Code of Practice for
Constructing and Abandoning
Coal Seam Gas Wells
in Queensland

Version 1.0

November 2011
1 Acknowledgements

This Code of Practice has been facilitated by the Department of Employment, Economic Development and Innovation (DEEDI) with significant input from the coal seam gas industry coordinated via the Australian Petroleum Production and Exploration Association (APPEA) and from the Department of Environment and Resource Management (DERM).

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This Code may be amended from time to time as new technologies, procedures or equipment are made available, or in the light of further field experience.

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2 Introduction

Coal Seam Gas (CSG), a natural gas consisting mainly of methane, is an important energy source for Queensland and currently supplies around 80% of reticulated gas for Queensland’s domestic, commercial, manufacturing and industrial needs. It is piped throughout many of Queensland’s major cities and is essential to the State’s economy. Natural gas is also reticulated throughout almost every major city in the world and this fuel is relied upon to drive economic growth.

CSG is extracted from coal seams in several Basins in Queensland. Unlike extraction of conventional natural gas where gas is generally produced at much higher pressures, the development of a coal seam gas field requires many more wells to be drilled at regular spacings to extract equivalent quantities of gas.

There have been some community concerns in regard to the impact of CSG (and other wells) on the valuable and significant water resources in the coal seams and surrounding formations, particularly in the Great Artesian Basin.

Well integrity during construction, operation and abandonment is fundamental to ensuring sustainable gas production and is also critical to ensure safety outcomes and the protection of groundwater resources. This Code addresses safety and environmental issues in the construction and abandonment of CSG wells.
3 Purpose

This Code of Practice has been developed to ensure that all CSG wells are constructed and abandoned to a minimum acceptable standard resulting in long term well integrity, containment of gas and the protection of groundwater resources.

CSG wells and their associated facilities can be made low risk through compliance to high design standards, robust safety obligations, documented industry standards and experience, and strong governance programs. Whilst CSG Operators have their own standards and procedures with regard to well construction and abandonment, this Code of Practice has been developed as a minimum acceptable standard for these operations.

The Code is designed to complement the CSG Operator’s internal risk assessment processes and operating procedures. It outlines the recommended process for managing the construction of CSG wells and their eventual abandonment throughout Queensland. This ensures that these activities are completed in a consistent manner and that the processes are effectively monitored to ensure that –

- The environment, in particular underground sources of water are protected;
- Risk to the public and CSG workers is managed to a level as low as reasonably practicable;
- Regulatory and applicable Australian and International Standards and requirements, as well as the Operator’s internal requirements, are understood and implemented;
- The life of a CSG well is managed effectively through appropriate design and construction techniques and ongoing monitoring.

The Queensland Petroleum Act 1923, Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) and the Petroleum and Gas (Production and Safety) Regulation 2004 (P&G Regulation) stipulate broad requirements for the construction and abandonment of petroleum wells which include CSG wells. They also reference some International standards in regard to well equipment and construction.

This Code provides more detailed requirements and guidance to CSG well construction, well management including abandonment and related drilling activities. It is intended that this Code of Practice will have enforceable effect in Queensland by being called up under the P&G Regulation as a “safety requirement”. However the provisions of the P&G Act and the P&G Regulation take precedence over the Code where there is any conflict.

Petroleum activities which include CSG activities are also regulated as part of the conditions within an Environmental Authority for petroleum activities issued under the Environmental Protection Act 1994.
Under the Environmental Authority, petroleum tenure holders are required to monitor, identify and manage risks to the environment.

This includes a requirement to conduct a groundwater quality monitoring program to identify and manage impacts to groundwater quality. Petroleum tenure holders are required to communicate these impacts to DERM.

The Queensland Water Act 2000 provides a regulatory framework for petroleum tenure holders to monitor, assess and manage the impacts of their underground water rights on water bores, aquifers and springs.

The Code of Practice for Constructing and Abandoning CSG Wells in Qld has been developed so that it is consistent with principles of groundwater resource protection (see Appendix 3 - References).

4 Scope and application

4.1 Scope

This Code of Practice covers only Coal Seam Gas (CSG) wells and does not cover the safety or environmental issues associated with conventional oil and gas exploration and production. The Code may be extended or other Codes developed to address those well types and issues.

The Code covers all CSG well types including exploration, appraisal and production wells. For the purposes of the Code a CSG well is a “prescribed well” as defined in the P&G Act, where the well is drilled on a petroleum authority and where the purpose of the well is to explore for or produce natural gas from a coal seam reservoir.

As the safety of people, integrity of assets and protection of the environment are inextricably connected, it is appropriate that any code addressing one, must of necessity address, or be cognisant of, the others.

The Code looks specifically at two stages of well life, namely construction and decommissioning (commonly called abandonment in the petroleum industry). Within those stages, it considers equipment and material selection, risk assessment (both safety and environment), industry practices, management, monitoring and reporting.

The Code does not, however, address the manufacture or the certification of drilling rigs or associated equipment or the operation of a well. These are adequately covered in existing technical standards. It also does not include well stimulation activities such as fraccing. Likewise the Code does not refer to any necessary technical training of the various operatives.
4.2 Application of this Code of Practice

The contents of this Code of Practice are classified into the following categories:

a) Principles – these are the fundamental objectives that underlie mandatory requirements in (b).

b) Mandatory requirements – these are requirements that are enforceable by the regulator and must be complied with. The terms “shall” or “must” are used for mandatory requirements.

c) Good industry practice1 – these are recommended methods and techniques to assist in satisfying mandatory requirements, provide efficient CSG wells and ensure long term well integrity. The terms “should” or “may” are used for good industry practice recommendations.

Where there is a conflict in this Code and the safety requirements or other relevant provisions in the P&G Act, the provisions of that Act shall apply.

Compliance with this code is directed at the CSG Operator being the entity responsible for management of the safe operations of exploring for and producing coal seam gas on the land to which a CSG tenure applies. The Operator should ensure that all parties undertaking work covered by the Code (e.g. drilling contractors) also comply with it.

Ultimately the P&G Act and P&G Regulation will dictate who has the statutory obligation to follow the Code. On the date of publication of this Code, this lies with the petroleum tenure holder. However users of the Code should always check the obligations in the current version of the legislation (see http://www.legislation.qld.gov.au/OQPChome.htm).

A glossary for specific terms, abbreviations and acronyms used in this Code of Practice is provided in Appendix 1.

