MOOREBANK INTERMODAL COMPANY

Moorebank Intermodal Terminal Project Environmental Impact Statement

Volume 4

October 2014

PARSONS BRINCKERHOFF

Technical Paper 4
Preliminary Risk Assessment

Technical Paper 4 – Preliminary Risk Assessment

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Moorebank Intermodal Terminal - Preliminary Risk Assessment

July 2014

Moorebank Intermodal Company

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798

Level 27, Ernst & Young Centre
680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101
Email sydney@pb.com.au

Certified to ISO 9001, ISO 14001, AS/NZS 4801
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Author: Vanessa Personnaz, Ainslie Just

Signed: .....

Reviewer: Ainslie Just, Delyth Toghill

Signed: 

Approved by: Paul Greenhalgh

Signed: 

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Glossary

%	percent
<	less than
>	greater than
δ	population density (person/ha)
ADG Code	Australian Dangerous Goods Code
A	affected area (hectares)
AS/NZS	Australian Standard/New Zealand Standard
BLEVE	boiling liquid expanding vapour explosion
°C	degrees Celsius
C	number of fatalities
C1/C2	combustible liquid class 1/class 2
CH_4	methane
C_3H_8	propane
C_4H_{10}	butane
CO_2	carbon dioxide
CBD	central business district
DG	dangerous goods (goods included in the ADG Code)
DNSDC	Defence National Storage and Distribution Centre
e.g.	for example
f_A	correction factor for populated area (part of circle)
f_d	correction factor for populated area (distance)
f_m	correction factor for mitigation effects
g	gram
g/mol	gram per mole (molecular weight)
ha	hectare

hazardous materials	substances (including dangerous goods) that have the potential to cause harm to human life and health, or to the environment
HIPAP	Hazardous Industry Planning Advisory Paper
IAEA	International Atomic Energy Agency
IBC	intermediate bulk container
IFR	individual fatality risk
IMT	intermodal terminal
IMEX	import/export
kg	kilogram
kL	kilolitre
km	kilometre
kPa	kilopascal
kW/m^2	kilowatt per square metre
L	litre
LGA	local government area
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LEP	local environmental plan
m	metre
mm	millimetre
m^3	cubic metre
MIC	Moorebank Intermodal Company (the Project Proponent)
ML	megalitre
MPa	megapascal
MSDS	material safety data sheet
N*	the average probability number for the transport of the substance
n/a	not applicable

nc	probability number correction parameter for the safety conditions of the transport system
$n_{t\delta}$	probability number correction parameter for the traffic conditions
n_p	probability number correction parameter for wind direction towards the populated area
NSW	New South Wales
p.	page
PP	protected place
ppm	parts per million
PHA	preliminary hazard analysis
PRA	preliminary risk assessment
SD	separation distances
SF_6	sulfur hexafluoride
SEPP	State Environmental Planning Policy
SME	School of Military Engineering
SSFL	Southern Sydney Freight Line
t	tonne
the Project	Construction and operation of the Moorebank IMT and associated commercial infrastructure. Also includes the development of a rail link and road access points to the site.
WHS	work health safety

Executive summary

Background

The Moorebank Intermodal Company (MIC), the Proponent, is currently evaluating the development of a new Intermodal Terminal (IMT) at Moorebank, located in South-West Sydney, which is planned to handle import/export container traffic from Port Botany and interstate rail freight. The Moorebank IMT (the 'Project') would provide an integrated transport solution for the movement of freight to, from and within, the Sydney basin.

The primary function of the Moorebank IMT is to be a transfer point in the logistics chain for shipping containers and to handle both international import/export cargo (IMEX) and domestic interstate and intrastate (regional) freight.

The need to address Sydney's insufficient intermodal rail freight capacity has been under consideration for some years, having been recognised as a major barrier to the future development of Sydney and improvements in national productivity. An IMT at Moorebank was first proposed by the Commonwealth in 2004.

The Commonwealth Department of Finance and Deregulation (DoFD) commenced the Moorebank Intermodal Feasibility Study in September 2010. The MPO was established to conduct the Study, with input from a team of advisers including Parsons Brinckerhoff as technical advisors. The Feasibility Study included economic and financial analysis, technical feasibility and design of a concept master plan for the IMT facility.

The Feasibility Study was followed by the DBC in February 2012 (KPMG 2012). In April 2012, after reviewing the findings of the DBC, the Australian Government committed to proceeding with the Moorebank IMT Project, with operations to commence in 2017 subject to planning approval. To secure that planning approval, MIC has commissioned a preliminary risk assessment as part of an Environmental Impact Statement (EIS) currently being prepared in fulfilment of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Final EIS Guidelines and the Secretary for the NSW Department of Planning and Environment's (NSW DP&E's) Environmental Assessment Requirements (NSW SEARs)under the *Environmental Planning and Assessment Act 1979*.

The objective of this report is to identify and assess risks arising from the operation of the IMT, in particular the handling and storage of dangerous goods and hazardous materials, within the Project area. The assessment specifies the level and extent of risk assessment required (preliminary screening, risk classification and prioritisation or risk analysis and assessment) to demonstrate that the IMT activities do not pose any significant threat to the surrounding land uses.

To meet the NSW DGRs, the hazard and risk analysis assessment of the IMT facilities has been carried out in accordance with the NSW Department of Planning and Infrastructure's (DP&I) (formerly the Department of Planning (DoP)) State Environmental Planning Policy (SEPP) 33 Guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 (Risk Criteria for Land Use Planning), HIPAP No. 6 (Guidelines for Hazard Analysis), and HIPAP No. 10 (Land Use Safety Planning).

It is important to note that dangerous goods have been explicitly excluded from the types of freight that will be handled by the Project. Therefore the only sources of risk from hazardous materials that will be likely to affect the Project will be those materials stored at the facility for use as part of its operation and any goods shipped through the terminal contrary to the explicit restrictions on dangerous goods as a result of either human error or intentional deception.

The nature and quantities of any dangerous goods that might be shipped through the IMT despite the prohibition cannot be predicted with any certainty. However, it is highly unlikely that dangerous goods that might have serious consequences for either the terminal itself or surrounding areas in the event of an accident would be present other than very infrequently and then in only limited quantities (constrained by the size of standard shipping containers). It is also unlikely that dangerous goods would be stored in close proximity, so that 'domino' effects are unlikely to result in an accident involving one container affecting other containers of dangerous goods. There are significant separation distances between the operational areas of the IMT and the nearest residential areas and sensitive land uses, which would further reduce to negligible levels any risk from unknown substances moving through the IMT that might affect persons outside the site.

An existing gas supply pipeline running along Moorebank Avenue will be used to provide natural gas to the facility via an internal reticulation system. The risk arising from operation of the pipeline will not be affected by or attributable to its connection to the Project. The risks created by any leaks from the reticulation system within the IMT would be in addition to existing risks in the area, but would not be significantly different from those for any other commercial operation using a reticulated natural gas supply in the area.

Up to 100 kL of liquefied natural gas (LNG) will be stored on the IMT Project site for fuelling terminal operating equipment. It is assumed that delivery of LNG will be either by road or rail tanker through the transport networks outside the IMT site. A similar quantity of diesel will be stored on the site for refuelling locomotives.

As part of the concept master plan, space for a possible service station is allocated along Moorebank Avenue to provide refuelling and related facilities for trucks and other vehicles. If included in the Project the service station would likely include underground storage of diesel and petrol, and LPG storage, probably also underground. This would be a commercial operation, and would not differ from similar public service stations located throughout the Sydney area and the country generally. Detailed design of this facility has not been undertaken at this stage and the development would be subject to further planning and assessment applications.

Assumptions have been made in preparing the risk assessment where this was necessary because of the level of design information available at this stage of the Project where a concept level planning approval is being sought. These assumptions are deliberately conservative and have been detailed in the assessment. In completing the assessment, the ultimate proposed development stage has been assumed as being likely to pose the greatest level of risk, although in practice the risk is not likely to change significantly during the proposed staged development.

Results

The preliminary risk assessment of the proposed IMT has shown that none of the hazardous materials legally stored on-site, principally fuel for equipment, trucks and locomotives, or the related activities such as transportation of these materials, could create an off-site impact that would significantly affect members of the public.

Prohibited dangerous goods that are introduced into the IMT are unlikely to be present in such quantities, or for such periods of time, that any credible accident would result in an off-site risk approaching the land use risk criteria specified in the Hazardous Industry Planning Advisory Paper No. 10-Land use safety planning.

A SEPP 33 screening assessment has shown that, with the exception of LNG, none of the material present on-site will be stored or handled in quantities that trigger any of the screening criteria. Because the screening threshold for LNG is exceeded, the development is potentially hazardous, and a preliminary hazard analysis has been undertaken.

Reticulated natural gas is not stored on site and the inventory in the pipework is small. It is therefore not assessable under the SEPP 33 screening system but could conceivably give rise to a risk to persons outside the IMT boundaries. A risk assessment of reticulated natural gas shows that the potential area of impact is small, and has not identified any potential impact to sensitive land uses or residential areas that would constrain the development. Any risk arising from the gas distribution pipeline running along Moorebank Avenue will not change as a result of the Project, and is a risk to which the population as a whole is routinely exposed in any area where gas is reticulated.

LPG storage at a possible service station that might adjoin the IMT Project is dealt with separately under SEPP 33, but no guidelines are provided. The location must be in accordance with relevant location guidelines and standards. The possible LPG storage (as identified within the concept master plan design) will be designed and constructed to comply with the Australian Standard for the storage and handling of LPG. The effect area for the LPG storage does not extend to any residential or sensitive use area.

The size and location of any LNG storage tank on the site would be such that the available buffer distance to the site boundary would prevent any significant consequence outside the IMT Project site.

Other dangerous goods likely to be used on the IMT Project site are not present in quantities that would give rise to risks to the public or off-site assets, but might cause workplace health and safety risks to personnel on site or risks to the biophysical environment. These risks can be managed within safe levels by the appropriate use of engineering design and controls, good management practices and appropriate disposal methods for wastes.

1. Introduction

1.1 The Moorebank Intermodal Terminal Project

The Moorebank Intermodal Terminal (IMT) Project (the Project) involves the development of approximately 220 hectares (ha) of land at the Project site (refer to Figure 1.1) for the construction and operation of an IMT and associated infrastructure, facilities and warehousing. The Project includes a rail link connecting the Project site to the Southern Sydney Freight Line (SSFL) and road entry and exit points from Moorebank Avenue.

The primary function of the IMT is to be a transfer point in the logistics chain for shipping containers and to handle both international IMEX cargo, and domestic interstate and intrastate (regional) cargo. The key aims of the Project are to increase Sydney's rail freight mode share including: promoting the movement of container freight by rail between Port Botany and western and south-western Sydney; and reducing road freight on Sydney's congested road network.

The Project proponent is Moorebank Intermodal Company (MIC), a Government Business Enterprise set up to facilitate the development of the Project.

The Project site is currently largely occupied by the Department of Defence's (Defence) School of Military Engineering (SME). Under the approved Moorebank Units Relocation (MUR) Project, the SME is planned to be relocated to Holsworthy Barracks by mid-2015, which would enable the construction of the Project to commence.

The key features/components of the Project comprise:

- an IMEX freight terminal – designed to handle up to 1.05 million TEU per annum (525,000 TEU inbound and 525,000 TEU outbound) of IMEX containerised freight to service 'port shuttle' train services between Port Botany and the Project;
- an Interstate freight terminal – designed to handle up to 500,000 TEU per annum (250,000 TEU inbound and 250,000 TEU outbound) of interstate containerised freight to service freight trains travelling to and from regional and interstate destinations; and
- warehousing facilities – with capacity for up to 300,000 square metres (m^2) of warehousing to provide an interface between the IMT and commercial users of the facilities such as freight forwarders, logistics facilities and retail distribution centres.

The proposal concept described in the main EIS (refer Chapters 7 and 8) provides an indicative layout and operational concept for the Project, while retaining flexibility for future developers and operators of the Project. The proposal concept is indicative only and subject to further refinement during detailed design.

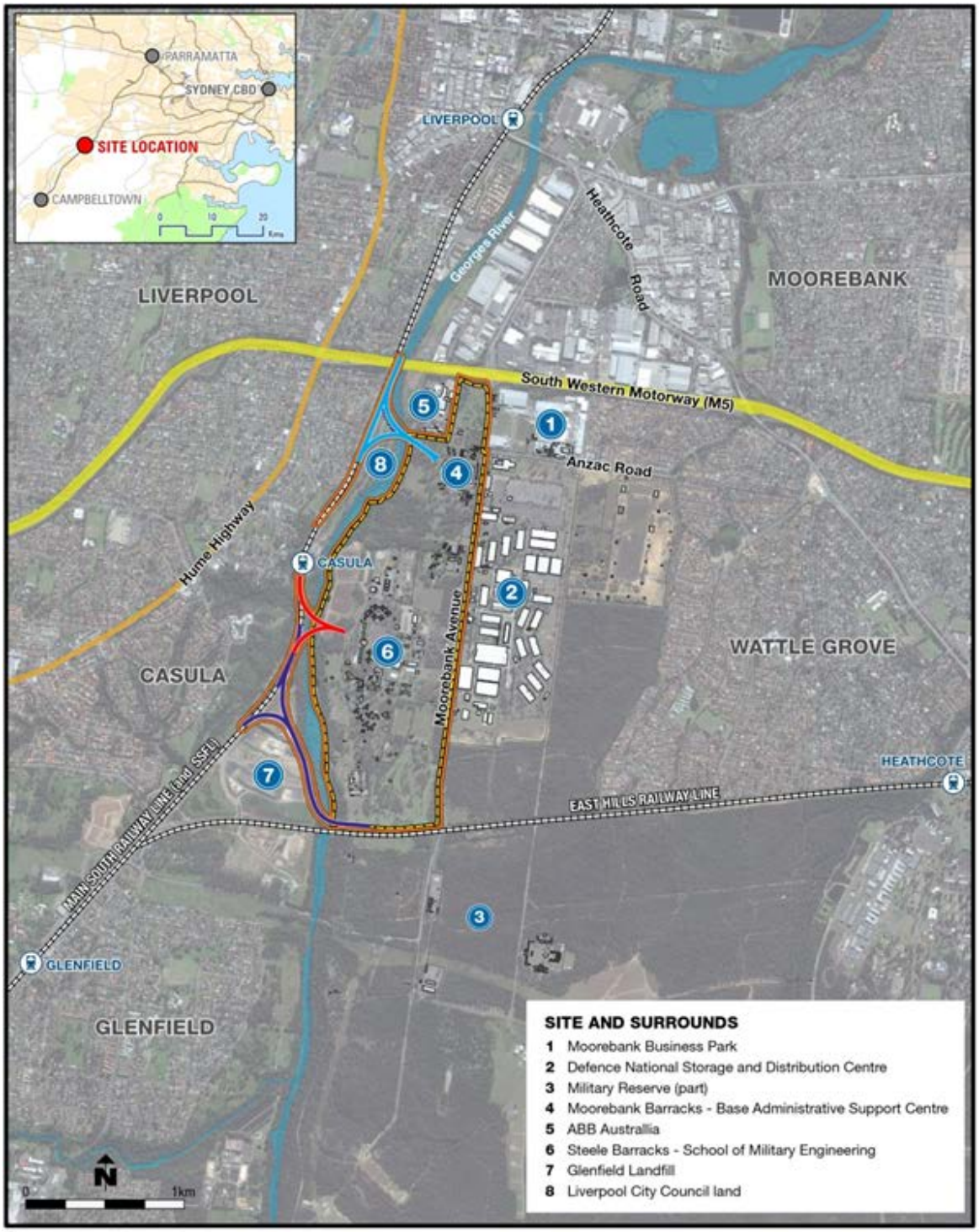

Figure 1.1 Project site and context

1.2 Rail access options and layouts

The Project is intended to connect to the SSFL, which was commissioned in January 2013 within the Main South Railway Line corridor. The SSFL connects Port Botany to west and south-western Sydney, and would provide a direct route for freight trains from Port Botany to the Project site.

Three separate rail access options are included as part of the proposal concept as detailed in the EIS, as shown in Figure 1.1. These options comprise:

- northern rail access option — with rail access from the north-western corner of the Moorebank IMT site, passing through the former Casula Powerhouse Golf Course (which is currently owned by Liverpool City Council (LCC)) and crossing the Georges River and floodplain;
- central rail access option — with rail access from the centre of the western boundary of the Moorebank IMT site, passing through Commonwealth land on the western bank of the Georges River (referred to as the 'hourglass land'); and
- southern rail access option — rail access from the south-western corner of the Moorebank IMT site, passing through the Glenfield Landfill site (owned by Glenfield Waste Services) and crossing the Georges River and floodplain.

In order to maintain flexibility for future developers and operators of the Project, the proposal concept, as presented in the EIS, provides three indicative IMT internal layouts; one for each of three proposed rail access options. Once the selected developer/operator has been appointed, the Project would progress to the detailed design phase and one of the three rail access options identified above would be selected.

1.3 Indicative Project development phasing

The Project is proposed to be phased (staged) in its development, as summarised in Figure 1.2. The proposed indicative phasing includes both construction and operational phases, which are likely to overlap at certain times. For the purposes of assessment of the Project, five project development phases have been identified and detailed in this EIS. These are indicative only, but illustrate the type of construction and operation activities that would occur over time at the Project site.

The Project would likely commence in 2015 with the Early Works development phase and would progress with concurrent construction and operation through to the Project Full Build Phase (operation of full IMEX terminal, warehousing and interstate terminal) by approximately 2030.

The development phasing is proposed in line with the forecast market demand for processing of containers through the Project.

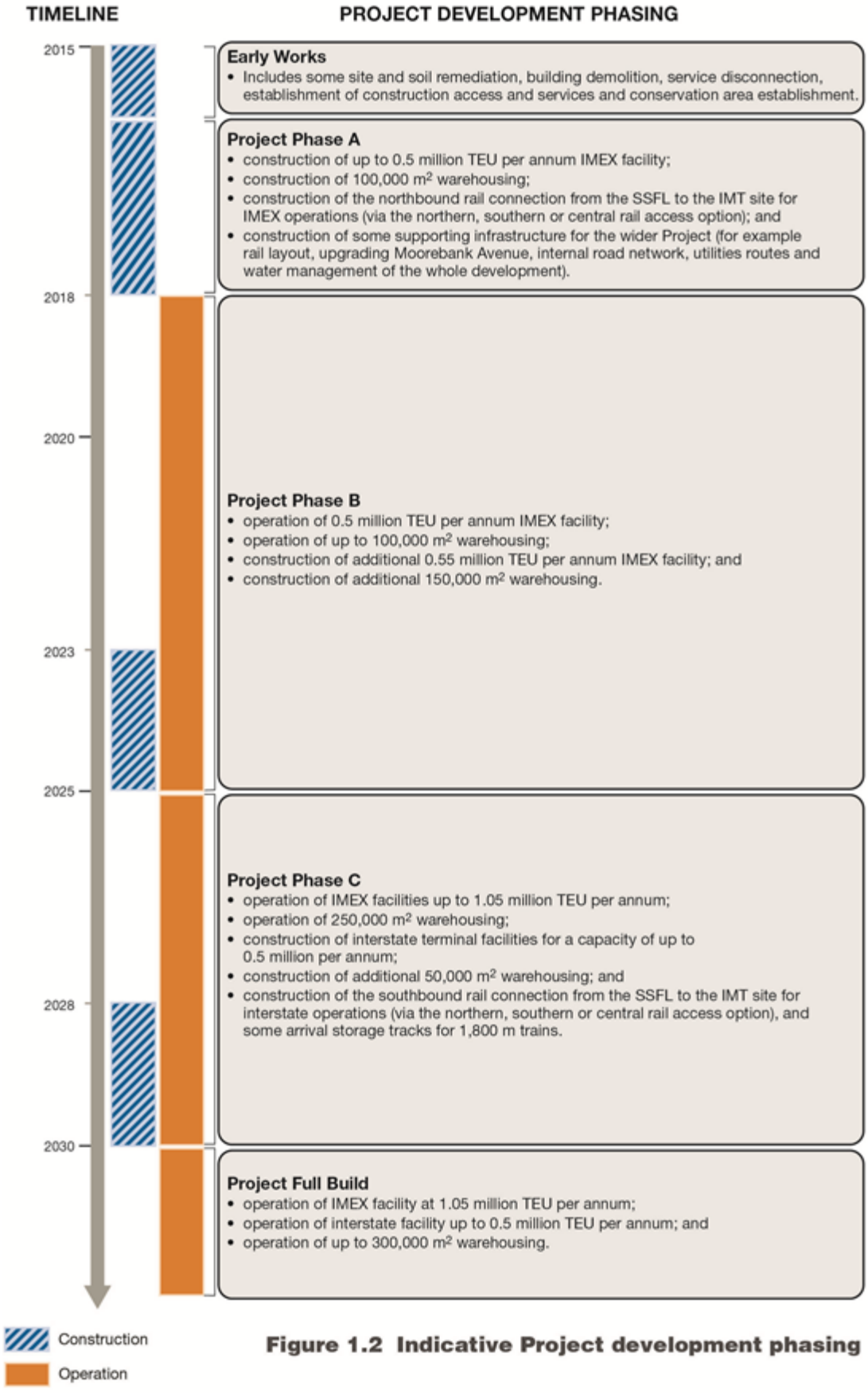

Figure 1.2 Indicative Project development phasing

1.4 Road access to the site

Freight trucks would access the Project site from Moorebank Avenue, via the M5 Motorway. Trucks would then access the M7 Motorway and Hume Highway by the M5 Motorway. An upgrade to Moorebank Avenue would be included as part of the first phase of Project development (Project Phase A) to enable safe and efficient access to the Project site.

