



Wholesale Market Gas Quality Monitoring Procedures (Victoria)

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Current version release details

Version	Effective date	Summary of changes
0.1	1 May 2024	AEMO is making these gas quality monitoring procedures as required by the AEMC's "DWGM distribution connected facilities" and "Review into extending the regulatory frameworks to hydrogen and renewable gases" rule changes. These Procedures replaces the existing AEMO documents "Gas Quality Guidelines" and "Gas Quality Standard and Monitoring Guidelines Declared Transmission System".

1. Introduction

1.1. Purpose and scope

These are the Wholesale Market Gas Quality Monitoring Procedures (Victoria) (**Procedures**) made under section 91BL of the National Gas Law ([NGL](#)) and ~~R~~rule 289B of the National Gas Rules (NGR).

These Procedures provide for the application of the *standard gas quality specifications* in relation to the Victorian *Declared Transmission System* (DTS) including all *system injection points*, *DTS monitoring points* and *DDS transfer monitoring points* along with other matters.

[The application of the *standard gas quality specifications* in relation to the DTS was developed by incorporating the requirements of the:](#)

- [\(a\) *standard gas quality specifications \(AS 4564\)*.](#)
- [\(b\) *Victorian Gas Safety \(Safety Case\) Regulations 2018 \(Regulations\)*.](#)

[These Procedures provide general information about gas quality and how AEMO will respond to short term gas quality excursions outside the *standard gas quality specifications*.](#)

[The off-specification gas injection process, outlined in section 2.5.1 of these Procedures, seek a critical balance between risks to public safety by the supply of off-specification gas, and risks to public safety associated with curtailment of the injection, subsequent system disruption and re-lights in gas consumer premises. See also the following provisions of the Victorian Gas Safety Act 1997:](#)

- [\(a\) *section 32\(c\) – a ‘gas company’ must manage and operate each of its facilities to minimise, as far as ‘practicable’, the hazards and risks to the safety of the public and customers arising from interruptions to the supply of gas and the reinstatement of an interrupted gas supply; and*](#)
- [\(b\) *section 33 - a ‘gas company’ must ensure that, as far as ‘practicable’, the gas which it conveys meets the prescribed standards of ‘quality’.*](#)

[Under rule 289\(5\), AEMO may accept delivery of off-specification gas, such as where, in AEMO’s reasonable opinion, acceptance is necessary to ensure safety, security or reliability of the DTS \(and the relevant Registered participant has accurately notified AEMO of relevant information under rule 289\(4\)\).](#)

[However, AEMO may also refuse to accept delivery or continued delivery of all or some off-specification gas under rule 289\(2\), for such a period as AEMO may determine.](#)

AEMO notes that these new *gas quality monitoring procedures* incorporate primary gases (e.g. Hydrogen) that are not part of the *standard gas quality specifications*. Participants should be aware that a future update to the *standard gas quality specifications* (including an update to AS_4564 or modification by a regulatory instrument) to incorporate primary gases may require further consultation and updates to these Procedures.

AEMO has made reasonable endeavours to take into consideration potential changes to the Australian Standards based on information provided from industry and the Future Fuels CRC. However, AEMO notes that if the Australian Standards are changed and this is required to be reflected within these Procedures, that *gas quality monitoring systems* may also need to change over time to reflect the updated standards.

The ~~National Gas Law (NGL)~~ and the NGR prevail over these Procedures to the extent of any inconsistency.

These Procedures may only be amended in accordance with Part 15B of the NGR.

1.2. Application

These Procedures apply to AEMO and each person to whom they are expressed to apply.

1.3. Legal and regulatory framework

These Procedures have been made under section 91BL of the NGL.

AEMO is required to have these *gas quality monitoring procedures* to include:

- (a) the application of the *standard gas quality specifications* in relation to the DTS;
- (b) *gas quality monitoring requirements*, including:
 - (i) monitoring standards; and
 - (ii) the use of *gas quality monitoring systems* and other required *gas quality monitoring measures*;
- (c) the equipment to be included in *gas quality monitoring systems* and equipment standards;
- (d) the matters to be addressed in *gas quality monitoring plans*;
- (e) the process for making an election or seeking approval or consent from AEMO to become a *responsible gas quality monitoring provider*;
- (f) the arrangements for applying for temporary or permanent modifications to *gas quality monitoring arrangements*;
- (g) the arrangement for monitoring compliance with *gas quality monitoring arrangements*;
- (h) testing of *gas quality monitoring systems* and the costs of tests; and
- (i) other matters AEMO reasonably considers necessary or desirable to deal with in the *gas quality monitoring procedures* relation to *gas quality monitoring* for the DTS or the operation of the ~~Market~~.

The *gas quality monitoring procedures*, as required by rule 289B(3), may include information relating to the application of the *standard gas quality specifications* in a *DDS*, where that information is available to AEMO.

1.4. Definitions and interpretation

1.4.1. Glossary

Terms defined in the NGL and the NGR have the same meanings in these Procedures unless otherwise specified in this clause.

Terms defined in the NGL and NGR are intended to be identified in these Procedures by italicising them, but failure to italicise a defined term does not affect its meaning.

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Table 1 Glossary of terms

Term	Definition
AEMO monitoring point	An AEMO monitoring point in these Procedures refers to <i>system injection points</i> , <i>DTS monitoring points</i> , and <i>DDS transfer monitoring points</i> . For the avoidance of doubt, <i>gas quality monitoring arrangements</i> for a <i>monitoring point</i> at a <i>market injection point</i> that is a <i>DDS injection point</i> is approved by the <i>Distributor</i> .
Becquerel (Bq)	Number of nucleus decays per second in a given quantity of radioactive substance.
CTM	Custody Transfer Metering facility (CTM) is defined in the Wholesale Market Metering Procedures.
DDS	<i>declared distribution system</i> [Note only declared distribution systems that are directly connected to the DTS are covered by Part 19]
DTS	<i>declared transmission system</i>
ESV	Energy Safe Victoria
Gas Chromatograph (GC)	Instrument used for measuring gas composition and calculating gas heating value.
gas composition data or GCD	Gas composition data (GCD) represents the measurement of <i>gas</i> for each <i>gas quality specifications</i> parameters at each <i>gas quality monitoring system</i> . The heating value and gas composition data is an input to the <i>heating value allocation model</i> .
Heating Value Allocation Model	This model is defined in the Wholesale Market Metering Procedures.
heating value zone	heating value zone which is defined in the Wholesale Market Metering Procedures.
H ₂ O	Water
H ₂ S	Hydrogen sulphide
HCDP	Hydrocarbon dewpoint
HV	Heating value
Julian time	Time based on Julian calendar as a numbered sequence.
m ³	Cubic metre of <i>gas</i>
Max	Maximum
Microgram (µg)	A unit of mass equal to one millionth (10 ⁻⁶) of a gram.
Milligram (mg)	A unit of mass equal to one thousandth (10 ⁻³) of a gram.
Min	Minimum
MIBB	<i>Market Information Bulletin Board</i>
MJ	Megajoules (10 ⁶ Joules)
NGL or Law	National Gas Law
NGR or Rules	National Gas Rules
Online monitoring	Online monitoring requires the installation of <i>gas quality monitoring system</i> equipment and the automated provision of data from the <i>gas quality monitoring system</i> equipment to AEMO.
Offline monitoring	Offline monitoring requires sending <i>gas</i> samples for testing offsite on a periodic basis, as agreed with AEMO. The test results are provided, in timely manner, to AEMO.
Regulations	Gas Safety (Safety Case) Regulations
responsible gas quality monitoring provider	As defined by rule 289C of the NGR.
RTU	Remote Terminal/Telemetry Unit. (Usually, when associated with a metering installation, where the greater part of flow and <i>energy calculations</i> are carried out)
SCADA	Supervisory Control And Data Acquisition (SCADA) – the systems used (among other things) to collect data from GCs, <i>CTMs</i> and send data to <i>CTMs</i>
Sulphur	AS_4564 uses the US spelling for sulfur in place of the Australian spelling of sulphur.

Term	Definition
sulphide	AS_4564 uses the US spelling for sulfide in place of the Australian spelling of sulphide.
SWN	System wide notice (SWN) as defined in the <i>electronic communication procedures</i> which is part of the Wholesale Market Management Procedures.
SWZ	A <i>system withdrawal zone (SWZ)</i> includes all <i>settlement metering points</i> that withdraw gas from the <i>market</i> within the specified zone as defined in the <i>system security procedures</i> .
TBM	Tertiary Butyl Mercaptan - a mercaptan used in gas odourisation
THT	Tetrahydrothiophene - a cyclic sulphide used in gas odourisation.
TJ	Terajoule (10 ¹² Joules)

1.4.2. Interpretation

The following principles of interpretation apply to these Procedures unless otherwise expressly indicated:

- (a) These Procedures are subject to the principles of interpretation set out in Schedule 2 of the NGL.
- (b) References to time are references to Australian Eastern Standard Time.
- (c) Rounding is carried out in accordance with AS 2706 – 2003.

1.5. Related documents

The following documents support these Procedures.

