Tooheys Pty Ltd

Tooheys Brewery, Lidcombe - Cogeneration Facility

Response to Submissions

November 2009

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Contents

Appendices

1 Introduction

This report provides responses to the submissions that were received during the public exhibition of the Environmental Assessment (EA) for a proposed cogeneration facility for the Tooheys brewery, located at 29 Nyrang Street, Lidcombe.

This report should be read in conjunction with that EA.

Submissions were received from the following groups:

- Department of Planning (DoP) Major Hazards Unit
- Department of Environment, Climate Change and Water (DECCW)
- Auburn Council.

The full submissions are included in Appendix A.

2 Response to issues raised by DoP Major Hazards Unit

2.1 Environmental Assessment

Issue

The EA does not provide sufficient description of the project, especially for the production of steam and hot water. Furthermore, it is unclear how the hot water will be generated from the engine cooling system and how it will be used to produce chilled water (Last statement of para 3, Sec 3 Project Description of the EA).

Tooheys Response

An updated project description has been provided in Appendix B.

2.2 Preliminary Hazard Assessment

Issue

1. *Throughout the PHA, the Department of Planning has been referred to as DUAP and DIPNR, which are old names of the Department. The PHA should be updated to correct these references.*
2. *The PHA undertakes a semi quantitative analysis to demonstrate that the proposed modification will not impose significant risk on the surrounding land uses. It is recognised that there will be no off-site impact from a jet fire in the engine room. Nevertheless, the Department is concerned with the possible knock-on effects from a jet fire and the impacts of an explosion, especially on the ammonia storage. In this relation the following should be clarified.*
   a. *The cogeneration plant will be installed in an enclosed area (the engine room). In relation to this matter:*
      i. *Why have possible accidents resulting in flash fire or explosion not been considered in the risk assessment? In case of a credible scenario, the domino effects on the surrounding equipment and storage (including Depot F1-F5, ammonia storage) should be taken into account.;*
      ii. *What measures will be in place to ensure that the ventilation system will be effective? What warning system will be in place for failure of the ventilation system?*
      iii. *Is the ventilation sufficient to eliminate a build up of methane in the engine room in a case of 120 mm hole at 100kPa?*
      iv. *Would methane detectors be installed in the engine room?*
   b. *The radiation levels calculated for jet fire and provided in Section 5.2.1 of the PHA (Fire inside the Engine Room) need further clarification, in particular:*
      i. *It is surprising that the maximum heat radiation inside the engine room will be only 7.8 kW/m2. TNO (Yellow book, Chapter 6) calculates 11 kW/m2 at 49.8 m from the centre of the flame for a typical high pressure methane jet fire and Surface Emissive Power for the methane flame of 225 kW/m2 . Although the pressure of the release in the PHA model is lower (100 kPa), high heat radiation would be expected in the vicinity of the flame;*
      ii. *Confirm if the methane pressure of 100 kPa is gauge or absolute;*

iii. *Please clarify if the distances provided in Column 3 of Table 5-1 Calculated Distance from Model are measured from the edge of the flame;*

iv. *What is the length of the jet fire and is it likely to directly impinge on equipment in the engine room.*

v. *Fig 5-2 Heat Radiation vs. Distance Plot for Fire inside the Engine Room shows a heat radiation of 4.4 kW/m2 at the edge of the fire and a maximum of 7.8 kW/m2 at greater distance from the fire. This again is surprising and some explanation should be provided.*

Tooheys Response

A file note to DoP addressing the specific concerns raised in the Hazards Unit response was issued and is included as Appendix C.

An addendum to Preliminary Hazards Assessment has been issued and included as Appendix D.

3 Response to issues raised by DECCW

Issue

.. the discharge point for the co-generation engine will need to be included in the existing Environmental Protection Licence as a discharge point and will be required to have stack testing. To complete the stack testing the sampling point will need to be designed to meet Test Method 1.

Tooheys Response

This is accepted by Tooheys.

4 Response to issues raised by Auburn Council

Issue

- *Noise – there should be no increase in noise levels, particularly in relation to nearby residential properties;*
- *Construction management – the traffic route for construction vehicles should not be along residential streets;*
- *No additional adverse amenity impacts on the local area in relation to air quality, noise and water quality;*
- *The site is flood prone;*
- *The site adjoins a heritage item (item 2-3-2-100A Canalisation of Haslams Creek in Auburn Local Environmental Plan 2000).*

Tooheys Response

These issues have either been addressed in EA for the cogeneration plant or relate to the ongoing management of the entire site which is subject to the original Conditions of Approval for the operation of the site or the EPL.

Appendix A

Submissions Received

Appendix B

Updated Project Description

Appendix C

File Note to DoP re: Preliminary Hazards Assessment

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Addendum to Preliminary Hazards Assessment

Tooheys Pty Ltd

Tooheys Brewery, Lidcombe - Cogeneration Facility

Response to Submissions

ARUP

Appendix A

Submissions Received

NSW GOVERNMENT | Planning

Contact: Christine Chapman
Phone: 02 9228 6537
Fax: 02 9228 6466
Email: christine.chapman@planning.nsw.gov.au
Our ref: S06/00631

Ms Melanie Koerner
ARUP Pty Ltd
Level 10 201 Kent Street
SYDENY NSW 2000

19 October 2009

Dear Ms Koerner

Tooheys Brewery - Proposed Cogeneration Facility (08_0163)
Response to Submissions

I have attached copies of the submissions that the Department received during the consultation period for the above referenced project.

Auburn Council has not yet provided a submission on the project. This will be forwarded to you once it has been received. The Department may also request further information from you as the assessment of the project progresses.

The Department requests that you respond to the issues raised in submissions. Specifically, provide the Department with a revised Preliminary Hazard Assessment for the project.