1.5 Planning and environmental approvals

The Project is subject to both Commonwealth and NSW State Government approvals, and this Environmental Impact Statement (EIS) has been prepared to support applications for both approvals (EPBC number 2011/6086 and SSD-5066). The Project is a 'controlled action' under the (Commonwealth) Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Therefore, MIC is seeking approval for the construction and operation of the Project from the (Commonwealth) Department of the Environment (DoE) under Part 9 of the EPBC Act.

Under the (NSW) Environmental Planning and Assessment Act 1979 (EP&A Act), MIC is seeking a staged development approval for the Project as State significant development (SSD). At this stage, MIC is seeking Stage 1 SSD approval for the proposal concept (as described in EIS) from NSW Planning and Infrastructure (NSW P&I) under Part 4, Division 4.1 of the EP&A Act (hereafter referred to as the Stage 1 SSD approval). The Stage 1 SSD approval application also includes a package of 'early works' that comprises remediation, clean-up and demolition or relocation of existing buildings, and establishment of a conservation area. This EIS is seeking approval for these early works without the need for any further approvals. Subject to Stage 1 SSD approval being received, the Project (with the exclusion of the early works) will be subject to further development applications and environmental assessment under the EP&A Act (hereafter referred to as the Stage 2 SSD approvals).

1.6 Purpose of this report

The purpose of this Technical Paper and the overall EIS is to seek approval for the Moorebank IMT Project 'concept' under both the EPBC Act and the EP&A Act as a Stage 1 state significant development (SSD).

In seeking approval, MIC is seeking to establish a staged approval process, whereby successive stages of development on the Project Site would be subject to further environmental assessment and separate planning approval once further detailed Project information is developed. That is, MIC is currently seeking approval for the Project 'concept' (i.e. the broad parameters of the Project), sufficient to satisfy both:

- a Stage 1 SSD application under the NSW EP&A Act
- Commonwealth EPBC Act requirements for the Project, in relation to impacts of the proposed controlled action on matters protected under the EPBC Act (which comprise listed threatened specials and communities and impacts on the environment by a Commonwealth agency).

Therefore, this Technical Paper and the EIS assess the impacts of all three proposed development phases of the Project (A, B and C) to a concept level, but with more detailed assessment of matters protected under the EPBC Act. Operation phase impacts have been assessed and are presented for the concept master plan. The Project would be the subject of further detailed design and future development applications as those details are developed, with environmental impact assessments to be conducted in detail at that time. Impacts and mitigation measures would be confirmed during these subsequent applications.

1.7 Environmental impact assessment requirements

This Technical Paper has been prepared by Parsons Brinckerhoff to address environmental impact assessment requirements of both the Commonwealth Government under the EPBC Act (the 'Final EIS Guidelines'); and the Secretary for the NSW Department of Planning and Environment's (NSW DP&E's) Environmental Assessment Requirements (NSW SEARs).

Specifically this Technical Paper addresses the requirements outlined in the Table 1.2.

Table 1.1 EIS requirements addressed within this Technical Paper

Requirement	Where addressed in the technical paper
EPBC Act – Final EIS Guidelines	
5. DESCRIPTION OF THE ACTION All construction and operational components of the action must be described in detail. … The information must include:	
▪ Full details of risk assessments which have been undertaken regarding potential threats from flood and fire and strategies to address these risks.	▪ Fire risk: this Technical Paper, section 4. ▪ Flood risk: see Chapter 16 of the EIS. ▪ Bushfire risk: see Chapter 21 of the EIS.
IMPACTS TO THE ENVIRONMENT BY A COMMONWEALTH AGENCY The EIS must provide a detailed and comprehensive analysis of the existing environmental conditions, likely changes. The following should be addressed in relation to impacts to the environment: ▪ Provide an assessment of the likely and potential impacts on all aspects of the environment associated with spills, floods, fire and release of contaminants. ▪ The assessment needs to consider all hazardous items that will or could potentially be transported and/or stored at the intermodal terminal. ▪ Discuss the likelihood of hazardous materials being illegally transported using rail infrastructure and stored at the Moorebank Intermodal.	▪ Fire risk: this Technical Paper, sections 3–5. ▪ Illegal transport of dangerous goods: this Technical Paper, section 2.6.1. ▪ Flood risk: see EIS Chapter 16. ▪ Bushfire risk: see EIS Chapter 21.

Requirement	Where addressed in the technical paper
NSW EP&A Act - SEARs	
The EIS must … include the following: **Hazards and Risks** - including but not limited to:	
▪ potential hazards and risks associated with the site as a whole and offsite, taking into account activities that have the potential to cause harm to people and/or the environment, including potential impacts associated with storing and handling dangerous goods on-site and transporting such goods to and from the site consistent with the Department's guideline Applying State Environmental Planning Policy (SEPP) 33 and taking into account the Hazardous Industry Planning Advisory Paper No 10: Land Use Safety Planning (Department of Planning (DoP)	▪ Hazards and risk assessment in accordance with SEPP 33: This Technical Paper, section 3.2.
▪ a Preliminary Hazard Analysis, if relevant, in accordance with the Hazardous Industry Planning Advisory Paper No. 6 Guidelines Hazard Analysis (DoP)	▪ Preliminary Hazard Analysis: This Technical Paper, section 4.
▪ bushfire protection, taking into account Planning for Bushfire Protection (Rural Fire Service).	▪ See EIS Chapter 21.

1.8 Objectives

The objective of the preliminary risk assessment (PRA), including if required under SEPP 33 a preliminary hazard analysis (PHA), is to:

- qualitatively assess the risks posed to humans and to the social and biophysical environment in the locality, by all unplanned or emergency events that might arise during the construction or operation of the proposed IMT
- determine whether any significant risk remains after the project design (including all appropriate risk mitigation measures) is considered
- provide the regulatory agencies with sufficient information regarding the risks involved in the proposal to enable them to properly assess the development application.

1.9 Scope

The scope of the study is to:

- Review the existing information.
- Perform a risk assessment in accordance with statutory requirements, on materials and processes that, in an emergency situation, have the potential to cause injury or damage beyond the boundaries of the facility. Where results from the preliminary risk assessment indicate that no off-site impact will occur then an off-site risk analysis should not be required.
- Provide a report detailing the findings of all the above, with risk contours if relevant, major contributors and recommendations.

The IMT Project will be constructed in three phases allowing for future growth. However, for the purpose of this report, the final '2030 full build' formed the basis of the assessment as it presents the potential worst case scenario on the site.

It should be noted that, because detailed design of the Project facility has not commenced, details regarding specific engineering design and controls are not available and the risk assessment is therefore necessarily limited, being based on the concept design and application of good engineering practice.

1.10 Risk assessment process

The risk assessment process used in this study involves the following broad steps, consistent with the standard AS/NZS ISO 31000:2009 Risk management - Principles and guidelines:

- setting the context for the assessment (largely contained in this section, in particular the legislative requirements for the assessment)
- the identification of scenarios arising from the sources of risk that are likely to be relevant in the context (detailed in sections 2 and 3), requiring in this case:
  - the identification of hazardous materials
  - the identification of credible adverse events that might arise from those materials
  - application of a screening process to determine which materials might lead to an unacceptable level of risk given the quantities involved
- an analysis of the risk that results from the combination of the estimated consequences and frequencies (section 4), including a preliminary hazard analysis if required by the results of the screening process
- an evaluation of the estimated risks against relevant criteria, in this case the land use planning criteria specified by the NSW Department of Planning and Infrastructure (NSW DP&I) (formerly the Department of Planning).

1.11 General inclusions and exclusions

This PRA considers principally the risks to human, social and biophysical environments arising from sudden and unexpected events such as accidents and the results of equipment failure, operator error and the results of external events involving (but not necessarily under the direct control of) the proponent. Therefore the assessment does not consider any risks that are unrelated to a single event (for example, cumulative effects from long-term exposure to a substance); however, these are covered in the human health risk assessment undertaken for the Project (EnRiskS, 2014).

The PRA does not generally address issues that are the direct and recognised result of controlled activities undertaken intentionally as part of the development and described in the development application, such as occupational health risks from normal construction-related activities covered by relevant legislation and guidelines, or the normal operational discharge of stormwater to a holding pond.

The concept master plan does not allow for dangerous goods to be accepted in the Moorebank IMT's freight container storage and transit areas. Therefore risks arising from dangerous goods in storage and/or transit were not assessed quantitatively in this report. It is possible that some dangerous goods may be processed or stored in the IMT as a result of either human error or intentional deception.

In either case, the nature and quantities of any hazardous goods that might be shipped through the IMT cannot be predicted with any certainty, but it is considered highly unlikely that significant quantities of dangerous goods with the potential to create a serious accident will be present at any particular time.

The largest 'package size' of dangerous goods would be constrained by the size of standard shipping containers. With the exception of a few very dangerous materials (which are even less likely to be shipped in bulk and to either inadvertently or intentionally evade the prohibition on dangerous goods), the maximum quantities involved are not generally large enough to pose an off-site risk. It is even less likely that any prohibited dangerous goods present would be stored in proximity, so that domino effects are unlikely to result in an accident involving one container affecting other containers of dangerous goods. There are also significant separation distances between the operational areas of the IMT and the nearest residential areas and sensitive land uses, which would further reduce to negligible levels any risk from unknown substances moving through the IMT that might affect persons outside the site.

Where design information is not yet available, assumptions have been made as part of this assessment. Assumptions were based on the information collected at the time of writing this report, and are generally considered conservative. If any of these assumptions changes during the development of the Project, a review of the findings should be carried out.

1.12 Legislative requirements

The New South Wales (NSW) Department of Planning and Infrastructure (formerly Department of Planning) has developed risk assessment and land use safety planning processes and frameworks to ensure the orderly development of industry and the protection of community safety. These processes are implemented under the EP&A Act as part of the environmental impact assessment procedures.

An integrated assessment of hazards and risks that accounts for both the technical and the broader locational safety aspects of potentially hazardous industry is established under the SEPP No 33-Hazardous and Offensive Industries (Department of Planning, 2011).

To support the SEPP 33 assessment process and assist stakeholders in implementing the assessment, SEPP 33 Guidelines and a number of Hazardous Industry Planning and Advisory Papers (HIPAPs) were published by the former Department of Planning and were updated in 2011.

Relevant HIPAPs for this assessment are HIPAP No. 4-Risk Criteria for Land Use Planning (Department of Planning, 2011a), HIPAP No. 6-Guidelines for Hazard Analysis (Department of Planning, 2011b), and HIPAP No. 10-Land Use Safety Planning (Department of Planning, 2011c).

SEPP 33 and the HIPAP guidelines specifically cover risks from fixed installations and do not encompass transportation by pipeline, road, rail or sea. A complete method covering fixed installations and transport (including pipeline) is described in the International Atomic Energy Agency (IAEA) *Manual for the classification of risks due to major accidents in process and related industries* (IAEA, 1996), which is recommended as an assessment method in HIPAPs Nos. 4 and 6.

Therefore, the risk assessment of the fixed installations at the IMT is based on the SEPP 33 guidelines and related HIPAPs while the pipelines delivering gas to the site is assessed using the IAEA manual.

2. Site data and background information

This section presents background information on hazardous materials required on-site for the IMT Project including their type, quantity present, location and how they are used or stored on-site.

2.1 Site location

The site is currently occupied by the School of Military Engineering and a number of other Defence units. Georges River and Moorebank Avenue define, respectively, the western and eastern boundaries of the site. The southern boundary is delineated by the East Hills railway line while the northern area of the site is occupied by the M5 Motorway and ABB medium voltage production facility (refer Figure 1.1).

Localities surrounding the Project site consist of residential areas (Casula, Wattle Grove and Glenfield), industrial, commercial and governmental lands. The latter include the Holsworthy Military area to the south and the Defence National Storage and Distribution Centre (DNSDC) to the east.

2.2 Site layout

The concept site layout for each rail access option is shown in Figures 2.1 to 2.3. The proposal concept has been designed to achieve efficient operation of the IMT and includes the following:

- rail access from the SSFL to the western boundary of the Project site via a crossing of the Georges River;
- heavy vehicle access to the facility via Moorebank Avenue at the eastern boundary of the Project site;
- warehousing located to allow efficient access to the IMEX terminal and Moorebank Avenue;
- support functions (terminal administration, maintenance and repair) for the IMT located close to the IMEX and interstate terminals and close to container stacks;
- rail track occupying the available space between the warehousing and the conservation area (as explained further in section 7.6 for IMEX rail and section 7.8 for interstate rail); and
- warehousing located immediately adjacent to the proposed IMEX terminal for operational efficiency and direct access between IMEX and warehousing.

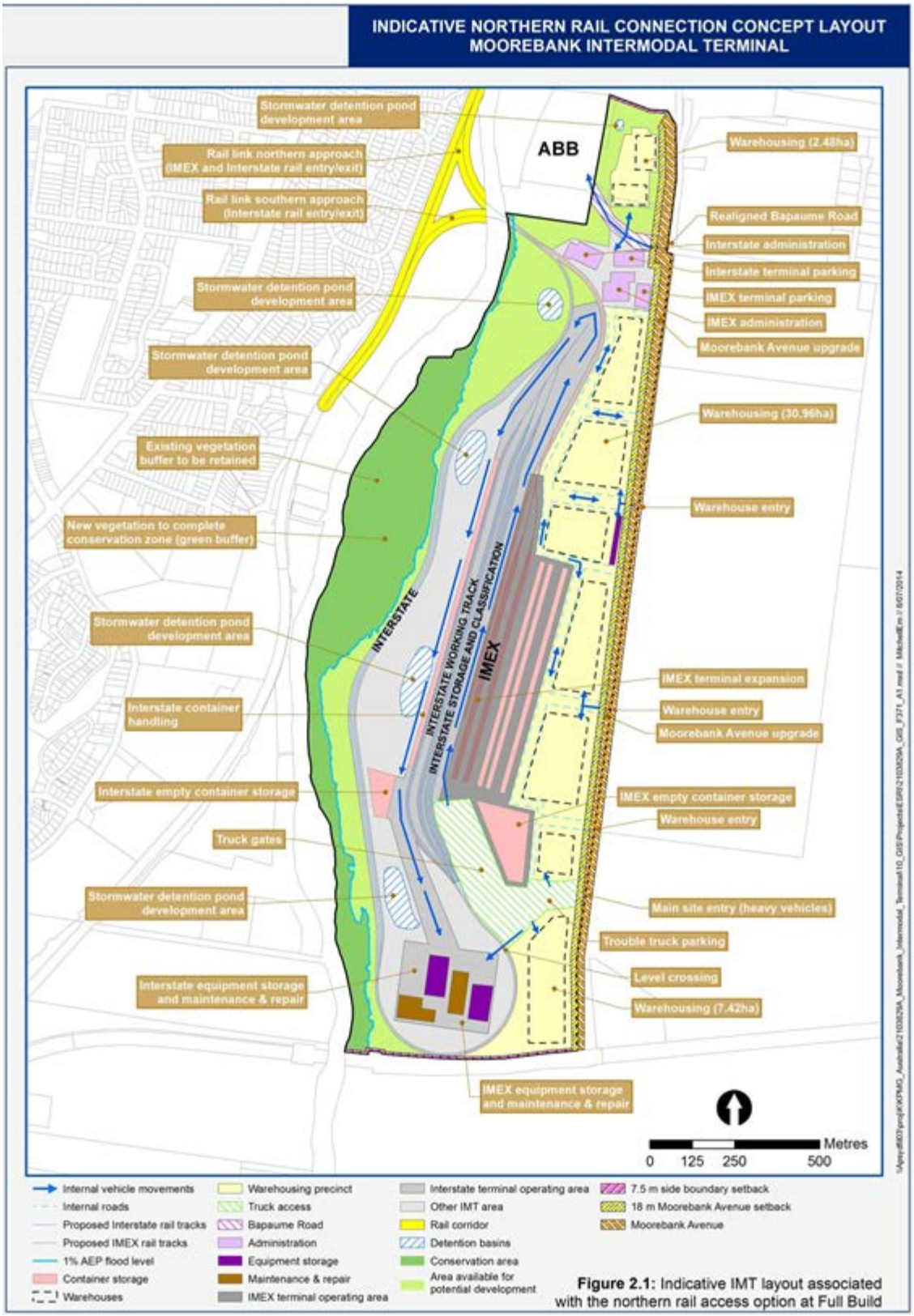

Figure 2.1: Indicative IMT layout associated with the northern rail access option at Full Build

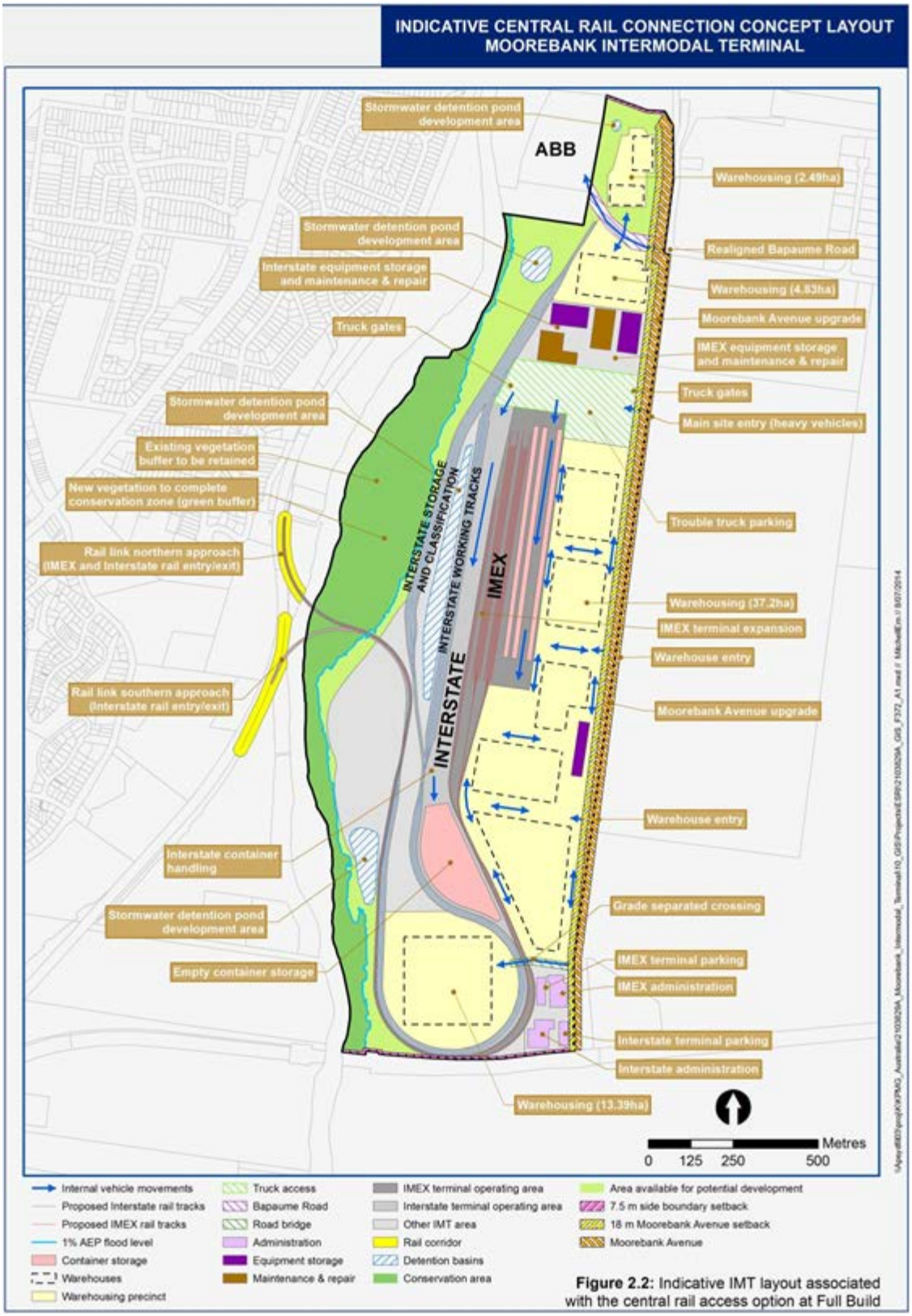

Figure 2.2: Indicative IMT layout associated with the central rail access option at Full Build

