

**Audit report**

**Arrow Energy Gathering System – Surat Field**

**19 March 2019**

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## Summary

An audit was conducted by the Petroleum and Gas Inspectorate (the Inspectorate) 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 on 19 March 2019 in relation to the Surat gathering system (operating plant) located at Surat Basin for which Arrow Energy Pty Ltd (Arrow Energy) is the operator.

The objective of the audit was to assess the Safety Management System for compliance with the Act. The scope of the audit was to use the Australian Pipeline and Gas Association (APGA) Code of Practice – Upstream Polyethylene Gathering Networks – CSG Industry in conjunction with the Act to assess the compliance of the Arrow Energy management systems for their gathering system.

The audit consisted of the review of the Network Management System, the Network Integrity Management Plan, Safety Management Study, Remaining Life Review and other associated documents.

One non-conformance was identified in the audit relating to the Integrity Management Plan. In addition, the audit identified several opportunities for improvement, which are detailed in this report.

Arrow Energy have been requested to provide the Petroleum and Gas Inspectorate a detailed action plan, within 20 business days of this report being issued, for the timely completion of the identified issues.

**Dated at Brisbane, this 23 day of April 2019.**

Marshall Holmes

Lead Auditor

**Executive Petroleum Engineer**

Petroleum and Gas Inspectorate

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## Introduction

The audit was conducted on 19 March 2019 in relation to the Surat gathering system (operating plant) located at Surat Basin for which Arrow Energy is the operator.

Arrow Energy is a major CSG production company in Queensland. This gathering system is deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act).

An Extract from the Arrow Energy Network Management System (NMS) is below.

## Surat PE Gathering Network Description

Arrow's PE gathering network in the Surat basin is located on three main areas, namely:

- Kogan
- Daandine – Statheden, and
- Tipton.

*It covers an area of approximately 560km<sup>2</sup> with gas and water flowlines, trunklines and gathering lines with diameters ranging from DN63 up to DN630. The PE gathering network was first constructed and commissioned in the Kogan field in 2004.*

*The system is based on a minimum and maximum operating temperature of 0 and 35 degrees Celsius.*

*The gas gathering network transports CSG from the wells located on each field to the relevant CGPF (Kogan, Daandine and Tipton). The normal operating pressure in the gas gathering network ranges from 250kPag to 260kPag and the normal operating temperature from 24°C to 31°C.*

*Overpressure protection is provided at the wellhead skids by means of PCV's on legacy wells and PSV on new wells. Low point drains (LPD's) are installed along the gas gathering network on the legacy gas network, while automatic ones are now installed on new gas networks.*

*The water gathering network transports PFW from the wells to the feedwater and transfers dams, for further processing at the water treatment plants at Daandine and Tipton. A portion of untreated PFW water is sent to some end users in the Surat Basin.*

*Water overpressure protection is provided at the wellhead skid by a combination of PSV and a local control panel which stops the pump motor upon reception of High Pressure Signal. PSV's are set to 680kpag on legacy wells and 560kPag on new wells.*

*High Point Vents (HPV's) are installed along the water network, to avoid an increase in backpressure – due to vapour accumulation. HPV's also mitigate the risk of potential vacuum formation caused due to downward sloping of some section of the water network. Automatic HPV's are used to transfer vapours either to the gas gathering network (where suitable differential pressure exists) or to the atmosphere.*

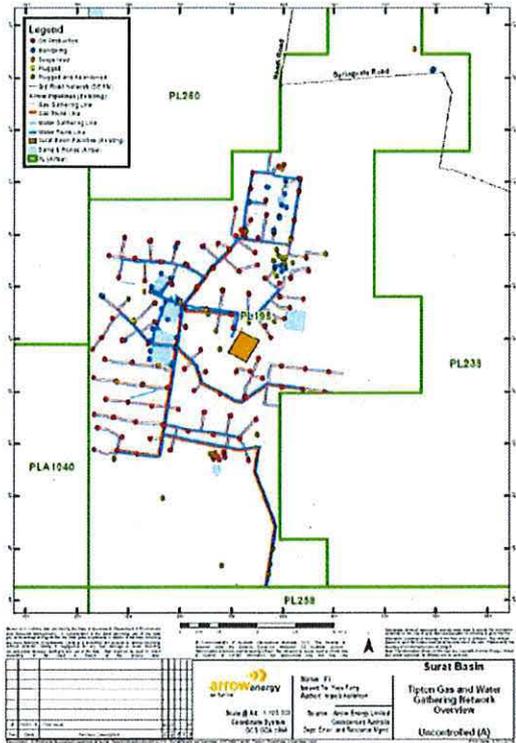


Figure 2 - Tipton Network

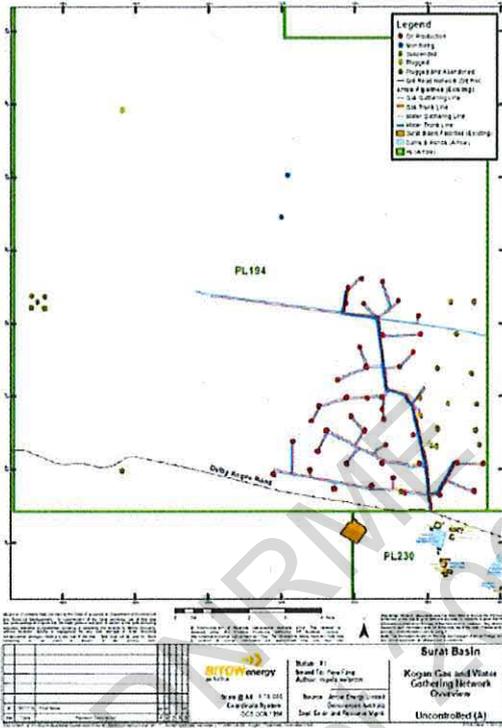


Figure 3 - Kogan Network

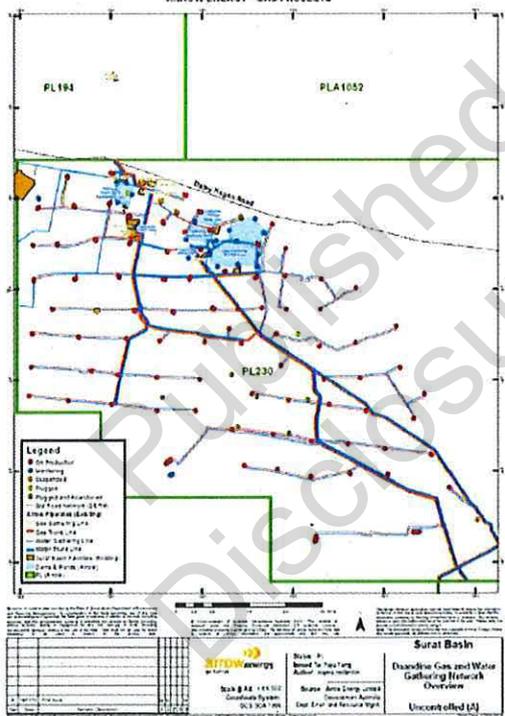


Figure 4 - Daandine Network

## Objectives

To conduct an audit of the Surat gathering system (operating plant) located at Surat Basin for which Arrow Energy is the operator.

## Scope

The scope of the audit was to assess the compliance of the internal procedures developed by Arrow Energy on the management, operational and pipeline integrity of the Surat gathering system.

The APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry in conjunction with the P&G Act forms the basis for the audit scope. The Code of Practice is listed in the Petroleum and Gas (Safety) Regulation 2018 as a safety requirement for these gathering systems.

The audit team reviewed and assessed the Arrow Energy Network Management System (NMS) for their operations and associated documents, including but not limited to; Safety Management System, Integrity Management Plan, Safety Management Study. This audit was aimed at the systems that Arrow Energy have implemented.

The Arrow Energy gathering system was selected for an audit as part of a risk-based sample across the regulated section of the petroleum and gas industry. This is the fifth audit undertaken on compliance to the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry version 4 supplementary. An extract from the Code of Practice (CoP) is below:

*The Code of Practice was prepared on behalf of the Australian Pipelines and Gas Association (APGA) by members of the Association who are associated with the Coal Seam Gas (CSG) industry. Representative members of all sections of the industry were active participants, including all major CSG producing companies, constructors, and manufacturers of polyethylene (PE) resin, pipelines and fittings as well as CSG engineers.*

An additional objective of this audit was to identify issues with the APGA Code of Practice with respect to operating company's systems. The Code of Practice is currently being revised as part of the development of version 5.

## Participants

The following persons participated in the audit:

### Audit team

Role	Name	Position
Team leader		
Team member		
Team member		
<b>Auditee's personnel</b>		
Role		
Nominated representative		
Participant – full time		s.73 irrelevant information
Participant – full time		
Participant – part time		

Participant – part time	s.73 irrelevant information
Participant – part time	

## Activities

The audit was conducted as follows:

Date	Location	Activity
19 March 2019	111 Eagle Street, Brisbane	Opening meeting
19 March 2019	111 Eagle Street, Brisbane	Document review
19 March 2019	111 Eagle Street, Brisbane	Collecting and verifying information
19 March 2019	111 Eagle Street, Brisbane	Closing meeting

## Criteria

The audit was conducted against the following criteria:

Source	Criteria
<i>Petroleum and Gas (Production and Safety) Act 2004</i>	1. Section 675
Petroleum and Gas (Safety) Regulation 2018	2. Section 67
Code of Practice – Upstream Polyethylene Gathering Networks – CSG Industry	3. All

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## Evidence and related findings

The findings outlined in this audit report relate to the audit against the requirements of section 675 of the *Petroleum and Gas (Production and Safety) Act 2004*.

In addition, the findings outlined in this audit report relate to the audit against the requirements of APGA Code of Practice, which is mandated as a safety requirement for pipelines as detailed in the *Petroleum and Gas (Safety) Regulation 2018 in section 67*.

The audit focused on management for the gathering system as well as integrity management.

The audit provided the audit team with a sound understanding of the Arrow Energy management process for their CSG gathering systems.

Arrow Energy have been extensively involved in the development of the code of practice for the PE gathering systems to date particularly in the last three years.

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## Network Management System

The APGA Code of Practice for PE gathering systems specifies the requirement to have a Network Management System (NMS). Section 2.2 of the Code of Practice (CoP) details the general contents for the system.

Extract from the Code of Practice.

*The NMS shall address the Operator's approach to the following areas –*

- a) Management;*
- b) Planning;*
- c) Implementation;*
- d) Measurement and evaluation;*
- e) Consultation, communication and reporting;*
- f) Safety Management;*
- g) Environmental Management;*
- h) Construction and Commissioning;*
- i) Site Safety.*

### Auditor findings/comments

Arrow Energy provided the audit team a copy of their Network Management System Bowen and Surat Basin ORG-ARW-PPL-PLA-00001 version 2.0 dated 19/02/2019.

This document is a high-level document that refers to key documents and procedures that have been developed by Arrow Energy for their CSG developments.

The audit team discussed the Network Management System in detail and relevant comments are:

- All of the key elements that are detailed in the APGA CoP section 2 are included in the Arrow Energy NMS.
- One issue identified relates to the review frequency. On the front page of the NMS the frequency is stated as 5 years. However in section 3.6 the review period is listed as 2 years. In the current version of the CoP this frequency is detailed as 2 years however the proposed wording in version 5 of the CoP this period is proposed to be changed to 5 years as this aligns with other similar standards such as AS 2885 and AS 4645. It is also noted that the review period from version 1 to version 2 is just over 2.5 years.
- An observation made by the audit team is that there are many specific details in the NMS that are not commonly detailed in other companies NMS's. An example is the frequency of gas leak detection. This frequency is also detailed in the Integrity Management Plan and if this frequency changes then both documents will need to be reviewed.

### Opportunity's for improvement

- Arrow Energy should considerer aligning the review frequencies in their NMS.

## Safety Management System

Arrow Energy provided a copy of their Safety Management System Manual to the audit team. This manual is ORG-ARW-HSM-MAN-00016 version 2.0 dated December 2018.

The audit team discussed the Safety Management Plan in general terms and noted the following:

- This document maps the requirements of the P&G Act to the Arrow Energy systems, procedures and standards that are applicable.
- The audit team noted in section 5 that most of the formal safety assessments that are mandated or used are not detailed. For a gathering system, the key formal safety assessments are the Safety Management Study's as well as HAZOP's. Several companies also undertake other studies for their systems such as SIL assessments and LOPA studies. This section covers the outputs of these studies such as a hazard register or an ALARP demonstration but not the formal safety assessments themselves.
- In addition section 6 focuses is on interactions with other operating plant. The key interactions from a gathering system perspective would be the interactions with the APA processing plant at Kogan North, the EIM operated pipelines, other pipeline operators in the area such as Jemena and APA. These are not included in this section as the response relates to the interactions with Arrow's contractors and other internal interactions.

These formal safety assessments are undertaken in the Arrow Energy processes as well as the interactions with the other operating plant listed above which is why this is a comment only.

As this document is not the key focus of the audit, no additional comments were documented.

## Safety Management Study

The APGA CoP requires that a Safety Management Study (SMS) be undertaken at specific phases of the gathering systems life. One of the objectives of this audit was to review the SMS's that Arrow Energy have undertaken as well as to review the requirements in the CoP with respect to the ongoing operational requirements. The audit team discussed this issue at length as Arrow Energy have undertaken many SMS's for their gathering systems in the developmental and operational phases.

Arrow Energy have combined these smaller developmental SMS's into two larger SMS's – one for the Surat and one for the Moranbah field. The SMS for Moranbah was reviewed in November 2015 and the Surat SMS was reviewed in 2016. Both these SMS's were provided to the audit team as well as the SMS Action Closeout Report. These documents are:

- Surat SMS Report S00-ICD-PPL-REP-0001 rev 0
- Moranbah SMS Report BMGP01-IDC-PPL-REP-00001 rev 0
- SMS Action Closeout Report ORG-ICD-PPL-REP-00001 rev 0

Extract from the APGA CoP:

### Appendix A1

*The network safety management process required by this Code of Practice is of fundamental importance to the network design, its operation and maintenance. It is the means by which network safety is demonstrated. It also forms the basis for all operations and maintenance of the network.*

*The safety management process is integrated and continuous. It requires consideration of design aspects and operating procedures in a combined, holistic way so that the network can be operated safely. Analysis is updated and refined using information as it becomes available throughout the life cycle of the network.*

*The essential outcomes of a management process are:*

- a) Assurance that the threats to the network and associated risks are identified and understood by those that are responsible for addressing the threats and risks; and
- b) Appropriate plans are made to manage these risks.

*The network safety management process requires the application of multiple independent controls to protect the network from each identified threat.*

*Physical (route selection, barrier or exclusion), procedural and design methods should be applied to all threats with the objective of preventing failure of the network, minimising the consequence to the public (including the Operator's personnel and Contractors) and the environment.*

### Appendix A2.1

*Safety management studies should be undertaken at intervals during the network design and operational phases to facilitate periodic reassessment of the threats and the implementation of controls as knowledge of the threats is gained over time.*

*c) Operation: A review of the detailed safety management study that complies with this Code of Practice should be undertaken at least every five (5) years and should consider at least the following:*

- Any loss or degradation of integrity.
- Land use change, specifically changes within the radiation contour.
- Any change to location-specific or non-location-specific threats.
- Construction defects or deviations from specification.
- Testing defects and pressure test failures.
- The previous safety management studies.

## Auditor findings/comments

The audit team reviewed the Surat SMS Report and relevant comments are:

- The overview of the SMS report noted that though some of the gathering system has been in operation for over 10 years this is the first time a SMS has been conducted for these networks. It should be noted that the first version of the CoP that was called up in the P&G Regulations was version 1.1 (October 2011). The CoP was called up in the P&G Regulations in an amendment completed in 25 November 2011.
- The SMS workshop was undertaken on 24 March 2016.
- This SMS review was for the entire Surat gathering system.
- All the key design input data, location class are included in the report. Both general and location specific threats are included.
- All credible threats were risk assessed in the workshop including an all controls fail scenario.
- One action item was identified in the review.
- The audit team noted that the attendance register was different to the attendees in the report. Arrow Energy advise that the sheet from personnel in the field has not been included in the report.

Relevant comments from the SMS Action closeout report are as follows:

- The one action from the Surat SMS report that was identified in the SMS has been detailed as being closed out.
- The audit team questioned why the actions from the Moranbah SMS were not relevant to the Surat SMS. Key threats include ID's 8, 17 and 32 and would apply across all gathering systems. Arrow Energy detailed that these were specific to the Moranbah field due to several issues with the local contractors and not applicable to the Surat fields.

The audit team proposed several benefits in having the Petroleum and Gas Inspectors participate in the SMS and remaining life review process so that both parties understand the threats and controls for their system.

#### **Opportunity's for improvement**

- Arrow Energy should consider inviting the Petroleum and Gas Inspectorate to their SMS reviews, as they may be able to share other industry learnings and issues to this safety management process.

## Network Integrity Management Plan

The APGA Code of Practice for PE gathering systems which is a safety requirement as detailed in the Petroleum and Gas (Safety) Regulation 2018 in Section 67 states the requirement to have a Network Integrity Management Plan. Section 11.5 of the Code of Practice details the general contents for the plan.

Extract from the Code of Practice below;

### **11.5 PIPELINE NETWORK INTEGRITY MANAGEMENT PLANS**

*Structural pipeline integrity is achieved when the pipeline is leak tight, operating within the design parameters and able to safely withstand all identifiable forces to which it may be subjected during operation, including the MAOP.*

*The Operator shall establish systems and processes that ensure pipeline structural integrity for the design life of the pipeline. The Operator should be able to demonstrate that appropriate systems are established, implemented and maintained.*

*The objective of maintaining structural integrity of the pipeline is to ensure that the operation and maintenance of the pipeline will not cause injury to the public, pipeline personnel, damage to the environment or disruption of production.*

### **Auditor findings/comments**

Arrow Energy provided a copy of their Network Integrity Management Plan (IMP) for the Surat Basin S00-ARW-PPL-PLA-00003 version 1.0 dated 25/05/2016

This document is comprehensive and relatively mature.

This document was reviewed and discussed in detail. Below are the main comments discussed in the audit process.

- All the key elements for integrity management required in the CoP are detailed in the Arrow Energy plan
- The audit team reviewed the activities and frequencies detailed in the plan versus the activities and frequencies detailed in the Arrow Energy management system (SAP) and noted several differences. These include :
  - 3.1 Right of Way (ROW) Patrolling and Surveillance. Arrow Energy state in their IMP that this activity is undertaken at least every 3 months and post wet season on a yearly basis. SAP has an annual work order but no three monthly work order. This issue was discussed as Arrow's operators do visit each well on a routine basis (at least monthly) and as part of this process will drive past the gathering system. The team discussed this issue and if the well checklist has an item specifically for gathering systems checks and that the operator was aware of the obligation to check the ROW for issues such as landowner interference / signage etc (as per section 3.1 ) then this would be suitable. Arrow Energy have confirmed that all the gathering system in the Surat is located along side an access track and would be covered by the operators when undertaking well inspections. Arrow Energy also confirmed that some of the newer sections of gathering system are checked on a monthly basis until sufficient time has passed and the subsidence of the new pipeline has been maintained. In addition, the IMP has very detailed words to describe where the recorded data is located and what is recorded. It was noted that Arrow Energy could not locate these records in the required location

and was suggested that the IMP could be reviewed in this section to align with current practice.