Table 2 Related documents

Reference	Title	Location
Regulations	Gas Safety (Safety Case) Regulations 2018	https://www.legislation.vic.gov.au/in-force/statutory-rules/gas-safety-safety-case-regulations-2018/001
Emergency Protocol	Emergency Protocol	https://www.aemo.com.au/energy-systems/gas/emergency-management/victorian-role
Connection Approval Procedures	Wholesale Market Connection Approval Procedures (Victoria)	https://www.aemo.com.au/energy-systems/gas/declared-wholesale-gas-market-dwgm/procedures-policies-and-guides
Maintenance Planning Procedures	Wholesale Market Maintenance Planning Procedures (Victoria)	
Management Procedures	Wholesale Market Management Procedures (Victoria)	
Metering Procedures	Wholesale Market Metering Procedures (Victoria)	
System Security Procedures	Wholesale Market System Security Procedures (Victoria)	
DWGM Heating Value and Gas Composition Data Sources	DWGM Heating Value and Gas Composition Data Sources	

2. Application of the standard gas quality specifications

2.1. Introduction

Gas injected into the Victorian *Declared Transmission System (DTS)* and a *Declared Distribution System (DDS)* at *market injection points* must meet the *gas quality specifications*, which means:

- (a) the *standard gas quality specifications*; or
- (b) in the case of a *system injection point*, a gas quality standard approved by AEMO in respect of that *system injection point* pursuant to rule 287(1); or
- (c) in the case of a *DDS injection point*, a gas quality standard approved by the *Distributor* in respect of that *DDS injection point* pursuant to rule 287A(1).

AEMO monitors gas that is injected into the *DTS* to ensure it meets the *standard gas quality specifications* or the agreed gas quality standard for the *DTS*, as per (a) and (b) above.

Distributors monitor gas that is injected at *DDS injection points* into their respective *DDS* to ensure it meets the *standard gas quality specifications* or the agreed gas quality standard for the *DDS*, as per (c) above.

AEMO is provided the *gas quality specifications* data, as required by rule 289E(5), by the *responsible gas quality monitoring provider* for each *DDS injection point* and publishes this data to the MIBB.

For the avoidance of doubt, AEMO is not required to undertake action in regard to the *gas quality specifications* at *DDS injection points*.

2.2. Gas quality specifications

The *standard gas quality specifications* are defined in Part 19 of the NGR.

AEMO determines the application of the *standard gas quality specifications* in relation to *system injection points*, *DTS monitoring points* and *DDS transfer monitoring points* (collectively referred to as AEMO monitoring points).

The application of the *standard gas quality specifications* in relation to the *DTS* is shown in Table 3.

The application of the *standard gas quality specifications* in relation to the *DTS* was developed by incorporating the requirements of the:

- (a) *standard gas quality specifications* (AS 4564).
- (b) Gas Safety (Safety Case) Regulations (Regulations).

The units in the table are as follows:

- (c) Cubic metre (m³) refers to a cubic metre of gas at standard conditions of 101.325 kPa absolute and 15°C.
- (d) Pressures are gauge unless otherwise specified.

AEMO has applied the normative values as required by the *standard gas quality specifications* (AS 4564). Other values required by AS 4564 are described in section 2.3.

Table 3 DTS standard gas quality specifications limits

Parameter/Characteristic	Gas Quality Specifications Limit
Required under <i>standard gas quality specifications</i> and the Regulations	
Wobbe Index – Max	52.0 MJ/m ³
Wobbe Index – Min	46.0 MJ/m ³
Higher Heating Value – Max	42.3 MJ/m ³
Oxygen – Max	0.2 mol%
Hydrogen Sulphide – Max	5.7 mg/m ³
Gas Odourisation ¹	Odourisation at rates between 7.0 and 14.0 mg/m ³ of a 70/30 blend of THT/TBM.
Total Sulphur – Max (including odorant)	50 mg/m ³
Water content of gas – Max ²	73 mg/m ³
Water Dewpoint at Maximum Transmission Pressure – Max	0°C
Hydrocarbon Dewpoint – Max	2.0°C at 3,500 kPa
Total Inerts – Max (including Oxygen)	7.0 mol%
Oil – Max	20 mL/TJ
Elemental Sulphur – Max	1.0 µg/m ³
Mercury – Max	1.0 µg/m ³
Radioactivity – Max	600 Bq/m ³
Other contaminants ³	Not to cause damage or be a hazard to health. ⁴
Additional requirements (see section 2.4)	
Mercaptan Sulphur – Max	5.0 mg/m ³
Temperature – Max	50.0°C
Temperature – Min	2.0°C

2.3. Standard gas quality specifications parameter limits

AEMO has determined the application of the following *standard gas quality specifications* parameters in relation to the DTS on the basis of the informative standard detailed in AS 4564 or a methodology defined in AS 4564.

2.3.1. Gas Odourisation

The *standard gas quality specifications* (AS 4564) require gas odourisation to have an odour intensity that is detectable at a level not exceeding 20% LEL.

¹ See section 2.3.1

² See section 2.3.2

³ See section 2.3.4

⁴ See section 4.3 of AS 4564 - 2020 - Specification for general purpose natural gas.

This requirement is consistent with Regulation 7 of the Gas Safety (Gas Quality) Regulations which provides that for the purposes of clauses 33(1), 33(2) and 79A(1) of the Gas Safety Act 1997, it is a prescribed standard of quality that all *gas* must:

- (a) have an odour which is distinctive and unpleasant; and
- (b) have an odour level that is discernible at one-fifth of the lower explosive limit of the *gas*.

AEMO has determined that the gas odorant specification requirement for the DTS is a blend of 70% THT and 30% TBM injected into the gas stream at a rate of at least 7 mg/m³ in the gas. AEMO has determined this gas odorisation regime meets the *standard gas quality specifications* (AS 4564) and the Regulation requirements.

This blend is used as the odour is familiar to the community. Other odorant blends and injection rates are acceptable if they also meet the *standard gas quality specifications* and Regulation requirements.

While odorant injection rates from 7 to 14 mg/m³ of gas are acceptable, rates of up to 23 mg/m³ (usually for a limited term associated with “conditioning” new pipelines) are acceptable, provided that this rate of injection does not create “nuisance” leak reporting.

2.3.2. Water content

The *standard gas quality specifications* (AS 4564) requires the maximum water content to be determined by a dewpoint of 0°C at the highest MAOP in the relevant transmission system and in any case not to exceed more than 112.0 mg/m³.

For the purposes of *gas* injected at a *system injection point*, the relevant transmission pressure for determining water dewpoint is deemed to be 15,000 kPa. AEMO has determined that the water content of 73 mg/m³ is the *gas quality specifications* limit for this parameter.

2.3.3. Objectionable constituents

AEMO has determined the limits for other objectionable constituents, as described in the *standard gas quality specifications* (AS 4564) as an informative parameter, as being the following gas quality specifications limits:⁵

- (a) Elemental Sulphur – Max as 1.0 µg/m³
- (b) Mercury – Max as 1.0 µg/m³
- (c) Radioactivity – Max as 600 Bq/m³

2.3.4. Other contaminants

The *gas*, as required by AS 4564, must not contain the following:⁶

- (a) Materials, dust and other solid or liquid matter, waxes, gums, gum forming constituents, and unsaturated or aromatic hydrocarbons to an extent which might cause damage to, or interfere with, the proper operation of pipes, meters, regulators, control systems,

⁵ See section A.3.13 of AS 4564 - 2020 - Specification for general purpose natural gas.

⁶ See section 4.3 of AS 4564 - 2020 - Specification for general purpose natural gas.

- equipment or appliances or which might cause the gas to be harmful or toxic to persons having contact with it in normal work operations or usage;
- (b) Unsaturated or aromatic hydrocarbons to an extent that causes unacceptable sooting; or
 - (c) Other substances to the extent that they cause damage to, or problems in the operation of, pipelines or appliances or that cause the products of combustion to be toxic, or hazardous to health, other than substances that are usually found in natural gas combustion products.

2.4. Additional requirements in gas quality specifications

In regard to mercaptan sulphur, AEMO uses these parameters to inform the parameters for odourisation and total sulphur, incorporated in the *standard gas quality specifications*.

For temperature, these are the default temperatures which are informed by the DTS_SP's connection agreement with each connected party, which is required for the safe operation of the DTS.

This section also explains the additional requirements that have been determined by AEMO, under rule 287(1), for the *gas quality specifications* in respect of a *system injection point* for a hydrogen or biomethane gas production facility or a hydrogen blend processing facility.

2.4.1. Mercaptan sulphur

This mercaptan sulphur level relates to the smell of gas before odourant is added. It is based on the level likely to impact on odourisation levels.

Mercaptan sulphur is continuously measured only if initial measurements indicate that significant levels of mercaptan sulphur are present in the gas-producing geological formations.

AEMO has determined this is an additional *gas quality specifications* parameter limit as it informs the total sulphur and odourant parameters, required by AS 4564, that would be applied at a *system injection point*.

2.4.2. Temperature

AEMO has applied the default maximum (50°C) and minimum temperatures (2°C), in consultation with the DTS_SP for the *gas quality specifications* in relation to the DTS. Alternate temperatures may be agreed as part of the connection agreement with the DTS_SP.

The temperature parameters are dictated by the connection agreement between the DTS_SP and each connected party. The minimum and maximum temperatures are specified in the connection agreement are required for the safe operation of the DTS at that location.

The minimum and maximum temperature *gas quality specifications* parameter is set to reduce any potential threat to *system security* posed by the harmful effect of:

- (a) high temperature of gas to the DTS pipeline equipment, this includes risks of:
 - (i) prolonged high gas temperatures can have a harmful effect on pipeline steels (e.g. stress cracking), valve and regulator seals and components, and corrosion protection coatings.
- (b) low temperature of gas to the DTS pipeline equipment, this includes risks of:

- (i) low gas temperatures could also have harmful effects on pipeline steels and other materials;
- (ii) a related danger is that at temperatures below 0°C, ice can form on the exterior of pipelines and equipment;
- (iii) ice on control equipment can result in unstable pressure regulation or operational failure of components;
- (iv) low temperature also increases the risk of hydrate (ice-like materials) formation inside the pipeline system; and
- (v) low temperatures also increase the risk of hydrocarbon liquids forming in the pipeline, especially if the hydrocarbon dew point exceeds the gas temperature.

