providing a safe working environment.

Employees cannot always be relied upon to act safely enough around machinery in motion to avoid accidents. From time to time, they will react differently to the same environment because of physical, mental, or emotional changes—sometimes reacting safely, sometimes not. Even the well-coordinated and well-trained worker may at times perform unsafe acts which could lead to injury or death.



OPERATING POWERED TOOLS

Employees should know the application, limitations, and potential hazards of every tool they use. They should be trained in the safe way to use these tools. Such training should cover at least the points cited here.

Employees should dress properly to prevent loose clothing from catching in moving parts. Safety glasses, dust or face masks, or other protective clothing and equipment must be used where necessary (for instance, when using grinders or other tools which throw off chips, splinters, etc.). Employees should learn to be alert to potential hazards in the work area, such as damp locations or the presence of highly combustible materials. Work areas must be kept free of clutter.

Before beginning any job, the employee should know how to select the proper tool for the job. After choosing a tool, he should check to see that ground prongs are in place on electrical tools (or that the tool is marked "double-insulated") and that guards are in place and in working order. It is very important for employees to understand that these guards are for their protection and that they create serious hazards by removing or altering the guards. The employee should know never to use a tool with a frayed cord or a loose or broken switch. He should also know what to do with that broken tool (tag it as "broken" and remove it from the tool supply). Adjusting keys and wrenches must be removed before the tool is turned on.

To ensure others' safety, employees should be instructed not to surprise or distract anyone using a powered tool.

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 indentified only by trade names. Many such formulations contain mixtures of several substances, which can make an evaluation of the hazard potential of the product as a whole difficult. Note that exposure to certain hazardous substances, such as benzene or asbestos (alone or in mixtures), can cause deadly diseases that do not show up until years after exposure.

To begin identifying occupational health hazards, a materials analysis (product inventory) should be made that lists all solvents, lubricants, drilling muds, acids and alkalies, and other materials used around the rig. If the composition of a material cannot be readily determined, this information should be requested from the manufacturer or supplier. Many provide Material Safety Data Sheets 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, hazards at your worksite may be determined and suitable controls prescribed. Assistance in this effort is available from NIOSH regional offices (see back pages). A noise survey should also be conducted.

Skin conditions such as chemical burns, skin rashes, and dematitis are widespread in U.S. industries. Certain cleaning compounds, including skin cleaners, may cause dermatitis of the arms and hands and an irritation of the hair follicles on the front of the thighs. 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. If the workers' skin condition does not improve, other substances or processes may be the cause of the dermatitis. This will warrant further testing and, perhaps, medical consultation.

Check to see that all workers have the necessary personal protective equipment on the job. This would include respirators being available when mixing drilling mud and adjusting mud with acids and alkalis.

Welding is occasionally performed on rigs. Welders should be taught the hazards of welding certain materials, such as galvanized metal. They should also be aware of the toxic properties of various flux coatings on welding rods. If oxy-acetylene welding equipment is used, it is important to keep the oxygen away from oil and oily machines, clothes, rags, and so on. The oil or oily material could ignite spontaneously.

All gas and propane motors around the rig, such as those used in the light plant and boilers, should be checked regularly for high carbon monoxide emission. This is especially important during the winter or if the motors operate in confined spaces.

It is very important that the driller and all the roughnecks dress in appropriate clothing for the location. This means hard hat, safety shoes, ear protection for high noise areas, and adequate clothing for either hot or cold climate.

CONTROL METHODS

Various control methods can be used to prevent or reduce employee exposure to health hazards in the workplace. Some of these methods, which can be used singly or in combination, are:

SUBSTITUTION of less toxic materials (for example, changing from gas heaters to electric heaters in the doghouses and change rooms, which would eliminate the buildup of carbon monoxide during the winter).
CHANGE OF PROCESS (for example, using a closed mixer instead of hand stirring drilling mud).
ISOLATION (such as enclosure) of a hazardous process to reduce worker exposure to contaminants.
VENTILATION to reduce the amount of airborne contamination. This may be either local exhaust ventilation (which removes contaminants at the point of generation) or general dilution ventilation (see "Occupational Health and Environmental Control"). Air levels must be measured to determine the adequacy of the venitlation system.
ADMINISTRATIVE CONTROLS to limit the total amount of time any individual is exposed to a specific health hazard (for example, chemical vapors or gases) during the course of a workday.
TRAINING AND EDUCATING employees by explaining to them what hazards they are exposed to and how to reduce or avoid exposure (see "Employee Training").
PERSONAL PROTECTIVE EQUIPMENT, such as respirators, protective clothing, and other items (see "Personal Protective Equipment").
PERSONAL HYGIENE. Before eating and before leaving work, every employee should wash hands and face to remove any chemicals contacted at work. Employees should also wash their hands before using toilet facilities. Employees should not be permitted to store food near or to eat or smoke around toxic chemicals, or in contaminated areas. If chemicals such as caustics, epoxies, solvents, or resins get on the skin, they should be washed off immediately.

Spare clothing should be available so that employees can change immediately (after showering or other decontamination) in case work clothes become grossly contaminated with toxic liquids. Moreover, work clothing should be changed and washed daily if it is even moderately contaminated with these substances. It should be washed separately from other family laundry. Personal hygiene should be emphasized.

THE INDUSTRY AND ITS HAZARDS

Oil and Gas Well Drilling and Servicing

This Health and Safety Guide was written for oil and gas well drilling and servicing. The potential exists for accidents and illnesses caused by improper use of equipment and misuse of various chemicals. The more evident safety hazards include tripping, unguarded machinery, and wet or slippery floors. The frequency and severity of accidents and illnesses can be greatly reduced by following proper health and safety procedures: good housekeeping, effective guarding of machinery, wearing of safety apparel, and the wearing of appropriate personal protective equipment, such as respirators. Prompt first aid treatment of cuts, scrapes, burns, and bruises is important in order to prevent infection.

There is the potential for serious injury on drilling and well servicing rigs. The most serious injuries occur among new employees who are not adequately trained on different work procedures. Special precaution should be taken to train all new employees on proper procedures for the use of manual tongs (lead tongs and backup tongs), power and hydraulic tongs, and spinning chain; the proper lifting and use of slips; and for stabbing pipe when making a new connection so that fingers do not get caught. These are just several of the more important things that should be taught to a new employee in order to avoid serious injuries.

There are numerous health hazards connected with this industry which should be recognized. Hydrogen sulfide (H_2S) is a deadly gas which is found naturally, trapped underground in pockets. Drilling can release large quantities of this gas. H_2S can paralyze the respiratory system, and sudden exposure to high concentrations (about 1000 ppm in air, or greater) can be fatal. High noise levels around the rig motors, compound, mud pumps, and boiler house may cause hearing loss. Hearing protection should be provided to workers who are exposed to these high noise levels, if engineering controls cannot correct the problem.

Asbestos, a cancer-causing fiber, is frequently found in drilling mud. Respirators should be furnished to protect workers when mixing drilling mud.

Workers may experience heat stress if they do not have up to ten days to gradually adjust their bodies to working in high temperatures. Workers may suffer frostbite and nerve damage if they stay in very cold temperatures for extended periods. Proper clothing should be required to protect them from extreme cold and from the effects of "wind chill". Clothing must be kept clean and dry. Wet or dirty clothing loses its ability to protect against the cold.

Vibration may be a health hazard on drilling and servicing rigs. The effects of vibration are well documented. It tends to most affect workers who have arthritis, although arthritis is one of the least well-documented effects.

FREQUENTLY VIOLATED REGULATIONS

INTRODUCTION

This section is a review of OSHA regulations which are applicable generally 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). 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 hygienists in plant 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 and of scrap, chips, and other debris. Areas which are constantly wet or often wet where employees must walk or work should have nonslip 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.

