

Occupational Safety and Health for Oil and Gas Well Drilling and Servicing Operations

API RECOMMENDED PRACTICE 54
FOURTH EDITION, FEBRUARY 2019

ADDENDUM 1, JUNE 2021



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Occupational Safety and Health for Oil and Gas Well Drilling and Servicing Operations

1 Scope

1.1 Coverage

The purpose of this document is to recommend practices and procedures for promoting and maintaining safe and healthy working conditions for personnel in drilling and well servicing operations.

1.2 Applicability

These recommendations apply to rotary drilling rigs, well servicing rigs, and special services as they relate to operations on location. It is intended that the applicable requirements and recommendations of some sections of the document be applied, as appropriate, to other sections. The recommendations are not intended to cover seismic drilling or water well drilling operations. These recommendations do not apply to site preparation and site remediation operations.

1.3 Responsibility

Employers have the responsibility to identify, communicate, and mitigate hazards at the work site. A process of risk assessment may be an effective method to protect employees at the work site.

2 Normative References

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced standard applies (including any addenda/errata).

API Recommended Practice 500, *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Division 1 and Division 2*

API Recommended Practice 505, *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1 and Zone 2*

ASSE Z359.1, *The Fall Protection Code*

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*

ISEA Z87.1, *American National Standard for Occupational and Educational Eye and Face Protection Devices*

ISEA Z89.1, *American National Standard for Industrial Head Protection*

NACE MR0175/ISO 15156-1, *Requirements for Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment*

NFPA 70, *National Electrical Code*

NFPA 2112, *Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire*

NFPA 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire*

3 Terms, Definitions, and Abbreviations

3.1 Terms and Definitions

For the purpose of this document, the following terms and definitions apply.

3.1.1

acidizing

The act of pumping an acidic solution into a wellbore to remove materials from the perforations, pipe, and walls of the producing formation or pumping the solution into formations to improve permeability.

3.1.2

adequate ventilation

Air volume and velocity that is sufficient to dilute, render harmless, and carry away toxic, flammable, or explosive concentrations of gasses, dust, fumes or vapors.

3.1.3

approved

Officially agreed to or accepted as satisfactory.

3.1.4

authorized person

A person assigned by an employer to perform or supervise the performance of a specific type of duty or duties at the worksite.

3.1.5

blooey line

Return line for air drilling.

3.1.6

blowout

An uncontrolled flow of well fluids or formation fluids, or both, from the wellbore or into lower pressured subsurface zones (underground blowout).

3.1.7

blowout preventer

BOP

A device attached to the wellhead or tree that allows the well to be closed in with or without a string of pipe or wireline in the borehole.

3.1.8

casing

Pipe installed in the wellbore and cemented (or secured by some other means) in place to retain the borehole dimension and seal off hydrocarbon and water-bearing formations.

3.1.9

cathead spool

A concave, rotating, pulley-type device mounted on the end of the cat shaft of the drawworks.

3.1.10**catline**

A line powered by the cathead used to lift or pull equipment around a rig.

3.1.11**catwalk**

Elongated platform adjacent to the rig floor where pipe is laid out and lifted into the derrick.

NOTE The catwalk is connected to the rig floor by a pipe ramp on rigs with a sub-structure; some catwalks include moveable troughs and rams that can elevate and push pipe to the rig floor or lower pipe away from the rig floor without using a winch or cat line to move the pipe.

3.1.12**cellar**

A stabilized excavation around the wellhead to provide space for equipment at the top of the wellbore.

3.1.13**cementing**

Making cement into a slurry and pumping it into a wellbore.

3.1.14**circulate**

Cycling fluid from the surface through the pipe and back to the surface through the annular space.

NOTE Annular space is the space surrounding the pipe in the wellbore.

3.1.15**combustible liquid**

A liquid having a flashpoint at or above 100 °F (37.8 °C).

NOTE Check with local regulatory or other recognized authority for applicable requirements.

3.1.16**confined space**

A tank, excavation, or space that meets the following:

- is large enough and configured so that personnel can bodily enter and perform assigned work;
- has limited or restricted means for entry or exit (e.g. tanks and vessels, storage bins, hoppers, vaults, cellars, excavations, and pits);
- is not designed for or meant to be continuously occupied by personnel.