Short-term small excursions can be tolerated from a safety perspective provided the average levels are maintained within specification.

2.4.3. Hydrogen gas production facility and blend processing facility

~~Hydrogen blending with gas in the DTS from a system injection point is to be assessed on a case-by-case basis.~~ Hydrogen blend processing facility and hydrogen gas production facility connection approval [to the DTS](#) will be made by AEMO in consultation with the DTS_SP and Energy Safe Victoria (ESV) as a key concern is the [potential for](#) hydrogen embrittlement on existing [transmission](#) pipeline infrastructure.

Hydrogen production may typically result in purity of the delivered hydrogen content being between 98% and 100%.⁷ AEMO's gas quality parameter for hydrogen is informed by: SA HB 225:2023 Guideline for blending hydrogen into pipelines and gas networks.⁸

AEMO may agree, under rule 287(1), a gas quality standard in respect of a *system injection point* for a hydrogen blend processing facility and hydrogen production facility. [Hydrogen blending with gas in the DTS from a system injection point is to be assessed on a case-by-case basis.](#) The *gas quality specifications* parameters may need additional parameters to be specified, [which may include](#)ing:

- Hydrogen blend (%) and the impact on Wobbe Index as well as Heating Value,
- Potential hydrogen embrittlement on existing pipeline infrastructure (including interconnected pipelines and facilities which may use the hydrogen gas blend),
- Hydrogen compatibility on downstream Type B appliances,
- Hydrogen blend and impact on natural gas feedstock facilities⁹,
- Hydrogen blended rate of change (such that drastic fluctuations in injection rates and heating values are mitigated),

⁷ Source: <https://www.hy4heat.info/wp2>, accessed on 25 August 2023

⁸ Source: https://infostore.saiglobal.com/en-au/standards/sa-hb-225-2023-1332595_saig_as_as_3291166, accessed on 25 August 2023

⁹ Source: SA HB 225:2023 Guideline for blending hydrogen into pipelines and gas networks in section 4.3.4.4 Chemical feedstock states "Some consumers use gas as a chemical feedstock for a process such as ammonia production. Where a consumer is identified in the area proposed to receive the blend, an individual customer assessment should be conducted to ensure the blend will not cause adverse effects tot the customers process."

- Safety of hydrogen connection (i.e., remote isolation, fail safe design etc.), and
- Additional odourisation that may be required for hydrogen blended gas injections.

[The measurement and monitoring of the other gas quality monitoring parameters \(e.g. online and offline monitoring\), above, is to be addressed in the gas monitoring plan for each hydrogen gas production facility and blend processing facility as per the process defined in section 2.7.3 and section 2.9.](#)

Overall the gas blend, as required by rule 287(3), must meet the *gas quality specifications* when gas is withdrawn from the DTS. The only exception is if there is an agreement under rule 287(5).

AEMO considers the potential contaminants from a hydrogen production facility may be carbon monoxide, nitrogen, argon, and carbon dioxide.¹⁰ In addition, AEMO considers oxygen and water as hydrogen, produced via electrolysis, in industrial scale production may have the potential to include these contaminants.

The hydrogen *gas production facility* operator must provide its expert engineering analysis including appropriate design and testing information to demonstrate that a uniform hydrogen blend will be consistently produced by the facility. AEMO will perform analysis for each hydrogen production facility, to ensure the hydrogen blend will remain within the gas quality specifications.

2.4.4. Biomethane gas production facility

AEMO's gas quality parameters for a *system injection point* for biomethane are informed by: IS EN 16723-1 Natural Gas and Biomethane for use in Transport and Biomethane for Injection in the Natural Gas Network – Part 1: Specifications for Biomethane for Injection in the Natural Gas Network.¹¹

The *standard gas quality specifications* contain a consideration of methane from Biomethane facilities, but do not include specific gas quality parameter limits for any additional gas quality specification parameters.

AEMO may agree, under rule 287(1), a gas quality standard in respect of a *system injection point* for a Biomethane *gas production facility*. [Biomethane connections will be assessed on a case-by-case basis \(including the source of the biomethane\)](#). The *gas quality specifications* may need additional parameters to be specified, [which may include](#)^{ing}:

- Carbon monoxide;
- Total volatile silicium or silicon (as Si);
- Heavy metals and its compounds;
- Fluorine and its compounds;
- Chlorine and its compounds;
- Fluorinated compounds;

¹⁰ Source: <https://www.hy4heat.info/wp2>, reported potential contaminants for hydrogen production facilities include carbon monoxide, nitrogen, argon, carbon dioxide as accessed on 25 August 2023

¹¹ Source: https://infostore.saiglobal.com/en-au/Standards/I-S-EN-16723-1-2016-880107_SAIG_NSAI_NSAI_2091014/, accessed on 25 August 2023

- (g) Mono aromatics (BTEX);
- (h) Poly aromatics (PAHs);
- (i) Hydrocarbons;
- (j) Mercaptans;
- (k) Terpene;
- (l) Biological agents;
- (m) Dust impurities;
- (n) Ammonia (NH₃); and
- (o) Amine.

[The measurement and monitoring of the other gas quality monitoring parameters \(e.g. online and offline monitoring\), above, is to be addressed in the gas monitoring plan for each biomethane gas production facility as per the process defined in section 2.7.3 \(along with whether monitoring should be online or offline, as per section 2.9\).](#)

~~Biomethane connections will be assessed on a case-by-case basis.~~ Biomethane gas production facility connection approval [to the DTS](#) will be made by AEMO in consultation with the DTS_SP and ESV.

2.4.5. Approving a gas quality standard different to the gas quality specifications

For the purpose of AEMO considering a gas quality standard that is different to the *standard gas quality specifications* for the purpose of rule 287(1), the *responsible gas quality monitoring provider* (or intending provider) must:

- (a) submit a proposal for consideration by AEMO for the applicable *system injection point*, and
- (b) obtain AEMO's approval for an alternative gas quality monitoring arrangement in accordance with the Rules and section 2.7.3.

For the avoidance of doubt, the consultation and approval under section 2.7.3 may include the process to obtain approval from *Registered participants* who withdraw gas at an impacted *transmission delivery point*, as required by 287(5).

2.5. Application of the gas quality specifications in the DTS

Gas injected at *system injection points* into the DTS must meet the *gas quality specifications*.

AEMO monitors gas injected into the DTS at *system injection points*, *DTS monitoring points* and *DDS transfer monitoring points* which have a *gas quality monitoring system* to ensure the *gas quality specifications* are maintained at all *withdrawal connection points*.

The following sections detail the process to apply when *off-specification gas* is injected into the DTS.

Section 2.5.1 is provided for guidance only and does not form part of these Procedures.

2.5.1. Overview of off-specification gas injections into the DTS

The off-specification gas injection process outlined in these Procedures seek a critical balance between risks to public safety by the supply of off-specification gas, and risks to public safety associated with curtailment of the injection, subsequent system disruption and re-lights in gas consumer premises. ~~See also the following~~ [The provisions of the Gas Safety Act¹² as discussed in section 1.1, covers a 'gas company' and its role in minimising hazards including to gas quality.](#) ÷

- ~~(a) — section 32(e) — a 'gas company' must manage and operate each of its facilities to minimise, as far as 'practicable', the hazards and risks to the safety of the public and customers arising from interruptions to the supply of gas and the reinstatement of an interrupted gas supply; and~~
- ~~(b) — section 33 — a 'gas company' must ensure that, as far as 'practicable', the gas which it conveys meets the prescribed standards of 'quality'.~~

Under rule 289(5), AEMO may accept delivery of *off-specification gas*, such as where, in AEMO's reasonable opinion, acceptance is necessary to ensure safety, security or reliability of the DTS (and the relevant *Registered participant* has accurately notified AEMO of relevant information under rule 289(4)).

However, AEMO may also refuse to accept delivery or continued delivery of all or some *off-specification gas* under rule 289(2), for such a period as AEMO may determine.

Blending of gas in the DTS from multiple injection facilities may maintain the *gas quality specification* while a specific facility may inject *off-specification gas*. This allows time for a *DWGM facility operator* to undertake corrective action for the facility to resume the injection of gas that meets the *gas quality specifications* (without requiring AEMO to cease accepting delivery from the facility).

Where *off-specification gas* conditions become protracted, extreme and/or frequent, or otherwise represent a situation not adequately covered by these Procedures, AEMO (in consultation with the jurisdictional regulator (Energy Safe Victoria)) may implement different risk management strategies. For example, in the event that repeated excursions may compromise gas safety, potential curtailment actions will be evaluated on the level of impact and risk involved.

In the event of off-specification gas flows, injections may be scheduled at the next scheduling horizon for the gas day to minimise the overall risk by reducing the quantity of off-specification gas injected.

These Procedures do not cover mitigation of the effects of gas quality within the gas quality specification range.

As such, AEMO has developed an *off-specification gas* monitoring and notification framework that accounts for this blending of *gas* within the DTS.

AEMO's notification of *off-specification gas* is based on measurements made at a *gas quality monitoring system* at a *system injection point*.

