Gas Governance Issues in Quality: Issues Paper

Date issued: 7 September 2010
Submissions close: 18 October 2010

GAS INDUSTRY COMPANY LIMITED

153573.11

About Gas Industry Co.

Gas Industry Co was formed to be the co-regulator under the Gas Act.

Its role is to:

- recommend arrangements, including rules and regulations where appropriate, which improve:
  - the operation of gas markets;
  - access to infrastructure; and
  - consumer outcomes;
- administer, oversee compliance with, and review such arrangements; and
- report regularly to the Minister of Energy and Resources on the performance and present state of the New Zealand gas industry, and the achievement of the Government's policy objectives for the gas sector.

Authors

Ian Wilson and
Concept Consulting Ltd

153573.11

Executive summary

The purpose of this paper is to present the findings of a review of industry arrangements for managing gas quality, summarise the areas where Gas Industry Co thinks further evaluation is desirable, and suggest next steps.

This paper has been released together with Gas Industry Co's review of gas distribution arrangements, *Gas Governance Issues in Distribution: Issues Paper*. However, because this paper raises issues of wider concern about the responsibility and liability for gas quality throughout the supply chain in New Zealand, it has been issued as a separate paper. Some participants believe responsibilities for gas quality are unclear, or that potential liability for gas quality issues are not well aligned to the participants best able to manage such risks. This has been a point of contention between producers, transmission companies, distributors, and retailers.

Background

In this paper 'gas quality' refers to the components and contaminants present in gas. The New Zealand Standard NZS 5442:2008 Specification for reticulated natural gas (the Gas Specification) specifies gas quality by prescribing ranges and limits for its various components. Gas that does not comply with the gas specification is known as non-specification gas. This review did not set out to review the the Gas Specification itself; however, the Gas Specification is relevant to any consideration of the reasonableness of industry arrangements for managing gas quality.

Maintaining an acceptable standard of gas quality is important for the gas industry—it affects combustion performance, safety, the reliability of gas supply, and the long-term integrity of the gas transport system. Gas quality-related incidents are potentially costly and could disrupt the supply of gas to entire gas distribution networks.

The regulatory environment and Gas Industry Co's role in gas quality

Taking into account the legislative framework under the Gas Act, this paper proposed the following regulatory objective:

> To ensure industry arrangements include reasonable terms and conditions regarding gas quality that: allow for the safe, efficient, and reliable delivery of gas; and provide for risks to be properly and efficiently managed by those parties best able to manage such risks. .

This paper also describes other relevant legal and regulatory obligations on industry participants, including under the Commerce Act and the Consumers Guarantee Act.

Approach to the review

The review of gas quality arrangements in New Zealand was conducted by:

- examining the current industry arrangements for managing gas quality;

- exploring the mechanisms by which gas might become non-specification, the potential for damage to be caused by non-specification gas, and the circumstances in which the causer can be identified;

- analysing comparable overseas regimes to identify features that are potentially applicable in New Zealand, as well as possible gaps in the local regime; and

- considering the reasonableness of the industry arrangements.

The review's findings

The review identified three main matters for further investigation: whether arrangements for monitoring gas quality are sufficiently prescriptive; gaps in the contractual arrangements for ensuring the parties who are liable for damages from non-specification gas are the causers, or those best able to manage the risk; and lack of gas quality monitoring procedures.

Monitoring arrangements

New Zealand's arrangements for monitoring gas quality are not as prescriptive as other regimes; for example, in Victoria, continuous monitoring of virtually all gas quality parameters is mandatory. By comparison, the New Zealand regime allows periodic sampling of parameters such as water and sulphur. As a result there is a higher risk that non-specification gas is not immediately identified, and it may not be possible to identify the causer.

The current arrangements, where producers monitor gas composition, are logical if the transmission system owners (TSOs) actively audit the producers (the interconnection agreements (ICAs) provide for this audit role). The review raises the question of whether it would be reasonable for industry arrangements to require that TSOs, as reasonable and prudent operators, should continuously monitor the water content in the transmission system to reduce the risk of a hydrate-related supply failure. We consider that further analysis is required to determine whether industry arrangements are sufficiently prescriptive in this area.

Contractual arrangements for aligning liabilities and indemnities

Gas Industry Co thinks contractual provisions regarding losses or damage caused by non-specification gas could be improved. The proposed regulatory objective would be best met if liability for such losses or damage passes to the causer of the issue or to those participants best able to manage the risk. However, we believe current industry arrangements could result in situations where compensation for gas quality losses may be irrecoverable and liability can not be passed to the appropriate party.

These situations could arise because there are gaps in the industry arrangements (for example, some key interconnection points do not have an interconnection agreement (ICA)); and where there are industry arrangements, the agreements limit liability for damage.

Where there is no ICA, the network system owner has limited ability to recover its losses from the TSOs. This issue would likely be improved if Vector and the network system owners progress the development of ICAs for their interconnection points.

Gas Industry Co acknowledges that some consumers and participants may be able to insure against gas quality losses. However, we consider it is more reasonable for liability to fall on the causer or party best able to monitor the risk than to require all other participants to insure against a risk they have little ability to mitigate. This is especially so considering the Gas (Safety and Measurement) Regulations 2010 require all gas in transmission and distribution networks complies with the Gas Specification.

Gas standards and quality procedures

Australia's quality procedure sets notification, alert, and curtailment limits for each component of the gas specification. The review concluded TSOs should consider similar procedures for managing gas quality in New Zealand.

The review found New Zealand's gas specification limit for water is higher than other standards we looked at, which increases the risk of hydrate formation. We think this might warrant further consideration and have referred this issue to MED's Energy Safety Division for its consideration.

Comparison with Transmission Access Issues Review

Gas Industry Co first considered gas quality in its June 2006 *Gas Transmission Access Issues Review*.

In this current review, we have refined the issues by considering the effects of poor gas quality (for example a network outage) and which participants can cause or best manage the risks of non-specification composition and contamination. The assessment identified that in some scenarios the causer of non-specification gas cannot be identified.

The *Gas Transmission Access Issues Review* concluded liability or responsibility for gas quality falls most appropriately in the physical transport chain and not with shippers and retailers. This report differs slightly from this position in relation to the liability of retailers supplying gas to end users on a gas network. In most cases, end users do not have a separate network service agreement (it is bundled with their gas supply agreement). Therefore, to provide a consumer redress for gas quality issues the industry agreements could require retailers to bear responsibility for gas quality liability. If so, it would be reasonable for retailers and other participants in the supply chain to have provisions in their industry arrangements that pass any such liability to the causer of the gas quality issue, or the party best able to manage the risks.

Next steps

Gas Industry Co thinks it important to receive feedback on this paper before finalising the next steps. We expect some further work will be needed to assess the reasonableness of current industry arrangements in relation to gas quality, including:

- a cost-benefit analysis could be performed to assist in determining whether it is reasonable for industry arrangements to require continuous monitoring of gas composition;

- a detailed review of current industry monitoring and management arrangements for gas contamination; and

- detailed review of the effectiveness of the gas quality auditing role provided by the TSOs.

Following feedback on this paper, we expect to prepare an Options Paper. The Options Paper will consider whether regulation is appropriate for ensuring that industry arrangements provide reasonable terms and conditions in respect of gas quality. It will pay particular attention to liability for damage caused by non-specification gas.

Contents

1 Introduction

1.1 Purpose

The purpose of this paper is to present the preliminary findings of a review by Gas Industry Company Limited (Gas Industry Co) regarding gas quality. Gas Industry Co invites submissions on this paper before we consider further work in this area.

1.2 What is gas quality?

In this paper, 'gas quality' describes the components and contaminants present in gas. Gas quality is regulated by regulations and standards under the Gas Act 1992 (the Gas Act). Under regulation 41 of the Gas (Safety and Measurement) Regulations 2010 (the Regulations) all reticulated natural gas must comply with the New Zealand Standard NZS 5442:2008.

NZS 5442:2008 is titled *Specification for reticulated natural gas* (the Gas Specification). The Gas Specification prescribes ranges and limits for the various components of gas. The Regulations require every gas retailer and every gas wholesaler to ensure the gas it delivers to an end user's point of supply complies with the Gas Specification.

1.3 Why is Gas Industry Co reviewing gas quality arrangements?

Maintaining an acceptable standard of gas quality is important for the whole gas industry. Gas quality affects combustion performance, safety, the reliability of gas supply, and the long-term integrity of the gas transport system. Therefore, it is not surprising most industry arrangements include provisions regarding gas quality. The Gas Specification itself expects commercial contracts to cover certain matters relevant to gas quality.

Difficulties arise from the co-mingling of gas in the transmission system. Co-mingling blurs the chain of responsibility for gas quality and increases the risk of being unable to identify the party responsible for non-specification gas. As the number of fields supplying gas has increased, so has the difficulty in managing gas quality. When gas from the Maui field dominated supply, the quality of gas was generally stable and few, if any, gas quality-related issues were recorded. More recently, the number of gas quality-related incidents has increased, possibly as a result of the increasingly diverse sources of

gas. Such incidents have the potential to be costly for the industry and disrupt the supply of gas to end users.

Gas Industry Co understands gas quality issues have for some time been a point of contention between industry participants. We are aware of industry concerns that the responsibilities for achieving compliance with the Gas Specification are unclear. Also, there are issues regarding who should bear liability for non-compliant gas in pipelines. Some industry participants are concerned downstream participants are the most likely to suffer damage or liability from a gas quality incident, but an upstream participant is likely to be the responsible party. In particular, retailers and distributors are most likely to suffer damage, but a producer or transmission system owner (TSO) is likely to be the responsible party, because it either caused the gas quality incident or failed to prevent it. In addition, Gas Industry Co has received numerous requests from a distributor suggesting gas quality issues need further consideration.

1.4 How does this paper relate to other Gas Industry Co work?

Issues regarding responsibilities for gas quality on the transmission network have been raised by Gas Industry Co as far back as June 2006[1]. In 2006 Gas Industry Co also consulted on a review of NZS 5442, which led to the 2008 revision of the standard[2].

Gas Industry Co is issuing this paper as a companion to *Gas Governance Issues in Distribution: Issues Paper* [3]. That paper considers whether some problems associated with gas distribution warrant the development of gas governance arrangements. Although gas quality issues are not limited to gas distribution, gas quality issues are a significant aspect of distribution arrangements, and the issues are usefully considered together.

This paper considers the issue of gas quality across the entire gas transport system. In particular, it examines whether the current terms and conditions in industry agreements (including in relation to transmission and distribution pipelines and retail supply) are reasonable in their approach to gas quality.

This paper discusses Gas Industry Co's role as specified in the Gas Act 1992 (the Gas Act) and the April 2008 Government Policy Statement on Gas Governance (GPS). It also discusses the roles of other regulatory bodies with respect to gas quality, and industry participants' statutory legal and regulatory obligations (including those under the Gas Act, Commerce Act 1986, and Consumer Guarantees Act 1993).

---

[1] See the *Gas Transmission Access Issues Review* paper, available here: http://www.gasindustry.co.nz/sites/default/files/consultations/13/Transmission_Access_Issues_Paper.pdf
[2] See *Review of New Zealand Specification for Reticulated Natural Gas, March 2006*, available here: http://www.gasindustry.co.nz/sites/default/files/consultations/25/Consultation_Paper.pdf
[3] The companion paper is available from Gas Industry Co's website: [insert web page]

A glossary of certain terms used in this paper is provided at the end of this document.

1.5 Invitation for submissions

Gas Industry Co invites submissions on this Issues Paper. We are particularly seeking responses to the questions highlighted at various points in the body of the text. Submissions on the questions should be provided in the format shown in Appendix A.

Submissions are due by **5pm, Monday 18 October 2010**. Please note that submissions received after this date may not be considered.

We prefer receiving submissions in electronic form (Microsoft Word format and PDF). Submissions may be uploaded on our website at www.gasindustry.co.nz. You will need to log in as a user and upload the submission on the consultation page by clicking on the submissions button.

Gas Industry Co will acknowledge receipt of all submissions electronically. If you do not receive electronic acknowledgement of your submission within two business days, please contact Jay Jefferies on 04 472 1800.

Gas Industry Co values openness and transparency and therefore submissions will generally be made available to the public on our website. If you intend to provide confidential information in your submission, please discuss this first with Ian Wilson at Gas Industry Co (04 472 1800).

