

Audit Report

Origin Energy Condabri 2 Abandonment

August 2019

Published on DNRME
Disclosure Log Act 2009



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Summary

An audit was conducted by the Petroleum and Gas Inspectorate (PGI) in relation to the management of safety and health under the *Petroleum and Gas (Production and Safety) Act 2004* (the Act).

The audit was conducted during July-August 2019 in relation to the abandonment procedure of Condabri 2 for which Origin Energy is the operator. The abandonment procedure was assessed through the well abandonment report submitted on 17/04/2015 by Origin Energy after final cut and cap of the well was completed. The report is assessed under the requirements of section 38 of the Petroleum and Gas (Production and Safety) Regulation 2004, dated 1 January 2015, and the code of practice for constructing and abandoning coal seam gas wells and associated bores in Queensland Edition 2.0, dated October 2013, which were the legislation in force at the time of the abandonment work.

Of the 36 criteria in Section 38 of the Production and Safety Regulation, 21 were compliant, 2 were non-compliant and 13 were not applicable. Of the 9 mandatory criteria in section 6.9 of the construction and abandonment code, 8 were compliant, 0 were non-compliant and 1 was not applicable. Of the 4 good industry practice criteria in section 6.9 of the construction and abandonment code, 1 was compliant, 2 were non-compliant and 1 was not applicable.

A number of areas for improvement are noted in the report along with a request for a written plan within 20 business days of the below date for what has been, or will be implemented, to prevent similar non-compliances occurring in the future.

Dated at Brisbane, the 20th day of August, 2019.

s.73 irrelevant information

Bill Date

Chief Inspector Petroleum and Gas

Petroleum and Gas Inspectorate

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1 Introduction

In Queensland, petroleum and gas safety is regulated under the P&G Act and relevant subordinate legislation. One piece of subordinate legislation, the Petroleum and Gas (Safety) Regulation 2018 (Safety Regulation), establishes that drilling, converting and abandoning of petroleum wells, CSG wells and water bores must be carried out as per the construction and abandonment code (Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 1 dated 1 September 2018). The requirements for well abandonment are detailed under the construction and abandonment code with abandonment being fundamental in ensuring 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. Another piece of subordinate legislation, the Petroleum and Gas (General Provisions) Regulation 2017 (General Provisions Regulation), outlines the requirement for prescribed report including a well abandonment report (WAR).

An audit was conducted by the Petroleum and Gas Inspectorate in July-August 2019 in relation to the abandonment of Origin Energy's Condabri 2 well. The aim was to determine whether the Condabri 2 WAR complies with the General Provisions Regulation and that the abandonment procedure complies with the construction and abandonment code.

1.1 Description of Facility

Origin Energy operates the Condabri field (Petroleum Lease 265) which is east of Condamine, Queensland that produces CSG from the Walloons Coal Measures in the Surat Basin. Condabri 2 was drilled as an appraisal well for Authority to Prospect 702 to appraise the Condabri field for commercial production. The well was designed to core the Walloons Coal Measures reaching total depth of 924 mGL and remained an open hole with an intermediate casing to 551 mGL and surface casing down to 63 mGL. Origin Energy made the decision to abandon the well due to the old well design not meeting current requirements.

2 Audit Plan

At the time the audit was conducted the relevant legislative requirements for abandonment were:

- Section 2.2.9 the construction and abandonment code for well abandonment requirements.
- Section 37 of the General Provisions Regulation for the WAR requirement.

However, the abandonment work was conducted by Origin Energy in March 2015 and the WAR was submitted on 17/04/2015. The relevant code of practice at the time the abandonment work was conducted was the *Code of Practice for constructing and abandoning coal seam gas wells and associated bores in Queensland* (Version 2 October 2013) while the relevant regulation when the abandonment report was submitted was the Petroleum and Gas (Production and Safety) Regulation 2004 dated 1 January 2015 (Production and Safety Regulation). The audit was conducted against the relevant legislations in place at the time the work was conducted.

There was no material change in the regulation between when the report was submitted and the current legislation. The construction and abandonment code had some minor changes to the content in that time.

2.1 Scope and Objectives

The scope of the audit was to verify the WAR meets the requirements set out in section 37 of the General Provisions Regulation and that the abandonment procedure applied to Condabri 2 complies with the requirements in the construction and abandonment code. The objectives of this audit is to ensure that the following principles of good CSG well abandonment have been applied:

- isolate aquifers within the well from each other and from permeable hydrocarbon zones
- isolate permeable hydrocarbon zones within the well from each other unless commingling is permitted
- ensure there is no pressure or flow of hydrocarbons or fluids at surface both internally in the well and externally behind all casing strings
- recover/remove surface equipment so as to not adversely interfere with the normal activities of the owner of the land on which the well or bore is located.

The specific criteria assessed in the audit are detailed in Section 3.1 of this report.

2.2 Participants

The following persons participated in the audit:

Audit team

Role	Name	Position
Team leader	Michael Scott	Principal Inspector (wells)
Team member	s.73 irrelevant information	
Reviewer	Bill Date	Chief Inspector

Auditee's personnel

Role	Name	Position
Nominated representative	s.73 irrelevant information	
Nominated representative		

2.3 Activities

The audit was conducted as follows:

Date	Location	Activity
4 July 2019	Correspondence	Audit initiation letter sent to Origin Energy
July-August 2019	s.73 irrelevant information	Conducted audit and prepare report
19 July 2019	Correspondence	Request for additional information
1 August 2019	Correspondence	Origin request for an additional week to respond
9 August 2019	Correspondence	Origin response to request for additional information
13 August 2019	Correspondence	Follow up response from Origin to request for additional information
19 August 2019	Correspondence	Send out preliminary report
20 August 2019	s.73 irrelevant information	Close out meeting
20 August 2019	Correspondence	Send out final report

3 Well Abandonment Report Review

The audit consisted of a review of the operator's WAR document submitted to QDEX after abandonment of Condabri 2 was completed. In addition, the implementation of the processes detailed in the document were qualitatively investigated. The submitted WAR consists of the following data:

- A summary of the well abandonment report including a well card, drilling and completions summary, post abandonment well schematic and a geological summary
- Appendix 1 – A location map, showing the location of Condabri 2
- Appendix 2 – Daily completions and workover reports detailing the process of P&A dated from 20/03/2015 – 22/03/2015
- Appendix 3 – A diagram of the Surat Basin Stratigraphy
- Appendix 4 – Well completion report summarising the details of the completed well after initial drilling and completions were completed including a schematic of the well design.
 - WCR Appendix 1 – Daily drilling reports dated from 02/11/2007 – 21/11/2007
 - WCR Appendix 2 – Well location survey
 - WCR Appendix 3 – Drill Stem Test reports for Condabri 2
- Appendix 5 – Cementing service reports for the plugs

Origin Energy also provided additional information that was not available in the data that had been submitted to Queensland Digital Exploration Reports System (QDEX). This was requested by the PGI after an initial review of the WAR. This included a copy of the Condabri 2 well program.

A summary of the findings of the audit are provided in **Section 3.1**.

3.1 Evidence and related findings

3.1.1 The following findings were identified against section 38 of the Production and Safety Regulation.

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Section			Requirement	Compliance	Compliance of the updated abandonment report post the PGI audit review	Comments/Findings
(1)			If a petroleum well or bore is plugged and abandoned, the relevant petroleum authority holder must lodge a well or bore abandonment report—			
	(a)		for a petroleum well or bore that is plugged or abandoned before the rig release day for the well or bore—with the well or bore completion report for the well or bore required under section 37; or	N/A	N/A	
	(b)		otherwise—not later than 2 months after the completion day.	Compliant	Compliant	Abandonment work was completed on 22 nd March 2015 and the report was submitted on 17 th April 2015.
(2)			The report must contain each of the following—			
	(a)		on the first page, each of the following details—			
		(i)	the type and number of the relevant petroleum authority;	Compliant	Compliant	
		(ii)	the identifying name of the well or bore;	Compliant	Compliant	
		(iii)	the name of the author of the report;	Compliant	Compliant	
		(iv)	the name of the authority holder;	Compliant	Compliant	
		(v)	the name of the operator of the well or bore;	Compliant	Compliant	
		(vi)	the name of the person submitting the report;	Compliant	Compliant	
		(vii)	the date of the report, in day-month-year format;	Compliant	Compliant	
	(b)		a summary and history of the well or bore, including a location map and the date on which a well or bore completion report for the well or bore was lodged;	Compliant	Compliant	Possible area for improvement is adding in some additional information into the well summary and history. This includes a history of workovers and other similar activity conducted on the well and the amount of gas and water produce by the well. A brief explanation of why the well was abandoned was provided which is good.
	(c)		the following details about the well or bore—			

	(i)	its total depth in metres;	Compliant	Compliant	
	(ii)	the position at the top and bottom, expressed as required under subsection (3), and the thickness, of any of the following intersected by the well or bore— (A) a coal seam; (B) a natural underground reservoir; (C) an aquifer;	Compliant	Compliant	
	(iii)	the depth in metres of any perforations in the casing of the well or bore;	Compliant	Compliant	
	(iv)	the type of drilling rig used to drill the well or bore;	Compliant	Compliant	
(d)		if stimulation of a coal seam was carried out in the well or bore under the relevant petroleum authority, the matters stated in subsection (4);	N/A	N/A	
(e)		all surveys and measurements made in the well or bore, including any detailed interpretation of a survey or measurement;	Non-Compliant	Non-Compliant	Multiple surveys and measurements were not submitted. These include the cement bond log (CBL), the gyro survey and the cementing report for the 3 cement plugs that were set when the well was drilled and subsequently left in hole as part of the abandonment. The CBL and gyro survey were provided in an updated report but the cementing report was not.
(f)		in relation to the completion or abandonment of the well or bore, each of the following—			
	(i)	details of the casing and equipment installed in the well or bore, with diagrams showing the major dimensions and features of the casing and equipment;	Compliant	Compliant	

		(ii)	a full description of all equipment, including prescribed equipment, that is retained in the well or bore, including the size and nature of the equipment and any features of the equipment that may cause a hazard to coal mining operations; Example of features that may cause a hazard to coal mining operations— aluminium, electronics or batteries	Compliant	Compliant	
		(iii)	the surveyed location of any prescribed equipment;	Compliant	Compliant	
		(iv)	the method of the cementing operations carried out in or on the well or bore, including the location and type of plugs, the intervals covered, the volume and type of cement used, any losses of cement due to voids or permeable strata, and the methods used to overcome losses of cement;	Compliant	Compliant	
		(v)	the method, materials and volume of cement used to cement voids;	Compliant	Compliant	
		(vi)	a description of any other abandonment procedures used for the well or bore;	Compliant	Compliant	
		(vii)	any other details of the activities undertaken in drilling, completing and plugging and abandoning the well or bore, including an assessment of their possible impacts, that would assist a person in making an assessment of potential risks to safe and efficient mining of coal.	Non-Compliant	Non-Compliant	No details provided regarding an assessment of potential risks to safe and efficient mining of coal. The revised report stated that no additional activities were undertaken. This still does not address the requirements e.g. there is no assessment of the possible impact from the use of and leaving steel casing in-situ post abandonment.

(3)		For subsection (2)(c)(ii), the position at the top and bottom of the coal seam, natural underground reservoir or aquifer must be identified in relation to—	Compliant	Compliant	
	(a)	for a directional well—			
		(i) total vertical depth in metres; and	N/A	N/A	
		(ii) the horizontal plane; or	N/A	N/A	
	(b)	otherwise—the depth in metres.	Compliant	Compliant	
(4)		For subsection (2)(d), the matters are each of the following—			
	(a)	the depth in metres of the top and bottom of the interval over which the stimulation was carried out;	N/A	N/A	
	(b)	a description of the equipment used to carry out the stimulation;	N/A	N/A	
	(c)	for the interval mentioned in paragraph (a), a graphic representation of each of the following—			
		(i) casing pressure with time;	N/A	N/A	
		(ii) calculated bottom hole pressure with time;	N/A	N/A	
		(iii) slurry rate with time;	N/A	N/A	
		(iv) proppant concentration with time;	N/A	N/A	
		(v) calculated bottom hole concentration with time;	N/A	N/A	
	(d)	any record made about the stimulation by the person who carried it out;	N/A	N/A	
	(e)	any other details about the stimulation that would assist a person in making a future assessment of the impact of the stimulation on the coal seam and any increased risk to safe and efficient mining of coal.	N/A	N/A	

3.1.2 The following findings and related evidence were identified against the mandatory requirements listed in the Code of Practice relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	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.	Compliant	<ul style="list-style-type: none"> APLNG have provided a downhole diagram post abandonment showing position and size of the plugs on page 3 of the abandonment report. Workover and completion reports provided in Appendix 2 and 4 of the abandonment report have details of the cement plugging procedure 	The well has been cemented to surface and has isolated all the hydrocarbon production zones and aquifers. It is considered that it is sealed sufficiently as to prevent leaks of gas and water.
2	A horizontal well must be abandoned as per the requirements in Schedule 3 Part 4, section 11 of the P&G Regulation.	N/A		Condabri 2 is a vertical well.
3	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.	Compliant	<p>Cement was used as the primary sealing material for all plugs as stated in the documentation. Cement composition provided on page 2 of the well abandonment report.</p> <p>Origin provided the service company cement service reports and this was also included in Appendix 5 of the updated version of the well abandonment report. This includes lab analysis and testing of the cement slurry.</p>	

4	<p>For Production Wells</p> <ul style="list-style-type: none"> the well is to be abandoned by cementing from total depth to surface or a cement plug must be set inside the casing as close as practical above the uppermost hydrocarbon production zone. The plug must be pressure tested to 500 psi above the estimated leak off pressure. Where the plug is not cemented to surface, plug must also be tagged with a minimum 2000lb (1000kg) set down weight. 	Compliant	<ul style="list-style-type: none"> APLNG have provided a downhole diagram post abandonment showing position and size of the plugs on page 3 of the abandonment report. Workover and completion reports provided in Appendix 2 and 4 of the abandonment report have details of the cement plugging procedure 	The downhole diagram and individual cement job locations provided by APLNG show that the well is cemented from total depth to surface.
5	<p>For Exploration Wells</p> <ul style="list-style-type: none"> the well is to be abandoned by cementing from the total depth to the surface or a cement plug must be set across the open hole section inside the lowermost casing shoe. This plug must be pressure tested to 500 psi (3.5MPa) above the estimated leak off pressure. Where the plug is not immediately cemented to the surface, the plug must also be tagged with a minimum 2000 lb (1000 kg) set down weight 	Compliant	As per Criteria 4 of this table.	As per Criteria 4 of this table.
6	<p>For all wells</p> <ul style="list-style-type: none"> there must be a minimum of two adjacent cement barriers across all formations above the uppermost hydrocarbon zone the innermost casing string must be filled to surface with cement 	Compliant	<ul style="list-style-type: none"> APLNG have provided a well design schematic and a post abandonment well diagram showing the cement depths and heights in appendix 4 and page 3 of the abandonment report respectively. Workover and completion reports provided in Appendices 2 and 4 of the abandonment report have details of the cement plugging procedure 	The diagram shows two continuous cement barriers including the cementing behind the surface and intermediate casing as well as the cement plugging to surface.

7	BOPs and/or the 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	Compliant	Workover reports provided in Appendix 2 of the abandonment report have details of the cement plugging procedure for plug.	BOPs were removed post wait on cement and tagging of the cement plug as found in Workover report dated 22/03/2015.
8	Wellheads must be removed, and casing string(s) must be cut minimum 1.5m below surface. A wellhead marker plate must be installed as per legislative requirement	Compliant	Workover reports provided in Appendix 2 of the abandonment report have details of the cement plugging procedure for plug. Origin provided the abandonment program which details the requirements for this criteria.	<ul style="list-style-type: none"> • Workover report dated 22/03/2015 mentions digging around well to the desired cutting depth, although the cutting depth is not specified anywhere in the abandonment report. • Workover report dated 22/03/2015 mentions welding an informational plate to the casing but no information regarding whether or not it meets legislative requirements and what information is on the plate is available in the abandonment report.
9	Complete and accurate records of the entire abandonment procedure must be kept, submitted as part of the Well Abandonment Report once final cut and cap has been completed	Compliant	Abandonment report submitted after final cut and cap was completed. Includes quick summary with diagrams, location map, Surat Basin stratigraphy daily drilling, workover and completions reports, DST results and cement job reports	See areas for improvement.