3.1.17**critical equipment**

Equipment and other systems determined to be essential in preventing the occurrence of or mitigating the consequences of an uncontrolled event.

NOTE Such equipment may include vessels, machinery, piping, blowout preventers, wellheads and related valving, flares, alarms, interlocks, fire protection equipment, and other monitoring, control, and response systems.

3.1.18**deadline (drilling operations)**

The end of the drilling line that is not reeled onto the hoisting drum of the rig.

NOTE This end of the drilling line is anchored and does not move as the traveling block is hoisted.

3.1.19**deadline (well servicing operations)**

The tension line between the crown and mast base used to secure the power swivel stiff-arm.

3.1.20**derrick**

The fixed tower component of a drilling or well servicing unit.

3.1.21**derrick hand**

Person whose work assignment is the drilling fluid system on the drilling rig and work station is up in the derrick while pipe or rods are being hoisted or lowered into the hole on a well service rig.

3.1.22**doghouse**

An enclosure or building on the floor of a land rig that can be used as an office for the driller, a storehouse for small objects, or both.

3.1.23**drill pipe**

The seamless tubing used to rotate the drill bit and circulate the drilling fluid.

NOTE The joints of drill pipe are coupled together with special threaded connections called tool joints.

3.1.24**drill stem**

The drilling assembly from the swivel or top drive to the bit composed of the drill string (work string), subs, drill collars and other downhole tools such as stabilizers and reamers.

NOTE This assembly is used to rotate the bit and carry the drilling fluid to the bit.

3.1.25**drill stem test****DST**

A test taken by means of special testing equipment run into the wellbore on the drill string (work string) to determine the producing characteristics of a formation.

3.1.26**drill string (work string)**

Several sections or joints of drill pipe or tubing joined together for use in the wellbore.

3.1.27**driller**

The person responsible for the operation of the drilling and hoisting equipment of the rig under normal conditions.

3.1.28**driller's cabin**

A steel building on the floor of a land rig that provides the driller a sheltered command-and-control location with a direct line of sight to well center and overhead into the mast to operate various machinery and control systems during normal well drilling operations.

3.1.29**drilling line**

The wire rope used in the rig's main hoisting system.

NOTE Also known as tubing line in well servicing applications.

3.1.30**elevators**

A device attached to the traveling block that latches around and supports the pipe or rods during hoisting or lowering operations.

3.1.31**energy isolation device**

A mechanical device that physically prevents the transmission or release of energy.

3.1.32**energy source**

A source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

3.1.33**flammable liquid**

A liquid having a flashpoint below 100 °F (37.8 °C).

NOTE Check with local regulatory or other recognized authority for applicable requirements.

3.1.34**flowback operation**

The process of allowing fluids to flow from the well following a treatment, either in preparation for a subsequent phase of treatment or in preparation for cleanup and returning the well to production.

3.1.35**freezing operation**

Creation of a plug by freezing a liquid in a pipe or fitting to confine the pressure while removing defective or inadequate equipment downstream of the plug.

3.1.36**full body harness**

Straps which may be secured about a person in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders, with means for attaching it to other components of a personal fall arrest system.

3.1.37**guard**

To cover, shield, fence, enclose, or otherwise protect by means of suitable covers or casings, barrier rails, or screens to eliminate the possibility of accidental contact.

3.1.38 guyline

A wire rope for attaching an elevated structure, such as a derrick or mast, to a ground anchor for stability.

NOTE See API 4F or API 4G for additional information.

3.1.39 hazardous atmosphere

Atmosphere that has the potential to expose entrants to the risk of death, incapacitation, impaired ability to self-rescue (e.g. escape unaided from a permit required confined space), injury, or acute illness.

NOTE 1 The potential risks from exposure to a hazardous atmosphere could be caused from one or more of the following:

- atmospheric oxygen concentrations below 19.5 % and above 23.5 %;
- flammable gas, vapor, or mist in excess of 10 % lower explosive limit (LEL);
- airborne combustible dust at a concentration that meets or exceeds its LEL;
- atmospheric concentration of a substance for which a permissible exposure limit (PEL) is published in applicable government regulations, safety data sheets (SDS), standards, or other published or internal documents and could result in responder exposure in excess of its PEL;
- other immediately dangerous to life or health (IDLH) atmospheric conditions.