¹² Gas Safety Act 1997 (Victoria) Version as at 10 September 2023

2.5.2. Monitoring off-specification gas

AEMO applies a hierarchy of responses when *off-specification gas* injections are detected, based on the *off-specification gas* limits defined in Table 3 and duration of the *off-specification gas* excursion. The order of responses can be briefly outlined as follows, from requiring least to most action:

- (a) Confirm: This response level applies to *gas* that is within specification, but close to the specified limit. It is a trigger point for the *responsible gas quality monitoring provider* to check the gas quality monitoring equipment and confirm it is measuring correctly.
- (b) Notify *gas quality specification* limit: This response level applies to *gas* that has exceeded the *gas quality specification* limit. It is a trigger point for *Registered participants* to be notified and for the *gas quality monitoring provider* and the applicable *DWGM facility operator* to take immediate action to bring the given gas quality parameter/s within specification.
- (c) Mitigate: This response level applies to *gas* that may adversely impact certain parties. It is a trigger point for actions to be taken by:
 - (i) The *gas quality monitoring provider* and the applicable *DWGM facility operator* to immediately return gas injection to meet the *gas quality specifications*. The *off-specification gas* at this level may require AEMO to not accept delivery at the *system injection point*.
 - (ii) *Registered participants* to undertake corrective action to mitigate the impact of *off-specification gas* to end users.
- (d) Curtail: This response level applies to *gas* that may cause significant adverse impacts to one or more relevant parties. It is a trigger point for the injection of the *gas* to not be accepted by AEMO for delivery at the *system injection point*.

Different *off-specification gas* conditions may require different responses. The limits include specific excursion duration and a physical limit for a given *gas quality specifications* parameter which is defined in Table 4.

Registered participants, including the *responsible gas quality monitoring provider* and *DWGM facility operators*, must notify AEMO as required by rule 289(4) as soon as they become aware that *off-specification gas* has been delivered, or is likely to be delivered, at a *system injection point*. In the absence of information to the contrary, AEMO must treat all results received from *gas quality monitoring systems* as real.

A *responsible gas quality monitoring provider*, when using an alternate test or measurement result must confirm and validate test results (i.e. online, offline and manual backup measurement included) before providing these to AEMO.

2.5.3. Off-specification gas duration and response

The duration of *off-specification gas* excursions is detailed in the following sections for each *off-specification gas* limit and summarised for each *gas quality specification* parameter in section 2.5.4. The *gas quality specification* limits are defined in Table 3.

Confirm limit and response

Exceedance of the Confirm Limit is based on a duration of:

- (a) 15 continuous minutes, or
- (b) multiple separate excursions that occur for a cumulative of 15-minutes in any 30-minute period.

AEMO will continue to accept the gas at the Confirm Limit, as required by rule 289(3), as the gas complies with the *gas quality specifications*.

AEMO may contact the relevant *responsible gas quality monitoring provider* when gas quality measurements exceed the Confirm limit to perform confirmation and/or validation checks.

Notify limits and response

Any gas quality measurement exceeding the Notify Limit will result in AEMO sending a SWN to all *Registered participants* gas quality contacts in accordance with section 2.5.5.

Exceedance of the Notify Limit is based on a duration of:

- (a) 15 continuous minutes, or
- (b) multiple separate *off-specification gas* excursions that occur for a total of 15-minutes in any 30-minute period.
 - (i) Where *off-specification gas* excursions are intermittent, an interval where the gas is within specification for more than 30 minutes, before again exceeding the Notify limit, defines the start of a separate excursion and further additional notifications are required.

Additional actions may be taken if, after the duration detailed in (a) and (b) above, the excursion continues, and the Curtail Limits (being Notify Limits that have an extended duration) are exceeded for:

- (c) more than 12 continuous hours or rolling 12 hours in 24 hours, for all gas quality parameters except for odorant, hydrogen sulphide and Wobbe Index.
- (d) more than 5 continuous hours or rolling 5 hours in 10 hours for odorant, hydrogen sulphide and Wobbe Index.

Actions which may be taken include:

- (e) AEMO may refuse to accept delivery of the *off-specification gas*, as per rule 289(2); or
- (f) AEMO may agree to accept *off-specification gas* (including at a modified *flow rate*, as per rule 289(2)) from a *system injection point*, if the requirements of rule 289(5) are met, and AEMO notifies *Registered participants* by SWN, as required by 289(6); or
- (g) If the *DWGM facility operator* does not comply with AEMO's refusal to accept delivery of the *off-specification gas*, then AEMO may direct the *DWGM facility operator* under clause 91BC of the NGL to fulfill the requirement of (e) or (f) above.

Mitigate limits and response

Any gas quality measurement exceeding the Mitigate Limit will result in AEMO sending a SWN to all *Registered participants* gas quality contacts in accordance with section 2.5.5.

Exceedance of the Mitigate Limit is based on a duration of:

- (a) 15 continuous minutes, or
- (b) multiple separate *off-specification gas* excursions that occur for a total of 15-minutes in any 30-minute period.
 - (i) Where *off-specification gas* excursions are intermittent, an interval where the gas is within specification for more than 30 minutes, before again exceeding the Mitigate limit, defines the start of a separate excursion and further additional notifications are required.

Additional actions may be taken if, after the duration detailed in (a) and (b) above, the excursion continues, and the Curtail Limits (being Mitigate Limits that have an extended duration) are exceeded for:

- (c) more than 3 continuous hours or rolling 3 hours in 12 hours for all gas quality parameters except for odorant (3 continuous hours or rolling 3 hours in 5 hours) and temperature (24 continuous hours or rolling 24 hours in 48 hours).
- (d) multiple separate *off-specification gas* excursions that occur for a total of 3 hours in any 12 hour period.

Actions which may be taken include:

- (e) AEMO may refuse to accept delivery of the *off-specification gas*, as per rule 289(2); or
- (f) AEMO may agree to accept *off-specification gas* (including at a modified *flow rate*, as per rule 289(2)) from a *system injection point*, if the requirements of rule 289(5) are met, and AEMO notifies *Registered participants* by SWN, as required by rule 289(6); or
- (g) If the *DWGM facility operator* does not comply with AEMO's refusal to accept delivery of the *off-specification gas*, then AEMO may direct the *DWGM facility operator* under clause 91BC of the NGL to fulfill the requirement of (e) or (f) above.

Registered participants are required to carry out any necessary mitigation for *off-specification gas* appropriate for their organisations (and for Retailers' gas consumers) based on independent expert advice. Mitigation limit steps may include notifications to specific categories of gas consumer.

Curtail limits and response

Exceedance of the Curtail Limit is based on a duration of:

- (a) 15 continuous minutes, or
- (b) multiple separate *off-specification gas* excursions that occur for a total of 15-minutes in any 30-minute period.
 - (i) Where *off-specification gas* excursions are intermittent, an interval where the gas is within specification for more than 30 minutes, before again exceeding the Curtail Limit, defines the start of a separate excursion and further additional notifications are required.

Additional actions may be taken if, after the duration detailed in (a) and (b) above, the excursion continues, and the Curtail Limits (being Mitigate Limits that have an extended duration) are exceeded for:

- (c) more than 30 continuous minutes or rolling 30 minutes in 3 hours for all gas quality parameters except for temperature and odorant.
- (d) more than 2 continuous hours or rolling 2 hours in 3 hours for low odorant.
- (e) more than 2 continuous hours or rolling 2 hours in 12 hours for low temperature.

Actions which may be taken include:

- (f) AEMO may refuse to accept delivery of the *off-specification gas*, as per rule 289(2); or
- (g) AEMO may agree to accept *off-specification gas* (including at a modified *flow rate*, as per rule 289(2)) from a *system injection point*, if the requirements of rule 289(5) are met, and AEMO notifies *Registered participants* by SWN, as required by rule 289(6); or
- (h) If the *DWGM facility operator* does not comply with AEMO's refusal to accept delivery of *off-specification gas*, then AEMO may direct the *DWGM facility operator* under clause 91BC of the NGL to fulfill the requirement of (f) or (g) above.

Registered participants are required to carry out any necessary mitigation for *off-specification gas* appropriate for their organisations (including for Retailers their gas customers) based on independent expert advice. Curtail Limit steps may include notifications to specific categories of gas consumer.

Reinstate Level

The *DWGM facility operator* must be able to inject gas without exceeding the Notify Limit before AEMO may agree to accept delivery from the *system injection point*.

The process for AEMO to agree to recommence injections, after refusing to accept delivery under rule 289(2), from a *system injection point* is:

- (a) The *DWGM facility operator* must notify AEMO in writing the Reinstate level will be achieved within 15 minutes of the time AEMO accepts delivery from the *system injection point*.
- (b) AEMO will monitor the *gas quality monitoring system* at the *system injection point* to ensure it is at the Reinstate level within the 15 minutes timeframe.
- (c) If this is not achieved, AEMO will refuse to accept delivery from the *system injection point*. AEMO may agree otherwise based on its assessment of the gas blend meeting the *gas quality specifications* within the DTS.

2.5.4. Summary of off-specification gas limits and excursion durations

The following *gas quality specification* parameters are measured by *gas quality monitoring systems* at AEMO monitoring points.