The following findings and related evidence were identified against the good industry practice for the requirements listed in the Code of Practice relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	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).	Non-Compliant	3 cement plugs were set at the time of drilling. The cementing report from this is not available.	
2	If no caliper data is available, 20–30% above theoretical volume or local knowledge should be used.	Non-Compliant	As above.	
3	A 50 m weighted high-vis pill should be spotted below each cement plug that is not set directly above a physical barrier.	N/A	Cement plug set during drilling in November 2007 was set to TD with each subsequent pug above set on top of cement.	
4	Plugs should normally be a minimum of 45 m in length (height). In general cement plugs should not exceed 150 m in length. If the hole is badly washed out, it may be better to set two short plugs over the washed out section than to try to cover this interval with one plug.	Compliant	WCR plugs All three plugs are >45m and <150m. (Plug 1 - 80m, Plug 2 - 110m and Plug 3 - 46m) WAR plugs Plug 1 - 509-629m - 120m Plug 2 - surface-509m - >150m but set with coil tubing	

4 Conclusions

The submitted well abandonment procedure for Condabri 2 was audit against the requirements for the abandonment of wells as per Section 38 of the Petroleum and Gas (Production and Safety) Regulation 2004 dated 1 January 2015 and Section 6.9 of the *Code of Practice for constructing and abandoning coal seam gas wells and associated bores in Queensland* (Version 2 October 2013).

Of the 36 criteria in Section 38 of the Production and Safety Regulation, 21 were compliant, 2 were non-compliant and 13 were not applicable. The two criteria the audit found the submitted abandonment report to be non-compliant with were:

- Section 38 (2) (e) – all surveys and measurements made in the well or bore, including any detailed interpretation of a survey or measurement;
- Section 38 (2) (f) (vii) – any other details of the activities undertaken in drilling, completing and plugging and abandoning the well or bore, including an assessment of their possible impacts, that would assist a person in making an assessment of potential risks to safe and efficient mining of coal.

The PGI requests that Origin provide a written plan within 20 business day of this signed report, for what has been or will be implemented, to prevent similar non-compliances occurring in the future. The PGI notes that an updated revision of the abandonment report was prepared post the initial audit review and the PGI recommends that this be submitted to QDEX (if not already done). The PGI also recommend that if the cement report is located then this should be incorporated and that when access to site is organized then photos of the site should be taken, provided to the PGI and also incorporated in a revised abandonment report.

Of the 9 mandatory criteria in Section 6.9 of the construction and abandonment code, 8 were compliant, 0 were non-compliant and 1 was not applicable.

Of the 4 good industry practice criteria in Section 6.9 of the construction and abandonment code of practice 1 was compliant, 2 were non-compliant and 1 was not applicable. The non-compliance was due to the fact that the cementing report conducted during the drilling of the well was not provided and could not be located. The PGI cannot speculate on whether, if the unavailable information were to be provided, whether the work would be compliant with the good industry practice criteria.

As per the Petroleum and gas reporting guidelines dated October 2018 available on the DNRME website it is recommended that all appropriate information is provided in the well abandonment report to address all requirements under the construction and abandonment code of practice. Examples from this audit where compliance with the construction and abandonment code could not be confirmed based of the information submitted in the well abandonment report include:

- Information addressing cement testing criteria
- Information confirming wellhead marker plate details and the depth of the cut casing below surface

It is also highly recommended that photos are taken before, during and after the cut and cap process, including the marker plate used, with these photos incorporated into the submitted abandonment report.

As a result of the audit process, other areas for improvement identified were:

- Ensuring that the regulation requirements are addressed directly in the abandonment report for clarity e.g. noting that no prescribed equipment was surveyed.
- Errors such as where it is stated “NA” under wireline but a CBL was conducted.

- Adding the abandonment program as an appendix to the submitted abandonment report, especially when the daily reports in the abandonment report refer to it. This is much more relevant than adding the well completion report as an appendix which separately needs to be submitted to QDEX anyway.
- Providing additional information in the well summary and history e.g. a history of workovers and other similar activity conducted during the well life and the amount of gas and water produce by the well.

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Appendix 1 – Abbreviations, Terms and Definitions

Abbreviation/Term	Definition
Construction and abandonment code	The document called 'Code of practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland', published on a Queensland Government website and current version 1 dated September 1 2018
P&G Act	Petroleum and Gas (Production and Safety) Act 2004
General Provisions Regulation	Petroleum and Gas (General Provisions) Regulation 2017
Safety Regulation	Petroleum and Gas (Safety) Regulation 2018
Production and Safety Regulation	Petroleum and Gas (Production and Safety) Regulation 2004
PGI	Petroleum and Gas Inspectorate
P&A	Plugging and Abandoning
WAR	Well Abandonment Report
CSG	Coal seam gas

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Audit Report

QGC Kenya East 166 Abandonment Procedure

August 2019

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Summary

An audit was conducted by the Petroleum and Gas Inspectorate (PGI) in relation to the management of safety and health under the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act).

The audit was conducted during July and August 2019 in relation to the abandonment procedure for Kenya East 166 for which QGC is the operator. The audit was conducted against the requirements of Section 37 of the *Petroleum and Gas (General Provisions) Regulation 2017* (P&G Regulation) and Section 2.2.9 of the Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 1 dated 1 September 2018 (the Code of Practice). The abandonment report issued by QGC Pty Ltd (QGC) on 30 January 2019 (Document no. QCOPS-BB09-WEL-RPT-000001) was predominately used to conduct the audit.

Of the 39 criteria in Section 37 of the General Provisions Regulation, 25 were compliant, 1 was non-compliant and 13 were not applicable. Of the 20 mandatory criteria in Section 2.2.9 of the construction and abandonment code, 16 were compliant, 0 were non-compliant and 4 were not applicable.

A number of areas for improvement are noted in the report and it is recommended that these be addressed with an updated report submitted to QDEX by the end of September 2019.

Dated at Brisbane, the 26 day of August, 2019.

s.73 irrelevant information

Bill Date

Chief Inspector Petroleum and Gas

Petroleum and Gas Inspectorate

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1 Introduction

In Queensland, petroleum and gas safety is regulated under the P&G Act and relevant subordinate legislation. One piece of subordinate legislation, the Petroleum and Gas (Safety) Regulation 2018 (Safety Regulation), establishes that drilling, converting and abandoning of petroleum wells, CSG wells and water bores must be carried out as per the construction and abandonment code (Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 1 dated 1 September 2018). The requirements for well abandonment are detailed under the construction and abandonment code with abandonment being fundamental in ensuring 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. Another piece of subordinate legislation, the Petroleum and Gas (General Provisions) Regulation 2017 (General Provisions Regulation), outlines the requirement for prescribed report including a well abandonment report (WAR).

An audit was conducted by the Petroleum and Gas Inspectorate in July 2019 in relation to the abandonment of QGC's Kenya East 166 well. The aim was to determine whether the Kenya East 166 WAR complies with the General Provisions Regulation and that the abandonment procedure complies with the construction and abandonment code.

1.1 Description of Well

QGC along with its joint venture partners produce over 60% of Queensland's domestic gas demand. Kenya East 166 is a coal seam gas development well operated by QGC, in Petroleum Lease (PL) 278. The aim of the well was to target, evaluate and produce coal seam gas out of the Walloon Subgroup Coal Measures. The well was drilled to 761m MDRT and encountered coals in the Walloon Subgroup. The abandonment of the well was completed on 16 January 2018 and the subsequent abandonment report issued on 30 January 2019.

2 Audit Plan

The audit was conducted against the requirements for the abandonment of wells, bores and other drill holes as per Section 2.2.9 of the construction and abandonment code and Section 37 of the General Provisions Regulation.

2.1 Scope and Objectives

The scope of the audit was to verify the WAR meets the requirements set out in section 37 of the General Provisions Regulation and that the abandonment procedure applied to Kenya East 166 complies with the requirements in the construction and abandonment code. The objectives of this audit is to ensure that the following principles of good CSG well abandonment have been applied:

- isolate aquifers within the well from each other and from permeable hydrocarbon zones
- isolate permeable hydrocarbon zones within the well from each other unless commingling is permitted
- ensure there is no pressure or flow of hydrocarbons or fluids at surface both internally in the well and externally behind all casing strings

- recover/remove surface equipment so as to not adversely interfere with the normal activities of the owner of the land on which the well or bore is located.

The specific criteria assessed in the audit are detailed in Section 3.1 of this report.

2.2 Participants

The following persons participated in the audit:

Audit team

Role	Name	Position
Team leader	Michael Scott	Principal Inspector (wells)
Team member	Dawood Paracha	Graduate Engineer
Reviewer	Bill Date	Chief Inspector

Auditee's personnel

Role	Name	Position
Nominated representative	s.73 irrelevant information	

2.3 Activities

The audit was conducted as follows:

Date	Location	Activity
4 July 2019	Correspondence	Audit initiation letter sent to QGC
July-August 2019	s.73 irrelevant information	Conduct audit and complete an audit report
16 July 2019	Correspondence	Request for additional information
30 July 2019	Correspondence	Response from QGC to request for additional information
7 August 2019	Correspondence	Send out preliminary report
8 August 2019	s.73 irrelevant information	Meeting to discuss audit findings
23 August 2019	Correspondence	Additional information provided by QGC
26 August 2019	Correspondence	Send out final report

3 Well Abandonment Procedure Review

The audit consisted of a review of the operator's submitted abandonment procedure and associated documentation for Kenya East 166. The following documents were received from the operator as part of the audit:

- Kenya East 166 Well Abandonment Report [QCOPS-BB09-WEL-RPT-000004]
- Initial response to request for additional information including Appendices 1 to 6.
 - Appendix 1 – Response to queries
 - Appendix 2 – Cement program
 - Appendix 3 – Cement report (provided in the well abandonment report also)
 - Appendix 4 – Slurry laboratory results
 - Appendix 5 – Snap shot of a daily report from the 26th of February 2015 showing results from a gas test conducted at the well

- Appendix 6 – Cut and cap works docket and job description from the 16th of January 2018
- Additional information provided post the meeting to discuss the audit findings on the 8th of August 2019.
 - Appendix 1 – Kenya #166 Well Abandonment Audit Response
 - Attachment 2 – Photos and generic wellhead removal and final abandonment
 - Attachment 3 – Cement procedures

A summary of the findings of the audit are provided in **Section 3.1**

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3.1 Evidence and related findings

The following findings and related evidence were identified against the mandatory requirements of Section 2.2.9 of the Code of Practice:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	Any well, bore or drill hole that is to be abandoned shall be sealed and filled in such a manner to prevent leakage of gas and/or water.	Compliant	<ul style="list-style-type: none"> Section 1 of the report states that the well has been plugged and abandoned as per the Code of Practice. Cement Bong Log provided in Appendix B shows a satisfactory quality of cement bond to prevent gas and/or water leakage. 	The abandonment procedure is generally compliant with legislative and code of practice requirements.
2	A horizontal well must be abandoned containing a slotted liner that is not made of steel, including for example, a slotted PVC liner.	Not Applicable		Kenya East 166 is a vertical well.
3	<p>Cement shall be used as the primary sealing material. Cement testing should be carried out as per requirements set out in 2.2.3 of the Code.</p> <p>Section 2.2.3 of the Code of Practice provides for the following relevant cement testing:</p> <ul style="list-style-type: none"> Cement laboratory testing, with minimum ultimate compressive strength of 500 psi (3.5 MPa) Free water test to ensure free water content of the cement is less than 2% 	Compliant	<ul style="list-style-type: none"> Well Plug & Abandonment Plan provides cement as the primary sealing material. Schematic diagrams provided in Well Plug & Abandonment Plan shows surface and production casing are cemented to surface. 13.6 barrels of cement returned to surface for the surface casing. 17.1 barrels of cement returned to surface for the production casing. End of well cement report in Appendix C does not provide a compressive strength and free water test result. <p>QGC provided additional information which included:</p> <ul style="list-style-type: none"> Kenya East 166 Cementing Program which includes a UCA chart including compressive strength. 	<p>It is recommend that sufficient information is provided in the well abandonment report to address this criteria. This may include submitting the cement program as an attachment with the abandonment report.</p> <p>The laboratory test provided containing the free water test was from April 2017. Information on how often laboratory and onsite tests are conducted is requested.</p>

			<ul style="list-style-type: none"> Lab results for Kate 116 dated 4th April 2017. This indicated a test which contained 0% free fluid 	
4	<p>Prior to commencing abandonment, the Operator must confirm the absence of pressure/flow externally behind all casing strings. This requires a surface casing vent flow test to determine if hydrocarbons, liquid, or any combination of substances is escaping from the casing vent assemblies.</p>	Compliant	<p>The Well Abandonment Report provides no evidence of a surface casing vent flow test. QGC provided additional information which included:</p> <ul style="list-style-type: none"> An explanation that gas tests are performed on wells prior to the commencement of any workovers in accordance with QGC's workover procedure Snap shot of a daily report from the 26th of February 2015 showing results from a gas test conducted at the well Explanation that QGC has adopted standard well abandonment forms since 2018, which include details of leak tests and pressure data. 	<p>It is recommended that a summary of the specific gas tests that have been conducted to confirm the absence of pressure/flow externally behind all casing strings and to meet the surface casing vent flow test criteria is provided in the well abandonment report. This may involve attaching the completed abandonment form when the well abandonment report is submitted.</p>
5	<p>Sucker rods, pump and tubing (unless used as a sacrificial stinger) and any other debris in the well or bore that can practicably be removed are removed.</p>	Compliant	<p>Daily abandonment reports in Appendix A states the removal of downhole equipment and tubing.</p>	
6	<p>There must be a continuous cement barrier with a minimum 30 m length adjacent to the impermeable formation (cap rock) overlying the uppermost hydrocarbon zone.</p>	Complaint	<ul style="list-style-type: none"> Kenya East Well Plug & Abandonment Plan provides schematic diagrams for well abandonment showing a continuous cement barrier of 370 mKB from the surface to the top of the Walloon Coal Measures. Cement barriers of 179 mGL overlying the uppermost hydrocarbon zone 	<ul style="list-style-type: none"> Hydrocarbon zones to be isolated are Springbok Sandstone and Walloon Coal Measures. The top of the hydrocarbon zones to be isolated is at a depth of 179 mGL.

7	<p>There must be a minimum of two adjacent cement barriers across all aquifers above the uppermost hydrocarbon production zone. This can be achieved by the following:</p> <ol style="list-style-type: none"> i. Having the surface casing set below the aquifer and cemented to surface and the production casing cemented from 30 m below the base of the lowermost aquifer to 30 m above the uppermost aquifer. In cases where the production zone is less than 30 m below the lowermost aquifer, casing is to be cemented from as low as practical below that aquifer. ii. Fully cementing the inner most casing string from the production zone to the surface provided the cement plug(s) are adjacent to good annulus cement iii. If production casing has not been cemented with an overlap inside the surface casing shoe the operator must remediate the well until the required barriers are achieved. This could involve removing the production casing above the cement top if technically and commercially feasible to do so or performing remediation cement squeezes. Cement top up jobs are not an approved method of remediation unless isolation can be confirmed with cement bond logs 	Compliant	<p>Well Plug & Abandonment Plan provides the following two cement plugs:</p> <ol style="list-style-type: none"> I. Cement plug # 2 is from 10 mKB to 180 mKB II. Cement plug # 1 is from 180 mKB to 370 mKB <p>The well was then topped up with a pre-mix cement mixture.</p> <p>The top of the Walloon Coal Measures (as picked by QGC) is at 358.6mGL = 363.1mKB with the ECP set at 376.19-378.78mKB. The bridge plug used to set cement plug 1 on was set at 370mKB.</p> <p>The sector bond log run in January 2018 and the cement bod log petrophysical interpretation provided in Appendix B of the well abandonment report confirm sufficient cement quality.</p>	
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8	Pre-existing mineral exploration drill holes that are fully uncased must be cleaned out to total depth or Hang-Up-Depth and fully cemented to surface	Not Applicable	Kenya East 166 is not a pre-existing mineral exploration drill hole and is fully cased.	
9	Cement plugs shall not exceed 200m in length unless installed with coil tubing or sacrificial stinger. A 50m weighted high-vis pill must be spotted below each cement plug that is not set directly above a physical barrier	Compliant	Well Abandonment Report Section 3 provides that: <ul style="list-style-type: none"> • Cement plug # 2 is from 10 mKB up to 180 mKB. • Cement plug # 1 is 180 mKB up to 370 mKB. 	Both cement plugs are set directly above a physical barrier and do not require a 50m weighted high-vis pill
10	Cement plugs for decommissioning must meet the minimum requirements as detailed in the 2.2.9.2.1 of this Code and consider the following: Abandonment plug requirements and verification methods : <ol style="list-style-type: none"> The preferred method where possible is to cement inner casing string to surface. Consecutive stacked cement plugs set inside casing do not require additional tagging provided initial verification method is performed. If unable to achieve the required 1000 kg set down weight (e.g. plug is too shallow or coil tubing is used) the minimum force with which plugs must be verified is maximum string weight. Note: that the use of slick-line of wireline is not an approved method of verifying the tops of plugs. 	Compliant	Section 3 of the Well Abandonment Report provides the following to meet this criteria: <ul style="list-style-type: none"> • Cement barriers of 179 mGL to surface overlying the uppermost hydrocarbon zone • Bridge plug set at 370 mKB is pressure tested to 1500 psi and tagged to 2.2 klb. 	For a cased hole, section 2.2.9.2.1 of the requires the following: <ul style="list-style-type: none"> • Cement plugs must provide coverage to surface or at least 30 m overlap with the impermeable formation overlying the uppermost hydrocarbon zone. • Verified cement plugs must also be place to provide minimum 30 m coverage above aquifers unless these are already isolated by two cemented casing strings. • Cement plug supported by a pressure tested mechanical barrier must be verified by tagging the mechanical barrier or top of the cement plug with a minimum 1000 kg set down weight.
11	Plugs that do not pass pressure testing must be remediated until requirements are achieved as noted below:	Not Applicable		Section 3 provides that bridge plug is tested to 1500 psi and tagged to 2.2 klb.