NOTE 2 In other regions, permissible exposure limit (PEL) may have other terms used, e.g. occupational exposure limits (OEL).

3.1.40 hazardous substance

A substance that, by reason of being explosive, flammable, toxic, corrosive, oxidizing, irritating, or otherwise harmful, has the potential to cause injury, illness, or death.

3.1.41 hot oil operations

The act of heating oil (or other fluids) and pumping it into the piping, tubing, casing, or formation to remove paraffin and asphaltines.

3.1.42 hot work

An operation that can produce enough energy from flame, spark or other source of ignition, with sufficient energy to ignite flammable vapors, gases, or dust.

NOTE 1 Hot work includes such things as, but not limited to, electric arc and gas welding, chipping, burning, heating, grinding, gas cutting, abrasive blasting, brazing, and soldering.

NOTE 2 See API 2009 for additional information.

3.1.43 hot tapping

The technique of attaching a mechanical or welded branch fitting to piping or equipment in service, or under pressure, and creating an opening in that piping or equipment by drilling or cutting a portion of the piping or equipment within the attached fitting.

NOTE A special saddle is used to attach a valve and lubricator to the pipe.

3.1.44**hydraulic fracturing**

The propagation of fractures in a rock layer, as a result of the action utilizing one or more of the following: a pressurized fluid; chemical additives; physical proppants, in order to release petroleum, natural gas, or other substances to be extracted.

NOTE See API 100-1 and API 100-2 for information and guidance.

3.1.45**joint**

A length of pipe that can be either drill pipe, casing, or tubing.

3.1.46**kelly**

The square, hexagonal or other shaped steel pipe connecting the swivel to the drill pipe.

NOTE The kelly moves through the kelly bushings and rotary table and rotates the drill string.

3.1.47**lanyard**

A flexible line of rope, wire rope, or strap which often has a connector at each end for connecting the full-body harness to a deceleration device, lifeline, or anchorage.

3.1.48**location (well site or worksite)**

The place where well servicing or drilling is occurring.

3.1.49**lock-out/tag-out**

A process to isolate and render inoperable hazardous energy sources.

3.1.50**lubricator**

A fabricated length of tubular pipe equipped with a pack-off and bleed valve(s) that is installed to provide access while working on a well under pressure with wireline or other tools and equipment.

3.1.51**making a connection**

Act of screwing a section of pipe or rods onto the string suspended in the wellbore.

3.1.52**mast**

The mobile tower component of a drilling or well servicing unit.

3.1.53**mobile offshore drilling unit****MODU**

A vessel capable of engaging in drilling or well workover operations for the exploration or exploitation of subsea resources.

3.1.54**monkey (tubing) board**

The derrick hand's working platform in the mast/derrick.

3.1.55**mud bucket**

Device used to enclose pipe connections to deflect fluid released when a joint or stand of pipe containing liquid (wet string) is unscrewed.

3.1.56**near miss (near hit, near loss)**

An unplanned event that did not result in injury, illness or damage, but which had the potential to do so.

3.1.57**open hole**

Uncased part of the wellbore.

3.1.58**operator**

Lease owner or their designated agent who is responsible for the overall operation of the lease.

3.1.59**perforating**

Making holes in pipe, cement, or formation at desired depths performed with an explosive device utilizing shaped charges.

3.1.60**personal fall arrest system****PFAS**

A system designed and used to arrest an individual in a fall from a working level.

3.1.61**piping and instrumentation diagram****P&ID**

A diagram that shows the details about the piping, vessels, and instrumentation.

3.1.62**pole mast**

Structure consisting of one or more tubular sections, telescoping or not telescoping, that are the load-bearing members.

NOTE The structure, when erected to working position, often requires guylines; it may be attached to a carrier, skid base, or substructure.

3.1.63**pumping unit**

Surface equipment used for the purpose of mechanically lifting fluids from a well.

3.1.64**qualified person/personnel**

A person(s) who, by possession of a recognized degree, certificate, or professional standing, or who by knowledge, training, or experience, can successfully demonstrate the ability to solve or resolve problems relating to the subject matter or the work.

3.1.65**rabbit**

An instrument or device that is dropped, pulled, or pushed through a section of pipe to ensure that it is free of obstruction.

3.1.66**racking**

Act of placing stands of rods, tubulars, drill pipe, or drill collars in an orderly arrangement in the mast/derrick.