- 3.2 Gas Leak detection. Both the IMP and SAP align in this activity being undertaken at 2 yearly intervals. The last surveys of the Surat field were completed in March 2019. The audit team questioned why this activity was undertaken at 2 yearly intervals instead of a less frequent interval. Arrow Energy have detected a number of leaks on their gathering system in the past but this activity's frequency may be reviewed when the IMP is reviewed.
- 3.3 Critical Function Testing – Pressure Safety Valve (PSV). Arrow Energy advise that the PSV's that protect the gathering system are all located at well pad's (in Moranbah there are several located on the gathering system itself) and are included in SAP. The frequencies align with the frequencies detailed in AS 3788. Approximately 20% of these are tested each year. All these tests are monitored via management reports. A review of SAP detailed that there are several PSV's (29) overdue for testing.
- 3.4 Temperature Monitoring. Both the IMP and SAP align in this activity. The last tests in this area were undertaken in October 2018.
- 3.5 Network Joint Integrity Assessment. These tests are undertaken on an opportunity basin when modifications or additions are made to the network. When modifications occur a section of the old network is taken out for external assessment (usually by ALS). The results of these tests are included in the Remaining Life Review process.
- 3.6 Aboveground facilities. The IMP and SAP both state that all High Point Vents (HPV) and Low Point Drains (LPD) are inspected at 3 monthly intervals. A review of SAP confirmed this as well as analysis of several completed checklists.
- 4.1 Quarterly activities. Item 1 ROW Patrol should be reworded to align with proposed / current process.
- 4.2 Half-yearly Activities Item 3. Valve operating and maintenance checks. The IMP states that this activity is undertaken at 6 monthly intervals whereas SAP has this activity occurring at 12 monthly intervals. These frequencies should align.
- 4.2 Half-yearly Activities Item 4. There is no equivalent activity in SAP. Arrow Energy needs to review this activity to determine if relevant and to align their IMP and SAP.
- 4.4 Long term activity item 4. The riser five-year check also aligns with the SAP work order. Arrow Energy advise that ALS undertake this test.

### **Non-Compliances**

- Arrow Energy needs to align their Integrity Management Plans activities and frequencies with what activities and frequencies are included in their SAP system.

### **Opportunity's for improvement**

- Arrow Energy to consider reviewing their well checklist to see if the gathering system could be added as a specific item. If included, the operators will need to be made aware of this change to the scope of a well check to include gathering system ROW patrolling.

## Design Basis

The CoP in section 4 requires the basis of design for the gathering system and all modifications to be documented in a design basis.

In addition, the design basis shall be revised at the completion of a project to reflect the as built design.

As part of this audit Arrow Energy provide a copy of the Tipton Expansion Project Gathering Pipelines Design Report 00-L-REP-5005 rev 0 dated 02-Nov-2018 to the audit team.

### Auditor findings/comments

Relevant comments of the design report for Tipton include:

- Arrow Energy confirmed that their design uses the prescribed design and not the fit for purpose design processes.
- The battery limit at the fence line for the downstream facility was discussed, as this is different to many of the CSG companies that use a flange as the battery limit.
- The design life of 25 years was discussed at length as the design conditions would allow a design life of 100 years to be used. This issue is further discussed in the following section on Remaining Life Review.
- The design factors used in the calculation process are included in other reference documents

Arrow Energy hold a lessons learnt workshop at the end of their construction projects. The lessons learnt are incorporated into the original Design Basis for completeness. This aligns with the requirements detailed in section 4.3.1 of the CoP.

## Remaining Life Review

The CoP in section 11.10 requires that the integrity and remaining life of an existing pipeline be assessed at regular intervals.

Arrow Energy has recently undertaken this Remaining Life Review. This review is document number ORG-EIM-PPL-00001 revision 1.0 dated 31/01/2019. This is the first remaining life review that the audit team is aware of being completed by any CSG company.

### Auditor findings/comments

Relevant comments the remaining life review include the following:

- In the executive summary, there is a comment that the gathering lines in the Surat Basin were designed for 50 years. However, the design basis for Tipton expansion has a design life of 25 years. In addition, the SMS for the Surat gathering system has the design life for Kogan North at 15 years, Tipton West at 36 years and Daandine/Stratheden at 15 years. Arrow Energy need to align these documents.
- The temperature of the fluids being transported is a key factor to the design life. Arrow Energy now have accurate data on this temperature and can use this data to redesign their gathering system with respect to the design life, if required.
- The outcome of the remaining life review states that the gathering system is essentially fit for another ten years of service life.
- The report has some incorrect statements regarding physical and procedural controls – however these do not alter the end result of this document.
- The failure events are well documented including the cause and effects of the failure. The analysis of the pipeline failure and the condition assessment is thorough and well considered.
- The change in Maximum Allowable Operating Pressure MAOP through a formal Management Of Change (MOC) is reviewed in this document.
- In addition, the location class, SMS, NMS and IMP were also reviewed in this remaining life review process.

### Opportunity's for improvement

- Arrow Energy should consider aligning the design life of their gathering system as the Remaining Life Review, Safety Management Study and Design Basis all record different design life's for their gathering system.

## Emergency Response Management

### Reference:

- Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) Emergency Plans
- APGA PE Code of Practice-Version 4.0 Section 11 Operations
  - 11.2.2 CSG field emergency response plan
  - 11.2.2.1 Emergency planning and preparation
  - 11.2.2.2 Emergency response and recovery

Arrow Energy has developed the following key documents related to emergency response processes.

- Emergency Response Plan – Surat and Bowen Basins ORG-ARW-HSM-PLA-000506
- Emergency Response Procedure – Surat Basin Pipelines S00-ARW-HSM-PRO-00002

### Auditor findings/comments

These plans and procedures are mature, having been updated many times in the past 10 years. These review frequencies align with the minimum requirements detailed in the CoP.

All key elements are covered in the plan and procedure for the Surat gathering system.

Comments below are with respect to the Emergency Response Plan:

- Section 18 Exercise Schedule. This was discussed in detail and Arrow Energy provided examples of a gathering system exercise that has been completed in the past.
- The example of this emergency exercise process is one that was completed on the 1<sup>st</sup> August 2018 involving their contractor Ipipe. The After Action Report was provided to the audit team, which provided a summary of the exercise, relevant photographs, items that went well as well as opportunities for improvement. The seven opportunities for improvement have been entered into the Arrow Energy management system for tracking. These items were assigned an action party and a due date that is monitored by Arrow Energy management for completion.
- Section 19 Training and Competency Requirements. This issue was discussed with key Arrow Energy personnel (irrelevant information) who detailed the training requirements for emergency response. A list of the key Arrow Energy personnel who have completed the Site Emergency Response training was provided to the audit team.
- The EMT role checklists are suitable for these roles.
- The Incident Action Guides listed in the plan provide suitable guidance for these specific emergencies that are detailed in the CoP.
- The audit team discussed when other exercises are undertaken consideration should be made to actually call the Inspectorate so ensure that both parties are aware of the exercise being undertaken. This will ensure that the Inspector response is relevant and that the exercise is recorded in the departments record keeping system

Comments below are with respect to the Emergency Response Procedure:

- Isolation for gathering systems is not detailed in this plan – however Arrow Energy are developing an isolation philosophy for their gathering systems that has evolved over the last fourteen years. An example of this is the Isolation plan for the Tipton Expansion Project (00-L-PL-0008). This plan

details the philosophy for this expansion project that is used to develop the field as well to maintain and operate the field. This plan has been used in various safety assessments including a HAZOP and SMS and commissioning workshops.

- Arrow Energy detail how temporary repairs will be made to their gathering system using electrofusion saddles or stainless steel repair clamps and the time that they are allowed to remain in service.
- The stainless steel repair clamps (size and quantity) that are kept in their emergency response warehouse in Dalby were detailed. These clamps are for the smaller sizes (up to 110 mm) – however they can be joined together if required.
- Arrow Energy rely on their key contractors to provide the relevant fittings and equipment to undertake any necessary repairs to their gathering systems in the event of an emergency rather than having Arrow Energy trained operators and equipment. This is common in the CSG industry due to the relatively low number of incidents.
- Arrow Energy shared an action item from a Management of Change (MOC) that states that their emergency response plan must be updated when the first large diameter (>630 mm) pipe is constructed. In addition, there will be a requirement to have the larger fittings available for their emergency response as these are not as commonly available as the current smaller sized fittings.
- Key emergency contacts are supplied in Appendix C of the procedure.
- The audit team noted that the Petroleum and Gas Inspectorate contact details are incorrect. In particular, the emergency hot line number detailed is the general admin number which is not manned out of hours. The correct number was provided to Arrow Energy.

#### **Opportunity's for improvement**

- Arrow Energy should consider calling the Inspectorate when exercises are being undertaken rather than simulating the call.
- Arrow Energy should update their Emergency Response Procedure with respect to the Petroleum and Gas Inspectorates emergency details.

User ID	User Full Name	Training Title	Position	Division	Training record complete	Training Record Status
11						
12	7113				10/08/2018 07:19	Completed
13	72869				12/12/2018 11:48	Completed
14	72264				16/12/2018 13:14	Completed
15	73652				24/10/2018 11:28	Completed
16	76				05/08/2018 10:05	Completed
17	72888				12/09/2018 14:10	Completed
18	72202				2/12/2018 11:31	Completed
19	73516				23/11/2018 15:16	Completed
20	73554				13/12/2018 07:22	Completed
21	72920				23/09/2018 11:43	Completed
22	72422				24/12/2018 12:46	Completed
23	72585					Approved / Overdue
24	73568				24/07/2018 10:32	Completed
25	752				29/09/2017 09:08	Completed
26	71243				21/07/2018 13:50	Completed
27	71228				24/08/2018 06:40	Completed
28	762				29/08/2018 10:31	Completed
29	73478				18/12/2018 11:40	Completed
30	73634				18/09/2018 14:48	Completed
31	72062				20/08/2018 01:54	Completed
32	71047				27/08/2018 15:17	Completed
33	72482				03/01/2019 15:20	Completed
34	73693					Approved / Overdue
35	73601				28/12/2018 07:15	Completed
36	73698				22/02/2019 15:44	Completed
37	7127				03/07/2018 11:14	Completed
38	7131					Registered / Overdue
39	7142				06/08/2018 14:20	Completed
40	71608				15/02/2019 12:44	Completed
41	72626				16/08/2018 10:06	Completed
42	7160				18/08/2018 07:40	Completed
43	7166				18/03/2018 16:42	Completed
44	73476				12/12/2018 12:54	Completed
45	71676				23/12/2018 10:39	Completed
46	73477				08/09/2017 16:27	Completed
47	7207				09/09/2018 11:58	Completed
48	73590				21/06/2018 07:06	Completed
49	72950				23/08/2018 16:25	Completed
50	73689				28/02/2019 11:23	Completed
51	73479				03/01/2019 07:07	Completed
52	7171				05/12/2018 07:01	Completed
53	73538				12/05/2018 23:47	Completed
54	7172				08/09/2018 08:14	Completed

s.73 irrelevant information

Residual Risk Ranking	Action Owner	Hazard Description	Required for Go Live?	Due Date	Action Status
High	relevant info	see attached, highest risk ranking has been recorded for MOC.	Yes	31/08/2018	Not Started

Implementation Actions

+ Add Edit X Delete

Action Type	Action Owner	Action	Required for Go Live?	Due Date	Action Status
Design Codes & Standards Utilized	relevant info	Process to advise on velocity limits for an isolation arrangement on DN 800/1000 (e.g. DN630 valve with large bypass or multiple smaller sized PE valves).	Yes	27/07/2018	Closed
Emergency Management Plan	relevant info	Develop a standard Isolation design for DN 800/1000. Ensure field operations is involved in design review of isolation design.	Yes	31/08/2018	Closed
Design Codes & Standards Utilized	relevant info	Update pipe specification for DN800 (and DN1000 if DN1000 is approved in MOC). Update valve datasheets for DN800 (and DN1000 if DN1000 is approved in MOC). Update all standard PE design calculations (mentioned in item 8 above).	Yes	31/08/2018	Closed
Design Codes & Standards Utilized	relevant info	All standard PE gathering design calculation should be redone with DN800/1000 if and when they are added to piping specifications (external load, buoyancy, MAOP, vacuum). This will eliminate this hazard.	Yes	30/06/2019	Closed
Emergency Management Plan	relevant info	PE gathering emergency response plans must be updated for larger sizes when the first installation of > DN630 PE gathering occurs.	No	30/06/2019	In Progress
	relevant info	Keep or have available (guaranteed) DN800/1000 material / fittings on site for emergency response critical sparring (or getting contractor to store on Arrow's behalf). This will ensure repair time is not extended due to sourcing materials / fitting that are not readily available in larger sizes.	No	30/06/2019	In Progress

## General Findings

Arrow Energy produce several key community and stakeholder awareness documents. Examples include:

- Buried Pipelines
- Construction : wells and gathering



### Buried pipelines

Arrow Energy's (Arrow) existing operations in the Surat and Bowen basins include many kilometres of buried pipelines that transport coal seam gas (CSG) to and from gas processing and power generation facilities. These pipelines are marked above ground with signage and below ground with buried marker tape.

If you are planning any activities near an Arrow pipeline, please read the following information carefully.

**Do**

- Contact Arrow on 1800 038 856 if you plan to dig, drill, excavate or bore above or near the pipeline.
- Contact the national dial before you dig (DBYD) service on 1100 if you are proposing to excavate on or near the Arrow Pipelines right of way (ROW).
- Report any soil erosion along the pipeline.
- All of Arrow's above ground facilities (e.g. high point vents) are fenced and marked with signage. Please report any Arrow above-ground facilities that are unfenced or damaged to 1800 038 856.
- Contact Arrow's 24 hour emergency hotline on 1800 779 488 if you suspect that pipeline is leaking gas.

**Don't**

- Don't trench, dig, drill or bore anywhere on the pipeline before contacting Arrow on 1800 038 856.
- Don't enter or touch any Arrow above ground facilities. Unauthorized entry is not permitted as facilities may be electrically energised (this includes valves and drain points).
- Don't touch an exposed pipeline. Pipelines can become electrically energised during storms and electrical faults. Report any exposed pipeline to 1800 038 856. Only trained and authorised (by Arrow) personnel should access pipeline equipment.
- Don't go within 500 metres of a suspected pipeline leak.

**Reporting activities**

Contact Arrow on 1800 038 856 before carrying out any of these activities near the pipeline or above ground facilities:

grading	transport of heavy loads	building
digging	use of vibrating machinery	erosion control
drilling	blasting	excavating
trenching	boring	tunnelling
drainage work		

**In the event of an emergency**

If you witness an emergency along the pipeline immediately move at least 500 metres away from the site and call Emergency Services on 000, then call Arrow's 24 hour emergency line 1800 779 488.

When you call Arrow's emergency hotline, we'll ask you:

- your location, name and contact number
- the nature of the emergency
- whether anyone is injured or missing
- whether you have contacted Emergency Services

Please note the information provided in this fact sheet only applies to Arrow's existing pipelines.

**Contact details**

Freecall: 1800 038 856  
 Email: [info@arrowenergy.com.au](mailto:info@arrowenergy.com.au)  
 Visit: [www.arrowenergy.com.au](http://www.arrowenergy.com.au)

BRISBANE **DAWY** MORANBAH

Please contact Arrow if you require any information about maintaining the state of the pipeline easement.

**arrowenergy**  
go further

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The audit team reviewed these documents and identified that they are very useful documents to be provided to the key stakeholders in the CSG production fields.



Arrow Energy has a proven process for constructing coal seam gas (CSG) wells and their gas and water collection (or gathering) systems. Landholders and Arrow agree where well sites and gathering infrastructure should be, agree on compensation and access conditions in a conduct and compensation agreement (CCA). Then, it is time to construct.

The major steps are:

- constructing wellpads (a levelled area of ground where the well will be installed)
- constructing or upgrading access tracks as required
- drilling and completing the wells
- installing the well pad infrastructure – i.e. well head skid and generator or power connection
- connecting the well to Arrow's water and gas networks with underground collection pipes (the gathering system).



### Constructing wells and well pad infrastructure



- After the landholder and Arrow agree where the well infrastructure will be placed (see *area wide planning*):
  - a survey team will peg out the area
  - an access track will be established (if there is not already an existing track or road).

**Construction timeframe:**  
2 to 5 days

**Construction hours:** ☀️



- A wellpad area will be cleared and levelled. Depending on the site, some of the pad area may be built up and stabilised with gravel.
- Initially, the pad will be much larger than its final form:
  - a pad for a single well is 110m x 100m,
  - a multi-well pad is up to 110m x 200m, but can accommodate up to eight wells.

**Construction timeframe:**  
4 to 8 days depending on pad size

**Construction hours:** ☀️



## Legislative Non-compliance

The audit team identified one legislative non-compliance during this audit. This was:

- Arrow Energy need to align their Integrity Management Plan activities and frequencies with activities and frequencies that are included in their SAP system.

## Opportunity for improvement

There were a number of opportunities for improvement that were discussed with Arrow Energy representatives on 19 March 2019, relating to their Gathering System. These are detailed in the above sections and summarised below. It is recommended that Arrow Energy review these comments and make any relevant actions to their gathering system plans and procedures, systems and relative documents.

- Arrow Energy should consider aligning the review frequencies in their NMS.
- Arrow Energy should consider inviting the Petroleum and Gas Inspectorate to their SMS reviews, as they may be able to share other industry learnings and issues to this safety management process.
- Arrow Energy to consider reviewing their well checklist to see if the gathering system could be added as a specific item. If included, the operators will need to be made aware of this change to the scope of a well check to include gathering system ROW patrolling.
- Arrow Energy should consider aligning the design life of their gathering system as the Remaining Life Review, Safety Management Study and Design Basis all record different design life's for their gathering system.
- Arrow Energy should consider calling the Inspectorate when exercises are being undertaken rather than simulating the call.
- Arrow Energy should update their Emergency Response Procedure with respect to the Petroleum and Gas Inspectorates emergency details.

## Conclusions

The audit found that Arrow Energy has created a suitable management system for the operations and integrity management of their gathering system operations in Queensland.

The audit identified one non-compliance with their Integrity Management Plan in relation to aligning the activities and frequencies with their operation management work order system. The audit also identified several recommendations (opportunities for improvement) which if accepted and implemented, could enhance the SMS and help with operations in the future.

Arrow Energy is requested to provide the Petroleum and Gas Inspectorate with a detailed action plan for the timely completion of the identified issues. The action plan needs to include time frames and state the actions to be taken to rectify any identified issues.

If Arrow Energy has any evidence that any of the identified issues are compliant then this evidence needs to be provided along with the action plan.

It is expected that the action plan is provided to the Inspectorate within 20 Business days from the date of the report being issued and that the rectification of the issues would be fully complete within 12 months.

The P&G Inspectorate would like to undertake a following up inspection at a later date to validate that the identified items have been successfully closed out. Arrangements for this inspection will be undertaken as per our standard arrangements with Arrow Energy.