	<ul style="list-style-type: none"> i. If sufficient depth is available to meet requirements an additional cement plug may be installed and re-tested ii. For failed mechanical barriers an additional mechanical barrier may be installed and re-tested iii. If insufficient depth is available the plug(s) will have to be circulated or drilled out. The plug(s) must then be rerun and pressure tested. 			
12	<p>Plugs that are confirmed as too low or too high after tagging are unacceptable. The Operator must remediate until requirements are achieved as noted below.</p> <ul style="list-style-type: none"> i. A plug is too low if it has a top less than 15 vertical meters above the zone it was intended to cover. Such a plug must be built up to required depth and its location confirmed. ii. High plugs must be drilled out if the theoretical plug base is less than 15 vertical meters below the base of the zone it was intended to cover. The plug must be re-cemented and its location confirmed 	Not Applicable		No remediation required since plugs satisfy criteria 6 and 7 of this table
13	BOPs and/or the 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	Compliant	Daily abandonment reports in Appendix A state that the bridge plug was pressure tested and tagged on 5 January 2018 prior to BOP and wellhead removal.	
14	Water based fluid mixed with Biocide, oxygen scavenger and/or corrosion inhibitor shall be left in the wellbore	Compliant	Daily abandonment report for 16 January 2018 in Appendix A provides that production casing is topped up with a pre-mix. No composition of	It is recommended that all relevant information is provided in the well

	above the top most cement plug and in-between cement plugs if the well is not cemented to the surface		<p>the premix is mentioned to determine compliance with this criteria.</p> <p>QGC provided additional information that the pre-mix is a Class A concrete powder and water. In addition to this the cut and cap works docket and job description from the 16th of January 2018 was provided to verify the pre-mix cement composition.</p>	abandonment report to confirm compliance with this criteria.
15	Prior to conducting a surface abandonment, the Operator must confirm the absence of pressure/flow internally within the well and externally behind all casing strings. Wells with no history of external flow/pressure may be cut and capped immediately. All other wells must be monitored for a minimum of 6 months prior to conducting surface abandonment.	Compliant	<p>Well abandonment summary provided in Table 1 of the Well Abandonment Report provides that Kenya East 166 has had no history of flow/pressure behind the casing.</p> <p>In the absence of pressure/flow history behind the casing, monitoring of the well is not required under the Code of Practice.</p> <p>Also see criteria 4 above.</p>	See criteria 4 above.
16	A surface cement plug of minimum 10m in length must be placed on top of the casing	Compliant	Section 3 provides that plug # 3 of 10 mKB is installed.	
17	Wellheads must be removed, and casing string(s) must be cut minimum 1.5m below surface	Compliant	Section 2.2 Well History states compliance with this requirement.	
18	The well must be capped below the surface across all casing strings with a steel marker plate that is fastened and installed to prevent pressure build up within the casings and restricting access to the casing strings at surface	Compliant	<p>Section 2.2 Well History states the following in regards to this requirement:</p> <ul style="list-style-type: none"> • Capped innermost casing string • Laid marker tape <p>All casing strings are to be capped not just the innermost string and a marker plate is to be fastened to the casing.</p> <p>An additional response was provided on the 23rd August 2019 which included a photo depicting a generic marker plate used by QGC for its abandonments.</p>	It is highly recommended that photos are taken before, during and after the cut and cap process, including the marker plate used and surface signage. These photos should be incorporated into the submitted abandonment report. It is noted that QGC's latest abandonment template addresses this.

19	<p>The steel marker plate must be installed as per legislative requirements:</p> <ol style="list-style-type: none"> i. the identifying name of the well or bore ii. the total depth in metres of the well or bore iii. the date the well or bore was abandoned. 	Compliant	<p>Section 2.2 Well History provides that a well sign was installed during the wellhead upper abandonment activity. It is unclear where the well sign was installed and if this is the required steel marker plate with the appropriate requirements.</p> <p>An additional response was provided on the 23rd August 2019. This included a photo of the surface signage at Kenya East 166.</p>	See criteria 18.
20	<p>Complete and accurate records of the entire abandonment procedure must be kept and submitted as part of the Well Abandonment Report once final cut and cap has been completed</p>	Compliant	<p>Well Abandonment Report includes the following to comply with this criteria:</p> <ul style="list-style-type: none"> • Daily abandonment reports • Cement Bong Log • End of well cement report 	

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The following findings and related evidence were identified against the good industry practice requirements of Section 2.2.9 of the Code of Practice:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	Use of an integrated open-hole volume calculated from a calliper on a wireline log to calculate cement volumes where possible (this applies mostly to exploration wells which are to be plugged and abandoned).	Not applicable	Open-hole log run on initial drill. Open-hole section behind	
2	If no calliper data is available, 20–30% above theoretical volume calculated from nominal casing diameter and gauge hole size should be used, along with local hydrogeological knowledge and offset well data.	Not applicable		
3	Plugs should normally be a minimum of 30 m in length (height). If the hole is badly washed out, it may be better to set two short plugs over the washed out section than to try to cover this interval with one plug.	Compliant	Plugs are greater than 30m.	
4	After placement of a cement plug the rate to pull the work string should be controlled to avoid intermixing of the plug and other fluids in the hole.	Compliant	Extract from the job procedure with the pull rate supplied on the 23 rd of August 2019.	
5	Excess cement should be used when placing plug and circulated off the top of the plug to minimise contamination issues.	Compliant		
6	Work string wiper dart/balls should be used to separate cement and fluids during placement. If wiper darts are used a catcher sub should be included in the work-string.	Compliant	While balls/darts were not used to separate fluid and cement in the abandonment, QGC provided the procedures that are implemented which provided an alternate means of compliance.	

7	Displacement rates during cement plug placement should be kept as high as possible without exceeding the open-hole fracture gradient. This aids in the displacement of the wellbore fluids by the spacer and cement flowing up the annulus. Spacer volumes should be adjusted to provide adequate contact time based on the estimated displacement rate.	Compliant	Open-hole fracture gradient not an issue as bridge plug isolating the formation. Cement pumped at 4bpm.	
8	The Wait on Cement (WOC) time for tagging should be based on the pre-job lab testing of the slurry at BHST, preferably on an Ultrasonic Cement Analyser (UCA). Typically the time to 500 psi compressive strength is adequate for tagging cement. If the cement plug does not take weight, it is recommended to increase WOC in 4 hours increments up to a maximum of 12 hours additional WOC time.	Not applicable	Cement plug run to surface and not tagged.	

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The following findings were identified against Section 37 of the General Provisions Regulation:

Section		Requirement	Compliance	Comments/Findings
(2)		If the tenure holder or authority holder plugs and abandons the petroleum well or bore after its rig release day, the tenure holder or authority holder must lodge a report about the abandonment	Compliant	Well abandonment report for Kenya East 166 was issued on 30 January 2019.
(3)		The report must be lodged within 2 months after the day the plugging and abandoning of the well or bore is completed	Non-Compliant	Kenya East 166 was plugged and abandoned in January 2018 and the audit report was lodged on 30 January 2019, as per QDEX records.
(4)		The report must contain the following information -		
	(a)	On the first page, each of the following details -		
	(i)	the type and number of the tenure or authority	Compliant	
	(ii)	the identifying name of the well or bore	Compliant	
	(iii)	the name of the author of the report	Compliant	
	(iv)	the name of the tenure or authority holder	Compliant	
	(v)	the name of the operator of the well or bore	Compliant	
	(vi)	the name of the person submitting the report	Compliant	
	(vii)	the date of the report in day-month-year format	Compliant	
	(b)	a summary and history of the well or bore -	Compliant – area for improvement	The summary could contain more information such as the amount of gas and water produced over the life of the well and the reasoning for abandoning the well.
	(i)	spatial information showing its locations	Compliant	
	(ii)	the day on which a petroleum well or bore completion report for the well or bore was lodged	Compliant	
	(c)	the following details about the well or bore -		
	(i)	its total depth in metres	Compliant	
	(ii)	the position at the top and bottom, expressed as required under subsection (5), and the thickness of a coal seam, natural underground reservoir or aquifer intersected by the well or bore	Compliant	
	(iii)	the depth in metres of any perforations in the casing of the well or bore	Compliant	
	(iv)	the type of drilling rig used to drill the well or bore	Compliant	
	(d)	if stimulation of a coal seam was carried out in the well or bore under the tenure or authority, the matters stated in subsection (6)	Not Applicable	

	(e)	all surveys and measurements made in the well or bore, including any detailed interpretation of a survey or measurement	Compliant	The following were included <ul style="list-style-type: none"> • Continuous Gyro • Sector Bond Log • End of well cement report Wireline logs in DLIS and DPK format
	(f)	the following in formation in relation to the completion or abandonment of the well or bore	Compliant	
	(i)	details of the casing equipment made in the well or bore, with diagrams showing the major dimensions and features of the casing equipment	Compliant	
	(ii)	a full description of all equipment, including prescribed equipment, that is retained in the well or bore, including the size and nature of the equipment and any features of the equipment that may cause hazard to coal mining operations	Compliant	No prescribed equipment is detailed that may cause hazard to coal mining operations
	(iii)	the surveyed location of any prescribed equipment	Not Applicable	
	(iv)	the method of the cementing operations carried out in or on the well or bore, including the type of plugs, the intervals covered, the volume and type of cement due to voids or permeable strata, and the methods used to overcome losses of cement	Compliant	
	(v)	the method, materials and volume of cement used to cement voids	Compliant	Provided in Appendix C – End of Well Cement Report
	(vi)	a description of any other abandonment procedures used for the well or bore	Compliant	
	(vii)	any other details of the activities undertaken in drilling, completing and plugging and abandoning the well or bore, including an assessment of their possible impacts, that would assist a person in making an assessment of potential risks to safe and optimal mining of coal	Compliant	No potential impact on future coal mining identified
(5)		For subsection (4)(c)(ii), the position at the top and bottom of the coal seam, natural underground reservoir or aquifer must be identified in relation to -	Compliant	
	(a)	for a directional well -		
	(i)	total vertical depth in metres	Not Applicable	
	(ii)	the horizontal plane	Not Applicable	
	(b)	otherwise depth in metres	Compliant	Kenya East 166 is a vertical well and hence subsection (5) (b) applies.
(6)		For subsection (4)(d), the matters are-		Kenya East 166 was not simulated.
	(a)	the depth in metres of the top and bottom of the interval over which stimulation was carried out	Not Applicable	
	(b)	a description of the equipment used to carry out the stimulation	Not Applicable	

	(c)		for the interval mentioned in paragraph (a), a graphic representation of each of the following -		
		(i)	casing pressure with time	Not Applicable	
		(ii)	calculated bottom hole pressure with time	Not Applicable	
		(iii)	slurry rate with time	Not Applicable	
		(iv)	proppant concentration with time	Not Applicable	
		(v)	calculated bottom hole concentration with time	Not Applicable	
	(d)		any record made about the stimulation by the person who carried it out	Not Applicable	
	(e)		any other details about the stimulation that would assist a person in making future assessment of the impact of the stimulation on the coal seam and any increased risk to safe and optimal coal mining	Not Applicable	

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4 Conclusions

The well abandonment procedure for Kenya East 166 was audit against the requirements for the abandonment of wells as per Section 37 of the General Provisions Regulation and Section 2.2.9 of the construction and abandonment code.

Of the 39 criteria in Section 37 of the General Provisions Regulation, 25 were compliant, 1 was non-compliant and 13 were not applicable. The audit found QGC to be non-compliant with section 37 (3) which requires the operator to submit an audit report within two months of plugging and abandonment of the well. The well was plugged and abandoned in January 2018 and the abandonment report was lodged on the 30 January 2019. QGC has provided details on improvements to their processes which will addresses this non-compliance.

Of the 20 mandatory criteria in Section 2.2.9 of the construction and abandonment code, 16 were compliant, 0 were non-compliant and 4 were not applicable.

Of the 8 good industry practice criteria in the construction and abandonment code of practice 5 were compliant, 0 were non-compliant and 3 were not applicable.

The audit team also identified the following errors/areas for improvement in the report:

- The header on page 7 states 'Crocker Gully 2 Well Abandonment Report' and a date of 25/01/2018.
- All pages of the report (except page 7) includes the date 30/01/2018 in the header. It is unclear what this date corresponds to. It is recommended to change this to 30/01/2019, the date of submission of the report.
- The location map provided in Figure 1 highlights Kenya East 188 incorrectly and does not highlight Kenya East 166.
- The well number provided in page 6 of Appendix C states Kenya East 172.
- It is recommended for improving future abandonment procedures and reports that more information is provide in the well summary such as the total fluids produced over the life of the well and the reasoning for abandoning the well.

As per the *Petroleum and gas reporting guidelines* dated October 2018 available on the DNRME website it is recommended that all appropriate information is provided in the well abandonment report to address all requirements under the construction and abandonment code of practice. Examples from this audit where compliance with the construction and abandonment code could not be confirmed based of the information submitted in the well abandonment report include:

1. Information addressing cement testing criteria.
2. Information on tests that have been conducted to confirm the absence of pressure/flow externally behind all casing strings and to meet the surface casing vent flow test criteria.
3. Information on the composition of pre-mix used to top up the production casing.
4. Information on cut and cap details such as the specifics of the marker plate used.

In regards to the first example above about cement testing criteria, the Inspectorate request information on how often laboratory and onsite tests are conducted.

The final recommendation of this audit report is that the errors that are noted are corrected and the additional information provided by QGC during the audit process, to confirm compliance, is added to a revision of the abandonment report. This updated report should then be resubmitted to QDEX. QGC have noted this would be done by the end of September 2019.

Appendix 1 – Abbreviations, Terms and Definitions

Abbreviation/Term	Definition
Construction and abandonment code	The document called 'Code of practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland', published on a Queensland Government website and current version 1 dated September 1 2018
P&G Act	Petroleum and Gas (Production and Safety) Act 2004
General Provisions Regulation	Petroleum and Gas (General Provisions) Regulation 2017
Safety Regulation	Petroleum and Gas (Safety) Regulation 2018
PGI	Petroleum and Gas Inspectorate
WAR	Well Abandonment Report
CSG	Coal seam gas

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Audit Report

Origin Duke 15 Abandonment

March 2020

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Summary

An audit was conducted by the Petroleum and Gas Inspectorate (PGI) in relation to the management of safety and health under the *Petroleum and Gas (Production and Safety) Act 2004 (the Act)*.