Appropriate industry standards, recommended practices, technical reports and industry experience should be considered in the design and implementation of the well construction process. This includes the use of standards and specifications developed by the American Petroleum Institute (API). A list of relevant industry standards is provided in Appendix 2.

1 Note: While the requirements stated in “Good Industry Practice” are not mandatory, it is expected that they, or similar activities achieving the same outcomes, will be implemented
5 General description of CSG drilling activities

5.1 Introduction

There are generally two phases of CSG operations – exploration and production. Once a well is no longer required for CSG operations, it is abandoned. Abandoning wells involves the sealing of wells to prevent the intermixing of fluids and pressures between aquifers, preventing the escape of fluids to surface and preventing injury and preventing harm to people and harm to the environment. It includes the process of decommissioning as described in legislation.

CSG exploration drilling aimed to identify gas bearing reservoirs and sediments generally targets a large area, with typically one well per 30 to 60 square kilometres (km$^2$) depending on the area.

If exploration indicates the potential for gas production, pilot wells may be drilled to confirm production performance and to further define reservoir properties. A pilot test is essentially a small scale production trial, with associated infrastructure.

Production wells are typically spaced at some 600m -1200m or more, and may operate for many years or even for several decades.

5.2 Outline of the Well Construction Process

The main steps involved in CSG well construction and abandoning for either exploration or production are –

- Site identification and location;
- Site (or ‘lease’) access and preparation;
- Well design;
- Work Program issued for well construction;
- Well drilling;
- Logging and/or testing;
- Running and cementing casing;
- Well stimulation (if required);
- Well completion;
- CSG production; and
- Well abandoning and site rehabilitation.
During the normal course of any drilling program there will be various company and contractor personnel who will need to travel to the drill site. These people are required for –

- Site checks and surveying;
- Earthworks (e.g. for access to site and to clear the drill pad area);
- Drilling rigs and support vehicles;
- Water carting;
- Specialist testing service providers;
- Well site supervision and geological personnel;
- Cement and casing deliveries;
- Well intervention / well treatment equipment (workover rigs etc); and
- Support vehicles/services.

5.3 Site identification and location

All wells are first planned in a desktop process to identify potential or suitable well sites within known constraints such as tenement boundaries, topographic constraints and environmental restrictions.

Potential exploration well sites additionally have a desktop review undertaken to identify locations which may best define the geology of an area or project. In some cases this may be based on earlier seismic surveys.

After the desktop assessment it is essential to then ‘ground-truth’ the proposed site, and at this stage it is critical that consultation with the relevant stakeholders takes place to choose the most appropriate site and consider all other constraints (e.g. access routes).

In most cases there is reasonable flexibility in locating proposed wells so as to be able to avoid particular sites. As a general rule there is more flexibility to move exploration wells than to move production wells. Well sites can usually be identified that present the least impact to the environment and existing land use.

Petroleum companies are required by law to conduct various checks on any site where works are proposed.

These checks are either office or field based, and may include –

- Environmental checks (e.g. distance from specific flora and fauna communities);
- Cultural heritage inspections (particularly with regard to indigenous cultural heritage);
- Topography restrictions and issues (avoiding water courses, ravines, steep cliff faces etc);
• Land use restrictions (including consultation with landholders);
• Other stakeholder liaison.

5.4 Risk Assessment

CSG Operators must carry out a risk assessment to identify the risks that may occur during well construction, operation and abandonment. Risks to be managed must include, as a minimum, site access and preparation, well integrity, groundwater protection and safety of personnel and the community.

Once agreement is reached on the location of a well, the primary considerations in preparing a drill site are safety and the environment.

For safety of both site personnel and landholders, well sites should be sized and prepared appropriately and may also be fenced for safety and to provide a barrier to exclude livestock and large wildlife.

The environmental procedures used in preparing the site may include the stockpiling of topsoil which is kept separate for rehabilitation, and minimising the footprint where possible.

In most cases ground pits (or sumps) are excavated to hold drilling or waste water. Sufficient storage for wellsite activities needs to be provided in these sumps which may be lined with heavy grade plastic if required.

Generally it may be necessary to dig a ‘cellar’, which is approximately 2m square and 2m deep, to house the Blow Out Preventer (BOP) and the lower section of the wellhead. The BOP is safety specific equipment which provides the mechanism by which the well may be sealed at surface in case of unplanned flow from the well, or a build-up of pressure within the well. This serves to minimise the risk of release of any well fluids to the environment.
6 Mandatory requirements and recommendations

6.1 Well design

6.1.1 Principles
CSG wells are designed to ensure the environmentally sound, safe production of gas (predominantly methane) and other wellbore fluids by containing them inside the well, protecting groundwater resources, isolating the productive formations from other formations, and by proper execution of treatment/stimulation and/or completion operations.

Well design and construction must ensure that no leaks occur through or between any casing strings. The fluids produced from the well must travel directly from the producing zone to the surface inside the well conduit, without contamination of groundwater or other aquifer resources.

All CSG wells therefore must be designed to ensure the safe and environmentally sound production of gas by –

- preventing any interconnection between hydrocarbon bearing formations and aquifers;
- ensuring that gas is contained within the well and associated pipework and equipment without leakage;
- ensuring zonal isolation between different aquifers is achieved;\(^2\) and
- not introducing substances that may cause environmental harm.

6.1.2 Mandatory Requirements
The Design Basis for CSG wells must incorporate the following –

- consideration of casing setting depths taking into account aquifer and production zone locations, and the requirements for Well Control;
- provision for installation of Blow Out Preventors;
- use of appropriate casing weight and grade, and casing running procedures;
- use of appropriate well design and construction materials;
- use of appropriate casing centralisation;
- use of engineered cement slurry and effective cement placement techniques; and

\(^2\) Note: Some formations such as the Walloons and Bandanna may be considered as a single entity and not require zonal isolation. The regulator should be consulted for other formations.
• design to ensure all fluids produced from the well travel directly from the production zone to the surface without groundwater contamination.

6.1.3 Good Industry Practice

a) Offset well information should be reviewed to assist in the design process for new wells.

b) Nearby water bores should also be included in the record keeping and data-set as part of the offset review.

c) Consideration should be made of offset data detailing any evidence of tubular corrosion. If corrosion has been observed, petroleum tenure holders will need to conduct a risk assessment and take action to ensure well integrity.

d) Formation horizons or zones from which water bores produce should be noted during the offset well review and used to assist the placement of surface and/or production casing.

e) Sustainable construction practices and operating procedures should be used, for example, to conserve water usage and minimise waste.

f) All CSG well designs and construction procedures should include contingency planning to mitigate the effects of failures in the event of unplanned process upsets or events during construction.

g) Casing hardware including float equipment, centralisers, cement baskets, wiper plugs (top and bottom), stage tools and external casing packers should be selected as appropriate as part of the well design to ensure the required zonal isolation.