Should you wish to clarify any of the issues raised in the submissions, please do not hesitate to contact me on (02) 9228 6537 or christine.chapman@planning.nsw.gov.au

Yours sincerely

Christine Chapman
Major Development Assessment

Memorandum

To	Christine Chapman		
cc.			
From	Lilia Donkova through Derek Mullins		
Date:	13/10/09	**File no**	**File**

Subject: Tooheys Brewery Lidcombe – Cogeneration Facility

I have reviewed the hazard related issues in the submitted EA and PHA for the above development. The information provided in the EA and the PHA should be updated, as a minimum, with the following information.

A. Environmental Assessment, dated September 2009

The EA does not provide sufficient description of the project, especially for the production of steam and hot water. Furthermore, it is unclear how the hot water will be generated from the engine cooling system and how it will be used to produce chilled water (Last statement of para 3, *Sec 3 Project Description* of the EA).

B. Preliminary Hazard Assessment, Report No 109128_Final_PHA_Rep

1. Throughout the PHA, the Department of Planning has been referred to as DUAP and DIPNR, which are old names of the Department. The PHA should be updated to correct these references.
2. The PHA undertakes a semi quantitative analysis to demonstrate that the proposed modification will not impose significant risk on the surrounding land uses. It is recognised that there will be no off-site impact from a jet fire in the engine room. Nevertheless, the Department is concerned with the possible knock-on effects from a jet fire and the impacts of an explosion, especially on the ammonia storage. In this relation the following should be clarified.
    a. The cogeneration plant will be installed in an enclosed area (the engine room). In relation to this matter:
        i. Why have possible accidents resulting in flash fire or explosion not been considered in the risk assessment? In case of a credible scenario, the domino effects on the surrounding equipment and storage (including Depot F1-F5, ammonia storage) should be taken into account.;
        ii. What measures will be in place to ensure that the ventilation system will be effective? What warning system will be in place for failure of the ventilation system?
        iii. Is the ventilation sufficient to eliminate a build up of methane in the engine room in a case of 120 mm hole at 100kPa?
        iv. Would methane detectors be installed in the engine room?

b. The radiation levels calculated for jet fire and provided in Section 5.2.1 of the PHA (Fire inside the Engine Room) need further clarification, in particular:

   i. It is surprising that the maximum heat radiation **inside** the engine room will be only 7.8 kW/m^2. TNO (Yellow book, Chapter 6) calculates 11 kW/m^2 at 49.8 m from the centre of the flame for a typical high pressure methane jet fire and Surface Emissive Power for the methane flame of 225 kW/m^2 . Although the pressure of the release in the PHA model is lower (100 kPa), high heat radiation would be expected in the vicinity of the flame;

   ii. Confirm if the methane pressure of 100 kPa is gauge or absolute;

   iii. Please clarify if the distances provided in Column 3 of Table 5-1 *Calculated Distance from Model* are measured from the edge of the flame;

   iv. What is the length of the jet fire and is it likely to directly impinge on equipment in the engine room.

   v. Fig 5-2 Heat Radiation vs. Distance Plot for Fire inside the Engine Room shows a heat radiation of 4.4 kW/m^2 at the edge of the fire and a maximum of 7.8 kW/m^2 at greater distance from the fire. This again is surprising and some explanation should be provided.

Regards,

Lilia Donkova

Our reference : DOC09/48024
Contact : Stuart Clark, 9995 6835

Mr Chris Ritchie
Manager – Industry, Major Development Assessment
Department of Planning
GPO Box 39
Sydney NSW 2001

Dear Mr Ritchie

TOOHEYS BREWING-PROPOSED COGENERATION FACILITY (06-0303MOD1) ENVIRONMENT ASSESSMENT

I refer to your correspondence to Department of Environment and Climate Change and Water (DECCW) on 1 October 2009. The modification application is being assessed and determined under section 75W of the *Environment Planning Assessment Act 1979.*

The application presented meets the majority of concerns that DECCW had previously outlined to Tooheys with the project. However the discharge point for the co-generation engine will need to be included in the existing Environment Protection Licence as a discharge point and will be required to have stack testing. To complete the stack testing the sampling point will need to be designed to meet Test Method 1.

DECCW has recommended conditions of approval for the proposed project in Attachment 1.

DECCW has also developed proposed conditions that will be included in Tooheys existing Environment Protection Licence number 1167 should the proposal be approved. These are included in Attachment 2 and may be subject to change upon the submission of compliant air emissions monitoring results.

Please do not hesitate to contact Mr Stuart Clark on 9995 6835 if you wish to discuss this matter further.

Yours sincerely

16/10/09.

JAMES GOODWIN
Unit Head Sydney Industry
<u>Climate Change and Environment Protection</u>

The Department of Environment and Conservation NSW is now known as the Department of Environment and Climate Change NSW

PO Box 668, Parramatta NSW 2124
Level 7, 79 George St, Parramatta NSW
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Department of **Environment and Climate Change** NSW

ATTACHMENT 1: RECOMMENDED CONDITIONS OF APPROVAL

1. The Proponent must operate the cogeneration facility that is the subject of this approval in a manner which complies with the air emission limit conditions specified in Environment Protection Licence no. 1167, issued under the *Protection of the Environment Operations Act.*

2. The Proponent must monitor exhaust emissions from the cogeneration facility that is the subject of this approval in accordance with the requirements of Environment Protection Licence no. 1167, issued under the *Protection of the Environment Operations Act.*

3. The Proponent must ensure that the design and construction of the cogeneration facility that is the subject of this approval includes an air emissions sampling position that complies with Test Method TM-1, as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*, published by the Department of Environment, Climate Change and Water. The air emissions sampling position must allow the sampling of exhaust emissions from cogeneration facility in accordance with the requirements of Environment Protection Licence no. 1167, issued under the *Protection of the Environment Operations Act.*

ATTACHMENT 2: PROPOSED AMENDMENTS TO LICENCE NUMBER 1167

P1 Location of monitoring/discharge points and areas

EPA identification	Type of monitoring	Type Discharge	Discharge Location
7	Discharge to air; air emissions monitoring	Discharge to air; air emissions monitoring	Exhaust from co-generation engine (relevant drawing details to be included)