Gas Industry Co will release a paper containing a summary of submissions as well as our analysis and conclusions.

2 Background

2.1 Reticulated gas must comply with the Gas Specification

As noted in section 1.2, the Regulations require all gas in transmission and distribution networks to comply with the Gas Specification. The Gas Specification includes requirements for the safety and suitability of methane-based gas that is:

- transported and supplied for use in natural gas burning appliances and equipment; and
- for use as fuel in natural gas vehicles.

The Gas Specification attaches 'informative' appendices, which are summarised in the Gas Specification as follows:[4]

> Appendix A provides information on the derivation of the specification. Other informative appendices provide guidance on matters to be considered in contracts and to identify test methods for the verification of compliance. In the 2008 revision, further appendices were added giving guidance on quality monitoring and control and to provide an audit checklist.

Limits for composition and rate of change of composition

The Gas Specification prescribes the range and limits for components of gas including oxygen, carbon dioxide, sulphur, water and contaminants, and the related measures of density and Wobbe Index. The Wobbe Index is a measure of the combustion quality of a gas.

The Gas Specification recognises that in some circumstances rate of change of gas composition is important, but it does not set limits for this parameter. The Gas Specification recommends supply and transport contracts specify limits for the rate of change of gas composition, if relevant.

[4] See last paragraph on page 6 of the Standard.

Limits for contaminants

The Gas Specification sets qualitative limits for contaminants. It requires the contaminants do not damage or affect the operation of the pipeline, meters, regulators, control systems, equipment or appliances but provides no guidance on preventative monitoring.

Test methods

The Gas Specification lists acceptable test methods for the components, but the means of assurance, frequency and location of testing, and the party responsible are not specifically defined. The test methods must achieve a 95% confidence level in the measurements, and a sample frequency that is *likely* to detect deviations. Appendix D of the Gas Specification recommends gas supply and transport contracts consider the frequency of verifying compliance.

Non-specification gas

Gas not complying with the gas specification is known as non-specification gas. This paper distinguishes between gas that is non-specification because of *contaminants* and gas that is non-specification because of an incorrect *composition.*

Although the Gas Specification includes pipeline requirements, the main offence under the Regulations relates to gas quality at the point of supply. The Gas Specification sets out the gas quality standards, and the Regulations set out the consequences of failing to meet the standards. Regulation 41(4) requires every gas retailer and every gas wholesaler to ensure the gas it delivers at an end user's point of supply complies with the Gas Specification. Failure to comply with this obligation is a grade A offence and a body corporate may be liable to a fine of up to $50,000.

Upstream participants may be liable under contractual arrangements for failing to ensure all reticulated gas complies with the Gas Specification. However, usually the terms of the contractual arrangements include limitations on such liability. We discuss contractual obligations further in section 4.

2.2 Sources of non-specification gas

Production facilities

Production facilities can introduce non-specification gas into the transmission system. Either components of the gas composition can be out of range, or the gas can contain contaminants such as oil.

In terms of non-specification *composition*, the nature of the non-specification may be an out-of-range Wobbe Index; or a component, such as water, may be above the maximum limit. However, even if a

producer injects non-specification gas into the pipeline it may be diluted, resulting in the gas delivered to end users meeting specification.

Production facilities can also introduce gas with non-specification *contamination* into the transmission system. Liquid separators and filters are installed to reduce the amount of contaminants passing into a transmission system, but it is impossible to remove contaminants completely. Under normal operating conditions a small quantity of oil is expected to enter the pipeline. Applying the limit suggested in the Gas Specification (for compressor stations), up to 20 litres of oil is acceptable for every petajoule of gas entering the pipeline.

The performance of filters and separators is dictated by their design and maintenance. Inadequate sizing and poor maintenance can result in a much higher than expected amount of oil to flow into the pipeline. If the rate at which oil (or other contaminants) enters the transmission system is such that it affects the operation of equipment (such as regulators), then the gas is non-specification.

Pipelines

Once gas has entered the transmission pipeline its *composition* will normally not change. However gas pipelines can introduce contaminants into the gas stream in the form of dust from the pipeline and oil from compressor stations, adding to any contaminants that may have been introduced from production stations.

A 'black powder' dust can form in a pipeline throughout the pipe's life. The dust results from a chemical reaction between the iron in the steel and the hydrogen sulphide in the gas, forming iron sulphide. Dust and oil can be carried by gas as it is transported through the pipeline; but filters and separators installed at delivery points usually remove these contaminants, so the gas delivered from the transmission system is normally free[5] of them. However, dust and oil can build up in a pipeline over time then arrive as a 'slug', overwhelming the filters and allowing non-specification gas to enter the downstream network. This could occur when a cleaning pig is passed through the pipeline in preparation for an intelligent pig inspection. In this case, the contamination might originate from one or more producers (perhaps over the course of several years), but it is the TSO's pigging that causes non-specification gas to be delivered. A TSO can minimise this risk with on-going cleaning and pigging procedures to prevent excessive build-up of contaminants.

Distribution networks can also introduce contaminants such as construction dust and swarf. It is very unlikely that liquid contaminants such as oil would be introduced within the distribution network because these networks have no compressors. Similarly, it is very unlikely that black powder dust will form in any significant quantities because the pipelines are mainly polyethylene, and operate at much lower pressures than transmission pipelines.

[5] 'Free' here means in respect of the requirements of the Gas Specification.

In normal operation, it is highly unlikely for a TSO to cause non-specification *composition*. A change in composition could occur if, for instance, the pipeline was depressurised and air allowed to enter the pipeline. This is so unlikely that the possibility of a TSO causing non-specification composition is not considered in this paper.

2.3 Consequences of non-specification gas

The consequences of non-specification gas are varied and are dictated by the nature of non-compliance with the Gas Specification.

When the composition is outside the specification

Generally the effect of non-specification gas *composition* is to reduce the efficiency of end users' combustion equipment while the non-specification gas is present, with no long-term effect on equipment. However, in some instances sulphur has been deposited on gas burners and built up over time to have a longer-lasting effect on appliance performance.

Certain combustion equipment is sensitive to gas composition and may need to stop burning gas until the non-specification gas is purged from the system. At the extreme, the non-specification gas could cause significant safety concerns[6]. Gas flow to affected regions might have to be curtailed while the non-specification gas is purged from transmission and/or distribution systems.

Where gas is used as a feedstock[7] it is passed through catalyst beds. Such catalysts are suitable for a narrow range of gas composition and can be easily contaminated by non-specification gas.

When the level of contaminants is outside the specification

Contaminants are generally filtered out of gas as it passes into, or out of, the transmission system. In some circumstances contaminants may cause a blockage or malfunction of gate station equipment leading to a loss of supply into the downstream distribution network. At the extreme, a gate station regulator failure could cause a pressure collapse in the downstream distribution network. If this occurred at a major gate station such as Waitangarua (supplying Wellington), Wellington end users would be affected for many weeks while the system is purged and individual end users re-connected.

Where contaminants carry over into downstream networks they are generally filtered out before gas is delivered to combustion equipment. But if contaminants do pass through to combustion equipment they can affect the performance of the equipment (where oil is the contaminant), or may block gas jets and interrupt the equipment (where dust is the contaminant).

---

[6] Non-specification gas could cause a flame-out, which could result in the accumulation of unburnt gas. Poor combustion can also result in unflued heaters producing dangerous levels of carbon monoxide.

[7] In New Zealand, gas is used as a feedstock for the production of methanol, ammonia urea, and hydrogen peroxide.

Hydrate formation and sulphur deposition

Although water is not a contaminant *per se*, it can become a contaminant if hydrates are formed when high-pressure gas is depressurised through regulators. Depressurisation occurs at gate stations where gas leaves the transmission system and enters downstream networks. There are several well-documented cases of regulator blockages occurring at gate stations.

The TSOs require producers to monitor daily the water content of injected gas and do random spot checks. Potentially the TSOs could continuously monitor water content to reduce the risk of hydrate formation. As hydrate formation could cause the collapse of a major gas network, it could be argued that reasonable and prudent operators (RPOs) should continuously monitor water content. Section 6 of this paper further considers monitoring issues.

Sulphur deposition may also cause blockages at delivery points. Deposits are thought to occur through a desublimation process in the presence of liquid contaminants and certain pressure and temperature conditions[8].

Table 1 gives some examples of the effects of non-specification gas.

Table 1 Possible effects of non-specification gas

System or industry participant affected	Possible effects of non-specification gas
Transmission system	• corrosion of the transmission pipelines (usually caused by a combination of water and hydrogen sulphide, oxygen or carbon dioxide) • sulphur deposition on turbine meters leading to incorrect meter reading • formation of hydrides causing blockages in regulators
Distribution system	• blockage and malfunction of pressure regulators at gate stations or within distribution network leading to incorrect pressure and/or supply interruption • failure to detect leaks if odorant has been absorbed
End users	• shortened process heat exchanger life • increased emissions, reduced reliability/availability and decreased parts life in gas turbines • nuisance safety trips • failure to detect leaks if odorant has been absorbed • combustion problems, sooting, flame instability, flame-out, damage to process equipment • safety concerns from elevated levels of carbon monoxide from unflued heaters

[8] Pack, David J., *Elemental Sulphur: Formation in Natural Gas Transmission Pipelines*, School of Oil and Gas Engineering, University of Western Australia, 2005.

Q1: Are there any significant effects of non-specification gas, other than those identified in section 2.3, that Gas Industry Co should consider?

Quantifying the risks

The risks and costs from non-specification gas are difficult to quantify. However, a major regional interruption to gas supply could conceivably result in multi-million dollar losses. Losses could include lost revenue, costs associated with purging and re-commissioning the gas distribution networks, and costs to consumers for loss of gas supply and possibly damage to equipment. This paper has not assessed the likelihood of such an event, but based on anecdotal evidence, a major incident of this nature is conceivable.

2.4 Current gas quality monitoring arrangements

The Gas Specification requires gas composition to be monitored, but does not state who has this responsibility. It requires test methods and frequencies to be established that would result in a deviation from specification being detected with reasonable confidence. Appendix D of the Gas Specification suggests contractual arrangements cover the verification of composition. Maui Development Limited's (MDL) and Vector Limited's (Vector) interconnection agreements (ICAs) stipulate the frequency of monitoring of certain parameters.

All production stations use a gas chromatograph to measure gas composition for metering purposes. Chromatographs commonly measure methane to hexane, carbon dioxide, and nitrogen percentages, which are used to derive the density and Wobbe Index. The remaining gas composition values, as defined by the Gas Specification (such as water and sulphur), are measured at production stations. TSOs also measure gas composition for metering purposes, using gas chromatographs, at major metering and mixing points, such as Rotowaro and Faull Rd. We understand the TSOs carry out spot checks at gate stations for water content. The TSOs also receive and review gas quality data from the producers. Table 2 summarises the parameters currently monitored in New Zealand.

Table 2 Gas quality measurement in New Zealand

Parameter	Production plant	TSO (at strategic points)
Wobbe Index	Yes	Yes
Relative density	Yes	Yes
Oxygen	Yes	No
Hydrogen	Note 1	No
Hydrogen sulphide	Note 1	No
Total sulphur	Note 1	No
Water	Yes	Spot checks
Halogens	Note 1	No
Hydrocarbon dew point	Yes	No
Contaminants	No	No

Note 1: The need to test for these parameters arises from the likelihood the component exceeds the specification, as determined by the producer.

2.5 International comparison

The regimes in Denmark and in Victoria, Australia are considered relevant for making a useful comparison. They both have multiple gas sources giving rise to a co-mingled gas supply, gas volumes comparable to New Zealand's, and open access transport arrangements that are well described. Appendix B contains the full comparison, which is summarised below.

In Denmark the TSO is responsible for physically monitoring the gas quality (unlike in New Zealand or Australia). The costs of damages caused by non-specification gas where responsibility could not be attributed to a 'causer' are socialised.

In Victoria, the Victoria Transmission System is supplied by transmission pipelines delivering gas from remote fields. In New Zealand, by contrast, gas is injected directly into the transmission system by the producers (there is generally no intermediate TSO). Taking account of this difference, the responsibility for monitoring the gas quality essentially lies with the same party—the injecting TSO in Victoria and the injecting producer in New Zealand.

