

NZ GCP 3 : 1993

NEW ZEALAND GAS CODE OF PRACTICE

for

ODORISATION OF GAS

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THE GAS ACT 1992
APPROVAL OF GAS CODE OF PRACTICE
FOR
ODORISATION OF GAS

Part IV of the Gas Act 1992 ("the Act")

On the third day of February 1993, the Secretary of Commerce acting pursuant to section 37 of the Act issued the Gas Code of Practice for Odorisation of Gas ("the Code").

On the fourth day of February 1993, pursuant to section 39 of the Act the Secretary published in the Gazette a notice of intention to apply to me for approval of the Code, and there has been consultation with such persons (or their representatives) as will be affected by the Code and they have had the opportunity to consider possible effects and comment on those effects.

The comments concerning those effects have been considered and where necessary amendments were made to the Code.

Therefore pursuant to section 39 of the Act, I, John Luxton, Minister of Energy, have this day approved the Code as attached to this approval, which Code shall come into force on the first day of April 1993.

Dated this 18th day of March 1993.

John Luxton
Minister of Energy.

COMMITTEE REPRESENTATION

This Code of Practice for Odourisation of Gas was prepared by the Ministry of Commerce, Office of the Chief Inspecting Engineer (Gas).

The following were involved in the preparation of this Code of Practice:

New Zealand Institution of Gas Engineers
Gas Association of New Zealand Inc.

REVIEW

This Code of Practice will be revised as occasions arise. Suggestions for improvement of this Code are welcome. They should be sent to the

Office of the Chief Inspecting Engineer (Gas)
Ministry of Commerce
PO Box 1473
Wellington

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FOREWORD

This Code has been prepared by a committee of the New Zealand Institution of Gas Engineers and the Gas Association of New Zealand with the objective of providing information (with supporting explanation) for possible adoption as a means of compliance with regulatory requirements relating to gas odour.

The committee also prepared an Odourisation Manual to assist in the effective operation of odourisation equipment and in the safe handling of odorant.

The purpose of regulatory requirements for gas odour is to ensure that persons are warned of the presence of escaping gas, well before gas concentrations in the atmosphere reach levels capable of causing fire or explosion.

At the time of writing, all gases reticulated to New Zealand consumers had odorant added to meet regulatory requirements.

Since the legislation places reliance on the response of the human olfactory system for the determination of a satisfactory level of odour, the Code makes requirements for olfactory tests.

In addition, the Code specifies minimum odorant concentrations in gas. This is because the following factors detrimentally affect the reliability of olfactory tests:

- Wide variation in human olfactory responses.
- Absence of adequate training facilities in New Zealand for standardising olfactory responses to gas odour.

Minimum odorant concentrations specified in this Code are based on:

- Overseas research related to the odourisation of natural gas and propane.
- Overseas odourisation practice.
- New Zealand experience in correlating odorant concentration with odour levels.

At the time of writing, the only odorants added to reticulated gas in New Zealand were 50:50 blends of tertiary butyl mercaptan and alkyl sulphides. Therefore, odorant concentrations and odourisation rates specified in the Code only apply to these blends.

The Code specifies odorant concentrations for mercaptan compounds only. This is because in mercaptan-containing odorant blends, the mercaptan has the greatest odour impact and because

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cost-effective methods of measuring other odorant compounds have not yet become available in New Zealand.

Because of similarities in gas composition and operations, overseas research and odorisation practice is frequently directly applicable to New Zealand natural gas. However, this is not necessarily the case for New Zealand liquefied petroleum gas, tempered liquefied petroleum gas and biogas.

The same odorant concentration in different fuel gases may give rise to varying olfactory responses. This is because components of the fuel gas, particularly heavier hydrocarbons, may mask the smell of the odorant. This odorant masking effect has been taken into account in recommendations in the Code for minimum odorant concentrations in liquefied petroleum gas and tempered liquefied petroleum gas.

Most natural gas suppliers receive gas which has been odorised in the transmission system. In recognition of this, the Code specifies procedures for dealing with factors which might affect odorant concentrations or odour levels in gas received by gas suppliers from the transmission system.