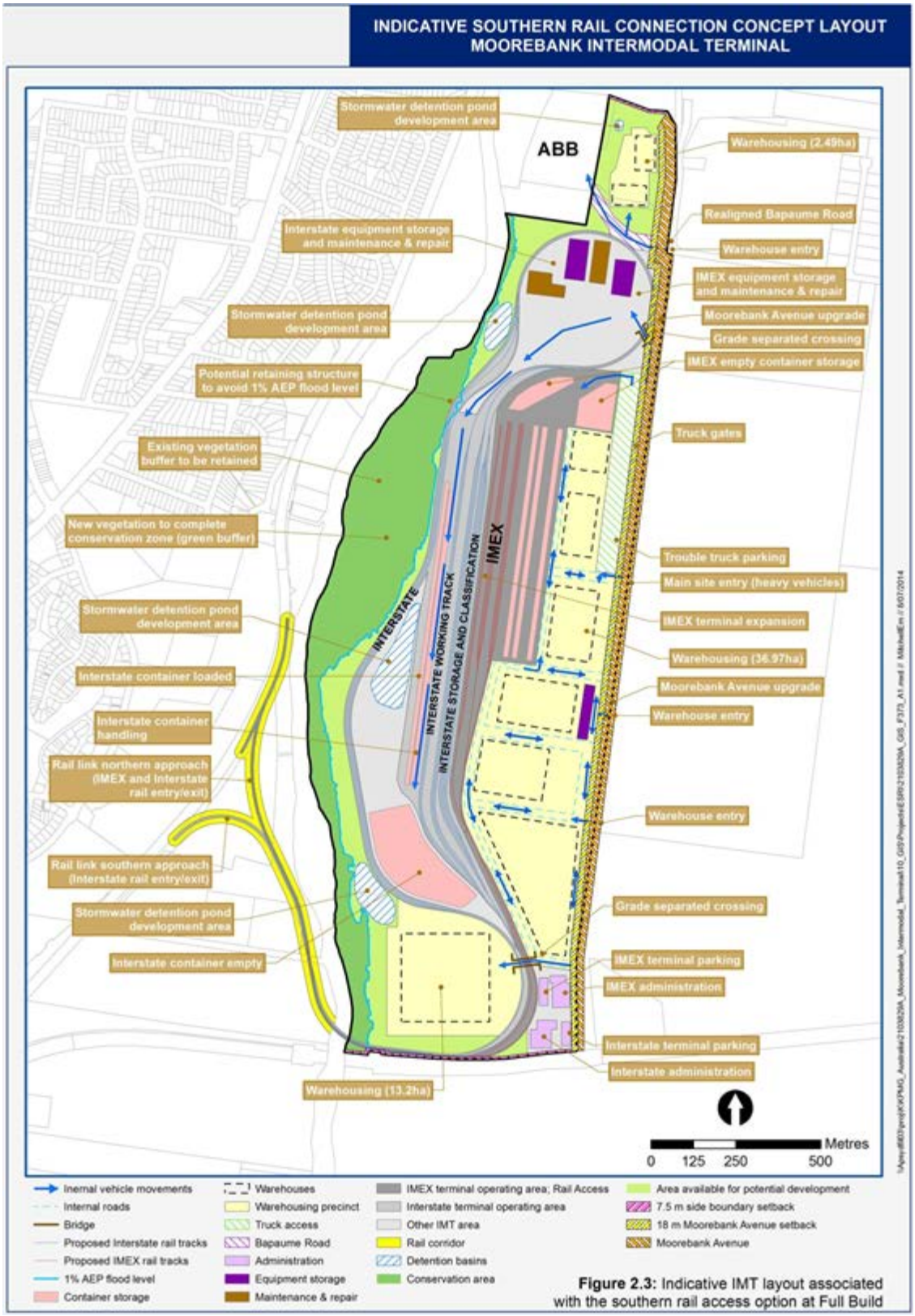

Figure 2.3: Indicative IMT layout associated with the southern rail access option at Full Build

2.3 Road access

Vehicles travelling to and from the site would access the M5 freeway via Moorebank Avenue, located south of Anzac Road. Moorebank Avenue is owned by Defence, and connections to Moorebank Avenue would be within Commonwealth owned land.

2.4 Security

The IMT will be located within a fenced off area accessed through security gates and serviced by security cameras. Access controls for truck and personnel arrival and departures will be used.

2.5 Surrounding land use

Land uses in the immediate vicinity of the Project are subject to the provisions of the Liverpool Local Environmental Plan 2008 and the Campbelltown (Urban Area) Local Environmental Plan 2008. Land uses surrounding the project include residential, commercial, industrial, recreational, environmental and special purpose (Defence Infrastructure).

To the north-west, west and south-west of the Project site, the land use is predominantly low to medium density residential in the suburbs of Casula, Glenfield and Liverpool, but incorporating some commercial, environmental and open space recreational land uses. Immediately to the north, land use is predominantly industrial incorporating some open space recreational land in the suburb of Moorebank. The industrial area of the DNSDC is located along Moorebank Avenue to the east of the Project. Further east beyond the DNSDC, special purpose land provides a buffer before giving way to the residential areas of Wattle Grove and Holsworthy.

The land to the south of the Project is zoned special purpose under the Liverpool Environment Plan (LEP) and reserved for military purposes. This area is also known as the Holsworthy Military Area.

Special purpose zoning also applies to the major road and rail infrastructure surrounding the Project including the M5 Motorway, Hume Highway, the Main South Railway Line and the SSFL, and the East Hills Railway Line.

2.6 Hazardous materials

2.6.1 Inventory

During operation, a limited range of hazardous materials would be stored and used on site. Diesel and liquefied natural gas (LNG) would be used on site to refuel, respectively, locomotives and mobile equipment. Lubricants and solvents would be required to carry out maintenance work and would be stored in workshops or dangerous goods stores.

Diesel, liquefied petroleum gas (LPG) and unleaded petrol would be present on-site at the public service station that, if included in the project, might be located near the warehouse entry point off Moorebank Avenue.

Natural gas would be supplied to site for minor commercial use. A gas reticulation network would be built on-site to supply IMT users and connected to the natural gas distribution network. An existing gas main runs along Moorebank Avenue, and has sufficient capacity to supply the IMT.

As noted in section 1.9, no dangerous goods would be accepted in the IMT's freight container storage and transit areas. It is possible that some dangerous goods may be processed or stored in the IMT as a result of either human error or intentional deception.

The nature and quantities of any hazardous goods that might be shipped through the IMT contrary to the prohibition cannot be predicted with any certainty, but it is considered highly unlikely that significant quantities of dangerous goods that might have serious consequences for either the terminal itself or surrounding areas will be present. Quantities would be limited to the capacity of containers, and it is unreasonable to expect that multiple containers would be involved and located in proximity so as to increase the quantities involved and the resulting risks. Further, the location of the nearest residential areas and sensitive land uses is well beyond the greatest credible area that might be affected by the limited quantities of any unknown dangerous goods possibly present from time-to-time.

Table 2.1 identifies the assumptions made in this assessment.

Table 2.1 Assumptions made in the assessment

Assumptions
The fuel tank sizes for the possible service station adjoining the facility, as indicated in Table 2.2 below, were estimated based on typical tank sizes found at service stations.
Conservative (high) estimates of lubricant/oil and solvent quantities were assumed.
The size of the liquefied natural gas (LNG) storage tank was estimated to be 100 kL, which is considered conservative.

The type and quantity of dangerous goods (DGs) and other material likely to be stored/used on site are summarised below in Table 2.2.

Table 2.2 Hazardous material on-site

Hazardous material	Usage	DG?	Quantity	Storage type
Diesel	used to refuel locomotives	no but C1 combustible liquid	485 kL (total)	5 x 97 kL category 5 tanks
Diesel	fuel for sale at possible public service station.	no but C1 combustible liquid	<30 kL (total)	1 x 30 kL category 4 tanks
Unleaded petrol	fuel for sale at possible public service station.	yes	<30 kL (total)	1 x 30 kL category 4 tanks
LPG	fuel for sale at possible public service station.	yes	<50 kL	1 x 50 kL
LNG	used to refuel mobile equipment on site	yes	<100 kL	1 x 100 kL tank

Hazardous material	Usage	DG?	Quantity	Storage type
Natural gas	commercial use on site	yes	n/a	pipeline
Lubricants, oils and associated waste	used for maintenance purposes	not generally classed as a DG, but combustible	<1,000 L	Drums and <50 L containers in workshop
Solvents and other cleaners	used for maintenance purposes.	yes	<1,000 L	Drums and <50 L containers in workshops

n/a: Not applicable
Source - KPMG 2012, Moorebank Intermodal Terminal Project—Detailed Business Case

2.6.2 Classification

Table 2.3 summarises the main classification of the hazardous materials to be stored on-site under the Australian Dangerous Goods Code (the ADG Code).

Table 2.3 Hazardous material main classification

Product name	UN number	Proper shipping name	Class	Sub-risk	Packaging group
LPG	1075	Liquefied Petroleum Gas	2.1	n/a	n/a
LNG	1972	Natural Gas Refrigerated Liquid	2.1	n/a	n/a
Natural gas	1971	Natural Gas	2.1	n/a	n/a
Unleaded petrol	1203	Motor Spirit	3	n/a	II
Solvents and cleaners	e.g. 1993	Flammable liquids	3	n/a	II
Diesel	n/a	Diesel Fuel	C1 combustible	n/a	n/a
Lubricants and associated waste	n/a	Combustible Liquid	C2 combustible	n/a	n/a

n/a: Not applicable
Source: National Transport Commission (NTC) Australian Dangerous Goods Code

2.6.3 Properties of hazardous materials

2.6.3.1 LNG

LNG is generally stored in double-walled refrigerated tanks at temperatures of about -160°C and pressures slightly above atmospheric. The space between the tank walls is filled with insulation to keep the contents cold and minimise the evaporation of LNG caused by heat entering the tank. When released from storage and heated by contact with the environment or warm materials it evaporates to form highly flammable gaseous methane (natural gas), which is lighter than air once warmed to ambient conditions and generally disperses quickly in unconfined areas. It may accumulate in a confined area or in low-lying areas when the vapour is cold, to form a flammable or explosive cloud.

A copy of the material safety data sheet (MSDS) for LNG is included in Appendix A.

Active constituents (typical):

- 85–90% methane
- 4–5% ethane
- 1–5% carbon dioxide.

Hazards:

- Fire hazard: highly flammable. On burning may emit toxic fumes
- Health effects: can cause cold burns (frostbite) and asphyxiation in high concentration.

Physical and chemical properties:

LNG has the following physical and chemical properties:

- Formula: CH_4 (methane – main constituent)
- Molecular weight: 16.04 g/mol
- Flash point: -218°C
- Physical state: liquefied gas
- Colour: colourless
- Odour: odorised
- Flammable range: 5% to 15% (v/v)
- Liquid density(-160°C): 0.415 kg/L
- Relative density (air=1): 0.615; (>1 at -218°C).

2.6.3.2 Liquefied Petroleum Gas (LPG)

A copy of the MSDS for LPG is included in Appendix A.

LPG gas is a mixture of butane and/or propane gas. Propane and butane are highly flammable gases capable of travelling at distance from the source of release to collect in low lying areas. A release of any of these gases at a concentration in the flammable range can pose a threat of either asphyxiation, flash fire, jet fire (if released under pressure) or vapour cloud explosion (if released following mixing in air and delayed ignition).

Active constituents (typical):

- 0–99% propane
- 0–99% butane
- propene
- n-butane

- ethyl mercaptan <0.1% (stenching agent/odorant).

Hazards:

- Fire hazard: highly flammable. On burning may emit toxic fumes
- Health effects: can cause cold burns (frostbite), asphyxiation.

Physical and chemical properties:

LPG has the following physical and chemical properties:

- Formula: C_3H_8 (propane) C_4H_{10} (butane)
- Molecular weight: between 44.1 g/mol (propane) and 58.1 g/mol (butane)
- Flash point:-104 to - 60°C
- Physical state: liquefied gas
- Colour: colourless
- Odour: odorised
- Flammable range: 1.5% to 9.6% (v/v)
- Relative density (air=1): 1.53–2.0.

2.6.3.3 Natural gas

A copy of the MSDS for natural gas is included in Appendix A. Natural gas has the following properties:

Active constituents (typical):

- 95.7% methane
- 2.37% ethane
- 1.27% nitrogen
- 0.5% carbon dioxide
- <0.16% of propane, i-butane, n-butane, i-pentane, n-pentane and hexane.

Hazards:

- Fire hazard: extremely flammable
- Health effects: headache and mildly toxic, in high concentrations may cause asphyxiation.

Physical and chemical properties:

- Formula: CH_4 (main constituent)
- Physical state: gas
- Colour: colourless
- Odour: will be odorised
- Molecular weight: 16.72 g/mol
- Vapour density (air=1): 0.615.

2.6.3.4 Other flammable liquids

Solvents and other industrial cleaners are usually classified as flammable liquids. The quantity that will be held in store is unlikely to exceed a thousand litres. Flammable liquids of this type typically have the following properties:

Active constituents:

- organic mixture

Hazards:

- Fire hazard: extremely flammable. On burning may emit toxic fumes
- Health effects: irritation and low toxicity.

Physical and chemical properties (typical):

- Physical state: liquid
- Colour: Light amber liquid
- Odour: strong fuel odour
- Flash point: <23°C for PGII and <60°C for PGIII
- Vapour density (air=1): >1
- Specific gravity: <1.

2.6.3.5 Combustible liquids

The mobile plant and any stand-by generator for the Project will contain lubricating oil. The quantity inside operational equipment, together with both new oil that will be held in store ready to be added to equipment and used oil awaiting disposal that may be held in storage, is unlikely to exceed a few thousand litres. These materials are classed as combustible and are not generally classified as dangerous goods. Combustible liquid has the following properties:

Active constituents:

- organic mixture.

Hazards:

- Fire hazard: combustible liquid. On burning may emit toxic fumes
- Health effects: irritation and low toxicity.

Physical and chemical properties (typical):

- Physical state: liquid
- Colour: Light amber liquid
- Odour: mild odour
- Flash point: >60°C
- Vapour density (air=1): >1
- Specific gravity: <1.

2.6.4 Required separation distances

Table 2.4 shows the required minimum separation distances (SD) between the proposed DG storage locations and various protected or public places (PPs) under the relevant standards.

Table 2.4 Required separation distances from Dangerous Goods storage locations

Required SD (metres) from DG storage to PP	LNG storage	LPG storage	Diesel tanks	Unleaded petrol tank	Flammable and combustible liquid (warehouse - package store)
Standard (source of information)	AS 3961-2005	AS/NZS 1596-2008	AS 1940-2004	AS 1940-2004	AS 1940-2004
Fence-line (boundary)	1 m	20 m	7.5 m	2 m	3 m
Proposed site office	11 m	20 m	7.5 m	Underground tank – no specific separation distance	3 m
Fill point platform	6 m	20 m	7.5 m		3 m
Railway line	11 m	11 m	-		-
Other general protected place	20 m	15 m	13 m		3 m

Note: Where chemicals with differing packing group, or flammable liquids, are stored in the same location, the quantities were aggregated and the most hazardous packing group was used as reference.

Source – as per the identified standards in the table.

3. Risk identification and screening

The process of identifying whether a significant risk is likely to exist as a result of the IMT Project consists of two main activities. The first activity requires the identification of sources of risk (often described as hazards), and the second activity is the application of a method to determine which of the hazards is likely to give rise to risks that might be significant in the context of the assessment.

In this preliminary risk assessment, the hazards have been largely determined in the preparation of the hazardous material inventory detailed in section 2. Credible scenarios arising from these sources of risk have been identified in this section. Their significance has been determined by the application of the SEPP 33 screening method to assess whether or not the Project is potentially hazardous under SEPP 33.

A further preliminary assessment stage has been undertaken by preparing a qualitative risk assessment. The qualitative risk assessment used the risk matrix method to identify the most significant risks and to assist in identifying mitigation measures that might be applied to manage significant risks.

3.1 Hazard identification

Hazard identification followed a systematic process to identify all credible hazards for the IMT Project. The potentially hazardous materials were identified as described in the previous section.

This section identifies activities undertaken as part of operations at the IMT and the potential hazard that might arise from activities. Each hazard is then categorized in classes of hazardous scenarios.

Activities that would be undertaken as part of the IMT Project are:

- construction and commissioning activities
- transport of equipment and materials to site
- rail traffic and logistics
- road traffic and logistics
- container loading and unloading
- container storing
- equipment maintenance
- mobile plant refuelling
- locomotive refuelling
- possibility of a public fuel service station
- waste disposal

- transport of material (including waste) off-site.

The types of hazardous incidents considered in this PRA are summarised in Table 3.1.

Table 3.1 Potential hazardous incidents considered

Scenario	Potential causes	Potential for off-site impacts
Gas leak (natural gas, LNG, LPG and carbon dioxide)	Weld/cylinder failure, equipment failure, impact, corrosion, drive-away during loading or refuelling, vehicle accident, other operational error, malicious damage, sabotage	Possible for natural gas if incident occurs outside of the site boundary. This is unlikely for the natural gas as the pipeline will be buried
Loss of containment of flammable/combustible or corrosive liquids	Impact, unloading, operational error, equipment failure	Yes. Mainly the fumes, smoke, and other combustion products from a fire event
Vehicle accident during the transport of potentially hazardous material to the site	Poor road access or visibility, road conditions, other vehicles, vehicle or tank fault, driver fatigue and other management issues	Yes, and might create environmental harm
Flooding	Extreme weather event impacting dangerous goods storage areas.	Yes but unlikely – may cause environmental harm Flooding map of the site indicates that only the western buffer area of the IMT may be affected by ARI100 floods
Inappropriate waste disposal	Failure to comply with waste management plans, lack of training or use of uncertified contractors	Yes – might create environmental harm

These classes of activities and potential incidents have been summarised in Table 3.2 which details credible hazards relevant to the proposed IMT Project.

Waste dangerous goods will comprise mainly those dangerous goods that are used by the IMT, such as solvents. The types of risk will be similar, but the quantities involved will be much less than for the main dangerous goods storages, and the risks will be significantly lower.

Table 3.2 Possible scenarios and hazards

Materials / Activities	Natural gas, LPG and LNG	Diesel and unleaded petrol underground storage	Flammable liquids	Combustible liquids	Hazardous waste
Transport to site	Vehicle accident Loss of containment, liquid or gas leak, gas venting	Vehicle accident Loss of containment	Vehicle accident Loss of containment	Vehicle accident Loss of containment	Vehicle accident Loss of containment
Unloading	Loss of containment, liquid or gas leak, gas venting	Loss of containment	Loss of containment	Loss of containment	n/a
Transport off-site	n/a	n/a	n/a	n/a	Vehicle accident Loss of containment Improper disposal
Storage on-site	Loss of containment, liquid or gas leak, gas venting	Loss of containment	Loss of containment Flooding	Loss of containment Flooding	Loss of containment Flooding
Construction/ commissioning	Loss of containment, liquid or gas leak, gas venting	Loss of containment	Loss of containment	Loss of containment	Loss of containment
Operation	Loss of containment, liquid or gas leak, gas venting	Spill from mis-operation: drive-away etc.	Loss of containment Flooding	Loss of containment Flooding	Loss of containment Flooding
Equipment maintenance	Loss of containment, liquid or gas leak, gas venting	n/a	See below	Loss of containment	Poor housekeeping, waste management practices Loss of containment
Waste storage/on site disposal	n/a	Improper disposal of spill and contaminated stormwater	Loss of containment Improper disposal of waste, spills	Loss of containment Improper disposal of waste, spills	Loss of containment Fire

Materials / Activities	Natural gas, LPG and LNG	Diesel and unleaded petrol underground storage	Flammable liquids	Combustible liquids	Hazardous waste
Main consequences for above scenarios	Formation of vapour cloud. If source of ignition present, boiling liquid expanding vapour explosion (BLEVE), pool or jet fire, vapour cloud explosion. WHS issue, asphyxiation, cold burns.	Environmental harm, WHS issue. If source of ignition present, pool fire	Environmental harm, WHS issue, if source of ignition present, pool fire	Environmental harm, WHS issue	Environmental harm, WHS issue

n/a: not applicable

3.2 Hazard screening under SEPP 33

SEPP 33 - Hazardous and Offensive Development applies to any proposals which fall under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'. To determine the level of applicability of the SEPP 33, an initial screening is recommended to exclude from detailed study developments which do not pose significant risk.