We note that in other regimes:

- where there is a grid operator (for example, Ireland and Holland, as well as Victoria), that operator is responsible for ensuring injection point gas flows are continuously monitored for compliance with the relevant gas specification; and

- the gas specification is almost entirely focused on gas composition, rather than contaminants, and the gas industry's concern is the interchangeability of gas sources with different characteristics.

2.6 Gas Industry Co's *Guidelines on Interconnection with Transmission Pipelines*

The *Guidelines on Interconnection with Transmission Pipelines*[9] presents Gas Industry Co's view on the features of good interconnection processes, and the scope and content of related documents. The Guidelines propose that all transported gas should comply with the requirements of the Gas Specification. The Guidelines suggest responsibility and liability at receipt and delivery interconnection points as set out below.

Receipt interconnection points

The injecting party should be responsible for:

- ensuring that the gas meets the requirements of the Gas Specification;
- ensuring design, maintenance, monitoring, and testing of the production facility and gas treatment equipment comply with the Gas Specification;
- reporting on its compliance with the Gas Specification to the TSO; and
- indemnifying the TSO for direct losses arising from non-compliance with the Gas Specification.

Delivery interconnection points

The TSO should be responsible for:

- ensuring the specification of transported gas is not materially affected by contamination from compressor oil or pipeline detritus (this includes having filtration to ensure pipeline contaminants are removed to a level that complies with the Gas Specification);
- advising the interconnected party of any event affecting its ability to supply specification gas; and
- indemnifying the interconnected party against any losses directly attributable to pipeline-borne contaminants, except where the interconnected party owns the filtration and liquid removal equipment.

[9] Available from Gas Industry Co's website: http://www.gasindustry.co.nz/work-programme/interconnection?tab=1715.

2.7 Summary

Whenever gas with non-specification *composition* is found, or can be inferred from its effects, one or more producers are almost certainly the causer(s). The effects of gas with non-specification composition include regulator blockages caused by hydrate formation or sulphur deposition. If all producers are monitoring their gas quality in line with the Gas Specification, it is likely, but not certain, the causing producer can be identified. Identification would be more likely if the Gas Specification or the TSO ICAs required continuous monitoring and disclosure of the information.

If gas has non-specification levels of *contamination*, identifying the causer can be difficult. It may be difficult to identify whether the contaminant (say oil) originated from a producer or from the TSO's compressor. Even if the contaminant originated from a producer, it doesn't necessarily follow that the producer is the causer—the TSO could be the causer because of how it operates the pipeline. For example, an unreasonable delay in using a cleaning pig could result in the filters being overwhelmed when the pipe is next cleaned. If the contamination is iron sulphide dust, it almost certainly formed in the transmission pipeline.

The non-specification type and potential causers are summarised in Table 3.

Table 3 Non-specification type and potential causers

Non-specification *type*	**Potential Causer**
Composition	Producer
Hydrate formation or sulphur deposition	Producer
Contamination: oil	Producer or TSO
Contamination: dust (iron sulphide)	TSO

Q2: Do you agree with the assessment of the types of non-specification gas and potential causer as set out in Table 3?

3 Regulatory objective

3.1 Overall context

The Gas Act and the GPS provide the policy context for the analysis of distribution issues in the gas industry.

Subpart 2 of Part 4A of the Gas Act provides for co-regulation of the gas industry by the Government and Gas Industry Co (as the approved industry body under 43ZL(1) of the Gas Act).

The Minister of Energy and Resources is responsible for the energy portfolio. The Minister monitors the performance of, and receives recommendations and advice from, Gas Industry Co. Responsibility for gas industry matters was transferred to the Associate Minister of Energy and Resources on 5 March 2009.

This section of the paper examines the context provided by the Gas Act and the GPS. It then sets out a proposed regulatory objective for work on gas quality.

3.2 Gas Act objectives

When recommending rules or regulations under the Gas Act, Gas Industry Co must have regard for the objectives set out in section 43ZN. In effect, these objectives also apply to other means of dealing with issues in gas governance.

The principal objective of Gas Industry Co in recommending gas governance regulations and rules is to:

> …ensure that gas is delivered to existing and new customers in a safe, efficient, and reliable manner.

The other objectives are:

- the facilitation and promotion of the ongoing supply of gas to meet New Zealand's energy needs, by providing access to essential infrastructure and competitive market arrangements; and
- barriers to competition in the gas industry are minimised;
- incentives for investment in gas processing facilities, transmission, and distribution are maintained or enhanced;

- delivered gas costs and prices are subject to sustained downward pressure;
- risks relating to security of supply, including transport arrangements, are properly and efficiently managed by all parties; and
- consistency with the Government's gas safety regime is maintained.

3.3 GPS objectives and outcomes

Objectives

The GPS requires Gas Industry Co to have regard to two further principal objectives—fairness and environmental sustainability—in all of its recommendations.

Gas Industry Co must also have regard to the other objectives set out in the GPS as follows:

- energy and other resources used to deliver gas to end users are used efficiently;
- competition is facilitated in upstream and downstream gas markets by minimising barriers to access to essential infrastructure to the long-term benefit of end users;
- the full costs of producing and transporting gas are signalled to end users;
- the quality of gas services where those services include a trade-off between quality and price, as far as possible, reflect customers' preferences; and
- the gas sector contributes to achieving the Government's climate change objectives as set out in the New Zealand Energy Strategy, or any other document the Minister of Energy and Resources may specify from time to time, by minimising gas losses and promoting demand-side management and energy efficiency.

Outcomes

The GPS sets out specific outcomes Gas Industry Co is expected to pursue through its work programme. The outcomes relevant to gas quality cover those for an efficient retail market, and access to key infrastructure.

Outcomes for an efficient retail market are:

- an efficient market structure for the provision of gas metering, pipeline, and energy services; and
- a clear understanding of the respective roles of gas metering, pipeline, and gas retail participants.

Outcomes for access to key infrastructure are:

- gas industry participants and new entrants are able to access ….distribution pipelines…. on reasonable terms and conditions; and
- consistent standards and protocols apply to the operations relating to access to all distribution pipelines.

3.4 Proposed regulatory objective

From the above, it is apparent that resolving gas quality issues is not specifically mentioned as an objective in section 43ZN of the Gas Act or in the GPS. However, Gas Industry Co may consider whether the terms and conditions regarding gas quality in industry arrangements are reasonable in relation to terms and conditions for transmission or distribution pipeline access arrangements (see section 45F(2)(c)) and for retail arrangements (see section 43G(2)(h)).

Any changes considered must be consistent with, or underpin, one or more of the following objectives:

- gas is delivered to existing and new customers in a safe, efficient and reliable manner (section 43ZN(a));
- the facilitation and promotion of the ongoing supply of gas to meet New Zealand's energy needs, by providing access to essential infrastructure and competitive market arrangements (section 43ZN(b)(i));
- barriers to competition in the gas industry are minimised (section 43ZN(b)(ii)); and
- risks relating to security of supply, including transport arrangements, are properly and efficiently managed by all parties (section 43ZN(b)(v) and GPS).

From the above, we propose the following regulatory objective for gas quality:

> To ensure industry arrangements include reasonable terms and conditions regarding gas quality that: allow for the safe, efficient, and reliable delivery of gas; and provide for risks to be properly and efficiently managed by those parties best able to manage such risks.

The wording of the proposed regulatory objective is non-technical, but to help explain its meaning, below is Gas Industry Co's view on what 'safe', 'efficient', and 'reliable' mean in this context.

Safety and reliability

Aspects of supply that relate to safety and to reliability are generally closely interdependent. For example, excursions from gas quality standards can affect both the safe and reliable operation of a gas

appliance. For the purpose of this paper, the key aspects of a safe and reliable gas supply are as follows.

- composition: maintaining the burning characteristics of the gas within a defined range, as specified by the Gas Specification.
- Contaminant levels: restricting the levels of particles of liquid (condensates) and dust.
- Continuity of supply: avoiding interruption to supply.

Efficiency

We believe each conception of efficiency—productive, allocative, and dynamic—is relevant.

The productive efficiency of gas quality arrangements refers to providing best practice arrangements at least cost. Allocative efficiency refers to providing gas quality arrangements that would emerge in a competitive market where end users respond to prices that reflect costs. Dynamic efficiency recognises the importance of innovations in technology in providing allocative and productive efficiency over time. There can be tensions between these conceptions of efficiency.

For gas quality we would expect efficiency to be evidenced by the following:

- clarity of roles, rights and obligations;
- obligations met at least cost;
- as far as possible, parties should be responsible only for risks they can manage;
- parties most able to control the risk should be responsible for providing the mitigation;
- accountability for damage caused by a gas quality issue, provided the causer can be identified;
- where the causers cannot be identified, or the costs of doing so are disproportionate to the benefit, all potential causers should meet the costs of any damage caused; and
- minimal restrictions to adopting new monitoring, control, and mitigation technologies.

Q3: Do you agree with the proposed regulatory objective? If you disagree please explain why and/or provide an alternative.

4 Current gas quality arrangements

This section summarises the current contractual obligations in respect of gas quality. Section 5 summarises relevant statutory obligations.

4.1 Overview of contractual arrangements

In New Zealand, interconnection, gas transport, and gas sales contracts are separate, but retailers typically provide a bundled 'delivered gas' product to their mass-market users.

Interconnection agreements

ICAs deal with issues arising from the physical interconnection of assets, and the physical transfer of gas between the interconnected parties—the 'asset owners'. ICAs are in place at all transmission receipt points. They are also usually in place at delivery points supplying major users who are directly connected to a transmission pipeline—direct supply users (DS Users). However, ICAs are not commonly in place:

- at gas gates supplying distribution networks;
- between the network system owner (NSO) and the owners of downstream gas measurement systems (GMSOs); and
- between GMSOs and mass-market end users (MM Users).

In summary, ICAs are generally present upstream of transmission systems, and generally absent downstream of transmission systems. Figure 1 shows where ICAs are present.

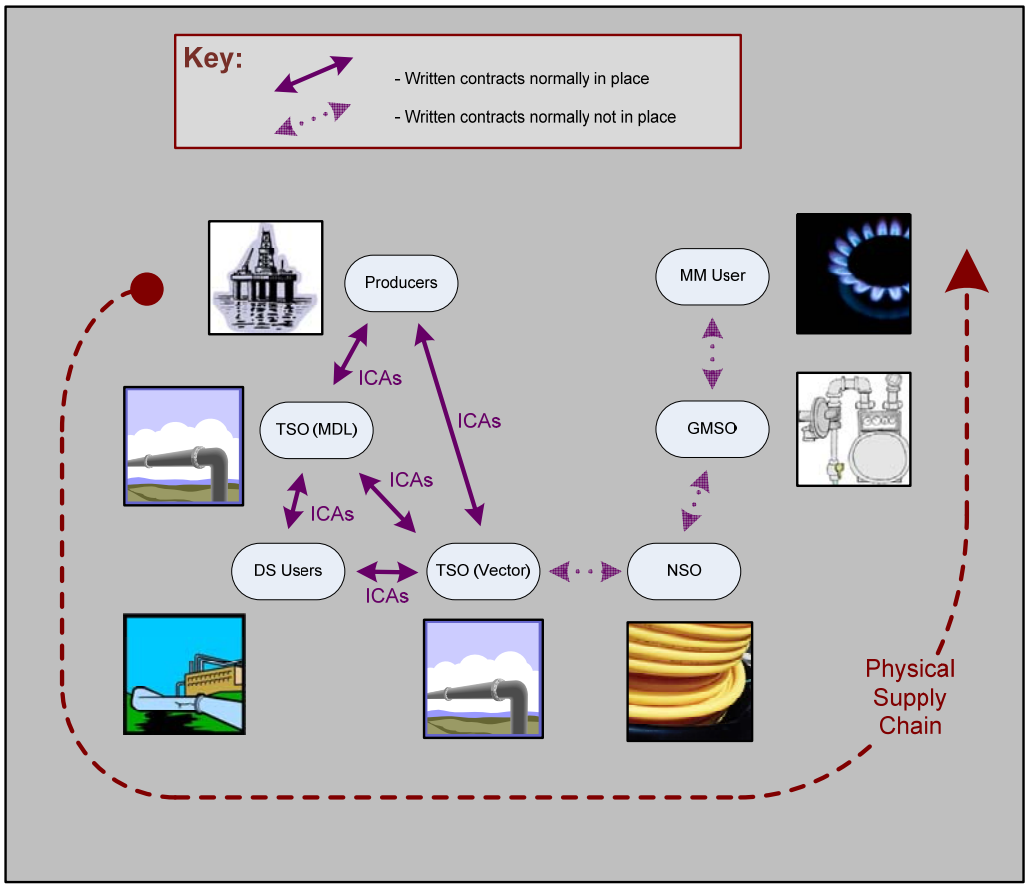

Figure 1 Interconnection agreements (ICAs)

Transport agreements

Transport contracts include transmission services agreements (TSAs), and network services agreements (NSAs). Although end users may make their own transport arrangements, commonly it is retailers who contract to have gas transported. Transport contracts deal with such matters as where the gas is to be received and delivered, and in what quantities. Figure 2 shows where transport agreements are present.