6.2 Casing

6.2.1 Principles

Casing should be designed to withstand the various compressive, tensile and bending forces that are exerted while running-in the hole, as well as the collapse and burst pressures that it may experience during different phases of the well’s life e.g. cementing, pressure testing, stimulation and production cycles.

Casing strings should be designed to facilitate installation of Blow Out Preventor equipment.

As well as providing a mechanism of extracting gas from the production zones, casing also acts to protect other resources such as groundwater.
6.2.2 Mandatory Requirements

a) Casing, casing connections, wellheads, and valves used in a CSG well must be designed to withstand the loads and pressures that may act on them throughout the entire well life cycle. This includes casing running and cementing, any treatment pressures, production pressures, any potential corrosive conditions, and other factors pertinent to local experience and operational conditions.

b) For CSG wells all surface and production casing in pressure containing applications must meet the relevant requirements of the Petroleum and Gas (Production and Safety) Regulation 2004, Schedule 1, ‘Mandatory and preferred standards for safety requirements’. Any deviation from these standards must be addressed as per Chapter 1, Part 3, Section 7 of the same Regulation, in particular Section 7 and Schedule 1.

c) In all CSG wells, conductor pipe does not need to meet the above requirements.

d) Barriers shall be installed to prevent surface pollutants from entering the well, and prevent wellbore fluids and gas from escaping to the surface environment.

e) When designing casing strings and casing connections for CSG wells, CSG operators and their drilling engineers must design each well’s casing string using appropriate Design Safety Factors. For example typical Design Safety Factors used in the hydrocarbon industry at large are 1.1 for burst, 1.0 for collapse, 1.3 for static tension and 1.25 for tri-axial analysis. The Design Safety Factors used by a CSG Operator need to be appropriate for the anticipated well life, service conditions and local experience.

f) To verify casing integrity during the well construction process, casing must be pressure tested prior to drilling out for the next hole section (in the case of surface or intermediate casing), and prior to completion operations commencing (in the case of production casing). The test pressure must be greater that the anticipated formation pressure possible at the surface, but must not exceed the burst pressure rating of the casing with the safety factor applied.

g) Minimum casing setting depth should be sufficient to meet isolation requirements of groundwater aquifers and provide an acceptable kick tolerance for the next hole section to be drilled. The kick tolerance criteria shall be selected by the operator and will be dependent upon knowledge of the local pore pressure and fracture gradient profiles, and of the likely kick conditions in the well.

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3 Note: “Pressure containing applications” include all applications where the integrity of the casing is required to maintain well control.
• The surface casing shall not be set shallower than 60m total vertical depth, unless the surface casing is for a directional well with the top of the production zone less than 300m, then the surface casing shall be no less than 40m.

• When the surface casing is not run to 60m, sealing for the intermediate or production casing must be cemented from shoe to surface.

• Steel casing connections must be made up to ensure an aligned, round, secure, and leakproof joint;

• Welded joints are not permitted.

6.2.3 Good Industry Practice

a) For casing run in CSG wells, pipe body and connections should have verifiable properties (i.e. in terms of burst, collapse and tensile strengths). Note that casing manufactured to API specifications by definition must meet strict requirements for compression, tension, collapse and burst resistance, as well as quality and consistency.

b) When making up a casing connection it is important to apply the recommended torque. Too much torque may over-stress the connection and result in failure of the connection. Too little torque may result in leaks at the connection.

c) The correct use of casing dope, and its impact on torque make-up should be incorporated into casing running procedures.

d) Operators should consider the potential impact of high casing pressure on cement bond quality when determining pressures for any casing tests carried out before cement has properly set.

e) Petroleum tenure holders, their drilling contractors and their well-site supervisors should review and ensure compliance with the Work Program to run, install and test all casing strings during well construction.

f) Long term monitoring and recording of the casing condition should be undertaken.
6.3 Cementing

6.3.1 Principles
CSG wells need to be cemented to –

- prevent migration paths and isolate the targeted zone from other formations;
- protect groundwater resources from contamination;
- maintain aquifer pressures and quality;
- obtain and maintain well integrity; and
- protect the casing from corrosion.

6.3.2 Mandatory Requirements

a) To prevent interconnection between zones of differing pressure and water quality –

- All surface casing must be cemented from shoe to surface.
- For cementing production and intermediate casing, operators must design to ensure cement is either brought to surface or designed to an appropriate safety overlap distance of at least 50m back inside the previous casing shoe. Where cement is not returned to surface, pressure testing must be performed and recorded to verify zonal isolation has occurred after all the cement has reached a compressive strength of 500 psi. Testing pressures must be no less than 500 psi over the previous casing Leak Off Test at the shoe.
- Production casing cement must be designed so that the base of the cement is no more than 30m above the prognosed depth of the top production zone.
- If the cementing operations do not verify zonal isolation then written notification must be sent to:

  The Chief Inspector, Petroleum and Gas
  PO Box 15216
  CITY EAST QLD 4002
  Email: gassafe@deedi.qld.gov.au

  This notification must be sent within 72 hours of the initial cementing operation and prior to any remediation work being undertaken. Subsequently, the integrity of the well must be reviewed and measures put in place prior to bringing the well on production to ensure well integrity for the lifetime of the well.
b) Cement constituents and properties must be suitable for the intended conditions of use and used in compliance with the relevant MSDS requirements.\footnote{Note: API RPs 10A, 10B, 10D and 65-2, Guidance Document HF-1 and Technical Reports 10TR are the recommended benchmarks for cementing wells.}

c) Appropriate cement laboratory testing procedures must be carried out (see API RP 10B-2) in advance of the well being drilled to ensure the resulting slurry meets the requirements of the well design. The testing, as a minimum, must include Compressive Strength development with time. In the case where a number of similar wells are drilled in an area with constant cement materials and mix water properties, then a representative lab test may suffice.

d) Wait on cement setting time:

- Wait on cement time prior to slacking off or removing BOP’s must be based on the cement achieving a minimum of 100 psi (0.7 MPa) compressive strength at the temperature of any potential flow zone in the annulus just cemented. API RP 65 – Part 2 addresses this issue.