3.1.67**rated working pressure**

The maximum internal pressure that equipment is designed to contain or control, or both.

NOTE Working pressure is not to be confused with test pressure.

3.1.68**rig up/rig down**

The on-site erection and connection of equipment and components in preparation for drilling or well servicing operations and the taking apart of equipment for storage and portability prior to moving off the rig floor or location.

3.1.69**risk assessment**

A systematic process to identify the potential causes of harm or hazards, and the precautions that can be taken to prevent or mitigate the hazards.

3.1.70**rod (sucker rod)**

A length of steel, aluminum, fiberglass, or other suitable material, which are screwed together to make up the mechanical link (rod string) from the surface pumping unit to the pump in the well.

3.1.71**simultaneous operations**

Two or more independent operations (such as drilling, workover, wireline, facilities construction, and so forth) conducted under common operational control in which the activities of an operation may impact the safety of personnel, equipment or the environment of the other(s), or a combination thereof.

NOTE Failure to coordinate can result in the potential clash of activities that can cause an undesired event or set of circumstances.

3.1.72**snubbing**

Pulling or running pipe under pressure through a sealing element where special equipment is used to apply external force to push the pipe into the well, or to control the pipe movement out of the well.

3.1.73**special services**

Those operations utilizing specialized equipment and personnel to perform work processes to support well drilling and servicing operations.

3.1.74**stabbing board**

A platform in the mast/derrick on which personnel work while casing is being run to aid in guiding a tubular joint into another tubular joint for makeup.

3.1.75**strand**

Several round or shaped wires helically laid about an axis.

3.1.76**stand of pipe**

Multiple joints of pipe screwed together positioned within the derrick/mast or mousehole.

3.1.77**substructure**

Depending on the design of the rig, the structure on which the derrick or mast may sit.

NOTE The substructure may provide space for wellhead and well control equipment.

3.1.78**supervisor**

Person who has been given the control, direction, or supervision of work performed by one or more personnel.

NOTE Supervisors may be referred to as rig operators, operators, drillers, rig managers, company men, and others depending on job and area.

3.1.79**swabbing**

Lifting of well fluids to the surface using a piston-like device installed on a wireline.

NOTE Swabbing can inadvertently occur due to piston action as pipe or assemblies are pulled from the well.

3.1.80**swing rope**

A vertically suspended rope that is hung above the boat landing on an offshore platform and is used to facilitate personnel transfer between boat and platform, and vice versa.

3.1.81**swivel**

Device at top of the drill stem that permits simultaneous circulation and rotation.

3.1.82**tree**

The valves and fittings assembled at the top of a completed well to control the flow of hydrocarbons and other fluids.

3.1.83**tour**

Designates the work period of a rig crew.

NOTE Often pronounced as if it were spelled "t-o-w-e-r."

3.1.84**tripping**

The process of removing and/or replacing tubulars from the well.

3.1.85**tubing**

Pipe installed in the wellbore inside casing strings and extending from the wellhead to a depth below, at, or above a producing, disposal, or injection formation through which the produced or injected fluids flow.

3.1.86**welder (certified)**

A person who can provide documentation attesting to that person's capability to create welds of acceptable quality following a defined welding procedure.

3.1.87**welder (qualified)**

A person who has demonstrated the capability to create welds of acceptable quality following a defined welding procedure.

3.1.88**winch (tugger) line**

A wire rope powered by a winch and used for the controlled moving of loads around a rig.

3.1.89**V-door**

The opening at the rig floor that leads to the catwalk and pipe rack area.

3.1.90**V-door ramp**

A ramp that extends from the catwalk to the rig floor V-door opening to allow for transfer of pipe and equipment.

3.1.91**well servicing rig**

Equipment and machinery assembled primarily for the purpose of well work involving pulling or running tubulars or sucker rods, to include but not be limited to redrilling, completing, recompleting, workover, and abandoning operations.

3.1.92**wire rope**

Several wire strands helically laid along an axis.

3.1.93**wireline**

A special wire or wire rope used to convey a tool(s) into and out of a wellbore.