1 SCOPE

1.1 General

1.1.1

This Code applies to:

- (a) Gas (including LPG) supplied or intended to be supplied through a distribution system; and
- (b) Gas (not including LPG) supplied or intended to be supplied to a consumer from a container; and
- (c) Gas supplied or intended to be supplied to a consumer from a transmission system, where that gas is sold to the consumer by the owner of the gas in the transmission system.

1.2 Interpretation

1.2.1

"Information Notes" are used, between square brackets and in italics, to provide explanation or guidance on provisions of this Code. These notes do not constitute specifications, recommendations or requirements.

1.2.2

In this Code, unless the context otherwise requires:

"Consumer" has the meaning given to it in the Gas Act 1992 except that it includes CNG refuellers.

"Distribution system" has the meaning given to it in the Gas Act 1992, except that it does not include any part of the transmission system.

"Gate station" means the point that gas is supplied to a distribution system from a transmission system:

"Evaporation odouriser" means an odouriser which introduces odorant in the form of vapour into a gas stream:

[Information note: Wick and bypass odourisers are common types.]

"Injection odouriser" means an odouriser which injects liquid odorant into the gas stream:

"Liquefied Petroleum Gas" or "LPG" means a substance composed predominantly of propane or butane or a mixture of propane and butane:

"m³" means standard cubic metre:

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"Mercaptan" means a chemical compound or compounds of the mercaptan family, including tertiary butyl mercaptan (commonly used in odorant blends for reticulated gas) and ethyl mercaptan (commonly used as an odorant for LPG in containers):

"Mercaptan Detector Tube" means a device which indicates the concentration of mercaptan by the length of a colour change:

"Odorant" means a substance added to gas to impart a distinctive and unpleasant odour to gas in the atmosphere:

"Odorant Concentration" means the mass of odorant relative to the amount of gas (expressed in terms of milligrams of odorant per standard cubic metre of gas):

"Odorant Masking" or "Masking" means the masking of the distinctive odour of odorant by substances in the gas:

"Odorant Fade" means the loss of odorant in the gas system from such processes as chemical breakdown or uptake in gas systems:

"Odoriser" means a device designed to introduce odorant into a gas stream:

"Odorisation" means operations involving the addition of odorant to gas or the maintenance of odorant concentrations and odour levels in gas:

"Odorisation Rate" means the rate of dosage of odorant into gas (expressed in terms of milligrams of odorant per standard cubic metre of gas):

"Odorometer" means a device for mixing gas with air, drawn from the surrounding atmosphere, in variable, known ratios so that the odour of the gas/air mixture can be evaluated:

"Odour level" means the lowest concentration of gas in the atmosphere at which a person judges the odour to be distinctive and unpleasant so that the presence of gas is readily detectable:

"Odour threshold" means the lowest concentration of gas in the atmosphere at which a person is able to recognise the odour of a gas:

"Standard cubic metre" means the amount of gas contained in one cubic metre at an absolute pressure of 101.325 kilopascals and a temperature of 15°C:

"Supplementary odorisation" means the further addition of odorant to odorised gas:

"Tempered Liquefied Petroleum Gas" or "TLP gas" means a mixture of Liquefied Petroleum Gas and air, supplied through pipes:

"Transmission system" means all fittings used to transport gas at pressures exceeding 2000 kilopascals but does not include pipes and fittings used at CNG installations.

1.2.3

Where words and expressions used in this Code are defined in the Gas Act 1992 or regulations made thereunder, these definitions shall apply in this Code unless particular definitions are given in clause 1.2.2 of this Code.

2 QUALITY ASSURANCE

2.1 General

2.1.1

Gas suppliers shall ensure that they have quality assurance procedures for odourisation in accordance with this Code.

2.1.2

Where odourised gas is received from a transmission system, and is supplied to consumers without further odourisation, the person supplying gas to these consumers shall be satisfied that the person supplying gas from the transmission system has in place quality assurance procedures that will ensure minimum odourant concentrations specified in this Code.