- Cement top up after cement recedes after coming to the surface must occur as soon as possible and before any downhole activity commences.

- Wait on cement time prior to drill out must equate to the laboratory testing time for cement surrounding the casing shoe to have achieved a minimum compressive strength of 500 psi (3.5 MPa).

e) Operators must ensure all zones (both hydrocarbon and groundwater aquifers) are isolated with cement with a minimum ultimate compressive strength of 500 psi (3.5 MPa).

f) Operators must determine and document in their well procedures a minimum required ultimate compressive strength for cement slurries to be used across zones which may be hydraulically fracture stimulated. For example, requirements for ultimate compressive strength of 1,400 psi (10 MPa) to 2,000 psi (14 MPa) are often used in the hydrocarbon industry for cement across zones requiring fracture stimulation treatment.

g) Operators must ensure that the required compressive strength slurry for fracture stimulation also be placed at least 150m above any zone to be hydraulically fractured. API Guidance Document HF-1 addresses this issue.
h) During all cement jobs, returns to surface must be continuously monitored and recorded to confirm the effectiveness of the cement placement. Pressures during the cement job and in particular immediately prior to plug bump must be similarly recorded as a potential indicator of height of cement column and downhole problems.

i) Calcium chloride or other chloride-based accelerants must not be added to the cement mix unless the free water content of the cement is specified as <2%.

j) A minimum of 16mm cement sheath surrounding the nominal OD of the surface casing over the total cementing depth must be demonstrated. Calculations for a vertical well must include a deviation of 3 degrees from vertical at casing depth unless otherwise proven.

k) A minimum of 13mm cement sheath surrounding the nominal OD of the production casing over the total cementing depth must be demonstrated. Calculations for a vertical well must include a deviation of 3 degrees from vertical at casing depth unless otherwise proven.

l) Casing centraliser spacings are to be such that the requirements of (j) and (k) above are achieved.

m) Centralisers and their connections to the casing must meet API Recommended Practice 10TR4 or its equivalent.

n) It is mandatory that wiper plugs be used for production casing and they are recommended for surface casing to enable plug bump and pressure test of the casing before cement cures.

6.3.3 Good Industry Practice

a) Petroleum tenure holders should ensure proper wellbore preparation, hole cleaning and conditioning prior to the cement job. Once casing has been run to landing depth, CSG operators should circulate a minimum of one hole volume immediately prior to commencing cementing procedures.

b) Movement of the casing (rotation and reciprocation) should be considered where appropriate to improve drilling mud removal and promote cement placement.

c) Cement slurry design should include testing to measure the following parameters depending on site-specific geologic conditions (this list is not exhaustive) –

- Slurry density;
- Thickening time (compared to proposed pumping time);
- Fluid loss control;
- Free water;
• Compressive strength development versus time (at representative bottomhole conditions);
• Fluid compatibility (cement, source / mix water, drilling mud, spacers used);
• Mechanical properties.

d) Cement job design should include proper cement spacer design and volume to ensure the appropriate contact time during pumping.

e) Caliper logs in production hole sections, where available, should be used to confirm cement volume requirements. The level of excess cement requirements should be based on local experience.

f) Water and cement slurry samples should be taken (periodically during each cement job) by the petroleum tenure holder’s well site supervisors as an aid to monitoring cement job quality and visual confirmation of speed of cement set up. Cement samples should be maintained on site for the duration of the well.

g) Baseline cement bond log evaluation should be considered in each new field area where confirmation of cement placement has not been demonstrated. This should be undertaken by cement returns to surface and adequate displacement pressures or pressures immediately prior to plug bump. Cement bond log evaluation should continue until repetitive success of slurry design and cement jobs, and confirmation of adequacy of cement bond for zonal isolation is confirmed (e.g. five wells in each new field or area of different geological conditions).

h) Leak-off tests or formation integrity tests should be used on drill out of surface casing shoes as a potential guide to shoe integrity (i.e. good cement around the casing shoe) as well as assisting with well design for well control risk.

i) Petroleum tenure holders should ensure all cementing operations are carried out with proper mixing, blending and pumping of the cement job at the wellsite. These activities should be properly supervised and recorded. This includes recording any cementing problems encountered.

6.4 Wellheads

6.4.1 Principles

The primary purpose of a wellhead is to provide the suspension point and pressure seals for the casing strings that run from the bottom of the hole sections to the surface pressure control equipment.

The wellhead ensures well integrity at the surface and enables the installation of Blow Out Preventers to containment of gas and water.
Wellheads are threaded or welded onto the first string of casing, which has been cemented in place during drilling operations, to form an integral structure of the well.

Wellhead design needs to facilitate installation of Blow Out Preventor equipment

6.4.2 Mandatory Requirements

a) Operators are required to use wellheads compliant with the Petroleum and Gas (Production and Safety) Regulation 2004

b) Operators must monitor wellheads for leaks or emissions in accordance with the separate code of practice for this purpose: “Code of Practice for coal seam gas well head emissions detection and reporting”, published by DEEDI on its website.

6.4.3 Good Industry Practice

a) CSG operators should ensure that during initial wellhead installation and subsequent well intervention workovers, wellhead seal tests are conducted to test the mechanical integrity of the wellhead sealing components (including valve gates and seals) and confirm they are capable of holding against well pressure.

b) It may be advisable in some circumstances and CSG well types to ensure A and B wellhead sections are used to ensure surface integrity of the surface casing annulus (between production casing and surface casing), as an additional barrier to potential leak paths.
6.5 Drilling fluids

6.5.1 Principles

While drilling, fluid is circulated down the drill string and up the annulus between the drill string and hole wall. This drilling fluid serves to lubricate the drilling assembly, remove the formation cuttings drilled, maintain pressure control of the well, and stabilise the hole being drilled. Drilling fluid is generally a mixture of water, clays, fluid loss control additives, density control additives, and viscosifiers.

The standard drilling fluid currently used in the CSG industry is water-based. It may be either fresh water or may be based on salt brine. Potassium chloride, the principal salt component, is often used as a weighting agent and to help control swelling clays. Organic polymers or clay may be added to the base fluid to raise the viscosity and aid in removal of drill cuttings.

After use, drilling fluid is returned to the drilling sumps where the solids settle to the bottom of the sump. The liquid may then be recirculated.