If Arrow Energy require any more details as to this report, please contact:

Marshall Holmes

Executive Petroleum Engineer - Petroleum and Gas  
Department of Natural Resources, Mines and Energy

Email: [marshall.holmes@dnrme.qld.gov.au](mailto:marshall.holmes@dnrme.qld.gov.au)

Phone – office 07 31998223, mobile irrelevant informat

## Audit Sources

### Documents viewed:

Doc No	Document	Rev	Date
ORG-ARW-PPL-PLA-00001	Network Management System Bowen and Surat Basin	2.0	19/02/2019
ORG-ARW-HSM-MAN-00016	Safety Management System Manual	2.0	December 2018
S00-ICD-PPL-REP-0001	Surat SMS Report	0	25/05/16
BMGP01-IDC-PPL-REP-00001	Moranbah SMS Report	0	11/11/15
ORG-ICD-PPL-REP-00001	SMS Action Closeout Report	0	01/03/2019
S00-ARW-PPL-PLA-00003	Network Integrity Management Plan for the Surat Basin	1.0	25/05/2016
ORG-ARW-HSM-PLA-000506	Emergency Response Plan – Surat and Bowen basins	11.0	May 2018
S00-ARW-HSM-PRO-00002	Emergency Response Procedure – Surat Basin Pipelines	2.0	26/02/2019
ORG-ARW-HSM-FOR-0000149	Emergency Management & Business Continuity Exercise After Action Report Form	0	01/08/2018
	Screen shot of Arrow Energy Emergency Response Training.		
00-L-PL-0008	Gathering Network Isolation Plans – Tipton Expansion Project	0	29/10/2018
00-L-REP-5005	Tipton Expansion Project Gathering Pipelines Design Report	0	02-Nov-2018
ORG-EIM-PPL-00001	Remaining Life Review.	1.0	31/01/2019
	HPV, LPD and valve checklist		

### Distribution list

Name	Position	Organisation	Format
s.73 irrelevant information		Arrow Energy	Digital copy

Release

# **Petroleum and Gas Inspectorate Audit Report**

**Operating Plant Audit of Origin Energy Gathering System on  
5<sup>th</sup> December 2017**

**GPA 23194**

Published on DNRME  
Disclosure Log Act 2009



This publication has been compiled by Petroleum and Gas Inspectorate of Resources Safety and Health, Department of Natural Resources, Mines and Energy.

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## Summary

Origin Energy operate significant gathering systems as part of their CSG operations.

The Origin Energy Integrated Gas gathering system is currently maintained and operated by Origin Energy under the requirements of the Petroleum and Gas (Production and Safety) Act 2004, and APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

This gathering system is deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act).

An audit of the Origin Energy Safety Management System (SMS) was conducted by Auditors from the Department of Natural Resources, Mines and Energy, Petroleum and Gas Inspectorate (P&G Inspectorate) on 5 December 2017 at the Origin Energy office at 135 Coronation Drive, Milton, Brisbane.

The objective of the audit was to assess the SMS for compliance with the P&G Act. The scope of the audit was to use the APGA Code of Practice in conjunction with the P&G Act to assess the compliance of the Origin Energy Network Management Systems (NMS) for the Origin Energy Gathering system.

The audit consisted of a desktop review of the Network Management System, the Network Integrity Management Plan, Safety Management Study and other association procedures.

No significant non-conformances were identified in the audit. The audit identified several opportunities for improvement and technical non-compliances, which are detailed in this report.

Origin Energy have been requested to provide the Petroleum and Gas Inspectorate a detailed action plan for the timely completion of the identified issues.

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## Audit details

Audit details	
Reference number	GPA 23194
Lead auditor	Marshall Holmes, Executive Petroleum Engineer Petroleum and Gas
Others assisting	Derek Fagan, Senior Inspector Jon Mcloughlin, Senior Inspector

## Document history

Date	Version	Author	Reason
2 January 2018	A	M. Holmes	First Draft
3 January 2018	B	D. Fagan	Second Draft
5 January 2018	C	J. McLoughlin	Third Draft
5 January 2018	D	D. Fagan	Fourth Draft
10 January 2018	E	D. Fagan	Draft
12 January 2018	F	M. Holmes	Draft
17 January 2018	0	M. Holmes/D.Fagan	Report Issued

## Endorsement

Date	Title	Name	Signature
17/1/18	Executive Petroleum Engineer Petroleum and Gas	Marshall Holmes	s.73 irrelevant information

## Introduction

An audit was conducted by the Petroleum and Gas Inspectorate (P&G Inspectorate), Department of Natural Resources, Mines and Energy (DNRME) in relation to the Origin Energy Gathering Systems for their Integrated Operations with respect to the Petroleum and Gas (Production and Safety) Act 2004 and the APGA Code of Practice – Upstream Polyethylene Gathering Networks – CSG Industry.

Origin Energy are a major CSG production company in Queensland. Gathering systems are deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (the P&G Act).

Origin Energy is an integrated energy company whose operations span exploration, production, generation and the sale of energy to customers across Australia.

Origin Energy in Queensland operates over 4000 km of Polyethylene gathering networks. The gathering networks transports gas and water from well separators to gas processing facilities and water treatment plants via a networked system of flow and trunklines. Loss of containment events have safety, environmental and production consequences, with the potential to affect a significant number of wells.

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## Audit Plan

### Scope and objectives

The scope of the audit was to assess the compliance of the internal procedures developed by Origin Energy on management, operational and pipeline integrity. This is to meet their legislative requirements against the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry in conjunction with the P&G Act. The Code of Practice is listed in the Petroleum and Gas Regulations in schedule 1 Part 1 as a preferred standard.

The audit team reviewed and assessed the Origin Energy Network Management System (NMS) for their operations and associated documents, including but not limited to; Safety Management Plan, Integrity Management Plan, Safety Management Study. This audit was aimed at the systems that Origin Energy have implemented. At a later date, the details of these systems will be reviewed to determine how they have been implemented.

The audit is prepared for the Office of the Chief Inspector to demonstrate the effectiveness of the Network Management System for the operating plant and whether it is fulfilling its obligations in respect to safety management.

The Origin Energy Gathering System was selected for an audit as part of a risk-based sample across the regulated section of the petroleum and gas industry. This is the fourth audit conducted to the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

*The Code of Practice was prepared on behalf of the Australian Pipeline Industry Association (APIA) by members of the Association who are associated with the Coal Seam Gas (CSG) industry. Representative members of all sections of the industry were active participants, including all major CSG producing companies, Qld regulator, constructors, and manufacturers of polyethylene (PE) resin, pipelines and fittings as well as CSG engineers.*

An objective of this audit was to identify issues with the APGA Code of Practice with respect to operating company's systems. The Code of Practice is currently being revised as part of the development of version 5.

### Arrangements for the audit

This audit was initially flagged with Origin Energy during the Stakeholder Engagement Committee with the operating plant companies on the 18<sup>th</sup> May 2017 and followed up with several email and phone conversations, to arrange the date and scope of the audit.

Marshall Holmes as Lead Auditor made contact with Origin Energy both by telephone and email to request a copy of the current Origin Energy plans, documents and procedures relating to their gathering systems as per the scoping document for their operations to review prior to the audit.

The audit was conducted on the 5<sup>th</sup> December 2017 by auditors from the Inspectorate, in accordance with departmental guidelines.

Specific records were requested as part of the lead up to audit. These documents included:

- |                                         |                |        |
|-----------------------------------------|----------------|--------|
| • Emergency Response Plan               | CDN/ID 3677536 | rev 16 |
| • Integrity management Plan             | CDN/ID 3675627 | rev 4  |
| • Network Management System             | CDN/ID 3675639 | rev 1  |
| • Polyethylene Pipelines Repair Plan    | CDN/ID 6522887 | rev 1  |
| • Safety Management Plan – Spring Gully | CDN/ID 6270028 | rev 3  |

- SMS Q-4500-15-RP-1433 rev 1
- Spring Gully Emergency Isolation Plan Q-8200-55-TR-009 rev 0

Origin Energy attendees at the audit meeting were as follows:

Name	Position	Organisation
s.73 irrelevant information		Origin Energy
		Origin Energy
		Origin Energy
		Origin Energy

### Audit team

The audit team consisted of DNRME P&G Inspectors having the following competencies;

- Extensive gas related activity skills.
- Extensive technical/scientific/engineering competency
- Communication and interpersonal skills.
- Analytical and reporting skills.
- Auditing Skills

Name	Position	Organisation
Derek Fagan	Senior Inspector	DNRME
Jon McLoughlin	Senior Inspector	DNRME
Marshall Holmes	Executive Petroleum Engineer – Lead Auditor	DNRME

## Audit Findings

The findings outlined in this audit report relate to the audit against the requirements of section 675 of the *Petroleum and Gas (Production and Safety) Act 2004*.

The findings outlined in this audit report relate to the audit against the requirements of APGA Code of Practice, which is a preferred standard for pipelines as detailed in the *Petroleum and Gas (Production and Safety) Regulations 2004*.

The audit focused on management for the gathering system as well as integrity management.

The audit provided the audit team with a sound understanding of the Origin Energy management process for their CSG gathering Systems.

Origin Energy have been extensively involved in the development of the code of practice for the PE gathering systems to date.

## Network Management System

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 specifies the requirement to have a Network Management System. Section 2.2 of the Code of Practice (CoP) details the general contents for the system.

Extract from the Code of Practice.

*The NMS shall address the Operator's approach to the following areas –*

- a) Management;*
- b) Planning;*
- c) Implementation;*
- d) Measurement and evaluation;*
- e) Consultation, communication and reporting;*
- f) Safety Management;*
- g) Environmental Management;*
- h) Construction and Commissioning;*
- i) Site Safety.*

*The NMS shall include a description of the flowline(s) covered by the NMS including suitable maps (alignment sheets and/or GIS) showing the route of the flowline(s), the location of associated facilities such as compressor and pump stations, low point drains, high point vents and valve stations.*

*Each element of the NMS is described below and supports each other. The NMS shall comply with those requirements. Much of the responsibility for creating and implementing the NMS lies with the Operator.*

### *2.2.2.1 Management Structure*

*A defined management structure for the network shall be established to identify key positions and personnel. An appropriate management structure shall be maintained.*

### *2.2.2.2 Responsibilities, accountabilities and authorities*

*The responsibilities, accountabilities and authority levels of personnel and or contractors with respect to the various aspects of the operation and maintenance of the network shall be detailed in the NMS.*

Origin Energy provided the audit team a copy of their Network Management System Plan PE Gathering and Pipelines CDN/ID 3675639 rev 1 dated 01/02/2017.

This document is a high-level document that refers to key documents and procedures that have been developed by Origin Energy for their CSG developments.

One of the objectives for the audit was to review the requirements for the NMS in the APGA CoP

The audit team discussed the Network Management System in detail and relevant comments are:

- Most of the key requirements detailed in section 2.1 of the COP are included in the Origin Energy NMS. However, the requirement to include a description of the flowlines covered by the NMS including suitable maps, locations of associated facilities is missing.
- The requirement to detailing the resourcing requirements (section 2.2.2.4 in the CoP) is not described in the Origin Energy NMS.
- The wording in section 2.1 seems to have been distorted when this document was printed – Origin Energy may need to review this section.
- Section 3.1 does not align with the requirements to include the outcomes of Safety Management studies and other risk assessments when developing the policies and procedures as required in section 2.3.2 of the CoP
- Section 3.2 does not align with the wording in section 2.3.3 of the CoP Origin Energy need to review this section.
- Section 5. It is noted that the section numbers in the P&G Regs have been revised.
- Section 8 refers to the term SFAIRP. The P&G Act and the APGA CoP use ALARP – Origin Energy should revise this section to align with applicable legislation.

As stated above one of the objectives of the audit was to identify issues with the current wording of the APGA CoP NMS requirements and this was not meant to be a failing on Origin Energy but on the requirements detailed in the CoP.

In the development of version 5 of the APGA CoP, it is proposed that the requirements for the NMS will be reviewed and the audit team would require the assistance of Origin Energy in the process to obtain the required wording in section 2 of the CoP

## Safety Management Plan

Origin Energy provided a copy of their Spring Gully Safety Management Plan to the audit team. This plan is CDN/ID 6270028 rev 3 dated 18/09/2017. This plan is very comprehensive and has undergone several revisions in recent years.

The audit team discussed the Safety Management Plan in detail and noted that there are many overlaps with the APGA CoP required NMS.

Relevant comments on this plan include:

- It was noted that some of the licenced pipelines in the plan have since been sold to Jemena.
- Section 4.2.3 states that the Gas gathering network has a minimum depth of cover of 600 mm whereas the APGA CoP states that the minimum depth of cover is 750 mm. Origin Energy need to confirm what sections of the gathering network have been laid to less than 750 mm depth of cover.
- Section 7. This section details that Risk Management processes that have been implemented by Origin Energy. The audit team suggested that the required Safety Management Studies that are a requirement for the design and ongoing operations for the

gathering system should be included as these form the basis for the safety management / risk management for the gathering system.

- Section 11.1 – it was noted that this section does not align with the relevant section in the NMS. This is just a comment and not a requirement that Origin Energy need to review their plan.
- Appendix F. As above the audit team suggested that, the SMS's could be added to the list of Engineering Assurance studies, as there are an engineering assurance study.
- Appendix G. Origin Energy has developed an Emergency isolation plan Q-8200-55-TR-009 for the Spring Gully PE pipelines. This plan could be added to this appendix as it forms a key element of the Emergency shut down and isolation valve summary for this field.
- Appendix I. It was suggested by the audit team that SMS's be added to this list of Formal Safety Assessments, as they are a key formal safety study for the safety management for the gathering system.

## Safety Management Study

The APGA CoP requires that a Safety Management Study (SMS) be undertaken at specific phases of the gathering systems life. One of the objectives of this audit was to review the SMS's that Origin Energy have undertaken as well as to review the requirements in the CoP with respect to the ongoing operational requirements. The audit team discussed this issue at length as Origin Energy have undertaken over 100 SMS's for their gathering system and the intent is to gather the relevant SMS outcomes per field when these are reviewed every 5 years.

Extract from the APGA CoP:

### Appendix A1

*The network safety management process required by this Code of Practice is of fundamental importance to the network design, its operation and maintenance. It is the means by which network safety is demonstrated. It also forms the basis for all operations and maintenance of the network.*

*The safety management process is integrated and continuous. It requires consideration of design aspects and operating procedures in a combined, holistic way so that the network can be operated safely. Analysis is updated and refined using information as it becomes available throughout the life cycle of the network.*

*The essential outcomes of a management process are:*

- a) Assurance that the threats to the network and associated risks are identified and understood by those that are responsible for addressing the threats and risks; and*
- b) Appropriate plans are made to manage these risks.*

*The network safety management process requires the application of multiple independent controls to protect the network from each identified threat.*

*Physical (route selection, barrier or exclusion), procedural and design methods should be applied to all threats with the objective of preventing failure of the network, minimising the consequence to the public (including the Operator's personnel and Contractors) and the environment.*

### Appendix A2.1

*Safety management studies should be undertaken at intervals during the network design and operational phases to facilitate periodic reassessment of the threats and the implementation of controls as knowledge of the threats is gained over time.*

*c) Operation: A review of the detailed safety management study that complies with this Code of Practice should be undertaken at least every five (5) years and should consider at least the following:*

- Any loss or degradation of integrity.
- Land use change, specifically changes within the radiation contour.
- Any change to location-specific or non-location-specific threats.
- Construction defects or deviations from specification.
- Testing defects and pressure test failures.
- The previous safety management studies.

The review should also be completed:

- At any review for changed operating conditions.
- Before recommencement of operation following a flowline failure where such failure has resulted from a mechanism not previously included in preceding studies.
- At any time when new or changed threats including land use occur.
- At any time where there is a change of knowledge affecting the safety of the flowline or network.
- At any review for extension of design life.

Origin Energy provided the audit team a copy of;

- SMS NC Williams Workpack Q-4500-15-RP-1433 revision 1 dated 03/03/2017

The SMS was viewed by the audit team and the following, but not limited observations were made;

- The SMS that was provided to the audit team was undertaken in August 2015 but not issued until 2017. In this period the CoP undertook several revisions and the version of the CoP that the SMS was undertaken was not listed. The audit team recommended that the version of the CoP used in the SMS be added to new Origin Energy SMS's.
- Section 2 states that damage to pipelines is recognised, as one of the most prominent threats and that regular ROW patrols is required to mitigate this threat. See below in the section on Integrity management for more comments re this issue.
- Origin Energy detailed the formal certificate (C1 to C6) process that ensures that all outstanding items that are identified in SMS are closed out before the pipeline system is handed over to operations.

The audit team proposed several benefits in having the Petroleum and Gas Inspectors participate in the SMS and remaining life review process so that both parties understand the threats and controls for their system.

## Management of Change

Extract from Origin Energy NETWORK MANAGEMENT SYSTEM PLAN PE GATHERING AND PIPELINES;

### 2.3 Change Management

*Section 9 of the HSE System Directive specifies to requirements for MOC systems within Origin. Integrated Gas use the Engineering Management of Change Procedure (CDN 3675673) to control change to operations with the potential for negatives HSE consequences.*

Origin Energy provided the auditors with a copy of Engineering Management of Change Procedure (MOC), Document Number: CDN/ID 3675673 post desktop element of the audit, which was later viewed by the audit team.

The audit team requested to view an example of a completed Management Of Change (MOC), which was subsequently provided. The following, but not limited documentation was provided and viewed by the auditors in relation to MOC;

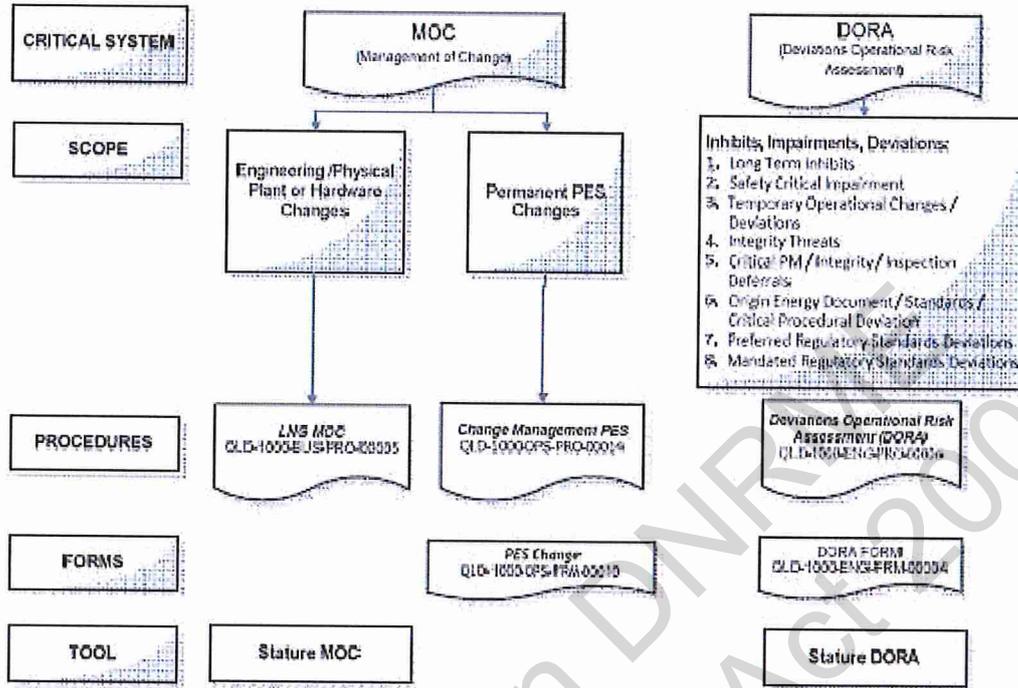
- Copy of MOC Detailed Report for MOC: MOC-2016-36331
- Copies of Process Engineering Flow Schematics associated to TCIP To Condabri North Loop Line (MOC-2016-36331)

Origin Energy also provided documentation in relation to Deviation for TCIP to CNN Loop Line DORA (Deviations Operational Risk Assessment), which has been identified as being any other MOCs currently in progress that this proposed change (MOC-2016-36331) interacts with. This being, but not limited to;

- Copy of Deviation Detail Report: DEV-2016-33781 Form
- Associated documentation in relation to request for deviation from a preferred standard under section 7 (4) of the *Petroleum and Gas(Production and Safety) Regulation 2004*
- Associated Risk & Assessment documentation
- Water pipeline converted to gas – Pipeline offset marker sign details
- Scope of work-DP073, CONDABRI CENTRAL TO NORTH LOOP LINE – Design and Construct, Document No. Q-4500-95-SW-1035
- Memorandum: Determination of reasonably practicable additional control measures for Converting Water Line

Origin Engineering Management of Change, Section 3.1: Relationship between MOC and other critical Process Safety systems looks at the relationship between Management of Change process relative to other LNG Process Safety systems; in particular the DORA process for risk assessment, approval and monitoring. See the diagram below;

Image 1 – The various processes for managing change



The Example of MOC viewed and subsequent documentation provided to the auditors found that the system was robust. The only points identified for clarification are detailed below;

- Page 7 of 10, Detail Report DEV-2016-33781 were Risk Acceptance Decision has been identified as “Reject and Return to Risk Assessor”?
- Unable to confirm if Post Start-up (Change Owner) or Close Out has taken place for MOC-2016-36331 as this was not provided as part of the Detail Report for MOC.