Some *gas quality specification* parameters are measured and reported for online monitoring, which represents automated measurement via gas quality monitoring equipment. Other gas quality specification parameters are measured and reported to for offline monitoring, which represents manually sampled, measured and reported gas quality specification parameters. These are detailed in the following tables:

Table 4 Summary of online monitoring gas quality specifications parameter limits and response thresholds

			Low Limit				High Limit			
Parameter		Units	Curtail	Mitigate	Notify	Confirm	Confirm	Notify	Mitigate	Curtail
Time for initial response	Continuous	mins	15	15	15	15	15	15	15	15
	Rolling		15m in 30m	15m in 30m	15m in 30m	-	-	15m in 30m	15m in 30m	15m in 30m
Time until AEMO refuses to accept delivery	Continuous	hours	0.5	3.0	12.0	-	-	12.0	3.0	0.5
	Rolling		30m in 3h	3h in 12h	12h in 24h	-	-	12h in 24h	3h in 12h	30m in 3h
Wobbe Index		MJ/m ³	44	45	46 5 hrs /in 10 hrs	47	51.5	52 5 hrs /in 10 hrs	52.5	53.5
Heating Value		MJ/m ³	- ¹³	-	-	-	41.8	42.3	42.6	43.0
Hydrocarbon dew point		°C	-	-	-	-	1	2	3	5
Water content		mg/m ³	-	-	-	-	65	73	93	105
Hydrogen Sulphide		mg/m ³	-	-	-	-	4.5	5.7 5 hrs /in 10 hrs	5.8	10
Total sulphur		mg/m ³	-	-	-	-	45	50	100	200
Temperature ¹⁴		°C	-10 2 hrs /in 12 hrs	-2 24 hrs /in 48 hrs	2	3	45	50	55	60
Oxygen		Mol%	-	-	-	-	0.15	0.20	2.0	5.0
Total inerts		Mol%	-	-	-	-	6.5	7.0	7.2	7.5
Odorant		mg/m ³	2.0 2 hrs /in 3 hrs	4.0 3 hrs /in 5 hrs	7.0 5 hrs /in 10 hrs	-	-	14.0 5 hrs /in 10 hrs	24	-
Mercaptan sulphur		mg/m ³	-	-	-	-	4.5	5	10	-

[For the avoidance of doubt, acceptable limits for other gas quality monitoring parameters may be developed \(i.e. for Hydrogen and Biomethane gas production facilities\) as part of the alternate gas quality monitoring arrangements \(see section 2.7.3\).](#)

Table 5 Summary of offline monitoring gas quality specifications parameter limits

Parameter	Confirm	Notify	Mitigate	Curtail	Reinstate Levels
Oil (mL/TJ)	-	20	-	-	20
Other contaminants	Not to cause damage or be a hazard to health ¹⁵ .				
Mercury (µg/m ³)	N/A	1.0	4.0	7.0	1.0
Radioactivity (Bq/m ³)	N/A	600	2,500	5,000	600

¹³ “-“ indicates no response is required / level does not exist for the parameter.

¹⁴ AEMO’s approach to setting the minimum and maximum temperature parameters is detailed in section 2.4.1.

¹⁵ See section 4.3 of AS 4564 – 2020 – Specification for general purpose natural gas.

Parameter	Confirm	Notify	Mitigate	Curtail	Reinstate Levels
Elemental Sulphur ($\mu\text{g}/\text{m}^3$)	N/A	1.0	See Elemental Sulphur ¹⁶	See Elemental Sulphur ¹⁷	1.0

2.5.5. Notification of Off-Specification Gas

AEMO will send a SWN to inform *Registered participants* of:

- off-specification gas* excursions that exceed Notify, Mitigate and Curtail limits by location including the impacted *market injection point* and the impacted *system withdrawal zone(s)*.
- When *off specification gas* injections have returned within the *gas quality specification*.
- AEMO's refusal to accept delivery of gas from the *system injection point* that is injecting *off-specification gas*, unless it is returned within *gas quality specification*.
- AEMO's direction of *system injection point* to cease (or reduce) injections under clause 91BC of the NGL due to *off-specification gas*.
- AEMO's decision to accept injections from a *system injection point* when a *DWGM facility operator* has provided evidence gas injections will meet the Reinstate Level.

2.6. Gas quality monitoring requirements

2.6.1. Gas quality monitoring standards

AEMO has applied the gas quality monitoring standards, as described in 'AS 4564 - Specification for general purpose natural gas', to inform the standards to be used to undertake gas quality monitoring at AEMO monitoring points.

2.7. Gas quality monitoring systems

Gas quality monitoring systems are required at (or near) each *system injection point*, *DTS monitoring point* and *DDS transfer monitoring point* that AEMO considers necessary -or desirable to enable AEMO to monitor the quality of gas in the DTS or for the calculation of *Market settlements*.

The purpose of a *gas quality monitoring system* is to monitor that the *gas quality specification* parameters of gas injected into the DTS is within the *gas quality specifications*.

The *gas quality monitoring systems* use the gas quality monitoring equipment outlined in section 2.7.2 to monitor the *gas quality specifications* parameters.

¹⁶ Refer to the Elemental Sulphur in section 5.15.

¹⁷ Refer to the Elemental Sulphur in section 5.15.

2.7.1. Gas quality monitoring points

AEMO requires a *gas quality monitoring system* at all *system injection points*. The *gas quality monitoring systems* are required at, or an appropriate distance from, a *system injection point* as agreed with AEMO.

In addition to *system injection points*, AEMO may require gas quality monitoring equipment to be installed at:

- (a) *DTS monitoring points*; and
- (b) *DDS transfer monitoring points*

The *Distributor* is responsible for approving any *gas quality monitoring system* at *DDS injection points*.

AEMO may request a new *gas quality monitoring system* to be setup at a *DTS monitoring point* or *DDS transfer monitoring point* in order to ensure the Heating Value Allocation Model accurately operates within the gas quality measurement uncertainty limits detailed in section 2.8.8.

AEMO publishes the monitoring points used to determine heating values and gas composition data source from *gas quality monitoring systems* in the technical document DWGM Heating Value and Gas Composition Data Sources.

2.7.2. Gas quality monitoring system equipment

A *gas quality monitoring system* must include a *gas chromatograph* for the determination of gas composition (including inert gases), heating value, relative density and Wobbe Index as required by rule 289G(1)(a).

Other *gas quality monitoring system* equipment at a *DTS monitoring point* and *market injection point* must, unless AEMO agrees otherwise, include:

- (a) Oxygen analyser;
- (b) Sulphur analyser for hydrogen-sulphide and total sulphur (AEMO may also require mercaptan sulphur);
- (c) Water analyser;
- (d) Hydrocarbon dewpoint measurement equipment (where the hydrocarbon dewpoint is not directly measured the *responsible gas quality monitoring provider* must provide documentation and supporting extended gas analysis results that specify how the hydrocarbon dewpoint is calculated);
- (e) Flow meter;
- (f) Pressure and temperature indication;
- (g) Odorant injection skid that includes:
 - (i) The calculated odorant concentration based on the dosing pump stroke rate; and
 - (ii) Actual odorant flow indication (in addition to the odorant concentration based on pump stroke rate). This is because odorant concentration based on pump stroke can provide a false odorant concentration if there is an issue with the injection skid

- that results in no odorant being injected into the gas (i.e. blockage or low tank level); and
- (iii) Monitoring of odorant consumption compared to gas deliveries to confirm that odorant dosing calculations and skid measurements are correct; and
 - (h) primary gas analyser (e.g. hydrogen analyser) appropriate for the primary gas being injected.

2.7.3. Approval of alternate gas quality monitoring arrangements

- (a) AEMO may agree to alternate *gas quality monitoring system arrangements*, which include:
 - (i) Alternate *gas quality monitoring arrangements* for the operation of *gas quality monitoring systems* (excluding alternate *gas quality monitoring system* equipment, discussed in (b)) may be agreed by AEMO on a case-by-case basis.
 - (ii) Alternate *gas quality monitoring system* equipment, discussed below.
- (b) AEMO may agree to an alternate *gas quality monitoring system* equipment having regard to alternate measuring methods or the characteristics of the particular gas supply, as allowed by rule 289G(1)(b). AEMO may agree to alternate measurements at an AEMO monitoring point, that may include:¹⁸
 - (i) *gas quality specifications* determined an appropriate distance from the *metering installation* at the *market injection point*, as agreed with AEMO, especially in regard to a primary gas (e.g. hydrogen) *gas production facility* utilising in-pipe blending;
 - (ii) The use of an appropriate analyser for a *primary gas* (e.g. hydrogen) that is being injected by a *primary gas production facility* or a *blend processing facility*;
- (c) For AEMO to consider the appropriateness of proposed alternate measuring methods, *gas quality monitoring system* equipment, or non-continuous measurement at an AEMO monitoring point, the proposal is to contain at least the following information:
 - (i) monitoring point location.
 - (ii) Expected minimum, maximum and average injection rate (TJ/h).
 - (iii) Proposed alternate, measuring method, gas quality monitoring equipment or non-continuous measurement.
 - (iv) Justification for the proposal.
 - (v) Relevant evidence to support the proposal.
- (d) If an alternate *gas quality monitoring system* is proposed at an existing or planned AEMO monitoring point by an existing or intending *responsible gas quality monitoring provider*:
 - (i) AEMO will consider the proposal against the requirements of the Law, jurisdictional legislation, Rules, these Procedures including meeting gas quality measurement uncertainty limits.
 - (ii) AEMO may also consider whether the proposal:

¹⁸ AEMO does not consider that a biomethane facility will require an alternate metering installation to a natural gas facility.