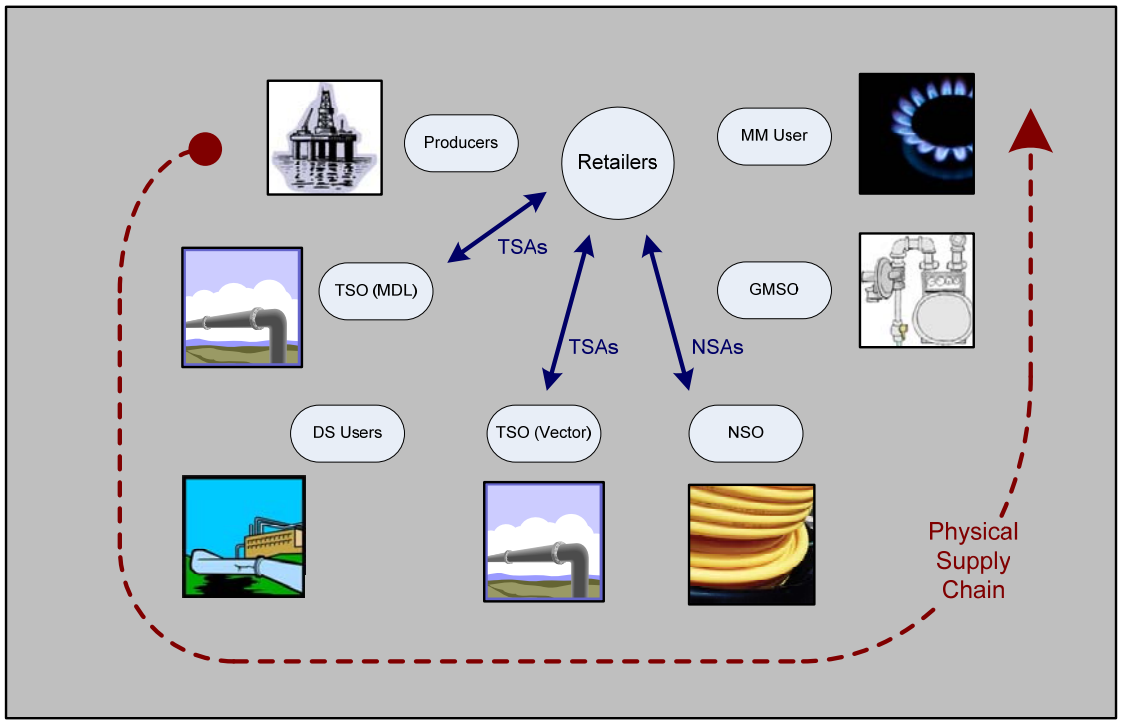

Figure 2 Transport agreements (TSAs and NSAs)

Gas sale agreements

Gas sale agreements (GSAs) deal with the purchase or sale of gas. Although end users may buy their own gas, generally it is retailers who contract to buy gas from producers, and sell it to end users. GSAs deal with such matters as where the gas is to be bought or sold, and in what quantities. These matters might sound similar to those the ICAs deal with—and they can overlap to an extent—but ICAs are concerned with aggregate physical flows at a location, whereas GSAs are concerned with individual retailer contract entitlements. For example, a producer who contracts to sell gas to several retailers at a single point will have GSAs with different retailers (and each GSA may have different terms and conditions); but this producer will have only one ICA at that location. Figure 3 shows where gas supply agreements are present.

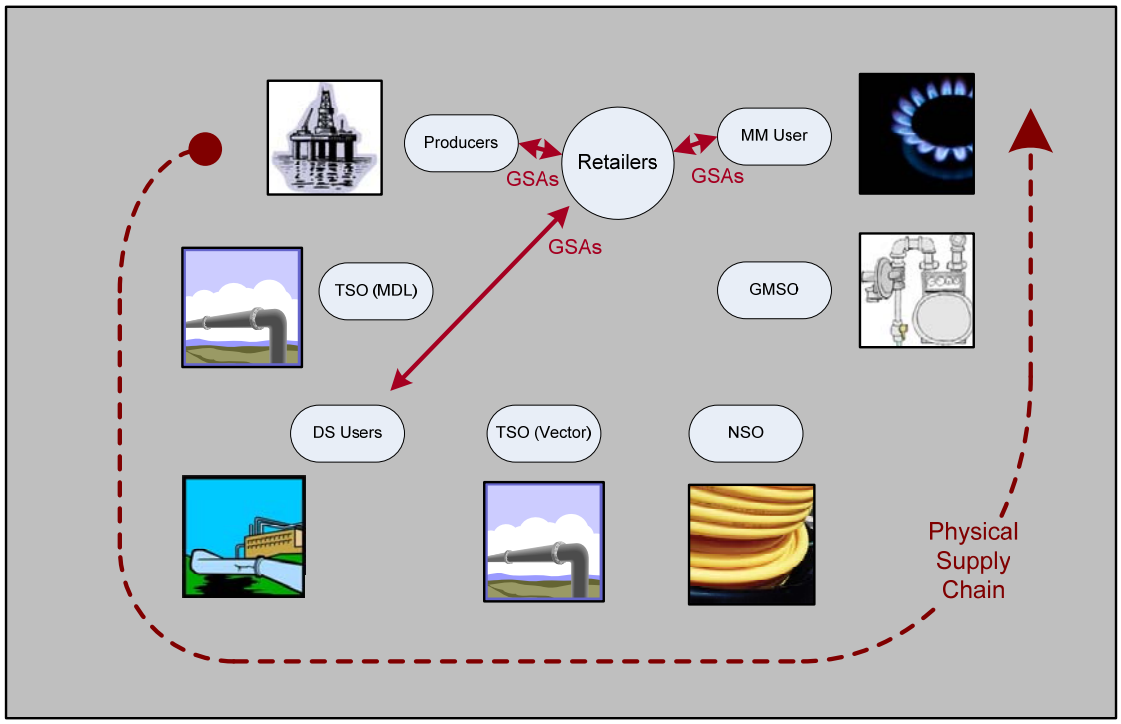

Figure 3 Gas sale agreements (GSAs)

Industry codes

Figures 2, 3 and 4 show the potentially large number of transactions required to deliver gas from a producer to an end user, especially where gas flows from one transmission system to another and back again.

The Gas Specification is referenced by various agreements and codes including:

- *Maui Pipeline Operating Code* (MPOC) and associated ICAs and TSAs;
- *MDL Agreement for Establishment of Interconnection Points;*
- *Vector Transmission Code* (VTC);
- *Vector Interconnection Agreement for Receipt Points and Delivery Points;*
- Wholesale gas sale agreements (wholesale GSAs);
- Retail gas sale agreements (retail GSAs); and
- Network service agreements (NSAs).

We have performed a high level review of the provisions for gas quality and liability for non-specification gas within industry codes and contracts. A summary of the key findings of our review is given below. However, the complexity of the provisions for gas quality in the codes and agreements reviewed makes it difficult to accurately describe and identify every possible outcome, so some arrangements have been simplified or omitted for clarity. We encourage submitters to provide further clarification on any contractual obligations or other aspects of our findings.

4.2 MPOC (including ICA and TSA)

The MPOC requires each direct injecting party to ensure injected gas complies with, and is monitored in accordance with, the Gas Specification. The injecting party is also required to ensure the same obligations apply to any indirect injecting party[10]. Injecting parties are required to notify MDL of any non-specification gas, and MDL is in turn required to notify other affected parties. Section 17 of the MPOC requires direct injecting parties to monitor gas quality as shown in Table 4.

Table 4 MPOC requirements for gas quality monitoring

Gas quality component	Required monitoring
Wobbe Index and relative density	Continuous
Water content and hydrocarbon dew point	As required, but at least daily
Hydrogen sulphide and total sulphur	As required, but at least quarterly
Oxygen	Continuous
Halogens and hydrogen	As required, but at least quarterly

Notes: The frequency of inspection may be relaxed in some circumstances, but must still comply with the Gas Specification.

If an injecting party injects non-specification gas or fails to meet the monitoring requirements, that party is exposed to potential liability claims. Injecting parties indemnify MDL for any losses incurred as a result of non-specification gas injections. MDL indemnifies other pipeline users for losses they incur as a result of non-specification gas being injected.

Parties are not liable if they performed their contractual obligations to a RPO standard. Liability is capped and limited to direct losses and any damages made or money paid to a third party.

4.3 MDL's *Agreement for the Establishment of Interconnection Points*

MDL's *Agreement for the Establishment of Interconnection Points* covers the design, construction, and commissioning of new interconnection points. This agreement extends the gas quality provisions of

[10] Section 17.1 of the MPOC defines a 'Direct Injecting Party' as a party who injects gas into the Maui Pipeline directly from a gas production or processing facility. An Indirect Injecting Party is a party who injects gas into a transmission pipeline that then flows into the Maui Pipeline.

the MPOC to the commissioning and testing period—that is, any gas injected during testing must comply with the gas specification.

4.4 Vector Transmission Code

Section 12 of the VTC stipulates that ICAs must require injecting parties to:

- comply with the Gas Specification;
- demonstrate that facilities, systems, and procedures comply with obligations to inject only specification gas; and
- notify Vector of any injection of non-specification gas (Vector in turn must notify other affected parties).

Vector is not obliged to monitor gas quality. However, if Vector caused gas to become non-specification gas, and did not act as a RPO to comply with a TSA, it is liable for direct losses. Its liability is capped.

Vector indemnifies shippers for any loss they might incur as a result of taking non-specification gas. If third parties contribute to a breach of gas quality standards, Vector's liability is limited to the amounts recovered from those liable third parties plus any liability attributed to Vector.

A reasonable endeavours obligation to avoid step changes to gas composition applies under the VTC.

4.5 Vector interconnection agreement

Vector's standard receipt point and delivery point ICAs contain provisions relating to gas specification.

Receipt point

Under a receipt point ICA, injecting parties must:

- comply with the Gas Specification;
- demonstrate that facilities, systems, and procedures comply with obligations to inject only specification gas;
- terminate the flow of non-specification gas if it is detected; and
- use reasonable endeavours to avoid step changes to gas composition.

If Vector suspects that gas being supplied is non-specification, the interconnected party must promptly investigate. If the gas is non-compliant, Vector must terminate flow.

The receipt point ICA specifies the frequency with which a party must monitor gas quality. The frequency of monitoring is the same as that required by the MPOC. The ICA also requires continuous monitoring of temperature.

Vector is not obliged to monitor gas quality at receipt points but may request gas monitoring data from the interconnecting party.

Delivery point

Vector is not required to monitor gas quality and is not liable to the interconnected party for any non-specification gas delivered.

Written ICAs with interconnected distribution networks are not normally in place, although we understand that customary arrangements exist.

4.6 Wholesale GSA

Wholesale GSAs apply where a gas retailer purchases gas from a producer (or, occasionally, a wholesaler). These contracts are confidential but we understand typical provisions relating to gas quality are as follows.

Gas quality is specified by referring directly to the Gas Specification or to the gas quality requirement of the relevant transmission code. The point of sale will be a transmission receipt point where gas from either a gas treatment plant or an upstream transmission pipeline is injected into a transmission system. The seller passes title to the gas at the time of delivery.

The agreements include liability provisions if the seller supplies non-specification gas. However, it is likely that a wholesaler would claim that such an occurrence was beyond its reasonable control, and so seek to avoid all liability.

4.7 Retail GSA

The standard residential and commercial retail GSAs have arrangements for gas quality and associated liability. The terms and conditions generally state that the quality of the service will comply with applicable statutes and regulations and exclude liability for events outside the retailer's control.

