ROTARY DRILLING

Safety on the Rig

Fourth Edition, Rev.

UNIT I • LESSON 10

ROTARY DRILLING SERIES

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Units of Measurement

Throughout the world, two systems of measurement dominate: the English system and the metric system. Today, the United States is one of only a few countries that employ the English system.

The English system uses the pound as the unit of weight, the foot as the unit of length, and the gallon as the unit of capacity. In the English system, for example, 1 foot equals 12 inches, 1 yard equals 36 inches, and 1 mile equals 5,280 feet or 1,760 yards.

The metric system uses the gram as the unit of weight, the metre as the unit of length, and the litre as the unit of capacity. In the metric system, 1 metre equals 10 decimetres, 100 centimetres, or 1,000 millimetres. A kilometre equals 1,000 metres. The metric system, unlike the English system, uses a base of 10; thus, it is easy to convert from one unit to another. To convert from one unit to another in the English system, you must memorize or look up the values.

In the late 1970s, the Eleventh General Conference on Weights and Measures described and adopted the Système International (SI) d'Unités. Conference participants based the SI system on the metric system and designed it as an international standard of measurement.

The Rotary Drilling Series gives both English and SI units. And because the SI system employs the British spelling of many of the terms, the book follows those spelling rules as well. The unit of length, for example, is metre, not meter. (Note, however, that the unit of weight is gram, not gramme.)

To aid U.S. readers in making and understanding the conversion system, we include the table on the next page.

English-Units-to-SI-Units Conversion Factors

Quantity or Property	English Units	Multiply English Units By	To Obtain These SI Units
Length, depth, or height	inches (in.)	25.4	millimetres (mm)
		2.54	centimetres (cm)
	feet (ft)	0.3048	metres (m)
	yards (yd)	0.9144	metres (m)
	miles (mi)	1609.344	metres (m)
		1.61	kilometres (km)
Hole and pipe diameters, bit size	inches (in.)	25.4	millimetres (mm)
Drilling rate	feet per hour (ft/h)	0.3048	metres per hour (m/h)
Weight on bit	pounds (lb)	0.445	decanewtons (dN)
Nozzle size	32nds of an inch	0.8	millimetres (mm)
Volume	barrels (bbl)	0.159	cubic metres (m^3)
		159	litres (L)
	gallons per stroke (gal/stroke)	0.00379	cubic metres per stroke (m^3/stroke)
	ounces (oz)	29.57	millilitres (mL)
	cubic inches ($in.^3$)	16.387	cubic centimetres (cm^3)
	cubic feet (ft^3)	28.3169	litres (L)
		0.0283	cubic metres (m^3)
	quarts (qt)	0.9464	litres (L)
	gallons (gal)	3.7854	litres (L)
	gallons (gal)	0.00379	cubic metres (m^3)
	pounds per barrel (lb/bbl)	2.895	kilograms per cubic metre (kg/m^3)
	barrels per ton (bbl/tn)	0.175	cubic metres per tonne (m^3/t)
Pump output and flow rate	gallons per minute (gpm)	0.00379	cubic metres per minute (m^3/min)
	gallons per hour (gph)	0.00379	cubic metres per hour (m^3/h)
	barrels per stroke (bbl/stroke)	0.159	cubic metres per stroke (m^3/stroke)
	barrels per minute (bbl/min)	0.159	cubic metres per minute (m^3/min)
Pressure	pounds per square inch (psi)	6.895	kilopascals (kPa)
		0.006895	megapascals (MPa)
Temperature	degrees Fahrenheit (°F)	$\frac{°F - 32}{1.8}$	degrees Celsius (°C)
Mass (weight)	ounces (oz)	28.35	grams (g)
	pounds (lb)	453.59	grams (g)
		0.4536	kilograms (kg)
	tons (tn)	0.9072	tonnes (t)
	pounds per foot (lb/ft)	1.488	kilograms per metre (kg/m)
Mud weight	pounds per gallon (ppg)	119.82	kilograms per cubic metre (kg/m^3)
	pounds per cubic foot (lb/ft^3)	16.0	kilograms per cubic metre (kg/m^3)
Pressure gradient	pounds per square inch per foot (psi/ft)	22.621	kilopascals per metre (kPa/m)
Funnel viscosity	seconds per quart (s/qt)	1.057	seconds per litre (s/L)
Yield point	pounds per 100 square feet ($lb/100\ ft^2$)	0.48	pascals (Pa)
Gel strength	pounds per 100 square feet ($lb/100\ ft^2$)	0.48	pascals (Pa)
Filter cake thickness	32nds of an inch	0.8	millimetres (mm)
Power	horsepower (hp)	0.75	kilowatts (kW)
Area	square inches ($in.^2$)	6.45	square centimetres (cm^2)
	square feet (ft^2)	0.0929	square metres (m^2)
	square yards (yd^2)	0.8361	square metres (m^2)
	square miles (mi^2)	2.59	square kilometres (km^2)
	acre (ac)	0.40	hectare (ha)
Drilling line wear	ton-miles (tn•mi)	14.317	megajoules (MJ)
		1.459	tonne-kilometres (t•km)
Torque	foot-pounds (ft•lb)	1.3558	newton metres (N•m)