The audit was conducted during January and March 2020 in relation to the abandonment procedure of Duke 15 for which Origin Energy (Origin) is the operator. The abandonment procedure was assessed and reviewed through the well abandonment report submitted on 10/04/2017 by Origin after final cut and cap of the well was completed. This report was assessed against the legislation in force at the time of the abandonment work which were the requirements contained in the relevant sections of the *Petroleum and Gas (Production and Safety) Regulation 2004* (dated 3 February 2017) and the *Code of Practice for constructing and abandoning coal seam gas wells and associated bores in Queensland* (version 2 dated October 2013).

The audit found:

- Of the 34 criteria in section 38 of the *Production and Safety Regulation*, 19 were identified as being compliant, 2 were identified as non-compliant and 13 were identified as not applicable.
- Of the 10 criteria in sections 69, 70 and 72 of the *Production and Safety Regulation*, 6 were identified as being compliant, 1 was identified as non-compliant and 3 were identified as not applicable.
- Of the 36 criteria in schedule 3 of the *Production and Safety Regulation*, 15 were identified as being compliant, 5 were identified as unconfirmed based on current information and 16 were identified as not applicable.
- Of the 9 mandatory criteria in section 6.9 of the *construction and abandonment code*, 6 were identified as being compliant, 1 was identified as non-compliant and 2 were identified as not applicable.
- Of the 4 good industry practice criteria in section 6.9 of the *construction and abandonment code*, 1 was identified as being met and 3 were identified as not applicable.

Origin are requested, by close of business on the 9th of April 2020, to:

- update the Duke 15 well abandonment report,
- provide a written plan for what has been or will be implemented, to prevent similar non-compliances with the legislation from occurring in the future.

Dated at Brisbane, the 12th day of March, 2020.

s.73 irrelevant information

Michael Scott

Principal Inspector Wells

Petroleum and Gas Inspectorate

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1 Introduction

In Queensland, petroleum and gas safety is regulated under the P&G Act and relevant subordinate legislation. One piece of subordinate legislation, the *Petroleum and Gas (Safety) Regulation 2018 (Safety Regulation)*, establishes that drilling, converting and abandoning of petroleum wells, CSG wells and water bores must be carried out as per the construction and abandonment code (*Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland* (Version 2 dated 16 December 2019)). The requirements for well abandonment are detailed under the construction and abandonment code with abandonment being fundamental in ensuring 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. Another piece of subordinate legislation, the *Petroleum and Gas (General Provisions) Regulation 2017 (General Provisions Regulation)*, outlines the requirement for prescribed report including a well abandonment report (WAR).

An audit was conducted by the Petroleum and Gas Inspectorate between January and March 2020 in relation to the abandonment of Origin's Duke 15 well. The aim was to determine whether the Duke 15 WAR and the abandonment procedure comply with the relevant regulatory requirements.

1.1 Description of Facility

Duke 15 was a vertical coal seam gas well drilled by Origin in April 2011 targeting the Walloon Coal Measures. In June 2015 the well head was replaced and in May 2016 a CBL was conducted by a Schlumberger wireline unit. No other operations appeared to occur on the well during its life including a completion being run or a production test being performed. In February 2017 both the subsurface abandonment and surface cut and capped were completed.

2 Audit Plan

As discussed above, at the time the audit began the relevant legislative requirements for abandonment were:

- Section 3.16 of the *construction and abandonment code* for well abandonment requirements.
- Section 37 of the *General Provisions Regulation* for the WAR requirement.

However, the subsurface abandonment work was conducted by Origin between May 2016 and February 2017 with the surface abandonment conducted in February 2017. The WAR was submitted in April 2017. The audit was conducted against the relevant legislation in place at the time the work occurred which was:

- Section 6.9 of the *Code of Practice for constructing and abandoning coal seam gas wells and associated bores in Queensland* (version 2 dated October 2013) for a portion of the well abandonment requirements.
- Schedule 3 of the *Production and Safety Regulation* for a portion of the well abandonment requirements.
- Section 69, 70 and 72 of the *Production and Safety Regulation* for additional safety requirements
- Section 38 of the *Production and Safety Regulation* for the WAR requirement.

2.1 Scope and Objectives

The scope of the audit was to verify the WAR meets the requirements set out in section 37 of the *General Provisions Regulation* and that the abandonment procedure applied to Duke 15 complies with the requirements in the *construction and abandonment code*. The objectives of the audit were to ensure that the following principles of good petroleum well abandonment have been applied:

- Isolation of aquifers from each other and from permeable hydrocarbon zones
- Isolation of permeable hydrocarbon zones from each other unless commingling is permitted
- permeable formations containing fluids at different pressure gradients and/or significantly different salinities are isolated from each other to prevent crossflow
- there is no pressure or flow of hydrocarbons or fluids at surface both internally in the well and externally behind all casing strings
- recover/ remove surface equipment so as to not adversely interfere with the normal activities of the owner of the land on which the well or bore is located
- The site is left safe and free from contaminants.

The specific criteria assessed in the audit are detailed in Section 3.1 of this report.

2.2 Participants

The following persons participated in the audit:

Audit team

Role	Name	Position
Team leader	Michael Scott	Principal Inspector (wells)
Team member	Ian Bartels	Senior Inspector

Auditee's personnel

Role	Name	Position
Nominated representative	s.73 irrelevant information	

2.3 Activities

The audit was conducted as follows:

Date	Location	Activity
8 January 2020	Correspondence	Audit initiation letter sent to Origin
January-March 2020	s.73 irrelevant information	Conducted audit and prepare report
24 January 2020	Correspondence	Clarification register and request for response sent
17 February 2020	Correspondence	Origin response to clarifications
10 March 2020	Correspondence	Preliminary audit report distributed
10 March 2020	s.73 irrelevant information	Close out meeting
12 March 2020	Correspondence	Final audit report distributed

3 Well Abandonment Report Review

The audit consisted of a review of the operator's WAR document submitted to Queensland Digital Exploration Reports System (QDEX) after abandonment of Duke 15 was completed. The submitted WAR consists of the following data:

- Report and appendices
- Wireline logs – LAS files

Origin also provided additional information that was not available in the data that had been submitted to QDEX. This was in response to clarifications requested by the PGI after an initial review of the WAR. This included:

- Cement plug 2 pressure test chart – png file
- Schlumberger Duke 15 Plug & Abandonment Cement Program
- Internal Origin email in regards to the well potentially entering the Hutton sandstone
- Origin Duke 15 Plug and Abandonment Program
- Cement plug 1 pressure test chart – pdf file
- Cement plug 2 pressure test chart – excel file
- Duke 15 composite log

Following the preliminary report being distributed, Origin also provided a copy of the verticality log dated 21 April 2011.

A summary of the findings of the audit are provided in **Section 3.1** along with a summary of the clarification requests and Origin's response in **Section 3.2**.

3.1 Evidence and related findings

3.1.1 The following findings were identified against the relevant sections of the *Production and Safety Regulation*. This included:

- Section 38 Well or bore abandonment report
- Section 69 Requirement to remove particular equipment from coal seam
- Section 70 Requirement to cement particular voids in a prescribed well
- Section 72F Additional safety requirement—casing for wells and bores
- Section 72G Additional safety requirement—requirement to remove particular equipment from wells and bores
- Section 72H Additional safety requirement—requirement to fill wells, bores and voids
- Schedule 3 Requirements for plugging and abandoning petroleum wells and bores

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Section		Requirement	Compliance	Comments/Findings
38	(1)	If a petroleum well or bore is plugged and abandoned after the rig release day for the well or bore, the relevant petroleum authority holder must, within 2 months after the completion day, lodge a well or bore abandonment report for the well or bore.	Met	SLB Rigless work May 2016 Subsurface abandonment operations rig release 11 Feb 2017 P&A Date (Cut and cap) 13 Feb 2017 WAR report dated 07 Apr 2017 - cover page Report submitted 10 Apr 2017 (QDEX)
	(2)	The report must contain each of the following—		
	(a)	on the first page, each of the following details—		
	(i)	the type and number of the relevant petroleum authority;	Met	Duke ATP 788P - Cover page
	(ii)	the identifying name of the well or bore;	Met	Duke 15 - Cover page
	(iii)	the name of the author of the report;	Met	irrelevant inform Cover page
	(iv)	the name of the authority holder;	Met	Report states tenure holder is provided on the title page. Cover page specifies Origin.
	(v)	the name of the operator of the well or bore;	Met - area for improvement	Operator Information - Permit Operator - AUSTRALIA PACIFIC LNG PTY LTD (100%) - Section 5.2, Page 7. Not actually noted on the cover page.
(vi)	the name of the person submitting the report;	Met	Submitting person on title page (irrelevant inform) though not clear that this is the submitter). Available on QDEX - irrelevant informa	
(vii)	the date of the report, in day-month-year format;	Met	April 2017 and 07/04/2017 - Cover page	

	(b)	a summary and history of the well or bore, including a location map and the date on which a well or bore completion report for the well or bore was lodged;	Met - area for improvement	<p>Section 5 Summary, page 7 Section 5.1 Well History, page 7 Figure 1 Location map, page 9 The WCR report states the well was drilled as a future production well with the intent of being fracture stimulated. There is no specific mention in the abandonment report that the well did not end up being stimulated, never had a completion run or was production tested. This would provide clarity on the history of the well. It is also recommended that a statement is made in the abandonment report on why the well was abandoned.</p>
	(c)	the following details about the well or bore—		
	(i)	its total depth in metres;	Met	1165 mRT - Section 5.2 General Data, page 7
	(ii)	the position at the top and bottom, expressed as required under subsection (3), and the thickness, of any of the following intersected by the well or bore— (A) a coal seam; (B) a natural underground reservoir; (C) an aquifer;	Met	The reservoir summary data is provided in section 7.3 Stratigraphy - Table 7, Page 14. More details on the formations from surface to TD are provided in the drilling reports Appendix B.
	(iii)	the depth in metres of any perforations in the casing of the well or bore;	Not Met	The report states that no perforations were carried out on Duke 15 - Section 5.3 Perforation Data, Page 10. The well was perforated from 831-835mKB in order to conduct a cement squeeze during abandonment operations.
	(iv)	the type of drilling rig used to drill the well or bore;	Met	Rig types included in Drilling Reports - Appendix B
	(d)	if stimulation of a coal seam was carried out in the well or bore under the relevant petroleum authority, the matters stated in subsection (4);	N/A	N/A - Section 4 Requirements, page 5

	(e)	all surveys and measurements made in the well or bore, including any detailed interpretation of a survey or measurement;	Met	Section 6 Logging and Testing, page 11
	(f)	in relation to the completion or abandonment of the well or bore, each of the following—		
	(i)	details of the casing and equipment installed in the well or bore, with diagrams showing the major dimensions and features of the casing and equipment;	Met - area for improvement	Section 5.4 Casing and Cement Data, page 10 and Section 6.5 Downhole Diagram, page 12 The downhole diagram has a section on cement evaluation results and in it has no mention of the CBL that was conducted. The downhole diagram states the bridge plug is temporary but it has been used as part of the permanent abandonment design.
	(ii)	a full description of all equipment, including prescribed equipment, that is retained in the well or bore, including the size and nature of the equipment and any features of the equipment that may cause a hazard to coal mining operations; Example of features that may cause a hazard to coal mining operations— aluminium, electronics or batteries	Met	Section 6.5 Downhole Diagram, page 12
	(iii)	the surveyed location of any prescribed equipment;	Met	The general location is provided in Section 6.5 Downhole Diagram, page 12. The non-compliance with a deviation survey not being run is captured in other criteria.

		(iv)	the method of the cementing operations carried out in or on the well or bore, including the location and type of plugs, the intervals covered, the volume and type of cement used, any losses of cement due to voids or permeable strata, and the methods used to overcome losses of cement;	Not Met	Section 6.5 Downhole Diagram Figure 2: Downhole Diagram, page 12. The data provided in Appendix D Casing and Cement Data - page 21 was from the 9-5/8" surface casing job and 7" production casing job conducted during the drilling. This information should have been provided in the WCR and the relevant information from the abandonment should have been added to the WAR. The post job service company abandonment plug and squeeze job cement reports were not provided in the abandonment report. The location and type of cement plugs used for abandonment and the verification methods for the plugs are not summarized in the report. This includes no clear details of the cement plugs in the downhole diagram.
		(v)	the method, materials and volume of cement used to cement voids;	N/A	No relevant voids. It is noted that this requirement is not listed in the summary table in Section 4.
		(vi)	a description of any other abandonment procedures used for the well or bore;	Met - area for improvement	There is nothing specifically stated in the report addressing this requirement. It appears no other procedures were used. It is noted that this requirement is not listed in the summary table in Section 4.
		(vii)	any other details of the activities undertaken in drilling, completing and plugging and abandoning the well or bore, including an assessment of their possible impacts, that would assist a person in making an assessment of potential risks to safe and efficient mining of coal.	Met	Section 8 Impact Assessment, page16 <i>No events or information have been assessed at present which indicate that Duke 15 will have a negative impact on the safe and efficient mining of coal</i>
(3)			For subsection (2)(c)(ii), the position at the top and bottom of the coal seam, natural underground reservoir or aquifer must be identified in relation to—		
	(a)		for a directional well—		

		(i)	total vertical depth in metres; and	N/A	N/A - Section 4 Requirements page 6
		(ii)	the horizontal plane; or	N/A	N/A - Section 4 Requirements page6
	(b)		otherwise—the depth in metres.	Met	1165 mRT - Section 5.2 General Data, page 7
(4)			For subsection (2)(d), the matters are each of the following—		
	(a)		the depth in metres of the top and bottom of the interval over which the stimulation was carried out;	N/A	N/A - Section 4 Requirements page 6
	(b)		a description of the equipment used to carry out the stimulation;	N/A	N/A - Section 4 Requirements page 6
	(c)		for the interval mentioned in paragraph (a), a graphic representation of each of the following—		
		(i)	casing pressure with time;	N/A	N/A - Section 4 Requirements page 6
		(ii)	calculated bottom hole pressure with time;	N/A	N/A - Section 4 Requirements page 6
		(iii)	slurry rate with time;	N/A	N/A - Section 4 Requirements page 6
		(iv)	proppant concentration with time;	N/A	N/A - Section 4 Requirements page 6
		(v)	calculated bottom hole concentration with time;	N/A	N/A - Section 4 Requirements page 6
	(d)		any record made about the stimulation by the person who carried it out;	N/A	N/A - Section 4 Requirements page 6
	(e)		any other details about the stimulation that would assist a person in making a future assessment of the impact of the stimulation on the coal seam and any increased risk to safe and efficient mining of coal.	N/A	N/A - Section 4 Requirements page 6
69	(1)		The operator of an operating plant must use the operator's best endeavours to ensure all prescribed equipment that is in, or immediately adjacent to, a coal seam in a prescribed well or bore at the plant is removed before the well or bore is plugged and abandoned.	Met	No prescribed equipment left in hole except the bridge plug which was used as part of the abandonment.
	(2)		If, after using the operator's best endeavours as required under subsection (1), the equipment can not be removed before the well or bore is plugged and abandoned, the operator must ensure—		

70	(a)	the location of the equipment in the well or bore is surveyed before the well or bore is plugged and abandoned; and	Met	Deviation survey provided after the preliminary report was distributed. The well abandonment report states that no deviation data was recorded.
	(b)	details of the equipment and its location are included in an end of tenure report or well abandonment report for the well as required under the Petroleum and Gas (General Provisions) Regulation 2017, part 3.	Met – area for improvement	Bridge plug depicted on downhole diagram. Information provided as part of the audit but were not submitted with the report.
	(3)	The survey mentioned in subsection (2)(a) must be carried out as required under sections 55 and 57.	Not Met	Azimuth level of accuracy did not meet requirements.
	(4)	In this section— prescribed equipment means—		
	(a)	metal equipment, other than casing; and Note— For requirements about removing casing from a petroleum well, see schedule 3.		
	(b)	any other equipment that may create a hazard to coal mining operations. Examples of metal equipment— drilling equipment, geophysical logging tools		
	(1)	This section prescribes safety requirements for plugging and abandoning a prescribed well at an operating plant if—		
	(a)	a void is created by stimulation of a coal seam in the well; and		
	(b)	the void is sufficiently large that it may adversely affect—		
	(i)	the safe and optimal future mining of coal from the seam; or		
(ii)	the integrity of the natural underground reservoir in which the void is created.			
(2)	The operator must ensure that, as part of the plugging and abandoning of the well, the void is filled with as much cement as is reasonably practicable.	Met	As much cement as was reasonable practicable was used to fill voids.	