Losing drilling fluids down hole is undesirable as they are the primary means of controlling pressure within the well, and maintaining removal of formation cuttings drilled. When a loss is detected, loss circulation material (LCM) may be incorporated in the drilling fluid. LCM prevents fluid loss by blocking the pores in the host rock.

Underbalance techniques may be used for drilling where air, nitrogen or other underbalance “aerated” fluids are used as a drilling medium.

Operators and drilling contractors undertaking underbalance drilling should ensure that all risk assessment, well design, operational and crew training are addressed prior to and during execution of the project.

Drilling fluids and additives are regulated under the Environmental Authority issued under the Environmental Protection Act 1994, as they are classed as contaminants.

6.5.2 Mandatory Requirements

a) Drilling fluids must be selected and managed to ensure all products used during well procedures on CSG wells are used in accordance with the manufacturer’s recommendations and relevant Material Safety Data Sheets (MSDS).

b) The name, type and quantity of each chemical used on each well throughout the life of the well must be recorded.
6.5.3 Good Industry Practice

a) Drilling fluid should be a carefully monitored and controlled mixture designed to –
   • achieve best drilling results and ensure efficient removal of formation cuttings;
   • control formation pressures; and
   • minimise damage to formations.

b) Petroleum tenure holders should ensure that the drilling fluid selected is appropriate for the well design, any locally experienced drilling problems and anticipated geological conditions likely to be encountered.

c) The use of biodegradable substances in the drilling fluid is preferred.

d) The source of water used for all well procedures (drilling, workover and stimulation) should be recorded for future well monitoring purposes.

e) Products should be chosen, stored, and used at concentrations that minimise the risk of causing environmental harm.

f) Personnel, including contractors, should be aware of the environmental impact and spill emergency procedure of the products and substances in use on site.

g) Petroleum tenure holders should use established, effective drilling practices to achieve a stable, uniform, and, as far as possible, in-gauge hole.

6.6 Evaluation, logging, testing, coring

6.6.1 Principles

The types of logs that are run in a CSG well are selected by geologists at the time the well is designed. Common logging tools used for evaluation of CSG wells include natural gamma ray, density, caliper, resistivity and image logs.

Logging produces valuable information on all formations logged to accurately determine the nature and type of all strata encountered.

This information is used in optimising future well design and drilling operations as well as determination of the actual depth and thickness of all subsurface formations in the drilled hole.

Review of well logs assists in setting casing strings in the correct place to achieve well design objectives and to properly achieve the isolation requirements of the casing and cement.
Formation testing may be carried out on some wells. The formation is sampled by either drill pipe conveyed Drill Stem Test tools or by wireline deployed test tools.

In some exploration wells, the well design may be modified to cut ‘cores’ of the strata encountered. This involves drilling a core of solid rock and recovering it to surface. The core is examined for geological information and any coals are tested for gas content.

Cuttings samples, core samples fluid samples and other samples from the CSG well drilling process should be collected, stored and/or distributed according to legislative and regulatory requirements.

6.6.2 Mandatory Requirements

As required by s57 of the P&G Regulation, CSG Operators must ensure that accurate downhole survey of each CSG well is carried out, within the statutory specified timeframe, and to the specified level of accuracy. Such surveys may be carried out using the appropriate logging tools in vertical wells and/or measurement while drilling (MWD) techniques in deviated wells.

Sections 47-50 of the P&G Regulation cover requirements to keep samples of formation cuttings, cores and fluid samples.

6.6.3 Good Industry Practice

Where appropriate (e.g. when hole conditions and pressure regimes dictate), Operators should ensure secondary well Pressure Control Equipment (PCE) is in place during logging operations. This may include such equipment as wireline lubricators or pack-offs.

6.7 Well monitoring/maintenance

6.7.1 Principles

Wells, like any constructed asset, can deteriorate with age, operational and site specific conditions. This can lead to the well no longer being suitable for the intended use. Well monitoring and maintenance is required to preserve the well and its component parts in good repair for the life of the well.

6.7.2 Mandatory Requirements

a) Monitoring

- Throughout the life of a producing well, well conditions must be monitored on an ongoing basis to ensure integrity of the well and well equipment.
- Mechanical integrity/pressure monitoring and evidence of corrosion shall be used to determine the mechanical integrity of casing and other well equipment when the well is producing and during well treatments or well intervention/ workover operations.
Monitoring mechanisms and frequencies are to be determined by a comprehensive risk assessment.

Monitoring specifically for wellhead leaks or emissions must be carried out in accordance with the “Code of Practice for coal seam gas well head emissions detection and reporting”, published by DEEDI on its website.

b) Maintenance

- All products must be used in accordance with the manufacturers’ recommendations and relevant material safety data sheets.
- Maintenance mechanisms and frequencies are to be determined by a comprehensive risk assessment.

6.7.3 Good Industry Practice

a) Monitoring

- During well intervention, or workovers when equipment is removed from a well or depressurized for maintenance, a breakdown or visual inspection should take place and records taken of the condition of the equipment after being in service. Records should be kept of all intervention procedures and chemicals used.
- Operators should carry out regular wellhead maintenance and monitoring for any early signs of potential leaks, including monitoring of the surface casing annulus. If an annulus is being abnormally charged with gas, an analysis of gas content may assist determination of the source and nature of a potential leak.
- Routine operational visits by well operators/well pumpers should monitor, identify and report any abnormal well conditions including wellhead leaks to operating company management. These visits should also be used to monitor regular well pressures in addition to SCADA where used.
- Regular inspection of the casing and wellhead equipment and annulus pressures should readily indicate any leaks between any of the casing strings.
- Wellhead pressures, gas and water production rates of all CSG wells should be continuously monitored. This production data can then be analysed by production engineers to identify any abnormal behaviour or problems.

b) Maintenance

A Preventative Maintenance program should be in place to service all surface equipment at the wellsite.
6.8 Well abandonment

6.8.1 Principles
CSG well abandonment must ensure the environmentally sound and safe isolation of the well, protection of groundwater resources, isolation of the productive formations from other formations, and the proper removal of surface equipment.

The outcomes of well abandonment are to –

- isolate groundwater aquifers within the well from each other and hydrocarbon zones;
- isolate hydrocarbon zones within the well from each other, from groundwater aquifers or from zones of different pressure;
- isolate the surface casing or production casing from open hole;
- place a surface cement plug in the top of the casing; and
- recover / remove the wellhead.