It was noted that Origin Energy Management of Change process is predominantly completed electronically and printed documents may not have fully demonstrated the MOC process.

### Network Integrity Management Plan

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 states the requirement to have a Network Integrity Management Plan. Section 11.5 of the Code of Practice details the general contents for the plan.

Origin Energy provided a copy of their Network Integrity Management Plan – Polyethylene Gathering and Pipelines Rev 4 dated 06/06/2017 CDN/ID 3675627. This document is comprehensive and relatively mature, as it has had several reviews in recent years.

This document was reviewed and discussed in detail. Below are the main comments discussed in the audit process.

Extract from the Code of Practice below;

### **11.5 PIPELINE NETWORK INTEGRITY MANAGEMENT PLANS**

*Structural pipeline integrity is achieved when the pipeline is leak tight, operating within the design parameters and able to safely withstand all identifiable forces to which it may be subjected during operation, including the MAOP.*

*The Operator shall establish systems and processes that ensure pipeline structural integrity for the design life of the pipeline. The Operator should be able to demonstrate that appropriate systems are established, implemented and maintained.*

*The objective of maintaining structural integrity of the pipeline is to ensure that the operation and maintenance of the pipeline will not cause injury to the public, pipeline personnel, damage to the environment or disruption of production.*

#### **11.5.1 Pipeline Network Integrity Management**

*The Operator shall prepare and implement a pipeline network Integrity Management Plan (IMP) for the pipeline. The monitoring, inspection and mitigation of the identified threats shall be based upon risk based inspection, where the frequency of monitoring, inspection, and mitigation of each threat is based upon the risk level posed by that threat. The adequacy of the IMP shall be reviewed at intervals not greater than 5 years, or immediately upon a pipeline failure event.*

*Pipeline integrity management procedures shall be maintained for each monitoring, inspection or mitigation action that ensure the PE pipeline infrastructure remains fit for purpose at all times by implementing a systematic approach to operation, maintenance, testing and inspection activities and the application of sound engineering principles with due regard to safety and the environment.*

*Activities may include –*

- *Right of way inspection;*
- *Gas detection surveys for gas lines;*
- *Critical Function Testing (CFT) of over pressure protection devices;*
- *Checks to ensure the average temperature is not exceeding the maximum average temperature applicable for the selected design life.*

*Procedures shall be developed to ensure structural integrity of the pipeline infrastructure is retained during operation and maintenance activities. The procedures shall be approved.*

*The Operator shall address structural integrity issues of at least the following –*

- *Pipeline Joints; and*
- *PE Material over-temperature effects.*

*The Operator shall continually assess and maintain the pipeline integrity by reviewing pipeline operating conditions both time-dependent and time-independent factors through integrated operation controls and maintenance activities.*

*The data and information identified and collected for the assessments and reviews should form the basis for ongoing assessment of the risk and integrity of the pipeline. The findings of such a program will determine actions necessary to ensure the continuous safe and reliable operation of the pipeline.*

Comments re the Origin Energy Integrity Management Plan are as follows:

- Origin Energy have combined the Right Of Way (ROW) patrol and the leak survey into the one activity and the frequency of this operation is based on a risk process based on the location of houses, public roads, legacy equipment, watercourses and existing subsidence.
  - The audit team discussed this issue at length with Origin Energy as the ROW patrol and leak survey are very different types of maintenance activities. The intent of the ROW patrol is to be a proactive activity to determine the location of issues on

subsidence, signage, large leaks, erosion at watercourse and other crossings and to identify any third party interference – this was mainly for external interference protection. The leak survey activity is a reactive exercise to locate leaks on the gathering system. The ROW frequency of three yearly does comply with the current wording in section 11.7.1 but the intent of this section was to have an annual ROW patrol for smaller lines and more frequent for the major lines.

- The audit team strongly suggested that Origin Energy review their ROW patrol frequency as most lines are laid alongside access tracks and they are routinely travelled as part of the operators duties. Therefore, this increase in ROW patrolling would not have significant cost implications.
- One of the issues that the audit team discussed with Origin Energy during the audit was the frequent complaints from land owners to the P&G Inspectorate with respect to pipeline / gathering system is subsidence and the three yearly ROW patrol would not be a suitable control to control this threat in the view of the audit team. The intent of section 11.7.1 was based on the older wording in AS 2885 where the frequency of ROW patrols had a frequency of annual for suspended pipelines and more frequent for operational pipelines.
- The audit team also suggested that the frequency for ROW patrols could include a frequency based on patrols after significant rain events.
- The SMS provided to the audit team details that damage to gathering systems is recognised as one of the most prominent threats and that regular ROW patrols are required to control this threat. The audit team stated that a frequency of 3 years would not be classed as a control method for this threat.
- The audit team noted that the Integrity Management Plan specifically focused in Integrity issues and not on all the procedures for monitoring, inspection, maintenance activities as required in the Integrity maintenance plan (section 11.5.1)
- The audit team could find no wording in the Integrity Maintenance Plan to determine the activity to check that the average temperature does not exceed the applicable design temperature as required in section 11.5.1
- The Origin Energy HPV inspection frequency has a quarterly frequency for the legacy HPV's installed within 250 m of monitored subsidence with significant impact and within 250 m of a watercourse. The audit team discussed this issue at length with respect to the other frequent landowner complaint of continual venting HPV's. The audit team strongly indicated that this frequency be reviewed with respect to: HPV's with ongoing issues, land ownership, location to land owners, location to public roads etc.
- Section 6.2 states that the PE valves are checked and operability tested during the ROW patrol every 2 years. This does not align with the three yearly ROW frequency detailed in table 2.
- Section 7 of the Integrity Management Plan states that the leak management for PE pipelines is based on the preferred code of practice. This code of practice is a mandatory code – however the scope is only for wells currently. When the P&G Regs are revised the new version of this code of practice, which covers gathering systems, will be included.
- Section 10.2 wording for MAOP reviews does not align with the wording in the APGA CoP section 11.8.52 with respect as to when a review of the MAOP is required to be undertaken. Origin Energy need to reword this section to comply with the APGA CoP
- In addition the review of temperature is not on a case by case basis but as required by section 11.8.3.2 of the APGA CoP Origin Energy need to review this section to align with the CoP
- Origin Energy details that one of their significant integrity issues for the PE gathering systems relates to the steel risers at Wells, HPV's, and LPDs etc. Due to a number of issues Origin

Energy undertook a major program to inspect all phase one and earlier risers to determine the significance of the issue. Almost 1000 risers were inspected as part of this program. Origin Energy shared the outcomes of this program, which resulted in many risers being replaced or repaired. An outcome of this will be included in the next version of the APGA CoP to review the issue of non-metallic risers in specific locations.

- The audit team could find no reference to how they assess joint structural integrity as required in section 11.5.1 of the CoP This issue was discussed in detail in the audit and Origin Energy need to revise their Plan to reflect what they undertake in this area to assess their joint structural integrity.

Origin Energy provided the audit team a copy of their Polyethylene Pipelines Repair Plan. CDN/ID 6522887 rev 1 dated 29/9/2016. This document was very comprehensive and aligns with the APGA CoP for this activity.

The audit team discussed that the detailed sequence of activities in A.2, A.3 etc. do not include the reinforcement requirements that are detailed in the main body of this document and section 11.9.5.2 of the APGA CoP. Origin Energy discussed the option of reviewing this document to align the relevant sections in the appendices with the main body of the document.

## Emergency Management

Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) Emergency Plans

APGA PE Code of Practice-Version 4.0 Section 11 Operations

11.2.2 CSG field emergency response plan

11.2.2.1 Emergency planning and preparation

11.2.2.2 Emergency response and recovery

Origin Energy Network Management System Plan: PE Pipelines Document CDN/ID 3675639 references in 1.5.2 Integrated Gas, separate Emergency Response Plans for Spring Gully, Peat, Reedy Creek/Combabula, Condabri, Talinga and Orana. For the purpose of this part of Audit Origin Energy has supplied:-

- Network Management System Plan PE Gathering and Pipelines Doc CDN/ID 3675639 Rev 1 01/02/2017
- Spring Gully Safety Management Plan Doc CDN/ID 6270028 Rev 3 18/09/2017
- Emergency Response Plan Spring Gully Operations Doc CDN/ID 3677536 Rev 16 1/08/2017
- Incident Response Procedures Doc CDN/ID 3676134 Rev 4 01/12/2017 (Doc supplied as content of "flip charts")
- Emergency Response Team Guideline Doc CDN/ID 7039513 Under review Rev 0A 29/11/2017
- Emergency Response Activity Planning & Reporting Procedure Doc CDN/ID 3674898 Rev 6 12/10/2017

### Auditor findings/comments

All documents supplied indicate that the requirements of APGA PE Code of Practice-version 4 Section 11.2.1 CSG field emergency response plan (a) through to (d) and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (l) are complied with.

The requirements of APGA PE Code of Practice-version 4 Section 11.2.1.1 & 11.2.2.2 are also fulfilled in Incident Response Procedures Doc CDN/ID 3676134 Rev 4 and its associated branching documents.

The emergency response plans and systems are very comprehensive and easy to read but can be difficult to navigate due to complexity, however this comment from an outsiders point of view of the system who has not had Origin training. Auditors also did not have the advantage of the documents being live which would have hyperlinks for ease of navigation. On that point Origin needs to be sure that all required personnel have access to current and in date documents in the event of internet/network system failure.

APGA PE Code of Practice-version 4 Section 11.2.2 (g) and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (l) with regard to drills, exercises, training and use of emergency and rescue equipment needs to be validated by the Department attending a drill/exercise as per Origin Energy Emergency Response Activity Planning & Reporting Procedure doc CDN/ID 3674898 sections 5 to 7. This could be arranged with the detailed action plan requested in section 7 of this audit document.

### Training and Competency

Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (h) training and supervision program

APGA PE Code of Practice-Version 4.0 Section 2.2 Network management system elements

#### 2.2.2.3 Training and Competency

For the purpose of this part of Audit Origin Energy has supplied:-

- Network Management System Plan PE Gathering and Pipelines Doc CDN/ID 3675639 Rev 1 01/02/2017
- Spring Gully Safety Management Plan Doc CDN/ID 6270028 Rev 3 18/09/2017
- Emergency Response Plan Spring Gully Operations Doc CDN/ID 3677536 Rev 16 1/08/2017
- Integrated Safe System Of Work (ISSoW) LNG Doc CDN/ID 3675607 Rev 8 05/12/2017

### Auditor findings/comments

All documents supplied indicate that the requirements of APGA PE Code of Practice-version 4 Section 2.2.2.3 Training and competency and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (g) & (h) are complied with.

On 5 December 2017 Origin Energy office at 135 Coronation Drive, Milton, Brisbane auditors were shown Origin Competency Capability Program (CCP) on Intranet, which shows how training needs analysis, competency/pathway for individual employees.

Network Management System Plan PE Gathering and Pipelines Doc CDN/ID 3675639:2.2 Training and Competency states that training needs will be identified according to the "Gas Industry Training Package" and competency of contractors and suppliers shall be assessed against certification under "UEG11" or equivalent. Evidence that records have been retained or obtained to support the requirement could not be obtained and viewed at the time of the audit. This evidence could be provided at the time of the proposed excise/drill requested in 6.6 Emergency Management of this document.

## Permit to Work

The Code of Practice in section 2.10 details the requirement for Site Safety for the gathering system.

Extract from the Code of Practice

### 2.10 SITE SAFETY

*The safety of the public and maintenance personnel, repair personnel, the integrity of equipment and the pipeline network shall not be compromised.*

*Control processes shall be established for all personnel to ensure that risks are kept to as low as reasonably practicable (ALARP) and, where necessary, risk mitigation measures are implemented.*

*A permit to work process shall be required for site works involving high levels of risk, when working with any pipeline or its facilities, to ensure that high levels of OHS&E are maintained.*

*As a key requirement of the system, a job safety analysis (JSA) shall be carried out to ensure that all on site OHS&E hazards are identified and addressed prior to work commencing.*

*A permit to work should always be issued for –*

- *Work in pipe trenches;*
- *Pressure testing;*
- *Commissioning;*
- *Work on existing operating network including tie-ins;*
- *All other high risk tasks.*

Origin Energy provided the auditors with a copy of their NETWORK MANAGEMENT SYSTEM PLAN – PE GATHERING AND PIPELINES, Document No. CDN/ID 3675639 Revision 1, dated 01/02/2017.

Extract below;

### 8. Site Safety

*Each Origin asset is governed by a Safety Management Plan (SMP) as prescribed under the Petroleum and Gas (Production and Safety) Act 2004 (Qld) and Origin HSEMS (refer to section 1.5 for document numbers). The SMP details the systems, processes and control measures implemented to ensure the risks at each asset site have been eliminated or reduced 'so far as is reasonably practicable' (SFAIRP). In addition, the SMP is intended to provide personnel with an understanding of the type, location and nature of hazards present at the tenure and facilities and the risks and major accident events (MAEs) that could occur.*

*All activities during commissioning and operation will comply with the Integrated Safe System of Work (ISSoW) Manual (CDN 3675607). The ISSoW integrates the requirements of permit-to-work, isolation management, risk assessment, and simultaneous operations.*

Origin Energy also provided the auditors with a copy of document INTEGRATED SAFE SYSTEM OF WORK (ISSoW) Document No. CDN/ID 3675607, Rev 8, dated 05/12/2017 post desk top element of the audit.

Extract below from ISSoW;

#### 5.1 Permit Requirements

As a minimum, a permit is required for:

*Work within hazardous areas (with the exception of approved Operator routine duties);*

- *Work within specified restricted areas;*
- *Confined Space Entry;*
- *Excavations within Operational areas;*
- *High Voltage electrical work.*
- *Electrical work in hazardous areas including but not limited to:*
  - *Opening of electrical junction boxes; Connection, or disconnection of, electrical conductors;*
  - *Testing or access within the electrical encroachment limits of live apparatus;*
  - *Testing electrical isolations; and*
  - *Work on electric motors, alternators, instrumentation and other electrical devices.*
- *Road maintenance activities (Excavation permit) deeper than 300mm within 5 meters of a buried service*

The audit team requested to view an example of a completed Permit to Work form. Origin Energy provided copies of the following;

- Documentation relating to Permit to Work No. ORIGIN-000229330 for CPB – Trunkline CNN065-3Z – Pothole, Excavate and Backfill for Existing Gathering Crossing , and;
- Documentation relating to Permit to Work No. ORIGIN-0000235826 for CPB – CNS141-2-Brauer – Pothole, Excavate and Backfill for Existing Gathering & Electrical.

Additional documentation provided by Origin Energy as a package associated with permits was, but not limited to;

- Site Safety Review forms
- Permitted Works Emergency Response Plan form - No. QLD 1000 SAF FRM – CDN-ID 10041193
- Emergency Response Flowchart for Condabri
- Associated Emergency Response Plan isolation schematics for Gas & Water Gathering System (Q-4530-10-DF-1038) and Condabri South Wellhead Electrification (Q-4530-60-DL-0253)
- Location Map, plus Permit to Work Map.

The ISSoW Manual that was provided to the auditors was identified as being comprehensive. The following observations were made regarding additional documentation provided to the auditors;

- LNG Site Safety Review for CDN/ID 3675349 dated 28/6/17 for Permit No. 229330. It was observed that limited comments have been identified in relation to selected controls in Section 1 – Site Safety Review
- Gas test record CDN/ID: 3675350 attached to PTW 235826 identifies in Section 1 – details as Test type being Initial and Continuous. Section 2 – Test Record identifies times and Test types as being Initial only. If the test type carried-out is only initial as identified, a suggestion maybe to add comments for clarity in the Comments box provided as to not get confused with Spot test requiring frequency to be completed in Section 1 – Details.

- Permitted Works Emergency Response Plan (PWERP) form CDN/ID 10041193 associated with Permit Number 235826 and 229330 identifies in Section 3 – Approvals for Permit Holder and BCCR Supervisor. As the approvals section has not been signed as identified in Notes for use: Part 3 & 4, the audit team could not confirm if the PWERPs have been approved by the appropriate people.

## Job Hazard Analysis

Origin Energy Integrated Safe System of Work (ISSoW) Manual outlines in Section 4.2 Risk Assessment Levels

Extract below;

### 4.2 Risk Assessment Levels

*Risk assessment requirements vary subject to the initial risk of the proposed work scope. Risk assessments may include Task Risk Assessments (TRA), JSA's or Site Safety Reviews.*

*The initial risk of the task shall be determined in accordance with the Origin Risk Toolkit.*

*This initial risk of the tasks defines the level of TRA required. Level 1 TRA's shall be undertaken for low and medium risks work scopes, and Level 2 TRA's shall be applied to high initial risk and above. Such will identify the appropriate controls to be implemented.*

*Note however that if deemed or proven necessary (Risk Assessment or directive from SSM etc) a TRA2 can be utilised on a low or medium risk work scope.*

*The residual risk shall be assessed with consideration to the proposed controls. Residual risk shall be reduced to As Low as Reasonably Practicable (ALARP). Particular attention must be given to the accurate assessment of the residual likelihood and consequences associated with each identified hazard. In particular, if a risk reduction is being claimed based on a reduction in the consequence element, the assessor must be truthful in their assessment and the reviewer/approver must be rigorous in their review.*

*Acceptability of the residual risk must be considered with relation to the entire work scope. Where the residual risk is assessed as High or Very High further controls should be applied to reduce the risk to Low/Medium.*

Origin Energy did not provide any associated documentation in relation to completed Job Safety Analyses (JSA) or Task Risk Assessment (TRA), but did provided copies of LNG Site Safety Review forms (CDN/ID 3675349) associated with Permit Numbers 229330 and 235826.