The Standard Guardrail and Toeboard

Every open-sided floor or platform four feet or more above the adjacent floor or ground level must be railed on all open sides except where there is an entrance to a ramp, stairway, or fixed ladder.

Every stairway floor opening must be guarded on all open sides except the entrance to the stairway.

Every ladderway floor opening must be guarded by a standard railing and toeboard on all sides, with passage through the railing constructed so as to prevent a person from walking directly into the opening.

Every runway or catwalk four feet or more above ground level must have railings on all open sides.

Fixed Stairs On Pulling Units And Drilling Rigs

Riser height and tread width must be uniform throughout any flight of stairs.

All treads must be reasonably slip resistant.

Vertical clearance above any stair tread to any overhead obstruction must be at least seven feet, measured from the leading edge of the tread.

The minimum permissible width of a stairway is 22 inches. If the stairway is a path to an exit, it must be at least 28 inches wide.

The angle to the horizontal made by the staircases must be between 30 and 50 degrees.

All stairs should be adequately lighted.

If the stair tread is less than 9 inches wide, the risers should be open.

The following requirements apply to flights of stairs having four or more risers:

- A stair railing is required on each open side.
- If the stairway is less than 44 inches wide and both sides are enclosed, only one handrail is required, preferably on the right side descending.
- If the stairway is greater than 44 inches wide, a handrail is required on each enclosed side.
- If the stairway is greater than 88 inches wide, a stair railing located midway is also required.

A stair railing must be 30 to 34 inches high, and it must be of construction similar to the standard guardrail.

All stairs should be kept clear of snow and ice during winter to prevent falls and slips.

The stair steps should be made of a porous metal grating to allow the drainage of water from melted ice and snow.

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.)

Metal ladders must not be used near energized electrical equipment. Metal ladders should be so 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.

Any purchase order for ladders should include the requirement that the ladders meet OSHA standards.

Fixed Ladders On Pulling Units And Drilling Rigs

Fixed ladders must be designed to withstand a single concentrated load of at least 200 pounds.

Rungs of metal ladders must have a minimum diameter of 3/4 inch. Rungs of wood ladders must have a minimum diameter of 1-⅛ inches.

Rungs must be at least 16 inches wide, be spaced no more than 12 inches apart, and be free of splinters and burrs.

The preferred pitch for safe use is 75 to 90 degrees.

Unless caged or equipped with a ladder safety device, ladders with 90 degree pitch must have a 2-½ foot clearance on the climbing side. There must be at least a 7-inch clearance in back of all ladders to provide adequate toe space.

Vertical ladders must have either cages or a ladder safety device if they are more than 20 feet long.

Unless a ladder safety device is used, landing platforms must be provided on ladders greater than 20 feet long. A platform is required every 30 feet for caged ladders and every 20 feet for unprotected ladders (when no ladder safety device is used).

Side rails must extend at least 3-½ feet above landings.

EXITS AND EXIT MARKINGS

General Requirements

There are very few areas on most drilling rigs or pulling units that would require exit markings, because they are generally not enclosed. However, if you are working on an offshore platform or a self-contained drilling complex on the northern slope of Alaska, it will probably be necessary to provide and mark exits as follows:

The exit route must lead to a safe area.

Areas around exit doors and passageways leading to and from the exit must be kept free of obstructions.

Exit access must be arranged so that it is unnecessary to travel through any highly hazardous area in order to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other barriers).

Exits must be readily accessible at all times. Where exits are not immediately accessible from an open area, every occupant of that area must have access to two exits by separate paths. These paths must be through safe passageways, aisles, or corridors which lead directly to the exits.

Exit Markings

Every exit must have the word "EXIT" in plain, legible letters not less than 6 inches high with the strokes of the letters not less than 3/4 inch wide.

The visibility of the sign must not be impaired by decoration, furnishings, or other signs.

Doors, passageways, or stairways which are neither exits nor ways to an exit, but may be mistaken for an exit, must be clearly marked "NOT AN EXIT" or have a sign indicating their actual use, e.g., "STORAGE ROOM".

In areas where the direction to the nearest exit may not be apparent, an exit sign with a directional arrow must be used.

Exit signs must be illuminated by a reliable light source if occupancy is permitted at night, or if normal lighting levels are reduced at times during working hours.

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

NOTE: Administrative controls generally cannot be used on a drilling rig or pulling unit for limiting exposure to a health hazard. However, some health hazards can be eliminated very easily on drilling rigs and pulling units.

Enclosing or muffling machinery and using other engineering control practices, for instance, would substantially reduce one serious health hazard of the industry — noise.

Air Contaminants

Employees may be exposed to fumes, dusts, gases, and vapors resulting from various operations — welding, grinding and cleaning parts, spray painting, and the running of internal combustion engines. When workers are exposed to excessive amounts of air contaminants, engineering controls must be used wherever feasible. When such controls are not feasible or while they are being implemented, protective equipment must be used.

Acids

Various acids are added to drilling muds. When mixing these acids, face shields, rubber gloves, and a respirator should be worn. The acid should always be added to the mixture, not the mixture to the acid, and it should be stirred as it is added.

Asbestos

Some drilling muds contain small quantities of asbestos. Enough asbestos may become airborne during handling that a worker may be overexposed. Exposure at any time to more than two fibers of asbestos per cubic centimeter of air is illegal. Asbestos exposure can increase a worker's chance of developing some form of asbestos-related cancer later in life, if he does not wear the proper respiratory protection while mixing the mud.

Carbon Monoxide

Engine exhaust, space heaters, rig motors, boiler houses, and idling automobiles (the toolpusher's car) are the main sources of carbon monoxide exposures. If any of the workers complain of headaches, especially a toolpusher who has been sleeping in his car, carbon monoxide levels should be checked.

Hydrogen Sulfide (H_2S)

Hydrogen sulfide (sour gas) has the odor of rotten eggs and is very deadly. It first paralyzes the olefactory nerve, making it difficult or impossible to smell. Then, pulmonary edema can develop and kill the victim.

Hydrogen sulfide is found in many oil fields in Wyoming and western Texas. When drilling in a field where hydrogen sulfide is suspected, proper monitoring devices should be on the rig to signal when trace quantities of H_2S are present. All workers should be informed of the hazards of hydrogen sulfide exposure. Respirators should be available for workers' use in case of a release of H_2S. Leases that have a high concentration of hydrogen sulfide in their oil and gas should be marked and proper precautions taken before entering these leases.

Lead

Lead is present in drilling mud and is also sometimes found in very high concentrations in the paint sprayed onto drilling rig derricks. Lead poisoning may occur through the inhalation or ingestion of lead or lead fumes.

The symptoms of lead poisoning include fatigue, loss of appetite, metallic taste in the mouth, anemia, headache, nervous irritability, muscle and joint pains, and abdominal cramps. Chronic lead poisoning is slow and vague in its beginning and the signs and symptoms are not well-defined.

When welding metal to the derrick, lead fumes may be generated at high levels. Local exhaust ventilation should be provided if possible while welding, spray painting, or any other operations are going on which may cause workers to be exposed to lead. If ventilation is

not feasible or if the operation is part-time, respirators are recommended. Good housekeeping practices and personal hygiene can also reduce lead exposure. Separate lockers for work and street clothes should be set up.

Solvents

All organic solvents can have some effect on the central nervous system and the skin. Excessive solvent vapor inhalation may cause lack of coordination and drowsiness, which may increase the risk of accidents. In other cases, exposure may result in serious damage to the blood, lungs, liver, kidneys, and gastrointestinal tract. You should be aware of the properties and hazards of the solvents used by your employees. Avoid highly toxic solvents, e.g., benzene and carbon tetrachloride. Although some solvents are less toxic than others, good safety practices dictate that care be exercised in the use of any organic solvent.