The following matters should be considered when abandoning a well –

- the construction characteristics of the well;
- geological formations encountered;
- hydrogeological conditions i.e. aquifers;
- environmental risk; and
- regulatory requirements.

6.8.2 Mandatory Requirements

a) Wells must be abandoned in accordance with this Code and all relevant legislative requirements (i.e. Schedule 3 and Sections 69 and 70 of the P&G Regulation).

b) Any well or drill hole that is to be abandoned shall be sealed and filled in such a manner to prevent leak of gas and/or water.

c) A horizontal well must be abandoned as per the requirements in Schedule 3 Part 4, section 11 of the P&G Regulation).

d) Cement shall be used as the primary sealing material. Cement testing should be carried out as per requirements set out in Section 6.3 “Cementing” of this Code.
e) For production wells:

A cement plug must be set inside the casing as close as practical above the uppermost hydrocarbon production zone. This plug must be pressure tested to 500 psi (3.5 MPa) above the estimated (or previously recorded) leak off pressure. Where this plug is not cemented to surface, the plug must also be tagged with a minimum 2,000 lb (1,000 kg) set down weight.

f) For exploration wells:

A cement plug must be set across the open hole section and inside the lowermost casing shoe. This plug must be pressure tested to 500 psi (3.5 MPa) above the estimated (or previously recorded) leak off pressure. Where this plug is not cemented to surface, the plug must also be tagged with a minimum 2,000 lb (1,000 kg) set down weight.

g) For all wells:

- There must be a minimum of 2 adjacent cement barriers across all formations above the uppermost hydrocarbon production zone; and
- The innermost casing string must be filled to surface with cement.

h) BOP's and/or wellhead must not be removed until the cement plug across the surface casing shoe or plug across the uppermost perforations has been physically tagged for correct location and pressure tested.

i) Wellheads must be removed, and casing must be cut greater than 1.5m below surface. A wellhead marker plate must be installed as per legislative requirements.

j) Complete and accurate records of the entire abandonment procedure must be kept, with these records submitted as part of the legislative reporting requirements for the abandonment of CSG wells.

Note: If a CSG well intended for abandonment is proposed for conversion to a water well, the resulting water well must comply with the mandatory construction requirements for water wells under the respective legislative regime.

6.8.3 Good Industry Practice

a) Use integrated openhole volume calculated from caliper on wireline logs to calculate cement volumes where possible (this applies mostly to exploration wells which are to be plugged and abandoned).

b) If no caliper data is available, 20-30% above theoretical volume or local knowledge should be used.

c) A 50m weighted high-vis pill should be spotted below each cement plug that is not set directly above a physical barrier.
d) Plugs should normally be a minimum of 45m in length (height). In general cement plugs should not exceed 150m in length. If the hole is badly washed out, it may be better to set 2 short plugs over the washed out section than to try to cover this interval with one plug.

6.9 Recording and reporting data

6.9.1 Principles

Accurate information on the design, drilling, construction, reconditioning, and abandonment of wells needs to be recorded for future reference.

6.9.2 Mandatory Requirements

a) Under Subdivision 3 of the Petroleum and Gas (Production and Safety) Regulation 2004, a number of well reporting requirements are stipulated for daily drilling reports, well completion reports and well or bore abandonment reports. It is the responsibility of the petroleum tenure holder to ensure that these reporting requirements are fulfilled.

b) In addition, cementing reports, including all materials and compression strength vs time graphs, cement pump charts and pressure records, logging reports including well deviation details and details of centraliser placing must be completed and submitted to the regulator with well completion reports.

6.9.3 Good Industry Practice

Adequate record keeping should be carried out to verify veracity of the well design and construction process. A record of all work undertaken on a well should be maintained for each well’s entire life through to abandoning. These records may include, but not be limited to, the following –

- Engineering design basis;
- Kick tolerance/well control design assumptions;
- BOP pressure testing requirements, and actual test records;
- Laboratory test results for cement slurries;
- Casing tallies for all casing strings run (including lengths, weights, grades, inside diameter, outside diameter, setting depth);
- Cementing records for each casing string in each well;
- Casing pressure tests;
- Leak off test and/or formation integrity test reports;
- Wireline logs;
- Core description reports;
- Records of all equipment used;
• Records of mud chemicals, treatment and workover chemicals used during all well procedures (name, type and volume of each chemical used should be recorded);
• Records of drilling and cementing problems encountered during the well;
• Risk assessments;
• Well drilling and completion programs including casing running and cementing procedures;
• Daily rig reports;
• Daily geological reports, if relevant; and
• Service company reports.