	(3)		Subject to schedule 3, the cement used to fill the void must not be so strong that it unduly prevents the future optimal mining of coal from the seam.	Met	The cement composition was appropriate.
	(4)		This section applies in addition to the standard abandonment requirements for the well.		
72F	(1)		The operator of an operating plant that is drilling a well or bore in an overlapping area must ensure an approved casing is used for drilling or completing the well or bore.		
	(2)		If steel casing is used for drilling or completing the well or bore, the operator of the operating plant must ensure—		
	(a)		the spacing and layout of the steel casing is agreed to by the resource authority holders for the overlapping area; and		
	(b)		the steel casing is removed when the well or bore is abandoned unless the site senior executive otherwise agrees.	N/A	No overlapping coal or oil shale mining tenement
	(3)		The resource authority holders must ensure an agreement under subsection (2) is included in the joint development plan, or the joint interaction management plan, for the overlapping area.		
	(4)		In this section—approved casing means a type of casing agreed to by the resource authority holders for the overlapping area.		
	(1)		The operator of an operating plant that is drilling a well or bore in an overlapping area must ensure an approved casing is used for drilling or completing the well or bore.		
72G	(1)		The operator of an operating plant in an overlapping area must—		
	(a)		use the operator's best endeavours to ensure all prescribed equipment that is in, or immediately adjacent to, a coal seam in a prescribed well or bore at the plant is removed before the well or bore is plugged and abandoned; and	Met	No prescribed equipment left in hole except the bridge plug which was used as part of the abandonment and as such the intent of the requirement has been met.

	(b)		ensure the following is available for use at all times when drilling operations in a prescribed well or bore at the plant are carried out—		
		(i)	adequate equipment for preventing or mitigating the loss of prescribed equipment in the well or bore;		
		(ii)	adequate equipment for seeking to recover prescribed equipment lost in the well or bore.		
(2)			If prescribed equipment is lost in a prescribed well or bore at an operating plant in an overlapping area, the operator of the plant must—		
	(a)		within 24 hours after the equipment is lost—notify the site senior executive for the coal mine in the overlapping area; and		
	(b)		within 3 days after the equipment is lost—consult with the chief inspector about the period in which efforts to recover the lost equipment should be made; and		
	(c)		abandon efforts to recover the lost equipment only if the chief inspector agrees to the abandonment.		
(3)			In this section—prescribed equipment means—		
	(a)		metal equipment, other than casing; and		
	(b)		any other equipment or material that may create a hazard to coal mining operations.		
72H	(1)		This section prescribes safety requirements for plugging and abandoning a well, bore or void at an operating plant in an overlapping area.		
	(2)		The operator must ensure that, as part of the plugging and abandoning of the well, bore or void—		
		(a)	the well, bore or void is filled with cement from the bottom of the well, bore or void to the surface of the well, bore or void, unless the site senior executive otherwise agrees; and		

	(b)		packers and fluids are not left in the well, bore or void.	N/A	No overlapping coal or oil shale mining tenement
	(3)		This section applies in addition to the standard abandonment requirements for the well, bore or void.		

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Section				Requirement	Compliance	Comments/Findings
Schedule 3	2			Abandonment to be consistent with good industry practice		
		(1)		A well or bore must be abandoned in accordance with good industry practice, to the extent that practice is consistent with this regulation.	N/A	Refer to code of practice audit table
		(2)		However, a CSG well or bore must be abandoned in accordance with the construction and abandonment code, to the extent the code is consistent with this regulation.	N/A	Refer to code of practice audit table
	3			Capping of well or bore		
				The well or bore must be capped with a metal plate inscribed with the following information—	Met	The provided abandonment program specified the correct requirements while a photo was provided to confirm this.
			(a)	the identifying name of the well or bore;	Met	
			(b)	the total depth in metres of the well or bore;	Met	
			(c)	the date the well or bore was abandoned.	Met	
	4			Casing to be sealed		
		(1)		The casing of the well or bore must be sealed below ground level.	Met	Photo provided of casing stub cut below ground prior to backfill.
		(2)		The stub of the casing must be buried below the surface at a depth that—	Met	
			(a)	allows for the efficient later re-entry to the well or bore; and	Met	

		(b)	will not adversely interfere with the normal activities of the owner of the land on which the well or bore is located.	Met	
5			Isolation of aquifers and porous formations		
			An aquifer or porous formation, including, for example, a coal seam, that is intersected by a prescribed well or bore must be isolated so there is no interconnection of gas or water between the aquifers or porous formations.	Met	As per code of practice criteria information.
6			Casing of prescribed well or bore		
	(1)		Steel casing must be removed from any section of a prescribed well or bore that is within or immediately adjacent to a coal seam.	Met	Not technically and commercial feasible to remove casing
	(2)		However, subsection (1) need not be complied with—		
		(a)	if it is not technically or commercially feasible to remove the casing; or Example—production casing that has been cemented in place and can not feasibly be removed		
		(b)	for a CSG well, if the code requires that the casing remain in place.		
7			Cement to be used for plugs etc.		
	(1)		This section applies to a prescribed well or bore that is not a CSG well.		
	(2)		The prescribed well or bore must have a surface plug of cement in the casing.	N/A	
	(3)		Also, if the prescribed well or bore has more than 1 casing string and any inner casing string does not reach the surface, the inner casing string must, if required to comply with section 5, be plugged with cement at the top of the string.	N/A	

	(4)		Cement used as a plug in the prescribed well or bore must be of an industry accepted grade, having regard to the salinity of the fluids in the surrounding strata.	N/A	
	(5)		A plug in, or adjacent to, a coal seam in the prescribed well or bore must, if reasonably practicable, be adequately secured.	N/A	
	(6)		The operator of the well or bore must test any cement that is used as a plug in the well or bore and ensure that it complies with the requirements under this regulation.	N/A	
8			Requirement for packer left in prescribed well or bore		
	(1)		This section applies to a prescribed well or bore that is not a CSG well.		
	(2)		A packer in, or adjacent to, a coal seam in the prescribed well or bore that is not to be removed from the well or bore must, if reasonably practicable—	N/A	
		(a)	be made of a material that is intrinsically safe; and	N/A	
		(b)	be adequately secured.	N/A	
9			Fluid to be left in prescribed well or bore		
			A prescribed well or bore must be left full of fluid that is of sufficient density to—		
		(a)	help maintain the structural integrity of the well or bore; and	N/A	
		(b)	prevent gas influx.	N/A	
10			Requirements if steel casing or drill string is left in coal seam		

	(1)		This section applies if steel casing or drill string is left within a coal seam in a prescribed well or bore.		
	(2)		The well or bore must be abandoned in a way that assists future entry of the well or bore for the purpose of milling or removing steel from the coal seam.	Met	Well can be re-entered if required.
	(3)		In complying with subsection (2), the operator must ensure that each of the following is carried out before the well or bore is plugged and abandoned—		
		(a)	sucker rods, pump and tubing and any other debris in the well or bore that can practicably be removed are removed;	Met	All equipment except the bridge plug used in abandonment operations were removed from the well.
		(b)	perforated casing is cemented to ensure all aquifers and porous formations, including for example, coal seams, are isolated as required under section 5;	Met	The only perforations were those made and cemented during abandonment.
		(c)	if casing remains in the well or bore, the fluid left in the well or bore as required under section 9—		
		(i)	is anti corrosive; and	N/A	No fluid left in the hole
		(ii)	has corrosion inhibitor added to it if the fluid is or may become corrosive;	N/A	No fluid left in the hole
		(d)	casing strings are cut off at approximately 1.5m below ground level and all wellhead equipment is removed;	Met	Daily report from 11/2/2017
		(e)	before backfilling, a metal plate is welded fully across the top of the innermost casing string and marker tape is laid approximately 20cm above the top of the casing;	Met	It is recommended that photos throughout the cut and cap process are submitted in the well abandonment report to confirm compliance with relevant regulations. Under current legislation this is now a mandatory requirement.
		(f)	a plaque, stating the following information, is placed on the nearest fence, building or other permanent structure—	Unconfirmed	The provided abandonment program specified the correct requirements but photos have not yet been provided to confirm this was implemented. If photos are not provided this will be confirmed on a future inspection by the Inspectorate.

			(i)	the identifying name of the well or bore;	Unconfirmed	
			(ii)	the total depth in metres of the well or bore;	Unconfirmed	
			(iii)	the date on which the well or bore was abandoned;	Unconfirmed	
			(iv)	the distance and direction to the well or bore from the plaque.	Unconfirmed	
11				Requirement for liner		
	(1)			A horizontal well must be abandoned containing a slotted liner that is not made of steel, including for example, a slotted PVC liner.	N/A	Vertical well
	(2)			However, if the horizontal well has the potential to be a high risk area for future coal mining because of high levels of methane, the operator must conduct a risk assessment that includes an assessment of whether a Fire Resistant Anti Static (or FRAS) liner should be used in the well.	N/A	Vertical well

3.1.2 The following findings and related evidence were identified against the mandatory requirements listed in section 6.9 of the *construction and abandonment code* relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	Wells must be abandoned in accordance with this Code and all relevant legislative requirements (i.e. Schedule 3 and s.69 and 70 of the P&G Regulation).			Refer to relevant section of the audit tables
2	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.	Met	As per compliance with other criteria	
3	A horizontal well must be abandoned as per the requirements in Schedule 3 Part 4, section 11 of the P&G Regulation. This section states the requirement for liner - (1) A horizontal well must be abandoned containing a slotted liner that is not made of steel, including for example, a slotted PVC liner. (2) However, if the horizontal well has the potential to be a high risk area for future coal mining because of high levels of methane, the operator must conduct a risk assessment that includes an assessment of whether a Fire Resistant Anti Static (or FRAS) liner should be used in the well.	N/A	Vertical well	

4	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.	Met	Cement used as per reports. Testing results provided as part of clarification request 1. Included in the abandonment cement program were compressive strength charts and free water test results.																													
5	<p>For Production Wells</p> <ul style="list-style-type: none"> the well is to be abandoned by cementing from total depth to surface or a cement plug must be set inside the casing as close as practical above the uppermost hydrocarbon production zone. The plug must be pressure tested to 500 psi above the estimated leak off pressure. Where the plug is not cemented to surface, the plug must also be tagged with a minimum 2000lb (1000kg) set down weight. 	Met	<p>Six cement plugs were set filling the wellbore with cement from within the Juandah coals of the Walloon Coal Measures to the cut and cap depth just below surface. Plug 2 which was set to isolate the target reservoir (Walloon Coal Measures) and had a top depth of 694mKB was tagged and pressure tested to 500psi. A small leak was noted on the daily report during the pressure test. Refer to clarification requests 4 and 5 for information on how the chosen pressure meets the requirement and how the small leak meets an acceptable pressure testing criteria.</p> <p>The bridge plug set at the base of cement plug 1 was also tagged and pressure tested. As was cement plug 1.</p>	<p>Cement plug summary</p> <table border="1" data-bbox="1491 539 2011 783"> <thead> <tr> <th>Cement plug</th> <th>From (mKB)</th> <th>To (mKB)</th> <th>Length (m)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>838</td> <td>839.15</td> <td>1.15</td> </tr> <tr> <td>2</td> <td>694</td> <td>838</td> <td>144</td> </tr> <tr> <td>3</td> <td>484.6</td> <td>694</td> <td>209.4</td> </tr> <tr> <td>4</td> <td>322.45</td> <td>484.6</td> <td>162.15</td> </tr> <tr> <td>5</td> <td>151.77</td> <td>322.45</td> <td>170.68</td> </tr> <tr> <td>6</td> <td>0</td> <td>151.77</td> <td>151.77</td> </tr> </tbody> </table>	Cement plug	From (mKB)	To (mKB)	Length (m)	1	838	839.15	1.15	2	694	838	144	3	484.6	694	209.4	4	322.45	484.6	162.15	5	151.77	322.45	170.68	6	0	151.77	151.77
Cement plug	From (mKB)	To (mKB)	Length (m)																													
1	838	839.15	1.15																													
2	694	838	144																													
3	484.6	694	209.4																													
4	322.45	484.6	162.15																													
5	151.77	322.45	170.68																													
6	0	151.77	151.77																													
6	<p>For Exploration Wells</p> <ul style="list-style-type: none"> the well is to be abandoned by cementing from the total depth to the surface or a cement plug must be set across the open hole section inside the lowermost casing shoe. This plug must be pressure tested to 500 psi (3.5MPa) above the estimated leak off pressure. Where the plug is not immediately cemented to the surface, the plug must also be tagged with a minimum 2000 lb (1000 kg) set down weight 	N/A																														

7	<p>For all wells</p> <ul style="list-style-type: none"> • there must be a minimum of two adjacent cement barriers across all formations above the uppermost hydrocarbon zone • the innermost casing string must be filled to surface with cement 	Met	<p>Six cement plugs were set filling the wellbore with cement from within the Juandah coals of the Walloon Coal Measures to the cut and cap depth just below surface.</p> <p>A CBL was run which showed competent cement above 825mKB. Some spots such as 550-635mKB were questionable but this section remains confined within one interval (Westbourne Formation).</p> <p>Cement plug 1 was a squeeze job at the base of the Springbok and top of the Walloon Coal Measures. After the squeeze job the plug was milled out and the squeeze pressure tested to ensure isolation.</p>	
8	<p>BOPs and/or the 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</p>	Met	<p>BOPs nipped down at 06:00 on 11/02/2017 just prior to rig release.</p>	
9	<p>Wellheads must be removed, and casing string(s) must be cut minimum 1.5m below surface. A wellhead marker plate must be installed as per legislative requirement</p>	Met - area for improvement	<p>Daily report from 11/2/2017 details that a marker plate was installed with the information on the plate noted. The date of abandonment was not noted in the report but was on the plate as per the photo (photo provided as a clarification). The daily report also notes that the wellhead was cut 1.5m below ground.</p>	<p>Need to ensure consistency between daily reports and what occurs.</p>
10	<p>Complete and accurate records of the entire abandonment procedure must be kept, submitted as part of the Well Abandonment Report once final cut and cap has been completed</p>	Not Met		<p>There is no requirement to resubmit data such as logs and DST data that were submitted with the well completion report (Data such as the CBL which was run after the WCR was submitted should be contained in the WAR).</p> <p>In section 7.2 the report references Table 8, Table 8 is not included in the report.</p> <p>In multiple spots in the table in section 4 it refers to Section 6.4, Fig 2 for the downhole diagram. This diagram is in section</p>

				<p>6.5. As per other assessed criteria there are multiple areas where additional clarity could be provided on what occurred on the well. This includes:</p> <ul style="list-style-type: none"> - It is extremely hard to follow what happened on the abandonment based on the content of the report e.g. the location and type of cement plugs used for abandonment and the verification methods for the plugs are not summarized in the report including in the downhole diagram. Also it is noted in the daily report that there was a leak when pressure testing cement plug 2. However there is no information to show that relevant pressure testing acceptance criteria has been met. It is noted that this was provided as part of the clarification request. - The drilling fluid summary in Appendix E appears to be only from the drilling operations. It would have been appropriate to provide the relevant information from the abandonment operations. - Adding a clear and definitive statement into either the well completion or abandonment report on drilling into the Hutton e.g. "While the plan was to drill into the Hutton this did not occur." - The WCR report states the well was drilled as a future production well with the intent of being fracture stimulated. There is no specific mention in the abandonment report that the well did not end up being stimulated, a completion string was never run or the well was not production tested. This would provide clarity on the history of the well. - The downhole diagram has a section on cement evaluation results and in it has no mention of the CBL. The downhole diagram also states the bridge plug is temporary but it has been used as part of the permanent abandonment design. - The post job service company abandonment plug and squeeze job cement reports were not provided in the abandonment report. - The report states that no perforations were carried out on
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				<p>Duke 15 - Section 5.3 Perforation Data, Page 10. The well was perforated from 831-835mKB in order to conduct a cement squeeze during abandonment operations.</p> <ul style="list-style-type: none">- In section 6.1 the report states that no deviation survey was recorded but deviation data was available.
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The following findings and related evidence were identified against the good industry practice for the requirements listed in the *construction and abandonment code* relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence	Comments/Findings
1	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).	N/A	Abandonment plugs set in casing. Plug set at TD is within the Walloon Subgroup and is functionally not providing isolation so is not relevant.	
2	If no caliper data is available, 20–30% above theoretical volume or local knowledge should be used.	N/A		
3	A 50 m weighted high-vis pill should be spotted below each cement plug that is not set directly above a physical barrier.	N/A	Based plug set during drilling set on TD. Cement plug isolating the top of the Walloon Coal Measures set on a physical barrier (bridge plug) with cement plugs stacked on top of this.	
4	Plugs should normally be a minimum of 45 m in length (height). In general cement plugs should not exceed 150 m in length. If the hole is badly washed out, it may be better to set two short plugs over the washed out section than to try to cover this interval with one plug.	Met	Cement plugs were typically 150-200m in length. While some plugs were slightly longer than 150m they were a reasonable length and the intent of this requirement has been met.	