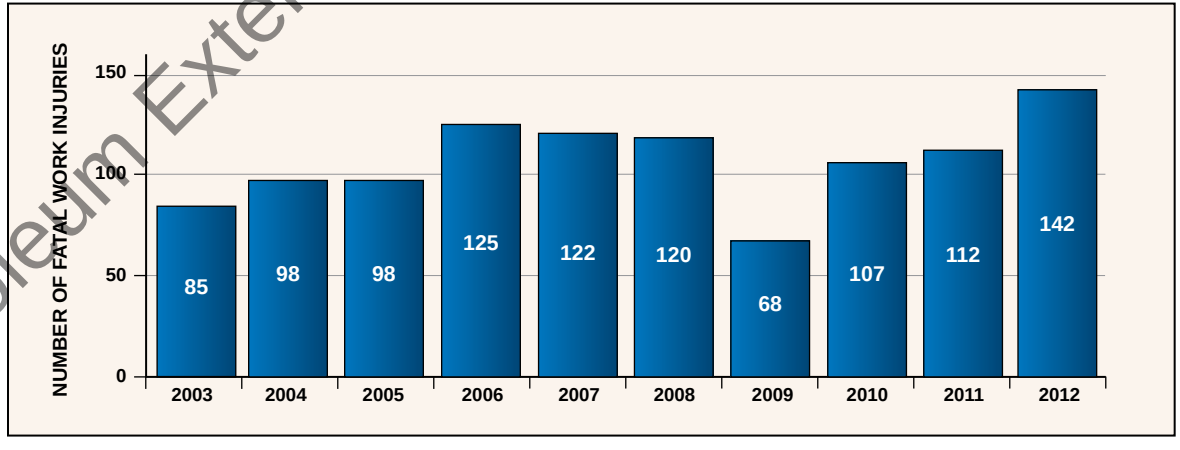
Introduction

In this chapter:

- The hazardous work environment of the drilling rig
- The most dangerous activities for those working in the oil and gas extraction industry
- The importance of complying with OSHA safety regulations

Working on a drilling rig is a tough, hazardous job where safety is a critical issue. A striking statistic illustrates that point: Between 2003 and 2012, there were 1,077 fatalities of oil and gas workers at U.S. job sites (fig. 1). To have an idea of how significant this number is, consider the following:

- There were approximately 450,000 workers in the industry in 2011.
- The fatality rate in the industry is several times higher than the overall rate for all U.S. industries.



Source: U.S. Bureau of Labor Statistics, U.S. Deparment of Labor, 2014

Figure 1. Fatalities in the U.S. oil and gas extraction industry number, on average, over 100 per year.

People and Safety

In this chapter:

- The chain of command for rig safety
- Responsibilities of individual crew members for safety
- How rig safety programs are developed
- The role of the safety director on a rig

Less than 5% of rig accidents are caused by mechanical failure. It is people who make rig operations safe, so everyone must develop a sense for safety and practice self-improvement. Before acting, an individual must automatically consider, "Will this put anyone in danger?" Every crewmember must be ever alert to risky or unsafe situations. Being alert is the best way to avoid injury to yourself and the crew. It is critical that a new crewmember receives supervision and instruction in safe operating procedures immediately upon reporting for work. Industry data show that 60% or more of rig injuries involve people on the job less than 6 months. Even an experienced person may need supervision, especially if coming from a different type or size of rig.