Skin contact with solvents may cause dermatitis, ranging in severity from a simple irritation to actual damage to the skin. Even the most inert solvents can dissolve the natural protective barriers of fats and oils, leaving the skin unprotected. When these natural lubricants are removed, the skin becomes subject to disabling and possibly disfiguring dermatitis or serious infection.

So-called "safety solvents" are safer only in that they are less flammable than other solvents. They are not necessarily less hazardous to employees' health.

Good personal hygiene is essential whenever solvents are used. The skin should always be protected from contact with solvents. Gloves, face shields, goggles, and other protective clothing should be used. Barrier creams may offer some degree of protection. The skin should never be washed with any organic solvent.

Occupational Noise Exposure

Excessive noise on drilling rigs can cause permanent hearing damage. The noise standard is one of the most commonly violated health standards on drilling rigs and pulling units. High noise levels are prevalent around the rig motors, mud pumps, and the compound. The contractor is responsible to make sure that the roughnecks, drillers, and toolpushers are not exposed to noise levels in excess of the legal limit. That limit is based on both sound level and the duration of the exposure at a particular level.

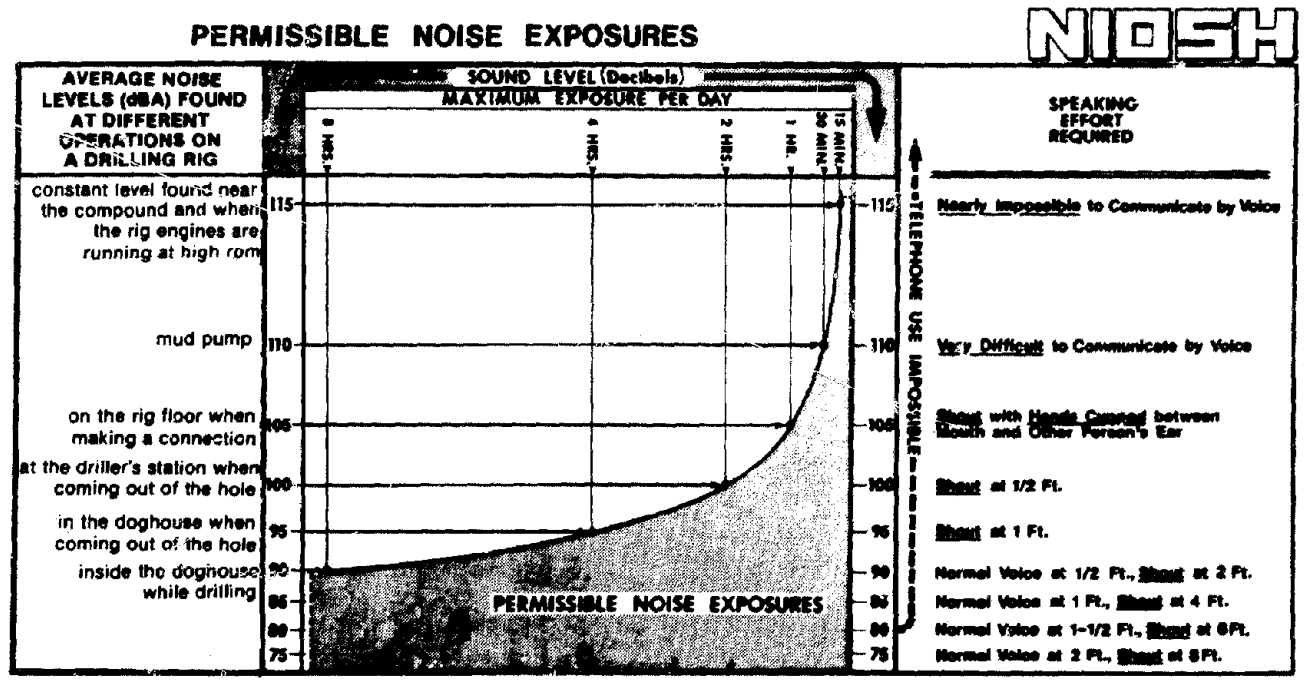
The current standard is a time-weighted average of 90 decibels A-scale (dBA) for an 8-hour exposure. Even at this noise level, hearing damage can be expected in some individuals. It is considered good practice to check the hearing every year by an audiometric test of all employees exposed to 85-90 dBA 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) must be used where the 90 dBA level (8-hour time-weighted average) is exceeded. Engineering control methods include the separation and isolation of noisy operations, impact reduction and vibration damping by lamination or lining with acoustic materials, and process change, where applicable. Mufflers on compressed air equipment exhausts and proper lubrication of machinery can also reduce noise levels. Noise-producing characteristics should be considered when purchasing new equipment.

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 earplugs. Some devices are more useful than others, depending on the noise level, the frequency structure of the noise, and how well the device fits the ear. Note that 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 the wearer.

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 at your worksite require 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 controls are put into effect to ensure the success of your hearing conservation program. 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 dosimeter accumulates the total noise exposure of the employee wearing it over a period of time. Some instruments combine both measurement functions in one unit.


PERMISSIBLE NOISE EXPOSURES
NIOSH
AVERAGE NOISE LEVELS (dBA) FOUND AT DIFFERENT OPERATIONS ON A DRILLING RIG
SOUND LEVEL (Decibels)
MAXIMUM EXPOSURE PER DAY
8 HRS.
4 HRS.
2 HRS.
1 HR.
30 MIN.
15 MIN.
constant level found near the compound and when the rig engines are running at high rpm
mud pump
on the rig floor when making a connection
at the driller's station when coming out of the hole
in the doghouse when coming out of the hole
inside the doghouse while drilling
115
110
105
100
95
90
85
80
75
TELEPHONE USE IMPOSSIBLE
PERMISSIBLE NOISE EXPOSURES
SPEAKING EFFORT REQUIRED
Nearly Impossible to Communicate by Voice
Very Difficult to Communicate by Voice
Shout with Hands Cupped between Mouth and Other Person's Ear
Shout at 1/2 Ft.
Shout at 1 Ft.
Normal Voice at 1/2 Ft., Shout at 2 Ft.
Normal Voice at 1 Ft., Shout at 4 Ft.
Normal Voice at 1-1/2 Ft., Shout at 6 Ft.
Normal Voice at 2 Ft., Shout at 8 Ft.

HAZARDOUS MATERIALS

Flammable and Combustible Liquids

The category "flammable" or "combustible" liquid is determined by the lowest temperature at which the vapors for the liquid will ignite. Vapors from flammable liquids ignite more easily than do those of combustible liquids. 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. Containers should 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 charge during liquid transfer operations.

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 or paint-laden 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.

Storage Cabinets

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

Metal cabinets must be constructed of at least 18 gauge sheet iron, double-walled with a 1½ inch air space and leakproof joints. Doors must have three-point locks and the sill must be at least two inches above the bottom of the cabinet.

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

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 four 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 entrance. Explanation of fire extinguisher codes is provided in material published by the National Fire Protection Association.

Outside Storage Areas

Outside flammable storage areas 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.

Spray Painting

The requirements described below apply to paints which present a fire hazard. Since both flammable and nonflammable paints and finishes may be used, it is advisable to equip areas as if only flammables were to be used. If only nonflammable paints, coatings, and cleaning solvents will be used, those provisions below which are directed only at fire prevention do not apply.

General Spray Operations

Portable lamps must be removed during spraying.

Low flash point thinners (less than 100° F) may be used for cleaning purposes only in a well-ventilated area.

"NO SMOKING" signs must be posted wherever flammable liquids, or mixtures containing them, are sprayed or stored.

Spray Areas

Spray areas must be at least 20 feet from flames, sparks, nonexplosion-proof electric motors, and other ignition sources.

Spray areas must be free from hot surfaces, such as heat lamps.