2.2 Procedures

2.2.1

Quality assurance procedures shall include consideration of:

- (a) the reliability of individual odourisers; and
- (b) the ready availability of standby equipment in the event of odouriser outages or malfunctions; and
- (c) odourant fade and masking.

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2.2.2

Where applicable, the quality assurance procedures of the gas supplier shall include:

- (a) odour level and odorant concentration tests:
- (b) action taken as a result of abnormally low odour level or odorant concentration or abnormal odour:
- (c) calibration and maintenance of all test equipment:
- (d) if population density is sufficient to obtain reliable data, rates of public reported leaks and action taken as a result of abnormal variations in public reported leaks:
- (e) procedures to demonstrate the effective operation of odorising systems, including:
 - (i) periodic checks for average odorisation rates and the data used for calculating these rates:
 - (ii) calibrations and maintenance of odorising systems:
 - (iii) actions taken as a result of odouriser malfunctioning.

3 TESTING FOR EFFECTS OF GAS COMPOSITION AND PIPELINE COMPONENTS

3.1 General

3.1.1

Before first supplying or changing significantly the composition of gas or odorant or carrying out operations which may affect significantly the composition of gas or odorant, the person supplying gas to consumers shall cause to have carried out olfactory and chemical tests to ensure that the gas odour meets regulatory requirements, and in particular, to determine whether there are components in the gas or pipeline which may cause odour masking or fading.

4 ODORANT SELECTION

4.1 General

4.1.1

Odorants shall be either a mercaptan or mercaptan/sulphide blend or tetrahydrothiophene or tetrahydrothiophene blended with either mercaptan or sulphide compounds.

4.2 Evaporation odorisers

4.2.1

Odorant blends shall consist of components with similar vapour pressures to prevent fractionation.

4.2.2

Blends of tertiary butyl mercaptan and ethyl methyl sulphide may be used in evaporation odorisers.

4.2.3

Blends of tertiary butyl mercaptan and dimethyl sulphide shall not be used in evaporation odorisers.

4.3 Injection odorisers

4.3.1

In the selection of odorant for an injection odoriser, due regard should be taken of odorants and odoriser types used prior to the point of injection, to ensure compatibility.

5 MINIMUM ODORISATION RATES, MINIMUM ODORANT CONCENTRATIONS AND ODORANT FADE

5.1 Relationship between odorant type, odorisation rate, odorant concentration and odour level

5.1.1

Minimum odorisation rates and odorant concentrations in this Code apply to the use of odorant blends consisting of 50 % tertiary butyl mercaptan (by mass) with 50 % of either ethyl methyl sulphide or dimethyl sulphide.

5.1.2

In situations where odorant blends other than those described in clause 5.1.1 are used, the gas supplier causing the gas to be odorised shall ensure that the odour level meets or exceeds that achieved at the odorant concentrations specified in this Code.

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5.2 Mercaptan Type

5.2.1

Minimum mercaptan concentrations in this Code-

- In the case of gases other than LPG and TLP gas, relate to tertiary butyl mercaptan, and-
- In the case of LPG and TLP gas, relate to tertiary butyl mercaptan and ethyl mercaptan.

[Information note: At the time of writing, New Zealand LPG was odourised with ethyl mercaptan. Since TLP gas is reticulated in New Zealand (and LPG may be reticulated), ethyl mercaptan is included in Code specifications for minimum mercaptan levels.]

5.3 Variations of odourant concentration in close proximity to odouriser

5.3.1

Odourant concentrations should not be measured in close proximity to the point of odourant addition.

[Information note: Large variations in odourant concentration typically occur in close proximity to the point of odourant addition.]

5.4 Minimum mercaptan concentration for natural gas and biogas

5.4.1

Gas suppliers shall maintain a minimum tertiary butyl mercaptan concentration of 3 mg/m³-

- In the case of natural gas, at the point where the ownership of gas passes from the supplier to the consumer and throughout any distribution system, and-
- In the case of biogas, at the point where the gas is supplied.

[Information note: As a result of odourant fade, natural gas containing less than 5 mg/m³ of tertiary butyl mercaptan at the gate station may not be sufficiently odourised to meet the above specification.]