Operator

Responsibility for rig safety follows the corporate chain of command. All are involved, from the operator down to the new floorhand.

Depending on the contract, an operator may specify the casing and mud programs to be followed, furnish the casing, have it delivered, inspected, and specify the setting depth. If operators furnish the mud, they will control the type and weight and be responsible

Personal Safety Equipment

In this chapter:

- Standard personal protective equipment for all crewmembers
- Specific requirements for safety-approved PPE items
- Personal items that cannot be worn on a rig
- Proper clothing for a rig
- Specialized equipment for certain operations

No matter how well-designed the rig or how well-supervised the crew, only careful, conscientious conduct by everyone can assure safe operations. Each person should receive instructions on the proper way to perform his or her work and the use of personal protective equipment (PPE). Safety standards prohibit the wearing of rings or other jewelry and loose clothing; they also prohibit long hair on a drilling rig. All these things are subject to being caught in moving machinery.

The mandatory personal protection items worn by each crewmember include a hard hat, safety boots, gloves, and safety glasses. Proper clothing is also important.

Safe Posture

In this chapter:

- The importance of good posture for safety
- Keeping the floor clean and dry
- The safe foot stance and posture for lifting
- Getting help from other crewmembers for heavy loads
- Using mechanical help for lifting

Strains, overexertion, and back injuries are a leading cause of *lost-time incidents* (*LTIs*), or accidents that take a person off duty. When lifting, good footing is of first importance. Clean up a slick or cluttered surface before lifting; otherwise, a slip or trip in the middle of a lift can be injurious. Good balance and posture are critical. Most strains and sprains occur as a result of an awkward, off-balance stance or by overreaching. A correct lifting posture is required. Squarely face the object to be lifted with feet spread a shoulder width apart. Bend the knees and test the weight and grip; then, with the back straight, lift with the legs while holding the load close to the body (fig. 15). Do not twist the back while moving the load, and set it down the same way it was lifted. Weight lifting competitions are not allowed.

Figure 15. Recommended way in which to lift an object

Offshore Transportation Safety

In this chapter:

- Special regulations that govern transportation offshore
- Safe procedures for traveling in a helicopter or boat
- Safe procedures for disembarking and boarding the rig
- Additional safety considerations for marine transport

In 2010, a blowout occurred at the Macondo Prospect off the coast of Louisiana. In response to the many fatalities among workers on the rig and the leaking of millions of barrels of oil into the Gulf of Mexico, the U.S. federal government enacted new laws governing the industry. The Bureau of Safety and Environmental Enforcement (BSEE) is the agency that oversees worker safety and enforces environmental safeguards for offshore drilling.

Someone who has worked on a land rig will find many of the safe operating procedures for an offshore rig familiar. In the challenging offshore drilling environment, however, there are additional safety considerations. So the BSEE has set regulations for such matters as the transportation of crewmembers by boat or helicopter.

Hand-Tool Safety

In this chapter:

- General safety rules for commonly used hand tools
- Special precautions for using individual hand tools
- Tips for storing tools and for transporting and working with them aloft in the derrick
- Precautions for using portable ladders

A member of a rig crew must be able to safely use a wide variety of tools. Many will be similar to home tools but more heavy duty. Keys to hand-tool safety include:

- Use the proper tool for the job.
- Inspect the tool before using it. Be sure the tool is not worn, broken, or damaged. Report damaged tools to the driller.
- Never use a tool a task it is not intended for. Do not use a wrench for the job of a hammer, for example.
- Be certain the area is clear of people and obstacles when swinging any tool.
- Maintain a good stance so the tool does not slip. Do not overreach!
- Carry tools safely. Tools slip from pockets, so use a tool belt, especially for sharp or pointed tools.
- If you don't know how to use a tool, ask for instructions.

Having the right tool readily available for a specific job reduces the temptation to use the wrong tool, which can cause an accident. Tool boards located around the rig provide an easy way to keep tools accessible and in good condition. Each crewmember should take the initiative, seeing that tools are not left lying around the rig, creating a hazard.