L3 Concentration limits

L3.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

POINT 7

Pollutant	Units of measure	100 percentile limit	Reference Conditions
Nitrogen Oxides	mg/m^3	250	Dry, 273K, 101.3kPa
Volatile organic compounds, as n-propane equivalent[1]	mg/m^3	40	Dry, 273K, 101.3kPa
Carbon monoxide[1]	mg/m^3	125	Dry, 273K, 101.3kPa

Note 1: The *Protection of the Environment (Clean Air) Regulation* provides for the monitoring of volatile organic compound (VOCs) emissions either directly as VOCs or using carbon monoxide (CO). The regulatory standard is taken to be satisfied if either the VOC or CO limit is met. DECCW will consult with the licensee to determine the preferred limit and monitoring requirements for VOCs (ie. VOCs as n-propane equivalent or CO).

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

POINT 7

Pollutant	Units of measure	Frequency[1]	Sampling Method
Carbon monoxide[2]	mg/m^3	Quarterly	TM-32
Dry gas density	kg/m^3	Quarterly	TM-23
Moisture content of stack gases	%	Quarterly	TM-22
Molecular weight of stack gases	g/g-mole	Quarterly	TM-23
Oxides of Nitrogen	mg/m^3	Quarterly	TM-11
Temperature	°C	Quarterly	TM-2
Velocity	m/s	Quarterly	TM-2
Volatile organic compounds, as n-propane equivalent[2]	mg/m^3	Quarterly	TM-34
Volumetric flow rate	m^3/s	Quarterly	TM-2

Note 1: The frequency of ongoing monitoring may be reviewed following the completion of at least four consecutive quarterly monitoring events that demonstrate compliance with the applicable limits specified in Condition L3.1

Note 2: The *Protection of the Environment (Clean Air) Regulation* provides for the monitoring of volatile organic compound (VOCs) emissions either directly as VOCs or using carbon monoxide (CO). The regulatory standard is taken to be satisfied if either the VOC or CO limit is met. DECCW will consult with the licensee to determine the preferred limit and monitoring requirements for VOCs (ie. VOCs as n-propane equivalent or CO).

Christine Chapman - Comments from Auburn City Council regarding 06_0303 Mod 1

From: "Anna Brennan-Horley" <anna.brennan-horley@auburn.nsw.gov.au>
To: "'christine.chapman@planning.nsw.gov.au'" <christine.chapman@planning.nsw.gov.au>
Date: 19/10/2009 3:12 PM
Subject: Comments from Auburn City Council regarding 06_0303 Mod 1

Dear Christine,

Further to your letter dated 1 October 2009, Auburn City Council wish to provide the following comments in relation to the Tooheys Brewery proposed Cogeneration Facility (06_0303 Mod 1).

- Noise – there should be no increase in noise levels, particularly in relation to nearby residential properties;
- Construction management – the traffic route for construction vehicles should not be along residential streets;
- No additional adverse amenity impacts on the local area in relation to air quality, noise and water quality;
- The site is flood prone;
- The site adjoins a heritage item (item 2-3-2-100A Canalisation of Haslams Creek in Auburn Local Environmental Plan 2000).

Please also note that it is anticipated that draft Auburn Local Environmental Plan 2009 will be publicly exhibited towards the end of October 2009.

JOHN BURGESS
GENERAL MANAGER

PER ***Anna Brennan-Horley***
Team Leader - Development Assessment
Planning & Environment
Auburn City Council
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Appendix B

Updated Project Description

To	Christine Chapman	Reference number 206814/MK	
cc	Andrew Meagher Gusni Mellington Fred Sadie	File reference	
From	Melanie Koerner x 9339 (Sydney)	Date 12 November 2009	
Subject	Tooheys Cogeneration Proposal: Updated Project Description		

The following information is provided in response to the Department of Planning Major Hazards Unit section comment that:

> *The EA does not provide sufficient description of the project, especially for the production of steam and hot water. Furthermore, it is unclear how the hot water will be generated from the engine cooling system and how it will be used to produce chilled water (Last statement of para 3, Sec 3 Project Description of the EA).*

The plant will consist of a 2MW generator set with associated mechanical and electrical systems to provide the brewery with:

- 2 MW of electrical power
- 0.73 MW of low pressure steam
- 0.75 MW of chilled water

Electrical Power

The generator set is a 2MW reciprocating gas engine (TCG 2020V20 Deutz) coupled to an 11kV alternator and mounted on a common skid base frame. The gas engine will be suitable for operating on Natural Gas, and be of a turbocharged, water-cooled configuration, with four-stroke operation and a normal operating speed of 1500 rpm. The engine supply will include dry-type air filters, 24VDC starting system, electronic governor and flexible bellows on exhaust outlets. A flanged high pressure gas connection is available on site for the supply of gas to the generator set. The connection is located within the same building and local to the proposed location of the co-generation plant.

The alternator will be a twin-bearing type, 4 pole, 11kV, 50Hz, 0.8 power factor with class ‘H’ insulation. The alternator will be supplied with permanent magnet exciter, automatic voltage regulation, anti-condensation heater and differential protection current transformers.

An auxiliary skid will be supplied to be installed alongside the generator set enclosure. The auxiliary skid will incorporate all equipment necessary for the generator auxiliary services, including:

- Exhaust gas heat exchanger
- Cooling system pumps and thermostatic valves

The electrical output of the generator set will be approximately 2014 kWe (under ISO conditions) at 11kV. The electrical output will be fed into a new HV cubicle in the adjacent HV building and will be used to offset the base load consumption of the brewery

Heat Recovery

Heat recovery will initially be from the high temperature jacket water (1065kw) and exhaust system (720kw).