3.2 Clarification Register

Clarification number	Finding or clarification request	Response
1	Can Origin please provide all relevant details and documents of testing that occurred on the cement used during abandonment operations including the cement plug set during drilling operations to isolate the Hutton Sandstone. Examples of testing include compressive strength development with time and a free water test as outlined in API RP 10B-2.	<ul style="list-style-type: none"> - Hutton Sandstone was not intersected during Drilling. - Cement lab reports attached in cement program 
2	In the final daily abandonment report from the 11/02/2017 it states that photos were attached. Can Origin please provide these photos. This final daily abandonment report also states that the well head excavation was to be back filled on the 14th of February. Can Origin please provide evidence, such as a daily report or a photo, of the final work being completed.	<ul style="list-style-type: none"> - Wait on backfill photos from field (scouting limited due to wet access) 
3	Can Origin please provide confirmation and evidence of marker tape being laid above the top of the casing stub prior to backfilling.	<ul style="list-style-type: none"> - No Photos available – In accordance with legislative requirements, the well program included instructions to lay marker tape  <p>Duke 15 - Plug and Abandonment Program</p> <p>approximately 20cm above the top of the casing.</p>
4	Can Origin please provide a copy of the chart for the pressure test conducted on cement plug 2.	<ul style="list-style-type: none"> - Plug 2 Pressure test chart attached  <p>Plug 1 pressure test demonstrates isolation across perforations</p>  <p>8. Duke # 15 - Casing test.pdf</p>
5	Can Origin please provide the basis for the 500psi value used for the pressure test for cement plug 2. The legislative	<ul style="list-style-type: none"> - Leak off test performed on 19/04/2011 indicated leak off at 10psi stabilised. - Cement squeeze locked at 675psi

	requirement is for a pressure test of 500psi above the estimated leak off pressure.	- Perforated interval (Plug #1 w/ squeeze was pressure tested at 534psi)
6	Can Origin please confirm what depth the top of the surface cement plug was at located at. It is not stated in any reports but appears to be at approximately 7mKB based on the downhole diagram. If this is correct can Origin please confirm what remained in the short gap in the well between the well cap at 1.5mGL (6.4mKB) and the top of cement at 7mKB.	- Cement top up performed at surface, and around bottom of cellar  prior to backfill.
7	Can Origin please provide details of how cement volumes were calculated and specify any excess included in the calculations.	- As per cement program  Duke15_P&A_Rev1_18Nov16.pdf
8	Can Origin please provide evidence and the details of a surface location plaque being placed for the well during surface abandonment.	- Wait on photos from Field (scouting limited due to wet access) - In accordance with legislative requirements, the program stated that the following information be listed on a plaque on the nearest permanent structure; <ul style="list-style-type: none"> o DUKE 15 o 1165 mGL o Date the well was abandoned o The distance and direction to the well or bore from the plaque. o Latitude and longitude of wellbore
9	The well completion report specifies the top of the Westbourne Formation is at 548.54mKB while the daily reports in the abandonment report specify it as 589.6mKB. Can Origin please explain this difference.	- Westbourne Fm is actually at about 587. Wellsite reps misinterpreted the top depth. Attached composite clearly shows Westbourne much deeper. - Prior to PnA, Well integrity review and risk assessment initiated a  review of original proposed formation tops. DUKE_15-TRAFFIC_L IGHTS_GG.pdf

10	<p>The well appears to have been drilled into the Hutton Sandstone. Can Origin please provide clarification of what methods were used to verify the cement plug that was set to isolate the Hutton Sandstone from the overlying Walloon Coal Measures.</p>	<p>Origin picks the Hutton Sandstone according to the guidelines from the following publication:</p> <p><i>Green, P.M., Carmichael, D.C., Brain, T.J., Murray, C.G., McKellar, J.L., Beeston, J.W. & Gray, A.R.G., 1997. Lithostratigraphic units in the Bowen and Surat Basins, Queensland. In</i></p> <p><i>The Surat and Bowen Basins, South-East Queensland. Queensland Department of Mines and Energy. Pp41-108</i></p> <p>In accordance with these guidelines, this well never penetrated the Hutton Sandstone, even though the well reached TD far below the prognosed depth of the Hutton.</p> <p>- Hutton Sandstone was not intersected during Drilling.  RE_Duke 15 PhA Audit.meg</p>
11	<p>Can Origin please confirm the composition of any fluid left in the well during abandonment and how it meets requirements such as containing appropriate corrosion inhibition.</p>	<p>- No fluid (cement only) left in the well at time of abandonment.</p>

4 Conclusions

The submitted well abandonment report for Duke 15 was audited against the legislation in force at the time of the abandonment work which were the requirements contained in the relevant sections of the *Petroleum and Gas (Production and Safety) Regulation 2004* (dated 3 February 2017) and the *Code of Practice for constructing and abandoning coal seam gas wells and associated bores in Queensland* (version 2 dated October 2013)

Of the 34 criteria in section 38 of the *Production and Safety Regulation*, 19 were identified as being compliant, 2 were identified as non-compliant and 13 were identified as not applicable. The two criteria the audit found the submitted abandonment report to be non-compliant with were:

1. the depth in metres of any perforations in the casing of the well or bore;
2. the method of the cementing operations carried out in or on the well.

Of the 10 criteria in sections 69, 70 and 72 of the *Production and Safety Regulation*, 6 were identified as being compliant, 1 were identified as non-compliant and 3 were identified as not applicable. The criteria the audit found the report to be non-compliant with was the level of accuracy for the deviation survey did not meet the relevant requirements.

Of the 36 criteria in schedule 3 of the *Production and Safety Regulation*, 15 were identified as being compliant, 5 were identified as unconfirmed based on current information and 16 were identified as not applicable. The unconfirmed requirements were in regards to a relevant surface plaque being installed. The provided abandonment program specified the correct requirements but photos have not yet been provided to confirm this was implemented. This will be confirmed on a future inspection by the PGI.

Of the 9 mandatory criteria in section 6.9 of the *construction and abandonment code*, 6 were identified as being compliant, 1 was identified as non-compliant and 2 were identified as not applicable. The criteria the audit found the submitted abandonment report to be non-compliant with was:

1. Complete and accurate records of the entire abandonment procedure must be kept and submitted as part of the Well Abandonment Report once final cut and cap has been completed.

Of the 4 good industry practice criteria in section 6.9 of the *construction and abandonment code*, 1 was identified as being met and 3 were identified as not applicable.

In regards to the non-compliances, the main concern is that multiple errors in the report and pieces of information not supplied within the report make it difficult for a reader to determine what occurred on the well and also ensure that requirements have been met. Examples include:

- The location and type of cement plugs used for abandonment and the verification methods for the plugs not being summarized in the report including in the downhole diagram. Also the daily reports state that there was a leak when pressure testing cement plug 2. However there is no information to show that relevant pressure testing acceptance criteria has been met.
- The drilling fluid summary in Appendix E appears to be only from the drilling operations. It would have been appropriate to provide the relevant information from the abandonment operations.
- The data provided in Appendix D was from the 9-5/8" surface casing cement job and 7" production casing cement job conducted during the drilling. This information should have been provided in the well completion report and the relevant information (abandonment cement plug post job service company report and post squeeze job service company cement report) from the abandonment should have been added to the WAR.

- The report incorrectly states that no perforations were carried out on Duke 15. The well was perforated from 831-835mKB in order to conduct a cement squeeze during abandonment operations.
- The downhole diagram has a section on cement evaluation results and in it has no mention of the CBL. The downhole diagram also states the bridge plug is temporary but it has been used as part of the permanent abandonment design.
- Adding a clear and definitive statement into either the well completion or abandonment report on drilling into the Hutton e.g. "While the plan was to drill into the Hutton this did not occur."
- The well completion report states the well was drilled as a future production well with the intent of being fracture stimulated. There is no specific mention in the abandonment report that the well did not end up being stimulated, that a completion string was never run or the well was not production tested. This would provide clarity on the history of the well.
- The well abandonment report states that no deviation survey was recorded but deviation data was available.

While the gaps were addressed through additional data and a comprehensive reply by Origin in response to the clarification request in the audit, relevant data must be supplied within the WAR. Two additional points that were noted during the audit:

- Additional information should have been supplied with the well completion report.
- There is no need to resubmit data in the WAR such as logs and DST data that were submitted with the well completion report. Data such as the CBL which was run after the well completion report was submitted should be contained in the WAR.

The PGI requests that by close of business on the 9th of April 2020 that Origin:

1. Update the abandonment report to address the errors and gaps highlighted in the audit including attaching all relevant information such as the deviation survey. The updated abandonment report should be submit via email to QDEX support, cc'ing the PGI.
2. Provide a written plan for what has been or will be implemented, to prevent similar non-compliances with the legislation from occurring in the future.

Appendix 1 – Abbreviations, Terms and Definitions

Abbreviation/Term	Definition
Construction and abandonment code	The document called 'Code of practice for the construction and abandonment of petroleum wells and associated bores in Queensland', published on a Queensland Government website and current version 2 dated 16 December 2019
P&G Act	Petroleum and Gas (Production and Safety) Act 2004
General Provisions Regulation	Petroleum and Gas (General Provisions) Regulation 2017
Safety Regulation	Petroleum and Gas (Safety) Regulation 2018
Production and Safety Regulation	Petroleum and Gas (Production and Safety) Regulation 2004
PGI	Petroleum and Gas Inspectorate
P&A	Plugging and Abandoning
WAR	Well Abandonment Report
CSG	Coal seam gas

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Audit Report

QGC McNulty 2 Abandonment

March 2020

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Summary

An audit was conducted by the Petroleum and Gas Inspectorate (PGI) in relation to the management of safety and health under the *Petroleum and Gas (Production and Safety) Act 2004 (the Act)*.

The audit was conducted during December 2019 and March 2020 in relation to the abandonment procedure of McNulty 2 for which QGC was the operator. The abandonment procedure was assessed and reviewed through the well abandonment report submitted on 22/02/2019 by QGC after final cut and cap of the well was completed. This report was assessed against the legislation in force at the time of the abandonment work which were the requirements of section 37 of the *Petroleum and Gas (General Provisions) Regulation 2017* (dated 1 September 2018) and the *Code of practice for construction and abandonment of coal seam gas wells and associated bores in Queensland* (version 3 dated 19 May 2017).

The audit found:

- Of the 36 criteria in section 37 of the *General Provisions Regulation*, 22 were identified as being compliant, 2 were identified as being non-compliant and 12 were identified as not applicable.
- Of the 20 mandatory criteria in section 6.9 of the *construction and abandonment code*, 13 were identified as being compliant, 4 were identified as non-compliant and 3 were identified as not applicable.
- Of the 8 good industry practice criteria in section 6.9 of the *construction and abandonment code*, 7 were identified as being met and 1 was identified as not applicable.

QGC are requested, by the close of business on the 28th of May 2020 to:

- Update the McNulty 2 abandonment report to address the errors and gaps highlighted in the audit report.
- Provide an explanation of how well integrity can be confirmed based on the non-compliances of the mandatory abandonment criteria in the construction and abandonment code.
- Provide a written plan for what has been, or will be implemented, to prevent similar non-compliances noted in the report from occurring in the future.

Dated at Brisbane, the 19th day of March, 2020.

s.73 irrelevant information

Michael Scott

Principal Inspector Wells

Petroleum and Gas Inspectorate

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1 Introduction

In Queensland, petroleum and gas safety is regulated under the P&G Act and relevant subordinate legislation. One piece of subordinate legislation, the *Petroleum and Gas (Safety) Regulation 2018 (Safety Regulation)*, establishes that drilling, converting and abandoning of petroleum wells, CSG wells and water bores must be carried out as per the construction and abandonment code (*Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland* (Version 1 dated 1 September 2018) in place at the time the audit commenced). The requirements for well abandonment are detailed under the construction and abandonment code with abandonment being fundamental in ensuring 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. Another piece of subordinate legislation, the *Petroleum and Gas (General Provisions) Regulation 2017 (General Provisions Regulation)*, outlines the requirement for prescribed report including a well abandonment report (WAR).

An audit was conducted by the Petroleum and Gas Inspectorate between December 2019 and March 2020 in relation to the abandonment of QGC's McNulty 2 well. The aim was to determine whether the McNulty 2 WAR complies with the *General Provisions Regulation* and that the abandonment procedure complies with the *construction and abandonment code*.

1.1 Description of Facility

McNulty 2 was a coal seam gas drilled by QGC in September 2001 which targeted the Walloon Coal Measures. The well was completed with a PCP in September 2001. In June 2017 SLR Rig 168 moved to site to remove the downhole completion and conduct subsurface abandonment. In December 2017 a Wellpro coil tubing unit performed additional subsurface work. On the 17th of January 2018 the well surface abandonment took place. The well abandonment report was submitted on the 22nd of February 2019.

2 Audit Plan

At the time the audit began the relevant legislative requirements for abandonment were:

- Section 2.2.9 the *construction and abandonment code* for well abandonment requirements.
- Section 37 of the *General Provisions Regulation* for the WAR requirement.

However, the subsurface abandonment work was conducted by QGC in June-December 2017 and the WAR was due to be submitted in March 2018. The relevant code of practice at the time the abandonment work was conducted was the *Code of practice for the construction and abandonment of coal seam gas wells and associated bores in Queensland* (Version 3 dated 19 May 2017). The relevant regulation when the abandonment report was submitted was the *Petroleum and Gas (General Provisions) Regulation 2017* (dated 1 September 2018). The audit was conducted against the relevant legislation in place at the time the work was conducted.

2.1 Scope and Objectives

The scope of the audit was to verify the WAR meets the requirements set out in section 37 of the *General Provisions Regulation* and that the abandonment procedure applied to McNulty 2 complies

with the requirements in the *construction and abandonment code*. The objectives of the audit were to ensure that the following principles of good petroleum well abandonment have been applied:

- isolate aquifers within the well from each other and from permeable hydrocarbon zones
- isolate permeable hydrocarbon zones within the well from each other unless commingling is permitted
- ensure there is no pressure or flow of hydrocarbons or fluids at surface both internally in the well and externally behind all casing strings
- recover/remove surface equipment so as to not adversely interfere with the normal activities of the owner of the land on which the well or bore is located.

The specific criteria assessed in the audit are detailed in Section 3.1 of this report.

2.2 Participants

The following persons participated in the audit:

Audit team

Role	Name	Position
Team leader	Michael Scott	Principal Inspector (wells)
Team member	Steven Powney	Senior Inspector
Reviewer	Bill Date	Chief Inspector

Auditee's personnel

Role	Name	Position
Nominated representative	s.73 irrelevant information	
Nominated representative		
Nominated representative		

2.3 Activities

The audit was conducted as follows:

Date	Location	Activity
15 November 2019	Correspondence	Audit initiation letter sent to QGC
December 2019 – March 2020	s.73 irrelevant information	Conducted audit and prepare report
7 January 2020	Correspondence	Clarification register and request for response sent
27 February 2020	Correspondence	QGC response to clarifications
12 March 2020	s.73 irrelevant information	Meeting to discuss clarification queries 5 and 6 in more detail
12 March 2020	Correspondence	QGC provided additional information
19 March 2020	Correspondence	Send out preliminary report
20 March 2020	s.73 irrelevant information	Close out meeting
29 March 2020	Correspondence	Send out final report

3 Well Abandonment Report Review

The audit consisted of a review of the operator's WAR document submitted to Queensland Digital Exploration Reports System (QDEX) after abandonment of McNulty 2 was completed. The submitted WAR consists of the following data:

- Report

- Appendix A – Daily Reports
- Appendix B – Cement Bond Evaluation
- Appendix C – End of Well Cement Report

The cement bond log conducted in June 2017 was also submitted on QDEX at the same time as the abandonment report.