Power-Tool Safety

In this chapter:

- Types of portable tools: electric and pneumatic
- General safety rules for using portable tools on a rig
- Precautions for using air and electric tools
- Keeping portable tools clean
- Precautions to avoid misfiring tools

Portable power tools are often used around a rig. They may be pneumatic (activated by compressed air) or electrically powered. Typical injuries from power tools include cuts, burns, and electrical shocks. Eye injuries and falls also occur when using power tools. Power tools can even cause gas explosions. Falling tools can also cause injury. Many injuries can be prevented with simple precautions:

- Electrical lines on the ground or rig floor may cause someone to trip. Flag them or string them overhead.
- Do not leave power tools aloft. Moving equipment or personnel on any level may pull the power line, causing the tool to fall.
- Keep all power lines away from hot surfaces like mufflers or ones undergoing welding operations. Lines should also be kept away from gasoline, oil, and chemicals.
- Inspect all lines—air or electrical—before use. Check closely for loose connections. Any worn, frayed, or kinked areas should be promptly repaired.
- Do not disconnect a power line while a tool is in use. Loss of power can jam the tool, exposing the user to injury. Likewise, never plug in to an electrical socket or turn on the air without determining that the person using the tool is ready.

Rig-Up Safety

In this chapter:

- Dangers of rigging up
- Why rigging up is only allowed during the day
- The importance of being alert and staying out of the way
- Special precautions for raising derricks, positioning equipment, and testing engines

Lost-time injuries (LTIs) occur most often when activity on the rig is intense. The most dangerous activities are equipment repair and maintenance, routine drilling operations, tripping in and out, and rigging up and down. During rig-up, there are many hazards (fig. 26):

- Getting caught in a *pinch point*
- Getting struck by a crane, truck, load, or falling tool
- Falling from a height
- Becoming entangled in lines
- Getting crushed by equipment being put into place

Courtesy of Bandera Drilling Co., Inc.

Figure 26. A forklift can crush a person or tip over.

Drilling Operations and Equipment Safety

In this chapter:

- Keeping drilling equipment in position
- Preventing falls of equipment and people
- Keeping things from getting entrained by equipment
- Special precautions for using drilling equipment
- Maintaining drilling line and slips to avoid accidents
- Preventing strain by using power equipment

Depending on the size of the rig, the crew usually numbers from four to six people. These people are the driller, derrickhand, motorhand, and two or three floorhands. The derickhand is under the direct superision of the driller; the entire crew is under the overall supervision of the rig manager (toolpusher). Offshore crews may be supplemented by a crane operator, roustabouts, a mechanic, and an electrician. Floating drill vessels employ a subsea engineer, barge master, and watch standers.

The basic crew is responsible for normal drilling operations, maintenance, and repairs of the rig. It may also run casing, handle blowout prevention, and do completion work. The crew is often assisted by contributions from many oilfield specialists: mud engineers, fishing tool operators, directional drilling operators, pressure control engineers, casing crews and cementers, and logging and perforating personnel. The operator may also employ an on-site consultant.

After drilling has reached total depth and downhole logging has been completed, a critical decision must be made. If the hole is cased and completed, will it be a commerical well that justifies the cost?

Rigging Practices

In this chapter:

- Selecting proper cables and rigging parts
- Allowing only qualified personnel to handle rigging
- Protecting the integrity of rigging for safety
- Instructions for safe handling of rigging

Rig personnel handle rigging every day, so it is important to recognize and correct unsafe rigging. All cables and rigging parts should be of good quality, size, and strength to handle the expected load (fig. 55). Check the manufacturer's recommendations if in doubt. Splicing, socketing, and seizing of wire rope should be done by a qualified person. Eye splices must have the proper size thimbles to protect the line from sharp bends and abrasion. The U-bolt attachments on wire rope clips must be fastened to the rope with the U-bolt side on the dead, or shortened, end of the rope. Align the clips with U-bolts all on one side of the rope (lower right, fig. 55). Check and tighten the clip nuts after initial use and frequently thereafter.

All cables and rigging parts should be of sufficient quality, size, and strength to handle the expected load.

Power Generation

In this chapter:

- Safely starting rig engines
- Using lockout-tagout procedures during maintenance
- Alarms and automatic shutdown controls for emergencies
- Avoiding burns and exposure to exhaust
- Protecting the crew with shielding

Engines

Engines should be equipped with alarms and automatic shutdown controls for emergencies.