Typically retail GSAs do not offer any form of compensation in relation to loss of gas supply (for example, following a gas quality incident) and most GSAs include provisions that significantly limit the retailer's liability. However, some retail GSAs provide for the retailer to pass money recovered from a

network operator (or other person) to end users who have suffered loss from an interruption, variation, or failure of supply.

4.8 Network service agreements

Three NSOs offer open access to their networks: Vector, Powerco, and GasNet. NSAs generally provide that only specification gas is transported through the network. Powerco and GasNet NSAs provide for non-specification gas to be transported if all retailers agree and the requesting retailer indemnifies the NSO against claims from others.

The NSO may shut off injection points where the gas supplied is non-specification. The exception is if an agreement has been reached for the transport of non-specification gas and the gas is safe to use.

Liability is limited to direct losses or damage to physical property where the loss has been caused by a breach of the agreement, and excludes events beyond the NSO's reasonable control.

4.9 Summary of contractual arrangements

With a few exceptions, the approach taken by the various TSOs, NSOs, retailers, and wholesalers is consistent. The Gas Specification is consistently referred to as the 'standard' for gas quality in New Zealand. The MDL and Vector agreements make the injecting party responsible for monitoring and ensuring gas quality. This responsibility is either direct or indirect. An indirect responsibility arises if the injecting party is another TSO who has had gas injected into its pipeline by a producer. The producer then has the indirect responsibility for ensuring gas quality.

In general, most of the contractual arrangements seek to significantly limit liability, including for gas quality related incidents. The analysis in sections 6 and 7 suggest the arrangements do not meet the proposed regulatory objective in all respects.

Figure 4 summarises the web of contractual relationships.

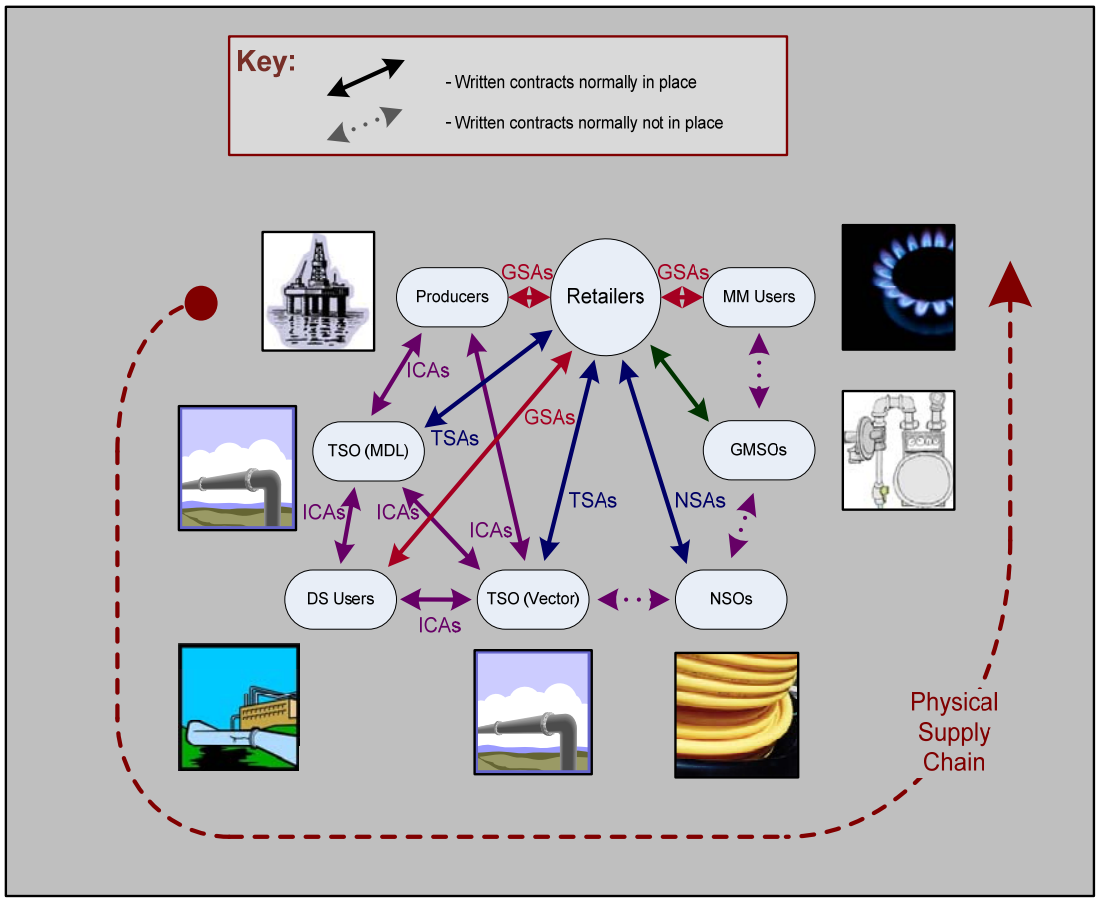

Figure 4 Web of contractual relationships

Q4:	*Do you agree we have interpreted the provisions contained within the transmission codes and contracts correctly? Are there additional contracts or provisions that should be considered?*

5 Regulation relevant to gas quality

5.1 Gas Act 1992 and Gas (Safety and Measurement) Regulations 2010

In the introduction we described how aspects of gas quality are regulated under regulations and standards passed under the Gas Act (see section 1.2 on page 1). Under the Gas (Safety and Measurement) Regulations 2010 (the Regulations) all reticulated natural gas must comply with the NZ Standard 5442: 2008 (the Gas Specification). (See section 2.1 on page 4.)

In respect of the Gas Specification, the Regulations provide that the retailer or wholesaler supplying gas to the end user's point of supply is responsible for ensuring the gas complies with NZS 5442 (regulation 41(4)). Failure to meet this obligation is a 'grade A offence' (regulation 41(5)), which would expose the company responsible to a fine not exceeding $50,000 (regulation 6).

In respect of continuity of supply and safety (which may be threatened by gas specification issues among other reasons), every owner and operator of the distribution system is responsible for the design, construction, maintenance, and operation of the distribution system (regulation 26(1)). Failure to meet this obligation is a 'grade A offence' (regulation 26(4)), which would expose the company responsible to a fine not exceeding $50,000 (regulation 6).

5.2 The Commerce Act 1986

The Commerce Act 1986 (the Commerce Act) prohibits a range of anti-competitive practices and also specifically regulates certain aspects of the gas industry. Heavy penalties can attach to breaches of the Commerce Act.

The sections in the Commerce Act prohibiting anti-competitive practices offer light-handed regulatory protection. These provisions prevent TSOs and distributors from taking advantage of market power and help encourage reasonable terms and conditions in industry arrangements. Broadly they apply to all open access contractual pipeline arrangements, including those for gas quality.

Many gas pipelines are also subject to industry-specific regulation. A new regime is soon to come into effect that recognises that price and service quality are inextricably linked. From 1 July 2012, gas pipeline services will be subject to price-quality regulation under Part 4 of the Commerce Act. The Commerce Commission's paper *Initial Default Price Quality Path for Gas Pipeline Businesses – Issues*

Paper 12 April 2010 (the DPP Issues Paper) notes that issues of gas quality may be relevant to the setting of the price-quality regulation.

The DPP Issues Paper noted that relevant measures for the quality of supply for gas services fall into four broad categories—reliability, system integrity, quality of gas, and customer service. The 'quality of gas' measure is described in the paper as indicators the delivered gas is to the right quality, free of contaminants, and at the appropriate pressure. Quality here relates to maintenance of quality during transmission or distribution.

Responses to the DPP Issues Paper have generally not supported 'quality of gas' being included as a regulated quality measure in the default price-quality path. Instead, submitters suggest the Commission should focus on system integrity and reliability. However, two submitters have noted the possibility for quality of gas issues to be monitored through information disclosure. Submitter feedback suggests injecting parties should have the primary obligations.

The Commerce Commission's concern is different from Gas Industry Co's focus. The Commission aims to ensure that, where there is little or no competition, the quality of services reflects end user demands (see section 52A of the Commerce Act). Gas Industry Co's interest is whether the industry arrangements are reasonable in their approach to gas quality (see section 43F and 43G of the Gas Act). However, it remains important the two regulators are consistent when proposing changes to the terms and conditions of transmission or distribution pipeline access arrangements. Gas Industry Co will maintain a good level of communication with the Commerce Commission. Helpfully, the legislative arrangements require the Commerce Commission to take into account relevant gas governance regulations, rules, or guidelines (see section 55I of the Commerce Act).[11]

5.3 Consumer Guarantees Act 1993

Under the Consumer Guarantees Act 1993 (the CGA), consumer[12,13] rights are expressed as a series of 'guarantees' that a seller automatically makes when a consumer buys goods or services. Amendments to the CGA in 2003 provide for the supply of gas to be included as a good and a contract for the

---

[11] Section 55I Impact of certain decisions made under Gas Act 1992
(1) The recommending body must advise the Commerce Commission as soon as practicable after making any recommendation for a gas governance regulation or rule under Part 4A of the Gas Act 1992, or after making any decision under gas governance regulations or rules, or after issuing any guidelines, that is or are likely to be relevant to the powers of the Commerce Commission under this Part.
(2) The Commission must take into account, before exercising any of its powers under this Part,—
(a) any gas governance regulation or rule under Part 4A of the Gas Act 1992, or decision under those gas governance regulations or rules, that relates to or affects the quality standards or pricing methodologies applicable to a pipeline owner:
(b) any guidelines issued by the recommending body of which it is advised under subsection (1) that are likely to be relevant to the powers of the Commerce Commission under this Part:
(c) the levy payable by any pipeline owner under the Gas Act 1992.

[12] 'Consumer' under the CGA means a person who (a) acquires from a supplier goods or services of a kind ordinarily acquired for personal, domestic, or household use or consumption; and (b) does not acquire the goods and services, or hold himself or herself out as acquiring the goods or services, for the purpose of (i) resupplying them in trade; or (ii) consuming them in the course of process of production or manufacture; or (iii) in the case of goods, repairing or treating in trade other goods or fixtures on land. The CGA does not apply tp business transactions.

[13] Note that the Consumer Guarentees Act 1993 is currently under review as part of the Government's Consumer Law Reform.

supply of gas to be included as a service. As a result, the sale of gas to consumers must comply with the guarantees. For example, sale of gas to consumers must comply with the 'acceptable quality' guarantee in the CGA. 'Acceptable quality' means gas supplied to consumers must be, for example, fit for purpose and safe. If gas doesn't comply, consumers could have a right of redress against the supplier (that is, the retailer) and against the 'manufacturer' (that is, the producer).

Whether consumers have a right to redress for poor quality gas under the CGA is determined case by case. Acceptable quality is a context-specific guarantee. It is unlikely consumers have a right to redress in all circumstances where they are affected by gas supply issues. For example, under most NSAs, most consumers have been specifically informed upstream events can interrupt supply (and consumers arguably have accepted this risk when they agree to purchase). However, if the right to redress is granted, it will cover redress only to the consumer—it would not, for example, give a right of redress to a retailer or distributor against a producer.

6 Discussion of potential issues

6.1 Liability for non-specification gas

Review of current liability arrangements

We consider the regulatory objective proposed in section 3.4 would be met by reasonable terms and conditions that would appropriately pass liability for losses to the causer. However, the nature of the supply chain, coupled with the transport of co-mingled gas, result in situations where the causer of a gas quality issue may have no direct contractual relationship with an affected party. Without appropriate back-to-back arrangements situations can arise where these missing links result in poor outcomes, suggesting the arrangements for the monitoring of gas quality and liability for gas quality issues need further consideration.

Examples of how liability for non-specification gas may be treated

At face value, the web of contractual arrangements appears to allow for several routes to carry liability back through the contract chain to the party who (say) injected non-specification gas that caused damage to an end user. Two possible scenarios are discussed below and illustrated in Figure 5 .

In Scenario 1, Producer 1 injects non-specification gas into the pipeline and a DS User suffers damage as a result. The DS User claims damages through its ICA with the TSO, who in turn claims damages through its ICA with Producer 1.

In Scenario 2, it is also Producer 1 who injects non-specification gas into the pipeline, but this time it is an MM User who suffers damage as a result. A possible sequence of claims is as follows.

1. The MM User claims damages through its GSA with its retailer.
2. The retailer claims damages through its TSA with one TSO.
3. That TSO claims damages through its ICA with the other TSO.
4. The other TSO claims damages through its ICA with Producer 1.