Electric lights in a spray area must be covered and guarded from accidental breakage. Fixtures and wiring must be explosion-proof.

Spray areas must be kept clean and free of combustible materials.

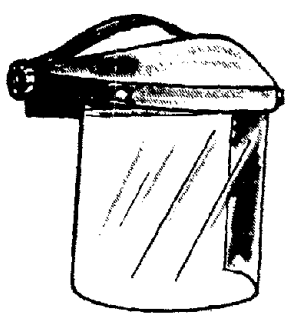
Mechanical ventilation must be used to remove vapors during spraying operations. Fumes and vapors must not be drawn through the breathing zone of the operator.

PERSONAL PROTECTIVE EQUIPMENT

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 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

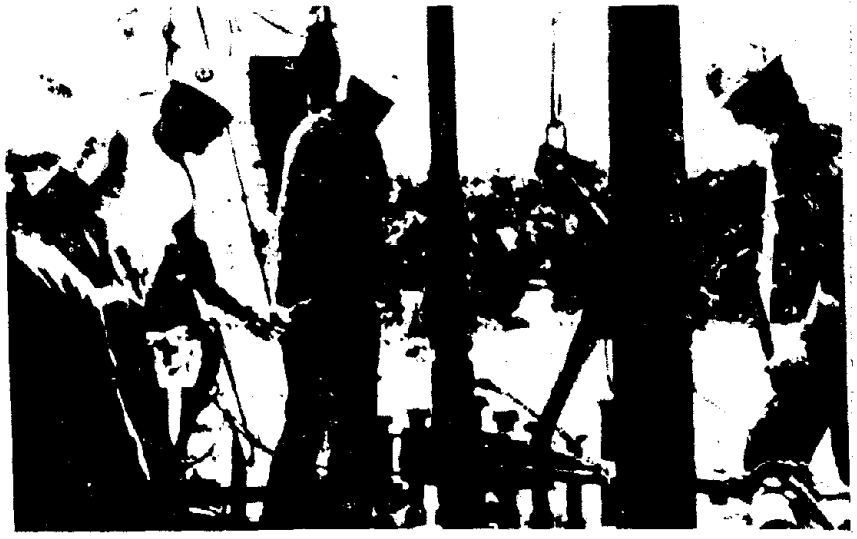
Eye and face protection are required where there is a possibility of injury from flying particles, chips, or sparks, or from splashes of liquids such as acids, caustics, and organic solvents. For example, employees must wear protective equipment when they work with grinders, power drills, or pneumatic chisels.



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. Employees should inform other workers if they wear contact lenses, so that the lenses may be removed in an emergency.

Head Protection

Adequate hard hats are required in all areas of drilling and well servicing rigs, because many injuries occur from objects falling from the derrick. There are also many areas where the hard hat protects the worker from bumps, such as in confined spaces underneath the substructure.



Foot Protection

All workers on drilling and well servicing rigs, including toolpushers and visitors, must wear foot protection.

Hearing Protection

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

Protective Clothing

Most roughnecks are accustomed to wearing the proper clothing to protect them against extremely hot and cold temperatures. Loose clothing should be avoided when working around moving machinery, such as elevators, power tongs, rotary tables, wire ropes, and chains.

Respiratory Protection

NIOSH-approved respirators or their equivalent 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 controls are not feasible, or while they are being implemented.

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 adjusted and tied.

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. Employees who wear dentures should be instructed to wear them at all times when using a respirator. Otherwise, this may also prevent a good face seal. Employees must not wear contact lenses when they are using a full-face respirator. If the lenses slip, the employee may break the respirator seal to replace them and be exposed to hazardous air contaminants.

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.

GENERAL ENVIRONMENTAL CONTROLS

Safe drinking water must be provided in all places of employment.

Receptacles for waste food are to be be covered and kept in a clean and sanitary condition

Sanitation

Restrooms are to kept in a clean and sanitary condition.

Employees working with toxic substances should wash and, where necessary, change from contaminated clothing before eating, drinking, smoking, or using toilet facilities.

Rodents, Snakes, Animals, Parasites, and Infectious Disease

Some drilling sites may present hazards which are not usually considered. Bites from rats, snakes, and other animals (especially rabid animals) need medical treatment. Cuts and abrasions can become infected, and parasitic bites (fleas, ticks, etc.) can result in infectious disease. During site clearing operations, workers must be protected against the hazards of irritating and toxic plants. The employer must train his employees in the proper first aid treatment and preventive measures needed for exposure to these types of hazards.

MEDICAL AND FIRST AID

The contractor should provide preemployment physicals for all employees. Roughnecks are a transient group of workers; therefore, it would be impossible to provide periodic physical examinations.

Emergency phone numbers should be posted in the toolpusher's trailer. 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. A means of transportation to the hospital should also be provided at all times.

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 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.

Some states have laws concerning medical practice which establish limits on first aid given by the lay person. Trained employees should understand where first aid ends and professional medical treatment begins.

NOTE: First aid is immediate, temporary treatment given in the event of accident or ilness — before the victim gets to a doctor or hospital.

Immediate first aid in some cases can prevent death or permanent impairment, and may lead to a complete recovery.

FIRE PROTECTION

Maintaining a clean and orderly workplace reduces the danger of accidents and fires. Rubbish should be disposed of regularly. If it is necessary to store combustible waste materials (other than liquids), a covered metal receptacle is required.

Cleaning materials can create fire and tripping or slipping hazards. Combustible sweeping compounds, such as oil-treated sawdust, can be fire hazards in some work environments. Floor coatings containing low flash-point solvents can be dangerous, especially near sources of ignition. All oily mops and rags must be stored in closed metal containers.

Some common causes of fires in all industry are:

- electrical malfunctions
- friction
- open flames
- sparks
- hot surfaces
- smoking
- disposal of incompatible materials

Proper maintenance and periodic safety inspections can reduce these hazards.

Fire Extinguishers

Fire extinguishers must be selected on the basis of the type of hazard, the degree of hazard, and the area to be protected. (The chart in the back of this guide will be helpful in making this selection.)

Extinguishers must be kept fully charged and in their designated places. They must not be obscured from view or obstructed. They must be located along normal paths of travel, i.e., so that travel distances do not exceed 75 feet for Class A extinguishers or 50 feet for Class B extinguishers. (These distances must be reduced for extremely hazardous conditions.) Management or a designated employee must inspect at least monthly to ensure that the extinguishers are in their

designated places, that they have not been tampered with or actuated, and that there is no corrosion or other impairment of the extinguisher's function.

Extinguishers must not be mounted higher than 5 feet (from the floor to the top of the extinguisher) if they weigh 40 pounds or less. If they weigh more than 40 pounds, the mounting must be within 3½ feet of the floor. (OSHA is considering the elimination of this requirement. Contact your OSHA area or regional office for more information.)

The extinguishers at your worksite must be examined at least once a year and recharged or repaired to ensure that they will operate. A tag must be attached to show the maintenance or recharge date and the signature or initials of the person performing the service. (OSHA may also eliminate these two requirements — maintenance and tagging.) They must be hydrostatically tested at appropriate intervals. Extinguisher sales representatives usually will perform this service. (Note that factory-sealed disposable and pump-type extinguishers do not require this service.)

COMPRESSED AIR EQUIPMENT

Employees should be familiar with the air compressor's operating and maintenance instructions.

New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII. The ASME 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). These valves must be tested at regular intervals to be sure they are in good operating condition.

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

No valves are allowed between the air tank and the safety valve.

Compressed air used to supply respirators must meet grade D requirements of the Compressed Gas Association:

- oxygen content 19.5-23.5%; balance primarily nitrogen
- hydrocarbon concentration less than 5 ppm
- carbon monoxide concentration less than 20 ppm
- carbon dioxide concentration less than 1000 ppm

MATERIALS HANDLING AND STORAGE

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

Hoists

Only personnel designated by the employer as qualified shall be permitted to operate hoists.