Rig supervisors should instruct personnel in the proper operation and maintenance of the prime movers and auxiliary engines. Internal combustion engines of 30 horsepower or more should not be started by hand cranking. An external power source is usually available—one that provides compressed air or hydraulic pressure, an electrical motor, or a smaller gasoline engine. Do not start an idle engine with the multiple-engine compound by using the power from an engine that is already running. Engines or motors that start automatically should have a proper sign posted to warn of automatic operation, and no repairs to such machinery should be started unless a proper lockout-tagout procedure is followed. Positive lockout and tagout measures must be provided to ensure that an engine cannot be inadvertently started during repairs, inspection, or adjustment. Engines should be equipped with alarms and automatic shutdown controls that activate during an emergency or operational difficulties such as overheating, overspeeding, low oil pressure, or excessive vibration. Engine controls should be periodically checked and be capable of immediate shutdown of rig power in the event of personnel injury or equipment failure.

Mud Pump and Tank Safety

In this chapter:

- Installing pressure-relief valves on the mud tanks
- Safely performing maintenance on mud tanks
- Providing safe footing around mud pumps and tanks
- Safe procedures for mixing mud
- Personal protective equipment for mixing mud

Mud Pumps

Mud pumps provide a continuous supply of fluid under high pressure to the drill string (fig. 58). Caution should be used when working around high-pressure components. All pumps must be fitted with a pressure gauge. A plugged bit or inadvertently closed valve can create extreme pressures that will endanger all those nearby. The manufacturer provides pressure relief valves (pop-off valves) to protect the pump and discharge lines from failure. Some pumps are equipped with adjustable, automatic-reset relief valves. These types of valves allow continuous operation without resetting after pressure surges. Shear relief valves depend on shear pins sized to contain a desired pressure. Supervisors should assure that no oversize pins are used. Nothing should be done that would eliminate or restrict the operation of any safety device. Relief valves should be shielded to protect workers from flying parts in case the shear pin is broken by excess pressure.

A pressure relief valve of an approved type must be part of the discharge manifold and placed ahead of any valve on the line. Relief bypass outlets should be short, without bends, and directed away from personnel and equipment. Discharge lines should be securely anchored when run into the mud tanks. Bypass fluid should not be returned to the pump suction or wasted.

Personnel must not tamper with safety devices on mud pumps.

Tubulars

In this chapter:

- Staying alert when tubulars are being moved
- Avoiding injuries while handling tubulars
- Proper procedures for racking and rolling pipe
- Safely lifting equipment above the rig floor
- Using a flagger and tag lines during lifts

The handling of tubular goods can be hazardous. "Never turn your back on moving pipe" is rule number one around the drilling rig. Moving pipe deserves your full attention.

Rig Floor

Employees must always be aware of moving pipe around them.

Do not leave drill pipe in the mousehole during a trip. When a stand of drill pipe is hoisted off the floor, it should be held back to keep it from swinging. The derrickhand should help break the swing of the pipe as the stand is led across the floor. Pipe should be racked by pushing against the outer face to set it back; never put hands on the back side and keep feet away from the pipe as it is set down. Always keep hands on the outside of casing, drill joints, subs, or collars. Never place hands on top of any tubular held in the slips when another joint is being stabbed. The driller should always be aware of the stabber's hands when lowering the elevators to avoid catching them between the tubular and the elevators.

Hazardous Energy

In this chapter:

- Selecting proper electrical parts
- Allowing only authorized personnel to install or repair them
- Grounding electrical equipment and housing it safely
- Using warning signs and guards around equipment
- General precautions to follow around electrical equipment
- Lockout-tagout procedures for electrical components

Electrical Hazards

All rig wiring should be insulated to prevent short circuits caused by weather, chemicals, and rough handling. Circuits must be built of standard, properly load-rated outdoor wiring and fixtures. Equipment repairs or cutting and splicing of electrical wiring should not be attempted by unauthorized personnel. Makeshift repairs are hazardous because an underrated element anywhere in the circuit can cause problems. If spliced, wiring should be equal to the original in strength and insulation. Wiring must be installed so that it is protected from abrasion, trampling, or burning by hot surfaces. Lead-in cables from the generators to the mast or derrick must be located and protected from damage when the rig is in operations or when heavy equipment is being moved. All guards on electrical equipment should be in place and in good repair. All motors, generators, equipment, lights, panels, and electric tools must have proper grounding. All auxiliary housing on location must be grounded.