3.2.1 Methodology

A screening method is provided in *Applying SEPP 33* (Department of Planning, 2011) that enables the applicability of SEPP 33 to be tested.

Because dangerous goods will be stored and used at the IMT site (but not accepted as freight), the screening process detailed in the guidelines was applied to determine the relevance of SEPP 33. Where any substance handled by the development exceeds the screening limits, a PHA is required to demonstrate that the risk is not significant.

3.2.2 Results

Table 3.3 identifies the dangerous goods and other hazardous materials subject to screening for the IMT Project.

Table 3.3 Determination of the level of screening for the IMT Project

Product	Class	Capacity (kL)	Number of vessels/ containers	Total capacity (tonnes)	SEPP 33 screening quantity (tonnes)	Road movements (transport screening criteria)[1]		SEPP 33 screening result	Rationale
						Week	Year		
LNG	2.1	<100	1	<42	For 42 tonnes: - 200 m to sensitive use - 150 m to other use	<30	<500	Above storage screening threshold at proposed location	Applying SEPP 33, Table 1 and Figure 7.
LPG (service station)	2.1	— Excluded from screening under SEPP33 as part of a service station development —							
Natural gas	2.1	— Excluded from screening under SEPP33 as not in a fixed installation —							
Combustible liquid (Diesel - service station)	C1	— Excluded from screening under SEPP33 as stored separately from any flammable liquids —							
Flammable liquid Unleaded petrol – (service station)	3, PGII	<30	1	<22	5 tonnes (25 tonnes for underground tanks)	<45	<750	Below storage and transportation screening thresholds	Applying SEPP 33, Table 1 and Table 2, p.17 & p.18
Combustible liquid (workshop)	3, PGII	<200 L	Multiple packages	<5	5 tonnes (if stored with Class 3)	n/a	n/a	Below storage screening threshold	Applying SEPP 33, Table 1 and Table 2, p.17 & p.18
Flammable liquid (workshop)	3, PGI	<200 L	Multiple packages	<5	5 tonnes (Class 3 PGII or III)	<30	<500	Below storage and transportation screening thresholds	Applying SEPP 33, Table 1 and Table 2, p.17 & p.18

Note 1 - The road movements quoted in the table are the screening limits specified in Applying SEPP 33. They are used as upper limits to demonstrate that the actual number of movements by the IMT operation would not be likely to exceed the screening criteria under any circumstances.

Source SEPP 33 - Hazardous and Offensive Development

The indicative size of the LNG storage proposed at the IMT is 100 kL (approximately 41.5 tonnes) or less. This exceeds the minimum screening threshold of 500 kg for class 2.1 gases (liquefied), and exceeds the threshold for a separation distance of 200 m to sensitive uses and approximately 150 m to other uses. Road movements are unlikely to be above the transportation thresholds of 30 per week or 500 per year. Therefore, the LNG storage at the IMT requires further risk assessment, and a PHA is required (refer Chapter 4 for the PHA).

The LPG storage for the possible service station falls within SEPP 33 but procedures for dealing with the storage are not covered by it. Compliance with the NSW DP&I publication, 'Hazardous Industry Locational Guidelines No. 1 – LPG Automotive Retail Outlets' (now incorporated in AS/NZS 1596 - 2008: The storage & handling of LPG), should be demonstrated. The quantity of LPG proposed to be stored on-site is above the manifest limit of 5 kL. NSW Workcover would need to be notified of the proposed storage following confirmation of detailed design and prior to operation.

Natural gas, class 2.1, is subject to the risk screening if stored in a fixed installation. The natural gas on site is only present in the reticulation piping system that delivers it to its points of use. Risks arising from dangerous goods transport via pipeline fall within the SEPP 33 but are analysed using the IAEA Manual (1994).

Combustible liquids, when not stored in bulk with any flammable liquids are not considered to be potentially hazardous. This would be the case for the proposed IMT diesel storage. The diesel is not considered potentially hazardous under SEPP 33 and no further assessment is required. However the volume of combustible liquid stored on-site is above the manifest limit of 100 kL. NSW Workcover would need to be notified of the proposed storage following confirmation of detailed design and prior to operation. The separation distance of the proposed diesel storage area from the site boundary is sufficient to ensure that there would be no significant effect outside the site.

The capacities of underground storage tanks for flammable liquids, such as those at the possible service station, are to be divided by five prior to their assessment against the screening threshold (to allow for the lower risk from underground storage tanks). The screening threshold for class 3, PGII is 5 tonne (above ground) or the equivalent of 25 tonne or 34 kL of unleaded petrol for an underground storage. Typical volumes of underground tanks at service stations range from 15 to 30 kL which is below the screening threshold. Therefore, no further assessment under SEPP 33 is required. However the volume of flammable liquids stored on-site is above the manifest limit of 2 kL (PGII). NSW Workcover would need to be notified of the proposed following confirmation of detailed design and prior to operation.

Lube oils at the proposed IMT workshop would be stored separate from any flammable liquids and are not considered potentially hazardous under SEPP 33. The total quantity of flammable and combustible liquids proposed to be stored in the lube store area would not exceed the storage quantity screening threshold, and is also below the transportation thresholds. Therefore, flammable and combustible liquids are not considered to be potentially hazardous at the site and no further assessment is required.

The preliminary risk screening indicates that the storage of diesel and flammable and combustible liquids would not pose an unacceptable level of risk to the surrounding community and is within the recommended risk levels recommended by the NSW DP&I guidance in SEPP 33 (Department of Planning, 2011). As no significant effects would be felt outside the IMT and possible service station sites for these materials, there is little likelihood of any fatalities as a result of any credible accident scenario, and no contribution to any individual or societal risk for members of the public or occupants of other sites.

Because the SEPP 33 threshold is exceeded for LNG storage, a PHA is required and has been completed (refer Chapter 4).

With the exception of natural gas, and flammable and combustible liquids used for general maintenance purposes, all the dangerous goods to be stored and used on-site would be above the NSW Workcover notification threshold, requiring that Workcover be notified of the proposed storages as noted above.

3.3 Risk matrix ranking and mitigation measures

3.3.1 Methodology

Because of the preliminary or uncertain nature of some information at this stage of the Project, such as the storage volumes of hazardous materials for the Project, a qualitative assessment has been undertaken below. The assessment follows principles outlined in IEC/ISO 31010 Risk management – Risk assessment techniques (the companion to AS/NZS ISO 31000 Risk management). The criteria used to classify the levels of consequence and likelihood, and to evaluate the risk levels that result, are typical of those used in this risk assessment technique. They are used to provide suitable context to the assessment process.

The assessment of consequences was made against several relevant criteria and an overall severity determined based on the perceived importance of each criterion and outcome. The criteria are listed in Table 3.4.

Table 3.4 Qualitative measures of consequence determined for this assessment

Severity	Public health and safety	Biophysical environment	Social, economic, property
I	No medical treatment required, no health effects.	Minor effects only, no irreversible effects or effects on ecosystems.	No loss of significant assets or property value, minor short term social effects.
II	Medical treatment required, reversible disability.	Moderate short-term impacts not involving ecosystem function.	Ongoing social effects, minor loss of assets.
III	Permanent partial disability or long term hospitalisation.	Significant medium term impacts on species or ecosystems.	Serious on-going social impacts, loss of significant assets.
IV	Fatality or severe permanent disability. Ongoing public health effects.	Serious long term reversible effects on ecosystems.	Major, permanent social disruption, major loss of assets or economic values.
V	Multiple fatalities, major chronic or acute public health effects to a significant population.	Major, long-term, irreversible effects on ecosystem function.	-

The probability or frequency of the event being considered was generally categorised qualitatively in accordance with the categories shown in Table 3.5.

Table 3.5 Qualitative measures of likelihood determined for this assessment

Level of likelihood	Descriptor	Description
A	Almost certain	Almost certain to occur when relevant conditions are met. Frequent or continuous. At least a monthly occurrence.
B	Likely	Will probably occur when relevant conditions are met. Might occur annually.
C	Possible	Might occur at some time. May occur a few times in a person's lifetime.
D	Unlikely	Could occur at some time. Not expected to occur more than once in a lifetime.
E	Rare	Not expected to occur even when relevant conditions are met. Only in exceptional circumstances. Not expected to be observed in a lifetime.

Table 3.6 is used to calculate the risk ranking from the likelihood and severity or consequence assessments. The risk categories shown in the table are:

- E – extreme: requires immediate action to reduce risk before development could proceed
- H – high: requires attention to manage risk as part of the design process or management of the operation
- M – moderate: requires specification of management responsibility
- L – low: can be managed by routine procedures.

Table 3.6 Qualitative risk ranking

Likelihood	Consequences				
	I Insignificant	**II Minor**	**III Moderate**	**IV Major**	**V Catastrophic**
A-almost certain	H	H	E	E	E
B-likely	M	H	H	E	E
C-possible	L	M	H	H	E
D-unlikely	L	L	M	M	H
E-rare	L	L	M	M	H

The assessment process and criteria are such that any uncontrolled risk classified as extreme requires immediate action to reduce the residual risk; that uncontrolled risks classified as high require senior management attention (typically the implementation of specific controls and systems); that moderate risks require that management responsibility be specified; and that low risks can normally be managed by routine procedures.

3.3.2 Results

The results from the risk assessment are presented in Table 3.7. None of the risks identified in Table 3.7 is considered intolerable. In each case, appropriate engineering controls and management systems are considered capable of ensuring that residual risks are maintained at an acceptable level.

The consequences and risk rankings shown in Table 3.7 are as described in Table 3.4 and repeated below for the following categories of risk:

- P: Public health and safety
- E: Biophysical environment
- S: Social, economic, property.

Table 3.7 Risk matrix

Hazard	Possible consequences	Mitigation/controls	Increased Likelihood	Consequences	Risk rating	Comments
Natural gas and Liquefied Natural Gas (LNG)						
Leak of natural gas to atmosphere from pipe system due to weld failure, impact, corrosion, operational error, sabotage etc.	Release of gas leading to gas cloud flash or jet fire if source of ignition or static electricity present.	Refer to the appropriate standard for gas reticulation network, including AS 2944-1 (2007) and AS 2944-2 (2007). Use correct schedule pipe. Install fire protection system if necessary for gas users. Ensure that cathodic protection for external corrosion is installed if appropriate.	D	P: II E: II S: II	Low Low Low	Existing gas main running along Moorebank Avenue. Project unlikely to increase risk of pipe failure significantly. Not likely to pose any significant risk onsite and off-site due to the small quantity and relatively low pressure at which the gas is delivered. Pipeline is installed underground. Access is therefore restricted and pipes are protected from impact on most of their length. Significant separation distances to residences, other assets. Most risk probably to vegetation in buffer area surrounding Project.
Leak of LNG during transport	Release of gas leading to gas cloud flash or jet fire if source of ignition or static electricity present.	Transport according to ADG Code, relevant standards and regulations. Ensure that contractor delivering the gas is trained, competent and certified by relevant authorities.	D	P: II E: II S: II	Low Low Low	No significant increase likely over existing level of risk from DG transport along highway and local roads.

Hazard	Possible consequences	Mitigation/controls	Increased Likelihood	Consequences	Risk rating	Comments
Leak of LNG to atmosphere from tank or pipe system due to weld failure, impact, corrosion, operational error, sabotage etc.	Release of gas leading to pool or jet fire and BLEVE if ignition source is present.	Use pipe of robust design, emergency isolation valves, and pressure relief system. Design the LNG storage to AS 3961-2005. Excess flow control, emergency isolation valves, gas detection. Secure access from unauthorised access. Significant separation distances to residences and other assets.	D	P: II E: III S: III	Low Moderate Moderate	Most risk probably to vegetation in buffer area surrounding Project.
Gas venting	Discharge of venting vapours from pressure relief device, if ignition source present, might ignite and impinge on adjacent tank or piping.	Design the LNG storage to AS 3961-2005. Secure access from unauthorised access. Significant separation distances to residences and other assets.	E	P: I E: I S: I	Low Low Low	Unlikely if good engineering practice used during the design of the storage area.
LPG						
Leak of LPG during transport	Release of gas leading to toxic gas cloud flash or jet fire if source of ignition or static electricity present.	Transport according to ADG Code, relevant standards and regulations. Ensure that contractor delivering the gas is trained, competent and certified by relevant authorities.	D	P: II E: II S: II	Low Low Low	No significant increase likely over existing level of risk from DG transport along highway and local roads.

Hazard	Possible consequences	Mitigation/controls	Increased Likelihood	Consequences	Risk rating	Comments
Leak of LPG to atmosphere from pipe system due to weld failure, impact, corrosion, operational error, sabotage etc.	Release of gas leading to, if source of ignition present, pool or jet fire or BLEVE. If located above low lying area might represent a risk of asphyxiation in high concentration.	Use pipe of correct schedule, emergency isolation valves, pressure relief system. Design the LNG storage to AS/NZS 1596-2008. Install fire protection system. Use a minimum of flanges. Secure access from unauthorised access.	D	P: II E: III S: III	Low Moderate Moderate	No significant increase likely over existing level of risk from DG transport along highway and local roads.
Gas venting	Discharge of venting vapours from pressure relief device, if ignition source present, might ignite and impinge on adjacent tank or piping.	Design the LNG storage to AS/NZS 1596-2008. Secure access from unauthorised access. Significant separation distances to residences and other assets.	E	P: I E: I S: I	Low Low Low	Unlikely if good engineering practice used during the design of the storage area.
Flammable liquids and combustible liquids						
Flammable/combustible liquids: spills/leaks during transport	Potential pool fire if source of ignition is present. Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected, potential loss of economic value of water.	Transport according to ADG Code, relevant standards and regulations.	D	P: I E: III S: II	Low Moderate Moderate	No significant increase likely over existing level of risk from DG transport along highway and local roads.

Hazard	Possible consequences	Mitigation/controls	Increased Likelihood	Consequences	Risk rating	Comments
Flammable/combustible liquids: spills/leaks from storage	Potential pool fire if source of ignition is present. Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected, potential loss of economic value of water.	Storage in accordance with AS 1940, secondary containment for all storages, located away from drainage paths.	C	P: I E: III S: III	Low Moderate Moderate	Requires proper engineering and ongoing management controls of all dangerous goods storages. Quantities will be small.
Flammable/combustible liquids: spills/leaks from operating equipment	Potential pool fire if source of ignition is present. Contamination of soil, watercourses; water quality degraded; aquatic ecosystems adversely affected.	Limited volumes in operating equipment. Retention systems will control runoff to watercourses.	C	P: I E: II S: II	Low Moderate Moderate	Quantities will be small.
Inappropriate waste disposal, failure of waste containment or inappropriate waste disposal, and/or poor containment design.	Contamination of land, contamination of watercourses or groundwater, degraded water quality, aquatic ecosystems adversely affected, potential loss of economic value of water.	No hazardous or regulated wastes will be disposed of on-site. All off-site disposal via approved transport operators and to approved facilities.	D	P: II E: III S: III	Low Moderate Moderate	Requires appropriate management controls and engineering standards to be maintained to prevent inappropriate disposal practices or design and operation of containment systems.

4. Risk analysis

This section analysing the risks identified in the previous section constitutes the PHA required as a result of the screening process completed in accordance with the SEPP 33 guidelines.

4.1 Risk analysis methodology

A methodology has been nominated in *Applying SEPP 33* guidelines (Department of Planning, 2011) for classifying and prioritising risk. It is based on the *Manual for the classification and prioritisation of risks due to major accidents in the process and related industries* prepared by the International Atomic Energy Agency (IAEA, 1996). The assessment criteria used in this technical report have, as far as possible been based on the New South Wales Department of Planning publications *Hazardous Industry Planning Advisory Papers No 4: Risk Criteria for Land Use Safety Planning,* and *No. 10: Land Use Safety Planning* (Department of Planning, 2011a and 2011c). This method is risk-based and relies on broad estimations of consequences and likelihood of accidents. The outputs may be expressed in terms of individual and societal fatality risk which can be compared against criteria for determining the appropriate level of further assessment.

This methodology will be applied in particular to assess the potential risk created by the natural gas pipeline and LNG storage.

This section includes the following inclusions/exclusions:

- The types of risk being considered for this section are risks to public health from fire, explosion and release of toxic substances from the gas pipeline and LNG storage outside the boundaries of the IMT.
- Risks to workers (occupational risks) are not being considered.
- This method is to be used for the prioritization of the different sources of risk but should not be used to estimate the absolute values of risk in isolation or as a basis for risk management. Where significant levels of risk are identified by this method, quantitative risk assessment methods would need to be applied following the completion of the detailed design and as part of subsequent development applications.

Based on the IAEA methodology, the assumptions used in the assessment include:

- The method uses only the most important variables that can be evaluated from the limited information generally available (e.g. population density, traffic safety).
- The assessments of consequences and probabilities have been made by categorising parameters into a number of bands that may differ from each other by up to one order of magnitude.
- The assumptions of fatality criteria are that:
  - There is 100% lethality in an area where physical or toxic effects are assumed to give 50–100% lethality.
  - Outside this area no fatalities are counted.

- Mitigation factors depend on the type of substance used.

- The basis for consequence calculations are:
  - There are three typical effect categories: circular (e.g. explosions), half circular (e.g. heavy cloud or plume), and elongated (e.g. dispersion).
  - Effect distances are considered up to 10,000 m from the source.
  - Estimates are provided for different activities related to processing, storage and transport of substances.
- The basis for probability calculations are:
  - Average failure frequencies are based on historical experience.
  - Correction factors applied to the average frequencies are related to typical differences found between industrial activities.
  - Estimation of event probability uses the 'probability numbers' concept (IAEA method, dection 5).

The method can be used to discriminate between the risks arising from a range of industrial activities, which may differ by up to one order of magnitude (IAEA, 1994, p.11).

4.1.1 Natural gas pipeline

The IAEA method recommends that a pipeline being assessed should be divided into sections of 1 km, with each section assessable under the IAEA methodology. However, the gas network within the site can be divided in three sections as follows:

- Section 1 - The east section is an existing distribution pipeline, approximately 3 km long, running along Moorebank Avenue and the industrial area of the DNSDC.
- Section 2 - At the south, it is assumed that a 1.3 km section crosses the IMT site. The land to the south of the Project is reserved for military purposes (mainly vegetation and undeveloped) and the East Hills Railway line.
- Section 3 - A 2 km section of the proposed gas network is located on the west side of the site area. The land use west of Section 3 is predominantly low to medium density residential in the suburbs of Casula, separated from the site by the Georges River, Main South Railway Line and an area of vegetation adjacent to the river (proposed for a future ‘conservation area’ as part of the IMT project).

4.1.1.1 Consequence calculations

Based on the procedural steps given by section 4 of the IAEA manual, the factors summarised in Table 4.1 were used for the estimation of the number of fatalities. References to tables are to tables in the IAEA manual.

Table 4.1 Factors used for the calculation of fatalities for gas pipeline

Activity		Pipeline	
Most important substance		Natural gas	
		Type of substance	Flammable gas
		Description of substance	Under pressure
		Reference number (Table IVb)	12
		Diameter	0.2–1 m
Effect distance category		**A (Table V)**	0–25 m
Effect area category (C)		**I (Table V)**	0.2 ha
Description of the area	Section 1	Distance to nearest dwelling >100 m (at northern end of Moorebank Avenue)	
	Section 2	Distance to nearest dwelling > 100 m	
	Section 3	Distance to nearest dwelling > 100 m	

The IAEA method indicates that the likely effect distance (within which >50% fatalities would be expected) for a gas pipeline and reticulation network of this sort is up to 25 m. Beyond this distance, <50% fatalities are expected, and based on the IAEA method, are not included in the overall assessment (see assumptions above).

No residential area (or other sensitive location) is located within a distance of several times the maximum effect distance for a natural gas pipeline. Therefore, no fatalities should arise from the likely events involving a natural gas pipeline, and no further calculations are required.

4.1.2 Liquefied natural gas storage

The concept master plan layout (see Figure 2.1) indicates that fuel storage is likely to be located at the southern end of the site in the vicinity of the equipment maintenance and storage areas. The LNG storage would probably therefore be located at least 50–100 m from the East Hills Railway Line and the Holsworthy military reserve, and at least 400 m from both Moorebank Avenue and the Georges River, and over 1 km from the nearest residence.