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

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, and monthly inspection records must be maintained.

Hoisting, lowering, swinging, or traveling is not permitted while anyone is on the load or hook.

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

Loads must not be carried over the heads of people.

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 trip setting of hoist limit switches must be determined by tests with an empty hook.

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

MACHINERY AND MACHINE GUARDING

Appropriate machine guarding must be provided to protect the operator and other employees in the machine area from hazards such as those created at the point of operation or by in-running nip points or rotating parts. Sources of such hazards that are located seven feet or less above the ground, floor, or working platform must be guarded to prevent accidential contact. Machine operations that generate sparks or flying chips must be guarded without regard for the seven-foot criterion if employees would be exposed to these hazards. Guards must be attached to the machine if possible, or secured elsewhere if attachment to the machine is not possible. The guard must prevent the operator from having any part of the body in the danger zone during the operating cycle of the machine. Guards must not themselves create an accident hazard. Machines designed for fixed locations must be securely anchored to prevent "walking" or tipping.

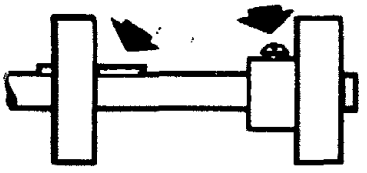
A booklet entitled "The Principles and Techniques of Mechanical Guarding", OSHA 2057, can be obtained by writing to your OSHA area office or to one of the OSHA regional offices listed in the back of this guide. Many equipment distributors can assist in obtaining the necessary protective devices.

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, nor are the guarding methods suggested here the only ones that may be effective.

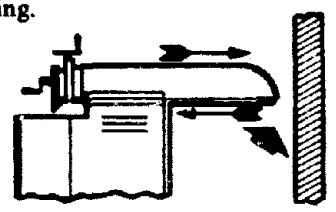
ROTATING AND RECIPROCATING MOTION

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 a hand into a dangerous position.

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



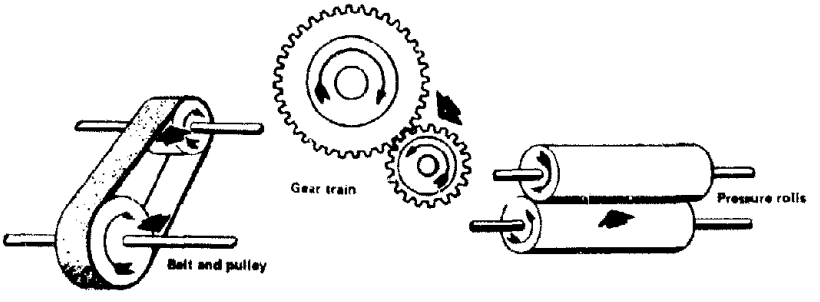
Rotating shaft and pulleys with key and set screw projecting



Reciprocating action of machine creating pinch point with fixed objects

IN-RUNNING NIP POINTS

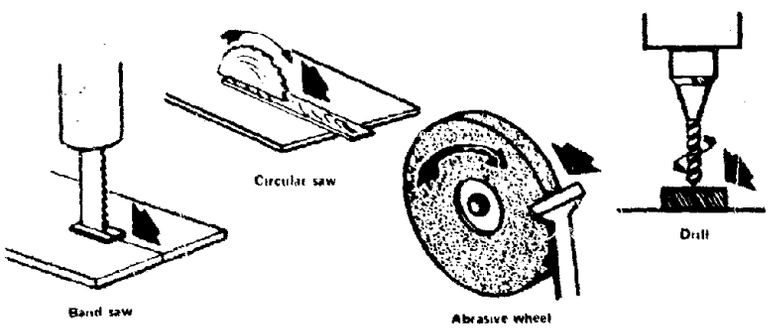
In-running nip points are a special danger created by the action of rotating objects. Whenever machine parts rotate toward each other or where one rotates toward a stationary object, an in-running nip point is formed. Objects or parts of the body may be drawn into this nip point and be bruised or crushed.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



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.



Classification of Guards

The various methods of machine guarding may be grouped under four main classifications:

ENCLOSURE GUARDS

Fixed enclosure guards are preferred to all other types. They prevent access to dangerous parts by completely enclosing a hazardous operation, and can also be effective in controlling dust or chips generated by the operation. They may be constructed to be adjustable to different operations, but, once adjusted, they must be fixed. As a general rule, power transmission apparatus is best protected by enclosure guards.

INTERLOCKING GUARDS

When a fixed enclosure guard is not practical, an interlocking enclosure or barrier guard should be considered as the first alternative.

An interlocking enclosure guard is not fixed; it may be opened for adjustments as the operation requires. These guards use an electrical or mechanical interlock with the operating mechanism that prevents the operation of the machine until the guard is closed and the operator can no longer reach the point of danger. Employees doing maintenance or major adjustment should never use the interlock as a substitute for the machine's power switch.

AUTOMATIC GUARDS

When neither an enclosure guard nor an interlocking guard is practical, an automatic guard may be used. An automatic guard acts independently of the operator, repeating its cycle as long as the machine operates. This type of guard removes the operator's hands, arms, or body from the danger zone as the machine cycles. It is operated by the machine itself, such as through a system of linkages connected to the operating mechanism.

TWO-HANDED OPERATING DEVICES

Two-handed operating devices, another category of guarding mechanism, are also designed to protect a machine operator from point of operation hazards. Although they are not guards in the technical sense, they have the same effect.

These devices may be used to activate the machine cycle. They require simultaneous action of the operator's hands on electrical switch buttons, air control valves, mechanical levers, etc. The actuating controls must be located so as to make it impossible for the operator to move his hands from the controls to the danger zone before the machine has completed its cycle or has braked to a stop. The two-handed controls must be designed to prevent the blocking, tying down, or holding down of one control, allowing a hand free access to a danger zone.

Bench Grinders

Wheel safety guards must cover the spindle nut, and flange projections. Three-fourths of the area of the grinding 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 ⅛ inch.

Tongue guards (upper peripheral guards) must be constructed so that they adjust to the wheel as it wears down. A maximum clearance of ¼ inch is allowed between the wheel and the tongue guard.

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

Fans

If fans are located within 7 feet of the floor (for example, floor fans), they must be guarded with grille or mesh that limits openings to not more than ½ inch (least dimension).

Air Compressors

The pulleys and drive belts of air compressors must be fully enclosed.

HAND TOOLS AND PORTABLE POWERED 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, and bent or broken wrenches should not be used.

Many hand-held electrical tools must be equipped with a "dead man" or "quick release" control, so that 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 either be double-insulated and identified as such or have its frame grounded.

Air-Powered Tools

Beware of compressed air — it can be dangerous. Alternate methods of cleaning surfaces should be sought. Compressed air must never be used to blow debris from a person. Compressed air may be used for cleaning surfaces if there is no other acceptable method. The downstream pressure of compressed air must remain below 30 psi whenever the nozzle is dead-ended. Effective chip guarding and personal protective equipment must be used. Two acceptable methods of meeting the 30 psi requirement are illustrated.

WELDING, CUTTING, AND BRAZING

Training

OSHA regulations require that cutters and welders be suitably trained in the safe operation of their equipment. NIOSH has published a training guide for arc welding and gas welding and cutting (see front cover). Note that rules covering operation of equipment must be enforced in order to satisfy these OSHA requirements.

Fire Protection

Management must set up special procedures for welding and cutting in locations where combustible or flammable materials are within reach of sparks and hot debris. Ideally, cutting or welding should not be done in any area near combustible material. If such materials are nearby, guards must be used to protect against the fire hazards from heat and sparks. Suitable fire extinguishing equipment (pails of water, buckets of sand, hose, or portable extinguisher) must be maintained for instant use.