Chilled Water

Heat from the engine jacket water will be utilised through the isolation heat exchanger and passed on to a single stage hot water absorption chiller. There will be some 1065 kW of heat available from the jacket water that can be converted into approximately 750 kW of chilled water for use within the brewery. The proposed model of the absorption chiller is a Broad BDH 75 with stainless tubes in the evaporator.

To allow operation of the generator set during times when the plant does not require chilled water from the absorption chiller, the isolation heat exchanger can be isolated via manual valves and the jacket water will be cooled via the dump heat exchanger.

A cooling tower will be supplied for cooling of the absorption chiller system. The cooling tower will be sized to allow for maximum operating conditions of the absorption chiller.

Low Pressure Steam

Waste heat from the engine exhaust system will be reclaimed via an exhaust gas heat exchanger for the purpose of producing steam for use within the brewery. It is anticipated that the exhaust discharge from the generator set will be utilised, via a waste heat boiler which will be a two pass fire tube construction, with a thermal capacity of approximately 720kW when producing 9 bar steam. create approximately 1MW of saturated steam at a nominal pressure of 800-900kPa. The steam produced will supplement the existing plant steam system.

Appendix C

File Note to DoP re: Preliminary Hazards Assessment

Benbow ENVIRONMENTAL

FILE NOTE

JOB NUMBER:	109128
CLIENT:	Tooheys Pty Ltd
DATE:	2 November 2009
SUBJECT:	Summary of Response to Department of Planning Inquiry via Email

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This is a summary of response to the Department of Planning (DoP) Inquiry that was forwarded to Gusni Melington by Andrew Meagher on 15 October 2009. This document is to provide explanation for the amendments made to the PHA document (109128_Final _PHA_Rep) previously submitted to DoP. The addendum report titled 109128_PHA _Addendum 1.

B. Preliminary Hazard Assessment, Report No 109128_Final_PHA_Rep

1. Throughout the PHA, the Department of Planning has been referred to as DUAP and DIPNR, which are old names of the Department. The PHA should be updated to correct these references.

   Response:

   The Department of Planning is not referenced on these documents as these were not released by Department of Planning but by DUAP and DIPNR.

   To refer to these as Department of Planning documents would not agree with the title description of the documents and would therefore be incorrect. If the Department of Planning are willing to issue us a letter that states any reference to a document previously released by DUAP and DIPNR is a document endorsed by the Department of Planning, we can cover the change in ownership of the documents.

   Otherwise in the Land and Environment Cover where planning matters are decided for New South Wales, a legal representative could argue that our reference to documents is in error.

   We will continue to release our PHA reports with reference to the actual title on the documents.

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2. The PHA undertakes a semi quantitative analysis to demonstrate that the proposed modification will not impose significant risk on the surrounding land uses. It is recognised that there will be no off-site impact from a jet fire in the engine room. Nevertheless, the Department is concerned with the possible knock-on effects from a jet fire and the impacts of an explosion, especially on the ammonia storage. In this relation the following should be clarified.

   a. The cogeneration plant will be installed in an enclosed area (the engine room). In relation to this matter:

      i Why have possible accidents resulting in flash fire or explosion not been considered in the risk assessment? In case of a credible scenario, the domino effects on the surrounding equipment and storage (including Depot F1-F5, ammonia storage) should be taken into account.;

      ii What measures will be in place to ensure that the ventilation system will be effective? What warning system will be in place for failure of the ventilation system?

      iii Is the ventilation sufficient to eliminate a build up of methane in the engine room in a case of 120 mm hole at 100kPa?

Response :

The room would be naturally ventilated and that ventilation was deemed adequate for the installation of two 12-15 MW natural gas fired boilers (existing equipments located in the engine room), which have much higher capacity compared to the 2 MW cogeneration plant. Based on this condition, the current ventilation would not likely to result in an accumulation of natural gas, hence an explosion scenario.

In the addendum, we have provided estimations on the time taken to reach the Lower Explosive Limit (LEL) in the event of pipe failure whilst taking the natural ventilation rate into consideration. At a conservative rate of 1 air change/hour, it would take around 30 minutes to reach the LEL. In real situation, a catastrophic pipe failure event would likely be noticed within a short timeframe as there would be disruption to the generator operation which would activate the pressure sensor/alarm and generate warning messages in the Master Control Panel. This would then be followed by manual isolation of the natural gas pipeline to completely stop natural gas release.

Although unlikely, an explosion scenario has been modeled and presented in the Addendum Report. The predicted overpressure level at the ammonia tank is around 116 mBar (or 11.6 kPa). To cause a structural failure to the ammonia tank, the level of overpressure needs to be close to 210 mBar. Given this prediction, a domino effect from the explosion scenario is unlikely.

The overpressure level at the closest residence is around 10 mBar (or 1 kPa). This readily satisfies the explosion overpressure criteria at residential area, which is 70 mBar.

iv Would methane detectors be installed in the engine room?

Response:

It is not deemed required to install methane detectors in the engine room due to the very low likelihood of major gas leak.

b. The radiation levels calculated for jet fire and provided in Section 5.2.1 of the PHA (Fire inside the Engine Room) need further clarification, in particular:

i It is surprising that the maximum heat radiation inside the engine room will be only 7.8 kW/m^2. TNO (Yellow book, Chapter 6) calculates 11 kW/m^2 at 49.8 m from the centre of the flame for a typical high pressure methane jet fire and Surface Emissive Power for the methane flame of 225 kW/m^2 . Although the pressure of the release in the PHA model is lower (100 kPa), high heat radiation would be expected in the vicinity of the flame;

Response:

There has been a revision on the jet flame calculation example in chapter 6 of TNO Yellow book (see attached summary of changes made in the latest version). I have attached the calculation example from the latest version for your reference.