4.1.2.1 Consequence calculations

Based on the procedural steps given by section 4 of the IAEA manual, the factors summarised in Table 4.2 were used for the estimation of the number of fatalities. References to tables are to tables in the IAEA manual.

Table 4.2 Factors used for the calculation of fatalities for LNG

Activity	Storage	
Most important substance	**Liquefied natural gas (LNG)**	
	Type of substance	Flammable gas
	Description of substance	Liquefied by cooling
	Reference number (Table IVa)	11
	Maximum storage volume	100 kL (42 tonnes)
Effect distance category	B	25-50 m
Effect area category (C)	II	0.4 ha
Description of the area	Residential area (Distance to nearest dwelling >1 km	

The effect distance for the type and quantity of material involved (25-50 m) indicates that no off-site fatalities would be expected from an accident involving the LNG storage. No further calculations are therefore required.

The separation distances specified in AS 3961-2005 can be satisfied by the conceptual site layout. No residential area (or other sensitive location) would be located within the screening distance specified by the SEPP 33 guideline, and the only other land use, other than the IMT facilities, that are located within the screening distance, is the East Hills Railway Line.

Transport of LNG to the site (and also LPG to the possible service station) is also relevant. The quantity of LNG in any load is likely to be at most 25 tonnes. This falls in the same effect category as the LNG storage, with the same effect radius and area of 25–50 m and 0.4 ha. The only areas where any residential area or sensitive land use would be located within this effect distance would be on the public road network, in particular the M5 motorway to the north of the IMT site, which would constitute the last section of the transport route. The IAEA manual sets the criterion for selecting a road or rail route for study for LPG transport as being within 200 m of the first occupied dwelling.

Although residences are typically set back from the motorway, in places the separation is less than the minimum effect distance of 25 m. However, it must be noted that this transport corridor (along with all other major roads in the network) is already used by a very large number of vehicles carrying a wide range of dangerous goods including some of a similar type to LNG. Many movements of LPG would also occur along this section of motorway. The relatively small number of deliveries to the IMT Project and possible service station of LNG and LPG would not be expected to increase the risk to residential or other land uses along the motorway, or any other part of the road network, by an appreciable amount. It is therefore not considered useful to undertake a detailed assessment of the transport risks for these materials for this Project. However, a preliminary assessment using the IAEA method is provided for LPG below.

4.1.3 Estimation of probabilities of LPG and LNG transport accidents

The additional probability of a major accident involving the transport of LPG to the possible IMT service station can be estimated using the procedure in section 6 of the IAEA manual.

The factors summarised in Table 4.3 are relevant for calculating probability number. References to tables are to tables in the IAEA manual.

Table 4.3 Factors for transport probability number calculation

Substance	**LPG (7)**	
Activity	**Road transport**	
	Average probability number ($N^*_{t,s}$) (Table XV)	9.5
Correction for the safety conditions of transport systems (routes without crossings)	*Parameter n_c (Table XVII)*	+1
Correction for the traffic density (50–200 movements per annum)	*Parameter $n_{t\delta}$ (Table XVIII)*	-2
Correction for wind direction toward the populated area (Effect category CI-circular)	*Parameter n_p (Table XIX)*	0

The probability number can be calculated using the equation 2:

$$N = N^*_{t,s} + n_c + n_f + n_p \qquad (2)$$

where:

- $N^*_{t,s}$ = the average probability number for the transport of the substance
- n_c = probability number correction parameter for the safety conditions of the transport system
- $n_{t\delta}$ =probability number correction parameter for the traffic conditions
- n_p = probability number correction parameter for wind direction towards the populated area.

The probability number N is therefore: 9.5 + 1 - 2 +0 = 8.5.

The expected accident frequency is therefore 3×10^{-9} per km per annum.

The number of accidents involving LNG is likely to be similar, so that the combined frequencies are likely to be of the order of 1×10^{-8} per km per annum.

The increased risk of fatality of the most at risk person as a result of an accident involving LPG or LNG transport to the IMT is therefore less than 1×10^{-8} per annum assuming an effect distance up to 1 km and a 100% likelihood of fatality. This is well below the most stringent land use planning criteria as detailed in HIPAP 10-Land use safety planning, which is set at 0.5×10^{-6} per annum for sensitive uses such as hospitals. (However, it must be noted that this criterion is for total risk exposure, not the increased risk from a proposed development. The assessment of the existing level of risk for individuals along a major transport corridor such as the M5 is beyond the scope of this study. The numbers are provided as an indication that the contribution to overall risk from the Project is not significant).

As the risk of death assuming 100% mortality from all accidents is less than 1×10^{-8} per annum, the risk of injury is similarly much less than 1×10^{-8} per annum, and well within the individual risk criteria detailed in HIPAP 10.

At accident rates of this order, the societal risk is unlikely to exceed the negligible range (as shown in Figure 10 of HIPAP 10). At an accident frequency of $1x10^{-8}$ per annum, the number of fatalities would need to exceed 100 to move outside the negligible risk area. (Again, it must be noted that this criterion is for total risk exposure, not the increased risk from a proposed development. The assessment of the existing level of societal risk along a major transport corridor such as the M5 is beyond the scope of this study. The numbers are provided as an indication that the contribution to overall risk from the Project is not significant).

4.1.4 Waste dangerous goods

The types and quantities of waste that are likely to be generated by the IMT are such that no significant off-site risk is likely to be posed that would exceed the risks arising from the dangerous goods storages considered in this section.

4.2 Quantitative risk assessment

4.2.1 Fatalities

The IAEA method has indicated that no fatal effect outside the IMT site is likely as a result of natural gas or LNG accidents. Estimates of the increased frequency of transport-related risks for people along major transport routes using the same method indicates that it is likely to be insignificant.

Natural gas (principally methane) is considered to be of relatively low reactivity and is therefore not highly likely to explode when compared to more reactive materials. Explosion of a gas cloud in open-air situations is generally considered unlikely. Unconfined clouds of less than 1 tonne are considered unlikely to explode, and few unconfined clouds of less than 5 tonnes have caused significant blast damage. Most vapour clouds that do explode do so before drifting more than 100 m (Lees 1996).

As an example of the likely impacts of a gas leak within the IMT, 100 m of 80 mm pipe has a volume of 0.5 m^3 or 500 L. Natural gas is typically delivered to business and commercial building at a nominal pressure ranging from 0.1 to 2 bars. At the maximum 2 bar line pressure, this would be equivalent to approximately 1 m^3 of natural gas if released into the atmosphere, or less than 0.8 kg of methane.

Based on the actual site layout, the equivalent length of nominal 80 mm gas supply pipe from the site boundary to the farthest point of use could be up to 8 km, giving a volume of about 40 m^3, but the majority of the line would be at a pressure lower than 2 bar. The maximum amount of methane present at any time would therefore probably be less than 65 kg.

In normal circumstances, a leak would be stopped quickly by emergency isolation systems, but the consequences of a leak are not likely to be serious.

Small leaks from items such as flanges and valves are much more likely to occur than a catastrophic failure, but for these more frequent events the quantities of gas involved and the consequences are much smaller. Leaks of smaller quantities of gas are considered to be non-hazardous beyond the plant boundary based on the SEPP 33 criteria.

4.2.2 Injury

Small leaks from items such as flanges, small pipe work and valves and appliances are much more likely to occur than a catastrophic pipeline failure, but for these more frequent events the risk of injuries are higher than the risk of fatalities. Small fittings generally fail due to impact and are more subject to general wear and tear.

With regards to potential injuries off-site, the risk is considered extremely low due to the distance of the boundary from the main operation area. However for completeness, models were developed to assess heat radiation, toxicity levels and explosion overpressure.

For the purpose of the simulation, the following was taken into account:

- A 25 mm open-ended pipe failure is assumed.
- According the HIPAP 4, a 4.7 kW/m^2 heat radiation level or a 7 kPa for explosion overpressure would cause injury to people.
- Injury risk for toxic gas/smoke/dust was assessed with the short term exposure limit (STEL) of carbon dioxide (30,000 ppm). CO_2 is the main by-product generated from a methane gas fire.
- These three criteria were used as reference for this assessment.

The consequence modelling indicates that thermal radiation levels of 4.7 kW/m^2 generated by a jet fire are measured at a downwind distance of 10 m from the source. The quantity of gas released and rate at which it is released prevent the lower explosive limit (LEL) being reached (no model was run for a confined area). Therefore, no explosion (i.e. overpressure levels of 7 kPa) can occur. Toxic cloud with a concentration of 30,000 ppm could not be determined as the affected zone was too small for the model to be reliable (less than 5 m from the source).

All the measured injury risk distances are well within the site boundaries and therefore off-site injuries are unlikely.

4.2.3 Property damage

According the HIPAP 4, a 23 kW/m^2 heat radiation level or a 14 kPa for explosion overpressure would create significant damage to properties. Model results for the injury section above indicates lower heat radiation and overpressures levels are well within the site boundaries; therefore off site property damage would be highly unlikely.

Potential for on-site property damage was measured down-wind at up to 8 m from the source for heat radiation levels of 23 kW/m^2. According to the model, no explosion is possible on-site (assumes an unconfined area release only); therefore no property damage from overpressure would be likely.

5. Risk assessment

5.1 Individual risk

The IAEA method and limited quantitative modelling has been used to determine that there is not likely to be any effect leading to a fatality outside the IMT site as a result of accidents involving the natural gas reticulation or LNG storage systems. The likelihood of serious injury is correspondingly low.

The transport of LNG to the site (and also of LPG to a possible service station) has the potential to increase the risk to persons living or working along the route, but the IAEA method has shown that the increased frequency of accidents arising from the IMT operations is likely to give rise to a negligible increase in risk compared to existing risk levels.

The risk from the possible presence of prohibited dangerous goods at the IMT is assessed as low as a result of the short periods during which they are likely to be present, the small quantities involved, and their likely separation across the site, all of which would reduce the likelihood and the consequences of any accident that might occur. The large separation distances to the nearest residential areas provided by the extensive buffer zones proposed, further limits any adverse consequences.

5.2 Societal risks

The IAEA method has been used to determine that there is not likely to be any effect leading to a fatality outside the IMT site as a result of accidents involving the natural gas reticulation or LNG storage systems. No increase in societal risk is therefore considered likely, and any increase that might arise would certainly fall within the negligible area of the acceptability criteria.

The transport of LNG to the site has the potential to increase the risk to persons living or working along the route, but again the very small increase in the risk of an accident means that up to 100 fatalities would be considered to fall within the negligible range, based on the societal risk criteria detailed in HIPAP 10 for land use planning.

5.3 Environmental risks

Natural gas (principally methane), is not considered toxic for the environment. As it is lighter than air, any leak is likely to disperse quite quickly without affecting the surroundings area. Methane is a powerful greenhouse gas, but the quantities likely to be involved do not make this a material issue.

Other dangerous goods including any waste materials present on the site will be suitably contained, with secondary containment and runoff controls where appropriate to prevent leaks or spills migrating to environmentally sensitive areas, in particular via stormwater systems to the Georges River.

Overall, significant damage to the biophysical environmental is not considered likely.

6. Conclusion

The preliminary risk assessment of the proposed IMT has shown that none of the hazardous materials stored on-site and related activities such as transportation could create an off-site impact and affect members of the public.

A screening assessment based on the SEPP 33 guidelines of the potential for risk to the public, the environment and off-site assets, likely to arise from the IMT Project's construction and operation, has shown that no material will be present on-site in quantities in excess of any of the screening criteria, with the exception of LNG.

A qualitative assessment of risk from incidents involving the hazardous materials likely to be present, supported by estimates of typical quantities and flow rates involved in worst-case scenarios, has indicated that the risk to the public and adjoining land users would fall below the generally accepted criteria for both individual and societal risk. Damage to off-site infrastructure or other assets is not considered likely.

The transport of LPG and LNG will give rise to a negligible increase to the existing risk to which individuals and societies are exposed along the major transport routes.

Other dangerous goods likely to be used on the IMT Project site are not present in quantities that would give rise to risks to the public or off-site assets, but might cause occupational health and safety risks to personnel or risks to the biophysical environment. These risks can be managed within safe levels by the appropriate use of engineering controls, good management practices and appropriate disposal methods for wastes.

This assessment would need to be reviewed once detailed design is further progressed.

Reference

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Appendix A

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

Diesel Fuel (All Types)

MSDS No. 9909

EMERGENCY OVERVIEW
CAUTION!
OSHA/NFPA COMBUSTIBLE LIQUID - SLIGHT TO MODERATE IRRITANT
EFFECTS CENTRAL NERVOUS SYSTEM
HARMFUL OR FATAL IF SWALLOWED

Moderate fire hazard. Avoid breathing vapors or mists. May cause dizziness and drowsiness. May cause moderate eye irritation and skin irritation (rash). Long-term, repeated exposure may cause skin cancer.
If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

NFPA 704 (Section 16)

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732) 750-6000
MSDS INTERNET WEBSITE: www.hess.com (See Environment, Health, Safety & Social Responsibility)

SYNONYMS: Ultra Low Sulfur Diesel (ULSD); Low Sulfur Diesel; Motor Vehicle Diesel Fuel; Diesel Fuel #2; Dyed Diesel Fuel; Non-Road, Locomotive and Marine Diesel Fuel; Tax-exempt Diesel Fuel

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Diesel Fuel (68476-34-6)	100
Naphthalene (91-20-3)	Typically < 0.01

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher. Diesel fuel may be dyed (red) for tax purposes. May contain a multifunctional additive.

3. HAZARDS IDENTIFICATION

EYES
Contact with liquid or vapor may cause mild irritation.

SKIN
May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Similar products produced skin cancer and systemic toxicity in laboratory animals following repeated applications. The significance of these results to human exposures has not been determined - see Section 11 Toxicological Information.

IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A). NIOSH regards whole diesel fuel exhaust particulates as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash).

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	> 125 ^{o}F (> 52 ^{o}C) minimum PMCC
AUTOIGNITION POINT:	494 ^{o}F (257 ^{o}C)
OSHA/NFPA FLAMMABILITY CLASS:	2 (COMBUSTIBLE)
LOWER EXPLOSIVE LIMIT (%):	0.6
UPPER EXPLOSIVE LIMIT (%):	7.5

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY'S SPILL CONTINGENCY OR EMERGENCY RESPONSE PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING PRECAUTIONS

Handle as a combustible liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Diesel fuel, and in particular low and ultra low sulfur diesel fuel, has the capability of accumulating a static electrical charge of sufficient energy to cause a fire/explosion in the presence of lower flashpoint products such as gasoline. The accumulation of such a static charge occurs as the diesel flows through pipelines, filters, nozzles and various work tasks such as tank/container filling, splash loading, tank cleaning; product sampling; tank gauging; cleaning, mixing, vacuum truck operations, switch loading, and product agitation. There is a greater potential for static charge accumulation in cold temperature, low humidity conditions.

Documents such as 29 CFR OSHA 1910.106 "Flammable and Combustible Liquids, NFPA 77 Recommended Practice on Static Electricity, API 2003 "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents and ASTM D4865 "Standard Guide for Generation and Dissipation of Static

Electricity in Petroleum Fuel Systems" address special precautions and design requirements involving loading rates, grounding, bonding, filter installation, conductivity additives and especially the hazards associated with "switch loading." ["Switch Loading" is when a higher flash point product (such as diesel) is loaded into tanks previously containing a low flash point product (such as gasoline) and the electrical charge generated during loading of the diesel results in a static ignition of the vapor from the previous cargo (gasoline).]

Note: When conductivity additives are used or are necessary the product should achieve 25 picosiemens/meter or greater at the handling temperature.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Diesel Fuel: (68476-34-6)	OSHA	5 mg/m, as mineral oil mist	
	ACGIH	100 mg/m^3 (as totally hydrocarbon vapor) TWA	A3, skin
Naphthalene (91-20-3)	OSHA	10 ppm TWA	
	ACGIH	10 ppm TWA / 15 ppm STEL	A4, Skin

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile, neoprene, or PVC are recommended. Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION
A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE
Clear, straw-yellow liquid. Dyed fuel oil will be red or reddish-colored.

ODOR
Mild, petroleum distillate odor

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	320 to 690 oF (160 to 366 ^{o}C)
VAPOR PRESSURE:	0.009 psia @ 70 ^{o}F (21 ^{o}C)
VAPOR DENSITY (air = 1):	> 1.0
SPECIFIC GRAVITY (H_2O = 1):	0.83 to 0.88 @ 60 ^{o}F (16 ^{o}C)
PERCENT VOLATILES:	100 %
EVAPORATION RATE:	Slow; varies with conditions
SOLUBILITY (H_2O):	Negligible

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers; Viton ®; Fluorel ®

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute dermal LD50 (rabbits): > 5 ml/kg
Acute oral LD50 (rats): 9 ml/kg
Primary dermal irritation: extremely irritating (rabbits)
Draize eye irritation: non-irritating (rabbits)
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenic: OSHA: NO IARC: NO NTP: NO ACGIH: A3

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

MUTAGENICITY (genetic effects)
This material has been positive in a mutagenicity study.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:	Diesel Fuel	Placard (International Only):
HAZARD CLASS and PACKING GROUP:	3, PG III	
DOT IDENTIFICATION NUMBER:	NA 1993 (Domestic) UN 1202 (International)	
DOT SHIPPING LABEL:	None	

Use Combustible Placard if shipping in bulk domestically

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a “petroleum exclusion” clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the *de minimis* levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Diesel Engine Exhaust (no CAS Number listed)	10/01/1990

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 3 (Combustible Liquid) and Class D, Division 2, Subdivision B (Toxic by other means)

16. OTHER INFORMATION

NFPA® HAZARD RATING HEALTH: 0
FIRE: 2
REACTIVITY: 0

Refer to NFPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING HEALTH: 1 * * Chronic
FIRE: 2
PHYSICAL: 0

SUPERSEDES MSDS DATED: 02/28/2001

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than
N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

Pri

NOHSC 16 Section

Material Safety Data Sheet

AUTOMOTIVE DIESEL FUEL

Infosafe™ No. ACRJ8 **Issue Date** November 2011 **Status** ISSUED by CALTEX BS: 1.10.9

Classified as hazardous according to criteria of NOHSC

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name AUTOMOTIVE DIESEL FUEL

Product Code

Company Name Caltex Australia Petroleum Pty Ltd (ABN 17 000 032 128)

Address 2 Market Street, Sydney
NSW 2000

Emergency Tel. 1800 033 111

Telephone/Fax Number Tel: (02) 9250 5000
Fax: (02) 9250 5742

Recommended Use Fuel.

Other Names

Name	Product Code
DIESEL FUEL UNMARKED	
EXTRA LOW SULFUR DIESEL	
DIESEL-EXTRA LOW SULFUR	
NEW GENERATION BIODIESEL	

VORTEX DIESEL-EXTRA LOW SULFUR DIESEL
ALPINE DIESEL XLSD (NSW, QLD, VIC)
HIGHLAND DIESEL XLSD (NSW, QLD, VIC)

Other Information The most recent MSDS for this product can be obtained from the Caltex Australia website - 'www.caltex.com.au'.

2. HAZARDS IDENTIFICATION

Hazard Classification HAZARDOUS SUBSTANCE.
NON-DANGEROUS GOODS.

Hazard classification according to the criteria of NOHSC. Dangerous goods classification according to the Australia Dangerous Goods Code.

Risk Phrase(s) R38 Irritating to skin.
R40 Limited evidence of a carcinogenic effect.

Safety Phrase (s) S2 Keep out of reach of children.
S16 Keep away from sources of ignition - No smoking.
S45 In case of accident or if you feel unwell seek medical advice immediately
S53 Avoid exposure - obtain special instructions before use.
S24/25 Avoid contact with skin and eyes.
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Information on Composition Extra Low Sulphur diesel - Mixture of diesel fuel, additives and no more than 10ppm sulphur.

Ingredients	**Name**	**CAS**	**Proportion**
	Diesel Fuel	68334-30-5	90-100 %

Methyl esters from lipid sources	67784-80-9	<10 %

4. FIRST AID MEASURES

Inhalation If inhaled, remove affected person from contaminated area. Keep at rest until recovered. If symptoms develop or persist seek medical attention.

Ingestion Do NOT induce vomiting. Wash out mouth and lips with water. Where vomiting occurs naturally have affected person place head below hip level in order to reduce risk of aspiration. Seek immediate medical attention.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. If symptoms develop seek medical attention.