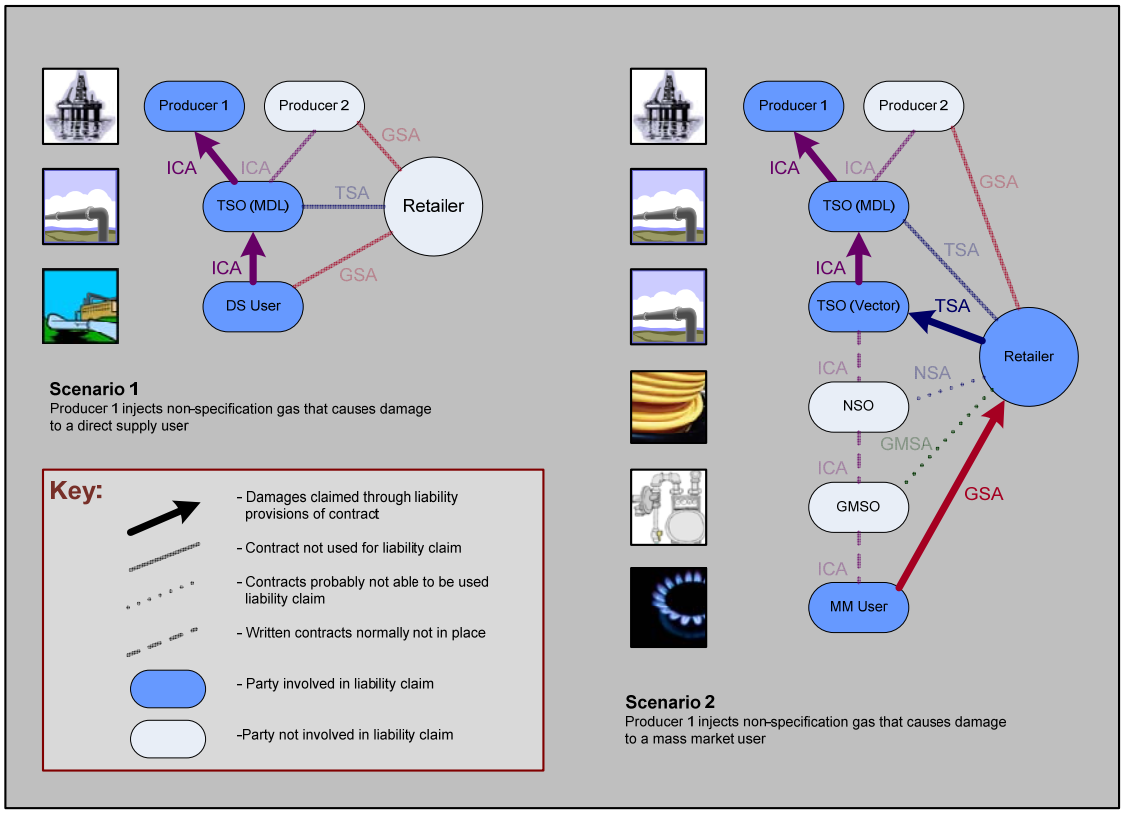

Figure 5 Examples of how liability for non-specification gas may be treated

Discussion

The examples are simplistic because they assume the causer can be identified, and only one party claims damages. In practice (for example, after a significant gas quality incident) several parties are likely to be damaged, and the causer may not be identified.

Also, even where the damage is demonstrable, and the causer readily identified, a chain of contractual culpability between the end user and the causer would not necessarily be clear and the contracts often limit or exclude liability for damage. For example, in Scenario 1, the TSO could potentially claim:

- *force majeure* for the duration of the non-specification event; or
- it acted as an RPO, despite the delivery of non-specification gas, and was therefore not liable; or
- the losses were not 'direct losses', and 'indirect losses' are excluded in the contract.

Similarly, in Scenario 2, the retailer would likely claim it was unable to control gas quality, and was therefore not liable under its retail contract[14].

In these scenarios the non-specification gas has a direct effect on the end user(s). If contaminated gas, or gas with hydrate-forming quantities of water, blocks the regulators in a gate station the effect is a loss of gas supply. The loss of supply could be wide spread and for a prolonged period.

The chain of contractual culpability is again unclear especially in respect of losses faced by the NSO. The retailer would likely claim it was unable to control gas quality, and was therefore not liable to the end users under its retail contract. Also, the contracts generally exclude all or most of the retailer's liability. That said, it is acknowledged that in practice some retailers may opt to give some form of compensation, even if not required to by the contract. For example, the retailer may want to protect their relationship with the customer. However, in such circumstances compensation is not assured.

Contamination may also cause damage to distribution system equipment but have no effect on the end user(s). Where no ICA exists between the TSA and NSO there is no contractual means of recovering the NSO's losses. Relying on other causes of action will likely be contentious, and the certainty of a successful outcome (although not considered here in detail) is considered insufficient to achieve the proposed regulatory objective.

Gas Industry Co acknowledges that some consumers and participants may be able to insure against gas quality losses. However, we consider it more reasonable for liability to fall on the causer or party best able to monitor the risk than to require all other participants to insure against a risk they have little ability to mitigate. This is especially so considering the Regulations require all gas in transmission and distribution networks complies with the Gas Specification.

Conclusion

From the above, it is clear that any compensation for damages resulting from non-specification gas in the pipeline is likely to be insufficient and the outcome of any claim somewhat uncertain. Although some residential consumer rights are protected by the CGA, these rights may be insufficent and the uncertainty for other market participants suggests that they may be over-insuring to cover the possible outcomes of a non-specification gas event. Such over-insurance would be inefficient.

In summary, damages resulting from a non-specification gas event may not be recoverable because:

- the causer cannot be identified;

[14] In this situation the retailer would have breached the Regulations by supplying non-specification gas (see section 5.1). However such a breach only exposes the retailer to a fine ,which would be paid to the Crown rather than to the consumer. The retailer may also be found responsible under the CGA for any damage sustained by residential users.

- the cost of legal action may be prohibitive (negligence claims in particular can be difficult to substantiate and costly to pursue);
- some contracts limit the service provider's liability entirely, and others limit it to cases of:
    - wilful default;
    - negligence;
    - failure to act as an RPO;
    - matters within the direct control of the service provider; and
- the gaps in contractual arrangements (for example, no ICAs at key interconnection points)

In addition, some of the contractual arrangements attempt to restrict the ability of the parties to bring claims in negligence.

Q5:	*Are there any aspects of the discussion in section 6.1, that you believe to be inaccurate or misleading? If so, please explain what these are.*
Q6:	*Do you consider that liability for quality issues is best addressed through contractual arrangements or regulation? Please explain why.*

6.2 Monitoring requirements

Gas composition

The Gas Specification does not prescribe the monitoring frequency, test method, or responsibilities for monitoring gas quality. Appendix D of the Gas Specification suggests contractual arrangements should cover matters concerning verification of composition. The MPOC and Vector Receipt ICAs make producers responsible for monitoring, and specify testing frequencies for several gas composition parameters.

Several important composition parameters, including water, are not required to be monitored continuously in New Zealand. The consequence is an increased risk of failure to detect the presence and source of non-specification gas. An analysis of the costs and benefits of contractual arrangements introducing continuous monitoring for all production stations is outside the scope of this paper but appears to warrant further consideration.

Gas contaminants

New Zealand has no requirement to monitor contaminants. Identifying the source of contamination can be challenging because measuring contamination on a continuous basis is difficult. Most methods for measuring contamination rely on collecting a sample of gas and analysing it for particles or liquid droplets. However sampling is an ineffective means of detecting non-specification contamination that is likely to be caused by a short duration surge in contamination levels. In some cases, liquid contaminants can be traced to a producer by matching oil types, but this test can be inconclusive.

A non-specification level of oil carry-over from a production station may occur if the separator operates incorrectly or is inundated by a large slug of oil. If the separator liquid level is continuously monitored, it should be possible to detect upset conditions that could lead to a non-specification level of oil carry-over. The producer responsible for the contamination could then be traced.

Q7: Do you think the proposed regulatory objective would be better achieved with more prescriptive arrangements for the monitoring of gas composition and contaminants?

Q8: Do you think further work to identify the options for more active gas quality monitoring, and to quantify the costs and benefits of those options, is justified?

6.3 Monitoring responsibilities

Gas composition

Assessing which elements of gas quality are likely to deviate from the Gas Specification requires an understanding of the characteristics of the supplying wells and the design of the processing facility. Applying the regulatory objective proposed in section 3.4, the party best placed to design and operate the monitoring system is the producer. This is consistent with the VTC and MPOC.

However, making producers responsible for monitoring could cause concern. Problems with gas composition are most likely to arise at the gas treatment stage, yet the producer is responsible for treatment and monitoring (in other words the producer would be monitoring itself). The TSOs can audit the producers under their ICAs, which mitigates this concern to an extent. The TSOs also directly monitor and measure gas composition to obtain the calorific value of gas in various parts of the transmission system. The TSOs' gas chromatographs are located at strategic points throughout the transmission system. However, the TSOs' focus is on calculating the calorific value (for metering purposes) so not all aspects of gas quality are measured, notably, water and sulphur.

Water content, which can lead to hydrate formation, should arguably be treated differently from other composition parameters. Although a TSO does not cause high water content, the risk and effects of hydrate formation can be influenced by the design of gate stations (for example, whether there are standby regulator streams and the degree of pre-heating before the pressure reduction). If the TSO

were to continuously monitor water, the risk of failure because of hydrate formation would reduce. TSOs could achieve continuous water monitoring by installing equipment at strategic points, or by specifying that all producers continuously monitor water content.

In Victoria, the Australian Energy Market Operator (AEMO) prescribes the monitoring requirements in detail but the party connected to the AEMO's system is responsible for carrying out the monitoring. In Denmark, Energinet.dk (the system owner) owns and operates the monitoring equipment at the interconnection points.

Although open access pipelines in New Zealand have System Operators (SO) who operate the pipeline on a day-to-day basis, the SOs have no direct responsibility for gas quality. This differs from many other regimes where the SO is a regulated role responsible for managing the quality and quantity of gas within the transport system.

Gas contaminants

We do not know the extent to which producers and TSOs monitor compressor oil use and the operating performance of separators, but we understand this monitoring to be *ad hoc*. The adequacy of contractual arrangements in meeting the proposed regulatory objective appears to warrants further review.

Applying the proposed regulatory objective in section 3.4, our initial view is that the owners of the compressor and separator facilities should be responsible for monitoring this equipment. The TSO should also have ready access to the monitoring carried out by the producers so that it can effectively respond to incidents such as increased oil carry-over into the pipeline.

Little information was available on contamination monitoring arrangements in overseas regimes. In Victoria, the AEMO specifies that facility operators must record compressor oil usage.

Discussion

The current arrangements for monitoring gas quality are summarised in Table 5.

Table 5 Current monitoring responsibility

Non-specification *type*	**Potential causer**	**Monitoring party (current)**
Composition	Producer	Producer, audited by TSO TSO for metering purposes, and *ad hoc* water tests
Contamination: oil	Producer or TSO	TSO and producer (partial)
Contamination: dust	TSO	TSO (through maintenance inspections)

The current monitoring arrangements are generally consistent with the objectives outlined in section 3. However, the review raises questions about the reasonableness of current industry arrangements in relation to the adequacy of:

- the monitoring of liquid separators at producer facilities and TSO compressor stations;
- oil consumption monitoring by TSOs; and
- water tests by the TSO, that is, whether *ad hoc* water tests are sufficient.

Q9: Do you think TSOs should monitor gas quality more actively (for example, by continuously monitoring the water content in the transmission system to manage the risk of hydrate formation)?

Q10: Currently, the TSOs audit producers' monitoring of gas composition. Do you think this arrangement provides sufficient assurance against the delivery of non-specification gas?

7 Conclusions

7.1 Overview

In developing this paper the Gas Industry Co has identified several areas in which the current industry arrangements appear to be inadequate to meet the objectives of the Gas Act and GPS and the proposed regulatory objective (section 3.4). The New Zealand arrangements also appear to fall short of arrangements in place in similar markets overseas.

Our review has identified three main areas where gas quality arrangements may not be consistent with the proposed regulatory objective:

- the contractual arrangements for monitoring whether delivered gas conforms to the Gas Specification;
- the gaps in the contractual arrangements for aligning liabilities and indemnities; and
- the lack of gas quality procedures.