QGC also provided additional information that was not available in the data that had been submitted to QDEX. This was in response to clarifications requested by the PGI after an initial review of the WAR. This included:

- Wellpro McNulty 2 cementing program
- Wellpro McNulty 2 cementing post job report
- McNulty 2 rehabilitated site and sign photo
- McNulty 2 well kill daily report (08/06/2017)
- Updated McNulty 2 CBL interpretation
- Halliburton McNulty 2 P&A cementing program
- Halliburton McNulty 2 cementing post job report

Following a meeting on the 12th of March 2020 to discuss clarification queries 5 and 6 in more detail QGC also provided:

- A copy of the pressure test chart for cement plug 1 conducted on the 18th June 2017.
- A copy of QGC's pressure testing acceptance criteria.

A summary of the findings of the audit are provided in **Section 3.1** along with a summary of the clarification requests and QGC's response in **Section 3.2**.

3.1 Evidence and related findings

3.1.1 The following findings were identified against section 37 of the *General Provisions Regulation*.

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Section			Requirement	Compliance	Comments/Findings
37	(2)		If the tenure holder or authority holder plugs and abandons the petroleum well or bore after its rig release day, the tenure holder or authority holder must lodge a report about the abandonment		
	(3)		The report must be lodged within 2 months after the day the plugging and abandoning of the well or bore is completed	Not met	Some work in June 2017. Went back Dec 2017. Cut and cap Jan 2018. 22/02/2019 Report submitted
	(4)		The report must contain the following information -		
		(a)	On the first page		
			(i) the type and number of the tenure or authority	Met	ATP 676P - Page 1 & 4
			(ii) the identifying name of the well or bore	Met	McNulty 2 Pages - 1, 2 & 4
			(iii) the name of the author of the report	Met	3 irrelevant informati Page 1
			(iv) the name of the tenure or authority holder	Met	QGC Pty Ltd - Page 1 & 4 (Same as operator).
			(v) the name of the operator of the well or bore	Met	QGC Pty Ltd - Page 1
			(vi) the name of the person submitting the report	Met	3 irrelevant informati Page 1
			(vii) the date of the report in day-month-year format	Met	22/02/2019 - Pages 1 & 2
		(b)	a summary and history of the well or bore -	Met - area for improvement	Section 1.2 Well history- Page 6. It is recommended that in all well abandonment reports that the total well life production volumes are provided, a statement on why the well was abandoned and a summary of all the workovers and interventions that took place.
			(i) spatial information showing its locations	Met	Latitude: S 26° 43' 43.84575", Longitude: E 150° 21' 09.53871" - Page 4 & Section 1.1- Map - Page 5
			(ii) the day on which a petroleum well or bore completion report for the well or bore was lodged	Met	22-02-2018- Page 1
		(c)	the following details about the well or bore -		
		(i) its total depth in metres	Met	Original Depth 450.00m GL - Well Summary - Page 4	

		(ii)	the position at the top and bottom, expressed as required under subsection (5), and the thickness of a coal seam, natural underground reservoir or aquifer intersected by the well or bore	Met	Section 1.3 - Walloon Coal Measures 140.2m GL (Top)- 449.95m GL (Bottom) - Page 7
		(iii)	the depth in metres of any perforations in the casing of the well or bore	Met	Section 1.4 - Page 7
		(iv)	the type of drilling rig used to drill the well or bore	Met	Mitchell Rig 108. Note Mitchell is spelt incorrectly on page 4.
	(d)		if stimulation of a coal seam was carried out in the well or bore under the tenure or authority, the matters stated in subsection (6)	Met	Section 1.5 Stimulations- No stimulation activity was performed on this well - Page 7
	(e)		all surveys and measurements made in the well or bore, including any detailed interpretation of a survey or measurement	Met	Section 4.2 Appendix B – Subsurface Internally Verified Cement Bond Evaluation Section 4.3 Appendix C – End of Well Cement Report Well Plug & Abandonment Plan - Page 9 CBL logs also submitted to QDEX along with the abandonment report
	(f)		the following in formation in relation to the completion or abandonment of the well or bore		
		(i)	details of the casing equipment made in the well or bore, with diagrams showing the major dimensions and features of the casing equipment	Met	Well Plug & Abandonment Plan - Page 9
		(ii)	a full description of all equipment, including prescribed equipment, that is retained in the well or bore, including the size and nature of the equipment and any features of the equipment that may cause hazard to coal mining operations	Met	Well Plug & Abandonment Plan - Page 9

		(iii)	the surveyed location of any prescribed equipment	N/A	
		(iv)	the method of the cementing operations carried out in or on the well or bore, including the type of plugs, the intervals covered, the volume and type of cement due to voids or permeable strata, and the methods used to overcome losses of cement	Met	Section 4.2 Appendix B – Subsurface Internally Verified Cement Bond Evaluation
		(v)	the method, materials and volume of cement used to cement voids	Met	Section 4.3 Appendix C – End of Well Cement Report
		(vi)	a description of any other abandonment procedures used for the well or bore	Met	Nil
		(vii)	any other details of the activities undertaken in drilling, completing and plugging and abandoning the well or bore, including an assessment of their possible impacts, that would assist a person in making an assessment of potential risks to safe and optimal mining of coal	Not met	No assessment provided. The report needs to provide some details even if it is that no impacts are present. However given the well is located approximately 6km from a working coal mine it is realistic that impacts exist.
(5)			For subsection (4)(c)(ii), the position at the top and bottom of the coal seam, natural underground reservoir or aquifer must be identified in relation to -		
	(a)		for a directional well -		
		(i)	total vertical depth in metres	N/A	
		(ii)	the horizontal plane	N/A	
	(b)		otherwise depth in metres	Met	
(6)			For subsection (4)(d), the matters are-		
	(a)		the depth in metres of the top and bottom of the interval over which stimulation was carried out	N/A	

	(b)	a description of the equipment used to carry out the stimulation	N/A	
	(c)	for the interval mentioned in paragraph (a), a graphic representation of each of the following -		
	(i)	casing pressure with time	N/A	
	(ii)	calculated bottom hole pressure with time	N/A	
	(iii)	slurry rate with time	N/A	
	(iv)	proppant concentration with time	N/A	
	(v)	calculated bottom hole concentration with time	N/A	
	(d)	any record made about the stimulation by the person who carried it out	N/A	
	(e)	any other details about the stimulation that would assist a person in making future assessment of the impact of the stimulation on the coal seam and any increased risk to safe and optimal coal mining	N/A	

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3.1.2 The following findings and related evidence were identified against the mandatory requirements listed in section 6.9 of the *construction and abandonment code* relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence
1	Any well, bore or drill hole that is to be abandoned shall be sealed and filled in such a manner to prevent leakage of gas and/or water.	Met	As per other criteria
2	A horizontal well must be abandoned as per the requirements in the P&G Regulation.	N/A	
3	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.	Met	Cement used as per schematic in the well plug & abandonment plan and other documentation. Wellpro cementing program (plug 4) and Halliburton cementing program (plug 3) provided which both show free water test results and compressive strength development with time.
4	Prior to commencing abandonment, the Operator must confirm the absence of pressure/flow externally behind all casing strings. This requires a surface casing vent flow test to determine if hydrocarbons, liquid, or any combination of substances is escaping from the casing vent assemblies.	Met - area for improvement	Wellhead arrangement did not allow for a surface casing vent flow test. This should have been stated in the well abandonment report or an alternate means of compliance should have been submitted and approved. Other work such as monitoring the well between subsurface and surface abandonment to ensure integrity especially on wells that do not have a thorough history of well integrity records throughout their life should have been implemented. The CBL and onsite gas test prior to abandonment were provided as data to confirm well integrity.
5	Sucker rods, pump and tubing (unless used as a sacrificial stinger) and any other debris in the well or bore that can practicably be removed are removed.	Met	All equipment removed from the well.
6	There must be a continuous cement barrier with a minimum 30 m length adjacent to the	Met	5-1/2" production casing set to 142.4mGL and top of Walloon Coal Measures at 140.2mGL.

	impermeable formation (cap rock) overlying the uppermost hydrocarbon zone.		
7	<p>There must be a minimum of two adjacent cement barriers across all aquifers above the uppermost hydrocarbon production zone. This can be achieved by the following:</p> <ul style="list-style-type: none"> • Having the surface casing set below the aquifer and cemented to surface and the production casing cemented from 30 m below the base of the lowermost aquifer to 30 m above the uppermost aquifer. In cases where the production zone is less than 30 m below the lowermost aquifer, casing is to be cemented from as low as practical below that aquifer. • Fully cementing the inner most casing string from the production zone to the surface provided the cement plug(s) are adjacent to good annulus cement • If production casing has not been cemented with an overlap inside the surface casing shoe the operator must remediate the well until the required barriers are achieved. This could involve removing the production casing above the cement top if technically and commercially feasible to do so or performing remediation cement squeezes. Cement top up jobs are not an approved method of remediation unless isolation can be confirmed with cement bond logs 	Met	<p>8-5/8" surface casing set at 70mGL. 5-1/2" production casing set to 142.4mGL and top of Walloon Coal Measures at 140.2mGL. Cement plugs set as per criteria 9.</p>

8	For pre-existing mineral exploration drill holes that are fully uncased, the openhole must be cleaned out down to TD or Hang-Up-Depth (HUD) and fully cemented to surface.	N/A	
9	Cement plugs shall not exceed 200 m in length unless installed with coil tubing or sacrificial stinger. A 50 m weighted high-vis pill must be spotted below each cement plug that is not set directly above a physical barrier.	Met	<p>Cement plug 1 - 280-348mGL - set on 4/9/2001 on drill rig</p> <p>Cement plug 2 - 195.7-246mGL - set on 4/9/2001 on drill rig -</p> <p>Note: DHD as well as the data card and section 2.3.5 in the WCR has 195.7 as top of cement. Daily report has 185m.</p> <p>Cement plug 3 - 112-195.8m - set 17/6/2017. Soft tag on 17/6/2017 at 112mGL (no initial hard tag). Later tagged at 107mRT.</p> <p>Cement plug 4 - 10-105mGL - set 19/12/2017 with coil tubing</p> <p>Plug 3 is set on plug 2 and plug 4 on plug 3.</p>
10	<p>Cement plugs for decommissioning must meet the minimum requirements of the Table 1 and Figure 1 below:</p> <ul style="list-style-type: none"> • The preferred method where possible is to cement inner casing string to surface • Consecutive stacked cement plugs set inside casing do not require additional tagging provided initial verification method is performed • If unable to achieve the required 1000 kg set down weight (e.g. plug is too shallow or coil tubing is used) the minimum force with which plugs must be verified is maximum string weight. Note that the use of slickline or wireline is not an approved method of verifying the tops of plugs 	Not met	<p>Cement plug 3 was not adequately verified via pressure test.</p> <p>Cement plug 3 was tagged with 2klbs but it was a soft tag and not where expected (100mRT versus 112mRT. Following pressure testing the plug was then re-tagged at 107mRT. It was also tagged by the coil tubing unit at 105mGL.</p>

11	<p>Plugs that do not pass pressure testing must be remediated until requirements are achieved as noted below:</p> <ul style="list-style-type: none"> • If sufficient depth is available to meet requirements an additional cement plug may be installed and re-tested • For failed mechanical barriers an additional mechanical barrier may be installed and re-tested • If insufficient depth is available the plug(s) will have to be circulated or drilled out. The plug(s) must then be rerun and pressure tested 	Not met	<p>There were 3 unsuccessful attempts to pressure test cement plug 3. A fourth attempt was then made and called good, however this did not meet QGC's own pressure testing acceptance criteria. Based on the available data, there was a requirement to set and verify an additional isolating cement plug on top of cement plug 3.</p>
12	<p>Plugs that are confirmed as too low or too high after tagging are unacceptable. The Operator must remediate until requirements are achieved as noted below.</p> <ul style="list-style-type: none"> • A plug is too low if it has a top less than 15 vertical meters above the zone it was intended to cover. Such a plug must be built up to required depth and its location confirmed. • High plugs must be drilled out if the theoretical plug base is less than 15 vertical meters below the base of the zone it 	N/A	
13	<p>BOPs and/or the wellhead must not be removed until the cement plug across the surface casing shoe or plug across the uppermost perforations has been physically</p>	Met	<p>18/6/2017 10:30 nipple down BOPs post plug verification.</p>

	tagged for correct location, then pressure tested.		
14	Water-based fluid mixed with Biocide, oxygen scavenger and/or corrosion inhibitor shall be left in the wellbore above the top most cement plug and in-between cement plugs if the well is not cemented to surface.	Not met	<p>The void in between cement plugs 1 and 2 and below cement plug 1 were placed in openhole so there is no requirement to have oxygen scavenger and/or corrosion inhibitor in these sections.</p> <p>The casing was filled with cement, however, there is insufficient evidence to show that cement plug 4 was brought all the way back to surface. The well abandonment report states that plug #4 was tagged at 10mGL. Based on the coil tag depth (105mGL) over 8bbl of cement would have needed to have been pumped to bring the slurry back to surface. The Wellpro post job report states 7.6bbl of cement was pumped. The diagram on page 4 of the Wellpro post job report also shows the top of cement at 10mRT, which is not at surface.</p> <p>In addition to this, the CBL conducted on the 16 June 2017 indicated free pipe behind casing down to approximately 12m. There was no mention or clarity provided in the well abandonment report on how this was rectified.</p>
15	Prior to conducting a surface abandonment, the Operator must confirm the absence of pressure/flow internally within the well and externally behind all casing strings. Wells with no history of external flow/pressure may be cut and capped immediately. All other wells must be monitored for a minimum of 6 months prior to conducting surface abandonment.	Met - area for improvement	As per criteria 4.
16	A surface cement plug minimum 10 m in length must be placed at the top of the casing. The surface plug acts as a barrier to prevent any long-term ingress into the wellbore and is not deemed to be a pressure containing barrier. Well barriers to be	Met	Cement plug 4 was set as the surface plug.

	established with the plugs below the surface cement plug.		
17	Wellheads must be removed, and casing string(s) must be cut minimum 1.5 m below surface.	Met	
18	The well must be capped below the surface across all casing strings with a steel marker plate that is fastened and installed in a manner as to prevent any potential for pressure to build up within the casings while restricting access to the casing strings at surface (vented/ported plate)	Met	Well history page 6 states that on 17/01/2018 - Wellhead Upper Abandonment - Standalone wellhead removal. Cut casing strings 1.5m below ground level. Capped inner most casing string. Laid marker tape. Backfilled to GL. Installed well sign. Daily operations report from 17/1/2018 was also provided.
19	The steel marker plate must be installed as per legislative requirements: <ul style="list-style-type: none"> • the identifying name of the well or bore; • the total depth in metres of the well or bore; • the date the well or bore was abandoned. 	Met - area for improvement	Program stated the correct requirements but no evidence provided that this was implemented. It is recommended that photos throughout the cut and cap process are included in the well abandonment report. This is now a mandatory requirement in legislation.
20	Complete and accurate records of the entire abandonment procedure must be kept, with these records submitted as part of the Well Abandonment Report once final cut and cap has been completed.	Not met	There were multiple errors, conflicting pieces of information or missing information in the report. This included: <ul style="list-style-type: none"> - Page 2 states "PURPOSE AND SCOPE: PROVIDE DETAILS OF ABANDONMENT per SECTION 38 of the PETROLEUM AND GAS (Production and Safety) REGULATION 2004. The relevant legislation was the Petroleum and Gas (General Provisions) Regulation 2017 Section 37. - In the well history section it states the casing was cut 1.5m below ground while in the abandonment plan it states the casing was cut 1.8m below ground. The daily report from the 17/1/2018 does not state the depth the casing was cut. It is not clear which is the correct depth. - In the well plug & abandonment plan, in the current configuration column, it has two labels reading plug #2 with difference tops of cement. One of these should read plug #1.