Extract from ISSoW

### Site Safety Review

*The Site Safety Review is the assessment of the worksite prior to work commencing. It is a documented process that identifies and captures:*

- *Any additional and specific controls deemed necessary by the PH or the PA (either prior to issue of the permit or during the work) that were not captured in the TRA or are due to the "conditions of the day".*
- *Work party sign on / off names and signatures.*

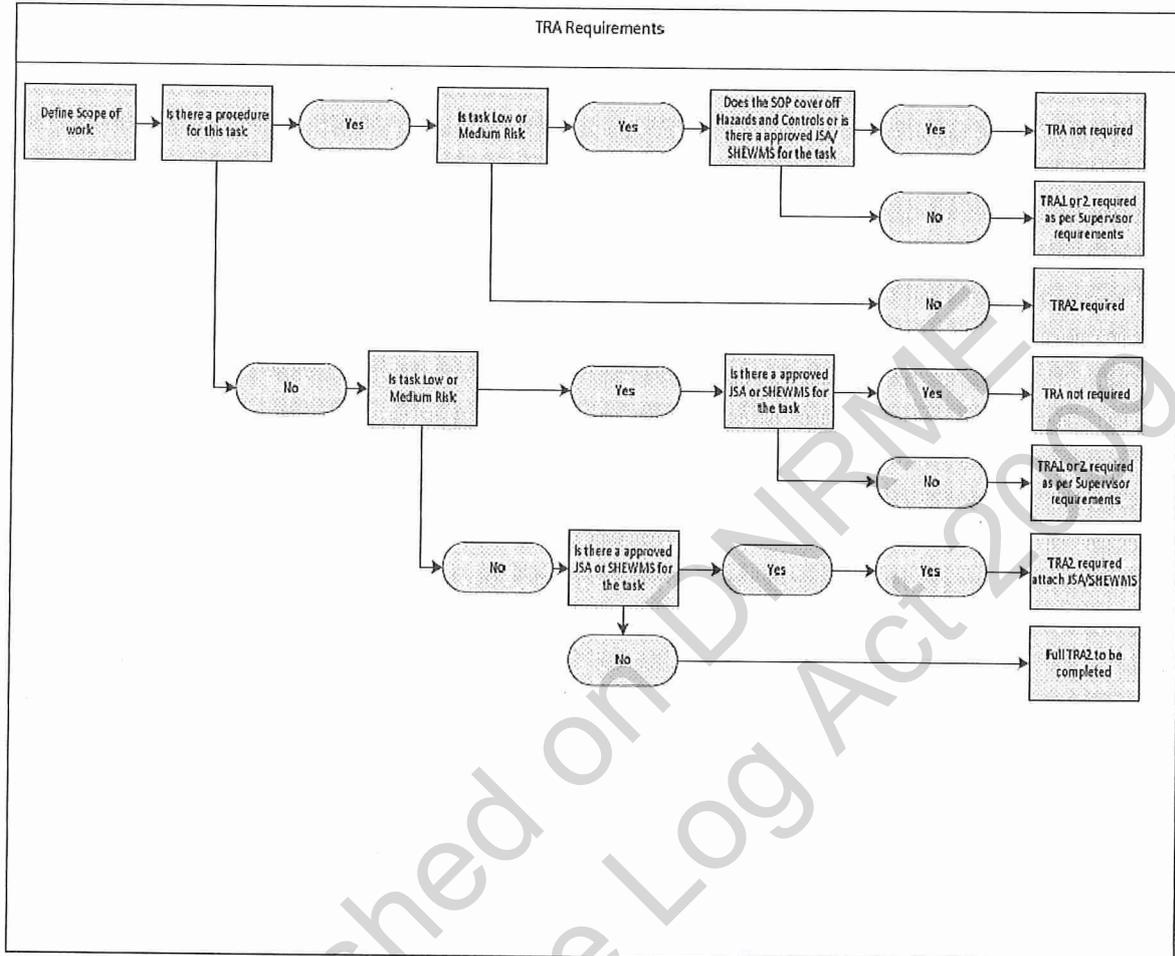
The TWO PTW examples provided by Origin (Origin-0000229330 and 0000235826) identify Excavation as High. Notes for use on the LNG Site Safety Review (CND/ID 3675349) states in part 2,

*"Site safe review can be performed by the Permit Holder (PH) or the Permit Authority (PA), except for high risk permits. High risk site safety reviews must be performed by the PA."*

It was identified on the example LNG Site Safety Reviews that the PH has signed off only not the PA.

Section 4.2.1 Task Risk Assessment (TRA) in the ISSoW Manual provides details for the identification of TRA requirements as per the table below;

Figure 2 - TRA requirement flow diagram.



The TRA Requirements identify that if a task is not Low or Medium Risk, then a TRA2 is required

**Extract below from ISSoW:**

4.4.2 Level 2 TRA

The Level 2 TRA is a more advanced risk assessment for initial risks identified as:

- High or Very High in Appendix F (Task Risk Guide), or
- Deemed above an initial medium risk in accordance with the Origin Risk Matrix.

A minimum of two persons shall be involved in the drafting, however there is no maximum number.

There is a requirement to document the members of the TRA 2 Team, in recognition that there may be "non Origin" persons in this Team, there is provision to document any "Guests" into the Risk Assessment Team.

The Level 2 TRA process involves:

- Breaking the job down into its component tasks and/or steps;
- Identifying hazards associated with such tasks and steps
- Evaluating the initial risks associated with such tasks and steps;
- Identifying control measures for each identified hazard; and
- Evaluating the residual risk to ensure it is ALARP.

Due to the documentation provided, it could not be confirmed by the auditors if the PTW process has been fully completed as per the Origin Energy Intergrated safe System of Work.

## Lockout / Tag Out

The ISSoW Manual in Section 9. Lockout Tag out used with ISSoW details, but is not limited to;

- Process
- Forced Removal of Locks and/or Tags
- Tag out
- Tags

No documentation was provided relating to Lockout and Tag Out being completed, but Origin Energy did identify within the ERPs associated with Permit to Work 229330 and 235826 required isolations in an emergency situation.

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## Legislative Non-compliance

The audit team did not identify significant legislative non-compliances during this audit.

However, a number of technical non-compliances were identified. These non-compliances may be best resolved with a revision to the APGA CoP.

## Opportunity for improvement

There were a number of opportunities for improvement that were discussed with Origin Energy representatives on 5 December, relating to their Gathering System. These are detailed in the above sections and it is recommended that Origin Energy review these comments and make any relevant actions to their gathering system plans and procedures, systems and relative documents.

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## Conclusion

Origin Energy is requested to provide the Petroleum and Gas Inspectorate with a detailed action plan for the timely completion of the identified issues. The action plan needs to include time frames and state the actions to be taken to rectify any identified issues.

If Origin Energy has any evidence that any of the identified issues are compliant then this evidence needs to be provided along with the action plan.

It is expected that the action plan is provided to the Inspectorate within 20 Business days from the date of the report and that the rectification of the issues would be fully complete within twelve months.

Please forward the action plan and the requested documentation to:

Marshall Holmes

Executive Petroleum Engineer - Petroleum and Gas  
Department of Natural Resources and Mines

Email: [marshall.holmes@dnrm.qld.gov.au](mailto:marshall.holmes@dnrm.qld.gov.au)

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## Appendix A

Audit report distribution list:

Name	Position	Organisation	Format
s.73 irrelevant information		Origin Energy	Electronic copy

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eleas

# **Petroleum and Gas Inspectorate Audit Report**

**Operating Plant Audit of QGC Gathering System on 7<sup>th</sup>  
December 2017**

**GPA 23196**

Published on DNRME  
Disclosure Log Act 2009



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## Summary

QGC operate significant gathering systems as part of their CSG operations.

The QGC gathering system is currently maintained and operated by QGC under the requirements of the Petroleum and Gas (Production and Safety) Act 2004, and APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

This gathering system is deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act).

An audit of the QGC Safety Management System (SMS) was conducted by Auditors from the Department of Natural Resources and Mines, Petroleum and Gas Inspectorate (P&G Inspectorate) on 5 December 2017 at the QGC office at 135 Coronation Drive, Milton, Brisbane.

The objective of the audit was to assess the SMS for compliance with the P&G Act. The scope of the audit was to use the APGA Code of Practice in conjunction with the P&G Act to assess the compliance of the QGC Network Management Systems (NMS) for the QGC Gathering system.

The audit consisted of a desktop review of the Network Management System, the Network Integrity Management Plan, Safety Management Study and other association procedures.

Several non-conformances were identified in the audit. The audit team also identified several opportunities for improvement, which are detailed in this report.

QGC have been requested to provide the Petroleum and Gas Inspectorate a detailed action plan for the timely completion of the identified issues.

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## Audit details

Audit details	
Reference number	GPA 23196
Lead auditor	Marshall Holmes, Executive Petroleum Engineer Petroleum and Gas
Others assisting	Derek Fagan, Senior Inspector Jon McLoughlin, Senior Inspector

## Document history

Date	Version	Author	Reason
2 January 2018	A	M. Holmes	First Draft
5 January 2018	B	D. Fagan	Second Draft
12 January 2018	C	J. McLoughlin	Third Draft
15 January 2018	D	D. Fagan	Draft
17 January 2018	0	D. Fagan/M.Holmes	Report Issued

## Endorsement

Date	Title	Name	Signature
17/1/18	Executive Petroleum Engineer Petroleum and Gas	Marshall Holmes	s.73 irrelevant information

## Introduction

An audit was conducted by the Petroleum and Gas Inspectorate (P&G Inspectorate), Department of Natural Resources, Mines and Energy (DNRME) in relation to the QGC Gathering Systems for their Integrated Operations with respect to the Petroleum and Gas (Production and Safety) Act 2004 and the APGA Code of Practice – Upstream Polyethylene Gathering Networks – CSG Industry.

QGC are a major CSG production company in Queensland. Gathering systems are deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (the P&G Act).

QGC in Queensland operates over 3000 km of Polyethylene gathering networks. The gathering networks transports gas and water from well separators to gas processing facilities and water treatment plants via a networked system of flow and trunklines. Loss of containment events have safety, environmental and production consequences, with the potential to affect a significant number of wells.

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## Audit Plan

### Scope and objectives

The scope of the audit was to assess the compliance of the internal procedures developed by QGC on management, operational and pipeline integrity. This is to meet their legislative requirements against the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry in conjunction with the P&G Act. The Code of Practice is listed in the Petroleum and Gas Regulations in schedule 1 Part 1 as a preferred standard.

The audit team reviewed and assessed the QGC Network Management System (NMS) for their operations and associated documents, including but not limited to; Safety Management Plan, Integrity Management Plan, Safety Management Study. This audit was aimed at the systems that QGC have implemented. At a later date, the details of these systems will be reviewed to determine how they have been implemented.

The audit is prepared for the Office of the Chief Inspector to demonstrate the effectiveness of the Network Management System for the operating plant and whether it is fulfilling its obligations in respect to safety management.

The QGC Gathering System was selected for an audit as part of a risk-based sample across the regulated section of the petroleum and gas industry. This is the sixth audit conducted to the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

*The Code of Practice was prepared on behalf of the Australian Pipeline Industry Association (APIA) by members of the Association who are associated with the Coal Seam Gas (CSG) industry. Representative members of all sections of the industry were active participants, including all major CSG producing companies, Qld regulator, constructors, and manufacturers of polyethylene (PE) resin, pipelines and fittings as well as CSG engineers.*

An objective of this audit was to identify issues with the APGA Code of Practice with respect to operating company's systems. The Code of Practice is currently being revised as part of the development of version 5.

### Arrangements for the audit

This audit was initially flagged with QGC during the Stakeholder Engagement Committee with the operating plant companies on the 18<sup>th</sup> May 2017 and followed up with several email and phone conversations, to arrange the date and scope of the audit.

Marshal Holmes as Lead Auditor made contact with QGC both by telephone and email to request a copy of the current QGC plans, documents and procedures relating to their gathering systems as per the scoping document for their operations to review prior to the audit.

The audit was conducted on the 7<sup>th</sup> December 2017 by auditors from the Inspectorate, in accordance with departmental guidelines.

Specific records were requested as part of the lead up to audit. These documents included:

Network Management System	not supplied
Integrity Management Plan	not supplied
Upstream Operations Emergency Response	QCQGC-BX00-HSS-PLN-000020 rev 3

Permit to Work Procedure

QCOPS-BX00-HSS-PCE-000002 rev 6

QCLNG Upstream Project – Acrux

QCLNG-BB71-HSS-RPT-300000 rev 00

QCLNG Upstream Project – Reduced Depth of Cover Safety Management Study – Gathering

QCLNG-BB00-HSS-000047 rev 00

QCLNG-Upstream Project – Kenya East Block Packages 1 & 2. Safety Management Study – Gathering

GCLNG-BB09-HSS-RPT-300000 rev 00

QGC attendees at the audit meeting were as follows:

Name	Position	Organisation
s.73 irrelevant information		QGC
		QGC

### Audit team

The audit team consisted of DNRME P&G Inspectors having the following competencies;

- Extensive gas related activity skills.
- Extensive technical/scientific/engineering competency
- Communication and interpersonal skills.
- Analytical and reporting skills.
- Auditing Skills

Name	Position	Organisation
Derek Fagan	Senior Inspector	DNRME
Jon Mccloughlin	Senior Inspector	DNRME
Marshall Holmes	Executive Petroleum Engineer – Lead Auditor	DNRME

## Audit Findings

The findings outlined in this audit report relate to the audit against the requirements of section 675 of the *Petroleum and Gas (Production and Safety) Act 2004*.

The findings outlined in this audit report relate to the audit against the requirements of APGA Code of Practice, which is a preferred standard for pipelines as detailed in the *Petroleum and Gas (Production and Safety) Regulations 2004*.

The audit focused on management for the gathering system as well as integrity management.

The audit provided the audit team with a sound understanding of the QGC management process for their CSG gathering Systems.

QGC have been extensively involved in the development of the code of practice for the PE gathering systems to date. For a significant period, a manager from QGC was the head of the APGA CoP steering committee.

## Network Management System

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 specifies the requirement to have a Network Management System (NMS). Section 2.2 of the Code of Practice (CoP) details the general contents for the system.

Extract from the Code of Practice.

*The NMS shall address the Operator's approach to the following areas –*

- a) Management;*
- b) Planning;*
- c) Implementation;*
- d) Measurement and evaluation;*
- e) Consultation, communication and reporting;*
- f) Safety Management;*
- g) Environmental Management;*
- h) Construction and Commissioning;*
- i) Site Safety.*

*The NMS shall include a description of the flowline(s) covered by the NMS including suitable maps (alignment sheets and/or GIS) showing the route of the flowline(s), the location of associated facilities such as compressor and pump stations, low point drains, high point vents and valve stations.*

*Each element of the NMS is described below and supports each other. The NMS shall comply with those requirements. Much of the responsibility for creating and implementing the NMS lies with the Operator.*

### **2.2.2.1 Management Structure**

*A defined management structure for the network shall be established to identify key positions and personnel. An appropriate management structure shall be maintained.*

### **2.2.2.2 Responsibilities, accountabilities and authorities**

*The responsibilities, accountabilities and authority levels of personnel and or contractors with respect to the various aspects of the operation and maintenance of the network shall be detailed in the NMS.*

As preparation for the audit, the Petroleum and Gas Inspectorate requested a copy of the QGC Network Management System to review. Unfortunately, at the time of the audit QGC has not developed and implemented a Network Management System as required by the APGA CoP.

During the audit, QGC provided the audit team a copy of their draft Network Management System for PE Gathering Network – QCOPS-BB00-GAS-MAN-000001 rev B dated December 2017.

This document has never been formally issued for use despite QGC being a leading member of the APGA Code of Practice for gathering systems which implemented the requirement to develop and instigate a Network Management System.

One of the objectives for the audit was to review the requirements for the NMS in the APGA CoP.

The audit team discussed the Network Management plan in a high level and relevant comments are:

- Most of the key requirements detailed in section 2.1 of the APGA CoP are included in the QGC NMS. However, the requirement to include a description of the flowlines covered by the NMS including suitable maps, locations of associated facilities is missing.
- The audit team could not find any reference to the requirements to plan for abnormal operations as per section 2.3.3 of the CoP. QGC need to review this section.
- Appendix A details the competency requirements for key gathering system personnel. It is noted that a certificate III in process plant operation is a requirement for Supervisors and operators. The APGA CoP and AS 2885 use the UEG system instead of the PMA system.

As stated above one of the objectives of the audit was to identify issues with the current wording of the APGA CoP NMS requirements and this was not meant to be a failing on QGC but on the requirements detailed in the CoP.

In the development of version 5 of the APGA CoP, it is proposed that the requirements for the NMS will be reviewed and the audit team would require the assistance of QGC in the process to obtain the required wording in section 2 of the CoP.

## **Safety Management System**

QGC did not provide the audit team a copy of their Safety Management System, as they do not have a single document for this system. Historically a Safety Management Plan was required to be in place for operators of operating plant.

## **Safety Management Study**

The APGA CoP requires that a Safety Management Study (SMS) be undertaken at specific phases of the gathering systems life. One of the objectives of this audit was to review the SMS's that QGC have undertaken as well as to review the requirements in the CoP with respect to the ongoing operational requirements. The audit team discussed this issue at length as QGC have undertaken to date over 100 SMS's for their gathering system and the intent is to gather the relevant SMS outcomes per field when these are reviewed every 5 years.

Extract from the APGA CoP:

*Appendix A1*

*The network safety management process required by this Code of Practice is of fundamental importance to the network design, its operation and maintenance. It is the means by which network safety is demonstrated. It also forms the basis for all operations and maintenance of the network.*

*The safety management process is integrated and continuous. It requires consideration of design aspects and operating procedures in a combined, holistic way so that the network can be operated safely. Analysis is updated and refined using information as it becomes available throughout the life cycle of the network.*

*The essential outcomes of a management process are:*

- a) Assurance that the threats to the network and associated risks are identified and understood by those that are responsible for addressing the threats and risks; and*
- b) Appropriate plans are made to manage these risks.*

*The network safety management process requires the application of multiple independent controls to protect the network from each identified threat.*

*Physical (route selection, barrier or exclusion), procedural and design methods should be applied to all threats with the objective of preventing failure of the network, minimising the consequence to the public (including the Operator's personnel and Contractors) and the environment.*

*Appendix A2.1*

*Safety management studies should be undertaken at intervals during the network design and operational phases to facilitate periodic reassessment of the threats and the implementation of controls as knowledge of the threats is gained over time.*

*c) Operation: A review of the detailed safety management study that complies with this Code of Practice should be undertaken at least every five (5) years and should consider at least the following:*

- Any loss or degradation of integrity.*
- Land use change, specifically changes within the radiation contour.*
- Any change to location-specific or non-location-specific threats.*
- Construction defects or deviations from specification.*
- Testing defects and pressure test failures.*
- The previous safety management studies.*

*The review should also be completed:*

- At any review for changed operating conditions.*
- Before recommencement of operation following a flowline failure where such failure has resulted from a mechanism not previously included in preceding studies.*
- At any time when new or changed threats including land use occur.*
- At any time where there is a change of knowledge affecting the safety of the flowline or network.*
- At any review for extension of design life.*

QGC provided the audit team a copy of many of the SMSs that have been undertaken over the past 5 years. Relevant comments on these SMS's are:

- The audit team noted that many of the SMS are close to the review date of 5 years. This is a common issue with all production companies and as discussed one method may be to

combine all the key threats and controls for the field into one SMS and this is the one SMS that is reviewed.

- Many of the older SMS's have a design life for the gathering system of 20 years. The current version of the CoP may have significantly higher design lives and MAOP s that could be used in new designs for the QGC fields.
- Concrete slabs are a common protection measure that has been applied in QGC designs. The audit team discussed the recent development in PE slabs that have been used on the Roma to Brisbane pipeline in recent months, which will reduce the costs to implement this protection system.
- In general, all the SMS's provided to the audit team were professionally completed.

QGC provided their Gathering SMS Philosophy during the audit. This document is QCQGC-BB00-PL-PHY-000001 rev 0 dated November 2017. This document details the philosophy that QGC used in their SMS for their gathering system. The generic threats are applied to all new developments as well as the location specific threats for analysis.