We discuss these issues below and suggest questions that could be usefully explored in future work. We also note some findings relevant to MED for a future review of the Gas Specification.

7.2 Contractual arrangements

Gas Industry Co considers the proposed regulatory objective would best be met by provisions that pass liability for losses/damage caused by gas quality-related issues to the causer of the issue or to those participants best able to manage such risks. However, there appears to be many situations where compensation for gas quality losses may not be recoverable and liability can not be passed back to the causer or parties best able to manage the risk.

These situations arise because there are gaps in the industry arrangements (for example, no ICA at key interconnection points). Where there are industry arrangements, the agreements limit liability for damage.

Provisions limiting liability for gas quality-related events appear in contracts for interconnection, transportation, and gas supply. The provisions are not entirely consistent. To the extent liability is included it is generally limited to matters within the direct control of the service provider, creating an environment where the ability of participants to be compensated for damage is constrained. The availability of compensation will be further constrained when the causer cannot be identified.

Contracts do not differentiate between non-specification composition, which cannot be caused by the TSO, and non-specification contamination, which can be caused by the TSO.

One gap in the contractual arrangements is the lack of an ICA at some delivery interconnection points. Where there is no ICA Vector has no contractual liability for damages to the NSO caused by non-specification gas. Liability might arise from other causes of legal action, such as negligence, but negligence may be difficult to prove. This issue could be resolved if Vector and the NSOs progress the development of ICAs for their interconnection points. The relevant terms and conditions of the ICAs would depend on the approach for dealing with *composition*-related losses[15], when the causer cannot be identified.

7.3 Monitoring arrangements

The review found the current arrangements, where the producers monitor the gas composition, are logical if the TSOs actively audit the producers (as provided for by the ICAs). The review also questioned whether, reasonable industry arrangements would require the TSO, as an RPO, to continuously monitor the water content in the transmission system to reduce the risk of a hydrate-related supply failure.

These questions might help guide further consideration of this issue.

- Should industry arrangements be more prescriptive about monitoring gas quality?
- What are the costs and benefits of introducing continuous monitoring for all production stations?
- Is it sufficient for producers' monitoring of gas composition to be enforced by TSO audit?

  Should TSOs continuously monitor the water content in the transmission system to reduce the risk of a hydrate-related supply failure?

[15] Vector cannot be the causer of non-specification gas composition.

7.4 Gas standard and procedures

In Australia, the AEMO has a gas quality procedure that sets notification, alert, and curtailment limits for each component of the gas specification. It appears appropriate for TSOs to consider similar procedures for the management of gas quality on transmission systems in New Zealand are justified. Such procedures would provide a higher level of preparedness.

7.5 Matters communicated to MED

The analysis with comparable international regimes identified some matters that might benefit from further consideration. For example, the limit for water in the Gas Specification, at 100 mg/m^3, is relatively high compared with some other countries, such as Denmark (65 mg/m^3), Australia (73 mg/m^3), and Ireland (50 mg/m^3). The significance of this difference cannot be readily determined but could give rise to a greater risk of hydrate formation and warrants further consideration.

Gas Industry Co has provided the Energy Safety team at the Ministry of Economic Development (MED) and the Gas Association of New Zealand with a copy of this report. Appendix B may be useful when the gas specification is next reviewed.

7.6 Comparison with findings of our earlier review

The issues identified in this report are generally consistent with the Gas Industry Co's June 2006 *Gas Transmission Access Issues Review.* In this current review, we have refined the issues by considering the possible effects of gas quality incident and the likely causers of non-specification composition and contamination.

The *Gas Transmission Access Issues Review* concluded liability or responsibility for gas quality falls most appropriately in the physical transport chain and not with shippers and retailers. This report differs slightly from this position in the case of retailers supplying gas to end users on a gas network. In most cases, end users do not have a separate network service agreement (it is bundled with their gas supply agreement). Therefore, we think retailers are a better 'fit' for gas quality liability, providing they have a back-to-back arrangement with upstream participants.

8 Next steps

The Gas Industry Co would like feedback on this paper before finalising the next steps. Depending on submitter feedback, we expect further work is needed in the following areas:

- cost-benefit analysis of contractual arrangements requiring continuous monitoring of gas composition;
- detailed review of the contractual provisions regarding monitoring and management arrangements for contamination; and
- detailed review of the effectiveness of the gas quality auditing role provided by the TSOs.

Following feedback on this paper, we expect to prepare an options paper. The options paper will assess whether regulation is appropriate for ensuring industry arrangements provide reasonable terms and conditions in respect of gas quality. It will pay particular attention to the allocation of liability for non-specification gas.

Appendix A Format for submissions

To assist Gas Industry Co analyse responses, please use the table below to format submissions. The questions are the same as those contained in the body of this document. Submitters are free to include other material in their responses.

QUESTION	COMMENT
Question 1: Are there any significant effects of non-specification gas, other than those identified in section 2.3, that Gas Industry Co should consider?	
Question 2: Do you agree with the assessment of the types of non-specification gas and potential causer, as set out in Table 3?	
Question 3: Do you agree with the proposed regulatory objective? If you disagree please explain why and/or provide an alternative.	
Question 4: Do you agree we have interpreted the provisions contained within the transmission codes and contracts correctly? Are there additional contracts or provisions that should be considered?	
Question 5: Are there any aspects of the discussion in section 6.1 that you believe to be inaccurate or misleading? If so, please explain what these are.	

Question 6: Do you consider that liability for quality issues is best addressed through contractual arrangements or regulation? Please explain why.	
Question 7: Do you think the proposed regulatory objective would be better achieved with more prescriptive arrangements for the monitoring of gas composition and contaminants?	
Question 8: Do you think further work to identify the options for more active gas quality monitoring, and to quantify the costs and benefits of those options, is justified?	
Question 9: Do you think TSOs should monitor gas quality more actively (for example, by continuously monitoring the water content in the transmission system to manage the risk of hydrate formation)?	
Question 10: Currently, the TSOs audit producers' monitoring of gas composition. Do you think this arrangement provides sufficient assurance against the delivery of non-specification gas?	

Appendix B Comparable international regimes

Introduction

We considered it useful for our review to have a benchmark against which we could compare New Zealand's gas quality arrangements. The purpose was to help identify features of well-functioning regimes potentially applicable in New Zealand and possible gaps in the local regime.

Characteristics of comparable regimes

In considering which overseas regimes might provide useful comparisons, we looked for the following characteristics:

- multiple gas sources giving rise to a co-mingled gas supply;
- gas volumes comparable to New Zealand's; and
- open access transportation arrangements.

To allow for timely analysis, we also sought regimes where information, including standard contract information, was readily available.

The regimes in Denmark and Australia best meet these criteria. Both have open access transport arrangements that are well described and publicly available. Denmark has a gas market of similar size to New Zealand. It is supplied by two off-shore production plants (connected to the mainland by two pipelines), and is connected by pipelines to Sweden and Germany. Although Australia's gas market is much larger than New Zealand's, the gas markets in individual states are reasonably comparable, and supplied from multiple fields.

Regimes in other countries were less well matched to the criteria, but did provide some useful information, which is also discussed below.

Denmark

Overview

The Danish gas transmission system (shown in Figure 6) consists of upstream pipelines in the Danish part of the North Sea and onshore transmission pipelines (the Energinet.dk system). There are three field operators and two underground gas storage facilities. Denmark has pipelines to Germany and

Sweden, which are generally used for export but occasionally gas is imported from Germany. There are two large gas storage facilities at Lille Troup and Stenlille, which are filled over the low demand summer period. A sub-sea pipeline takes gas from Tyra to the Netherlands.

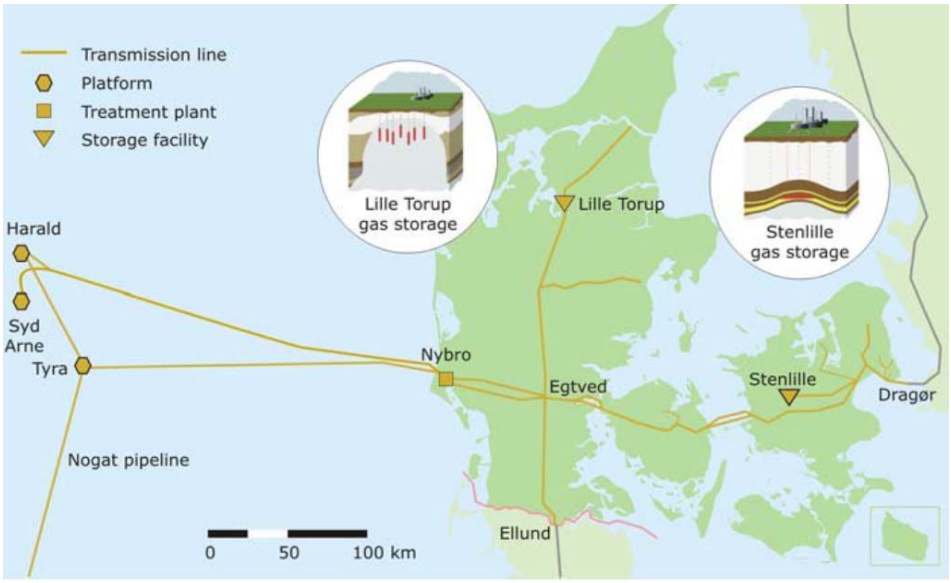

Figure 6 Danish gas system[16]

Gas quality arrangements

The Danish gas market was liberalised in 2004. The transmission system and gas market are owned and operated by Energinet.dk. The main gas quality issue reported by Energinet.dk is managing the Wobbe Index. The index can go outside specification if normal supplies from the North Sea are interrupted and replaced with gas at Ellund (from Germany), which has a higher Wobbe Index.

Danish shippers are required to ensure gas delivered to the Energinet.dk system at the entry points complies with Danish gas regulations. The regulations set similar standards to the Gas Specification, including limits for Wobbe Index, calorific value, CO2, HS2, and dust and other contaminants.

Gas quality is measured by Energinet.dk at the entry and exit points on the transmission system and at the gas storage facilities. Energinet.dk is responsible for ensuring that gas delivered to a shipper either to a distribution network or a storage facility meets the specification. The NSOs are responsible to the end users only for compliance with pressure and temperature.

There is provision for Energinet.dk and the shipper to agree to transport non-specification gas, in which case an off-specification fee applies. If non-specification gas is shipped without agreement there are provisions for damages with the shipper being liable to Energinet.dk.

[16] Energinet.dk website, www.energinet.dk.

Shippers must indemnify the NSO for direct and indirect claims, including claims by third parties. If non-specification gas cannot be attributed to a specific gas supplier, all gas suppliers at a transition point at the time in question are liable to indemnify the NSO for direct losses on a pro-rata basis. Indirect losses of the NSO as a consequence of claims made by end users are indemnified only by that end user's shipper.

Key points

Unlike New Zealand and Australia, the transmission system operator is responsible for physically monitoring the gas quality.

The costs of damages caused by non-specification gas where responsibility could not be attributed to a 'causer' are socialised.

Australia

The Victorian Transmission System (VTS, shown in Figure 7) is owned by Australia's largest natural gas infrastructure business, the APA Group. The VTS has an average annual throughput of over 220 PJ per annum. Gas is supplied into Victoria from:

- offshore Bass Strait gas fields (the Gippsland, Otway and Bass basins);
- the Dandenong LNG Gas Storage Facility;
- TRUenergy Underground Storage (Port Campbell); and
- Cooper Basin Gas (and Queensland and New South Wales (NSW) coal seam gas) via the Moomba to Sydney Pipeline (MSP) and NSW to Victoria Interconnect.

The market is operated by Australian Energy Market Operator (AEMO, formally VENcorp) and has three major buyers and multiple retailers[17]. Gas is covered by the National Gas Law 2008 and the National Gas Rules (NGR), which are enforced by the Australian Energy Regulator (AER). The NGR requires the TSO to monitor gas quality at each system injection point. The monitoring equipment must include a gas chromatograph, and analysers for water, oxygen, and sulphur.