Eye If in eyes, hold eyelids apart and flush the eyes continuously with running water. Continue flushing for several minutes until all contaminants are washed out completely. If symptoms develop and persist seek medical attention.

First Aid Facilities Eye wash and normal washroom facilities.

Advice to Doctor Treat symptomatically.

Other Information For advice, contact a Poisons Information Centre (Phone eg Australia 131 126; New Zealand 0800 764 766) or a doctor (at once).

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Use carbon dioxide, dry chemical or foam. DO NOT use water jet directly on the fire as this may spread the fire. Water or foam may cause frothing.

Hazards from Combustion Products	Under fire conditions this product may emit toxic and/or irritating fumes and gases including carbon monoxide and carbon dioxide.
Specific Hazards	Combustible liquid. Keep storage tanks, pipelines, fire exposed surfaces etc cool with water spray. Ensure adequate ventilation to prevent explosive vapour-air mixture and prevent build-up of electrostatic charges (i.e. by grounding). Vapour/air mixtures may ignite explosively and flashback along the vapour trail. Remove sources of re-ignition. Fire-exposed container may rupture/explode.
Precautions in connection with Fire	Fire fighters should wear Self-Contained Breathing Apparatus (SCBA) operated in positive pressure mode and full protective clothing to prevent exposure to vapours or fumes. Water spray may be used to cool down heat-exposed containers. Fight fire from safe location. This product should be prevented from entering drains and watercourses.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures	Wear appropriate personal protective equipment and clothing to prevent exposure. Extinguish or remove all sources of ignition and stop leak if safe to do so. Increase ventilation. Evacuate all unprotected personnel. If possible contain the spill. Place inert absorbent, non-combustible material onto spillage. Use clean non-sparking tools to collect the material and place into suitable labelled containers for subsequent recycling or disposal. Dispose of waste according to the applicable local and national regulations. If contamination of sewers or waterways occurs inform the local water and waste management authorities in accordance with local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling	Use only in a well ventilated area. Keep containers sealed when not in use. Prevent the build up of mists or vapours in the work atmosphere. Avoid inhalation of vapours and mists, and skin or eye contact. Do not use near ignition sources. Do not pressurise, cut, heat or weld containers as they may contain hazardous residues. Maintain high standards of personal hygiene i.e. Washing hands prior to eating, drinking, smoking or using toilet facilities.
Conditions for Safe Storage	Store in a cool, dry, well-ventilated area away from sources of ignition, oxidising agents, strong acids, foodstuffs, and clothing. Keep containers closed when not in use and securely sealed and protected against physical damage. Inspect regularly for deficiencies such as damage or leaks. Have appropriate fire extinguishers available in and near the storage area. Take precautions against static electricity discharges. Use proper grounding procedures. For information on the design of the storeroom, reference should be made to Australian Standard AS1940 - The storage and handling of flammable and combustible liquids. Reference should also be made to all applicable local and national regulations.
Storage Regulations	Classified as a Class C1 (COMBUSTIBLE LIQUID) for the purpose of storage and handling, in accordance with the requirements of AS1940. This product should be stored and used in a well-ventilated area away from naked flames, sparks and other sources of ignition.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards	No exposure standards have been established for this material, however, the TWA National Occupational Health And Safety Commission (NOHSC) exposure standards for oil mist, refined mineral oil is 5 mg/m³. As with all chemicals, exposure should be kept to the lowest possible levels. TWA (Time Weighted Average): The average airborne concentration of a particular substance when calculated over a normal eight-hour working day, for a five-day week.
Biological Limit Values	No biological limit allocated.

Engineering Controls	Provide sufficient ventilation to keep airborne levels below the exposure limits. Where vapours or mists are generated, particularly in enclosed areas, and natural ventilation is inadequate, a flameproof exhaust ventilation system is required. Refer to AS 1940 - The storage and handling of flammable and combustible liquids and AS/NZS 60079.10.1:2009 Explosive atmospheres - Classification of areas - Explosive gas atmospheres, for further information concerning ventilation requirements.
Respiratory Protection	Avoid breathing of vapours or mists. Where ventilation is inadequate and vapours or mists are generated the use of an approved respirator with organic vapour/particulate filter complying with AS/NZS 1715 and AS/NZS 1716 is recommended. Final choice of appropriate breathing protection is dependant upon actual airborne concentrations and the type of breathing protection required will vary according to individual circumstances. Expert advice may be required to make this decision. Reference should be made to Australian Standards AS/NZS 1715- Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716- Respiratory Protective Devices.
Eye Protection	If possibility of eye contact exists safety glasses or face shield as appropriate should be worn as described in Australian Standard AS/NZS 1337- Eye Protectors for Industrial Applications.
Hand Protection	Wear gloves of impervious material. Final choice of appropriate gloves will vary according to individual circumstances i.e. methods of handling or according to risk assessments undertaken. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.
Body Protection	Suitable protective work wear, e.g. cotton overalls buttoned at neck and wrist is recommended. Chemical resistant apron is recommended where large quantities are handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colour is variable - water 'white' through to light brown/ straw colour light to fluorescent green.
Odour	Characteristic odour.
Melting Point	Not available
Boiling Point	200-400°C
Solubility in Water	Insoluble.
Specific Gravity	0.82 (min) to 0.85 (max) at 15°C
pH Value	Not applicable
Vapour Pressure	<1 mmHg at 25°C
Vapour Density (Air=1)	>1.0
Viscosity	3.0 cst (40°C)
Flash Point	>61.5°C
Flammability	Combustible liquid
Auto-Ignition Temperature	>250°C (approximate)
Flammable Limits - Lower	Not available
Flammable Limits - Upper	Not available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable under normal conditions of storage and handling.

Conditions to Avoid	Heat, direct sunlight, open flames or other sources of ignition.
Incompatible Materials	Strong oxidising agents.
Hazardous Decomposition Products	Thermal decomposition may result in the release of toxic and/or irritating fumes and gases including carbon monoxide and carbon dioxide.
Hazardous Polymerization	Will not occur.

11. TOXICOLOGICAL INFORMATION

Toxicology Information	Acute toxicity data for diesel fuels as published by RTECS (Registry of Toxic Effects of Chemical Substances) are as follows: LD50 (Oral, Rat): 7,500 mg/kg
Inhalation	Mists and vapours generated may cause irritation of the upper respiratory tract. Inhalation of high concentration may lead to headache, dizziness, nausea, vomiting, drowsiness or narcosis.
Ingestion	May cause irritation of the gastrointestinal tract especially if more than several mouthfuls are swallowed. Symptoms may include abdominal discomfort, nausea, vomiting and diarrhoea. Ingestion of this product and subsequent vomiting can result in aspiration of the liquid into the lungs, causing chemical pneumonia and possible lung damage.
Skin	Will cause irritation to the skin that may result in redness, itchiness and swelling. Repeated or prolonged contact may dry and defat the skin, resulting in skin irritation and possibly lead to dermatitis.
Eye	May cause irritation in contact with the eyes, which can result in redness, stinging and lacrimation.

Chronic Effects Prolonged or repeated skin contact may cause skin irritation leading to dermatitis. Repeated or prolonged inhalation of high vapour concentrations can cause drowsiness and lead to narcosis or death.

Carcinogenicity This substance is classified as a Category 3 Carcinogen according to National Occupational Health and Safety Commission (NOHSC). That is, there is some evidence from appropriate animal studies that human exposure to this substance may result in the development of cancer, but this evidence is insufficient to place the substance in Category 2. Category 3 Carcinogens are substances that cause concern for humans owing to possible carcinogenic effects. Middle distillates have caused skin cancer in laboratory animals following lifetime application to the skin. Brief or intermittent skin contact is not expected to cause adverse effects if it is washed thoroughly. Avoid prolonged or repeated contact or breathing of vapour or mist.

12. ECOLOGICAL INFORMATION

Ecotoxicity Not available

Persistence / Degradability Not available

Mobility Not available

Environment Protection Prevent the material from entering the environment.

13. DISPOSAL CONSIDERATIONS

Disposal Considerations Do not allow into drains or watercourses or dispose of where ground or surface waters may be affected. Wastes including emptied containers are controlled wastes and should be disposed of in accordance with all applicable local and national regulations.

14. TRANSPORT INFORMATION

Transport Information	Not classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. (7th edition)

15. REGULATORY INFORMATION

Regulatory Information	Classified as Hazardous according to criteria of National Occupational Health & Safety Commission (NOHSC), Australia. Classified as a Scheduled Poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).
Poisons Schedule	S5
Hazard Category	Harmful,Irritant

16. OTHER INFORMATION

Date of preparation or last revision of MSDS	MSDS Reviewed: November 2011 Supersedes: January 2007
Contact Person/ Point	CHEMICAL EMERGENCIES: 1 800 033 111 TECHNICAL ADVICE: 1300 364 169 Health & Safety Advisor Tel: (02) 9250 5822 and (02) 9250 5734 PLEASE NOTE that although every care has been taken in compiling the above information, it is solely reliant upon data available to us at the date hereof. We believe the data to be correct, however for the reason just stated we are not in a position to warrant its accuracy. With that in mind and given that the full range of possibilities and conditions under which the information may be applied simply cannot be anticipated, YOU ARE CAUTIONED to make your own determinations as to the veracity and the suitability of the information to the particular

circumstances that apply, or may apply, to you from time to time. Consistent with that approach it is recommended that where you have a particular purpose which would necessitate a reliance on information of the nature herein you obtain your own independent expert advice particularly structured to the relevant purpose. If this material is printed, circulated, distributed or copied in any manner, it is not to be modified without prior written permission, and further, it is to include the wording of the above disclaimer.

End of MSDS

Print Date: 10/12/2011 BS: 1.10.9

Material Safety Data Sheet

Unleaded Petrol

Infosafe No. AMPHO **Issue Date** May 2004 **Status** ISSUED by CALTEX

Classified as hazardous

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name Unleaded Petrol
Company Name CALTEX AUSTRALIA LIMITED
Address MLC BUILDING 19 - 29 Martin Place SYDNEY
NSW 2000
Telephone/Fax Number Tel: (02) 9250 5000 Fax: (02) 9250 5742
Recommended Use Fuel.

Other Names

Name	Product Code
Petrol	
Gasoline	

Other Information The most recent MSDS for this product can be obtained from the Caltex Australia website - 'www.caltex.com.au'.

2. HAZARDS IDENTIFICATION

Hazard Classification

Classified as Hazardous according to the criteria of NOHSC.
Classified as Dangerous Goods according to the ADG Code.
Risk phrase:
R11 Highly flammable.
R38 Irritating to skin.
R45(1) May cause cancer.
R65 Harmful: may cause lung damage if swallowed.
R48/20/21/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
Safety phrase:
S16 Keep away from sources of ignition - No smoking.

	S2 Keep out of reach of children. S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.
Risk Phrase(s)	R11 Highly flammable. R38 Irritating to skin. R65 Harmful: may cause lung damage if swallowed. R45(1) May cause cancer. R48/20/21/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
Safety Phrase(s)	S2 Keep out of reach of children. S16 Keep away from sources of ignition - No smoking. S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.
Other Information	Use as a motor fuel only. Do not siphon with the mouth. Do not use in the vinicity of a fire, a hot surface or during welding.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	**Name**	**CAS**	**Proportion**
	Petroleum hydrocarbons	8008-20-6	90-100 %
	Benzene	71-43-2	0-5 %

4. FIRST AID MEASURES

Inhalation	Remove the source of contamination or move the victim to fresh air. Ensure airways are clear and have a qualified person give oxygen through a face mask if breathing is difficult. If irritation develops and persists, seek immediate medical attention.
Ingestion	DO NOT induce vomiting. Immediately wash mouth out with water. Seek immediate medical attention.
Skin	Remove all contaminated clothing. Wash gently and thoroughly with water and non-abrasive soap. Ensure contaminated clothing is washed before re-use or discard. If symptoms develops and persists, seek medical attention.
Eye	If contact with the eye(s) occur, wash with copious amounts of water, holding eyelid(s) open. Take care not to rinse contaminated water into the non-affected eye. If irritation develops and persists, seek medical attention.
First Aid Facilities	An eye wash fountain, safety shower and a general washing facility.
Advice to Doctor	Treat symptomatically, there is a risk of chemical pneumonitis if the material is aspirated into the lungs.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	CO_2, dry chemical, foam.
Specific Methods	Self-Contained Breathing Apparatus (S.C.B.A) and full protective clothing should be worn. Evacuate immediate area. Keep containers cool with water fog/spray. Heat will increase pressure of closed storage containers and may rupture/explode. Keep storage tanks, pipelines, fire exposed surfaces etc cool with water spray.

Specific Hazards	Ensure adequate ventilation to prevent explosive vapour-air mixture and prevent build-up of electrostatic charges (i.e. by grounding). Vapour/air mixtures may ignite explosively and flashback along the vapour trail. Remove sources of re-ignition.
Hazchem Code	3[Y]E

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures	Remove all sources of ignition. Increase ventilation. Evacuate all unnecessary personnel. Wear full protective equipment and clothing to minimise exposure. If possible contain the spill. Place inert, non combustible, absorbent material onto spillage. Use clean non-sparking tools to collect the material and place into a suitable labelled container. If large quantities of this material enter the waterways contact the Environmental Protection Authority, or your local Waste Management Authority.

7. HANDLING AND STORAGE

Precautions for Safe Handling	Repeated or prolonged exposure to this material should be avoided in order to lessen the possibility of disorders. Use in a well ventilated area. Prohibit sources of sparks, ignition and naked flames. Wear appropriate protective equipment. It is essential that all who come into contact with this material, maintain high standards of personal hygiene i.e. washing hands prior to eating, drinking, smoking or going to the toilet. Build-up of vapour or mist in the working atmosphere must be prevented. Ensure ventilation is adequate. DO NOT enter confined spaces where vapour or mist may have collected. Keep containers closed when not in use. Prevent accumulation of static electricity and earth all equipment.
Conditions for Safe Storage	Store in a cool, dry, well-ventilated area, out of direct sunlight. Avoid sparks, flames, and other ignition sources. Store away from incompatible materials such as materials that support combustion (oxidizing materials). Store in suitable, labelled containers. Keep containers tightly closed when not in use and when empty. Protect from damage. Have appropriate fire extinguishers available in and near the storage area. Do NOT pressurise, cut, heat or weld containers as they may contain hazardous residues. For information on the design of the store-room reference should be made to Australian Standard AS1940 - The storage and handling of flammable and combustible liquids. Reference should also be made to all Local, State and Federal regulations.
Other Information	MAJOR PRECAUTIONS: HIGHLY FLAMMABLE! VAPOUR-AIR MIXTURE EXPLOSIVE! Fuels are exempt from the Standard for the Uniform Scheduling of Drugs and Poisons, except when packed in containers having a capacity of 20 litres or less. Classified as a Scheduled (S5) Poison using the criteria in the SUSDP (Standard for the Uniform Scheduling of Drugs and Poisons) when used for other applications rather than as a fuel

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards

Name	STEL (mgm3)	STEL (ppm)	TWA (mgm3)	TWA (ppm)	FootNote
Benzene			3.2	1	

Other Exposure Information

SUBSTANCE EXPOSURE STANDARDS
Petrol (gasoline) TWA: 900 mg/m3 (under review)

TWA is the time weighted average concentration of the work atmosphere over a normal 8-hour work day and a 40-hour work week. Nearly all workers may be repeatedly exposed to this level, day after day, without adverse effect.

Engineering Controls	Provide sufficient ventilation to keep airborne levels to least possible levels. Where vapours or mists are generated, particularly in enclosed areas, and natural ventilation is inadequate, a flameproof exhaust ventilation system is recommended. Provide electrical earthing and equipment useable in explosive atmospheres. Refer to AS 1940-The storage and handling of flammable and combustible liquids and AS 2430-Explosive gas atmospheres for further information concerning ventilation requirements.
Respiratory Protection	Avoid breathing of vapours/mists. Where ventilation is inadequate and vapours/mists are generated, the use of an approved respirator with filter complying with AS/NZS 1715 and AS/NZS 1716 is recommended; however final choice of appropriate breathing protection is dependant upon actual airborne concentrations and the type of breathing protection required will vary according to individual circumstances. Expert advice may be required to make this decision. Reference should be made to Australian Standards AS/NZS 1715- Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716- Respiratory Protective Devices.
Eye Protection	Chemical safety glasses or face shield recommended as appropriate. Final choice of appropriate eye/face protection will vary according to individual circumstances including methods of handling or engineering controls as determined by appropriate risk assessments. Eye protection should conform to Australian/New Zealand Standard AS/NZS 1337- Eye Protectors for Industrial Applications.
Hand Protection	Impervious (Neoprene or nitrile rubber) gloves recommended as appropriate. Final choice of appropriate glove type will vary according to individual circumstances, including methods of handling or engineering controls as determined by appropriate risk assessments. Refer to AS/NZS 2161 Occupational protective gloves- Selection, use and maintenance. The use of barrier cream is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Purple mobile liquid, with a characteristic odour.
Boiling Point	30 - 205°C
Specific Gravity	0.73
pH Value	Not Applicable
Vapour Pressure	80 kPa
Vapour Density (Air=1)	3.5 (cf Air = 1)
Flash Point	-40°C (CC)
Flammability	Highly Flammable. Eliminate all ignition sources. Use only flameproof electrical equipment. Internal Combustable engines are not permitted for pumping. Earth containers when transferring product. Do not use plastic tubing or containers.
Auto-Ignition Temperature	370°C
Flammable Limits - Lower	None Allocated
Explosion Properties	LEL: 1.4 % UEL: 7.6 %
Other Information	Viscosity: < 1.4 cSt @ 40°C Solubility in water: Insoluble. Evaporative Rate: Not Available.

10. STABILITY AND REACTIVITY

Hazardous Reactions	DECOMPOSITION: Carbon monoxide and dioxide, smoke and fumes. REACTIVITY: May react vigorously with oxidising materials.

11. TOXICOLOGICAL INFORMATION

Toxicology Information	liver cancer in animals following exposure to wholly vapourised petrol. Additional studies limited to the volatile fraction of petrol have not resulted in kidney damage, which is generally considered to be a precursor to kidney cancer. Many scientists do not believe that the male rat is an appropriate animal model or predictor of human kidney cancer. Epidemiology studies in humans exposed to hydrocarbons have not indicated excess risk of kidney or liver cancer. Petrol contains benzene in concentrations from about 0.5 to 4.0 %. Chronic toxicology studies in laboratory animals and certain epidemiology studies have indicated that excessive benzene exposure may cause cancer of the blood-forming organs including leukaemia. While the benzene content of petrol is relatively low, it is important to minimise exposure to the skin and respiratory system to well within current exposure standards. Engineering controls including full enclosure, vapour recovery, or local exhaust ventilation are recommended where routine exposure may exceed applicable standards.
Inhalation	Vapours may cause headache, nausea with vomiting, dizziness, confusion and other effects of central nervous system depression. Loss of consciousness can occur at high concentrations followed by convulsions and death.
Ingestion	May cause irritation to the gastrointestinal system. Symptoms may include abdominal pain, nausea, vomiting, diarrhoea or depression of the central nervous system including nausea, headaches, dizziness, fatigue, loss of coordination, unconsciousness and possibly narcosis. Small amounts of liquid aspirated into the respiratory system during ingestion or vomiting may lead to aspiration into the lungs with a possibility of chemical pneumonia or lung damage.
Skin	Will cause irritation to the skin. This can result in itching and redness of the skin. Poisoning may occur from prolonged or massive skin contact.
Eye	May cause irritation in contact with the eyes, which can result in redness, stinging and lachrymation.
Chronic Effects	Prolonged and repeated exposure through inhalation or swallowing of this material can result in harmful effects including central nervous system effects. Systemic effects of chronic exposure can also include damage to heart, kidneys and liver. Prolonged or repeated skin contact may also result in skin irritation leading to dermatitis. May cause cancer: Benzene has been classified as a Carcinogen Category 1. Refer to Toxicology information for further information.

12. ECOLOGICAL INFORMATION

Ecotoxicity	No data is available for this material.
Persistence / Degradability	No data is available for this material.
Mobility	No data is available for this material.
Environment Protection	Environmentally hazardous material. Avoid contaminating waterways, sewers and drains.

13. DISPOSAL CONSIDERATIONS

Disposal Considerations	Dispose of waste according to federal, E.P.A., state and local regulations.