5.5 Minimum mercaptan concentration for liquefied petroleum gas

5.5.1

Gas suppliers shall maintain a minimum mercaptan concentration of 9 mg/m³ throughout the distribution system.

[Information note: Because of masking effects from hydrocarbons (especially butanes and higher hydrocarbons), increased odourant concentrations are specified for LPG over levels specified for natural gas and biogas. However, the minimum odourant concentrations specified for reticulated LPG are commensurate with those for New Zealand LPG from cylinders].

5.6 Minimum mercaptan concentration for tempered liquefied petroleum gas

Gas suppliers shall maintain a minimum mercaptan concentration of 6 mg/m³ throughout the

distribution system.

[Information note: Because of possible masking effects, increased odorant concentrations are specified for TLP gas over concentrations specified for natural gas and biogas. However, lower minimum odorant concentrations are specified for TLP gas than for LPG because TLP gas consists of LPG diluted with approximately 75 % air].

5.7 Odorant fade

5.7.1

Gas suppliers (including CNG refuellers) shall check for odorant fade when beginning odorisation, commissioning pipelines or CNG containers and when carrying out any other operation which might reasonably be expected to cause significant odorant fade.

5.7.2

When commissioning new or retested CNG storage vessels, gas refuellers shall carry out olfactory tests to ensure that the distinctive and unpleasant odorant smell remains in the gas.

5.7.3

If odorant fade is anticipated or encountered, resulting in odorant concentrations falling below the minimum specified in this Code, then the gas supplier shall either:

- (a) cause the odorisation rate to be increased; or
- (b) commence supplementary odorisation.

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5.8 CNG drying towers

5.8.1

Where gas is passed through desiccant towers, precautions shall be taken to ensure that the gas leaving the towers contains sufficient odorant to meet minimum odorant concentrations specified in this Code.

5.8.2

CNG drying towers should not be used or operated in a manner which might expose the general public to the smell of odorant during desiccant regeneration.

[Information note: The purposes of this provision is to ensure that a situation does not arise where the smell of odorant from regenerating drying towers obscures the smell of leaking gas or causes the public to ignore a gas-like smell in the vicinity of drying towers.]

6 MONITORING AND TESTING

6.1 Monitoring of Odourisation Rate and Testing for Odour Level and Odorant Concentration

6.1.1

Gas suppliers shall periodically carry out odorant concentration and odour level tests in accordance with this Code.

6.1.2

The gas supplier odorising the gas shall monitor the odorisation rate at regular intervals in accordance with this Code.

6.2 Use of mercaptan detector tubes

6.2.1

Where odorants containing 50 % (by mass) or more mercaptan are used, odorant concentration tests may be carried out using mercaptan detector tubes.

6.3 Olfactory testing

6.3.1

An odorometer shall be used in testing for odour level.

6.3.2

Gas shall be tested for odour level at concentrations at and below gas concentrations in air, equivalent to 1/5th of the lower flammability limit.

6.3.3

Any person carrying out olfactory tests shall not judge gas to meet regulatory requirements for gas odour when the person has only tested at the odour threshold.

*[Information note: Although gas is detectable at the odour threshold, it does not meet the regulatory criterion of being **readily** detectable and does not necessarily meet the additional criteria of being unpleasant and distinctive.]*

6.3.4

In order to evaluate and counter individual bias, persons who use odorimeters shall periodically participate in panel tests comprising at least four persons.

6.4 Minimum interval between tests

6.4.1

Where gas is supplied through distribution systems, the following requirements shall apply for the testing of odour level and odorant concentration:

- (a) gas shall be tested downstream of every point of odorant input, at intervals not exceeding one month, by the gas supplier who odorises the gas:
- (b) gas which is received odorised from the transmission system shall be tested at the gate station, at intervals not exceeding one month, by the gas supplier who is supplied with the gas:
- (c) gas shall be tested at selected gas measurement system outlets and other representative points throughout the distribution system, at intervals not exceeding three months, by the gas supplier supplying the gas.

6.4.2

Where gas which is supplied to consumers other than through a distribution system, the gas shall be tested at the point where the gas is supplied to consumers, at intervals commensurate with quality assurance procedures specified in this Code.