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### Appendix 1 – Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Abandonment</td>
<td>A process which involves shutting down the well and rehabilitating the site. It includes decommissioning the well.</td>
</tr>
<tr>
<td>ALARP</td>
<td>As Low As Reasonably Practicable (used in evaluating risk)</td>
</tr>
<tr>
<td>Annulus</td>
<td>The space between two concentric circles. Space between surrounding pipe and wellbore</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>Barrier</td>
<td>Any means of preventing an uncontrolled release or flow of wellbore fluids to surface.</td>
</tr>
<tr>
<td>BOP</td>
<td>Blowout Preventer. One of several valves installed in a wellhead to prevent the escape of pressure either in the annular space between the casing and the drill pipe or in the open hole during drilling, completion and work over operations.</td>
</tr>
<tr>
<td>Bores or borehole</td>
<td>Interpreted as wells or wellhole.</td>
</tr>
<tr>
<td>Casing</td>
<td>A pipe placed in a well to prevent the wall of the hole from caving in and to prevent movement of fluids from one formation to another.</td>
</tr>
<tr>
<td>Casing collar</td>
<td>Coupling between two joints.</td>
</tr>
<tr>
<td>Casing coupling</td>
<td>Tubular section of pipe that is threaded inside and used to connect two joints of casing.</td>
</tr>
<tr>
<td>Casing head</td>
<td>A heavy flanged steel fitting connected to the first string of casing. It provides a housing for slips and packing assemblies.</td>
</tr>
<tr>
<td>Cement</td>
<td>Powder consisting of alumina, silica, lime and other substances that hardens when mixed with water. Extensively used to bond casing to the walls of the wellbore.</td>
</tr>
<tr>
<td>Cementing</td>
<td>The application of a liquid slurry of cement and water to various points inside and outside the casing.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Cementing head</td>
<td>Component fitted to the bore for the use of cementing.</td>
</tr>
<tr>
<td>Cement plug</td>
<td>Portion of cement placed at some point in the wellbore.</td>
</tr>
<tr>
<td>Centraliser</td>
<td>A tool used to centre the casing in the hole.</td>
</tr>
<tr>
<td>Christmas tree</td>
<td>Control valves, pressure gauges and chokes assembled at the top of a well to control the flow after the well has been drilled and completed.</td>
</tr>
<tr>
<td>Circulation</td>
<td>The process of pumping a fluid down the well and back up to the surface in a drilling or workover operation.</td>
</tr>
<tr>
<td>Code</td>
<td>Unless otherwise specified, refers to this Code of Practice.</td>
</tr>
<tr>
<td>Company representative</td>
<td>An employee of the operator who supervises the operations at a drilling site or well site and coordinates the hiring of logging, testing, service and workover organisations. Also called the “company man”.</td>
</tr>
<tr>
<td>Completion (or Workover) Program</td>
<td>A petroleum tenure holder document that describes the detailed well procedures and risk mitigation for activities including Completions, Testing, Intervention, Well Repair and/or Abandonment.</td>
</tr>
<tr>
<td>Concrete</td>
<td>This is defined as a mixture of cement powder, water, sand and gravel. This mixture must set without separation.</td>
</tr>
<tr>
<td>Contractors</td>
<td>Third parties contracted by the petroleum tenure holder to provide well engineering equipment including drilling rigs, materials, equipment and services.</td>
</tr>
<tr>
<td>Coring</td>
<td>Process of cutting a vertical, cylindrical sample of the formations.</td>
</tr>
<tr>
<td>Corrosion</td>
<td>Any of a variety of complex chemical or electrochemical processes (except rust) by which metal is destroyed through reaction with its environment.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>CSG well</td>
<td>For the purposes of the Code a CSG well is a “prescribed well” as defined in the P&amp;G Act, but only where the well is drilled on a petroleum authority and where the purpose of the well is to explore for or produce natural gas from a coal seam reservoir. It does not include shot holes. A CSG well includes the casing for the well and any wellhead for the well attached to it.</td>
</tr>
<tr>
<td>DEEDI</td>
<td>Queensland Department of Employment, Economic Development and Innovation</td>
</tr>
<tr>
<td>DERM</td>
<td>Queensland Department of Environment and Resource Management</td>
</tr>
<tr>
<td>Drilling fluid/mud</td>
<td>Circulating fluid than can lift cuttings from the wellbore to the surface and to cool down the drill bit.</td>
</tr>
<tr>
<td>EC</td>
<td>Electrical conductivity</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Includes mud logging, wireline logging, formation evaluation while drilling, coring and well testing.</td>
</tr>
<tr>
<td>Exploration well</td>
<td>A well constructed to explore for CSG. In this Code, the definition of exploration wells also applies to appraisal wells and gas monitoring wells.</td>
</tr>
<tr>
<td>Flowing well</td>
<td>Also known as an artesian well. A well from which groundwater is discharged at the ground surface without the aid of pumping.</td>
</tr>
<tr>
<td>Formation pressure</td>
<td>Force exerted by fluids in a formation</td>
</tr>
<tr>
<td>Gas injection well</td>
<td>A well into which gas is injected for the purpose of maintaining or supplementing pressure in reservoir and/or for gas storage.</td>
</tr>
<tr>
<td>Horizontal well</td>
<td>Deviation of a borehole from vertical so that the borehole penetrates a productive formation in a manner parallel to the formation.</td>
</tr>
<tr>
<td>Injection well</td>
<td>Well through which fluids are injected into an underground stratum which may increase reservoir pressure.</td>
</tr>
<tr>
<td>Intermediate Casing</td>
<td>The string of casing set in a well after the surface casing.</td>
</tr>
<tr>
<td><strong>kg</strong></td>
<td>Kilograms</td>
</tr>
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<tr>
<td><strong>Kick</strong></td>
<td>An entry of water, gas, oil or other formation fluid into the wellbore during drilling. It occurs because the pressure exerted by the column of drilling fluid is not great enough to overcome the pressure exerted by the fluids in the formation.</td>
</tr>
<tr>
<td><strong>km²</strong></td>
<td>Square kilometres</td>
</tr>
<tr>
<td><strong>lbs</strong></td>
<td>Pounds (avoirdupois)</td>
</tr>
<tr>
<td><strong>Leak-off test</strong></td>
<td>Progressive wellbore formation pressure test until leak-off to provide well integrity information.</td>
</tr>
<tr>
<td><strong>Liner</strong></td>
<td>String of pipe used to case open hole below existing casing.</td>
</tr>
<tr>
<td><strong>m</strong></td>
<td>Metres</td>
</tr>
<tr>
<td><strong>may</strong></td>
<td>Is used when a standard is recommended as part of good industry practice.</td>
</tr>
<tr>
<td><strong>mm</strong></td>
<td>Millimetre(s)</td>
</tr>
<tr>
<td><strong>MPa</strong></td>
<td>Megapascal(s)</td>
</tr>
<tr>
<td><strong>MSDS</strong></td>
<td>Material Safety Data Sheet</td>
</tr>
<tr>
<td><strong>must</strong></td>
<td>Is used when a standard is mandatory.</td>
</tr>
<tr>
<td><strong>MWD</strong></td>
<td>Monitoring While Drilling</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td>Any work conducted including rig moves, drilling, running and cementing casing, evaluation, completion, workover and abandonment.</td>
</tr>
<tr>
<td><strong>Packer</strong></td>
<td>Piece of downhole equipment that consists of a sealing device. Used to block the flow of fluids through the annular space between pipe and the wall of the wellbore.</td>
</tr>
<tr>
<td><strong>Petroleum tenure holder</strong></td>
<td>Reference should be made to definitions in Schedule 2 of the <em>Petroleum and Gas (Production and Safety) Act 2004</em> - refers to the holder of particular petroleum authorities (authorities to prospect and petroleum leases). Note: ‘holder’ includes each holder recorded as a holder for the tenure</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>pH</td>
<td>Index of acidity or alkalinity of water.</td>
</tr>
<tr>
<td>Plug</td>
<td>Any object or device that blocks a hole or passageway.</td>
</tr>
<tr>
<td>ppg</td>
<td>Pounds per US gallon</td>
</tr>
<tr>
<td>Production Casing</td>
<td>A casing string that is set across the reservoir interval and within which the primary completion components are installed.</td>
</tr>
<tr>
<td>Production zone</td>
<td>Hydrocarbon producing zone of the formation.</td>
</tr>
<tr>
<td>psi</td>
<td>Pounds per square inch.</td>
</tr>
<tr>
<td>Pumping Time</td>
<td>Calculated time to mix, pump and fully displace cement slurry.</td>
</tr>
<tr>
<td>Regulator</td>
<td>Chief Inspector, Petroleum and Gas</td>
</tr>
<tr>
<td>SCADA</td>
<td>System Control And Data Acquisition (usually a telemetry data and control system)</td>
</tr>
<tr>
<td>Seal</td>
<td>Cement mixture pumped into the bore.</td>
</tr>
<tr>
<td>shall</td>
<td>Is used when a standard is mandatory.</td>
</tr>
<tr>
<td>should</td>
<td>Is used when a standard is recommended as part of good industry practice.</td>
</tr>
<tr>
<td>SG</td>
<td>Specific gravity</td>
</tr>
<tr>
<td>Surface</td>
<td>A natural ground surface or the top of the BOP flange when installed.</td>
</tr>
<tr>
<td>Surface Casing</td>
<td>A drilled and cemented pipe used to provide blow-out protection, to seal off water/hydrocarbon sands, and prevent loss of circulation. Also used to seal off water sands, weak formations and/or lost circulation zones. In some cases surface and intermediate casing requirements are provided by the same string.</td>
</tr>
<tr>
<td>Well or wellhole</td>
<td>This includes production, exploration, appraisal wells, test holes, shot holes and gas injection wells. Gas monitoring wells are classed as exploration wells in this code. Wells may also be referred to as bores or borehole.</td>
</tr>
<tr>
<td>Well Control Equipment</td>
<td>Includes the BOP stack, BOP control system, full open safety valves, circulating hose (and circulating head), drillstring safety valves (inside BOPs), mud and cement pumps, the choke and kill lines and manifold, and all associated pipework and valves.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Wellhead</td>
<td>The system of spools, valves and associated adapters that provide pressure control for production.</td>
</tr>
<tr>
<td>Well Intervention</td>
<td>An operation carried out by re-entering an existing well.</td>
</tr>
<tr>
<td>Workover</td>
<td>Well procedure to perform one or more of a variety of remedial/maintenance operations on a producing well to maintain or attempt production increase. Examples of workover operations are pump repairs, well deepening, plugging back, pulling and resetting liners, squeeze cementing and re-perforating.</td>
</tr>
</tbody>
</table>
Appendix 2 – Industry standards