No welding, cutting, or other hot work may be performed on used drums, barrels, tanks, or other containers until they have been cleaned thoroughly. There must be no flammable materials present nor any substances (such as greases, tars, acids, or other materials) which might produce flammable or toxic vapors when subjected to heat or ultraviolet radiation.

The atmosphere in the welding area must also be free of flammable or combustible gases and vapors.

Personal Protection

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

Tinted goggles or other suitable eye protection (e.g., helmets, hand shields) must be used during welding or cutting operations as protection against sparks, flying debris, and ultraviolet radiation.

Employees adjacent to the welding areas must be protected from ultraviolet rays, either by noncombustible or flameproof screens or shields, or by wearing appropriate goggles.

Flameproof gauntlet gloves should be worn, except when engaged in light work. (OSHA may eliminate this and the following two requirements. Contact your OSHA area or regional office for more information.)

Flameproof aprons (leather, for example) are desirable as protection against sparks and radiant heat.

Fire-resistant leggings or high boots should be worn.

Ventilation

Welders and cutters may be subjected to health hazards from gases or metal fumes, depending on the toxicity of the materials involved (types of metals, fluxes, coatings, etc.), the duration and location of the process, and ventilation.

Specific ventilation and respirator rules apply when welding or cutting is performed with:

- stainless steel, lead, zinc, cadmium, or beryllium
- metals coated with lead or mercury-containing materials, such as paint
- fluxes or other materials containing fluorides

Note that OSHA generally does not allow respirators to be used as a substitute for feasible engineering controls.

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	B	E
Zinc	A	B	
Fluorine	A	C	C
Cadmium	C	C	F
Beryllium	D	D	D
Mercury	C	C	F
Stainless Steel	mechanical ventilation adequate to remove the fumes generated		

A = Ventilation adequate to prevent the accumulation of toxic materials or possible oxygen deficiency. Where it is impossible to provide such ventilation, approved air-line respirators must be used.

B = 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.

C = If conditions warrant, mechanical local exhaust (B) or approved air-line respirators.

D = If conditions warrant, mechanical local exhaust (B) and approved air-line respirators.

E = Approved respirators.

F = If conditions warrant, approved respirators (E).

When welding or cutting is done with metals, coatings, or fluxes not covered in the table above, mechanical ventilation must be provided if:

- the volume of space per welder is less than 10,000 cubic feet, or
- the ceiling is less than 16 feet high, or
- work is done in confined spaces

Such mechanical ventilation must be at a 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. If such ventilation is impossible, NIOSH-approved supplied-air respirators (or their equivalent) must be used.

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

Valve protection caps must be used where the cylinder is designed to accept a cap, except when cylinders are in use or connected for use.

Stored oxygen cylinders must be kept separated from stored fuel gas cylinders or flammable or combustible materials (including oil and grease) by a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high and having a ½ hour fire resistance rating. Note that a sheet metal partition is not an acceptable method of separating cylinders.

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 emergency. In the case of manifolded or coupled cylinders, at least one such wrench must always be available for immediate use.

All cylinders must be legibly marked to identify contents.

To prevent toppling, no cylinder should be permitted to stand alone without being secured with lashing or chain.

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

Indoor storage of fuel gas is limited to a total capacity of 2,000 cubic feet or 300 pounds of liquefied petroleum (LP) gas.

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

THE NATIONAL ELECTRICAL CODE (NEC)

More fires are caused by electrical malfunction than any other cause, and standards pertaining to electrical equipment and its use are more frequently violated in all industries than any others.

Electrical Requirements

The National Electrical Code (available as 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, buildings, and property from hazards arising from the use of electricity. The code contains basic minimum provisions considered necessary for safety. Your electrician should be familiar with these requirements:

Each disconnecting means (e.g., circuit breaker or fuse box) 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
- when in a hazardous location

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

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

Outlets, switches, junction boxes, etc., must be enclosed in suitable fixtures.

Flexible cords may not be

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

Flexible cord must be fastened so that there is no pull on joints or terminal screws. It must be replaced when frayed or when the insulation has deteriorated.

All splices in flexible cord must be made with suitable splicing devices. Any splices, joints, and free ends of conductors must be properly insulated.

RECORDKEEPING REQUIREMENTS

OSHA requires that records be kept of factual information about accidents. Employers can use these records to evaluate the success of their safety and health activities and to identify 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 approved 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, 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 days.

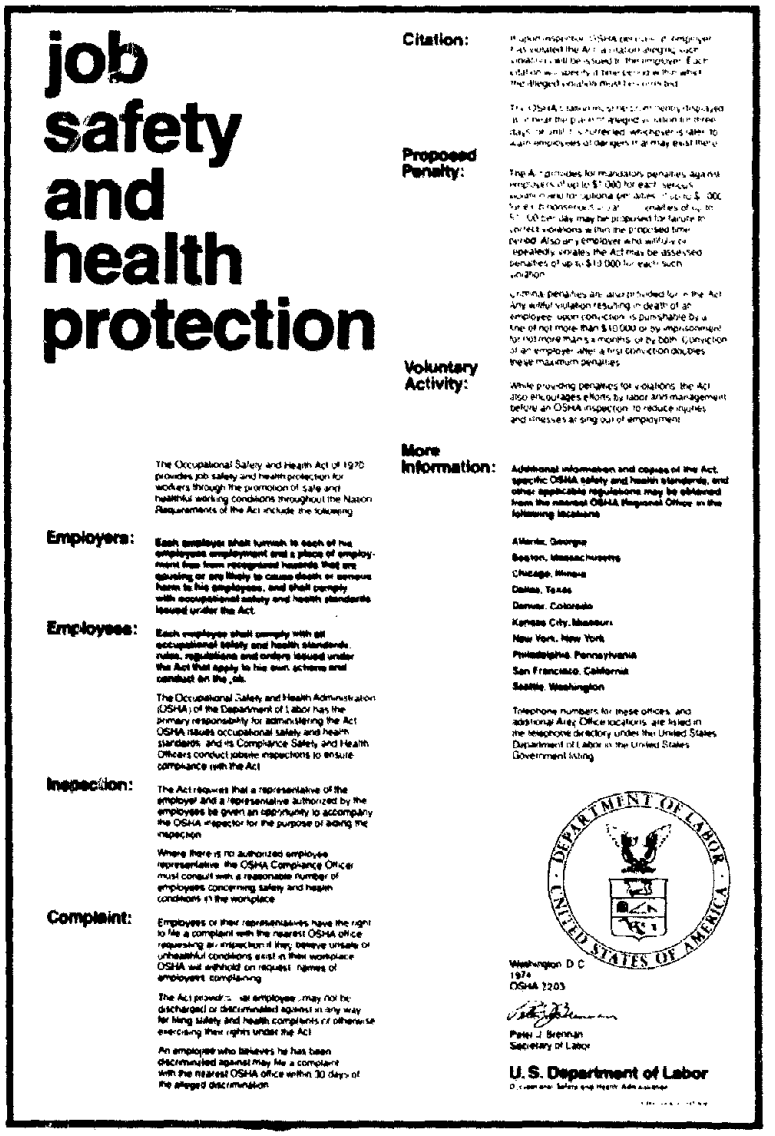
An annual summary, OSHA Form 200, must be posted for the entire month of February in a place where all employees are likely to see it. Both Forms 101 and 200 must be retained for five years, excluding the calendar year of occurrence.

The 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 (see back pages) or from the regional offices of the Bureau of Labor Statistics.

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.

Employers must post one of the full-sized versions (10 x 16 inches) of this OSHA poster or a state-approved poster.



job safety and health protection

Citation:

Proposed Penalty:

Voluntary Activity:

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.