- (A) is not feasible to implement for AEMO's systems;
 - (B) would impose unreasonable costs for AEMO to implement or apply; or
 - (C) is otherwise not consistent with the efficient operation of the *Market*.
- (iii) AEMO may consult the jurisdictional regulator, *DTS_SP*, *Distributors* and other impacted *Registered participants* on the proposal.
 - (iv) AEMO will inform the relevant consultative forum of an alternate *gas quality monitoring system* and AEMO's expectation on the impact to the market.
 - (A) If an AEMO approved alternate *gas quality monitoring system* is used at additional sites, then AEMO is not required to inform the consultative forum after the first alternate *gas quality monitoring system* is approved.
 - (v) AEMO will approve or not approve an -alternate *gas quality monitoring systems* based on AEMO's reasonable opinion on the alternate *gas quality monitoring systems'* compliance with the Law, jurisdictional legislation, Rules and these Procedures-.
- (e) The *Distributor* for a DDS may also agree to alternate *gas quality monitoring system* equipment for a *DDS injection point*, as per rule 289G.
 - (f) A permanent modification to a *gas quality monitoring arrangement* may require modification to *gas quality monitoring system*, the process to do this is discussed in section 2.7.5.

2.7.4. Temporary modifications to gas quality monitoring arrangements

Any temporary modification to a *gas quality monitoring arrangement*, must be approved by AEMO.

A temporary modification includes when:

- (a) Gas quality monitoring equipment is inoperable requiring:
 - (i) temporary replacement using alternate gas quality monitoring equipment;
 - (ii) temporary replacement requiring secondary gas quality monitoring equipment as per section 2.7.6; or
 - (iii) temporary offline monitoring of *gas quality specification* parameters, by:
 - (A) Sampling and testing
 - (B) A means other than continuous measurement (e.g. calculations);
- (b) A review identifies, as per section 2.9.1, a requirement to modify the *gas quality monitoring arrangements*; or
- (c) AEMO is unable to verify continuous gas quality via the designated *communication link*, in which case AEMO may request from the *responsible gas quality monitoring provider*, and the *responsible gas quality monitoring provider* must provide:
 - (i) confirmation from the facility operator of the measurement for given gas quality parameters;
 - (ii) downstream measurements considered representative of the system injection point; and

- (iii) an indication when communication channels are to be restored.

Where appropriate gas quality measurements are unavailable, AEMO may not accept deliveries at the *system injection point*.

A temporary modification to a *gas quality monitoring arrangement* may require modification to *gas quality monitoring system*, the process to do this is discussed in section 2.7.5.

2.7.5. Temporary or permanent modifications to gas quality monitoring systems

A *responsible gas quality monitoring provider* for a *gas quality monitoring system*, prior to making any temporary or permanent change (including modification, adjustment, repair or replacement) to the *gas quality monitoring system* which may impact gas quality monitoring accuracy or integrity of an AEMO monitoring point must:

- (a) minimise the amount of time a *gas quality monitoring system* is unavailable.
- (b) notify AEMO of the proposed change to the *gas quality monitoring system* in accordance with the *maintenance planning procedures* and in relation to any proposed change:
 - (i) the *responsible gas quality monitoring provider* must comply with the *maintenance planning procedures* in relation to the information, data submission and timing requirements for information about the change of a *gas quality monitoring system* by a *responsible gas quality monitoring provider*;
 - (ii) AEMO will assess the proposed change using the maintenance planning process specified in the *maintenance planning procedures*;
 - (iii) AEMO will assess any works undertaken using the undertaking maintenance process specified in the *maintenance planning procedures*.
- (c) The *responsible gas quality monitoring provider* must send notifications to *Registered participants* of any change, in regard to a *gas quality monitoring system*, including the following information:
 - (i) the start and proposed end date of the planned change on the *gas quality monitoring system*;
 - (ii) alternate gas quality monitoring data (if any) that may be used to verify gas quality at the *DTS monitoring point*;
 - (iii) include information to inform the *Market* on the impact to the facility connected to the *DTS monitoring point*; and
 - (iv) the actual end date and time of the *maintenance* on the *gas quality monitoring system* that confirms the *gas quality monitoring system* is active.
- (d) The *responsible gas quality monitoring provider* may request AEMO to send notifications to all *Registered participants* via SWN concerning the change.

Where appropriate gas quality measurements are unavailable at a *system injection point*, AEMO may not accept gas delivery.

2.7.6. Official data source and secondary data source for gas quality monitoring systems

Where multiple measurement instruments of a given type are installed at a particular site, the *responsible gas quality monitoring provider* must nominate which instrument is to be used as the official data source and which is to be considered as a secondary or tertiary data source.

Where the primary source is temporarily unavailable, the secondary or tertiary data source may be used by AEMO to maintain the operation of the *gas quality monitoring system*.

2.7.7. Publication of gas quality monitoring system data

The *gas quality monitoring systems* provide *gas quality specification* parameters to AEMO to allow the:

- (a) Publication, within day, of the *gas quality specification* parameters at each *market injection point*.
- (b) Publication, on a weekly basis, the *gas quality specification* parameters' daily average for each heating value zone.
- (c) Operation of AEMO's Heating Value Allocation Model which determines the heating value and gas composition data at each heating value zone.

2.8. Gas quality monitoring equipment standards

The following section details the *gas quality monitoring system* equipment standards.

2.8.1. Communication requirements

AEMO's SCADA system currently supports communication with RTUs for *gas quality monitoring system* installations [for online monitoring](#) via the BSAP (Bristol Standard Asynchronous Protocol) communications protocol.

The *responsible gas quality monitoring provider* may propose an alternate communication protocol to AEMO. AEMO may agree to the alternate communication protocol.

The *responsible gas quality monitoring provider* must cover the costs of development and implementation of the alternate communication protocol, unless agreed otherwise by AEMO.

Offline [monitoring](#) or manual measurement of *gas quality specifications* parameters must be provided to AEMO in timely manner, or at such times AEMO agrees (provided that the measurement is within the *gas quality specifications*).

2.8.2. Communication link reliability and availability

To ensure continuous transmission of gas quality data to AEMO in real time as required by rule 289G(3), a primary and secondary (back-up) form of communication is required for all *gas quality monitoring systems*.

The *gas quality monitoring system* must communicate gas quality data to AEMO at least once every six minutes.

The continuous communication requirement, under rule 289G, is that AEMO must receive the gas quality data every 6 minutes from the *gas quality monitoring system*.

2.8.3. Security and confidentiality

Gas quality data must be secure from either local or remote unauthorised access by suitable electronic access controls.

Gas quality data and passwords are *confidential information*, and each *responsible gas quality monitoring provider* must ensure they are treated as *confidential information*.

Gas quality monitoring systems will also need to meet relevant legislative security requirements.

2.8.4. Data requirements

Instantaneous readings and hourly average readings of measured [online monitoring](#) parameters are to be made available to AEMO.

Hourly average readings are to be retrievable by AEMO from the Remote Telemetry Unit (RTU) at the *monitoring point* for at least 35 days from when measurements were made.

The data requirements for the *responsible gas quality monitoring provider* to provide data to AEMO are detailed in the Technical Document: “Gas Metering – CTM Data Requirements”.

2.8.5. Meter time

The clock for a *gas quality monitoring system* must be referenced to Australian Eastern Standard Time (AEST) with an accuracy of ± 5 secs.

Time must be recorded based on the Julian calendar as a numbered sequence.

2.8.6. Time stamping of data

- (a) AEST must be used in data transfers for all *time stamping*.
- (b) Hourly average data is required for a variety of data points and refers to “hour to hour”, “on the hour” data.
- (c) All readings require a “*time stamp*” as below:
 - (i) For averaged data, the *time stamp* relates to the start time of the measurement period. For example, “hourly average” data for the 09:00 to 10:00 hour period would be time stamped 9:00:00 am.
 - (ii) “Daily average” readings are to be referenced to 6:00:00 am AEST for the start of the *gas day*.
 - (iii) For “instantaneous” (i.e. single measurement) readings, the *time stamp* indicates the time of measurement.

2.8.7. Measurement range and frequency

The *gas quality monitoring system* equipment must be capable of measuring the required parameters within the required uncertainty range for values considered “in-specification” as well

as values considered “out of specification” up until at least the “curtail limit” for that parameter. These limits can be found in Table 4 and 0.

All installed *gas quality monitoring system* equipment must measure up to (and down to) at least the “curtail limit” for each *monitoring point* for each *gas quality specifications* parameter.

The *Regulations* require that the instruments for testing of Wobbe Index and hydrogen sulphide (or an instrument that is of a class approved by Energy Safe Victoria (ESV)) determine results at least once every six minutes.

All other instruments should determine results at the same frequency of at least every six minutes or as otherwise approved by AEMO.

2.8.8. Gas quality measurement uncertainty and calibration

To demonstrate compliance with the *gas quality specifications* (including AS 4564) it is necessary to show, at the accepted levels of precision of the test and calculation methods, that the value of a *gas quality specifications* parameter is not beyond the specified limit. To meet this requirement, the *gas quality monitoring system* equipment's measurement methods must have acceptable and sufficiently low uncertainty as detailed in the tables below.

The *Gas Safety (Safety Case) Regulations (Vic)* require that Wobbe Index and hydrogen sulphide testing is carried out in accordance with methods accredited by NATA or approved by the jurisdictional regulator, ESV.

For calibration, the uncertainty of reference standards used to calibrate the monitoring instruments must be sufficient to ensure the reliable determination of the measured parameter. The preparation of reference standards must be traceable to national standards and must have acceptable certification.