The following industry standards may be appropriate for the application of this code of practice (the list is not exhaustive and additional standards may be referenced from the appropriate web sites):

- API Recommended Practice 65-2, Isolating Potential Flow Zones During Well Construction
- API Guidance Document HF1, Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines
- API Recommended Practice 10D-2/ISO 10427-2, Recommended Practice for Centralizer Placement and Stop Collar Testing
- API Specification 5B, Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads
- API Specification 5CT/ISO 11960, Specification for Casing and Tubing
- API Specification 6A/ISO 10432, Specification for Wellhead and Christmas Tree Equipment
- API Specification 16A, Specification for Drill Through Equipment
- Code of Practice for coal seam gas wellhead emissions detection and reporting (DEEDI, 2011).
- API Specification 10A/ISO 10426-1 Specification for Cements and Materials for Well Cementing
- API Recommended Practice RP10B-2/ISO10426-2 Recommended Practice for Testing Well Cements

Petroleum tenure holders may also consider the following references, to manage well construction issues associated with the whole of life cycle requirements for CSG wells:

- API Recommended Practice 5A5/ISO 15463, Field Inspection of New Casing, Tubing, and Plain-end Drill Pipe
- API Recommended Practice 5B1, Gauging and Inspection of Casing, tubing and Line Pipe Threads
- API Recommended Practice 5C1, Recommended Practice for Care and Use of Casing and Tubing
- API Recommended Practice 5C5/ISO 13679, Recommended Practice on Procedures for Testing Casing and Tubing Connections
- API Recommended Practice 5C6, Welding Connections to Pipe
- API Recommended Practice 10B-5/ISO 10426-5, Recommended Practice on Determination of Shrinkage and Expansion of Well Cement Formulations at Atmospheric Pressure
- API Specification 10D/ISO 10427-1, Specification for Bow-Spring Casing Centralizers
- API Recommended Practice 10F/ISO 10427-3, Recommended Practice for Performance Testing of Cementing Float Equipment
- API Technical Report 10TR1 Cement Sheath Evaluation
- API Technical Report 10TR2, Shrinkage and Expansion in Oilwell Cements
- API Technical Report 10TR3, Temperatures for API Cement Operating Thickening Time Tests
- API Recommended Practice 13B-1/ISO 10414-1, Recommended Practice for Field Testing Water-Based Drilling Fluids
- API Recommended Practice 13D, Recommended Practice on the Rheology and Hydraulics of Oil-well Drilling Fluids
- API Recommended Practice 53, Blowout Prevention Equipment Systems for Drilling Operations
- API Recommended Practice 54, Occupational Safety for Oil and Gas Well Drilling and Servicing Operations
- API Recommended Practice 59, Recommended Practice for Well Control Operations API Specification 16C, Choke and Kill Systems
- API Specification 16D, Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
- API Specification 16RCD, Drill Through Equipment (Rotating Control Devices)
- API Specification 16ST, Coil Tubing Well Control Equipment Systems
- ANSI/API Specification 15LR, Low Pressure Fibreglass Line Pipe and Fittings
- ANSI/API Specification 15R, High Pressure Fibreglass Line Pipe
- ASTM D2310 - 06 Standard Classification for Machine-Made “Fibreglass” (Glass-Fibre-Reinforced Thermosetting-Resin) Pipe
- ASTM D2517 – 06 Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
- AS/NZS 1477-1999 PVC Pipes and Fittings for Pressure Applications
- AS 2634 – 1983 Chemical Plant Equipment – Made from Glass-Fibre Reinforced Plastics (GRP) Based on Thermosetting Resins
- ISO 1872-1: 1993, Polyethylene (PE) moulding and extrusion materials - Part 1: Designation system and basis for specifications

These standards and specifications must only be used if they do not contradict the mandatory requirements stipulated in this Code of Practice.
Appendix 3 – References

Minimum Construction Requirements for Water Bores in Australia

Minimum Standards for the Construction and Reconditioning of Water Bores that Intersect the Sediments of Artesian Basins in Queensland

Note: The above publications are available at –