We have consulted the TNO representative on this matter and we have been advised that it is not relevant to compare the results from the modeling with the calculated results from the example. This is because a different approach was taken to estimate the leak rate. In the example, the leak rate is specified (i.e. arbitrarily chosen) whilst in the model, the leak rate is calculated based on the gas release model, which is more accurate to represent the real scenario. Some of the inputs used for the example were randomly chosen and thus they do not necessarily reflect a real case event.

ii Confirm if the methane pressure of 100 kPa is gauge or absolute;

Response:

The methane pressure of 100 kPa is the gauge pressure. Absolute pressure would be 201.1 kPa

iii Please clarify if the distances provided in Column 3 of Table 5-1 Calculated Distance from Model are measured from the edge of the flame;

Response:

The distance is from the point of release.

iv What is the length of the jet fire and is it likely to directly impinge on equipment in the engine room.

Response:

The estimated length of the jet fire is 6.6 m. It would not likely to pose direct impingement to the surrounding equipment, e.g. boilers which are located 7 m away. Refer to Addendum Report for further details.

v Fig 5-2 Heat Radiation vs. Distance Plot for Fire inside the Engine Room shows a heat radiation of 4.4 kW/m^2 at the edge of the fire and a maximum of 7.8 kW/m^2 at greater distance from the fire. This again is surprising and some explanation should be provided.

Response:

With a jet flame, the max heat flux occurs at a certain distance rather than at the point of release. This is because the gas being released needs time to completely mix with air before it gets burnt. . Since it came out as a jet, the gas would be at ambient temperature at a distance very close to the hole. Any fire close to it will be pushed away by the gas being released. In addition, it also needs time to achieve elevated temperature required for fully developed flame.

Appendix D

Addendum to Preliminary Hazards Assessment

ADDENDUM
PRELIMINARY HAZARD ASSESSMENT FOR PROPOSED COGENERATION PLANT AT TOOHEYS PTY LTD 29 NYRANG STREET, LIDCOMBE

Prepared for:	Andrew Meagher, Tooheys Pty Ltd Fred Sadie, Tooheys Pty Ltd Department of Planning

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Prepared by:	Filbert Hidayat, Environmental Engineer Gusni Melington, Senior Environmental Engineer R T Benbow, Principal Consultant *Benbow Environmental North Parramatta, NSW*

Report No:	109128_PHA_Addendum 1 November 2009 (Released: 12 November 2009)

Benbow
ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

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This report presents amendments and additional information for the Preliminary Hazard Analysis report (Ref: 109128_Final_PHA_Rep) on the installation of a cogeneration plant at the Tooheys brewery site located at 29 Nyrang St, Lidcombe.

The following supersedes Section 5.2 of the report.

5.2 Hazards Identified for Further Analysis

Following a review of the Hazard Identification Charts in Section 4.3, a series of potentially hazardous events or scenarios require a more comprehensive quantitative analysis. Each event or scenario will be discussed in detail.

The main pipeline supplying natural gas to the engine room is approximately 241 m in length, starting from the south eastern boundary near the LPG tank (Depot O). The supply pipe to the gas generator is an 80 mm branch off the existing 150 mm main supply line to the boilers. The length of this new pipe section is 5 m.

The potential for leak exists in such installations. This hazard has been thoroughly considered in the design and installation of the pipeline, therefore reducing the likelihood for a major natural gas leak or catastrophic pipe failure that could lead to fire or explosion if ignited. Note that the size of the generator is much smaller compared to the two natural gas fired boilers currently housed in the same room. There is no record of a natural gas leak being reported since these were commissioned which indicates good management practices exist.

Although the likelihood is minute, examples of worst case scenarios are presented to predict the impact of the following events at the surrounding installation and residential areas:

- Catastrophic pipe failure resulting in:
  - Torch fire (or jet fire), if immediately ignited close to source; and
  - Explosion, if accumulation of flammable gas occurs and reaches the conditions for explosion.

Consequences in terms of heat flux and overpressure impacts were assessed for the scenarios above based on worst case scenarios.

5.2.1 Torch Fire

An estimation of the consequences resulting from a fire event initiated by a major natural gas pipe leak inside the engine room has been modelled using Effects 7.6 by TNO safety software. This scenario considers that the new natural gas pipe connecting the mains to the generator has failed, releasing a significant amount of flammable gas in a jet which immediately finds a source of ignition.

The event of a pipe failure is represented by a 120 mm hole on the new pipe section located around 3.7 m from the ground. The flow from the entire pipe length of 246 m, supplying natural gas at 100 kPa (gauge) is considered to contribute to this event. Note that at the last 2 m of the pipe, the pressure is reduced to 20 kPa (gauge) for supply to the generator whereas the model has conservatively assumed a constant supply pressure of 100 kPa (gauge).

Pure methane was used as the representative chemical for natural gas. The outflow angle was assumed to be horizontal as this would give the most conservative heat impact. The torch fire model is considered most appropriate to predict the heat radiation impact from fire initiated by major flammable gas release from a pressurised pipe.

The predicted heat of radiation levels are tabulated in Table 5-1and Table 5-2. The predicted heat of radiation levels are plotted against distance measured from the point of release in Figure 5-1. The model represents the flame as a frustum of a cone, radiating as a solid body with a uniform surface emissive power. A torch fire resulting from this event would have an approximate frustum length of 6.6 m. The width of the base and the tip of the frustum are 0.03 m and 2.4 m respectively. The maximum surface emissive power is 77.7 kW/m^2.

As previously noted, the pipe is located at 3.7 m from the ground, therefore the likelihood for direct fire impingement to the boilers immediately located 7 m away from the pipeline would be very low. In addition, the model predicted a maximum heat radiation level of 7.8 kW/m^2 at 7.2 m from the point of release. This level of heat is much lower than the 12.6 kW/m^2 criteria, hence it would not be possible to cause extreme thermal stress or structural failure of the surrounding equipment in the engine room. These results would also negate the potential for heat impingement to the surrounding dangerous goods area, in particular, the ammonia storage area located outside the engine room to the south.