Confined Spaces Safety

In this chapter:

- Types of confined spaces
- Clearing a confined space with a hazardous atmosphere
- Preparing a confined space for the crew
- Personal protective equipment for workers
- Precautions for working in confined spaces

A confined space is considered to be any enclosure large enough for an employee to bodily enter and perform work but small enough to restrict the entry and exit of the employee (fig. 69). Confined spaces are not designed for continuous occupancy. Certain spaces are considered confined spaces if they have poor ventilation or a low oxygen level—the cellar and mud pits, for example. An authorized person such as the rig manager should test the space for oxygen deficiency, H_2S, or explosive gas before entry occurs.

Confined spaces are classified as:

- Nonpermit spaces
- Permit-required spaces

A nonpermit confined space does not contain atmospheric or other hazardous conditions with the potential to cause serious harm or death.

A permit-required space is one that:

- Contains or potentially contains a hazardous atmosphere
- Has the potential to engulf anyone who enters—with a cave-in, for example
- Has a floor or wall configuration that could trap or asphyxiate a person
- Contains any recognized, serious health hazard

Figure 69. Person being rescued from confined space

Chemical Hazards

In this chapter:

- OSHA's regulations for chemical hazards in the workplace
- Communication to employees about chemical hazards
- Understanding warning labels and material safety data sheets
- Working safely with caustic solution

Chemical Hazard Communication

The regulations of OSHA's Hazard Communication Standard (HCS) require employers to inform workers of potential chemical hazards in the workplace. Chemicals pose physical or health hazards—or both. Physical hazards are dangers to the outside of the body. Health hazards cause damage inside the body, such as a stomach cramp or nausea. Health hazards may be immediate and short-lived or they may build up gradually over time with repeated exposure.

The employer should provide training by identifying and listing potentially hazardous materials. Warning labels and *safety data sheets* (*SDSes*) must be provided (fig. 71). You should be informed on detection methods, safe work procedures, and use of PPE.

Figure 71. Safety data sheets

Well Control

In this chapter:

- The danger posed by blowouts
- Main pieces of well-control equipment
- Safely installing and operating the blowout preventers
- Detecting a well kick and circulating it out

Well-control equipment:
- Blowout preventer (BOP)
- Choke manifold
- Mud-gas separator

While drilling any hole for oil or gas, the crew can encounter abnormal pressures—ones that are either higher or lower than those expected. With abnormal pressures, comes the possibility a blowout, an uncontrolled flow of fluids into the atmosphere (fig. 75) or underground into lower-pressured zones. The danger to the crew, rig, and environment is obvious, as is the economic loss of a blowout.

A blowout preventer (BOP), choke manifold, and mud-gas separator provide a means to control pressures in the well.

Figure 75. Rig blowout and fire caused by failure to control high formation pressure

Well Servicing Safety

In this chapter:

- Planning for safe well servicing with third-party firms
- Preventing blowouts and fires during well servicing
- Handling casing and staying clear during cementing
- Preventing the accidental discharge of the perforating gun

Operations such as logging, drill stem testing, cementing, perforating, and fracture treating are done by third-party well service firms that are usually under contract to the operator. The service companies have their own safety rules that must be observed by rig employees, but it is the operator's responsibility to ensure that the service company's operations do not endanger the drilling operation or personnel. Service company personnel make up and handle their own equipment with assistance from the crew only as needed.

The service company supervisor, operator's representative, rig manager, and crew should conduct a safety planning session before any well service operation begins. Among points to consider are:

- Site hazards
- Hazards of the service operation
- Proper deployment of equipment and people that ensures safety and fire prevention
- Rig or equipment conditions that may affect the operation

Field Welding and Cutting Safety

In this chapter:

- Using a qualified welder for cutting and welding
- Special precautions for drilling near the hole
- General precautions for welding and cutting
- Personal protective equipment for the crew to wear

Only a qualified, experienced welder should perform welding and cutting operations. A contract welder is usually employed for this work and assisted by the rig crew. Permission and a hot work permit must be obtained before welding operations start anywhere within 150 feet (46 metres) of the borehole. Field welding is not permitted on tongs, elevators, blowout preventers, or other heat-treated equipment.