The review process in section 3 which is a current requirement to be undertaken at intervals not exceeding 5 years could be reviewed to expand this section. Consideration may be made to adding that SMS's for sections in the same field could be combined and reviewed together as they all form the one gathering system – similar to the process that is used for distribution systems. Consideration should be made also to expand assessment to consider other review requirements such as operating and maintenance history and fluid changes. The process in this document could also be considered to be added to the APGA as a companion document to provide guidance to the whole CSG industry.

The audit team proposed several benefits in having the Petroleum and Gas Inspectors participate in the SMS and remaining life review process so that both parties understand the threats and controls for their system.

## Management of Change

Extract from QGC Network Management System for PE Gathering Network QCOPS-BB00-GAS-MAN-000001, Rev B December 2017;

### 2.2.6. Change Management

*The QGC procedure for MOC is contained in QCOPS-BX)-HSS-PCE-000012, Management of Change.*

*The purpose of Management of Change is to define the principles of how QGC manages or modifies and defines the necessary controls required to implement these changes within all surface facilities for processing and production of hydrocarbons and associated activities. All management of change will be initiated, undertaken and closed out according to Procedure QCOPS-BX00-HSS-PCE-00012. For the purpose of this document, Management of Change will be referred to as MOC.*

*The MOC procedure ensures:*

- *All change/modifications to equipment, systems and procedures are carried out in a manner so as to not produce a hazard to safety, environment, production or plant operability.*
- *All change/modification to equipment, systems and procedures are reviewed and authorised by relevant stakeholders prior to implementation and that all change/modifications conform to the design criteria.*

QGC provided the auditors with a copy of Management Of Change (MoC) Standard, Document Number: QCQGC-BX00-HSS-STD-000020 Revision: 0 with Review due: July 2016 and also provided Management Of Change (MoC) Procedure, Document Number: QCCOPS-BX00-HSS-PCE-00012 Revision 0, with Review due: February 2018 prior to the audit, Which were viewed by the audit team.

The audit team requested the current version of the Management Of Change (MoC) Standard, but unfortunately received the Management Of Change (MoC) Procedure, Document Number: QCCOPS-BX00-HSS-PCE-00012 Revision 0, with Review due: February 2018

The audit team also viewed two examples of MoC's undertaken by QGC. These being;

- Detailed Report for MOC# 2017-1314, Description – (Emergency MOC) Wambo Cattle Water Infrastructure
- Detailed Report for MOC# 2017-1778, Description – David header interconnecting HDPE manifold.

Due to the MoC examples viewed being identified as not completed, the auditors requested if follow-up documentation could be provided to confirm that the MoC process as been carried-out as per the QGC Management Of Change Procedure (QCCOPS-BX00-HSS-PCE-00012).

QGC provided the auditors at a later date the requested documents which were viewed by the auditors. It was identified that the documents provided were the same as documents listed above so the audit team were unable to verify the MOC process at the time of writing the report.

## Network Integrity Management Plan

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 states the requirement to have a Network Integrity Management Plan. Section 11.5 of the Code of Practice details the general contents for the plan.

Prior to the audit QGC did not provide a copy of their Plan for review. During the audit QGC presented the audit team a copy of their draft Integrity Management Plan for PE Gathering Network. This document is QCOPS-BB00-GAS-PLN-000001 Rev A dated 29 November 2013. This document has never been formally been issued for use despite QGC being a leading member of the APGA Code of Practice for gathering systems which implemented the requirement to develop and implement an Integrity Management Plan.

This document was reviewed and discussed in the audit process. As the document was not provided before the audit, the comments below are only some main comments.

Extract from the Code of Practice below;

### **11.5 PIPELINE NETWORK INTEGRITY MANAGEMENT PLANS**

*Structural pipeline integrity is achieved when the pipeline is leak tight, operating within the design parameters and able to safely withstand all identifiable forces to which it may be subjected during operation, including the MAOP.*

*The Operator shall establish systems and processes that ensure pipeline structural integrity for the design life of the pipeline. The Operator should be able to demonstrate that appropriate systems are established, implemented and maintained.*

*The objective of maintaining structural integrity of the pipeline is to ensure that the operation and maintenance of the pipeline will not cause injury to the public, pipeline personnel, damage to the environment or disruption of production.*

#### **11.5.1 Pipeline Network Integrity Management**

*The Operator shall prepare and implement a pipeline network Integrity Management Plan (IMP) for the pipeline. The monitoring, inspection and mitigation of the identified threats shall be based upon risk based inspection, where the frequency of monitoring, inspection, and mitigation of each threat is based upon the risk level posed by that threat. The adequacy of the IMP shall be reviewed at intervals not greater than 5 years, or immediately upon a pipeline failure event.*

*Pipeline integrity management procedures shall be maintained for each monitoring, inspection or mitigation action that ensure the PE pipeline infrastructure remains fit for purpose at all times by implementing a systematic approach to operation, maintenance, testing and inspection activities and the application of sound engineering principles with due regard to safety and the environment.*

*Activities may include –*

- *Right of way inspection;*
- *Gas detection surveys for gas lines;*
- *Critical Function Testing (CFT) of over pressure protection devices;*
- *Checks to ensure the average temperature is not exceeding the maximum average temperature applicable for the selected design life.*

*Procedures shall be developed to ensure structural integrity of the pipeline infrastructure is retained during operation and maintenance activities. The procedures shall be approved.*

*The Operator shall address structural integrity issues of at least the following –*

- *Pipeline Joints; and*
- *PE Material over-temperature effects.*

*The Operator shall continually assess and maintain the pipeline integrity by reviewing pipeline operating conditions both time-dependent and time-independent factors through integrated operation controls and maintenance activities.*

*The data and information identified and collected for the assessments and reviews should form the basis for ongoing assessment of the risk and integrity of the pipeline. The findings of such a program will determine actions necessary to ensure the continuous safe and reliable operation of the pipeline.*

This document was reviewed and discussed in detail. As the Integrity Management Plan was not provided to the audit team prior to the audit the auditors could not study the plan and develop a series of questions based on it relative to the requirements of the APGA CoP. Below are the main comments discussed in the audit process.

- The draft procedure was written with respect to version 2.0 of the APGA CoP. QGC are updating the Integrity Management plan with respect to the latest version of the CoP as there have been some major changes since the CoP was developed.
- The integrity management Plan states that inspections and assessments should be based on the Network Management System – at the time of the audit QGC only had a draft Network Management system.
- QGC state in their plan that they has an annual Right Of Way (ROW) patrol process. QGC are also progressing with their drone innovation for completing the ROW patrols on their gathering systems. QGC demonstrated the capability of this system and the audit team was impressed with this technology. The next version of the drone will have a gas detector installed to enable the drone to locate leaks of their facilities and gathering systems.

- The QGC plan states that the CP system that is installed on many steel risers is tested every three months for spot checks and 12 monthly for a system audit. QGC indicated that this testing does not occur currently. This requirement needs to be reviewed and documented.
- The audit team could find no wording in the Integrity Maintenance Plan to determine the activity to check that the average temperature does not exceed the applicable design temperature as required in section 11.5.1
- The audit team could find no reference to the inspection and maintenance of valves that are installed on the gathering system.
- QGC details that one of their significant integrity issues for the PE gathering systems relates to the steel risers at Wells, HPVs, and LPDs etc. An outcome of this will be included in the next version of the APGA CoP to review the issue of non-metallic risers in specific locations.
- The audit team could find no reference to how they assess joint structural integrity as required in section 11.5.1 of the CoP. This issue was discussed in detail in the audit and QGC need to revise their Plan to reflect what they undertake in this area to assess their joint structural integrity.

## Emergency Management

Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) Emergency Plans

APGA PE Code of Practice-Version 4.0 Section 11 Operations

11.2.2 CSG field emergency response plan

11.2.2.1 Emergency planning and preparation

11.2.2.2 Emergency response and recovery

QGC Network Management System for PE Gathering Network Doc QCOPS-BB00-GAS MAN-000001

Rev B December 2017 references a field wide Emergency Response Procedure (ERP)

For the purpose of this part of Audit QGC has supplied-:

- QGC Network Management System for PE Gathering Network Doc QCOPS-BB00-GAS MAN-000001 Rev B December 2017
- QGC HSSE Management Plan Upstream Operations Emergency Response Doc QCQGC-BX-HSS-PLN-000020 Rev 3 Aug 2017
- Emergency Management Doc QCQGC-BX00-HSS-STD-000011 (referred to but not supplied to Audit team)
- Incident Management Plan QCQGC-BX00-HSS-PLN-000002 (referred to but not supplied to Audit team)
- Emergency exercise-Plant explosion FO2 FCS Kenya/Jordan 12/11/2017

## Auditor findings/comments

All documents supplied indicate that the requirements of APGA PE Code of Practice-version 4 Section 11.2.1 CSG field emergency response plan (a) through to (d) and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) are complied with.

The emergency response plans and systems are quite comprehensive and easy to read and can be navigated with simplicity, however some of the documents referred to in NMS QCOPS-BB00-GAS MAN-000001 Rev B December 2017 which were not supplied to Auditors should be checked for having current association. (QCQGC-BX00-HSS-STD-000011 & QCQGC-BX00-HSS-PLN-000002 for example)

APGA PE Code of Practice-version 4 Section 11.2.2 (g) and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (l) with regard to drills, exercises, training and use of emergency and rescue equipment needs to be validated by the Department attending a drill/exercise as per section 22.0 Upstream Operations Emergency Response Plan QCQGC-BX-HSS-PLN-000020 Rev 3 Aug 2017.

This could be arranged with the detailed action plan requested in the relevant section of this audit document.

## Training and Competency

Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (h) training and supervision program

APGA PE Code of Practice-Version 4.0 Section 2.2 Network management system elements

### 2.2.2.3 Training and Competency

For the purpose of this part of Audit QGC has supplied:-

Network Management System for PE Gathering Network Doc QCOPS-BB00-GAS-MAN-000001 Rev B- 01 December 2017

### Auditor findings/comments

Documents and evidence provided to auditors indicate that the requirements of APGA PE Code of Practice-version 4 Section 2.2.2.3 Training and competency and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (g) & (h) are complied with.

QGC Network Management System for PE Gathering Network Doc QCOPS-BB00-GAS-MAN-000001 Rev B- 01 December 2017 section 2.2.4 Training and Competency states all personnel will be competent to undertake tasks as directed. Competency based training is identified and maintained under QGC CAMS and managed by the Competency Assurance (CAMS) Manager in line with APGA CoP Companion Paper CP 02-001.

During audit process conducted in the offices of QGC 275 George Street 7<sup>th</sup> December 2017, auditors were shown examples of training and some of the CAMS system operations located on the intranet data bases. Auditors were provided with a number of training course programs and their associated attendance sheets for recent training. Appendix A of document QCOPS-BB00-GAS-MAN-000001 Rev B- 01 December 2017 provides operational personnel competency requirements, which is quite comprehensive but at the time of the audit individual personnel training needs analysis data could not be shown due to access permissions.

## Permit to Work

The Code of Practice in section 2.10 details the requirement for Site Safety for the gathering system.

Extract from the Code of Practice

### 2.10 SITE SAFETY

*The safety of the public and maintenance personnel, repair personnel, the integrity of equipment and the pipeline network shall not be compromised.*

*Control processes shall be established for all personnel to ensure that risks are kept to as low as reasonably practicable (ALARP) and, where necessary, risk mitigation measures are implemented.*

*A permit to work process shall be required for site works involving high levels of risk, when working with any pipeline or its facilities, to ensure that high levels of OHS&E are maintained.*

*As a key requirement of the system, a job safety analysis (JSA) shall be carried out to ensure that all on site OHS&E hazards are identified and addressed prior to work commencing.*

*A permit to work should always be issued for –*

- *Work in pipe trenches;*
- *Pressure testing;*
- *Commissioning;*
- *Work on existing operating network including tie-ins;*
- *All other high risk tasks.*

Extract from QGC Network Management System for PE Gathering Network QCOPS-BB00-GAS-MAN-000001, Rev B December 2017;

#### 2.3.4. Permit to Work System (PTWS)

*QCOPS-BX00-HSS-PCE-000002 outlines the Permit to Work procedure that applies to development and production activity within QGC in Queensland. The PTWS provides a method for ensuring that adequate safety checks and considerations are performed by appropriately qualified personnel for certain types of hazardous work. The key to this permit to work system is the assignment of accountability, responsibility, communication, and the concept of a Permit Authority process.*

QGC provided the auditors with a copy of Permit to Work Procedure (PTW Procedure), Document Number: QCOPS-BX00-HSS-PCE-000002.

The audit team requested to view an example of a completed Permit to Work form and associated documentation. QGC provided copies of the following;

- Permit To Work (PTW NO: PTW-17-32908), and
- Multi Day Permit To Work Continuation For (Associated PTW No: 32908)

As part of the PTWS, QGC also provided copies of the following documents;

- IPipe Services Safe Work Method Statement – Back Filling of Trenches (Location: Lauren Manifold 35 – SWMS No. 23)
- IPipe Services Procedure Document: Bell Hole Rescue Plan – QGC Lauren 35 Manifold
- QGC Excavation Certificate for Lauren Manifold 35

The PTW Procedure that was provided to the auditors was identified as being comprehensive. The examples provided of completed Work Permits (No. PTW-17-32908) were identified as satisfactorily filled out and as outlined in the PTW Procedure. The following items were identified as being opportunities for improvement relating to the completed Permit to Work forms and associated documents;

Permit To Work (PTW NO: PTW-17-32908)

- Step 5: Permit To Work Controls identifies "B. Atmospheric Check" as being continuous and recorded at intervals of 2Hrs. It was identified in Step 9: Atmospheric Check that the recorded times are inconsistent with the stated 2Hr period.

QGC Excavation Certificate for Lauren Manifold

- The document does not identify the Associated PTW No.

IPipe Services Procedure Document: Bell Hole Rescue Plan – QGC Lauren 35 Manifold

- Emergency Contacts Section identifies Department of Energy Environment Development and Infrastructure. These details may be incorrect with no explanation given on How, When or Why to contact
- Emergency Procedure Section in part 3. Requires GPS coordinates to be provided to Triple 000 (Emergency Services), but does not identify within the document the GPS coordinates or where they can be found

## Job Hazard Analysis

QGC provided the auditors with a copy of Procedure - Job Safety and Environmental Analysis (JSEA), Document Number: QCOPS-BX00-HSS-PCE-0000015, Rev 0, dated February 2012

Extract from JSEA Document Number: QCOPS-BX00-HSS-PCE-0000015 below;

### 3.0 JSEA GENERAL REQUIREMENTS

#### 3.1 JSEA general requirements

*At QGC Operations there are only two work flows in the field. Tasks are either completed as per the requirements of the Approved Task List or under a Permit to Work (PTW).*

*A JSEA will be required for all work carried out on QGC sites or QGC controlled activities where a PTW has been issued for the task (refer to PTW procedure QCOPS-BX00-HSS-PCE-000002).*

*A JSEA is NOT required if the task is listed on the Approved Task List (ATL). Tasks on the ATL are risk assessed prior to being approved and are usually covered by a SOP (or equivalent). Where a task is being undertaken that is on the Approved Task List a Stepback form will be used. However, if the Supervisor determines a higher level risk assessment is required then they may utilise the SWMS form QCOPS-BX00-HSS-FRM-000002 prior to commencing work.*

*JSEAs can only be conducted by the work crew at the location where the task is to be undertaken. Any risk assessment developed prior to assembling at the work place where the task is to be undertaken is not a JSEA and must not be signed off by the work crew as a JSEA.*

The audit team requested to view an example of a completed JSEA's. QGC provided copies of the following;

- Permit To Work (PTW NO: PTW-17-32908, and
- Multi Day Permit To Work Continuation For (Associated PTW No: 32908)

The auditors viewed both documents and identified Step7: Work Party Safety Briefing has been completed which is directly related to completing a JSEA.

Section 3.4 in the JSEA Document Number: QCOPS-BX00-HSS-PCE-0000015 outlines the Relationship with the Permit to Work System and the JSEA on how to be completed. The documentation provided demonstrated the JSEA has been completed as required.

### **Lockout / Tag Out**

QGC were requested if they could provide a copy of their Isolation Procedure to the auditors during the audit. QGC - Safe Isolation And Lock Out Tag Out Procedure, Revision 4, Document Number QCOPS-BX00-HSS-PCE-00009 was later provided to the auditors.

The audit team also requested to view an example of a documented completed Isolation. At the time of writing this report, no examples have been received by the audit team.

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## Legislative Non-compliance

The audit team identified two significant legislative non-compliances during this audit.

However, a number of technical non-compliances were identified. These non-compliances may be best resolved with a revision to the APGA CoP.

Non-compliances identified include:

- QGC need to develop and implement an Integrity Management Plan for their Gathering Network as per the requirements of the APGA CoP.
- QGC need to develop and implement a Network Management System for their Gathering Network as per the requirements of the APGA CoP.

## Opportunity for improvement

There were a number of opportunities for improvement that were discussed with QGC representatives on 7 December, relating to their Gathering System. These are detailed in the above sections and it is recommended that QGC review these comments and make any relevant actions to their gathering system plans and procedures, systems and relative documents.

## Conclusion

QGC is requested to provide the Petroleum and Gas Inspectorate with a detailed action plan for the timely completion of the identified issues. The action plan needs to include time frames and state the actions to be taken to rectify any identified issues.

If QGC has any evidence that any of the identified issues are compliant then this evidence needs to be provided along with the action plan.

It is expected that the action plan is provided to the Inspectorate within 20 Business days from the date of the report and that the rectification of the issues would be fully complete within twelve months.

Please forward the action plan and the requested documentation to:

Marshall Holmes

Executive Petroleum Engineer - Petroleum and Gas  
Department of Natural Resources and Mines

Email: [marshall.holmes@dnrm.qld.gov.au](mailto:marshall.holmes@dnrm.qld.gov.au)

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## Appendix A

Audit report distribution list:

Name	Position	Organisation	Format
s.73 irrelevant information		QGC	Electronic copy

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# **Petroleum and Gas Inspectorate Audit Report**

**Operating Plant Audit of Santos Gathering System on 6<sup>th</sup>  
December 2017**

**GPA 23195**

Published on DNRME  
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## Summary

Santos operate significant gathering systems as part of their CSG operations.

The Santos gathering system is currently maintained and operated by Santos under the requirements of the Petroleum and Gas (Production and Safety) Act 2004, and APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

This gathering system is deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act).

An audit of the Santos Safety Management System (SMS) was conducted by Auditors from the Department of Natural Resources, Mines and Energy, Petroleum and Gas Inspectorate (P&G Inspectorate) on 5 December 2017 at the Santos office at Turbot Street, Brisbane.

The objective of the audit was to assess the SMS for compliance with the P&G Act. The scope of the audit was to use the APGA Code of Practice in conjunction with the P&G Act to assess the compliance of the Santos Network Management Systems (NMS) for the Santos Gathering system.

The audit consisted of a desktop review of the Network Management System, the Network Integrity Management Plan, Safety Management Study and other association procedures.

No significant non-conformances were identified in the audit. The audit identified several opportunities for improvement and technical non-compliances, which are detailed in this report.

Santos have been requested to provide the Petroleum and Gas Inspectorate a detailed action plan for the timely completion of the identified issues.

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## Audit details

Audit details	
Reference number	GPA 23195
Lead auditor	Marshall Holmes, Executive Petroleum Engineer Petroleum and Gas
Others assisting	Derek Fagan, Senior Inspector Jon Mcloughlin, Senior Inspector

## Document history

Date	Version	Author	Reason
2 January 2018	A	M. Holmes	First Draft
11 January 2018	B	D. Fagan	Second Draft
12 January 2018	C	J. McLoughlin	Third Draft
17 January 2018	0	M. Holmes/D.Fagan	Report Issued

## Endorsement

Date	Title	Name	Signature
17/1/18	Executive Petroleum Engineer Petroleum and Gas	Marshall Holmes	s.73 irrelevant information

## Introduction

An audit was conducted by the Petroleum and Gas Inspectorate (P&G Inspectorate), Department of Natural Resources, Mines and Energy (DNRME) in relation to the Santos Gathering Systems for their operations with respect to the Petroleum and Gas (Production and Safety) Act 2004 and the APGA Code of Practice – Upstream Polyethylene Gathering Networks – CSG Industry.

Santos are a major CSG production company in Queensland. Gathering systems are deemed to be operating plant by virtue of Section 670 (2) (d) of the *Petroleum and Gas (Production and Safety) Act 2004* (the P&G Act).

Santos in Queensland operates over 3000 km of Polyethylene gathering networks. The gathering networks transports gas and water from well separators to gas processing facilities and water treatment plants via a networked system of flow and trunklines. Loss of containment events have safety, environmental and production consequences, with the potential to affect a significant number of wells.

Published on DNRME  
Disclosure Log Act 2009

## Audit Plan

### Scope and objectives

The scope of the audit was to assess the compliance of the internal procedures developed by Santos on management, operational and pipeline integrity. This is to meet their legislative requirements against the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry in conjunction with the P&G Act. The Code of Practice is listed in the Petroleum and Gas Regulations in schedule 1 Part 1 as a preferred standard.

The audit team reviewed and assessed the Santos Network Management System (NMS) for their operations and associated documents, including but not limited to; Safety Management Plan, Integrity Management Plan, Safety Management Study. This audit was aimed at the systems that Santos have implemented. At a later date, the details of these systems will be reviewed to determine how they have been implemented.

The audit is prepared for the Office of the Chief Inspector to demonstrate the effectiveness of the Network Management System for the operating plant and whether it is fulfilling its obligations in respect to safety management.

The Santos Gathering System was selected for an audit as part of a risk-based sample across the regulated section of the petroleum and gas industry. This is the fifth audit conducted to the APGA Code of Practice Upstream Polyethylene Gathering Networks – CSG Industry.

*The Code of Practice was prepared on behalf of the Australian Pipeline Industry Association (APIA) by members of the Association who are associated with the Coal Seam Gas (CSG) industry. Representative members of all sections of the industry were active participants, including all major CSG producing companies, Qld regulator, constructors, and manufacturers of polyethylene (PE) resin, pipelines and fittings as well as CSG engineers.*

An objective of this audit was to identify issues with the APGA Code of Practice with respect to operating company's systems. The Code of Practice is currently being revised as part of the development of version 5.

### Arrangements for the audit

This audit was initially flagged with Santos during the Stakeholder Engagement Committee with the operating plant companies on the 18<sup>th</sup> May 2017 and followed up with several email and phone conversations, to arrange the date and scope of the audit.

Marshall Holmes as Lead Auditor made contact with Santos both by telephone and email to request a copy of the current Santos plans, documents and procedures relating to their gathering systems as per the scoping document for their operations to review prior to the audit.

The audit was conducted on the 6<sup>th</sup> December 2017 by auditors from the Inspectorate, in accordance with departmental guidelines.

Specific records were requested as part of the lead up to audit. These documents included:

Folder Name/Audit Item	CoP Section	Document	Doc No.	Filename
NMS	All Sections	Santos GLNG Unstream Network Management Mapping	0007-220-SMP-0003	0007-220-SMP-0003 Rev 0.pdf
SMS	Section 2.7	Arcadia Mt Kingsley and Sunnyholt Gathering SMS	6312-050-REP-20001	5121-050-SMP-0003_E.pdf
SMS	Section 2.7	Phase 1 PE100 Gathering Network SMS	0007-050-SMP-0005	0007-050-SMP-0005 Rev0 GLUG Train 1 Gas Pipelines General & Repetitive
Basis of Design	Sections 3, 4, 5, 6, 7, 8	Santos GLNG Standardised HDPE Basis of Design	0007-150-DBM-0005	0007-150-DBM-0005.pdf
Isolation Plan	Section 4.9			
Repair Strategy	Section 11.9	Santos Specification for Onshore Pipeline Repairs	1515-120-SPC-0026	1515-120-SPC-0026.pdf
Repair Strategy	Section 11.9	HDPE Pipeline Repair By Replacement	9910-85-012	9910-85-012 HDPE Pipeline Repair by Replacement Rev 1.pdf
Measurement and Evaluation	Section 2.5	Incident Investigation and Reporting	EHSMS15	EHSMS15 Incident Investigation and Response.pdf
Measurement and Evaluation	Section 2.5	Willo Meter Investigation Report		Willo Meter investigation update final.pdf
Measurement and Evaluation	Section 2.5			
Management of Change	Section 2.2.2.5, 2.4, Section 9	SMS Production Management of Change Procedure	SMS12 ST5 PD2	SMS12_PS5_PD2_Production_Management_of_Change.pdf
Management of Change	Section 2.2.2.5	Santos Standard Waiver for Flowline Rating	1515-050-WVR-0062	1515-050-WVR-0062 Flowline Rating Approved.pdf
Management of Change/MOC (PDCR) Examples	Section 2.2.2.5	MOC-EQ-002969 Hallett Redirection Line Extension	MOC-EQ-002969	MOC-EQ-002969 (folder)
Commissioning Plan	Section 10	EHSMS 11.3		EHSMS 11.3 App. A Rev 2.2 signed.pdf
Emergency Response	Section 2.3.3	Emergency Preparedness EHSMS Standard	EHSMS13	EHSMS13 Emergency Preparedness.pdf
Emergency Response	Section 2.3.4	Santos Crisis Management Plan		Santos Crisis Management Plan.pdf
Maintenance	Section 11	Low Point Drain Monitoring Procedure	0007-220-PRO-0020	0007-220-PRO-0020.docx
Maintenance	Section 11	AVK High Point Vent Repair Procedure	0007-250-PRO-0122	0007-250-PRO-0122.docx
Maintenance	Section 11	Fairview High Point Vent Repair Procedure	1697-250-PRO-0250	1697-250-PRO-0250 Fairview Field High Point Vent Service Repair or Repla
Maintenance	Section 11	Low Point Drain Repair Procedure	1697-250-PRO-0002	1697-250-PRO-0002 Rekitting Low Point Auto Drain Components Work Inst
Community and Stakeholder Awareness	Section 2.6	SMS - Compliance		SMS - MS 4.0 COMPLIANCE Management Standard.pdf
Community and Stakeholder Awareness	Section 2.6	SMS - External Affairs	MS 6.1	SMS - MS 6.1 EXTERNAL AFFAIRS Management Standard.pdf
Pipeline Network Integrity Management	Section 11	Gathering Network IMP		SMS12_PS4_PD2_Surface_Integrity_Procedure.pdf
Pipeline Network Integrity Management	Section 2.5	GBM Portable		GBM Portable Inspections.pdf
Pipeline Network Integrity Management	Section 2.5	Bacteria Sampling		Bacteria Sampling Dashboard.pdf
Pipeline Network Integrity Management	Section 2.5	CO2 Sampling		CO2 Sampling Dashboard.pdf
Pipeline Network Integrity Management	Section 11	Temperature Remaining life review		
Pipeline Network Integrity Management	Section 11	Temperature monitoring		Gathering Network Temperature Reporting.pptx
Pipeline Network Integrity Management	Section 11	Safety Critical Maintenance Compliance		Safety Critical WO Compliance
Pipeline Network Integrity Management (Structural)	Section 4.17	Structural Integrity		6300-050-CAL-0005- Rev 0.pdf
Flow Stopping	Section 11	HDPE Squeeze-off Work Practice	0007-050-WPR-0002	0007-050-WPR-0002_0_dox
Hot Tapping	Section 11	Hot Tapping Checklist	0007-120-FIC-0089	0007-120-FIC-0089_1
Hot Tapping	Section 11	Hot Tapping Work Practice	0007-050-WPR-0001	0007-050-WPR-0001_0.pdf
Overpressure Protection and CFT	Section 4.18	PSV Test	QA-003	6311-PSV-00002 QA 003.pdf
Overpressure Protection and CFT	Section 4.18	Overpressure Protection Design Philosophy	0027-010-DPH-0002	0027-010-DPH-0002.pdf
Permit to Work, JSA, Lockout-Tagout	Section 11	Santos PTW Management Standard	SMS12 PS5 PD3	SMS12_PS5_PD3_Permit_to_Work_Procedure.pdf
Permit to Work, JSA, Lockout-Tagout	Section 11	Santos Equipment Isolation and Lockout Procedure	SMS12 PS5 PD4	SMS12_PS5_PD4_Equipment_Preparation_and_Isolation_Procedure.pdf
Permit to Work, JSA, Lockout-Tagout	Section 11			
Abandonment	Section 11	Santos Specification for Onshore Abandonment	1515-120-SPC-0100	1515-120-SPC-0100.pdf
Abandonment	Section 11	Example (Draft) Plug and Abandonment Workpack		Flowline P&A Pack - Mascotte to Caneon 1 tie in (80-RG-294-006).docx
Risk and Environmental	Section 11	Risk Management Standard		RISK Management Standard.pdf
Risk and Environmental	Section 11	Environmental Hazard Standard	EHSMS13	SMS-MS1_Risk-ST13_Environmental_Hazard_Controls_Procedure.pdf
Training	Section 11	TRACCESS Manage Wells and gathering systems	Unit 3.68	Unit 3.68_Manage wells and gathering systems RPL_EG.doc
Training	Section 11	TRACCESS Commission Wells and Gathering Systems	Unit 3.69	Unit 3.69_Commission wells and gathering systems RPL_EG.doc

Santos attendees at the audit meeting were as follows:

Name	Position	Organisation
s.73 irrelevant information	Integrity Engineer – Gathering Networks	Santos

### Audit team

The audit team consisted of DNRME P&G Inspectors having the following competencies;

- Extensive gas related activity skills.
- Extensive technical/scientific/engineering competency
- Communication and interpersonal skills.
- Analytical and reporting skills.
- Auditing Skills

Name	Position	Organisation
Derek Fagan	Senior Inspector	DNRME
Jon Mcloughlin	Senior Inspector	DNRME
Marshall Holmes	Executive Petroleum Engineer – Lead Auditor	DNRME

## Audit Findings

The findings outlined in this audit report relate to the audit against the requirements of section 675 of the *Petroleum and Gas (Production and Safety) Act 2004*.

The findings outlined in this audit report relate to the audit against the requirements of APGA Code of Practice, which is a preferred standard for pipelines as detailed in the *Petroleum and Gas (Production and Safety) Regulations 2004*.

The audit focused on management for the gathering system as well as integrity management.

The audit provided the audit team with a sound understanding of the Santos management process for their CSG gathering Systems.

Santos have been extensively involved in the development of the code of practice for the PE gathering systems to date.

## Network Management System

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 specifies the requirement to have a Network Management System. Section 2.2 of the Code of Practice (CoP) details the general contents for the system.

Extract from the Code of Practice.

*The NMS shall address the Operator's approach to the following areas –*

- a) Management;*
- b) Planning;*
- c) Implementation;*
- d) Measurement and evaluation;*
- e) Consultation, communication and reporting;*
- f) Safety Management;*
- g) Environmental Management;*
- h) Construction and Commissioning;*
- i) Site Safety.*

*The NMS shall include a description of the flowline(s) covered by the NMS including suitable maps (alignment sheets and/or GIS) showing the route of the flowline(s), the location of associated facilities such as compressor and pump stations, low point drains, high point vents and valve stations.*

*Each element of the NMS is described below and supports each other. The NMS shall comply with those requirements. Much of the responsibility for creating and implementing the NMS lies with the Operator.*

### *2.2.2.1 Management Structure*

*A defined management structure for the network shall be established to identify key positions and personnel. An appropriate management structure shall be maintained.*

### *2.2.2.2 Responsibilities, accountabilities and authorities*

*The responsibilities, accountabilities and authority levels of personnel and or contractors with respect to the various aspects of the operation and maintenance of the network shall be detailed in the NMS.*

Santos provided the audit team a copy of their Network Management Plan – Santos GLNG Upstream Management Mapping Document for Polyethylene Gathering Systems. This document is numbered 0007-220-SMP-0003 ver 0 dated 20 July 2017.

As per the title, this document is a mapping document listing key sections of the APGA CoP and referring them to the relevant sections in the Santos system.

One of the objectives for the audit was to review the requirements for the NMS in the APGA CoP.

The audit team discussed the Network Management plan in detail with Santos and relevant comments are:

- Most of the key requirements detailed in section 2.1 of the COP are included in the Santos NMS. However, the requirement to include a description of the flowlines covered by the NMS including suitable maps, locations of associated facilities is missing.
- Section 3.2 does not align with the wording in section 2.3.3 of the CoP. Santos need to review this section.

As stated above one of the objectives of the audit was to identify issues with the current wording of the APGA CoP NMS requirements and this was not meant to be a failing on Santos but on the requirements detailed in the CoP.

In the development of version 5 of the APGA CoP it is proposed that the requirements for the NMS will be reviewed and the audit team would require the assistance of Santos in the process to obtain the required wording in section 2 of the CoP.

## Safety Management Plan

Santos do not have a document that encompasses their Safety Management System – rather they have their Santos Management System that is currently undergoing a major change from their previous EHSMS.

At a later date the Santos Management System may be subject to a gathering system specific review.

## Safety Management Study

The APGA CoP requires that a Safety Management Study (SMS) be undertaken at specific phases of the gathering systems life. One of the objectives of this audit was to review the SMS's that Santos have undertaken as well as to review the requirements in the CoP with respect to the ongoing operational requirements. The audit team discussed this issue at length as Santos have undertaken over 100 SMS's for their gathering system and the intent is to gather the relevant SMS outcomes per field when these are reviewed every 5 years.

Extract from the APGA CoP:

### *Appendix A1*

*The network safety management process required by this Code of Practice is of fundamental importance to the network design, its operation and maintenance. It is the means by which network safety is demonstrated. It also forms the basis for all operations and maintenance of the network.*

*The safety management process is integrated and continuous. It requires consideration of design aspects and operating procedures in a combined, holistic way so that the network can be operated safely. Analysis is updated and refined using information as it becomes available throughout the life cycle of the network.*

*The essential outcomes of a management process are:*

*a) Assurance that the threats to the network and associated risks are identified and understood by those that are responsible for addressing the threats and risks; and*

*b) Appropriate plans are made to manage these risks.*

*The network safety management process requires the application of multiple independent controls to protect the network from each identified threat.*

*Physical (route selection, barrier or exclusion), procedural and design methods should be applied to all threats with the objective of preventing failure of the network, minimising the consequence to the public (including the Operator's personnel and Contractors) and the environment.*

#### Appendix A2.1

*Safety management studies should be undertaken at intervals during the network design and operational phases to facilitate periodic reassessment of the threats and the implementation of controls as knowledge of the threats is gained over time.*

*c) Operation: A review of the detailed safety management study that complies with this Code of Practice should be undertaken at least every five (5) years and should consider at least the following:*

- Any loss or degradation of integrity.*
- Land use change, specifically changes within the radiation contour.*
- Any change to location-specific or non-location-specific threats.*
- Construction defects or deviations from specification.*
- Testing defects and pressure test failures.*
- The previous safety management studies.*

*The review should also be completed:*

- At any review for changed operating conditions.*
- Before recommencement of operation following a flowline failure where such failure has resulted from a mechanism not previously included in preceding studies.*
- At any time when new or changed threats including land use occur.*
- At any time where there is a change of knowledge affecting the safety of the flowline or network.*
- At any review for extension of design life.*

Santos provided the audit team a copy of:

- GLNG Upstream General & Repetitive Threats for GLNG Phase 1 PE 100 Gas Gathering Network. Safety Management Study Report. Document number 0007-050-SMP-0005 dated 2/09/2014
- Arcadia – Mount Kingsley and Sunnyholt Gathering System Pre-Commissioning Safety Management Study Report. Document no 5121-050-SMP-0003 revision 0 dated 6/06/2017

Santos confirmed that they have the general threats SMS and them undertake a specific SMS for the particular section of the gathering system being constructed. The SMS was viewed by the Audit Team and no specific issues were identified.

The audit team proposed several benefits in having the Petroleum and Gas Inspectors participate in the SMS and remaining life review process so that both parties understand the threats and controls for their system.

## Management of Change

Extract from Santos GLNG Upstream Network Management Mapping Document for Polyethylene Gathering Systems, MyPlant: 0007-220-SMP-0003

### 2.2.2.5 Change Management

*The Operator shall establish procedures for managing changes to the NMS and procedures to ensure they are made in a controlled and authorised manner.*

*The change management procedures shall also ensure that any changes to the network's design or operation are managed in a controlled and authorised manner.*

*Any significant change to the network or its operating context shall be reviewed and approved. Significant change shall be considered to have taken place if the engineering design has been upgraded or modified, or if any event initiates an operational, technical or procedural change in the measures in place to:*

- a) protect the network and associated installations;*
- b) promote public awareness of the network;*
- c) operate and maintain the network safely;*
- d) respond to emergencies;*
- e) prevent and minimise product leakage;*
- f) carry out inspections; or*
- g) ensure that the plans and procedures continue to comply with the engineering design.*

*The change management procedures shall address implementation of any resulting NMS changes including notification and training of staff impacted by the change, and responsibilities for any identified actions as well as timelines for completion of those actions.*

Santos provided the auditors with a copy of ST5 – PD2 Production Management of Change (MoC), Document dated 20 July 2017, Version Number: 1.0 prior to the audit, which was viewed by the audit team.

Santos also provided an example of a completed MoC prior to the audit (EHSMS12.1 Surface Facilities – Change Management), this being;

- Plant / Data Change Review – Change Owner's Package (PDCR): 6311 Hallett Redirection Line Extension from M70 to M17

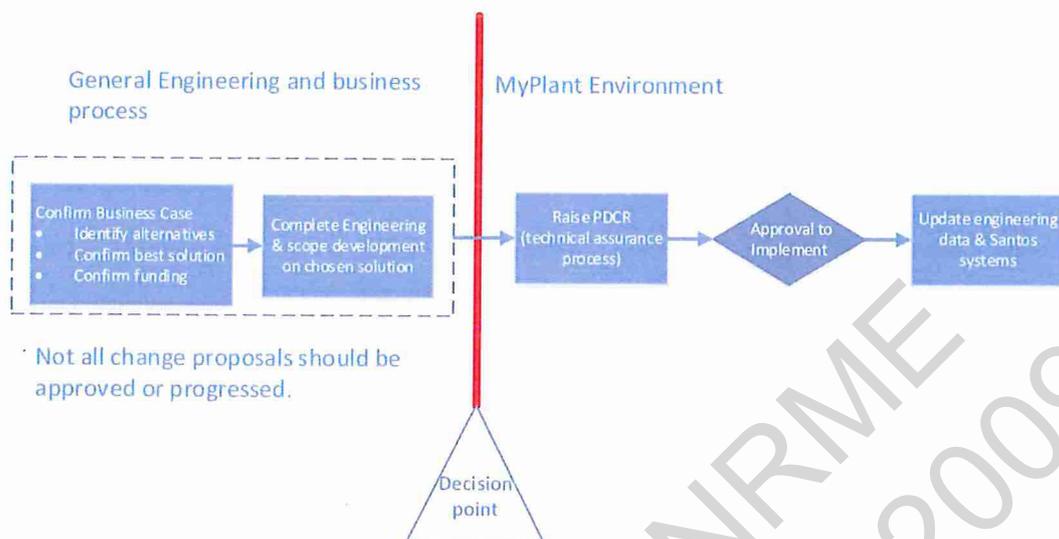
Santos has a system in place called the myPlant engineering data management system, which facilitates generation, management, storage and retrieval of operations and engineering data.

Extract from ST5-PD2 Production Management of Change;

#### 1.2.1 Plant/Data Change Review - PDCR

- *The PDCR is the standard MyPlant MoC process for changes to physical plant.*
- *The deliverables from the change and the extent of reviews are determined by Change Owner / Change Advisor.*

Image 1 – Diagram of Management of Change Business Process



The documents provided by Santos demonstrate that there is an MOC process in place. It is recommended a later date that an audit be carried-out by the Inspectorate to validate the MoC process by viewing examples directly on myPlant.

## Network Integrity Management Plan

The APGA code of practice for PE gathering systems which is a preferred code as detailed in the Petroleum and Gas Regulations in Schedule 1 states the requirement to have a Network Integrity Management Plan. Section 11.5 of the Code of Practice details the general contents for the plan.

Santos provided a copy of their Network Integrity Management Plan titled – CSG Production Systems IMP Methodology File Note. This document is numbered 5331-FN5330 R2 dated 27 November 2017

This document is comprehensive and relatively new.

Extract from the APGA Code of Practice below;

### 11.5 PIPELINE NETWORK INTEGRITY MANAGEMENT PLANS

*Structural pipeline integrity is achieved when the pipeline is leak tight, operating within the design parameters and able to safely withstand all identifiable forces to which it may be subjected during operation, including the MAOP.*

*The Operator shall establish systems and processes that ensure pipeline structural integrity for the design life of the pipeline. The Operator should be able to demonstrate that appropriate systems are established, implemented and maintained.*

*The objective of maintaining structural integrity of the pipeline is to ensure that the operation and maintenance of the pipeline will not cause injury to the public, pipeline personnel, damage to the environment or disruption of production.*

#### 11.5.1 Pipeline Network Integrity Management

*The Operator shall prepare and implement a pipeline network Integrity Management Plan (IMP) for the pipeline. The monitoring, inspection and mitigation of the identified threats shall be based upon risk-based inspection, where the frequency of monitoring, inspection, and mitigation of each threat is based upon the risk level posed by*

that threat. The adequacy of the IMP shall be reviewed at intervals not greater than 5 years, or immediately upon a pipeline failure event.

Pipeline integrity management procedures shall be maintained for each monitoring, inspection or mitigation action that ensure the PE pipeline infrastructure remains fit for purpose at all times by implementing a systematic approach to operation, maintenance, testing and inspection activities and the application of sound engineering principles with due regard to safety and the environment.

Activities may include –

- Right of way inspection;
- Gas detection surveys for gas lines;
- Critical Function Testing (CFT) of over pressure protection devices;
- Checks to ensure the average temperature is not exceeding the maximum average temperature applicable for the selected design life.

Procedures shall be developed to ensure structural integrity of the pipeline infrastructure is retained during operation and maintenance activities. The procedures shall be approved.

The Operator shall address structural integrity issues of at least the following –

- Pipeline Joints; and
- PE Material over-temperature effects.

The Operator shall continually assess and maintain the pipeline integrity by reviewing pipeline operating conditions both time-dependent and time-independent factors through integrated operation controls and maintenance activities.

The data and information identified and collected for the assessments and reviews should form the basis for ongoing assessment of the risk and integrity of the pipeline. The findings of such a program will determine actions necessary to ensure the continuous safe and reliable operation of the pipeline.

This document was reviewed and discussed in detail. Below are the main comments discussed in the audit process:

- The audit team noted that the Integrity Management Plan specifically focused on integrity issues and not all the procedures for monitoring, inspection, maintenance activities as required in the Integrity Maintenance Plan (IMP) (section 11.5.1) have been included.
- The Santos IMP details in table 5 and 6 that a ROW patrol is recommended to occur annually. ROW patrolling is a control for external interference and a frequency should be determined. This frequency may be based on a risk based process determined by location to houses, public roads, watercourses etc. and also may have a frequency depending of special events such as after major rain falls. The audit team recommended that Santos revise this section to reflect the intent of a ROW patrol and apply a suitable frequency instead of a recommendation.
- Santos demonstrated to the audit team that other integrity threats such as CO<sub>2</sub>, temperature and bacteria are being monitored at many points in the gathering systems. This aligns with the APGA CoP.
- Santos recommend that all HPVs and LPDs are inspected annually. The audit team discussed this recommendation and suggested that the wording be revised to state a frequency instead of making a recommendation. This frequency could be risk based depending on issues such as land ownership, maintenance history, location to public roads and houses etc.
- The audit team could find no reference to maintenance / inspection activities for valves on the gathering system and suggested that this activity be included in a revised version of the IMP.
- The audit team could find no reference to the operating philosophy as per section 11.5.1 from the APGA CoP detailed below:

*The Plan shall also detail the operating philosophy including design parameters of the pipeline, specifying operational limits, including the MAOP, temperature limits and design life.*

- Santos detailed that one of their significant integrity issues for the PE gathering systems relates to the metallic risers at Wells, HPVs, and LPDs etc. Santos has mitigated this to a degree by installing sacrificial anodes on many steel risers and manufacturing other risers from stainless steel. An outcome of this will be included in the next version of the APGA CoP to review the issue of PE risers in specific locations.
- The audit team could find no reference to how they assess joint structural integrity as required in section 11.5.1 of the CoP. This issue was discussed in detail in the audit and Santos need to revise their Plan to reflect what they undertake in this area to assess their joint structural integrity.

Santos provided the audit team a copy of their HDPE Squeeze-Off Work Practice 0007-050-WPR-0002 rev 0 dated 17/5/17. This document was very comprehensive and also aligns with the APGA CoP for this activity.

## Emergency Management

Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) Emergency Plans

APGA PE Code of Practice-Version 4.0 Section 11 Operations

11.2.2 CSG field emergency response plan

11.2.2.1 Emergency planning and preparation

11.2.2.2 Emergency response and recovery

For the purpose of this part of the audit Santos has supplied:-

- Santos Crisis Management Plan (SCMP) rev 1 Approved 4/06/2014
- EHSMS13 Emergency Preparedness (Management Standard) Rev 5 Approved 31/03/2015
- ST1-Emergency and Crisis Management Procedure Version 1 Approved 30 November 2017
- Bushfire Management Plan Document 0007-210-ERP-0006 Rev 2 issued 25/11/2017
- GLNG USO Emergency Response Plan Doc 0007-210-ERP-0008-Rev 5 Approved May 2015
- GLNG Upstream Emergency Response Plan Doc EQ ERP rev 6 July 2011
- GLNG USO Training and Exercise Calendar 2017

### Auditor findings/comments

All documents supplied indicate that the requirements of APGA PE Code of Practice-version 4 Section 11.2.1 CSG field emergency response plan (a) through to (d) and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (I) are complied with.

The emergency response plans and systems are very comprehensive and easy to read but can be difficult to navigate and even identify if still in use. It appears to Auditors that GLNG USO Emergency

Response Plan Doc 0007-210-ERP-0008-Rev 5 Approved May 2015 and GLNG Upstream Emergency Response Plan Doc EQ ERP rev 6 July 2011 may not be in use?

GLNG Upstream Emergency Response Plan Doc EQ ERP rev 6 July 2011, revision index states there is a revision ".7 May 2012" but actual document is revision 6.

Santos Crisis Management Plan (SCMP) rev 1 Approved 4/06/2014 in section 3.5 "Reviewing" states a review of the Santos Crisis Managements Plan will occur biannually as a minimum. Is the document supplied to audit team appears three years out of date.

## Training and Competency

Petroleum and Gas (Production and Safety) Act 2004 Section 675 (1) (h) training and supervision program.

APGA PE Code of Practice-version 4.0 section 2.2 Network management system elements

### 2.2.2.3 Training and Competency

For the purpose of this part of the audit, Santos has supplied-:

- GLNG Organising Training and Competency Strategy Doc 3301-GLNG-3-7.1-0005-DOC 5/08/2010 Rev 0
- Production Operations Training Strategy Doc 0007-220-STR-0001 Rev 0
- Competency and Training Procedure SMS-MS14 People-ST9 15 September 2017 Version 1
- Santos GLNG Upstream Network Management Mapping Document for Polyethylene Gathering Systems Doc 0007-220-SMP-0003 Version 1 approved 20 July 2017

### Auditor findings/comments

Documents and evidence provided to auditors indicate that the requirements of APGA PE Code of Practice- version 4 Section 2.2.2.3 Training and Competency and Petroleum and Gas (Production and Safety) Act 2004 Section 675(1) (g) appear to be complied with.

Organisation Training and Competency Strategy Document 3301-GLNG-3-7.1-0005-DOC is a comprehensive document, which encompasses the entire training and competency plan for the organisation and applies to all employees and contractors. The document however has not had any periodical reviews as stated in section 1.2 Scope. The document provided for the Audit is version 0 dated 05/08/2010.

A number of employee training needs analysis/matrix examples and employee training records systems were shown to auditors. Individual employee pathway to competency framework diagrams were also provided.

Production Operations Training Strategy Doc 0007-220-STR-0001 Rev 0 provided to auditors is not endorsed or signed.

Auditors were unable to identify the relationship between the "Santos Reference numbers" in Santos GLNG Upstream Network Management Mapping Document for Polyethylene Gathering Systems Doc 0007-220-SMP-0003 and documents provided to the Department for the purpose of the audit.

## Permit to Work

The Code of Practice in section 2.10 details the requirement for Site Safety for the gathering system.

Extract from the Code of Practice

### 2.10 SITE SAFETY

*The safety of the public and maintenance personnel, repair personnel, the integrity of equipment and the pipeline network shall not be compromised.*

*Control processes shall be established for all personnel to ensure that risks are kept to as low as reasonably practicable (ALARP) and, where necessary, risk mitigation measures are implemented.*

*A permit to work process shall be required for site works involving high levels of risk, when working with any pipeline or its facilities, to ensure that high levels of OHS&E are maintained.*

*As a key requirement of the system, a job safety analysis (JSA) shall be carried out to ensure that all on site OHS&E hazards are identified and addressed prior to work commencing.*

*A permit to work should always be issued for –*

- *Work in pipe trenches;*
- *Pressure testing;*
- *Commissioning;*
- *Work on existing operating network including tie-ins;*
- *All other high risk tasks.*

Santos provided the auditors with a copy of the Santos Work Permit Procedure (SWPP), Revision 0, Revision Date 13/01/2017

The audit team requested to view an example of a completed Permit to Work form. Santos provided a copy of the following;

- Santos Hot Work Permit Number 0006850 for Hot Tap 630 RG and 400 AW Golden Butt Welds for Tie In.

Santos also provided the following documentation associated with Hot Work Permit Number 0006850;

- Santos GLNG Standardised Field HDPE, HDPE Hot Tapping Work Practice, Document Number: 0007-050-WPR-0001
- Roma Recovery Hot Tap and Squeeze Off Workpack ID No. 0007-120-FIC-0088 for Sub Branch 6 (Gas)
- Roma Recovery Hot Tap and Squeeze Off Workpack ID No. 0007-120-FIC-0088 for Sub Branch 6 (Water)

The PTW Procedure that was provided to the auditors is comprehensive. The following observations were made in regard to Hot Work;

- Limited information regarding Gas Detection
- Limited information regarding process or recording of gas test results.

Observations made regarding Hot Work Permit Number 0006850 and Roma Recovery Hot Tap and Squeeze Off Workpack ID No. 0007-120-FIC-0088 for Sub Branch 6 (Gas and Water);

- Limited space provide on Hot Work Permit to record associated documents. No Reference has been made to ID/Document Numbers for associated documents listed
- No facility on Hot Work Permit for recording of gas test results
- The Hot Work Permit identifies that the Pre start gas test completed and satisfactory and additional continuous gas monitoring was in place. The recording of gas test results has been recorded as No
- Inconsistency of Initials within "Work Precautions Must Be In Place Prior To Work Commencing". Permit Authority – Copy 1 has One precaution Initialled while Permit Holder – Copy 3 has Six Initials. Precautions selected as not being required have not been Initialled
- Section 08, Site Evaluation, Excavation and Setup of Roma Recovery Hot Tap and Squeeze Off Workpack ID No. 0007-120-FIC-0088 for Sub Branch 6 (Gas and Water) requests Obtain Excavation Permit and record Excavation Work Permit no. The section has been initialled but no permit number recorded or explanation give.

### Job Hazard Analysis

The Santos GLNG Upstream Network Management Mapping Document for Polyethylene Gathering Systems, (MyPlant: 0007-220-SMP-0003), Section 1.9 Site Safety identifies from the following;

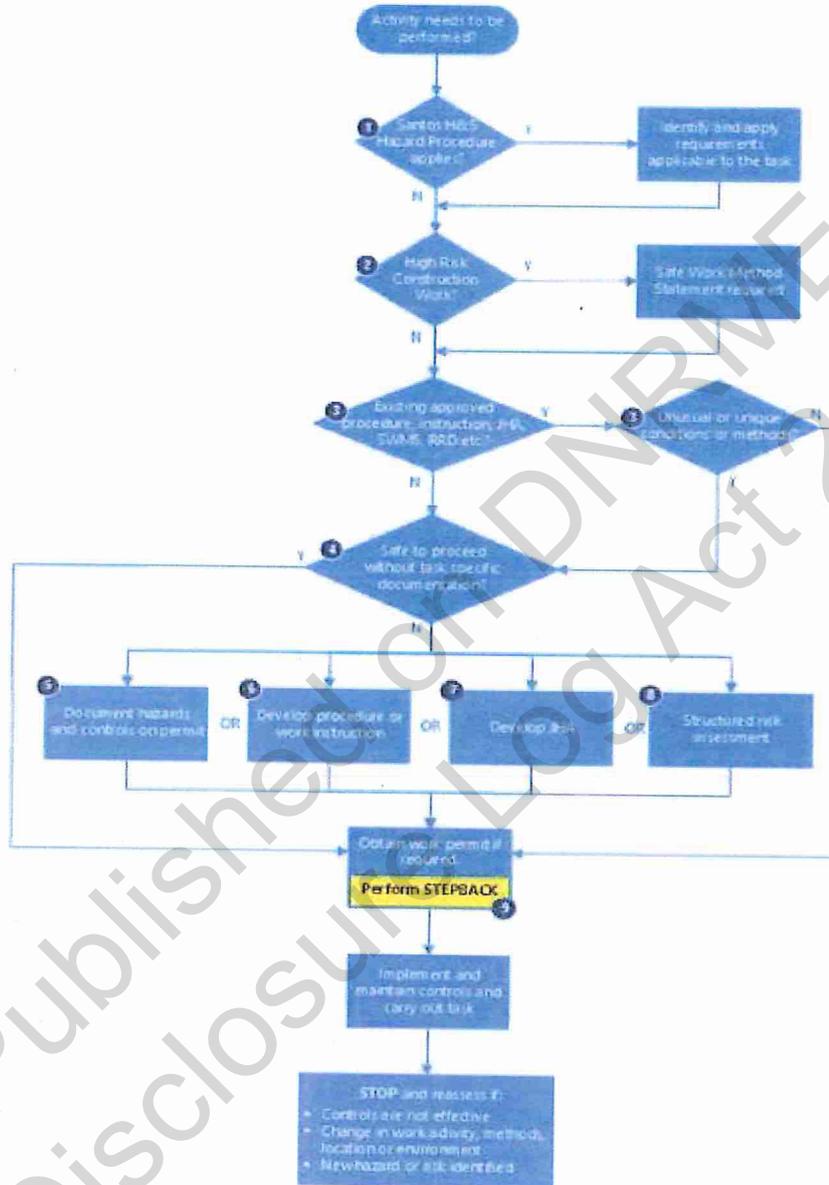
*As a key requirement of the system, a job safety analysis (JSA) shall be carried out to ensure that all on site WHS&E hazards are identified and addressed prior to work commencing.*

Santos Reference is SMS-Risk and the Description being Work Activity Risk Management

Santos provided the audit team with a copy of ST3-Work Activity Risk Management Procedure, Version 1.0, dated 30 May 2017, which was later viewed by the auditors. Appendix A outlines a Work Activity Risk Management Tools Flowchart.

Image 2 – Activity Risk Management Tools Flowchart

Appendix A Work Activity Risk Management Tools Flowchart



Flowchart Guidance Notes in relation to point 3 states;

*Existing approved procedure, instruction, JHA, SWMS, Regulated Routine Duty (RRD) etc. for the specific task to be performed. Prior to using check:*

- *It's current, approved and valid for the task to be performed*
- *It contains precautions and controls to conduct the task safely*
- *If there are any unusual or unique site conditions or work methods required that aren't addressed*

*If deficiencies or gaps are identified, the document needs to be updated, supplemented or a new one developed.*

The audit team requested to view an example of a completed JHA which was later provided to the audit team by email. The following copy of JHA was provided;

- MPC Group Job Hazard Analysis (JHA) Number 31464 which was identified as being for Project: Roma 3A, for task Hot Tap & Bucket Pump dated 28/08/17 to 04/08/2017

The MPC JHA Document Number: 31464 was viewed by the auditors and the following observations were made;

- Inconsistency with the "start and to" dates. Dates identified on the JHA are 28/08/17 to 04/08/2017
- Permit Required selected as Yes, but Permit Number has not been recorded

## Lockout / Tag Out

Santos provided a copy of the Santos Equipment Isolation & Lock out Procedure, Revision 0, and dated 13/01/2017 to the auditors prior to the audit. The auditors viewed the procedure which was identified as being comprehensive.

The audit team also requested to view an example of a documented completed Isolation. At the time of writing the audit report, the documentation had not been received.

It is recommended a later date that an audit be carried-out by the Inspectorate to validate the Santos Equipment Isolation & Lock Out Procedure.

### Non-compliance

- N/A

### Opportunity for improvement

PTW Procedure:

- Consider including information regarding Gas Detection
- Consider including information regarding process or recording of gas test results.

PTW Examples:

- Observations regarding PTW examples have been provided above. Santos to address issues identified in the observations if considered necessary.

JHA:

- Santos to ensure dates on contractor JHA's are checked and accurate
- Complete all required fields, e.g. Associated Permit No.

## Legislative Non-compliance

The audit team did not identify significant legislative non-compliances during this audit.

However, a number of technical non-compliances were identified. These non-compliances may be best resolved with a revision to the APGA CoP.

## Opportunity for improvement

There were a number of opportunities for improvement that were discussed with Santos representatives on 6 December, relating to their Gathering System. These are detailed in the above sections and it is recommended that Santos review these comments and make any relevant actions to their gathering system plans and procedures, systems and relative documents.

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## Conclusion

Santos is requested to provide the Petroleum and Gas Inspectorate with a detailed action plan for the timely completion of the identified issues. The action plan needs to include time frames and state the actions to be taken to rectify any identified issues.

If Santos has any evidence that any of the identified issues are compliant then this evidence needs to be provided along with the action plan.

It is expected that the action plan is provided to the Inspectorate within 20 Business days from the date of the report and that the rectification of the issues would be fully complete within twelve months.

Please forward the action plan and the requested documentation to:

Marshall Holmes

Executive Petroleum Engineer - Petroleum and Gas  
Department of Natural Resources and Mines

Email: [marshall.holmes@dnrm.qld.gov.au](mailto:marshall.holmes@dnrm.qld.gov.au)

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## Appendix A

Audit report distribution list:

Name	Position	Organisation	Format
.73 irrelevant informatio	Manager Health and Safety Upstream	Santos	Electronic copy

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