3.2 Abbreviations

BOP	blowout preventer
DST	drill stem test
IDLH	immediately dangerous to life or health
LEL	lower explosive limit
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MODU	mobile offshore drilling unit
P&ID	pipng and instrumentation diagram
PEL	permissible exposure limit
PFAS	personal fall arrest system
PPE	personal protective equipment
SDS	safety data sheets

4 Safety and Health Management System

4.1 General (Safety and Health Management)

4.1.1 One of the most effective ways to reduce workplace hazards and injuries is through a comprehensive, proactive safety and health management system. The safety and health management system are a systematic approach to minimize the risk of injury and illness that involves identifying, assessing, and controlling risks to workers in all workplace operations.

4.1.2 A safety and health management system may include the following, but not limited to:

- instruction on job safety analysis and risk assessment;
- instruction and monitoring of new personnel;
- instruction of personnel on work procedures, job responsibilities, and managing changes;
- regularly scheduled safety meetings in which the job tasks, probable hazards, and related safe practices are emphasized and discussed;
- a plan to facilitate and organize employer and employee actions during workplace emergencies;
- safety education through safety meetings, company publications, training, and other media;
- a shift or personnel changeover process to communicate ongoing operations and potential hazards,
- good housekeeping practices.

4.2 Risk Assessment

4.2.1 Each company should evaluate the workplace hazards and risks and develop and implement measures to manage identified risks.

4.2.2 Job tasks, including potential simultaneous operations, shall be risk assessed before operations commence. The risk assessment shall be communicated during a pre-job meeting with the crew and other involved personnel.

4.2.3 Each company should determine the best method to conduct a risk assessment appropriate for the task which may include, but are not limited to:

- a documented process,
- a visual or verbal process,
- the Job Safety Analysis, or
- other company specific process to recognize risk.

4.3 Hazard Communication

4.3.1 A hazard communication program that evaluates the presence and potential hazards of chemicals found in the workplace shall be established. Workers shall be provided with information concerning the hazard of chemicals and appropriate measures to protect themselves while working with hazardous chemicals. The program shall be

written and include information about hazard evaluation, labeling, safety data sheets, employee training and methods to review and update changes in the program based on chemical usage.

4.3.2 Elements of a program may include:

- a) **Hazard Evaluation**—An inventory of all the hazardous chemicals in the work area shall be completed. An evaluation of the potential hazard of a chemical should be conducted before the hazardous chemical is handled. This evaluation may include potential wellbore fluids, drilling fluids, additives/chemicals, and so forth. Generally applicable measures including engineering controls, safe work practices and PPE should be considered for safe handling and use of a hazardous chemical. This information shall be communicated to the worker.
- b) **Labeling**—A labeling system shall be developed that warns of the potential hazards of working with a hazardous chemical. Hazardous chemical labels shall identify (at a minimum) the material or substance and the physical and health hazards.
- c) **Safety Data Sheet (SDS)**—An SDS shall be available and readily accessible for each hazardous chemical used in the workplace. A system to collect and maintain information and inform workers about the chemical hazard information found on an SDS shall be part of the program.
- d) **Training (required)** Personnel shall be provided hazard communication training upon:
 - 1) initial assignment to a work area;
 - 2) when a new chemical has been introduced.
- e) **Training (recommended)** Personnel should also be provided with training, as appropriate, that includes:
 - 1) information regarding the method and observations that can be used to detect the presence of a release of a hazardous chemical in the work area;
 - 2) physical and health hazard information;
 - 3) measures to protect the worker from harmful exposure, including engineering, safe work practices, emergency procedures, PPE use, and so forth;
 - 4) specific details on how to recognize and understand labels in the work area, SDS interpretation, and safe procedures when working with hazardous chemicals.

4.4 Personal Protective Equipment (PPE)

4.4.1 General

Personnel shall use personal protective equipment (PPE) at the worksite as determined by a risk assessment. Efforts should be made to eliminate identified hazards through engineering or administrative controls. The following items may be considered as part of a PPE hazard assessment:

- a) The safety hard hat should meet the requirements of ISEA Z89.1, or equivalent standards;
- b) Eye protection equipment should meet the requirements of ISEA Z87.1, or equivalent standards;
- c) Safety shoes, safety boots, or toe guards should meet the requirements of ASTM F2413, or equivalent standards;
- d) Fire retardant or flame-resistant clothing (FRC) should meet the requirements of NFPA 2112 and NFPA 2113, or equivalent standards. See API 99 for more information on flash fire risk assessment;