Rig personnel who assist in welding operations should observe the following general precautions:

- Unless approved by the senior site supervisor, welding and cutting should not take place during high danger periods, such as when there are well-control problems or testing is taking place.
- The work area must be clean and clear of litter and combustibles.
- Rig workers should wear PPE, including goggles or a helmet (fig. 80), welders' gloves, and fall protection equipment.
- The work area should be well ventilated, and respirators should be made available if necessary.

Fire Detection and Suppression

In this chapter:

- Training in fire prevention and suppression
- How fires burn and are extinguished
- Operation and care of fire suppression equipment
- How fire detection equipment works
- Personal fire safety equipment on a rig

Flammable materials are all over a drilling site—oil and grease, natural gas, solvents, rubber hoses, cloth, and paper. Ignition sources are common, as well—lit cigarettes, welding torches, and sparks from motors, for example. So fire prevention, detection, and suppression are crucial to the safe operation of a drilling rig.

Everyone on a rig should be trained in fire prevention and know what to do when there is a fire.

Everyone on a drilling rig should have training in fire prevention and take every precaution to prevent fires: Where you see a no smoking sign, for instance, don't smoke. Anyone servicing or operating equipment that involves sparks or flames must know when and how to work safely.

All persons on a drilling rig should know what to do if they see a fire and know exactly what to do and where to go when a fire alarm sounds. Everyone should know where the rig's fire extinguishers are and how to operate them. Especially offshore, all crewmembers depend on each other for safety in the event of a fire.

Hydrogen Sulfide Safety

In this chapter:

- Areas of the rig where hydrogen sulfide gas is encountered
- Hazards of H_2S gas
- The need to use equipment to detect H_2S
- Preventive procedures and personal protective equipment
- Emergency evacuation and first aid for gas exposure

Hydrogen sulfide is a deadly gas. Also called sour gas or sulfur gas, it is common in some areas of the oilfield. It is more deadly than carbon monoxide and almost as toxic as hydrogen cyanide. When a well is drilled into a formation containing H_2S, the gas may be circulated to the surface in the drilling or formation fluids. Several areas around the rig then become potentially dangerous. One such area is around the bell nipple. The entire circulation system—shale shakers, pits, tanks, mud lines, pumps, and other components—has a high potential for H_2S contamination. Leaks in hoses, lines, and connections can create hazardous, toxic conditions.

The deadly gas H_2S can be hard to detect without instruments because it is colorless and, at a certain concentration, deadens the sense of smell.

Characteristics of H_2S Gas

H_2S gas is heavier than air (having a density of 1.189 compared to 1.0 for air) so it tends to accumulate in low areas around the rig such as the cellar, ditches, and open mud troughs. Low areas are especially hazardous when there is no wind or fans to disperse the gas.

H_2S is dangerous because it is colorless and can burn or explode once in the air. Restrictions on smoking, burning, or welding must be strictly observed. It burns with a blue flame that produces another dangerous gas, sulfur dioxide, or SO_2. In low concentrations, H_2S has the odor of rotten eggs. Smell cannot be relied on, however, to detect H_2S because the gas quickly destroys the sense of smell.

First Aid

In this chapter:

- The importance of basic first aid and CPR on rigs
- The general procedure for accidents: check, call, and care
- Handling some common, potentially serious emergencies
- Getting professional medical help quickly
- Immobilizing and transporting the victim

First aid is the immediate, on-site care given to a person who has been injured or becomes suddenly ill. It includes self-help when medical assistance is not readily available or is delayed. Drilling operations are frequently in remote locations, so professional medical care may be hours away. Knowledge of basic first aid and cardiopulmonary resuscitation (CPR) is critical because prompt and correct care can mean the difference between life and death or between rapid recovery and long hospitalization. Even minor delays in caring for an injury or sudden illness can be fatal. To ensure prompt care, the rig manager should contact local medical facilities and evacuation services soon after moving on location. Information for emergencies should then be posted in the doghouse and other designated places on the rig. All accidents, even minor ones, should be reported to the rig manager. The crew should understand that, except for very minor injuries, first aid should be followed by treatment at a medical facility.

Ideally, every employee would be trained in first aid and know what to do—and what not to do—in a medical emergency (fig. 100). With the frequent changes in drilling personnel, it may not be practical to enroll every employee in a first aid course, but there should be one person knowledgeable in first aid and CPR on each tour.

Emergency First Aid

There should be at least one person trained in first aid and CPR on each tour.

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To obtain additional training materials, contact:

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