The 4.7 kW/m^2 heat radiation level was estimated to occur at a distance of 10.5 m from the point of release. The heat contour diagram for the 4.7 kW/m^2 is shown in Figure 5-2. Table 5-2 clearly shows negligible heat of radiation impact potentially experienced by the closest residences in the area. Given these considerations, the impact of heat radiation due to a torch fire event from a catastrophic pipe failure is considered negligible.

It is noted that the above scenario was modelled to predict impacts in the case of an extreme torch fire scenario. In a real situation, a catastrophic pipe failure could only happen due to a very significant mechanical impact. The pipeline is located at 3.7 m above the ground therefore it is clear from any potential obstructions. In addition, there would not be any mobile equipment used in the room.

In normal operating conditions, the more likely gas leak event would be a small one from flange connections. Should the leak ignites, the resulting fire and heat impact would be much reduced due to the reduced volume of gas leaked.

Table 5-1: Estimated Distances for Specific Heat Radiation Levels (Torch Fire)

Heat Radiation Levels (kW/m^2)	Effect	Distance from the point of release (m)
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur).	10.53
12.6	Significant chance of fatality; High chance of injury; Wood can potentially be ignited; Thin steel insulation may suffer thermal stress and potential structural failure.	Not reached*
23	Fatality; Spontaneous ignition of wood; unprotected steel will suffer thermal stress and cause failure; Pressure vessel failure.	Not reached*

Note: * The predicted maximum heat of radiation is 7.8 kW/m^2

Table 5-2: Estimated Heat Radiation Levels at Nearest Receptors from the Point of Release (Torch Fire)

Receptors	Approximate Distance from the Source (m)	Heat Radiation (kW/m^2)
R1	262	0.000342
R2	246	0.000384
R3	243	0.000394
R4	254	0.000360
R5	261	0.000344
R6	466	0.000105
R7	449	0.000114
R8	445	0.000116
R9	423	0.000129
R10	535	0.000079
R11	1440	0.000011
R12	1380	0.000010

Figure 5-1: Heat Radiation vs. Distance Plot for a Torch Fire Scenario inside the Engine Room

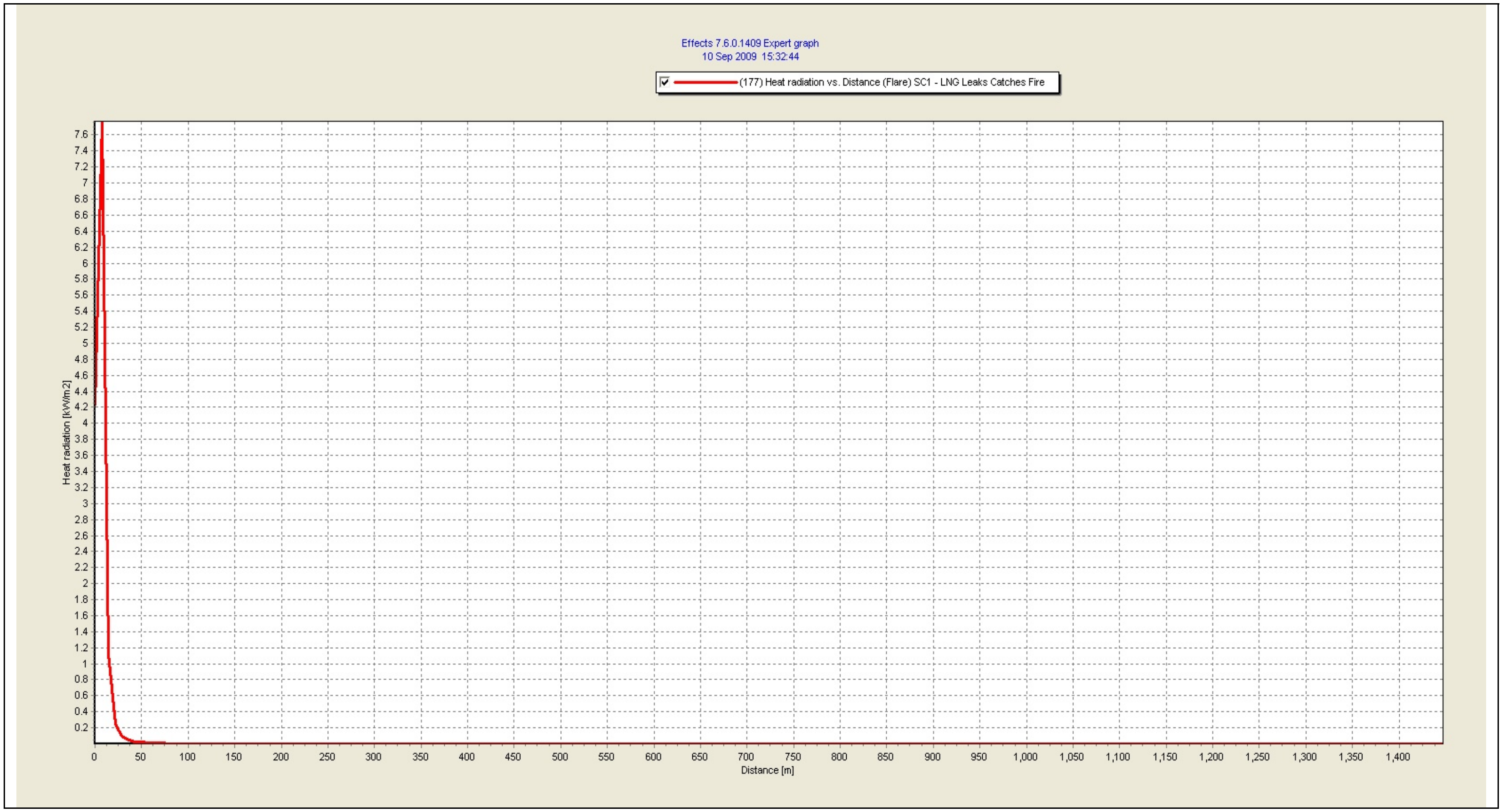

Figure 5-2: Heat Radiation Contour (4.7 kW/m²) for Fire inside the Engine Room (Torch Fire)