AEMO's requirements are listed in Table 6 and Table 7 covering online monitoring and offline monitoring uncertainty requirements respectively.

Table 6 Required measurement uncertainties for online parameter measurement

Parameter	Uncertainty	Comments
Composition	± 0.05% (repeatability)	Based on HV calculation.
Wobbe Index	± 0.04 MJ/m ³	
Heating Value	± 0.04 MJ/m ³	
Relative Density	± 0.1% of reading	
Hydrogen Sulphide	± 0.5 mg/m ³	
Total Sulphur	± 2.0 mg/m ³	
Mercaptan Sulphur	± 2.0% (repeatability)	Only where required.
Oxygen	± 0.01 mole%	
Water content	± 3.0 mg/m ³	
Total Inert gases	± 0.07 mole%	
Hydrocarbon Dewpoint	± 1.0°C	
Temperature	± 0.3°C	
Odourisation	± 0.2 mg/m ³	Calculated or measured.

Table 7 Required measurement uncertainties for offline sampling

Parameter	Uncertainty	Comments
Radioactivity	± 50 Bq/m ³	
Oil	See comments	Retrospective logging of oil collected. Reasonable levels of accuracy are to be used during the measurement and calculation process.
Mercury	See comments.	Reasonable levels of accuracy are to be used during the measurement and calculation process which is to be provided in the <i>gas quality monitoring plan</i> .
Elemental Sulphur	See comments	Reasonable levels of accuracy are to be used during the measurement and calculation process which is to be provided in the <i>gas quality monitoring plan</i> .
Other contaminants	See comments	Reasonable levels of accuracy are to be used during the measurement and calculation process.

2.9. Matters to be addressed in the gas quality monitoring plan

A *gas quality monitoring plan* for an AEMO monitoring point must be submitted to AEMO by the *responsible gas quality monitoring provider* for approval.

This *gas quality monitoring plan* is to ensure that the accuracy and reliability of the *gas quality monitoring system* is implemented and maintained as per rule 289H.

A *gas quality monitoring plan* must include:

- (a) The sources of the gas reasonably likely to be delivered to the *market injection point*;
- (b) Provision for periodic testing and calibration of the *gas quality monitoring system*;
- (c) Procedures for ensuring that the *gas quality monitoring system* including its data will remain free from interference;

- (d) Provision for storing all data relating to operation and calibration of the *gas quality monitoring system*; ~~and~~
- (e) Provision of the maintenance plan for the *gas quality monitoring system* in accordance with the requirement of the *maintenance planning procedures*; ~~and~~
- ~~(e)~~(f) If required, provision for the measurement and monitoring of the alternate gas quality monitoring arrangements (e.g. online and offline monitoring), as required by section 2.7.3 (which includes for Hydrogen (section 2.4.3) or for Biomethane (section 2.4.4)).

The *standard gas quality specifications* (i.e. AS 4564) set out that the testing of gas quality parameters must be at a frequency that ensures conformance at all times.

The sections below detail the requirements for inclusion in the *gas quality monitoring plan*.

2.9.1. Frequency of review and change management

A *gas quality monitoring plan* must be updated and re-submitted to AEMO at an interval not exceeding every three years by each *responsible gas quality monitoring provider*.

AEMO may request a yearly confirmation that there have been no material changes and confirm the current *gas quality monitoring plan* is still appropriate with the *responsible gas quality monitoring provider*.

If requested by AEMO, the *responsible gas quality monitoring provider* must promptly provide to AEMO confirmation that there have been no material changes and confirm the current *gas quality monitoring plan* is still appropriate or otherwise provide details of the changes and the reasons why the plan is not appropriate.

In addition, when material changes are made that impact either the gas being monitored or the *gas quality monitoring systems*, the *responsible gas quality monitoring provider* must promptly notify AEMO, and submit an updated *gas quality monitoring plan*. Changes that are material include:

- (a) New fields being brought online;
- (b) Changes to the type of plant processing equipment used; and
- (c) Changes in sample point location or measuring equipment.

Changes not requiring an update to the *gas quality monitoring plan* would be like-for-like equipment replacement and/or equipment repair which represents a temporary modification to *gas quality monitoring arrangements* and is discussed in section 2.7.4.

Changes requiring a modification to the *gas quality monitoring plan* would be expected to require a permanent modification to *gas quality monitoring arrangements* and are discussed in section 2.7.3.

Gas quality monitoring system equipment repair and replacement is subject to the maintenance planning process in the *maintenance planning procedures*.

The *responsible gas quality monitoring provider* must record any maintenance to a *gas quality monitoring system* and, if requested by AEMO, must promptly provide these maintenance records to AEMO.






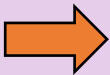


2.9.2. Site and system overview


The *gas quality monitoring plan* must include an overview of the *monitoring point* which includes:

- (a) A schematic diagram of the site showing all source(s) of the gas;
- (b) Locations (e.g. geographical location, relation to production facility, pipeline connection, etc.);
- (c) A list of gas quality parameters measured at each location (e.g. if some gas quality parameters are measured at an upstream point);
- (d) Any back-up or stand-by measurement equipment (including data communication pathways);
- (e) Other potential sources of gas quality information (e.g. upstream measurements, adjacent upstream facilities etc.);
- (f) Details of any measurements that are not made (e.g. ESV exemptions, intrinsic nature of the gas, prior measurements, etc.). Copies of any exemptions and other supporting evidence should be attached to the monitoring plan; and
- (g) Site and data security (e.g. chain-wire mesh enclosure, manned site, locked room, restricted access to servers etc.).

A single page schematic with colour coded symbols as outlined in Table 8 is required for each *gas quality monitoring system*. The schematic must show the source(s) of the gas, configuration of the site and location of all *gas quality monitoring system* related equipment (e.g. connected pipelines, storage or production facility(s), gas quality sample points (GC, sulphur, water, oxygen) odorant injection, flow meters, line valves, heaters and gas flow direction indication).

Table 8 Standard schematic symbols

Schematic Symbol	Description
	C6+ GC Sample Point
	C9+ GC Sample Point
	Water Analyser Sample Point
	Sulphur Analyser Sample Point
	Oxygen Analyser Sample Point
	Odorant Injection
	Valve
	Flow Meter

Schematic Symbol	Description
	Heater

2.9.3. Gas quality specifications parameters

Gas quality specifications parameters that must be included in the gas quality monitoring plan are outlined in Table 9 and the following sections. These parameters are split into two main categories: online monitoring and offline monitoring.

Table 9 Summary of gas quality specifications parameters

Parameter	Online	Offline	Comments
Composition	Yes		Not a “quality” parameter but required for Heating Value, Wobbe Index and corrected volume calculations.
Wobbe Index	Yes		
Heating Value	Yes		
Relative Density	Yes		Not a “quality” parameter but is used for Wobbe Index calculation.
Hydrogen Sulphide	Yes		
Total Sulphur	Yes		Includes contribution from odorant.
Mercaptan Sulphur	Yes		Only where required.
Oxygen	Yes		
Water content	Yes		
Total Inert gases	Yes		
Oil		Yes	
Hydrocarbon Dewpoint	Yes		
Temperature	Yes		
Radioactivity		Yes	
Odourisation	Yes		Verification of odorant flow (via a Coriolis meter) is required in addition to the flow calculation based on pump stroke rate.
Elemental Sulphur	Yes	Yes	Online or offline tests are acceptable.
Mercury	Yes	Yes	Online or offline tests are acceptable.
Other contaminants		Yes	Where particular other contaminants are controlled, this should also be described.

2.9.4. Online monitoring requirements for individual gas quality specifications parameters for the gas quality monitoring plan

For *online monitoring* at a *gas quality monitoring system*, the *gas quality monitoring plan* must consider the following items:

- (a) Type of gas quality monitoring equipment (e.g. GC, tuned laser, chilled surface, capacitance, etc.);
- (b) Gas quality data calculated in accordance with a standard listed in these Procedures, or otherwise agreed with AEMO;
- (c) Make and model of *gas quality monitoring system* equipment (including any fitted options and modifications);
- (d) *Gas quality monitoring system* equipment measurement range and expected uncertainty over that range as it complies with these Procedures;
- (e) Automated (e.g. GC) sampling frequency, reading update frequency and any averaging of output;
- (f) *Monitoring point* location (e.g. adjacent to meter, upstream of pressure reduction, downstream of filter etc.) and sample lag time to metering installation;
- (g) Any sample conditioning (e.g. heating, filters, liquids removal, drying, etc.);
- (h) Calibration:

- (i) frequency and duration as it complies with these Procedures; and
 - (ii) principle, frequency and source of calibration material as it complies with these Procedures;
- (i) Maintenance, repairs and service records,
 - (j) Any routine “spot tests” to check systems and frequency of testing (e.g. chilled mirror tests for hydrocarbon dewpoint or water content, or the application of a different calibration sample),
 - (k) Detection and reporting of *gas quality monitoring system* equipment faults (e.g. monitoring of equipment by the provider of the system, odorant flow indication or low odorant levels),
 - (l) Back-up (or secondary) *gas quality monitoring system* equipment or other offline alternatives,
 - (m) Prevention and/or detection of tampering and/or inadvertent interference with the equipment,
 - (n) Alternate sources of gas quality monitoring data in the event of equipment failure (e.g. measurements from adjacent facilities or within the facility),
 - (o) Details of the electronic storage of data by the provider of the monitoring system and the availability of that data to AEMO as required by the Rules and these Procedures, and
 - (p) Storage of maintenance and measurement system check records, and availability of that information to AEMO as required by the Rules and these Procedures.