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:

Employees:

Inspection:

Complaint:

Washington, D.C.
1974
OSHA 2203

Peter J. Brennan
Secretary of Labor

U.S. Department of Labor

CHECKLIST

Because safe conditions depend on identifying possible hazards and providing prompt corrective action, periodic inspections are one of the most important aspects of a successful safety and health program.

A checklist such as the one presented on the following pages should be helpful in performing an inspection of a drilling or well servicing rig. Because rigs vary in size and complexity, it is best that you develop (with the help of safety personnel and the toolpusher) a customized list from the information contained in this booklet and a walk-through inspection. Using this checklist, the drilling contractor, safety manager, toolpusher, driller, and roughnecks should take part in a regular inspection (preferably once a week). ***A check by a question would indicate that the requirement has been fulfilled.*** All health and safety violations that are found should be documented and corrected as soon as possible.

References made in the checklist subtitles refer to appropriate sections of the General Industry Standards, Title 29, Code of Federal Regulations, Part 1910.

GENERAL HEALTH AND SAFETY PROVISIONS

Is management aware of the potential health and safety hazards caused by the various operations on the rig? ☐

Has an accident prevention program been initiated? ☐

Has there been an industrial hygiene or safety inspection? If so, is there any documentation available to show results of this inspection? ☐

Is worker exposure kept within the acceptable levels (TLV's, OSHA Standards, etc.)? ☐

Are all containers such as mud pits, storage tanks, and so on labeled to identify their contents? ☐

Is protective equipment such as respirators, hard hats, and safety shoes worn? ☐

Are employees required to wear protective equipment when handling solvents and caustics to prevent eye or skin damage? ☐

Are all materials received at the drilling rig such as mud, solvents, pipe dope, and caustics marked as to their contents, and is there an OSHA Form 20 on each compound? ☐

GENERAL PRECAUTIONS

Are workers instructed not to wear loose, torn, or poorly fitted clothing? ☐

Does the employer require that workers remove clothing that has been saturated with solvent and thoroughly wash the exposed skin area? ☐

Are workers instructed not to wear rings, bracelets, watches, etc., around moving machinery? ☐

Are workers instructed to tie back long hair that could get caught in elevators, tongs, and other moving equipment? ☐

Are safety belts provided? ☐

Do the safety belts have a good safety line for attachment to the derrick? ☐

Is the rig climber, if one is available, in good working order? ☐

Does the derrick man check safety belts and tail rope before each trip? ☐

Are instruments provided on the rigs for checking hydrogen sulfide, oxygen, and other gas levels? ☐

Are paraffin solvents and other solvents used around pulling units labeled to show their toxicity and precautions to take when using them? ☐

Is information for contacting a doctor and emergency health service conspicuously displayed? ☐

Has an approved respirator program been established? ☐

Are only properly trained and designated personnel allowed to operate the drilling or servicing rig? ☐

Is there a safety form to fill out for reporting any unsafe condition to the driller or toolpusher? ☐

Are all belts, gears, shafts, pulleys, sprockets, drums, flywheels, and other reciprocating parts properly guarded? (It is not always feasible to guard rotary table, kelly, and cat head.) ☐

Are tools and equipment used by employees in safe condition? (For example, are pipe wrenches or chain tongs with welded handles not used?) ☐

Are all electrical tools equipped with proper grounding devices? ☐

Are all winch lines, anchors, blocks, hooks, clamps, and other fittings properly mounted and of suitable size and capacity? ☐

Are adequate warning signs posted in areas where personal protective equipment should be used (against noise, dust, etc.)? ☐

Is emergency equipment properly identified and easy to assemble? ☐

Are all containers of poisonous, toxic, flammable, and explosive material properly labeled and stored? ☐

Are compressed gas cylinders secured and adequately stored? ☐

Does the employer have rules for welding and cutting operations? ☐

Are all air compressors under the supervision of a competent crew member? ☐

Are safety pressure relief valves and discharge exhaust pipes pointed away from the work area? ☐

Are all plugs and pressure relief valves inspected at frequent intervals? ☐

Are all positive displacement pumps equipped with a safety relief valve and an operating pressure gauge? ☐

Is the safety relief valve set to discharge at or just below the working pressure of the pump, pipe, and fittings? ☐

Is each safety relief valve properly guarded? ☐

Is the discharge from the safety relief valve piped to an area that ensures that the emissions will not harm the workers? ☐

Are no valves permitted in either the discharge opening or discharge pipe of any safety relief valve? ☐

Is the pipe on both sides of the safety relief valve the same size as the openings into the valve? ☐

Is the piping on the discharge side of the safety valve adequately secured? ☐

Are all pumps directly connected to their safety relief valves, with no other valves in between? ☐

Are all fittings, hoses, pipes, pumps, and safety relief valves properly installed and rated to coincide with the pump pressure? ☐

OCCUPATIONAL NOISE EXPOSURE (29 CFR 1910.95)

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

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

If engineering controls cannot reduce the noise to safe levels:
- are affected employees given annual audiometric tests, if necessary? ☐
- do all employees in high noise areas wear hearing protection? ☐
- are annual noise surveys made to reevaluate the problem? ☐

FLAMMABLE AND COMBUSTIBLE LIQUIDS (29 CFR 1910.106)

Are all connections on drums and piped systems of flammable and combustible liquids vapor- and liquid-tight? ☐

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

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

Is combustible waste material (such as oily rags) 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 explosion-proof lights? ☐

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"? ☐

Are storage areas for flammables prominently posted as "NO SMOKING" areas? ☐

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

In fueling areas for internal combustion engines:
- are smoking or open flames not allowed? ☐
- are engines of vehicles being fueled turned off? ☐
- is a fire extinguisher located within 75 feet? ☐

FIRE HAZARDS

Is painting done only on the day shift? (The use of the rig lights at night is a fire hazard when paint is sprayed nearby.) ☐

Is there an effective fire protection and prevention plan? ☐

hers and equipment suitably located and marked to
method of operation? ☐

Are used rags, combustible waste, etc., stored in a closed metal container a. disposed of daily? ☐

Are well cellars, floors, and ground areas adjacent to the derrick kept reasonably free of accumulated oil? ☐

Are at least four 40 BC-rated fire extinguishers readily available on the drilling rig? ☐

Are there at least two nonfreeze type, 85-90 BC-rated fire extinguishers readily available on well servicing rigs? ☐

Are up-to-date records available showing when these fire extinguishers were last checked? ☐

Do solvents used for cleaning have high flash points (not less than 100° F)? ☐

Is a water hose present at all times on the rig floor in case of fire? ☐

Are "NO SMOKING" signs posted on the rig floor and adjacent areas? ☐

SAFETY TRAINING AND EDUCATION

Is there a training program to ensure employee recognition of safety and health hazards? ☐

Are employees aware of poisons, corrosives, and other harmful substances used in the operation? ☐

Are operating procedures, fire extinguisher chart, and safe lifting chart posted in the workplace? ☐

Are procedures listed and precautions taken for entry into confined and enclosed spaces? ☐

FIRST AID AND MEDICAL ATTENTION

Are adequate first aid supplies readily available, inspected, and replenished? (These supplies must be approved by a physician.) ☐

Is at least one employee on each shift currently qualified to give first aid? (Some states do not require trained first aiders if there is a hospital or clinic nearby.) ☐

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

Are emergency phone numbers posted? ☐

Where employees may be exposed to corrosive or other injurious chemicals, are quick drenching and flushing facilities provided for immediate use? ☐

PRESSURE VESSEL AND BOILER CERTIFICATION

Are there current certificates available from an insurance company or the state or local inspection branch for inspection of all pressure vessels and boilers? ☐

CHANGE ROOMS (Doghouses)

Are change rooms reasonably clean and sanitary? ☐

RECORDKEEPING (29 CFR 1903.2-1904.8)

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

Was a summary of all occupational injuries and illnesses compiled at the conclusion of each calendar year and recorded on OSHA Form 200? ☐

Was OSHA Form 200 posted during the month of February? ☐

Have all occupational injuries and illnesses, except minor injuries requiring only first aid, been recorded on OSHA Forms 101 and 200, or equivalent? ☐

Are OSHA Forms 101 and 200 kept current to within six days? ☐

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

INFORMATION SOURCES

The organizations listed here can provide publications and other information on a variety of occupational safety and health topics. NIOSH and OSHA regional directors, trade associations, and insurance companies can also supply useful information. The Small Business Administration will provide information concerning procedures for securing financial assistance in order to comply with OSHA standards (if necessary.)