14. TRANSPORT INFORMATION

Transport Information	This material is a Class 3 - Flammable Liquid according to The Australian Code for the Transport of Dangerous Goods by Road and Rail. Class 3 - Flammable Liquids are incompatible in a placard load with any of the following: - Class 1, Explosives - Class 2.1, Flammable Gases, if both the Class 3 and Class 2.1 dangerous goods are in bulk - Class 2.3, Toxic Gases - Class 4.2 Spontaneously Combustible Substances - Class 5.1 Oxidising Agents and Class 5.2, Organic Peroxides - Class 6 Toxic Substances (where the flammable liquid is nitromethane) - Class 7 Radioactive Substances.
U.N. Number	1203
Proper Shipping Name	MOTOR SPIRIT
DG Class	3
Hazchem Code	3[Y]E
Packaging Method	3.8.3
Packing Group	II
EPG Number	3.1.001
IERG Number	14

15. REGULATORY INFORMATION

Poisons Schedule	Not Scheduled
Hazard Category	Toxic,Irritant,Highly Flammable

16. OTHER INFORMATION

Date of preparation or last revision of MSDS	MSDS Review: May 2004. MSDS Supersedes: August 2000.
Contact Person/Point	CHEMICAL EMERGENCIES: 1 800 033 111 TECHNICAL ADVICE: 1300 364 169 Health & Safety Advisor Tel: (02) 9695 3607 or (02) 9250 5900

PLEASE NOTE that although every care has been taken in compiling the above information, it is solely reliant upon data available to us at the date hereof. We believe the data to be correct, however for the reason just stated we are not in a position to warrant its accuracy. With that in mind and given that the full range of possibilities and conditions under which the information may be applied simply cannot be anticipated, YOU ARE CAUTIONED to make your own determinations as to the veracity and the suitability of the information to the particular circumstances that apply, or may apply, to you from time to time. Consistent with that approach it is recommended that where you have a particular purpose which would necessitate a reliance on information of the nature herein you obtain your own independent expert advice particularly structured to the relevant purpose. If this material is printed, circulated, distributed or copied in any manner, it is not to be modified without prior written permission, and further, it is

	to include the wording of the above disclaimer.
Empirical Formula & Structural Formula	Mixture.
Literature References	REGULATIONS SPECIFICALLY APPLICABLE TO THE CHEMICAL PRODUCT: COMMONWEALTH OF AUSTRALIA: Respirators must follow AS1715/1716 standard for approved respirators. NEW ZEALAND: Respirators must follow NZS 1715/1716 standard for approved respirators. INTERNATIONAL (ALL COUNTRIES): In the absence of local approved authorities, follow U.S. NIOSH/MSHA, U.K. BSI, Australian AS1715/1716, or New Zealand NZS 1715/1716 standards. AUSTRALIA POISON SCHEDULE: Not applicable. NZ DANGEROUS GOODS CLASS: Not applicable. NZ TOXIC SUBSTANCES SCHEDULE: Not applicable.

End of MSDS

AGL NATURAL GAS

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AGL NATURAL GAS

SYNONYMS

"high methane", "natural gas NG"

PROPER SHIPPING NAME
METHANE, COMPRESSED or NATURAL GAS, COMPRESSED

PRODUCT USE
Operators should be trained in correct use & maintenance of respirators. Commercial heating and cooking gas fuel, fuel for vehicles. Fractionated and used as base raw material for the manufacture of many chemicals ammonia, acetylene. etc.

SUPPLIER
Company: AGL Energy Limited
Address:
72 Christie St Locked Bag 1837
St Leonards St Leonards
NSW 2065 NSW 2065
AUS
Telephone: (02) 9921 2999
Emergency Tel: 000

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
DANGEROUS GOODS. NON-HAZARDOUS SUBSTANCE. According to the Criteria of the ADG Code and NOHSC.

POISONS SCHEDULE
None

RISK
Extremely flammable.
Risk of explosion if heated under confinement.

SAFETY
Keep away from sources of ignition. No smoking.
Do not breathe gas/ fumes/ vapour/ spray.

Wear eye/ face protection.
Use only in well ventilated areas.
Keep container in a well ventilated place.
Keep container tightly closed.
Take off immediately all contaminated clothing.
In case of contact with eyes rinse with plenty of water and contact Doctor or Poisons Information Centre.
This material and its container must be disposed of as hazardous waste.

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Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
natural gas, compressed	68410-63-9	100
comprising		
methane	74-82-8	88.5^
ethane	74-84-0	8^
propane	74-98-6	0.2^
butane	106-97-8.	trace^
pentane plus (C5+)		trace^
carbon dioxide	124-38-9	2^
nitrogen	7727-37-9.	1.3^

Section 4 - FIRST AID MEASURES

SWALLOWED

Refer to procedure for inhalation.

EYE

Not applicable.

SKIN

Not applicable.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- Dry chemical powder.

Carbon dioxide.
Bromochlorodifluoromethane (BCF) (where regulations permit).

FIRE FIGHTING

Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves for fire only.
- May be washed to drain with large quantities of water.
- Consider evacuation (or protect in place).

Fight fire from a safe distance, with adequate cover.
If safe to do so, switch off electrical equipment until vapour fire hazard is removed.
DO NOT extinguish burning gas. If safe to do so, stop flow of gas.
DO NOT approach cylinders suspected to be hot.
If flow of gas cannot be stopped, leave gas to burn.

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If safe to do so, remove containers from path of fire.
Cool fire exposed containers with water spray from a protected location.
When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 1500 metres in all directions.

FIRE/EXPLOSION HAZARD
Flammable gas.
Severe vapour explosion hazard, when exposed to flame or spark.
Dangerous hazard when exposed to heat or flame.
Vapour may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, emits toxic fumes of: carbon monoxide (CO) and carbon dioxide (CO_2).

FIRE INCOMPATIBILITY
- Explosion hazard may follow contact with incompatible materials.
Reacts violently with oxidizing agents such as chlorine.
Contact with chlorine dioxide causes spontaneous explosion.
Contact with liquid fluorine causes spontaneous explosion, even at very low temperatures (-19 deg.C).
A mixture of liquid methane and liquid oxygen is an explosive.

HAZCHEM: 2[S]E

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS
Refer to major spills.

MAJOR SPILLS
Alert Fire Brigade and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Shut off all possible sources of ignition and increase ventilation.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- May be washed to drain with large quantities of water.
- Consider evacuation (or protect in place).

Apply leak detection solution to suspected sites in lines and equipment.
- Remove leaking cylinders to a safe place.
- Fit vent pipes. Release pressure under safe, controlled conditions
- Burn issuing gas at vent pipes.
- DO NOT exert excessive pressure on valve; DO NOT attempt to operate damaged valve.

PROTECTIVE ACTIONS FOR SPILL

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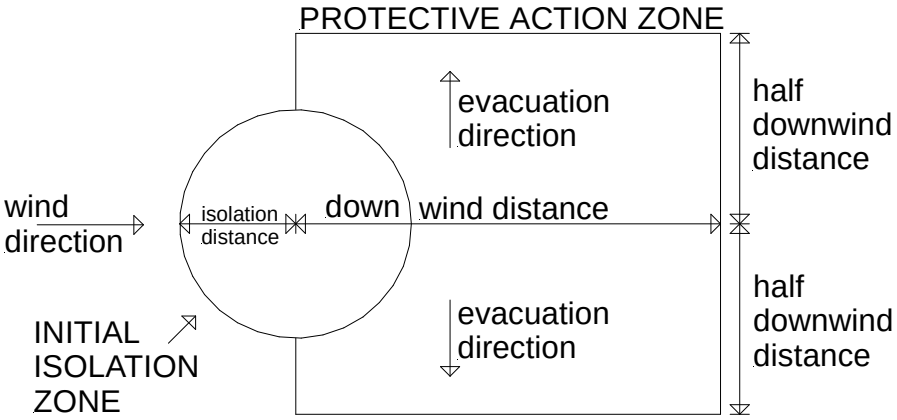

From IERG (Canada/Australia)

Isolation Distance	100 metres
Downwind Protection Distance	800 metres
IERG Number	4

FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills".
LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

5 Guide 115 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

Used in closed pressurised systems, fitted with safety relief valve. Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, naked flames.
- Atmospheres must be tested and O.K. before work resumes after leakage.
- Obtain a work permit before attempting any repairs.
- Do not attempt repair work on lines, vessels under pressure.

Handle and open container with care.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.

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- Avoid smoking, naked lights, heat or ignition sources.
- When handling, DO NOT eat, drink or smoke.
- Vapour may ignite on pumping or pouring due to static electricity.
- DO NOT use plastic buckets.
- Earth and secure metal containers when dispensing or pouring product.
- Use spark-free tools when handling.
- Avoid contact with incompatible materials.
- Keep containers securely sealed.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- Avoid generation of static electricity. Earth all lines and equipment.
- DO NOT transfer gas from one cylinder to another.

SUITABLE CONTAINER

- Cylinder:
- Ensure the use of equipment rated for cylinder pressure.
- Ensure the use of compatible materials of construction.
- Valve protection cap to be in place until cylinder is secured, connected.
- Cylinder must be properly secured either in use or in storage.
- Cylinder valve must be closed when not in use or when empty.
- Segregate full from empty cylinders.

WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.

- Check that containers are clearly labelled.

Packaging as recommended by manufacturer.

STORAGE INCOMPATIBILITY

Segregate from. oxygen gas, oxidising agents.

STORAGE REQUIREMENTS

Store in a cool, dry place. Store in a flame proof area.
No smoking, naked lights, heat or ignition sources.
Store in a cool area and away from sunlight. Store below 45 deg. C.
Store in a well-ventilated area. Store away from incompatible materials.
Store in an upright position. - Outside or detached storage is preferred.
Protect containers against physical damage.

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry area protected from environmental extremes.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations
- Consider storage in bunded areas - ensure storage areas are isolated from sources of community water (including stormwater, ground water, lakes and streams}.
- Ensure that accidental discharge to air or water is the subject of a contingency disaster management plan; this may require consultation with local authorities.

Rotate all stock to prevent ageing. Use on FIFO (First In-First Out) basis.

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³
Australia Exposure Standards	carbon dioxide (Carbon dioxide)	5000	9000	30000	54000

The following materials had no OELs on our records
• natural gas, compressed: CAS:68410- 63- 9

ODOUR SAFETY FACTOR (OSF)

OSF=0.068 (natural gas, compressed)
Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.
Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.
The Odour Safety Factor (OSF) is defined as:
OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm
Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

.

MATERIAL DATA

INGREDIENT DATA

NATURAL GAS, COMPRESSED:
Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results

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are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.
OSHA (USA) concluded that exposure to sensory irritants can:
- cause inflammation
- cause increased susceptibility to other irritants and infectious agents
- lead to permanent injury or dysfunction
- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.
TLV TWA: 1000 ppm as aliphatic hydrocarbon gases, alkane C1-C4
ES TWA: simple asphyxiant

PERSONAL PROTECTION

EYE
- Safety glasses with side shields; or as required,
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
Wear chemical protective gloves, eg. PVC.
Wear safety footwear.

OTHER
- Protective overalls, closely fitted at neck and wrist.
- Eye-wash unit.
IN CONFINED SPACES:
- Non-sparking protective boots
- Static-free clothing.
- Ensure availability of lifeline.
Staff should be trained in all aspects of rescue work.
Rescue gear: Two sets of SCUBA breathing apparatus Rescue Harness, lines etc.
Operators should be trained in correct use & maintenance of respirators.
Ensure that there is ready access to breathing apparatus.
Ensure ready access to a burns first aid kit.

RESPIRATOR
Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half- face Respirator	Full- Face Respirator

continued...

1000	10	AX- - AUS	-
1000	50	-	AX- - AUS
5000	50	Airline *	-
5000	100	-	AX- - 2
10000	100	-	AX- - 3
	100+		Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.
For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

Areas where cylinders are stored require good ventilation and if enclosed need discrete / controlled exhaust ventilation.
Local exhaust ventilation (explosion proof) usually required.
Ventilation should ensure that work place atmospheres do not reach 25% of lower explosive limit.
Respiratory protection in form of air supplied or self contained breathing equipment must be worn if oxygen concentration in the air is suspected to be less than 19%. Cartridge respirator do NOT give protection and may result in rapid suffocation.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Invisible, highly flammable gas which readily forms explosive mixtures in air.
Odourant in the form of tertiary butylmercaptan (TBM) 30% and tetrahydrothiophene (THT) 70% is added to allow detection, recognition.
Gas is less dense than air. Burns with a pale, luminous flame.
Practically insoluble in water. Soluble in alcohol, ether, hydrocarbons
Packed as a gas under pressure. Sudden release of pressure or leakage will result in generation of a large volume of highly flammable / explosive gas.

PHYSICAL PROPERTIES

Gas.
Does not mix with water.
Floats on water.

Molecular Weight: 16.04	Boiling Range (℃): - 162
Melting Range (℃): - 182	Specific Gravity (water=1): 0.615 (Air = 1)
Solubility in water (g/L): Immiscible	pH (as supplied): Not applicable
pH (1% solution): Not applicable.	Vapour Pressure (kPa): Not applicable.
Volatile Component (%vol): 100	Evaporation Rate: Not applicable
Relative Vapour Density (air=1): 0.615	Flash Point (℃): - 2 18
Lower Explosive Limit (%): 5.0	Upper Explosive Limit (%): 15.0
Autoignition Temp (℃): 540	Decomposition Temp (℃): Not av ailable
State: Compressed gas	Viscosity: Not available

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Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

Presence of incompatible materials. Presence of elevated temperatures.
- Presence of heat source and ignition source.
Product is considered stable under normal handling conditions.
Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
Refer to inhalation.

EYE
The gas is non harmful to the eyes.

SKIN
The gas is non harmful to the skin.

INHALED
The gas acts as a simple asphyxiant by partially displacing, replacing the air required to support human life.
Symptoms of asphyxiation include shortness of breath, rapid fatigue, nausea and vomiting, cyanosis (blue skin colour), diminished mental alertness and impaired muscular coordination. Prolonged exposure to oxygen deficient atmospheres can lead to collapse and death.

CHRONIC HEALTH EFFECTS
No long term effects.

TOXICITY AND IRRITATION
Not available. Refer to individual constituents.

NATURAL GAS, COMPRESSED:
unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

No data for AGL Natural Gas.
Refer to data for ingredients, which follows:

NATURAL GAS, COMPRESSED:
The lower molecular weight hydrocarbons are expected to form a "slick" on the surface of waters after release in calm sea conditions. This is expected to evaporate and enter the atmosphere where it will be degraded through reaction with hydroxy radicals.

Some of the material will become associated with benthic sediments, and it is likely to be spread over a fairly wide area of sea floor. Marine sediments may be either aerobic or

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anaerobic. The material, in probability, is biodegradable, under aerobic conditions (isomerised olefins and alkenes show variable results). Evidence also suggests that the hydrocarbons may be degradable under anaerobic conditions although such degradation in benthic sediments may be a relatively slow process.

Under aerobic conditions the material will degrade to water and carbon dioxide, while under anaerobic processes it will produce water, methane and carbon dioxide.

Based on test results, as well as theoretical considerations, the potential for bioaccumulation may be high. Toxic effects are often observed in species such as blue mussel, daphnia, freshwater green algae, marine copepods and amphipods.
Drinking Water Standards:
hydrocarbon total: 10 ug/l (UK max.).
DO NOT discharge into sewer or waterways.

Section 13 - DISPOSAL CONSIDERATIONS

Discharge to burning flare.
Ensure damaged or non-returnable cylinders are gas-free before disposal.
Return empty or damaged cylinders to supplier.

Section 14 - TRANSPORTATION INFORMATION

Labels Required: FLAMMABLE GAS
HAZCHEM: 2[S]E

UNDG:

Dangerous Goods Class:	2.1	Subrisk:	None
UN Number:	1971	Packing Group:	None

Shipping Name:METHANE, COMPRESSED or NATURAL GAS, COMPRESSED

Air Transport IATA:

ICAO/IATA Class:	2.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1971	Packing Group:	None
Special provisions: Cargo Only	A1		
Packing Instructions: Passenger and Cargo	200	Maximum Qty/Pack: Passenger and Cargo	150 kg
Packing Instructions: Passenger and Cargo Limited Quantity	Forbidden	Maximum Qty/Pack: Passenger and Cargo Limited Quantity	Forbidden
Packing Instructions:	-	Maximum Qty/Pack:	-

Shipping Name: METHANE, COMPRESSED

Maritime Transport IMDG:

IMDG Class:	2.1	IMDG Subrisk:	None
UN Number:	1971	Packing Group:	None
EMS Number:	F- D, S- U	Special provisions:	None

continued...

Limited Quantities: None
Shipping Name: METHANE, COMPRESSED or NATURAL GAS,
COMPRESSED with high methane content

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE: None

REGULATIONS
AGL Natural Gas (CAS: None):
No regulations applicable

natural gas, compressed (CAS: 68410-63-9) is found on the following regulatory lists;
Australia Inventory of Chemical Substances (AICS)
International Air Transport Association (IATA) Dangerous Goods Regulations
OECD Representative List of High Production Volume (HPV) Chemicals

Section 16 - OTHER INFORMATION

EXPOSURE STANDARD FOR MIXTURES

natural gas, compressed	0.0000	99.9

Operations which produce a spray/mist or fume/dust, introduce particulates to the breathing zone.
If the breathing zone concentration of ANY of the components listed below is exceeded, "Worst Case" considerations deem the individual to be overexposed.
At the "Composite Exposure Standard for Mixture" (TWA) (mg/m3): mg/m³

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

SAFETY DATA SHEET
FOR
Liquefied Petroleum Gas (LPGas)

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Supplier Name	Elgas Ltd, A.C.N. 002 749 260
Address	10 Julius Avenue, North Ryde NSW 2113 PO Box 1336, Chatswood NSW 2067 AUSTRALIA
Telephone	(02) 8094 3200
Fax	(02) 9018 0146
Emergency	1800 819 783 (24 hours)
Other Names	Propane, butane, propene or a combination of these products
Uses	As an energy source in the residential, commercial and automotive markets, a feedstock by the petrochemical industry, a propellant for aerosol spray cans, foam blowing applications and a refrigerant.

2. HAZARDS IDENTIFICATION

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO ASCC (NOHSC) CRITERIA.
CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE.

3. COMPOSITION / INFORMATION ON INGREDIENTS

			CAS Number
	LP Gas	Composition in accordance with the appropriate LPG Australia specifications and state regulations	68476 – 85 – 7
Main Components	Propane		0074 – 98 – 6
	Propene		115 – 07 – 1
	n-Butane		106 – 97 – 8
	Isobutane		75 – 28 – 5
Minor Components	Ethane		74 – 84 – 0
	1,3-Butadiene	<0.1%	106 – 99 – 0
Odourant:	Ethylmercaptan	Approx 25ppm	75 – 08 – 1

4. FIRST AID MEASURES

In all cases seek medical attention and see the Elgas Super Cold Contact Injuries Hospital Information Sheet for further information and procedures.

Eye	Treatment for cold burns: Immediately flush with tepid water or with sterile saline solution. Hold eyelids apart and irrigate for 15 minutes. Seek medical attention.
Inhalation	Remove from area of exposure immediately. Be aware of possible explosive atmospheres. If victim is not breathing apply artificial respiration and seek urgent medical attention. Give oxygen if available. Keep warm and rested.
Skin	Cold burns: Remove contaminated clothing and gently flush affected areas with warm water (30 C) for 15 minutes. Apply non-adhesive sterile dressing and treat as for a thermal burn. For large burns, immerse in warm water for 15 minutes. DO NOT apply any form of direct heat. Seek immediate medical attention.
Ingestion	For advice, contact a Poisons Information Centre on 13 11 26 (Australia Wide) or a doctor. Ingestion is considered unlikely due to product form.
Advice to Doctor	Treat symptomatically. Severe inhalation over exposure may sensitise the heart to catecholamine induced arrhythmias. Do not administer catecholamines to an overexposed person.