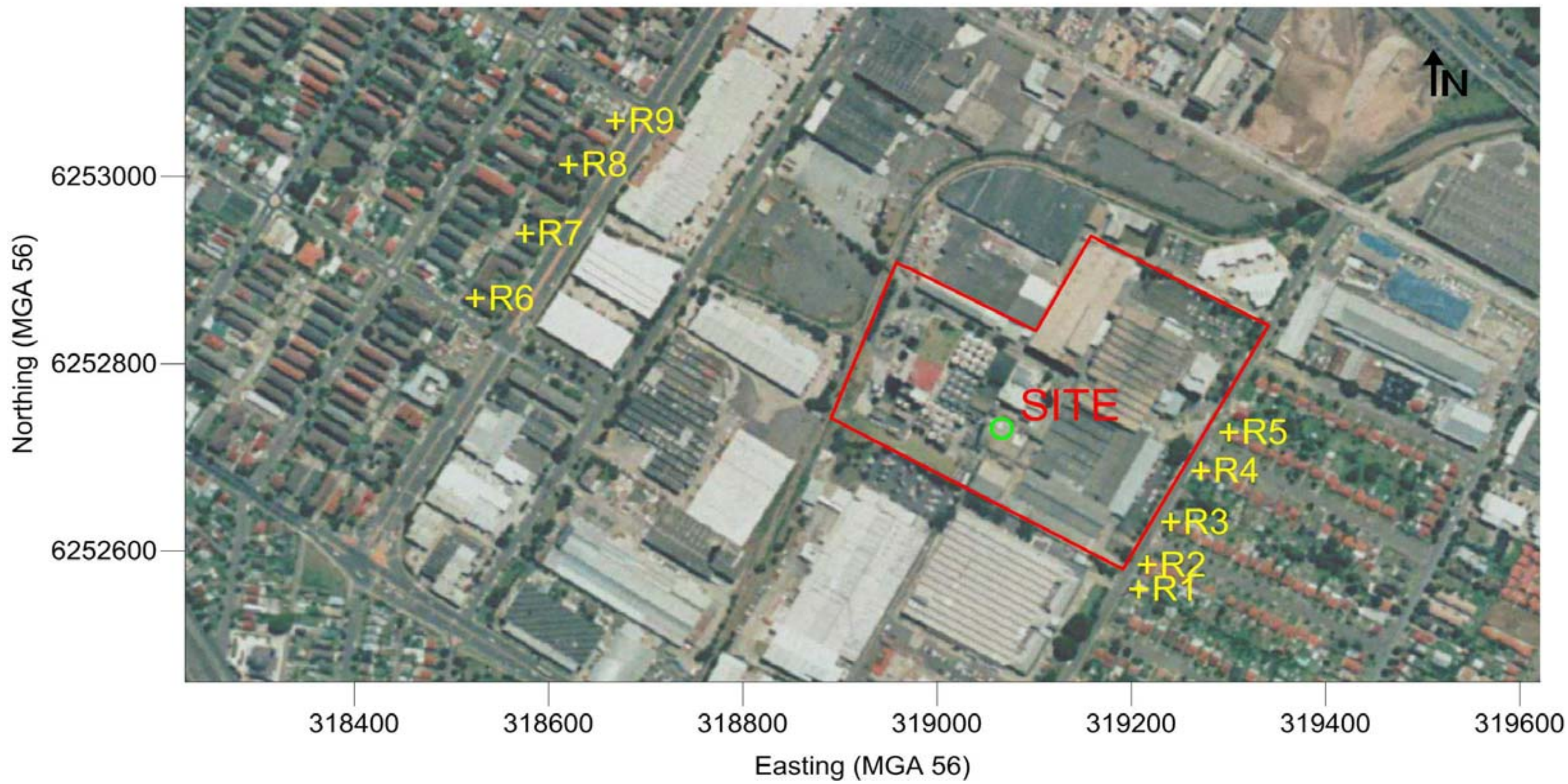

Image Source: Department of Lands © 2008 – SIX Viewer

5.2.2 Explosions

A prolonged gas release from a pipe failure scenario above could result in progressive formation of a vapour cloud containing a mixture of air and methane. If the lower explosive limit (LEL) of methane is reached and ignited, an explosion could occur at the right ambient pressure and temperature.

The existing boilers located at 7 m distance from the pipeline could be considered as ignition sources. From the previous scenario, the estimated leak rate is 0.27 kg/s. A gas dispersion modelling was performed with Effects 7.6 by TNO safety software to predict methane concentration at various distances from the release point. The area where methane concentrations are between its LEL and UEL (33.4 g/m^3 and 110.1 g/m^3) is considered to support an explosion event if ignited. The modelling was done for stability class D to F which represents a neutral to stable wind condition. The results are presented in Table 5-3 below.

Table 5-3: Estimated Distance to LEL and UEL from the Release Point

Stability Class	Distance to LEL (m)	Distance to UEL (m)
D	3.3	7.7
E	5.0	11.7
F	8.4	19.9

The results indicate that in the event of a catastrophic pipe failure, the concentration of methane could reach the LEL at the boilers area. This could potentially ignite and cause explosion. Due to this finding, a further modelling was conducted to estimate the overpressure impact from an explosion scenario.

An explosion scenario was simulated using the TNT model in the Effects 7.6 by TNO safety software. The point of ignition is assumed to occur at the boilers area. The overpressure levels assessed at the location of the ammonia tanks and at the closest identified residence were compared to the explosion overpressure criteria stipulated in HIPAP No4. The potential consequences for various overpressure levels are described in the following table.