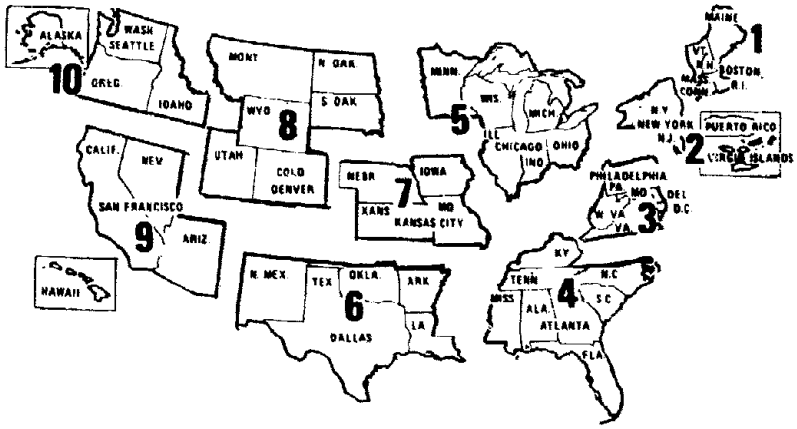
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1430 Broadway
New York, New York 10018

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

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago, Illinois 60611

NIOSH AND OSHA REGIONAL OFFICES

The following pages list NIOSH and OSHA regional 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 OSH Act, Employee Rights Posting Notice, and publications.



NIOSH REGIONAL OFFICES

DHEW, Region VI
1200 Main Tower Building, Room 1700-A
Dallas, Texas 75245
Tel.: 214/655-3081

DHEW, Region VII
601 East 12th Street
Kansas City, Missouri 64106
Tel.: 816/374-5332

DHEW, Region VIII
11037 Federal Building
Denver, Colorado 80294
Tel.: 303/837-3979

DHEW, Region IX
United Nations Plaza
San Francisco, California 94102
Tel.: 415/556-3781

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

DHEW, Region I
Government Center (JFK Fed. Bldg.)
Boston, Massachusetts 02203
Tel.: 617/223-6668/9

DHEW, Region II — Federal Building
26 Federal Plaza
New York, New York 10007
Tel: 212/264-2485/8

DHEW, Region III
3525 Market Street, P.O. Box 13716
Philadelphia, Pennsylvania 19101
Tel.: 215/596-6716

DHEW, Region IV
101 Marietta Tower, Suite 502B
Atlanta, Georgia 30323
Tel.: 404/221-2396

DHEW, Region V
300 South Wacker Drive
Chicago, Illinois 60606
Tel.: 312/886-3881

OSHA REGIONAL OFFICES

Region I
U.S. Department of Labor
Occupational Safety and Health Administration
18 Oliver Street, Fifth Floor
Boston, Massachusetts 02110 ..... Telephone: 617/223-6712/3

Region II
U.S. Department of Labor
Occupational Safety and Health Administration
1515 Broadway (1 Astor Plaza)
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
300 South Wacker Drive, Room 1201
Chicago, Illinois 60606 ..... Telephone: 312/353-4716/7

Region VI
U.S. Department of Labor
Occupational Safety and Health Administration
7th Floor, Texaco Building, 1512 Commerce Street
Dallas, Texas 75210 ..... Telephone: 214/749-2477/8/9 or 2567

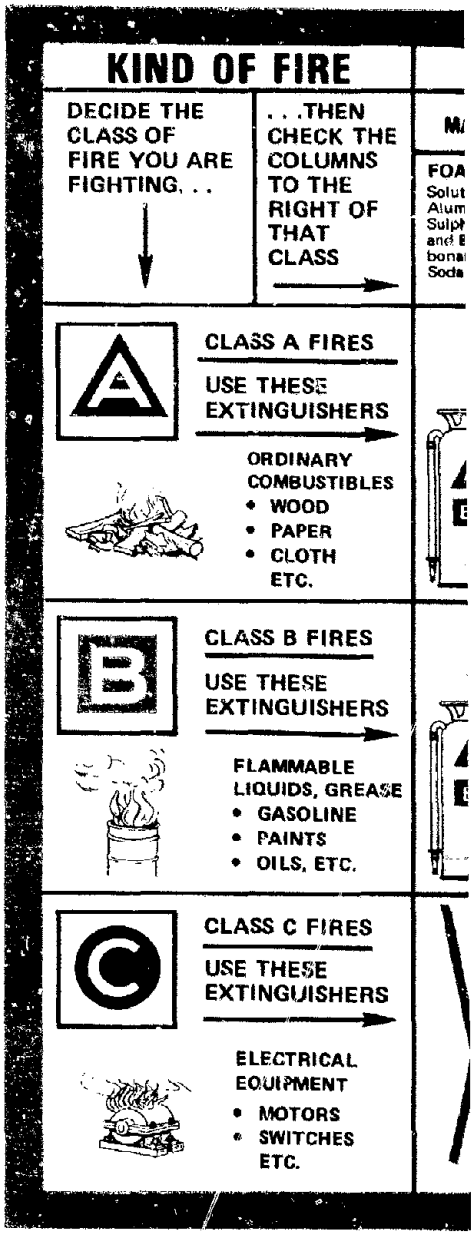
Region VII
U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 3000, 911 Walnut Street
Kansas City, Missouri 64106 ..... Telephone: 816/374-5861

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
1808 Smith Tower Building, 506 Second Avenue
Seattle, Washington 98104 ..... Telephone: 206/442-5930

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980--657-147/1025



KIND OF FIRE

CIDE THE
ASS OF
E YOU ARE
HTING. . .

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

APPROVED TYPE OF EXTINGUISHER

MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT

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

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

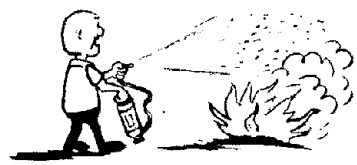
USE THESE EXTINGUISHERS

ELECTRICAL EQUIPMENT
- MOTORS
- SWITCHES

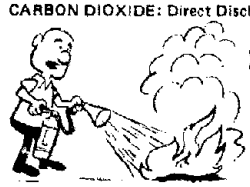
ETC.

HOW TO OPERATE

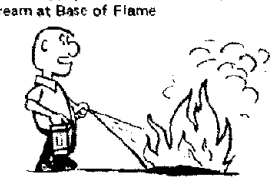
FOAM: Don't Play Stream into the Burning Liquid. Allow Foam to Fall Lightly on Fire.



CARBON DIOXIDE: Direct Discharge as Close to Fire as Possible. First at Edge of Flames and Gradually Forward and Upward

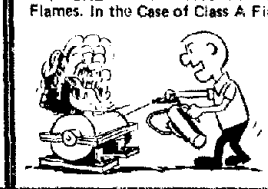


SODA-ACID, GAS CARTRIDGE: Direct Stream at Base of Flame



PUMP TANK: Place Foot on Footrest and Direct Stream at Base of Flames

DRY CHEMICAL: Direct at the Base of the Flames. In the Case of Class A Fires, Follow Up by Directing the Dry Chemicals at Remaining Material That is Burning



NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH