



Resources Safety & Health
Queensland

Hydrogen Safety Code of Practice

Petroleum and Gas Inspectorate

May 2022 | CONSULTATION DRAFT

Consultation Draft

Resources Safety and Health Queensland is publishing this draft Code of Practice for the purposes of;

1. providing a consolidated framework for current fuel gas requirements that apply to hydrogen applications and
2. consulting on policy proposals for improving regulatory provisions.

Following consultation the policy approach will be finalised and any relevant legislative amendments will be progressed, subject to Government processes and approval.

The policy proposals are not underpinned by legislation. Current legislation requirements continue to apply until further notice. The proposals are highlighted throughout the document in text boxes and collated in Appendix 7.

If you are undertaking a project that cannot comply with current legislative requirements, please contact the Petroleum and Gas Inspectorate at: hydrogensafety@rshq.qld.gov.au

Example of intext policy proposals

Throughout this document text boxes like the one below identify an issue with current requirements and outline the proposed policy approach.

Issue with current legislation

Throughout this document text boxes like this identify an issue with current requirements.

Policy Proposal

Throughout this document text boxes like this outline the proposed policy approach.

REFER TO [Appendix 7](#) TO REVIEW ALL POLICY PROPOSALS

Overview

The Queensland Government is committed to developing an effective, risk-based safety regulation that will support a sustainable and safe Queensland hydrogen industry. A safety code of practice is a tool that can inform industry specific stakeholders about safety requirements and approvals.

In Queensland, the safety of fuel gases, including hydrogen, is regulated under the [Petroleum and Gas \(Production and Safety\) Act 2004 \(P&G Act\)](#) which is administered by the Petroleum and Gas Inspectorate of Resources Safety and Health Queensland (RSHQ).

The existing Petroleum and Gas safety legislation is generally effective for most activities relevant to hydrogen fuel gas applications. RSHQ has been engaging with industry and government stakeholders about hydrogen since 2019. Further information on the stakeholder engagement process is provided [here](#). Industry stakeholders have identified some obligations do not support operational needs for the emerging hydrogen industry.

The consultation draft of the *Hydrogen Safety Code of Practice* (the Code) has been prepared to inform industry of current approval pathways and safety requirements for hydrogen when used as a fuel and to consult industry about policy proposals to improve regulatory effectiveness.

The Code has been developed in consultation with industry and government stakeholders and is a first step for hydrogen fuel gas proponents in understanding safety and other approval requirements. Sections 1-7 of the Code, read in conjunction with the provisions of the P&G safety legislation, set out current and proposed minimum compliance requirements for hydrogen activities. Appendices 1-6 include information about approvals, case studies and other resources. Policy proposals for improving legislative provisions are set out in text boxes and collated in [Appendix 7](#).

The policy proposals aim to support hydrogen operations while ensuring safety outcomes are achieved. Feedback about the proposals can be made [here](#) by **24 June 2022** and responses will inform a final policy approach. Government approval for related legislative amendments will be sought prior to the Code being finalised.

After the Code is finalised, it will be routinely revised as new standards, competencies and applications are developed. The Code aims to provide certainty about legislative requirements for hydrogen as a fuel gas, and guidance about how to comply with these requirements.

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Acronyms and terms

Table 1 describes the meaning of terms and acronyms used in this document. For terms defined in legislation (see Legislative Reference column), the description in Table 1 may be simplified. The P&G Act, P&G Safety Reg and GP Regulation can be referenced for the full definition.

Table 1 Acronyms and terms.

Acronym / Term	Description	Legislative Reference
Acceptable level	The level of risk for the activities is within acceptable safety limits, having regard to each relevant safety requirement, and is as low as is reasonably practicable (ALARP).	P&G Act s700 (1)
AS/NZS 2885 series	The Australian Standard series for Gas and Liquid Petroleum Pipelines.	-
AS/NZS 4645 series	The Australian Standard series for Gas Distribution Networks.	-
Appropriately authorised person	A person holding a GWL or GWA with approval to work with hydrogen.	-
Code	the draft Hydrogen Safety Code of Practice (this document).	-
Fuel cell gas device	A device that uses the chemical energy of fuel gas (hydrogen) to produce electricity. <ul style="list-style-type: none"> • Mobile fuel cells refer to fuel cells used in vehicles and vessels. • Stationary fuel cells refer to fixed applications for power generation and include portable units. 	-
Fuel cell gas system*	Fuel cell gas systems are type B gas devices that include a fuel cell and any of the following: <ul style="list-style-type: none"> • electrolyser/hydrogen production unit • containers • pipes • fittings • flues, and/or • instruments. 	-
Fuel gas	A substance including hydrogen, when used or intended to be used as fuel.	GP Regulation s6 (a)
FGDN	<i>Fuel Gas Delivery Network.</i> Examples of fuel gas delivery networks: <ul style="list-style-type: none"> • the delivery of cylinders of fuel gas to a consumer or to a distributor • the filling and storing of cylinders of fuel gas • the bulk delivery of fuel gas to a container • the filling of a tanker for delivery of fuel gas • the maintenance of containers and storage equipment used for the supply of fuel gas 	P&G Act Sch.2

Acronym / Term	Description	Legislative Reference
	<ul style="list-style-type: none"> the dispensing of fuel gas to vehicles. 	
Fuel gas network	A distribution system, including meters and meter regulators whether or not the meters or meter regulators are owned by the operator of the distribution system.	P&G Safety Reg Sch.7
GCC	A <i>gas compliance certificate</i> certifies the installation of a gas system meets required standards. It is commonly referred to as a Gas System Compliance Certificate. Access here Gas Compliance Certificate	P&G Safety Reg Sch.7
Gas Device	In general, a gas device is a device used or designed or intended for producing heat, light or power using fuel gas can is either a type A or type B gas device.	P&G Act s724
GDA	A <i>gas device approval authority</i> is granted by the Chief Inspector and authorises the holder to undertake gas device approval work.	P&G s731AA
Gas Fuel System*	<p>Current definition: A gas system that supplies gas as a fuel to an engine.</p> <p><i>Proposed definition: A gas system that supplies gas as a fuel to an engine or mobile fuel cell</i></p>	P&G Safety Reg Sch.7
Gas Work	The work of installing, removing, altering, repairing, servicing, testing or certifying a gas system.	P&G Act s725
GWA	A <i>gas work authorisation</i> is granted by the Chief Inspector and authorises the holder, or an individual working under the holder's authority, to undertake gas work in relation to a gas device type B.	P&G Act s727
GWL	A <i>gas work licence</i> is granted by the Chief Inspector and authorises the holder to undertake gas work in relation to a gas device type A or a fuel gas refrigeration device.	P&G Act s726
Gas related device	<p>Means any of the following:</p> <ul style="list-style-type: none"> a gas device a gas fitting a gas system a container of fuel gas a device used to transfer fuel gas from one container to another 	P&G Act Sch.2
GP Regulation	Petroleum and Gas (General Provisions) Regulation 2017.	-
Inspector	A public service officer appointed as an Inspector, Petroleum and Gas under s735(1)(c) of the P&G Act.	P&G Act s735
LEL	The <i>lower explosive limit</i> is the low end of the concentration range over which a flammable mixture of gas or vapour in air can be ignited at a given temperature and pressure.	-
Operating plant	<p>A legislative label for petroleum and fuel gas activities and facilities that are regulated under the P& G Act which includes a requirement for a Safety Management System.</p> <p>For hydrogen, operating plant include:</p> <ul style="list-style-type: none"> Dispensing of hydrogen to a vehicle Hydrogen transported via fuel gas delivery networks 	P&G Act s670

Acronym / Term	Description	Legislative Reference
	<ul style="list-style-type: none"> Hydrogen transported via distribution systems and pipelines. 	
P&G Act	Petroleum and Gas (Production and Safety) Act 2004	-
P&G safety legislation	The following instruments: <ul style="list-style-type: none"> the <i>Petroleum and Gas (Production and Safety) Act 2004</i> (P&G Act), and the Petroleum and Gas (Safety) Regulation 2018 (P&G Safety Reg). 	-
P&G Safety Reg	Petroleum and Gas (Safety) Regulation 2018	-
RPEQ	A <i>Registered Professional Engineer of Queensland</i> , is an engineer that has been formally recognised as meeting qualification and competency requirements defined in Queensland's <i>Professional Engineers Act (2002)</i> .	-
Reference standard*	<i>A standard that can be used as a reference when designing a hydrogen device or system. Compliance with a reference standard will generally be accepted as meeting the safety outcome for the component to which the standard applies.</i>	-
Safety Outcomes	Fuel gas is used safely, and its use will not cause harm to persons, domestic animals or property. Note, the PG Safety Reg currently defines these as safety outcomes for the design of a gas device.	P&G Safety Reg s138E(3)
SMS	A <i>safety management system</i> is a comprehensive and integrated system for managing health and safety risks. The P&G Act requires a safety management system for operating plant and sets out the matters which must be included.	P&G Act s674, s675
type A	A gas device type listed in the P&G Safety Reg s12 and Sch.1 that uses fuel gas for the purposes mentioned in the P&G Act s724(2) NOTE: the purposes mentioned in the P&G Act s724(2) are: for production of heat, light or power; or for refrigeration for which fuel gas is the fuel; or as a propellant.	P&G Act s724 (1) P&G Safety Reg s12
type B	A gas device that uses fuel gas for the purposes mentioned in the P&G Act s724(2) and that is not listed in s12 or Sch.1 of the P&G Safety Reg	P&G Act s724 (3)
WHS Act	Work Health and Safety Act 2011	-
WHS Regulation	Work Health and Safety Regulation 2011	-

* New and Updated Terms

Fuel cell gas system and *Reference standards* are new terms to enable effective regulation

Issue with current legislative requirements

Fuel cell electric vehicles currently meet the definition of “Other Gas systems in a vehicle or vessel” (P&G Safety Reg Chapter 6, Part 3, Div 3). Requirements for these gas systems typically apply to gas systems installed in caravans and boats for non-propulsive purposes. They are not suitable for fuel cell electric vehicles.

Gas fuel systems are defined as “A gas system that supplies gas as a fuel to an engine”.

Policy Proposal

It is proposed to amend the definition of a **gas fuel system** to include fuel gas supplied to a mobile fuel cell.

REFER TO [Appendix 7](#) OF THE CODE TO REVIEW ALL POLICY PROPOSALS

1 Introduction

The [Queensland Hydrogen Industry Strategy 2019-2024](#) identifies five key areas of focus, including, an effective policy framework. The Code consolidates legislative requirements under the P&G safety legislation that apply to hydrogen when used or intended to be used as a fuel gas. While existing legislation generally are effective for hydrogen fuel gas operations, stakeholder engagement has identified some obligations do not support operational needs for hydrogen fuel gas applications.

2 Objective

The objectives of this Code are to:

1. identify activities and facilities regulated by the P&G safety legislation that apply when hydrogen is used or intended to be used as a fuel gas
2. provide guidance on how to comply with the P&G safety legislation requirements, and
3. outline policy proposals for alternate means of achieving safe outcomes where current requirements are not effective.

3 Scope and application

Figure 1 summarises the scope of hydrogen activities and facilities that are operating plant, gas devices, and gas systems subject to the P&G safety legislation and those that are outside of the scope and application of the Code.

Hydrogen facilities and activities not regulated by the P&G safety legislation include:

- a) Aviation and space gas systems aviation and space regulated by the Civil Aviation Safety Authority (CASA).
- b) Marine applications regulated by the Australian Maritime Safety Authority (AMSA).
- c) Vehicle applications where hydrogen is being used as a fuel enhancer at levels below LEL of hydrogen (i.e., 4% by volume in air), and where the vehicle does not require hydrogen to operate.
- d) Applications where hydrogen is not used, or not intended to be used, as a fuel gas, including other substances used as hydrogen carriers (e.g., ammonia).
- e) Production of hydrogen except in fuel cell gas systems.
- f) Storage of hydrogen at sites determined to be [Major Hazard Facilities](#).

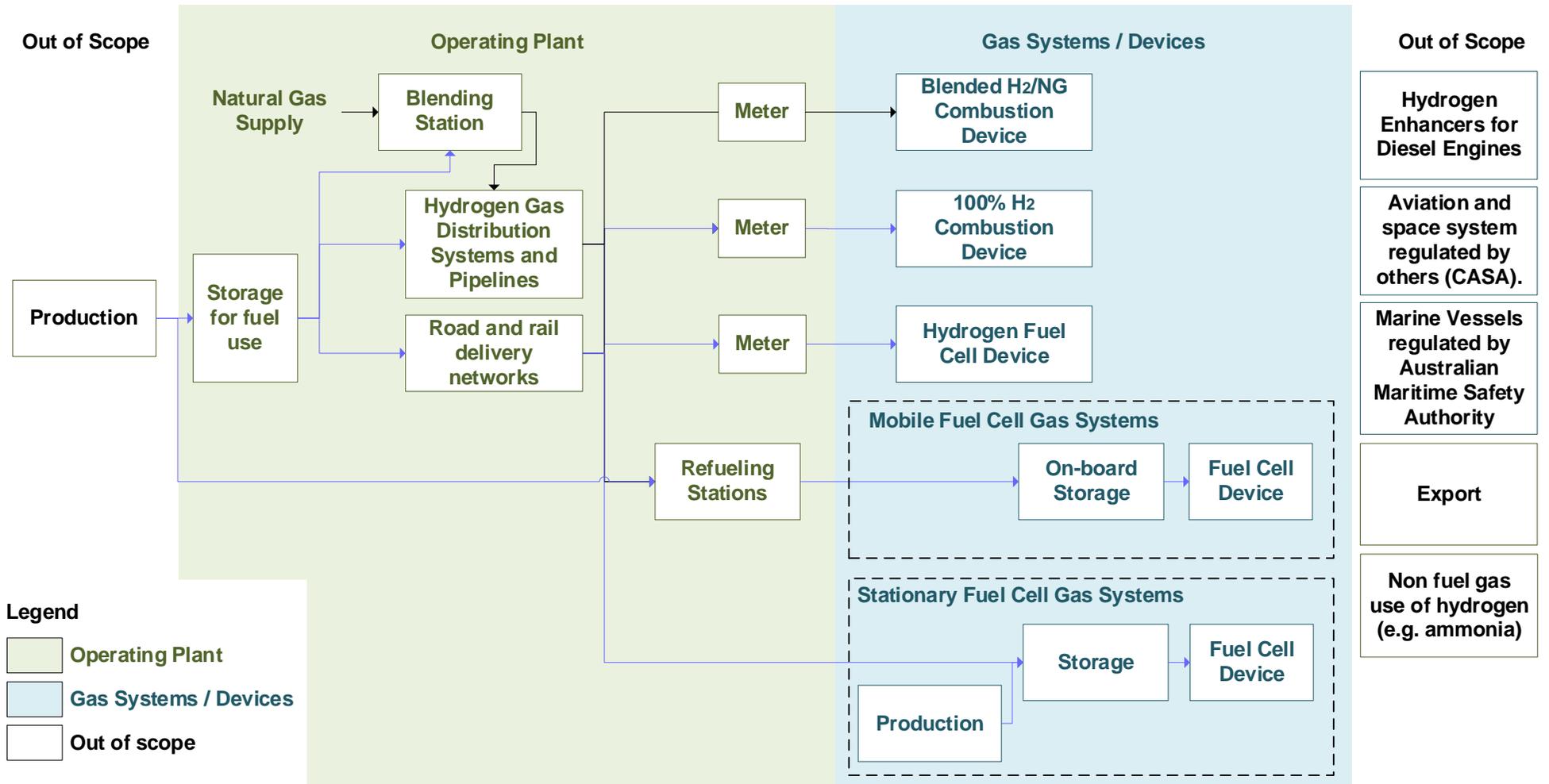


Figure 1 Scope of common operating plant and gas devices related to hydrogen.

4 How the Code works with legislation

4.1 P&G safety legislation

The P&G Act s3(1) prescribes as the main purpose of the P&G Act:

“to facilitate and regulate the carrying out of responsible petroleum activities and the development of a safe, efficient and viable petroleum and fuel gas industry.”

The Code has been developed to provide a consolidated document of requirements of the P&G safety legislation that apply to applications using hydrogen as a fuel gas. Section 5-7 of the Code, read in conjunction with the provisions of the P&G safety legislation, set out current and proposed minimum compliance requirements for activities and facilities that use, or intend to use, hydrogen as a fuel gas.

Where there is a conflict between the Code and the requirements or other relevant provisions in the P&G Act, the P&G Safety Reg or the GP Regulation, the provisions of the P&G Act, P&G Safety Reg or GP Regulation prevail.

4.2 Other relevant legislation

Other legislative instruments and frameworks also apply to the safety of hydrogen related activities. [Appendix 1](#) references relevant statutory bodies and [Appendix 2](#) outlines key elements of legislative frameworks for work health and safety, electrical safety, national heavy vehicles and professional engineer requirement.

5 Operating Plant

Section 5 of the Code describes hydrogen activities that are operating plant and their obligations under the P&G safety legislation. It also lists the specific safety requirements prescribed for distribution systems, pipelines and fuel gas delivery networks.

5.1 Hydrogen activities / facilities that are operating plant

Operating plant is defined in s670 of the P&G Act and includes fuel gas facilities, plant and activities. Table 2 summarises types of fuel gas operating plant that are relevant to hydrogen.

Table 2 Fuel gas operating plant relevant to hydrogen.

Operating plant type	Examples of hydrogen operating plant	Legislative Reference
Distribution pipeline	A pipeline that transports hydrogen as part of a gas reticulation system from a gate station to the reticulation system, or as a single 'point to point' pipeline to a specific commercial or industrial facility direct from a well or processing plant to an industrial facility, for use as a fuel source.	P&G Act s670(2)(e) P&G Act s16A
Distribution System	Distribution system - a system of distribution pipelines, meters and other equipment used in the supply of fuel gas, including hydrogen, to more than 1 consumer within a fuel gas market. A distribution system may convey pure hydrogen or hydrogen blended with another fuel gas.	P&G Act s670(2)(f) P&G Act Sch.2
Fuel gas delivery network (FGDN)	Hydrogen dispensing at a refuelling fuel station. This could include dispensers, tanks, vessels, containers, piping, compressors, pumps and electrolyzers.	P&G Act s670(5)(a) P&G Act Sch.2 P&G Safety Reg s11(1)(d)
Fuel gas delivery network (FGDN)	A fuel gas delivery network that transports hydrogen in containers, cylinders or tanks, includes: a) Delivery by tube-trailer or tanker of hydrogen in bulk to fuel gas consumer or fuel gas supplier b) The bulk delivery of hydrogen to a container.	P&G Act s670(5)(a) P&G Act Sch.2 P&G Safety Reg s11(1)
Prescribed activities – gas utilisation	Activities prescribed in the P&G Safety Reg: a) Use of gas devices with 50GJ/h or more gas capacity b) Using fuel gas to produce theatrical or other special effects.	P&G Act s670(5)(d) P&G Safety Reg s11(2)(a) s11(2)(b)

5.2 Obligations for operating plant

Chapter 9, Part 1 of the P&G Act specifies safety obligations for petroleum and gas operating plant so that risk is managed to an acceptable level. These obligations include responsibilities of key persons.

Section 699 of the P&G Act states an operator of operating plant has an obligation for risk to person or property to be at an acceptable level. Section 700 of the P&G Act defines acceptable level of risk.

Under the P&G safety legislation the primary method for managing risk at operating plant is through implementation of a SMS. Section 674 of the P&G Act requires an operator to make, implement and maintain a SMS as part of the overall obligation to reduce risk to an acceptable

level.

For smaller, FGDNs, s18 of the P&G Safety Reg specifies a generic SMS may be applied to operating plant if the combined water capacity of fuel gas containers in the network is not more than 5,000 L. A generic SMS is defined in s675A(3) of the P&G Act.

Key obligations required for operating plant in the P&G Act are listed in Table 3. This should be read in conjunction with the relevant legislative sections and information at the [Petroleum and Gas Inspectorate website](#) and the web pages specified in Table 3.

Table 3 Operating plant obligations.

Operating plant obligations	P&G Act Reference
<p>STATUTORY POSITION HOLDERS</p> <ul style="list-style-type: none"> • Operator / operator’s representative if operator is a corporation • Executive Safety Manager (ESM) • Site Safety Manager • Notification requirements • ESM general obligation <p>For more information, access: Safety & health notices for petroleum & gas</p>	<p>s673</p> <p>s687</p> <p>s692</p> <p>s694A</p> <p>s688</p>
<p>SAFETY MANAGEMENT SYSTEM</p> <ul style="list-style-type: none"> • Operator must ensure SMS is made or adopted • Content requirements (NOTE: If an existing SMS meets these requirements, a new SMS is not needed) • Operator to must take reasonable steps to ensure SMS obligation holders comply with their obligations • A person at an operating plant must take all reasonable steps to comply with SMS obligations. 	<p>s674</p> <p>s675</p> <p>s677</p> <p>s702</p>
<p>PLANT & EQUIPMENT</p> <ul style="list-style-type: none"> • Designers, importers, manufacturers and suppliers of plant and equipment for use at operating plant must take reasonable steps to ensure the plant or equipment complies with any relevant safety requirement • Installers must ensure plant and equipment they install at operating plant complies with all relevant safety requirements. 	<p>s696</p> <p>s697</p>
<p>RISK MANAGEMENT</p> <ul style="list-style-type: none"> • Risk to be kept to acceptable level by person with obligation under 	<p>s699</p>

Operating plant obligations	P&G Act Reference
Act or SMS <ul style="list-style-type: none"> • Acceptable level of risk • Achieving acceptable level of risk • The SMS is to include a formal risk assessment consisting of the systematic assessment of risk and a description of technical and other measures to control the identified risk. 	s700 s701 s675(e)
COMMISSIONING / DECOMMISSIONING <ul style="list-style-type: none"> • The chief inspector is given notice at least 20 business days before a plant is commissioned / decommissioned. For more information, access: Safety & health notices for petroleum & gas	s694A

WHS Act requirements (refer to [Appendix 2](#)) also apply to the hydrogen related operating plant. Safety matters can be addressed under one SMS to avoid duplication.

5.3 Safety requirements for gas distribution systems and pipelines

5.3.1 Gas distribution systems

Section 81 of the P&G Safety Reg requires the operator of a gas distribution system to ensure the design, construction, operation, maintenance and abandonment of a gas distribution system complies with the AS/NZS 4645 series. The AS/NZS 4645 series currently excludes mixtures of gases with a hydrogen content in excess of 15% by volume [AS/NZS 4645.1-2018 1.2 (d)].

5.3.2 Pipelines

Section 67(2) of the P&G Safety Reg specifies that an operator of the pipeline must ensure the design, construction, operation, maintenance and abandonment of the pipeline comply with one of the listed standards. Standards relevant for hydrogen in pipelines will be the AS/NZS 4645 series or the AS/NZS 2885 series.

Additional guidance about pipeline general safety considerations, including those that are not distribution systems, can be found in Appendix 5.

Issue with current legislative requirements

Hydrogen gas distribution systems are not accommodated by the current mandatory standard, AS/NZS 4645, which provides for gas with a hydrogen content up to 15% by volume.

Policy Proposal

Where the hydrogen component of fuel gas is outside the scope of AS/NZS 4645, an **alternative method of compliance** is proposed.

Alternative method of compliance

Section 675(1)(e) of the P&G Act provides for the SMS of an operating plant to have formal safety assessment. It is proposed that the chief inspector is notified of the formal safety assessment prior to supply commencing. Section 699 of the P&G Act would also apply requiring obligation holders to ensure risks are managed to an acceptable level. This includes ensuring quality is maintained within agreed limits.

REFER TO [Appendix 7](#) TO REVIEW ALL POLICY PROPOSALS

5.4 Safety requirements for fuel gas delivery networks

Fuel gas delivery network are operating plant when one of the criteria in the P&G Safety Reg s11(1) are satisfied. Under current provisions some fuel gas delivery networks are not operating plant if the network does not meet criteria outlined in the P&G Safety Reg s11(1).

Issue with current legislative requirements

Hydrogen applications are emerging rapidly and collaborative relationships with all hydrogen fuel gas delivery network operators is important to support safe development of the industry.

Policy Proposal

All hydrogen fuel gas delivery networks be prescribed as operating plant.

REFER TO [Appendix 7](#) TO REVIEW ALL POLICY PROPOSALS

6 Gas devices, gas systems and gas work

Section 6 of the Code describes hydrogen activities that are regulated by provisions of the P&G safety legislation for gas devices, gas systems and gas work. This part of the Code also describes the following requirements and provides guidance on how to comply with them:

- approval of gas devices
- installation and certification of gas systems
- holding a Gas Device Approval Authority (GDAA)
- obtaining a Gas Work License (GWL) and Gas Work Authorisation (GWA)
- conducting gas work on a gas system
- periodic inspections, and
- workshop requirements.

6.1 Gas devices that use hydrogen as a fuel gas

Section 724 of the P&G Act defines gas devices – type A and type B. In general, both are designed for producing heat, light or power using fuel gas. Section 724 also sets out specific devices for each type and provides for gas devices, type A to be prescribed the P&G Safety Reg (refer to s12 and Sch.1). A gas device type listed in Sch.1 of the P&G Safety Reg that uses hydrogen as fuel is a gas device (type A). Table 4 lists gas devices that use hydrogen as fuel.

Table 4 Examples of gas devices that use hydrogen.

Gas device	Description
Catalytic reactor gas device	Catalytic reactors are not listed in the P&G Safety Reg Sch.1 and are a gas device (type B).
Combustion gas device	<p>A combustion gas device uses hydrogen in a combustion reaction and hydrogen applications could be:</p> <ul style="list-style-type: none">• hydrogen blended with natural gas, or• pure hydrogen. <p>For hydrogen blends:</p> <ul style="list-style-type: none">• If an approved device is to be supplied with fuel gas within the gas quality specification for which the gas device is approved, no additional approval is required.• Where an approved device is to be supplied with fuel gas outside the gas quality specification for which the device is approved, a new device approval is required.

Gas device	Description
	<p>A gas device type listed in the P&G Safety Reg s12 and Sch.1 that uses hydrogen as fuel is a gas device (type A). Common type A combustion gas devices include cooktops, BBQs and hot water systems.</p> <p>A device that is not listed in the P&G Safety Reg s12 or Sch.1 is a type B.</p>
Fuel cell gas device	<p>Fuel cells are not currently listed in the P&G Safety Reg s12 or Sch.1 and therefore are a type B gas device.</p> <p>Mobile fuel cell gas systems refer to fuel cells used in vehicles and vessels.</p> <p>Stationary fuel cell gas systems refer to fixed applications for power generation and include portable units.</p> <p><u>A fuel cell gas system is a type b device.</u></p>

6.2 Approval of gas devices

Section 731AA of the P&G Act requires all gas devices (type A and type B) to be approved before installation or use. The proposed process for approval of a gas device using hydrogen is shown in Figure 2. It is proposed that a fuel cell (gas device (type B)) is approved as part of the [fuel cell gas system](#).

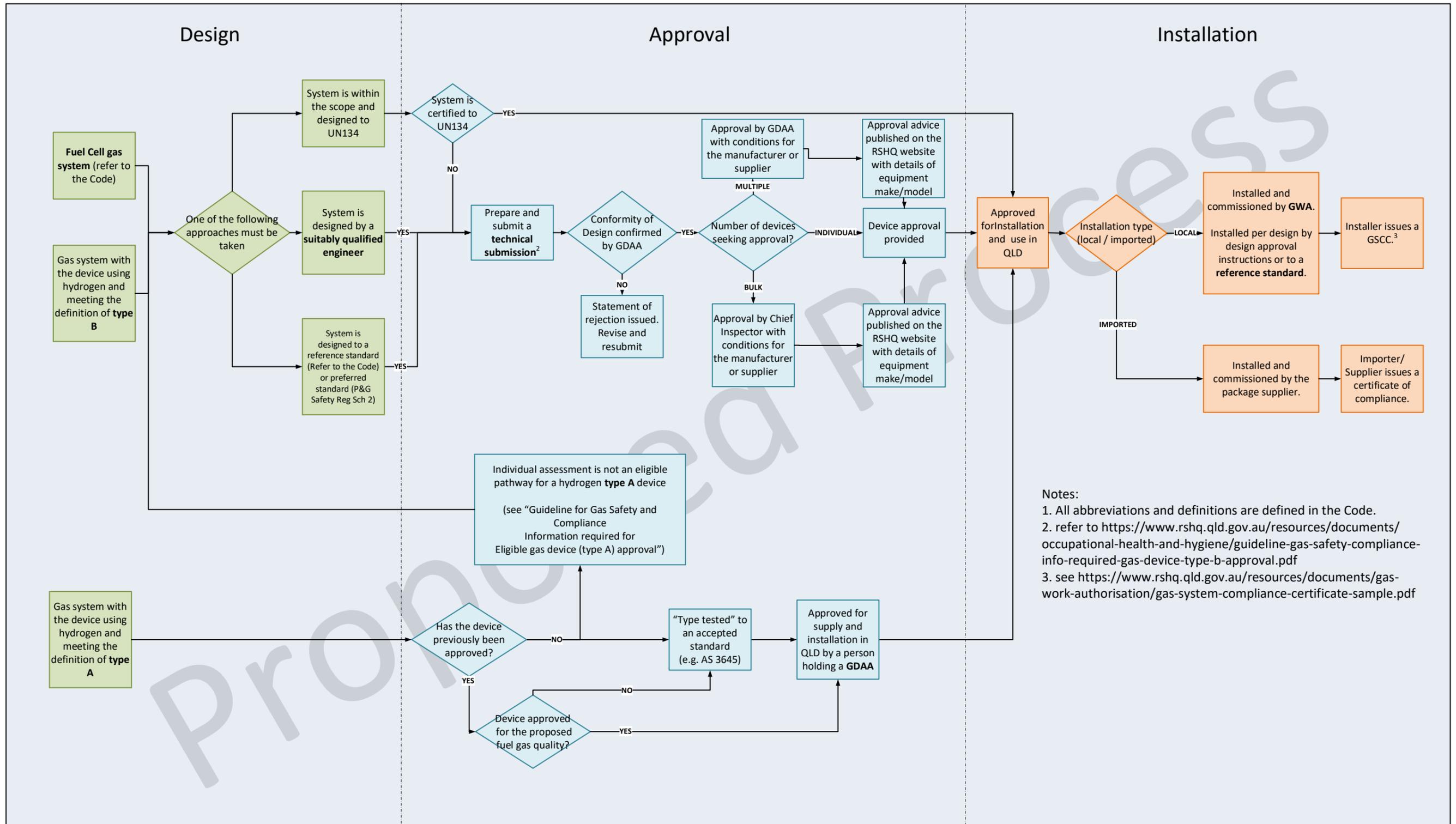
The P&G Safety Reg requires that gas devices are designed and approved to a preferred standard. If a preferred standard is not used compliance can be achieved by following the process outlined in section 15 of the P&G Safety Reg.

6.3 Installation and certification of gas systems

Section 734 of the P&G Act sets out requirements for gas systems to be installed in compliance with applicable safety requirements and for the gas system installation to be certified by the installer. The proposed process for approval of a gas device and installation and verification of a gas system using hydrogen is shown in Figure 2.

AS/NZS5601 is the preferred standard for gas system installation. Section 2 of AS/NZS5601.1 provides an outcome-based approach and if utilised would require a notice as outlined in section 15 of the P&G Safety Reg.

Figure 2 Proposed Gas device and gas system approval pathway.



Issue with current legislative requirements

Gas devices must be designed and approved to a preferred standard in the P&G Safety Reg. If a preferred standard is not used the process outlined in section 15 of the P&G Safety Reg must be followed, including notifying the Chief Inspector

The current preferred standards do not adequately incorporate all hydrogen gas devices (e.g., fuel cells). As the industry develops many hydrogen gas devices will require approval. It is not practical to notify the Chief Inspector for every device.

Policy Proposal

The code proposes the process outlined in Figure 2 for device approval

REFER TO [Appendix 7](#) TO OF THE CODE TO REVIEW ALL POLICY PROPOSALS

Issue with current legislative requirements

Current approval pathways require every Type B device to be individually approved.

Fuel cells are Type B devices and in a rapidly growing industry where vehicles and packaged systems will be widely used it is not seen to be practical to require each vehicle and packaged system to be individually approved.

Policy Proposal

There be provision for a GDAA holder to approve multiple type B devices and on the same approval (subject to conditions). Additionally, the Code proposes the Chief Inspector may issue a blanket approval and publish this on a Queensland Government website (e.g., for a specified model of an imported vehicle certified to UN R134)

REFER TO [Appendix 7](#) OF THE CODE TO REVIEW ALL POLICY PROPOSALS

Issue with current legislative requirements

Gas systems must be installed to a preferred standard in the P&G Safety Reg. There is no preferred standard for many hydrogen gas system installations. Under current legislative requirements the installer must notify the chief inspector and ensure an equal or lesser level of risk is achieved (refer to the P&G Safety Reg s15) for every installation. As the industry develops many hydrogen gas systems will be installed. It is not practical to notify the Chief Inspector for every installation.

Policy Proposal

The code proposes the process outlined in Figure 2 for gas system installation

REFER TO [Appendix 7](#) TO REVIEW ALL POLICY PROPOSALS

6.4 Holding a GDAA

Under section 731AD of the P&G Act, the chief inspector may grant a GDAA that authorises the holder to undertake gas device approval work with the scope specified in the granted authority. GDAA applications must be in the approved form which can be accessed at [Application to become a gas device approval authority](#).

A GDAA type B holder is able to approve a hydrogen fuel cell gas system. Specific information to support making an application can be accessed at [Gas device approval authority's requirements](#). Information and conditions for holders of a GDAA type be accessed at [Gas device approval authority holders – Queensland code of practice](#).

To apply for a GDAA with fuel cell gas systems included in the scope, a person must have:

- the appropriate engineering qualifications (e.g. RPEQ) (For more information, access: [Gas device approval authority's requirements](#)),
- a qualification in risk management, and
- the skills and knowledge (experience) to perform approval work under the authority described in Table 5.

Table 5 GDAA types relevant for hydrogen gas devices/systems.

Type	GDAA category	Skills and knowledge
Fuel Cell Gas Systems ¹	type B Class FC	<p>Examples of skills and knowledge that would support an application are:</p> <ul style="list-style-type: none"> • Previous experience working on similar devices • Formal training and qualifications on similar systems • Knowledge of hazardous area and electrical component requirements for hydrogen and/or other similar gases.
Hydrogen Catalytic reactor system	type B Class C	<p>For GDAA type B, requirements are as per the existing with additional information to support hydrogen use. For more information, access: Gas device approval authority's requirements.</p> <p>Examples of the additional skills and knowledge that would support an application are:</p> <ul style="list-style-type: none"> • Knowledge of characteristics of hydrogen • Knowledge of suitable materials, components and fittings for use in hydrogen service.

6.5 Obtaining a GWL and GWA for hydrogen

Under s725 of the P&G Act gas work is the work of installing, removing, altering, repairing, servicing, testing or certifying a gas system. Sections 725 and 726 requires gas work to only be undertaken by a person that holds a GWL or GWA that authorises the person to carry out the work.

Gas systems using hydrogen must be installed by a person who has hydrogen in the scope of their GWL or GWA. For type A devices, a GWL is required and for type B devices, a GWA is required.

Section 124 of the P&G Safety Reg prescribes the qualifications or experience required to obtain a GWL or GWA. Mostly, applicants meet the requirements of s124 of the P&G Safety Reg by completing a listed qualification (refer also Sch.5 of the P&G Safety Reg and the [Gas Work Licence Requirements](#) and [Gas Work Authorisation Requirements](#)).

Until the qualification framework is established, a person that wants to undertake gas work on hydrogen systems must be able to demonstrate a need for the GWL or GWA and skills and

¹ Fuel cell gas system include the fuel cell and system into which it is installed. Storage, piping, instruments and controls are to be considered and assessed as part of the device approval.

demonstrate skills and knowledge to work safely with hydrogen.

Evidence of skills and knowledge that would support an application for a GWL or GWA conditioned for hydrogen gas work could include:

- Previous experience working on similar devices and systems
- Formal training and qualifications working on similar device and systems
- Knowledge of the characteristics and properties of hydrogen hazard identification and risk management – general OHS and hydrogen specific (qualifications and experience)
- Knowledge of the suitable materials, components and fittings for use with hydrogen and/or other similar gases
- Knowledge of the storage and handling of hydrogen
- Working with (storage, transportation and use) gas pressures greater than 200kPag
- Awareness of hazardous area classification and requirements of electrical equipment to be installed in hazardous areas for hydrogen and/or other similar gases.

The application must be in the [approved form](#) with the chief inspector assessing applications on a case-by-case basis process that may include:

- a desktop review of the evidence provided,
- a meeting or discussion with the applicant, and
- as per s124(4) of the P&G Safety Reg , completion by the applicant of a written, oral or practical examination.

Under s728C(3) of the P&G Act, the chief inspector may limit the type of gas work or impose conditions. The chief inspector will provide the applicant with details of this at the time of application. As a practical example, the chief inspector may impose the condition that the holder completes the relevant qualifications within a reasonable timeframe when they are available. These conditions will be determined on a case-by-case basis.

6.6 Periodic Inspection

For commercial vehicles and vessels, the owner must ensure twelve monthly inspections of the fuel cell gas system are completed by an appropriately authorised person as required by s107 of the P&G Safety Reg. [Appendix 4](#) provides further detail on periodic inspection.

6.7 Workshop Requirements

Requirements for safe workshops are a condition of GWAs issued for vehicle workshops. Installation, conversion and maintenance of vehicles using hydrogen as a fuel must be undertaken in a workshop that complies with the conditions of the GWA and as set out in the [Queensland gas work authorisation requirements document](#). [Appendix 4](#) provides further detail on workshop requirements.

7 Proposed process for supply of unodourised hydrogen

Issue with current legislative requirements

There is currently no known commercially available odourant suitable for use in fuel cells. Without an alternate means of achieving safety outcomes and the removal of the odourant requirement for hydrogen fuel cells, using hydrogen fuel cells in Queensland will be non-compliant with existing fuel gas odour requirements.

Policy Proposal

Section 7 proposes an ***alternative means on compliance*** to odourising fuel gas.

Section 7 is a Policy Proposal and not reflective of current legislative requirements.

REFER TO [Appendix 7](#) TO REVIEW ALL POLICY PROPOSALS

Section 7 proposes a means of compliance where an operator proposes to supply fuel gas to a consumer without the prescribed odour, for example, a hydrogen refuelling station.

Section 627 of the P&G Act provides for a regulation to prescribe an odour for fuel gas when it is supplied for consumer use. Section 73 of the P&G Safety Reg prescribes the odour requirements for fuel gas when supplied through a fuel gas network.

Chapter 5, parts 2 and 3 prescribe safety requirements for fuel gas when supplied through a fuel gas network.

7.1 Proposed requirements for an operator supplying unodourised hydrogen

It is proposed an operator will be able to supply unodourised hydrogen to a consumer, if:

- the supply is to a vehicle or vessel through a dispenser, or
- they have obtained a copy of the gas compliance certificate (GCC), and
- that GCC shows that the system being supplied to is safe for use with unodourised fuel gas.

7.2 Proposed requirements for a consumer being supplied unodourised hydrogen

It is proposed that, other than for supply to a mobile fuel cell gas system, where a consumer requires fuel gas to be supplied unodourised, it will be the responsibility of the system owner to:

- obtain approval for the [gas device](#) from an appropriate [GDAA](#)
- ensure the gas system being supplied to is designed for unodourised fuel gas supply by a suitably qualified engineer
- have an [appropriately authorised person](#) install the gas system in line with system design and device approval and issue a GCC
- operate and maintain the gas system safety in line with the approval requirements including any conditions imposed, and
- retain evidence of the approval and GCC for the operating life of the gas system.

For the purpose of this section a suitably qualified engineer is a Registered Professional Engineer of Queensland (RPEQ) or equivalent.

It is proposed that to supply a mobile gas system the owner of the vehicle or vessel must:

- ensure the mobile [fuel cell gas system](#) is certified (approved) to *UN Regulation No. 134 - Hydrogen fuel cell vehicle safety* (UNR 134) or approved by an appropriate GDAA
- ensure the fuel cell gas system is installed by an appropriately authorised person (i.e., holder of an appropriate *gas work authorisation*)
- retain evidence of the UNR 134 certification or GDAA approval and GCC for the life of the gas system, and
- for commercial vehicles and vessels, retain records of the twelve monthly inspections of the fuel cell gas system.

7.3 Proposed process for design and installation of a gas system using unodourised hydrogen

Figure 2 gives an overview of the proposed process for approval of gas systems (including the gas device) to enable supply of unodourised hydrogen.

Guidance on the proposal for gas systems using unodourised hydrogen is provided in the sections below.

7.3.1 Proposed process for design of a gas system using unodourised hydrogen

The design of a gas system must achieve an acceptable level of risk in the P&G safety legislation. It is proposed that one way to achieve the safety outcome for a gas system is to meet the requirements of a reference standard.

Proposed reference standards for stationary and mobile fuel cell gas systems are listed in Table 6.

Table 6 Reference standards for fuel cell gas systems.

System Type	Reference Standard
Stationary fuel cell gas systems	<ul style="list-style-type: none">AS 62282.3.11:2021 Fuel cell technologies, Part 3.100: Stationary fuel cell power systems – Safety (IEC 62282-3-100:2019 (ED 2.0), MOD), andAS 62282.3.300:2021 Fuel cell technologies, Part 3.300: Stationary fuel cell power systems – Installation (IEC 62282-3-300:2012 (ED.1.0), MOD).
Mobile fuel cell gas systems	<ul style="list-style-type: none">UN Regulation No. 134 - Hydrogen fuel cell vehicle safety (UNR 134).

It is proposed that the design of a gas system using unodourised hydrogen must include appropriate:

- leak detection and automatic shut-off, and
- risk assessment and controls.

Specific guidance on the proposed process for the design of a fuel cell gas system using unodourised hydrogen is described below.

7.3.2 Proposed process for design of a fuel cell gas system using unodourised hydrogen

There are two types of fuel cell gas systems.

1. Stationary. A stationary fuel cell gas system could be either a fixed or a portable generator.
2. Mobile. A mobile fuel cell gas system is one that is used to power an electric vehicle or vessel.

A typical stationary fuel cell gas system is shown in Figure 3. Where applicable, design of a stationary gas system for use with hydrogen as a fuel should consider the performance and essential requirements in AS/NZS 5601.1 Section 2.

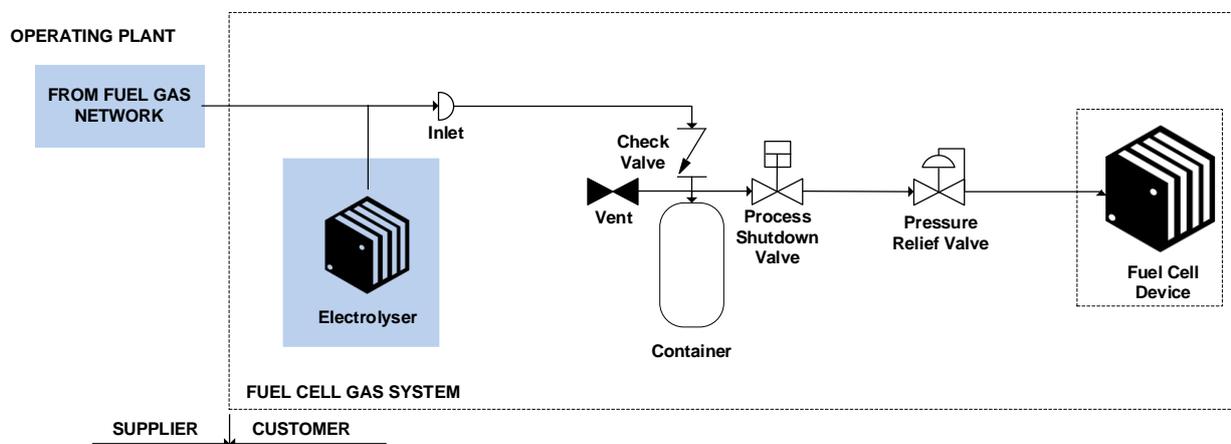


Figure 3 Typical stationary fuel cell gas schematic.

A typical mobile fuel cell gas system is shown in Figure 4.

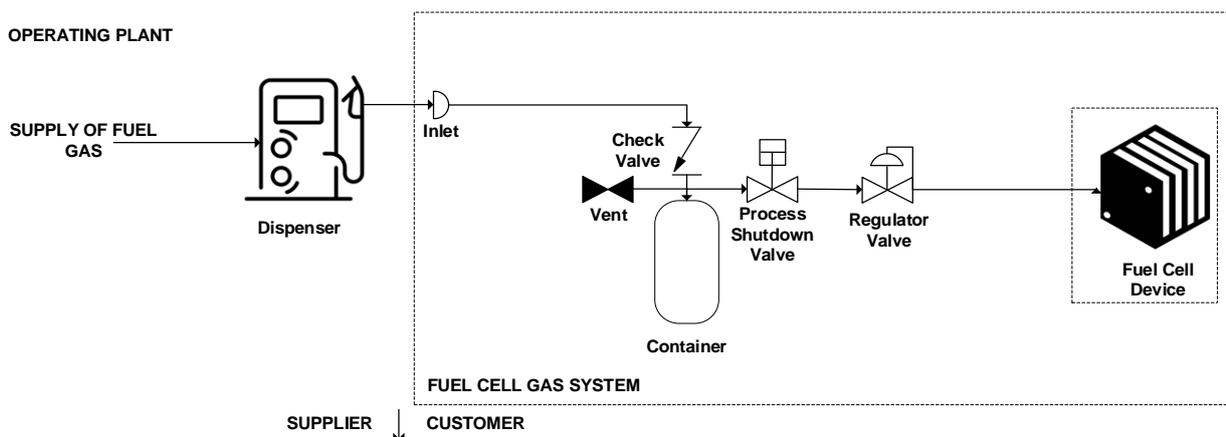


Figure 4 Typical mobile fuel cell gas system schematic.

There are three options proposed for mobile fuel cell gas system designs to be approved:

1. meet the requirements of *UN Regulation No. 134 - Hydrogen fuel cell vehicle safety (UN 134)*, or
2. meet the requirements of a reference standard, or
3. be designed by a suitability qualified engineer.

The proposed reference standards for a [fuel cell gas system](#) are listed in Table 6.

Table 7 provides a summary of the proposed approval methods for gas systems using unodourised hydrogen.

Table 7 Approval of gas systems using unodourised hydrogen.

System Type	Proposed Approval Process
Stationary fuel cell gas system	The system must be approved by an appropriate GDAA.
Mobile fuel cell gas system using option 1	The system must be certified by an independent certification body.
Mobile fuel cell gas system using option 2 or 3	<ul style="list-style-type: none"> • The system must be approved by an appropriate GDAA. • To obtain gas system approval, a technical submission is required to be submitted to an appropriate GDAA. • An example technical submission for a fuel cell gas system is at the following link Fuel Cell Gas System Example Technical Submission. • For more information, access: Gas Device Approval Authority List.

The proposed process requires that the gas device approval indicates the system is approved for supply of unodourised fuel gas.

7.3.3 Proposed process for installation of a gas system for unodourised hydrogen

- Gas systems must only be installed by an appropriately authorised person.
- The installer must install the system as per the approved design.
- Where the system is supplied with unodourised fuel gas, the commissioning check must test all controls associated with the unodourised fuel gas, including:
 - Leak detection
 - Automated shut-off
 - Natural and/or mechanical ventilation, and
 - Interlocks, where installed.
- The installer must issue a gas compliance certificate (GCC) for the installation, which must

indicate that the system is approved and safe for supply of unodourised fuel gas.

- The GCC shall reference or include a copy of the system design, technical submission and commissioning information.

Appendix 1 - Relevant Statutory Bodies and Contact Details

Table 8 summarises the key relevant statutory bodies. This list is not exhaustive.

Table 8 Relevant statutory body.

Statutory Body	Responsible for	Website contact details
Workplace Health and Safety Queensland (WSHQ)	Safety of workplaces	https://www.worksafe.qld.gov.au/contact
Queensland Electrical Safety Office (ESO)	Safety of electrical equipment and installation	https://www.electricalsafety.qld.gov.au/contact-us
Board of Professional Engineers Queensland (BPEQ)	Regulating the engineering profession	https://bpeq.qld.gov.au/
Civil Aviation Safety Authority (CASA)	Regulation of civil aviation	https://www.casa.gov.au/about-us/contact-us
Department of Environment and Science (DISER)	Consolidating the Government's efforts to drive economic growth, productivity and competitiveness	https://www.des.qld.gov.au/contactus/general
Transport and Main Roads (TMR)	Planning, managing and delivering Queensland's integrated transport environment	https://www.tmr.qld.gov.au/contactus
Australian Maritime Safety Authority (AMSA)	Regulation and safety oversight of Australia's shipping fleet and management of Australia's international maritime obligations	https://www.amsa.gov.au/about/contact-us
Department of energy and public works	Delivering projects to provide safe, secure, reliable, affordable, and sustainable energy resources to Queensland households and businesses	https://www.epw.qld.gov.au/contact/find
Department of resources	Regulating mining, and resources in the state	https://www.resources.qld.gov.au/
Department of state development	Economic strategy, industry stimulation, and infrastructure, local government and planning in Queensland	https://www.statedevelopment.qld.gov.au/about-us/contact-us
Department of Infrastructure, Transport, Regional Development and Communication	Delivering Australian Government policy and programs for infrastructure, transport, regional development, communications, cultural affairs, and the arts	https://www.infrastructure.gov.au/contact-us

Appendix 2 - Guidance on interaction with other legislation

A2.1 - Queensland Work Health and Safety Legislation

The work, health and safety legislation provides a framework to protect the health, safety and welfare of all persons in the conduct of a business or undertaking and other personnel who might be affected by the business or undertaking.

This legislation includes:

- the Work Health and Safety Act 2011 (WHS Act)
- the Work Health and Safety Regulation 2011 (WHS Reg).

While both the P&G and WHS legislative frameworks apply, safety matters can be addressed under one safety management system approach with minimal duplication.

Particular items under WHS legislation that may have applicability to hydrogen projects include:

- Hazardous Chemical requirements. Refer:
 - WHS Reg Chapter 7
 - [Managing risks of hazardous chemicals in the workplace code of practice 2021.](#)
- Pressure vessel design and registration. Refer:
 - WHS Reg Chapter 5 Part 5.3 and Sch.5
 - [Managing the risks of plant in the workplace Code of Practice.](#)

A2.2 - Electrical Safety Legislation

The purpose of the *Electrical Safety Act 2002* (the Electrical Safety Act) is to establish a legislative framework for preventing persons from being killed or injured by electricity and preventing property from being destroyed or damaged by electricity.

During the design, construction, installation and operation of hydrogen operating plant the requirements of the Electrical Safety Act 2002 and *Electrical Safety Regulation 2013* must be met.

The Electrical Safety Act includes requires the duties of care relevant to the situation are met (a person or business may have more than one duty). This includes:

- primary duty of care on all businesses that they operate in a way that is electrically safe,
- duties on designers of electrical installations and electrical equipment to ensure the equipment or installation is designed to be electrically safe and information is provided

about the way the electrical equipment or installation must be used or installed to ensure the equipment or installation is electrically safe,

- duties on manufacturers and importers of electrical equipment when made is electrically safe and is tested and examined to ensure it is electrically safe, and
- duties on installers and repairers of electrical equipment or electrical installations to ensure the electrical equipment or installation is electrically safe and is tested to ensure it is electrically safe.

Refer to *Electrical Safety Act 2002* Part 2 for all duties.

Where equipment is suitable for household, personal or similar situations the requirements of the in-scope electrical equipment safety system (EESS) also apply.

All electrical installations are required to comply with *AS/NZS 3000 – electrical installations (also known as the wiring rules)*.

It is electrical work to install electrical equipment in an electrical installation or to repair electrical equipment or electrical installations. All electrical work must be performed by a suitably licensed electrical worker and if the performance of electrical work is conducted under a contract of work, it must be performed under a Queensland electrical contractor licence.

The Electrical Safety Act specifies the requirements of the following key Australian electrical safety standards must be met:

- *AS/NZS 3000:2018 - Electrical installations (known as the Australian/New Zealand Wiring Rules,*
- *The AS/NZS 60079 series for hazardous areas equipment and installations, and*
- *AS/NZS 3820 - Essential safety requirements of electrical equipment.*

A2.3 - National Heavy Vehicle Legislation

The National Heavy Vehicle Regulator (NHVR) administers one set of laws (the HVNL) for heavy vehicles over 4.5 tonnes gross vehicle mass. The HVNL consists of the Heavy Vehicle National Law and five sets of regulations.

The HVNL does not regulate new vehicles. This is captured by the Australian government legislation and the requirements are set in the Australian Design Rules (ADR). Generally, the HVNL applies to vehicles having modifications post being supplied for use.

The HVNL s84 defines that a modification to a vehicle includes:

- the addition of a component, or
- a change to the vehicle from the manufacturer's specification.

A modification under NHVL could include:

- Addition of a gas system, supplied by an on-board hydrogen canister that delivers hydrogen to the existing diesel engine for blending
- Removing and replacing a diesel engine with a hydrogen fuel cell from a vehicle that has been approved for use under ADR.

For the modifications above, under the HVNL s85, approvals must be approved by:

1. An approved examiner under the HVNL s86, or
2. The National Heavy Vehicle Regulator.

In addition to the provisions in the NHVL, requirements under the P&G safety legislation apply.

The requirements under WHS legislation also need to be considered, for example, design and plant registration for pressure vessels.

A2.4 - Professional Engineers Legislation

To carry out a professional engineering service in Queensland or for Queensland, engineers are required to be registered with the Board of Professional Engineers Queensland (BPEQ). The only exceptions are if an unregistered person carries out the professional engineering service under the direct supervision of an RPEQ or the service is carried out only in accordance with a prescriptive standard. Once an engineer is registered they are awarded the protected title RPEQ.

The Professional Engineers Act 2002 provides for the registration of professional engineers, and for other purposes.

Further guidance is provided at this link: [BPEQ](#).

Appendix 3 - Case Studies

Table 9 summarises hydrogen project cases studies in Queensland.

Table 9 Hydrogen project case studies.

Type	Approvals Pathway
Domestic power generation unit including small electrolyser, hydride storage canister and fuel cell.	<p>RSHQ determined the fuel cell as a type B device which was a part of a fuel cell gas system [P&G Act s724 (3)].</p> <p>As there were no prescriptive standards, the proponent was required to submit a technical submission that was reviewed by the chief inspector.</p> <p>Electrical and other approval requirements were assessed separately to the gas device approval</p>
Imported hydrogen fuel cell light vehicles which met ADR for use on roads.	<p>RSHQ determined that the device within the vehicle was a type B appliance/device and in their legislative jurisdiction [P&G Act s724 (3)].</p> <p>The hydrogen fuel system in the vehicles is designed and certified to UN134. The installation had been completed by competent persons.</p> <p>It was determined that UN134 addresses gas safety risks.</p>
A hydrogen refuelling station including onsite hydrogen production and storage.	<p>RSHQ determined that the refuelling station supplied via an onsite electrolyser is operating plant [P&G Act s670, P&G Safety Reg s11].</p> <p>The operator prepared an SMS [P&G Act s674]. A commissioning notice was submitted to RSHQ.</p> <p>The relevant requirements for WHS and Electrical Safety also apply [the Code Appendix 2].</p>
Hydrogen facility that injects hydrogen gas into an existing gas distribution pipeline system.	<p>RSHQ determined that the project is a part of existing operating plant [P&G Act s670].</p> <p>The operator updated their existing safety management system [P&G Act s674] to ensure risks at the operating plant are</p>

Type	Approvals Pathway
	<p data-bbox="563 239 1011 271">maintained at an acceptable level.</p> <p data-bbox="563 329 1445 409">The operator also needs to ensure the gas quality requirements are met [P&G Act 620, P&G Safety Reg 72].</p> <p data-bbox="563 468 1398 548">The operator consulted with RSHQ on safety and quality control throughout the planning stages of the project.</p>
<p data-bbox="167 575 451 710">Large scale hydrogen production facility for export.</p>	<p data-bbox="563 575 1398 656">The production facility which includes storage is a Major Hazard Facility (MHF).</p> <p data-bbox="563 714 1254 745">The hydrogen production is a manufacturing activity.</p> <p data-bbox="563 804 1366 835">For these reasons the production facility is regulated by WHS.</p> <p data-bbox="563 893 1366 974">Relevant hydrogen pipeline may be included in the MHF or as operating plant under the P&G safety legislation.</p>
<p data-bbox="167 1001 528 1234">Hydrogen pipeline transporting hydrogen fuel from the production facility to the port liquefaction facility.</p>	<p data-bbox="563 1001 1422 1081">RSHQ have determined that the hydrogen pipeline is a pipeline as defined in P&G Act s16.</p> <p data-bbox="563 1140 1393 1220">Pipelines are operating plant and require a Safety Management System.</p> <p data-bbox="563 1279 1442 1458">Note: There is a difference between a pipeline and a distribution pipeline – A pipeline has a pipeline license (PPL) and a distribution pipeline does not. Both are operating plant but if a pipeline license is issued then WHS does not apply.</p>

Appendix 4 - General hydrogen safety considerations

A4.1 - International standards for mobile fuel cell gas systems

A number of international standards exist that may provide guidance for the design, installation and use of a fuel cell gas system.

- IEC 62282-4-101: Fuel cell technologies – Part 4-101: Fuel cell power systems for propulsion other than road vehicles and auxiliary power units (APU) – Fuel cell power systems for electrically powered industrial trucks – Safety.
- IEC 62282-4-102: Fuel cell technologies - Part 4-102: Fuel cell power systems for propulsion other than road vehicles and auxiliary power units (APU) - Fuel cell power systems for electrically powered industrial trucks - Performance test methods.
- SAE J2578 Recommended Practice for General Fuel Cell Vehicle Safety.
- SAE J2579 (R) Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles.

These documents are not reference standards.

A4.2 - Hydrogen refuelling stations standards

Hydrogen refuelling stations are a critical component to unlocking the opportunity for hydrogen mobility and while a number of standards exist, the framework is evolving.

In Australia, hydrogen refuelling stations have been built to a number of standards. While development of a complete safety framework is well underway in Australia, there is further work to be completed.

A number of existing Australian Standards apply to refuelling stations using hydrogen e.g. *AS 3000 –The wiring rules.*

To support the uptake of hydrogen in the mobility industry, the *ME-093 Hydrogen Technologies Committee* has adopted thirteen ISO (International Organization for Standardization) standards specific to hydrogen refuelling stations shown in Table 10.

Table 10 ISO standards that have been adopted as Australian Standards relevant for hydrogen refuelling stations.

Standard	Designation
AS 22734	Hydrogen generators using water electrolysis – Industrial, commercial, and residential applications
AS 16110.1	Hydrogen generators using fuel processing technologies

Standard	Designation
AS ISO 16110.2	Hydrogen generators using fuel processing technologies
SA TS 19883	Safety of pressure swing adsorption systems for hydrogen separation and purification
AS ISO 16111	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride
AS ISO 19881	Gaseous hydrogen – Land vehicle fuel containers
AS 19880.3	Gaseous hydrogen – Fuelling stations
AS 26142	Hydrogen detection apparatus – Stationary applications
AS ISO 14687	Hydrogen fuel quality – Product specification
AS ISO/TR 15916	Basic considerations for the safety of hydrogen systems
AS ISO 19880.8	Gaseous hydrogen — Fuelling stations, Part 8: Fuel quality control
AS ISO 19880.5	Gaseous hydrogen - Fuelling stations, Part 5: Dispenser hoses and hose assemblies
AS ISO 19880.8	Gaseous hydrogen - Fuelling stations, Part 8: Fuel quality control

There are a number of International Standards that exist for hydrogen refuelling stations. Key standards include:

- the ISO 19880 Series (Except the standards listed in Table 10)
- NFPA 2 - Hydrogen Technologies Code
- EIGA Doc 6/02 - Safety in storage, handling and distribution of liquid hydrogen
- EIGA Doc 211/17 - hydrogen vent systems for customer applications
- SAE J2600 and the SAE J2601 series
- ASME B31.12 - Hydrogen Piping and Pipelines.

These are developed by international standards bodies and can be adopted for use.

The International Standards listed above have not been adopted in Australia; they may be used for guidance while ensuring compliance with relevant mandatory requirements.

A4.3 - Parking garages and carparks with hydrogen vehicles

When parking and storing a hydrogen vehicle the workshop, garage and carpark need to be considered to ensure a safe work environment.

During normal operation, hydrogen gas is expected to permeate through the walls of plastic materials such as the tank liners of all-composite tanks and through O-ring seals. This is known as fuel system permeation.

A limit of the fuel system permeation rate is set to control the risk of fire in confined spaces such as vehicle garages.

Internationally, the method for calculating the limit is based on typical air changes in the garage and the lower flammability limit of hydrogen in air. The resultant fuel system permeation limit rate is specified to be 46 millilitres per hour per litre water tank capacity for each tank in the fuel system for ventilated enclosures.

For non-ventilated enclosures, the limit should be calculated and compared against the fuel system permeation rate.

A4.4 – Periodic inspection

For gas systems the periodic inspection should include:

- Gas tightness check
- Cylinder test date check
- Leak detector check
- Automatic shut-off operation check.

A4.5 - Workshops

Currently, there are no Australian Standards for hydrogen workshops; however, the National Fire Protection Agency (NFPA) has produced the following codes:

- *NFPA2 - Hydrogen Technologies Code* (NFPA2) Chapter 18, which provides guidance on minor repair garages, and
- *NFPA30 - Flammable and Combustible Liquids Code*, which provides guidance on major repair garages.

General considerations for workshops include the following:

- design of the facility
- requirements for electrical installation
- requirements for ventilation, and
- specific considerations for industrial truck repair garages.

A4.6 - Pipelines and gas distribution networks

For pipelines outside of the scope of AS 4645, the AS 2885 series applies. The AS 2885 series is predominantly for hydrocarbon fluid or carbon dioxide and was not developed with consideration for hydrogen service. The AS 2885 series does allow for transport of other fluids, including non-hydrocarbon gases, under AS 2885.0, Clause 1.2.2, but special considerations are required.

The Future Fuels Cooperative Research Centre is currently developing a hydrogen pipelines Code of Practice. This document will provide guidance on the design, construction and operation of hydrogen pipelines in Australia. Further guidance on this document is provided at this link:

[Hydrogen Pipeline Code of Practice: Design, Construction and Operation.](#)

A4.7 - Separation distances for hydrogen facilities

Currently, no Australian Standards provide guidance for hydrogen separation distances. The provision of adequate distances or separation zones around equipment is a fundamental consideration for a safe layout of plant, equipment, and buildings.

Separation distances are used to:

- Protect people from harmful events
- Protect buildings, structures and sensitive receptors from damage
- Prevent escalation (of events) within the facility.

Hydrogen in air has a wide explosive range and hydrogen itself has a very low ignition energy. In the event of a leak, these properties can lead to any of the following:

- jet fire (the leak is ignited after release, resulting in the formation of a long, stable flame from the source of the leak)
- flash fire (a flash fire occurs when a cloud of flammable gas mixed with air is ignited)
- vapour cloud explosion [VCE] (the leak is within a confined area, accumulates, and is subsequently ignited). *Note, confinement should be avoided; hydrogen is significantly lighter than air and can readily disperse if there is adequate ventilation.*

For each credible event (ignoring likelihood), the unmitigated consequences are evaluated to determine the separation distance. Typically, event contours are added to layout drawings showing the separation distances associated with each event and each source.

The location of facility plant and equipment should ensure populated buildings, critical assets, and public access are outside the worst case event contour zones. Where this is not possible, the likelihood of the events and their consequences will need to be evaluated using risk assessment techniques. Engineering controls should be implemented to reduce the risk to as low as

reasonably practicable (ALARP) and to demonstrate that the risk is below the tolerable risk target applicable to the land use.

Thus the final layout and separation distances take into account the following:

- a) The nature of the hazard(s)
- b) The equipment design and the operating conditions (pressure, temperature, inventory) and/or physical properties of the substance under those conditions
- c) Any external mitigating protection measures (e.g., fire walls, diking, deluge system, etc.) which reduce the escalation of the incident
- d) The “object” which is protected by the separation distance, i.e., the harm potential (e.g., people, environment or equipment).

Table 11 summarises useful international standards and codes for evaluating separation distances and consequences.

Table 11 Standards that provide guidance on separation distances.

Standard	Guidance Provided
NFPA 2 Hydrogen Technologies code	Minimum separation distances based on pressure and maximum pipe size.
API 521	Defines heat radiation levels (of interest) and their consequences.

A4.8 - Pressure Vessel Design Registration

The WHS Act Sch.5, provides the relevant information for plant and plant design registrations.

An indicative list of the documents that are required for design registration:

- Basis of Design
- Calculations
- Drawings
- Datasheets
- Technical specifications
- Bill of materials
- Statement signed by the designer
- Design verification statement.

Further guidance on the design registration for plant items is provided at this link: [Plant Design Registration](#).

Appendix 5 - Resources

Table 12 provides a list of useful hydrogen related resources.

Table 12 List of useful hydrogen related resources.

Resource	Description	Details
HyResource	Hydrogen related research.	https://research.csiro.au/hyresource/
Hydrogen Investor Toolkit	Hydrogen project development in Queensland.	https://www.statedevelopment.qld.gov.au/_data/assets/pdf_file/0023/17843/queensland-hydrogen-investor-toolkit.pdf
Standard Australia ME-093 Hydrogen Technologies	Australia standards for hydrogen.	https://www.standards.org.au/getmedia/da6c6fcb-96bb-4b45-a1b0-1f2882c03ec4/ME-093-Hydrogen-Technologies-Strategic-Work-Plan.pdf.aspx
Future Fuels CRC	Hydrogen related research.	https://www.futurefuelscrc.com/
Fuel Cell Standards	International standards for hydrogen.	https://www.fuelcellstandards.com/
H2Tools	International website for hydrogen safety.	https://h2tools.org/
ISO/TC 197 Hydrogen technologies	ISO standards for hydrogen.	https://www.iso.org/committee/54560.html

Appendix 6 – Contributors, Reviewers and Advisors

Table 13 is a list of the Contributors, Reviewers and Advisors involved in the preparation of the draft Code.

Table 13 List of Contributors, Reviewers and Advisors.

Contributors, Reviewers and Advisors
Ark Energy
Assure International
Australian Hydrogen Council
Foton Mobility Australia
Gas Energy Australia
Gas Technical Regulator Committee
GPA Engineering
H2Q
H2H Energy
Hyundai Mobility Australia
Hyzon Motors Australia
National Heavy Vehicle Regulator
North Queensland Hydrogen Industry Work Group
Queensland Electrical Safety Office
Queensland University of Technology
Risk and Energy Services
Standards Australia
Vehicle Standards - Department of Infrastructure, Transport, Regional Development and Communications
Western Australian Department Industry and Mines
Workplace Health and Safety Queensland

Appendix 7 – Hydrogen safety policy proposals for consultation

Appendix 7 a temporary section that collates the policy proposals highlighted in text boxes in the Code. The proposals have been informed by stakeholder feedback to address shortcomings of current legislative provisions.

A7.1 Prescribed quality of hydrogen

Current Legislative Requirement	Section 5 of the Code outlines fuel gas quality requirements of the P&G safety legislation. It also identifies alternative approval provisions for the supply of hydrogen where the general provisions in s72 of the P&G Safety Reg cannot be met.
Issue	No quality is prescribed for hydrogen and consumers are not guaranteed of a minimum specification of product.
Proposal	The prescription of <i>AS/ISO 14687 Hydrogen fuel quality - Product specification (AS/ISO 14687)</i> . AS/ISO 14687 provides a specific and relevant requirement for the quality and composition of hydrogen when supplied as a fuel gas, equivalent to what already applies to Liquid Petroleum and natural gas.

A7.2 Hydrogen gas distribution systems

Current Legislative Requirement	Section 81 of the P&G Safety Reg prescribes the AS/NZS 4645 series for the design of distribution gas systems. These standards limit the volume of hydrogen in the composition of fuel gas for gas distribution systems.
Issue	There are hydrogen gas distribution system projects that propose higher blends of hydrogen, with some proposing the use of 100% hydrogen as a fuel. At a national level, work is being undertaken to review the composition/quality requirements in the standard. This process may take a number of years before the revised standards are in place.
Proposal	Where the hydrogen component of fuel gas is outside the scope of AS/NZS 4645, the following alternative method of compliance is proposed. <u>Alternative method of compliance</u> Section 675(1)(e) of the P&G Act provides a method for formal safety assessment which can be applied to a gas distribution system. The chief inspector could receive notification of the formal safety assessment prior to supply commencing. Where hydrogen is supplied to a gas distribution system, the operators shall ensure that the risks are managed to an acceptable level. This includes ensuring quality is maintained within agreed limits

A7.3 Prescribed odour

Current Legislative Requirement	Section 627 of the P&G Act specifies that a regulation may prescribe an odour for fuel gas when it is supplied through a fuel gas network for consumer use. Section 73 of the P&G Safety Reg prescribes odour requirements for fuel gas when supplied through a fuel gas network.
Issue	It is expected not to be practicable for some gas systems using hydrogen to comply with the prescribed odour requirements.
Proposal	<p>Section 7 of the Code provides an alternative means of achieving safety outcomes for supply of unodourised hydrogen fuel gas.</p> <p>An operator is able to supply unodourised hydrogen to a consumer, if:</p> <ul style="list-style-type: none"> • the supply is to a vehicle or vessel through a dispenser, or • they have obtained a copy of the gas compliance certificate (GCC), and • that GCC shows that the system being supplied to is safe for use with unodourised fuel gas. <p>Other than for supply to a mobile fuel cell gas system, where a consumer requires fuel gas to be supplied unodourised, the system owner must:</p> <ul style="list-style-type: none"> • obtain approval for the gas device from an appropriate GDAA • ensure the gas system being supplied to is designed for unodourised fuel gas supply by a suitably qualified engineer • have an appropriately authorised person install the gas system in line with system design and device approval and issue a GCC • operate and maintain the gas system safety in line with the approval requirements including any conditions imposed • retain evidence of the approval and GCC for the operating life of the gas system. <p>For supply to a mobile gas system the owner of the vehicle or vessel must:</p> <ul style="list-style-type: none"> • ensure the mobile fuel cell gas system is certified (approved) to <i>UN Regulation No. 134 - Hydrogen fuel cell vehicle safety</i> (UNR 134) or approved by an appropriate GDAA • ensure the fuel cell gas system is installed by an appropriately authorised person (i.e., holder of an appropriate GWA) • retain evidence of the UNR 134 certification or GDAA approval and GCC for the life of the gas system • for commercial vehicles and vessels, retain records of the twelve monthly inspections of the fuel cell gas system.

A7.4 Fuel Gas Delivery Network Operating Plant

Current Legislative Requirement	Fuel gas delivery network are operating plant when one of the criteria in the Safety Reg s11(1) are satisfied. Under current provisions some fuel gas delivery networks are not operating plant if the network does not meet criteria outlined in the Safety Reg s11(1).
Issue	Hydrogen applications are emerging rapidly and RSHQ believe having collaborative relationships with all operators is important to support safe development of the industry. Under current provisions some fuel gas delivery network are not operating plant if the supply chain is below specific thresholds.
Proposal	An amendment to regulation to define <u>all</u> hydrogen delivery networks as operating plant.

A7.5 Gas Device Approval

Current Legislative Requirement	Gas devices must be designed and approved to a preferred standard in the P&G Safety Reg. If the preferred standard is not used the installer must notify the chief inspector and ensure an equal or lesser level of risk is achieved (refer to the P&G Safety Reg s15)
Issue	The preferred standards do not adequately incorporate all hydrogen gas devices (e.g. fuel cells). As the industry develops many hydrogen gas devices will require approval. It is not practical to notify the Chief Inspector for every device
Proposal	The code proposes the use of Reference standard and the process outlined in Figure 2 .

A7.6 Gas System Installation

Current Legislative Requirement	Gas systems must be installed using a preferred standard in the Safety Reg. If the preferred standard is not used the installer must notify the chief inspector and ensure an equal or lesser level of risk is achieved (refer to the P&G Safety Reg s15)
Issue	There is no preferred standard for hydrogen gas system installations. As the industry develops many hydrogen gas systems will be installed. It is not practical to notify the Chief Inspector for every installation.
Proposal	The code proposes the use of Reference standard and the process outlined in Figure 2 .

A7.7 Type B Multiple Device Approval

Current Legislative Requirement	Current approval pathways require every Type B device to be individually approved.
Issue	Fuel cells are Type B devices and in a rapidly growing industry where vehicles and packaged systems will be widely used it is not seen to be practical to require each vehicle and packaged system to be individually approved.
Proposal	A provision for a GDAA holder to approve multiple type B devices and on the same approval. Additionally, the Chief Inspector may issue a blanket approval and publish this on a Queensland Government website (e.g. for a specified model of an imported vehicle certified to UN R134).

A7.8 New and Updated Terms

NEW TERMS

Current Legislative Requirement	Current requirements for fuel gas do not reflect specific needs of some hydrogen applications.
Issue	For there to be specific and relevant requirements for some hydrogen applications, e.g., fuel cell gas system, definitions for some terms are needed, so that they can apply specifically to those applications.
Proposal	A definition for <i>fuel cell gas system</i> be included. This will enable specific requirements relevant to be prescribed, e.g., it will ensure the approval process for a hydrogen fuel cell considers the entire system in which it will operate so all operational components which present safety risks, including production and storage, are assessed. A definition for <i>Reference standard</i> be included. There are a number of Australian and International standards that are relevant for ensuring hydrogen applications operate safety. Initially, it is proposed these hydrogen standards (refer to Table 6) may be used to achieve safety outcomes.

UPDATED TERMS

Current Legislative Requirement	Fuel cell electric vehicles currently meet the definition of “Other Gas systems in a vehicle or vessel” (Refer: P&G Safety Reg Chapter 6, Part 3, Div 3).
Issue	Requirements in this division typically apply to gas systems installed in caravans and boats for non-propulsive purposes. They are not suitable for fuel cell electric vehicles.
Proposal	Gas fuel systems are defined as “A gas system that supplies gas as a fuel to an engine”. It is proposed to amend the definition of a gas fuel system to include fuel gas supplied to a mobile fuel cell.