2.9.5. Offline monitoring requirements for individual gas quality specifications parameter for the gas quality monitoring plan

For offline monitoring at a *gas quality monitoring system*, the *gas quality monitoring plan* must consider the following items:

- (a) The initial gas composition as measured based on sampling and testing from the gas supply source (i.e. from the reservoir or field). This provides the baseline to determine manual sampling frequency;
- (b) The *offline monitoring* test frequency as assessed against the requirement of the risk-based approach in AS 2885.6. The frequency will depend on the parameter and its concentration. Initial timing may include:
 - (i) If gas is treated to bring the gas within the *gas quality specifications* parameters, sampling should be monthly; and
 - (A) If a new gas supply source (i.e. reservoir or field) is being established then the manual sampling frequency must be agreed with AEMO. AEMO may require sampling frequency to occur multiple times within a month;
 - (ii) If gas is not treated to meet the *gas quality specifications* parameters, or negligible treatment is required, as agreed with AEMO, then manual sampling should be 6 monthly;
- (c) The offline monitoring test method and measurement principle are to be defined and agreed with AEMO;

- (d) Gas quality data calculated for the offline monitoring test in accordance with a Standard listed in these Procedures, or otherwise agreed with AEMO;
- (e) Offline monitoring test measurement range and expected uncertainty over that range as it complies with these Procedures;
- (f) *Monitoring point* location (e.g. adjacent to meter, upstream of pressure reduction, downstream of filter etc.) and sample lag time to metering installation;
- (g) Any sample conditioning (e.g. heating, filters, liquids removal, drying, etc.);
- (h) Calibration:
 - (i) frequency and duration as per these Procedures; and
 - (ii) principle, frequency and source of calibration material as it complies with these Procedures;
- (i) Maintenance, repair and servicing records for offline monitoring equipment; and
- (j) Storage of maintenance and measurement system check records, and availability of that information to AEMO as required by the Rules and these Procedures.

2.10. Monitoring compliance with gas quality monitoring arrangements

Compliance of a *gas quality monitoring provider* with their *gas quality monitoring arrangements* is achieved by:

- (a) The monitoring of *gas quality monitoring systems* by AEMO ([see section 2.10.1](#)), *Market Participants* and the *responsible gas quality monitoring provider* ([see section 2.10.2](#)).
- (b) If an issue is identified, testing may be requested to be undertaken by those identified in (a) above ([see section 2.10.3](#)).
- (c) If the testing determines there is an issue with the accuracy of the *gas quality monitoring system*, this must be promptly investigated and reported by the *responsible gas quality monitoring provider* to AEMO and *Registered participants* ([see section 2.10.4](#)).
- (d) If the investigation and report identify compliance issues AEMO may request an audit be undertaken by the *responsible gas quality monitoring provider* ([see section 2.10.5](#)).

These processes are outlined in the following sections.

2.10.1. AEMO's monitoring of gas quality monitoring systems

AEMO may use the data provided above to monitor the *gas quality monitoring system*.

In addition, AEMO may also monitor:

- (a) communication from the *gas quality monitoring system* of fault alarms (e.g. sulphur analyser tape low warning);
- (b) the data validation process, outlined in section 8.4 of the Wholesale Market Metering Procedures, to identify gas quality data issues;
- (c) the communication status to identify issues with the *communication link* at the *gas quality monitoring system*; and

- (d) the information provided by the *responsible gas quality monitoring provider* and *Market Participants* including:
 - (i) information, records and access to facilities required to be provided by a *Market Participant* to AEMO under rule 289F(4) to verify the gas quality monitoring of gas flows at a *market injection point* complies with the applicable *gas quality specifications*; and
 - (ii) the following information the *responsible gas quality monitoring provider* must record and provide promptly to AEMO on request:
 - (A) offline monitoring test results;
 - (B) calibration reports for the *gas quality monitoring system*;
 - (C) *gas quality monitoring system* maintenance records; and
 - (D) *gas quality monitoring plan* updates.

2.10.2. Responsible gas quality monitoring providers monitoring of gas quality monitoring systems

The *responsible gas quality monitoring provider* must periodically monitor the compliance of its *gas quality monitoring system*. This includes:

- (a) [online monitoring, in accordance with section 2.9.4](#);
- ~~(a)(b)~~ [Sampling and offline monitoring measurement, in accordance with section 2.9.5](#);
- ~~(b)(c)~~ [gas quality monitoring system calibration, is to be maintained in accordance with section 2.8.8](#);
- ~~(e)(d)~~ [Communications requirements are to be maintained in accordance with section 2.8.1 and the communication link reliability and availability in accordance with section 2.8.2 status, including gas composition data download failures](#);
- ~~(d)(e)~~ [RTU and array data monitoring are to be maintained in accordance with section 2.8.4](#); and
- ~~(e)(f)~~ [Any other components relevant to the accuracy of the gas quality monitoring system or integrity of the data not listed above outlined in this Procedure.](#)

2.10.3. Testing of gas quality monitoring systems

As per rule 289E, testing and calibrations of the *gas quality monitoring system* must be conducted by the *responsible gas quality monitoring provider*. These tests may be either:

- (a) Conducted periodically as per the *gas quality monitoring plan*.
- (b) Requested on an ad hoc basis by AEMO.

The *responsible gas quality monitoring provider* must promptly provide AEMO with the result of gas quality sampling undertaken within the *DTS* and *DDS* by the *responsible gas quality monitoring provider*. AEMO may use this data to validate the heating value allocation model results meet the gas quality measurement uncertainty limits detailed in section 2.8.8.

The costs of testing are determined by rule 289E(5) and rule 289E(6). For the avoidance of doubt, AEMO's requests for testing are at the cost of the *responsible gas quality monitoring provider*.

2.10.4. Investigation and reporting

The *responsible gas quality monitoring provider* must, if it becomes aware that the accuracy of a *gas quality monitoring system* does not meet the requirements of these Procedures, immediately notify AEMO and provide a report to ~~the~~ AEMO and impacted *Registered participants* detailing the issues with the accuracy of the *gas quality monitoring system* and the plan to fix these issues.

The *responsible gas quality monitoring provider* may request AEMO send a notification via SWN to provide this information to all *Registered Participants*.

2.10.5. Audit requirements

AEMO may by notice require a *responsible gas quality monitoring provider* to undertake an audit of *gas quality monitoring systems* for AEMO monitoring points if in AEMO's reasonable opinion a report provided to AEMO under section 2.10.4, or any information available to AEMO indicates:

- (a) there is a systemic issue identified at a *gas quality monitoring system(s)* operated by a *responsible gas quality monitoring provider* after an investigation and report;
- (b) gas quality data (including gas composition data and heating values) provided to AEMO by the *responsible gas quality monitoring provider*, shows a statistically higher likelihood of gas quality data issues on the basis of a historical, or other reasonable, benchmark; or
- (c) other recurrent issues identified for a *gas quality monitoring system*, that after an investigation and report, cannot identify and rectify the cause of the issue.

A *responsible gas quality monitoring system* must arrange for completion of an audit as soon as practicable after notice from AEMO.

The audit must be completed by an independent third party that, in AEMO's reasonable opinion, has the technical expertise to carry out the audit.

The audit must assess the *responsible gas quality monitoring provider's* compliance with the requirements for *gas quality monitoring system* for AEMO monitoring points in the Rules and the *Wholesale Market Procedures*.

The *responsible gas quality monitoring provider* must provide AEMO with a report from the auditor engaged to complete an audit as soon as practicable after completion of the audit.

Costs associated with an audit, including the costs of the auditor, are to be borne by the *responsible gas quality monitoring provider*.

3. Election of Responsible Gas Quality Monitoring Provider

3.1. Introduction

This section sets out the requirements for making an election to be a *responsible gas quality monitoring provider* and applying to cease to be the *responsible gas quality monitoring provider* for the *system injection point* under rule 289C(2).

3.2. Scope

The purpose of this section is to identify and confirm the authorisation of the *Registered participant* who has elected to be a *responsible gas quality monitoring provider* or who has applied to cease to be the *responsible gas quality monitoring provider* for the *system injection point* under rule 289C.

3.3. Process for the election to be a responsible gas quality monitoring provider

The requirements are as follows:

- (a) The *Registered participant* must download the form “Election of Responsible Gas Quality Monitoring Provider” from AEMO’s website.
- (b) The form must be fully completed and signed by an authorised representative of the *Registered participant*.
- (c) The *Registered participant* must submit the form to AEMO’s Support Hub.
- (d) The *Registered participant* must provide the ‘Election of Responsible Person’ form to AEMO and the DTS SP in the case of a *system injection point*, or the relevant Distributor in the case of a *DDS injection point*, as required by the connection agreement for which the connection has a *gas quality monitoring system*.
- (e) AEMO will inform the *Registered participant* of its determination in relation to an election to be a *responsible gas quality monitoring provider* or request to cease to be a *responsible gas quality monitoring provider* for a *system injection point*.
- (f) The relevant *Distributor* must inform the *Registered participant* of its determination in relation to an election to be a *responsible gas quality monitoring provider* or request to cease to be a *responsible gas quality monitoring provider* for a *DDS injection point*.
- (g) If approved by AEMO, AEMO will also inform the *Registered participant* of the date from which they are the *responsible gas quality monitoring provider* or from which they will cease to be the *responsible gas quality monitoring provider* for the *system injection point*.

If approved by a relevant *Distributor*, the *Distributor* must notify AEMO of its determination.