[17] Department of Primary Industries, http://new.dpi.vic.gov.au/earth-resources/earth-resources-industries/oil-and-gas/petroleum-explorers-guide-to-victoria/the-victorian-gas-market

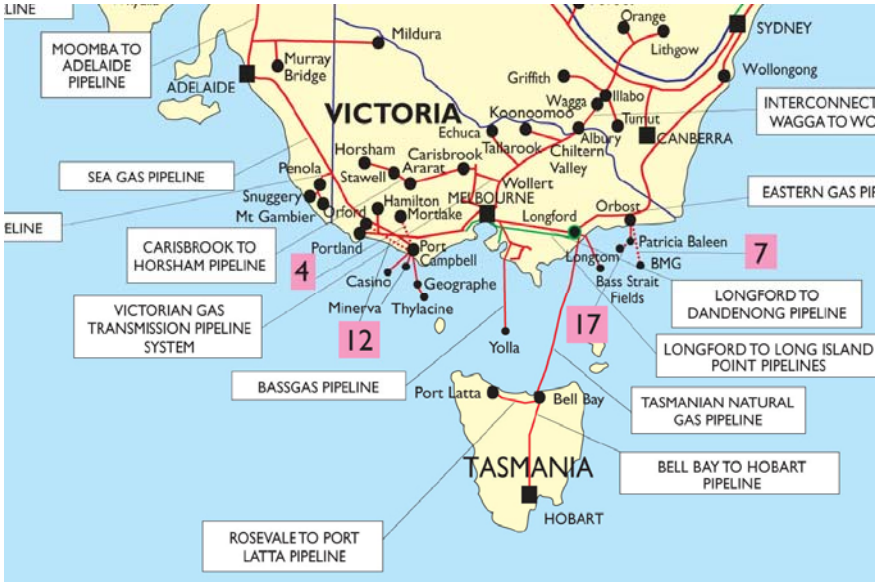

Figure 7 Victorian gas transmission system[18]

The AEMO publishes a detailed gas specification and rules for monitoring and compliance with the specification. The AEMO rules require continuous monitoring of gas composition. The gas quality monitoring system must be provided by the upstream TSO at each injection point and at other points AEMO considers necessary. The AEMO approves the monitoring system and the plan for testing and assurance of gas quality.

The injecting TSO is responsible for ensuring that gas delivered into the open access transmission system complies with the specification. The AEMO is responsible for ensuring that gas delivered from the transmission system complies. The rules do not cover the situation where the causer of any damage resulting from non-specification gas cannot be identified.

The rules provide for the AEMO to accept non-specification gas in certain circumstances (subject to approval by downstream participants). In this case, the injecting party is relieved of liability.

NSOs and retailers generally exclude liability for gas quality in their NSA and GSAs respectively. For example, the standard Redenergy gas supply contract states that *'You acknowledge that the …. variation or deficiency in the quality or pressure for gas is subject to a variety of factors outside our control'*.

Key points

In Victoria, the VTS is supplied by transmission pipelines delivering gas from remote fields. In contrast, in New Zealand, gas is injected directly into the transmission system by the producers (there is

[18] http://new.dpi.vic.gov.au/__data/assets/image/0018/22671/Vic_peg_img-6BIG.jpg

generally no intermediate TSO). Taking account of this difference, the party monitoring the gas quality is essentially the same—the injecting TSO in Victoria and the injecting producer in New Zealand.

Other countries

In considering what overseas regimes would be useful comparisons, we observed the following:

- Where there is a grid operator, many regimes (for example, Ireland and Holland, as well as Victoria) assign responsibility to that operator for ensuring injection point gas flows are continuously monitored for compliance with the relevant gas specification.

- Gas specifications in other regimes focus almost entirely on the gas composition, rather than contaminants. In many cases the gas industry's concern is the interchangeability of gas sources with different characteristics.

Comparing New Zealand's standards with other regimes

The scope of the Gas Specification, in respect of the parameters defined, is generally consistent with the national standards of other countries examined in this review. However in Australia and Denmark, the system operator imposes additional standards for the measurement of gas quality. For example, in Victoria, the AEMO sets standards for the method, frequency, and assurance processes for testing. They also set limits for alerts and curtailments. The AEMO standards require the monitoring to be continuous. By comparison, the MPOC and Vector ICA specify continuous monitoring only for Wobbe Index, density, and oxygen. The other parameters are 'as required' by the Gas Specification, which means the frequency is set by the producer.

The limit for composition

The limits for composition set out in the Gas Specification are compared with Australia and Denmark in Table 6.

Table 6 Gas composition comparison

Parameter	NZ	Australia (AS4564) & AEMO	Denmark
Wobbe Index	46-52 MJ/m^3	46-52 MJ/m^3	50.8-55.8
Relative Density (max)	0.8	-	0.69
Oxygen (max)	0.1 mol%	0.2 mol%	0.1
Hydrogen (max)	0.1 mol%	No	-
Hydrogen sulphide	5 mg/m^3	5.7 mg/m^3	5 mg/m^3
Total sulphur (max)	50 mg/m^3	50 mg/m^3	30 mg/m^3
Water (max)	100 mg/m^3	73 mg/m^3	-8°C @ 70 bar (~65 mg/m^3)
Halogens (as Cl), (max)	25 mg/m^3	-	-
Hydrocarbon dew point (max)	2°C @ 50 bar	2°C @ 35 bar	2°C @ 70 bar

Water specification

The limit for water in the Gas Specification, at 100 mg/m^3, is relatively high compared with some other countries, such as Denmark (65 mg/m^3), Australia (73 mg/m^3), and Ireland (50 mg/m^3). The significance of this difference cannot be readily determined but could give rise to a greater risk of hydrate formation and may warrant further consideration.

The water content is often specified as a dew point temperature measured at the pipeline's maximum operating pressure. Some care is needed when comparing countries with different operating pressures (because the pressure alters the dew point temperature).

Sulphur specification

The sulphur limit set in the Gas Specification is the same as the Australian specification, but somewhat higher than the Danish specification. The sulphur limits applied in the USA[19] were also reviewed and found to be generally in line with the Gas Specification. However, the Australian specification for natural gas (AS 4564) noted that '… operational problems have been reported in transmission systems with sulphur concentrations in natural gas below the 50 mg/m3 specified in this Standard. Research on this issue is continuing. The outcome of the research will be taken into account in subsequent review of the Standard'.

[19] Centre for Energy Economics, *Interstate Natural Gas, Quality Specifications & Interchangeability*, December 2004

The limit for contaminants

The most nebulous aspect of the Gas Specification is the limit for contaminants, which is defined in terms of the damage or malfunction the contaminants may cause. The ability of equipment[20] to cope with contaminants such as oil and dust depends, to an extent, on the design and maintenance of the equipment. Therefore, a certain level of contaminants may meet specification at one location but not at another.

The approach of defining the limit for contamination by the damage it may cause is widely used and there does not appear to be a practical alternative. The limits for contamination set out in the Gas Specification are compared with Australia and Denmark in Table 7.

Table 7 Gas contaminants comparison

Parameter	NZ	Australia (AS 4564) & AEMO	Denmark
Contaminants	Contaminant shall not cause damage or interfere in the proper operation of equipment.	Contaminant shall not cause damage or interfere in the proper operation of equipment, or result in sooting or a health hazard.	Technically free of gaseous, solid or liquid substances to the extent that the substances may risk the blocking, malfunction or corrosion of ordinary gas installation and standard gas equipment.
Oil carry-over	Compressor stations should have coalescing filters to reduce the oil carry-over to <20ml/TJ	Not covered by AS4564. AEMO requires oil consumption to be monitored, and appropriate coalescing filters.	Not stated.

The limit for oil carry-over

The Gas Specification provides a suggested limit for oil carry-over of 20mg/TJ from compressor stations. However this parameter cannot be measured directly and can only be inferred by calculating net oil consumption.

[20] For example: filters, meters, and pressure control valves.

Monitoring frequency

In Victoria, the AEMO stipulates the frequency and method of testing. A comparison of monitoring frequency between Vector/MPOC and the AEMO is summarised in Table 8. Comparative information for Denmark was not readily available.

Table 8 Comparison of gas quality monitoring frequency

Parameter	Vector ICA/MPOC	AEMO
Wobbe Index	Continuous	Continuous
Relative Density	Continuous	Continuous
Oxygen	Continuous	Continuous
Hydrogen	At least quarterly – Note 1	Continuous - Note 2
Hydrogen sulphide	At least quarterly – Note 1	Continuous
Total sulphur	At least quarterly – Note 1	Continuous
Water	At least daily	Continuous
Halogens	At least quarterly – Note 1	Continuous - Note 2
Hydrocarbon dew point	At least daily	At least every 15 minutes
Contaminants	Not specified	Not specified - Note 3

Notes
1 Can be relaxed if the contaminant is 'not present'.
2 The AEMO standard groups these parameters differently (for example, total inerts).
3 The frequency is unspecified, but the means of determining oil carry-over is specified, through the ongoing monitoring of oil usage and recovery from filter separators.

Glossary

AEMO	Australian Energy Market Operator
catalyst beds	A layer of catalyst-coated material in a catalytic converter through which the gases pass
CGA	Consumer Guarantees Act 1993
Commerce Act	Commerce Act 1986
Commission	Commerce Commission
composition	The mix of components in the gas such as oxygen, carbon dioxide, sulphur, and water
consumer	A person who buys goods that are mainly for personal, domestic, or household use (see also, 'end user')
contaminants	Unwanted components of the gas such as oil, dust, hydrates, and hydrides
damages	Loss or harm caused to one party's business caused by another party breaching its obligations to the first party
delivery point	An interconnection point on a pipeline where gas is taken from the pipe by the interconnected party
density	Mass per unit volume
deposition	See 'desublimation'
desublimation	The process of gas turning into a solid; it is more commonly referred to as deposition
dew point	The temperature below which some of the hydrocarbons in gas might condense at pipeline pressure forming liquid slugs, which could damage the pipeline
DPP Issues Paper	*Initial Default Price Quality Path for Gas Pipeline Businesses—Issues Paper 12 April 2010* (Commerce Commission)
DS users	Direct Supply users (major users directly connected to a transmission pipeline)

end user	In this paper, 'end user' refers to any industrial, commercial, or domestic consumer of gas. In some legislation, the word 'consumer' has been used with this same meaning. However, we have used 'consumer' to refer to domestic, or household, consumers.
Gas Act	Gas Act 1992
gas chromatograph	An instrument for analysing chemicals in a sample of gas
Gas Specification	NZS 5442:2008 *Specification for Reticulated Natural Gas*
GMSO	Gas Measurement System Operator
GPS	Government Policy Statement on Gas Governance issued under the Gas Act published 18 April 2008
GSA	Gas Sale Agreement (retail or wholesale)
Guidelines on Interconnection with Transmission Pipelines	Gas Industry Co, February 2009, available from Gas Industry Co's website: http://www.gasindustry.co.nz/work-programme/interconnection?tab=1715
hydrates	Ice-like crystalline solids formed from a mixture of water and natural gas, usually methane
hydrides	Compounds in which hydrogen is combined with another element
ICA	Interconnection Agreement
MDL	Maui Development Limited (an agent company for the Maui Joint Venture, which owns the Maui transmission pipeline)
MM users	Mass-market end users
MPOC	*Maui Pipeline Operating Code*, 8 August 2005
NSA	Network Service Agreement
NSO	Network Service Operator
pigging	Using pipeline inspection gauges or 'pigs' to perform various operations on a pipeline, usually cleaning or inspecting, without stopping the flow of gas

producer	Industry participant involved in exploration, drilling, and refinement of natural gas
receipt point	An interconnection point on a pipeline where gas is injected into the pipeline by the interconnected party
Regulations	Gas (Safety and Measurement) Regulations 2010
RPO	Reasonable and Prudent Operator, a standard of performance of obligations
SO	System Operator
slug	The liquids in a natural gas pipeline
swarf	Debris or waste from metalworking operations (fine metallic filings or shavings)
Transmission Access Issues Review	Gas Industry Co, 2006, available from Gas Industry Co's website http://www.gasindustry.co.nz/sites/default/files/consultations/13/Transmission_Access_Issues_Paper.pdf
transmission pipeline	High-pressure pipelines used to transport natural gas (excludes distribution networks)
TSO	Transmission System Owner
user	The users of the transmission services
Vector	Vector Limited in its role as owner of the Vector transmission pipelines
VTC	*Vector Transmission Code*, 21 January 2010
Wobbe index	A measure of the combustion quality of a gas