Table 5-4: Consequences of Explosion Overpressure Effects

Explosion Overpressure (mBar)*	Effect
70	Damage to internal partitions and joinery but can be repaired; Probability of injury is 10% with no fatality.
140	House uninhabitable and badly cracked
210	Reinforced structures distort; Storage tanks fail; 20% chance of fatality to a person in a building

*Note: 1 kPa is approximately equal to 10 mBar

Figure 5-3 describes the overpressure level at various distances from the centre mass of explosive cloud. The levels of overpressure predicted at the ammonia tank and the closest residence are listed in Table 5-5.

Figure 5-3: Overpressure vs. Distance

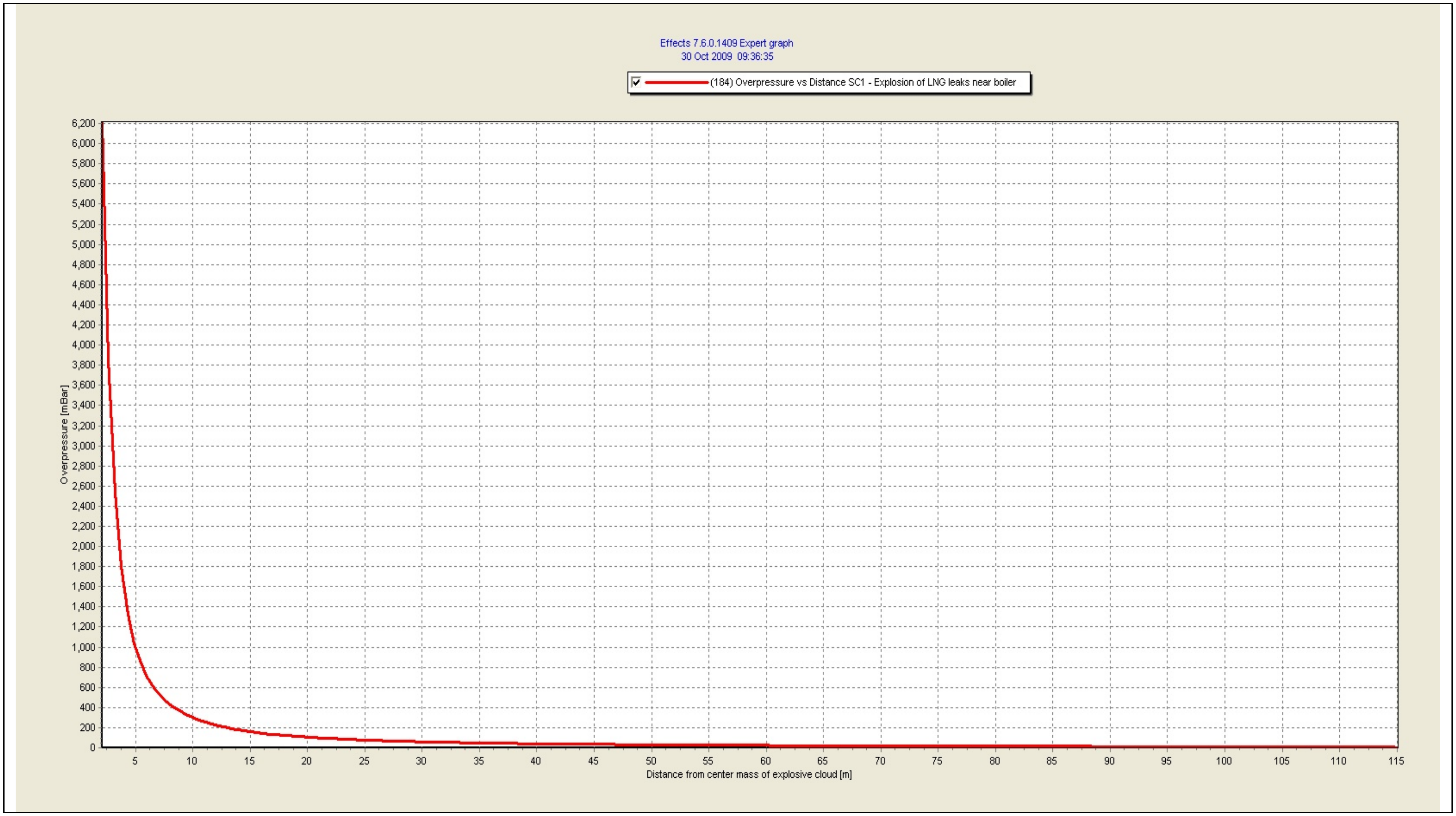

Table 5-5: Estimated Overpressure Levels

Description	Approximate Distance from centre of explosion (m)	Overpressure (mBar)
Ammonia tanks	18.8	116.2
Closest Residence (R3)	240	10.2

To cause a structural failure to the ammonia tank, the level of overpressure needs to be close to 210 mBar. The predicted overpressure level of 116.2 mBar would not likely to have a significant impact to the ammonia storage. At the closest residence, the predicted overpressure level is very low and therefore readily satisfies the 70 mBar criteria stipulated in the guidelines. It should also be noted that this model did not take into account protection from the engine room building itself. The actual overpressure level would be somewhat less than the predicted results due to the presence of the roof and walls surrounding the facility.

The accumulation of methane gas would be limited by the natural ventilation system which is required to provide air for combustion process the generator and remove heat generated by equipments in the engine room. The generator would utilise the air available in the room for combustion process therefore drawing more air to the engine room.

The time taken to reach the LEL can roughly be estimated by a material balance based on a constant release rate of 0.27 kg/s of methane for various ventilation rates. At a rate of 1 air change /hour, assuming 15 minutes delay before any methane gets vented out, it would take around 30 minutes to reach the LEL. An average of 2.5 air change/hour is likely achievable in a typical boiler house and at this rate, it would take at least 1 hour to almost reach the LEL. In a real situation, a catastrophic pipe failure event would likely be noticed within a short timeframe as there would be a disruption to the generator operation which would activate the pressure sensor/alarm and generate warning messages in the Master Control Panel. This would then be followed by a manual isolation of the natural gas pipeline to completely stop natural gas release.

This concludes the addendum report.

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