- The well plug & abandonment plan should have provided more details about the tagging of cement plug 3. The report body states the plug was tagged with 2klbs however this is not an accurate record of what occurred. The plug was tagged with 2klbs but it was a soft tag and not in the location expected (100mRT versus 112mRT). Following pressure testing the plug was then re-tagged at 107mRT.
- There is insufficient clarity provided in the report on the pressure testing verification of cement plug 3. This includes the actual value the pressure test was conducted to. The well plug & abandonment plan states that the cement plug isolating the Springbok and Walloon Coal Measures was pressure tested to 700 psi which is inconsistent with other documentation. There is also no mention of the multiple failed tests or sufficient evidence to show that the final test that was called good met requirements.
- The well plug & abandonment plan states that plug #4 was tagged at 10mGL. The clarification response says that Wellpro's records show cement was returned to surface around the wellhead. However all data within Wellpro's post job report does not support this.
- The CBL provided in Appendix B contained multiple errors including an incorrect date for when the log was run and comments in the interpretation section that did not pertain to the relevant well.
- In the well plug & abandonment plan, in the current configuration column it states the top of cement for two plugs as 195.8 mKR and 280.0 mKR. This is an error.
- The CBL conducted on the 16 June 2017 indicated free pipe behind casing down to approximately 12m. There was no mention on how this was rectified in the well abandonment report.
- The cementing programs and post job reports not being submitted with the abandonment report
- In regards to cement plug 2 (195.7-246mGL) set on 4/9/2001 on the drill rig. The downhole diagram in the WAR, as well as the data card and section 2.3.5 in the WCR has 195.7 as top of cement while the daily report has 185m. This appears to be an issue with the WCR.

The following findings and related evidence were identified against the good industry practice for the requirements listed in the *construction and abandonment code* relevant at the time the abandonment work was conducted:

Criteria Number	Criteria	Compliance	Evidence
1	Use of an integrated openhole volume calculated from a caliper on a wireline log to calculate cement volumes where possible (this applies mostly to exploration wells which are to be plugged and abandoned).	N/A	
2	If no caliper data is available, 20–30% above theoretical volume calculated from nominal casing diameter and gauge hole size should be used, along with local hydrogeological knowledge and offset well data.	Met	Cement programs were provided as part of the clarification response which detailed excess volumes.
3	Plugs should normally be a minimum of 30 m in length (height). If the hole is badly washed out, it may be better to set two short plugs over the washed out section than to try to cover this interval with one plug.	Met	All plugs were greater than 30m.
4	After placement of a cement plug the rate to pull the work string should be controlled to avoid intermixing of the plug and other fluids in the hole.	Met	The work string pull rate post setting cement plug 3 was provided in the Halliburton post job report.

5	Excess cement should be used when placing plug and circulated off the top of the plug to minimize contamination issues.	Met	Met as per programs and post job reports.
6	Work string wiper dart/balls should be used to separate cement and fluids during placement. If wiper darts are used a catcher sub should be included in the workstring.	Met	While balls/darts were not used to separate fluid and cement in the abandonment, QGC procedures have sufficient steps to meet the intent of this requirement.
7	Displacement rates during cement plug placement should be kept as high as possible without exceeding the open-hole fracture gradient. This aids in the displacement of the wellbore fluids by the spacer and cement flowing up the annulus. Spacer volumes should be adjusted to provide adequate contact time based on the estimated displacement rate.	Met	As per post job cement report pumped at 4bpm.
8	The Wait on Cement (WOC) time for tagging should be based on the pre-job lab testing of the slurry at BHST, preferably on an Ultrasonic Cement Analyser (UCA). Typically the time to 500 psi compressive strength is adequate for tagging cement. If the cement plug does not take weight, it is recommended to increase WOC in 4 hours increments up to a maximum of 12 hours additional WOC time.	Met	Waited 6.75hr prior to initially tagging cement plug 3. Based on the Halliburton program compressive strength should have been >500psi. After initial soft tag follow up tag was attempted >4 hours later.

3.2 QGC Response Letter and Clarification Register



QGC Pty Limited

275 George Street

Brisbane

QLD 4001

Australia

Website: shell.com.au

Dr Michael Scott
Principal Inspector (Wells)
Petroleum and Gas Inspectorate
Department of Natural Resources, Mines and Energy
Brisbane 4000

27 February 2020

Dear Mr Scott,

RE: Audit of abandonment of QGC McNulty #2

I refer to your correspondence dated 7 January 2020 seeking clarification and/or further information from QGC.

In response to the Departments request please find below a table detailing the QGC response.

QGC also requests the opportunity to update the Well Schematic currently held for this well at the conclusion of the audit to better reflect the operations that took place on this well. Our current procedures have improved the QA/QC of data that is submitted as part of the Well Abandonment Report, and many learnings from the 2019 P&A audit with DNRME have been implemented to improve what we record as part of our operations.

Please let me know if you would like to have a meeting to discuss any of the QGC response items.

If you require any further information, please contact Sam Heritage in the first instance on 07 3024 8043.

Yours sincerely,

3 irrelevant informat

Shell Australia – Risk and Assurance Lead

Clarification number	Finding or clarification request	QGC Response
1	Can QGC please provide all relevant details and documents of testing that occurred on the cement used during abandonment operations. Examples of testing include compressive strength development with time and a free water test as outlined in API RP 10B-2.	Originally, Halliburton intended to pump plug 3 and 4, but ended up only pumping Plug #3. Please see attached PDF files of Halliburton's cement program, and Post Job Report for this well. Wellpro pumped Plug #4 offline with a coiled tubing unit. Please see Attachment 1 & 2 PDF files for Wellpro's cement program and Post Job Report.

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Clarification number	Finding or clarification request	QGC Response						
2	Can QGC please provide details or evidence of what information was on the ID plate used on the casing stub during cut and cap operations. Can QGC also please provide details and evidence of whether a surface location marker was installed and what information was on that marker.	<div data-bbox="840 400 1971 499" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">  <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">Shell Australia</td> <td style="width: 50%; text-align: center;">1.0</td> </tr> <tr> <td colspan="2" style="text-align: center;">McNulty 2 – Plug & Abandonment Program</td> </tr> <tr> <td colspan="2" style="text-align: right;">13/10/2017</td> </tr> </table> </div> <p>6.6.2. Record wellhead pressures. Bleed off pressures as applicable. Record fluid type bled off.</p> <p>6.6.3. Excavate around wellhead 2m below ground level.</p> <p>6.6.4. Gas test production casing annulus vent, surface casing annulus and conductor annulus separately.</p> <p>6.6.5. Remove wellhead if applicable. Cut casing strings to leave upper most casing stump 1.5m below ground level.</p> <p>6.6.6. Install ported cap onto the stump of the inner most casing string. The well should be capped with the following information:</p> <ul style="list-style-type: none"> • Well name; • Well depth (in meters below GL); • P&A rig release date. <p>6.6.7. Backfill excavation to approximately 20cm above casing cap. Lay marker tape across well centre.</p> <p>6.6.8. Backfill excavation to ground level.</p> <p>6.6.9. Install well sign. Sign should be placed next to nearest fence, building or other permanent structure. Sign should be placed in a location so it does not interfere with agriculture or transport. The sign should contain the following information.</p> <ul style="list-style-type: none"> • Well name; • Well depth (in meters below GL); • P&A rig release date. • Distance & direction to well from sign (if applicable). <p>Please see above excerpt from program, as well as Attachment 3 - attached photo of sign erected at wellsite.</p>	Shell Australia	1.0	McNulty 2 – Plug & Abandonment Program		13/10/2017	
Shell Australia	1.0							
McNulty 2 – Plug & Abandonment Program								
13/10/2017								

Clarification number	Finding or clarification request	QGC Response
3	In the well abandonment report, in the well plug & abandonment plan, in the current configuration column it states top of cement for two plugs are 195.8 mKR and 280.0 mKR. Can QGC please confirm what mKR is a reference to. Is this supposed to read mKB?	Yes, meant to be KB. It is most likely a mix up between RT and KB.
4	The well plug & abandonment plan states that plug #4 was tagged at 10mGL. Can QGC please confirm when this tagged occurred and provide clarity on what was left in hole above this point. QGC proposes to update the schematic and resubmit.	No data can be located to support the 10m TOC stated on the schematic. According to the Wellpro program, the plug was designed to surface. After speaking with Wellpro for the purpose of this audit, their records state that returns were taken into the pit around the well.

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Clarification number	Finding or clarification request	QGC Response
5	<p>Can QGC please provide clarity on the success of the pressure test of the cement plug set at 112-195.8mGL on 17/6/2017. The daily reports state an initial attempt at 23:00 failed a 250psi pressure test (40psi drop or 16% over 5 minutes). Then on the 18/6/2017 at 01:00 there was a re-attempt and this was again unsuccessful as it didn't meet the 2% requirement. At 02:00 there was another re-attempted 500psi test against blind rams. This was unsuccessful as there was an 8% drop. At 04:00 the rig tagged TOC at 107mRT and circulated 2 x bottoms up. At 09:00 there was a re-attempted pressure test at 500psi. This was called good with a 1.5psi/minute drop. However over the 10 minute test this is a 15psi drop or 3% and this does not meet the 2% requirement that is stated in the daily reports. There are also statements saying the cement job would be completed offline. Coil tubing set a plug above this on the 18/12/2017</p>	<p>There are contradicting values within our records for the pressure test value. Two potential conclusions are that 1. 500psi is a typo within the daily report and should be a higher value, or the test failed, and the calculation was done incorrectly in the field. The revised program written for the offline plug (plug #4) states a successful pressure test of 800psi. The abandonment plan says we tested to 700psi. Plug #4 set by Wellpro was not pressure tested, as they removed the wellhead before pumping the plug, taking returns in and around the wellhead.</p>

Clarification number	Finding or clarification request	QGC Response
	<p>but this plug was not pressure tested. It is unclear how requirements have been met. The well plug & abandonment plan in the well abandonment report also states that the cement plug isolating the Springbok and Walloon Coal Measures was pressure tested to 700 psi. It is unclear how this occurred. Can QGC pressure provide clarity on this.</p>	
6	<p>Can QGC please confirm if a surface casing vent flow test was conducted prior to abandonment. It appears no pressures including production casing and tubing pressures are noted in the first daily report on the 13/6/2017. Can QGC please confirm how the absence of pressure and flow externally behind all casing strings was verified prior to abandonment operations commencing.</p>	<p>A 1 day well kill operation was performed on June 8, 2017. The daily report is provided as Attachment 4 for this operation, which states 0% LEL around wellhead, as well as Opsi on wellhead.</p>

Clarification number	Finding or clarification request	QGC Response
7	The CBL conducted on the 16 June 2017 indicates free pipe behind casing down to approximately 12m. Can QGC please confirm how this void was abandoned.	No recorded plan was made to rectify this during the abandonment. The void may be filled with cement returns or the backfill material, "local fill" used to fill the excavation from the wellhead cut off operations.
8	In appendix B the subsurface internally verified cement bond evaluation states the date of the CBL as the 11 Mar 2017. Can QGC please confirm if this is the log conducted on the 16 June 2017 or was there another CBL run.	Please find as Attachment 5 an email explaining the error in header made by our Petrophysics Team in saving the documentation. It also has the correct interpretation attached. The log indeed was run on 16 June 2017.
9	Can QGC please provide details of how cement plug 3 and 4 volumes were calculated and specify any excess included in the calculations.	Please refer to Attachment 6 & 7 cement programs for details on Cement plug #3 (Halliburton) and Cement plug #4 (Wellpro). Plug # 3 used 50% excess for the open hole section of it's plug. Plug #4 had no excess as was inside casing.
10	Can QGC please confirm the rate the work string was pulled out of hole post setting cement plug 3 (15:45 on the 17/6/2017).	Please refer to Attachment 8 the Halliburton PJR, Page 5, within pumping schedule section, stating 9.0m/min.

4 Conclusions

The submitted well abandonment report for McNulty 2 was audited against the requirements for the abandonment of wells as per section 37 of the General Provisions Regulation dated 1 September 2018 and Section 6.9 of the *Code of practice for the construction and abandonment of coal seam gas wells and associated bores in Queensland* (Version 3 dated 19 May 2017).

Of the 36 criteria in section 37 of the General Provisions Regulation, 22 were identified as compliant, 2 were identified as non-compliant and 12 identified as being not applicable. The two criteria the audit found the submitted abandonment report to be non-compliant with were:

1. Section 37 (3) – the report was not submitted by the due date;
2. Section 37 (4) (f) (vii) – no assessment was provided in the report detailing the potential impacts on the safe and optimal mining of coal.

Of the 20 mandatory criteria in section 6.9 of the construction and abandonment code, 13 were identified as compliant, 4 were identified as non-compliant and 3 were identified as being not applicable. The three criteria the audit found the submitted abandonment report to be non-compliant with were:

1. Cement plugs for decommissioning must meet the minimum requirements;
2. Plugs that do not pass pressure testing must be remediated until requirements are achieved;
3. Water-based fluid mixed with Biocide, oxygen scavenger and/or corrosion inhibitor shall be left in the wellbore above the top most cement plug and in-between cement plugs if the well is not cemented to surface;
4. complete and accurate records were not submitted as part of the well abandonment report.

Of the 8 good industry practice criteria in section 6.9 of the construction and abandonment code of practice 7 were met and 1 was not applicable.

In regards to the non-compliances and areas for improvements noted in the report, the main concern is that multiple errors, inconsistent or unclear information and information not supplied in the report make it difficult for a reader to determine what occurred on the well and also ensure that requirements have been met. Examples include:

- Photos of the cut and cap process should be included in the well abandonment report.
- Page 2 states "PURPOSE AND SCOPE: PROVIDE DETAILS OF ABANDONMENT per SECTION 38 of the PETROLEUM AND GAS (Production and Safety) REGULATION 2004. The relevant legislation was the Petroleum and Gas (General Provisions) Regulation 2017 Section 37.
- In the well history section it states the casing was cut 1.5m below ground while in the abandonment plan it states the casing was cut 1.8m below ground. The daily report from the 17/1/2018 does not state the depth the casing was cut. It is not clear which is the correct depth.
- The well plug & abandonment plan should have provided more details about the tagging of cement plug 3. The report body states the plug was tagged with 2klbs however this is not an accurate record of what occurred. The plug was tagged with 2klbs but it was a soft tag and not in the location expected (100mRT versus 112mRT). Following a period of pressure testing the plug was then re-tagged at 107mRT.
- There is insufficient clarity provided in the report on the pressure testing verification of cement plug 3. This includes the actual value the pressure test was conducted to. The well plug & abandonment plan states that the cement plug isolating the Springbok and Walloon Coal Measures was pressure tested to 700 psi which is inconsistent with other documentation.

There is also no mention of the multiple failed tests or sufficient evidence to show that the final test that was called good met requirements.

- The well plug & abandonment plan states that plug #4 was tagged at 10mGL. The clarification response says that Wellpro's records show cement was returned to surface around the wellhead. However the data within Wellpro's post job report does not support this.
- The CBL provided in Appendix B contained multiple errors including an incorrect date for when the log was run and comments in the interpretation section that did not pertain to the relevant well.
- The CBL conducted on the 16 June 2017 indicated free pipe behind casing down to approximately 12m. There was no mention on how this was rectified in the well abandonment report.
- The cementing programs and post job reports were not submitted with the abandonment report

The PGI requests that by close of business on the 28th of May 2020 that QGC:

1. Update the abandonment report to address the errors and gaps highlighted in the audit. The updated abandonment report should be submit via email to QDEX support, cc'ing the PGI.
2. Provide an explanation of how well integrity can be confirmed based on the non-compliances of the mandatory abandonment criteria in the construction and abandonment code.
3. Provide a written plan for what has been or will be implemented, to prevent similar non-compliances with the legislation from occurring in the future.

Appendix 1 – Abbreviations, Terms and Definitions

Abbreviation/Term	Definition
Construction and abandonment code	The document called 'Code of practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland', published on a Queensland Government website and version 1 dated September 1 2018. Note a new version of this document was released during the audit timeframe.
P&G Act	Petroleum and Gas (Production and Safety) Act 2004
General Provisions Regulation	Petroleum and Gas (General Provisions) Regulation 2017
Safety Regulation	Petroleum and Gas (Safety) Regulation 2018
PGI	Petroleum and Gas Inspectorate
P&A	Plugging and Abandoning
WAR	Well Abandonment Report
CSG	Coal seam gas

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