6.5 Maintenance and use of test equipment

6.5.1

Odorimeters, mercaptan detector tubes and other test equipment should be used, maintained and calibrated in accordance with the instructions of the manufacturer of the equipment, if any.

6.5.2

Odorimeters and gas sample lines to odorimeters shall be clean and odour free.

6.6 Tests after odouriser adjustment or maintenance

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6.6.1

When odourisation rates have been reset or equipment maintenance has been carried out, odour level and odourant concentration tests shall be carried out downstream of the dosage points as soon as possible.

7 PERSONNEL SELECTION AND TRAINING

7.1 General

7.1.1

Personnel shall be trained in the skills necessary to effectively operate odourisation systems, test for odour and odourant and keep test records.

7.2 Supply of documentation and procedures

7.2.1

Procedures specified or recommended by this Code shall be provided to the personnel to whom they relate.

7.3 Olfactory testing

7.3.1

The following classes of people shall not carry out odour level tests:

- (a) regular smokers;
- (b) people suffering from colds or other conditions of health likely to affect their olfactory response;
- (c) people who display an unusually high or low olfactory response to odourised gas.

7.3.2

Persons who carry out odour level tests should be trained to recognize the odour imparted by the gas supplied, under the following conditions:

- (a) when odourised to the minimum odourant concentration specified in this Code; and
- (b) before odourant is added.

7.3.3

Gas suppliers should evaluate the correlation between odour level and odorant concentration test results to identify and prevent anomalous test results caused by inadequate testing procedures or abnormal olfactory response.

8 EDUCATION PROGRAMMES

8.1 General

8.1.1

Gas suppliers should establish a continuing education programme to enable customers, persons engaged in excavation related activities and the public to recognise the odour of gas.

8.1.2

As part of such programmes, gas suppliers should provide information on the procedures for reporting gas leakages.

9 EMERGENCY AND CONTINGENCY PLANS

9.1 General

9.1.1

Gas suppliers shall have plans for responding to emergencies or contingencies which may involve under-odorisation.

9.2 Response to low odour level or odorant concentration by gas supplier

9.2.1

If odour levels or odorant concentrations in a distribution system become or appear to likely to become abnormally low, the following actions shall be taken forthwith by the gas supplier:

- (a) inform resellers of the gas who may reasonably be expected to be affected:
- (b) locate the cause and implement corrective action and if appropriate, cause standby odorising equipment to be activated:
- (c) if the cause is suspected to be related to odorised gas supplied by the gas wholesaler, notify the gas wholesaler.
- (d) closely monitor odour level and odorant concentrations throughout the distribution system until normal odour levels and odorant concentrations are achieved:
- (e) take any other practicable action to prevent the possibility of accident from undetected gas escape.

9.3 Response to accident

9.3.1

Where an accident has occurred which is suspected to involve an inability to detect the presence of

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escaping gas, the gas distributor who controls the system from which the gas has escaped or is suspected to have escaped, shall as soon as possible test the odour level and odorant concentration in the gas system.

10 GAS WHOLESALERS

10.1 Supply of Information

10.1.1

Where the gas wholesaler supplies odorised gas to a person reselling it, the gas wholesaler shall, as soon as practicable, advise the reseller of plans to commission or decommission any odoriser, to commission any long pipeline run, to significantly change gas composition or to carry out any other operation reasonably expected to affect odour levels or odorant concentrations in the gas supplied.

10.1.2

Where the gas wholesaler supplies odorised gas, the gas wholesaler shall comply with all reasonable requests for odorisation information by any person with responsibilities for ensuring that the gas is adequately odorised.

10.1.3

If a gas wholesaler who supplies odorised gas becomes aware of-

- (a) a fault with an odoriser operated by the gas wholesaler; or
- (b) abnormal odorant fade in the gas supplied by the gas wholesaler; or
- (c) abnormally low odour levels or odorant concentrations in the gas supplied by the gas wholesaler-

the gas wholesaler shall forthwith inform all persons who may reasonably be expected to be affected of the abnormality and of any corrective action.