5. FIRE FIGHTING MEASURES

Flammability	Highly flammable. Heating to decomposition produces acrid smoke and irritating fumes. Product will add fuel to a fire. Eliminate all ignition sources including cigarettes, open flames, spark producing switches / tools, heaters, naked lights, pilot lights, mobile phones etc. when handling.
Fire and Explosion	Highly flammable. Temperatures in a fire may cause cylinders or pressure vessels to rupture and pressure relief devices to be activated. Call Fire Brigade. This product will add fuel to a fire. Cool cylinders and vessels exposed to fire by applying water from a protected location and with water spray directing spray primarily onto the upper surface. Do not approach any LPGas container suspected of being hot.
Extinguishing	Stop flow of gas if safe to do so, such as by closing valves or by activating Emergency Shutdown Systems. If the gas source cannot be isolated, do not extinguish the flame, since re-ignition and explosion could occur. Await arrival of emergency services. Drench and cool cylinders or vessels with water spray from protected area at a safe distance. If it is absolutely necessary to extinguish the flame, use only a dry chemical powder extinguisher. Do not move cylinders for at least 24 hours. Avoid shock and bumps to cylinders. Evacuate the area of persons not fighting the fire. Carbon oxides (CO, CO_2) fumes may be produced should burning occur especially within an enclosed space (ie causing a deficiency of oxygen). Fire fighters should wear full protective clothing and be aware of the risk of possible explosion (especially in a confined space). Flashback may occur along vapour trail. Where possible, remove cool cylinders from the path of the fire. Do not re-use a fire-exposed vessel or cylinder – seek advice of supplier.
Hazchem Code	2YE (as defined in ADG7 published in 2007) 2WE (as defined in ADG6 published in 1998)

6. ACCIDENTAL RELEASE MEASURES

Spillage	As this product has a very low flash point any spillage or leak is a fire and / or explosion hazard. If a leak has not ignited, stop gas flow, isolate sources of ignition and evacuate personnel. Ensure good ventilation. Liquid leaks generate large volumes of heavier than air flammable vapour which may travel to remote sources of ignition (eg along drainage systems). Where appropriate, use water spray to disperse the gas or vapour and to protect personnel attempting to stop leakage. Vapour may collect in any confined space.
Gas Cylinders	If the cylinder is leaking, eliminate all potential ignition sources and evacuate area of personnel. Inform manufacturer / supplier of leak. If safe to enter the area, wear appropriate PPE and carefully move the cylinder to a well ventilated remote area, then allow to discharge. Do not attempt to repair leaking valve or cylinder fusible plugs. For vessels operate the Emergency Shutdown System (where fitted) and proceed as above.

7. HANDLING AND STORAGE

Precautions for Safe Handling

Avoid inhalation of vapour. Avoid contact with liquid and cold storage containers. When handling cylinders wear protective footwear and suitable gloves. Always ensure that cylinders are within test date, are fit for use and are leak checked prior to use. Do not fill excessively dented, gouged or rusty containers (refer AS2337.1). Only fill cylinders to 80% fill level (ullage tube via decanting or mass via mechanical filling). The maximum fill level for vessels is depdendent upon their size and location as detailed in AS / NZS 1596. Avoid contact with eyes. Class 2.1 Flammable Gas products may only be loaded in the same vehicle or packed in the same freight container with the classes of products as permitted in the ADG Code (see references). Cylinders shall only be transported in an upright, secure position in accordance with the National Road Transport Commission Load Restraint Guide and shall not be dropped.

Conditions for Safe Storage

Store and use only in equipment / containers designed for use with this product. Store and dispense only in well ventilated areas away from heat and sources of ignition. Do not enter storage vessels. If entry to a vessel is necessary, contact the supplier. Cylinders and vessels must be properly labelled. Do not remove warning labels. LPGas cylinders shall be stored in accordance with the requirements of the ADG Code, AS 4332 and AS/NZS1596. Do not store in pits and basements where vapour may collect. Store cylinders securely in an upright position. Note: forklift cylinders may be stored horizontally. Store away from incompatible materials particularly oxidising agents. Check vessels and cylinders are clearly labelled. Do not contaminate cylinders or vessels with other products.

Other Information

Product spilt on clothing may give rise to delayed evaporation and subsequent fire hazard. Check for leaks by sound and smell and by locating with soapy water or with approved detection devices. Use only equipment and pipework designed and approved (where applicable) for LPGas applications. Ensure that cylinders cannot be struck by forklift vehicles or by dropped or rolled objects, etc. Refer to Australian state and territory dangerous good regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation

Maintain adequate ventilation. Confined areas (eg tanks) should be adequately ventilated and gas tested and must NEVER be entered unless under supervision via a Permit Procedure.

Exposure Standards

Ingredient Name	Occupational Exposure Limits
LP Gas	**NOHSC** TWA: 1000 ppm 8 hour(s)
Butane	**NOHSC** TWA: 1900 mg/m^3 8 hour(s) TWA: 800 ppm 8 hour(s)
Propane	**ACGIH TLV** TWA: 1000 ppm 8 hour(s)
Propylene	**ACGIH TLV** TWA: 500 ppm 8 hour(s)

PPE

Wear suitable gloves and overalls to prevent cold burns and frostbite. In filling operations wear protective clothing including impervious gloves, safety goggles or face shield. All clothing should be of the anti-static, low flame spread type. When handling cylinders wear protective footwear.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTY	PROPANE		BUTANE	
Appearance **Odour** **Chemical Formula**	**Colourless Gas** **Characteristic Odour** **C_3H_8**		**Colourless Gas** **Characteristic Odour** **C_4H_{10}**	
Molecular Weight	**44.1**		**58.1**	
Boiling Point	**-42^{0}C**		**-0.5^{0}C**	
	Liquid at 15^{0}C	Gas at 101 kPa & 15^{0}C	Liquid at 15^{0}C	Gas at 101 kPa & 15^{0}C
Density (kg/m^3)	510	1.86	568	2.47
Relative Density: water = 1.0 air = 1.0	0.510	1.53	0.568	2.00
Litres/tonne m^3/tonne m^3/m^3 of liquid	1961 1.961 1.000	536000 536 274	1760 1.760 1.000	405000 405 235
Specific heat of liquid (kJ/kg/^{0}C)	2.512		2.386	
Latent heat of vapourisation (MJ/m^3) (MJ/kg = GJ/t)	232 0.358		239 0.372	
Heat combustion (MJ/m^3) (MJ/kg = GJ/t)	25000 50.1	93.3 50.1	28800 49.47	121.9 49.47
Volume of air (m^3) needed to burn 1m^3 of gas		23.7		31.0
Flash point Ignition temp.		-104^{0}C 493-549^{0}C		-60^{0}C 482-538^{0}C
Max. flame temp.		1970^{0}C		1990^{0}C
Limits of flammability in air (% by vol): upper % lower %		9.6 2.4		8.6 1.9

Other Properties:		Solubility (water): 0.07cm^3 / cm^3
Other name/numbers:	**LPGas**	UN 1075
	Propane	UN 1978
	Butane	UN 1011
	IsoButane	UN 1969

10. STABILITY AND REACTIVITY

Reactivity	Incompatible with oxidising agents, acids, heat and ignition sources. Do not use natural rubber flexible hoses. Also incompatible (potentially violently) with oxygen, halogens and metal halides.
Decomposition Products	Heating to decomposition produces acrid smoke and irritating fumes.

11. TOXICOLOGICAL INFORMATION

Health Hazard Summary	Asphyxiant gas. Symptoms of exposure are directly related to displacement of oxygen from air.
Eye	Non irritating. However, direct contact with evaporating liquid may result in severe cold burns with possible permanent damage.
Inhalation	Non irritating – Asphyxiant. Effects are proportional to oxygen displacement. Low vapour concentrations may cause nausea, dizziness, headaches and drowsiness. May have a narcotic effect if high concentrations of vapour are inhaled. High vapour concentrations may produce symptoms of oxygen deficiency which, coupled with central nervous system depression, may lead to rapid loss of consciousness.
Abuse	Under normal conditions of use the product is non hazardous, however abuse involving deliberate inhalation of very high concentrations of vapour can produce unconsciousness and / or result in a sudden fatality or brain damage.
Skin	Non irritating. Contact with evaporating liquid or supercold vessels or pipes may result in frost-bite with severe tissue damage.
Ingestion	Due to product form, ingestion is considered highly unlikely.
Toxicity Data	PROPANE (74-98-6) LC50 (Inhalation) : 50,000 ppm ISOBUTANE (75-28-5) LC50 (Inhalation): 57pph/15 min (rat)

12. ECOLOGICAL INFORMATION

Eco Toxicity	Not toxic to flora, fauna or soil organisms. Will not cause long term adverse effects in the environment and is not dangerous to the ozone layer.
Mobility	Spillages are unlikely to penetrate the soil. The product is likely to volatise rapidly into the air.
Persistence / Degradability	Unlikely to cause long term adverse effects in the environment.
Bioaccumulative Potential	This material is not expected to bioaccumulate.
Other Ecological Information	Unlikely to cause long term effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal	Cylinders should be returned to the manufacturer or supplier for disposal. Empty cylinders or vessels may contain some remaining product. Hazard warning labels are a guide to the safe handling of empty packaging and should not be removed. LPGas cylinders or vessels should NEVER be inadvertently disposed of in any land fill facility without being rendered visually and physically unusable before disposal. 'EMPTY' container warning: 'empty' containers can sometimes retain residue (liquid and / or vapour) and can be dangerous. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS AND OTHER SOURCES OF IGNITION THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to clean.
Legislation	Dispose of in accordance with relevant legislation.

14. TRANSPORT INFORMATION

Transport	Transport of LPGas is controlled in accordance with the requirements of the ADG Code and the Load Restraint Guide.
UN Number	1075
Shipping Name	PETROLEUM GASES, LIQUEFIED
DG Class	2.1
Subsidiary Risk(s)	None Allocated
Packing Group	None Allocated
Hazchem Code	See Section 5

15. REGULATORY INFORMATION

AICS	All chemicals listed on the Australian Inventory of Chemical Substances (AICS).
Poison Schedule	A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

16. OTHER INFORMATION

Principal Retail Centres

NSW Blacktown
22 Holbeche Road
Blacktown NSW 2148
Phone: (02) 9672 0777
Fax: (02) 9672 1481

QLD Brisbane
Tanker Street
Lytton QLD 4178
Phone: (07) 3396 2769
Fax: (07) 3893 1495

ACT Canberra
9 Lithgow Street
Fyshwick ACT 2609
Phone: (02) 6280 6355
Fax: (02) 6280 4217

WA Perth
2 Uppsala Place
Canning Vale WA 6155
Phone: (08) 6465 8561
Fax: (08) 6254 2893

NT Darwin
1227 Winnellie Road
Winnellie NT 0821
Phone: (08) 8947 4256

VIC Mulgrave
331-347 Police Road
Mulgrave VIC 3170
Phone: (03) 9767 7222
Fax: (03) 9767 7372

SA Adelaide
1 Newfield Road
Para Hills West SA 5096
Phone: (08) 8349 5050
Fax: (08) 8349 4624

Swap 'n' Go
Contact the principal retail centre in your state or territory

Stargas
Contact the principal retail centre in your state or territory

References

ALPGA (now LPG Australia) Specification for Liquefied Petroleum Gas for Automotive use 2004.

ALPGA (now LPG Australia) Specification for Liquefied Petroleum Gas for Heating use 2004.

ACGIH = American Conference of Governmental Industrial Hygienists

CAS Number = Chemical Abstracts Service Registry Number

HAZCHEM Code = Emergency action code of numbers and letters which gives information to emergency services

ICAO = International Civil Aviation Organisation

IATA = International Air Transport Association

IMDG = International Maritime Organisation Rules

NOHSC = National Occupational Health & Safety Commission, Australia

TWA = Time weighted average

STEL = Short term exposure limit

UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods
Petroleum and Gas Legislation / Queensland: 2004

Australian Standards as detailed within this document

The Australian Code for the Transport of Dangerous Goods by Road and Rail (commonly known as the ADG Code)

The Load Restraint Guide as prepared by the National Transport Commission

Pri

NOHSC 16 Section

Material Safety Data Sheet

UNLEADED PETROL

Infosafe™ No. AMPHO **Issue Date** May 2009 **Status** ISSUED by CALTEX BS: 1.10.9

Classified as hazardous according to criteria of NOHSC

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name UNLEADED PETROL

Product Code 200

Company Name Caltex Australia Petroleum Pty Ltd (ABN 17 000 032 128)

Address 2 Market Street, Sydney
NSW 2000

Emergency Tel. 1800 033 111

Telephone/Fax Number Tel: (02) 9250 5000
Fax: (02) 9250 5742

Recommended Use Fuel.

Other Names	**Name**	**Product Code**
	PETROL	
	GASOLINE	

2. HAZARDS IDENTIFICATION

Hazard Classification

HAZARDOUS SUBSTANCE.
DANGEROUS GOODS.

Hazard classification according to the criteria of NOHSC. Dangerous goods classification according to the Australia Dangerous Goods Code.

Risk Phrase(s)

R11 Highly flammable.
R65 Harmful: may cause lung damage if swallowed.
R45(1) May cause cancer.
R46(2) May cause heritable genetic damage.
R48/20/21/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.

Safety Phrase (s)

S2 Keep out of reach of children.
S16 Keep away from sources of ignition - No smoking.
S23 Do not breathe gas/fumes/vapour/spray
S24 Avoid contact with skin.
S53 Avoid exposure - obtain special instructions before use.
S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.

Other Information

Use as a motor fuel only. Do not siphon with the mouth. Do not use in the vinicity of a fire, a hot surface or during welding.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	Name	CAS	Proportion
	Petroleum hydrocarbons	8008-20-6	90-100 %
	Benzene	71-43-2	0-1 %

4. FIRST AID MEASURES

Inhalation	If inhaled, remove affected person from contaminated area. Keep at rest until recovered. If symptoms persist seek medical attention.
Ingestion	Do NOT induce vomiting. Wash out mouth and lips with water. Where vomiting occurs naturally have affected person place head below hip level in order to reduce risk of aspiration. Seek immediate medical attention.
Skin	Wash affected area thoroughly with soap and water. Remove contaminated clothing and wash before reuse or discard. If symptoms persist, seek medical attention.
Eye	If in eyes, hold eyelids apart and flush the eyes continuously with running water. Continue flushing for several minutes until all contaminants are washed out completely. If symptoms develop and persist seek medical attention.
First Aid Facilities	An eye wash fountain, safety shower and a general washing facility.
Advice to Doctor	Treat symptomatically, there is a risk of chemical pneumonitis if the material is aspirated into the lungs.
Other Information	For advice in an emergency, contact a Poisons Information Centre (Phone Australia 13 1126) or a doctor at once.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Carbon dioxide, dry chemical, foam.
Hazards from Combustion Products	Under fire conditions this product may emit toxic and/or irritating fumes and gases including carbon monoxide and carbon dioxide.

Specific Hazards	Highly flammable. Ensure adequate ventilation to prevent explosive vapour-air mixture and prevent build-up of electrostatic charges (i.e. by grounding). Vapour/air mixtures may ignite explosively and flashback along the vapour trail. Remove sources of re-ignition.
Hazchem Code	3YE
Precautions in connection with Fire	Fire fighters should wear Self-Contained Breathing Apparatus (SCBA) operated in positive pressure mode and full protective clothing to prevent exposure to vapours or fumes. Water spray may be used to cool down heat-exposed containers. Fight fire from safe location. This product should be prevented from entering drains and watercourses.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures	Wear appropriate personal protective equipment and clothing to prevent exposure. Extinguish or remove all sources of ignition and stop leak if safe to do so. Increase ventilation. Evacuate all unprotected personnel. If possible contain the spill. Place inert absorbent, non-combustible material onto spillage. Use clean non-sparking tools to collect the material and place into suitable labelled containers for subsequent recycling or disposal. Dispose of waste according to the applicable local and national regulations. If contamination of sewers or waterways occurs inform the local water authorities and EPA in accordance with local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling	Wear appropriate protective clothing and equipment to prevent inhalation, skin and eye exposure. Handle and use the material in a well-ventilated area, away from sparks, flames and other ignition sources. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Work from suitable, labelled, fire-resistant containers. Open containers carefully as they may be under pressure. Keep containers closed when not in use. Flameproof equipment is necessary in areas where the product is being used. Take precautionary measures against static discharges. Earth or bond all equipment. Do not empty into drains. Ensure a high level of personal hygiene is maintained when using this product, that is, always wash hands before eating, drinking, smoking or using the toilet facilities.
Conditions for Safe Storage	Store in a cool, dry, well-ventilated area away from sources of ignition, oxidising agents, strong acids, foodstuffs, and clothing. Keep containers closed when not in use and securely sealed and protected against physical damage. Inspect regularly for deficiencies such as damage or leaks. Have appropriate fire extinguishers available in and near the storage area. Take precautions against static electricity discharges. Use proper grounding procedures. For information on the design of the storeroom, reference should be made to Australian Standard AS1940 - The storage and handling of flammable and combustible liquids. Reference should also be made to all applicable local and national regulations.
Other Information	Fuels are exempt from the Standard for the Uniform Scheduling of Drugs and Poisons, except when packed in containers having a capacity of 20 litres or less. Classified as a Scheduled (S5) Poison using the criteria in the SUSDP (Standard for the Uniform Scheduling of Drugs and Poisons) when used for other applications rather than as a fuel.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards	No exposure standards have been established for the mixture by the National Occupational Health & Safety Commission (NOHSC). However, over-exposure to some chemicals may result in enhancement of pre-existing adverse medical conditions and/or allergic reactions and should be kept to the least possible levels.
Engineering Controls	Provide sufficient ventilation to keep airborne levels below the exposure limits. Where vapours or mists are generated, particularly in enclosed areas, and natural ventilation is inadequate, a flameproof exhaust ventilation system is required. Refer to AS 1940 - The storage and handling of flammable and combustible liquids and AS/NZS 2430.3.1:1997 : Classification of hazardous areas - Examples of area classification - General, for further information concerning ventilation requirements.
Respiratory Protection	If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable organic vapour filter should be used. Reference should be made to Australian/New Zealand Standards AS/NZS 1715, Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices, in order to make any necessary changes for individual circumstances.
Eye Protection	Chemical safety glasses or face shield recommended as appropriate. Final choice of appropriate eye/face protection will vary according to individual circumstances including methods of handling or engineering controls as determined by appropriate risk assessments. Eye protection should conform to Australian/New Zealand Standard AS/NZS 1337- Eye Protectors for Industrial Applications.
Hand Protection	Wear gloves of impervious material e.g. neoprene, nitrile. Final choice of appropriate gloves will vary according to individual circumstances i.e. methods of handling or according to risk assessments undertaken. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance. The use of barrier cream is recommended.

Body Protection	Suitable protective workwear, e.g. cotton overalls buttoned at neck and wrist is recommended. Chemical resistant apron is recommended where large quantities are handled. Industrial clothing should conform to the specifications detailed in AS/NZS 2919: Industrial clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Purple mobile liquid, with a characteristic odour.
Melting Point	Not available
Boiling Point	30 - 210°C
Solubility in Water	Insoluble
Specific Gravity	0.73-0.75 at 15°C
pH Value	Not Applicable
Vapour Pressure	67 kPa at 37.8°C
Vapour Density (Air=1)	3.5 (cf Air = 1)
Viscosity	< 1.4 cSt @ 40°C
Flash Point	- 40°C (Closed Cup)
Flammability	Highly Flammable liquid
Auto-Ignition Temperature	370°C
Explosion Limit - Upper	7.6%
Explosion Limit - Lower	1.4%

10. STABILITY AND REACTIVITY

Chemical Stability	Stable under normal conditions of storage and handling.
Conditions to Avoid	Heat and other sources of ignition.
Incompatible Materials	Strong oxidizing agents.
Hazardous Reactions	Thermal decomposition may result in the release of toxic and/or irritating fumes including carbon monoxide and carbon dioxide.
Hazardous Polymerization	Will not occur.

11. TOXICOLOGICAL INFORMATION

Toxicology Information	No toxicity data available for this product.
Inhalation	Vapours may cause headache, nausea with vomiting, dizziness, confusion and other effects of central nervous system depression. Loss of consciousness can occur at high concentrations followed by convulsions and death.
Ingestion	May cause irritation to the gastrointestinal system. Symptoms may include abdominal pain, nausea, vomiting, diarrhoea or depression of the central nervous system including nausea, headaches, dizziness, fatigue, loss of coordination, unconsciousness and possibly narcosis. Small amounts of liquid aspirated into the respiratory system during ingestion or vomiting may lead to aspiration into the lungs with a possibility of chemical pneumonia or lung damage.

Skin May cause irritation to the skin resulting in itching and redness of the skin. Poisoning may occur from prolonged or massive skin contact.

Eye May cause irritation in contact with the eyes, which can result in redness, stinging and lachrymation.

Chronic Effects Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Prolonged and repeated exposure through inhalation or swallowing of this material can result in harmful effects including central nervous system effects. Systemic effects of chronic exposure can also include damage to heart, kidneys and liver. Prolonged or repeated skin contact may also result in skin dryness and cracking, skin irritation leading to dermatitis.

Mutagenicity This material is classified as a Category 2 Mutagen according to National Occupational Health And Safety Commission (NOHSC). Category 2 Mutagens are substances that should be regarded as if they are mutagenic to humans.

Carcinogenicity This substance is classified as a Category 1 Carcinogen according to National Occupational Health and Safety Commission (NOHSC). Category 1 Carcinogens are substances known to be carcinogenic to humans.

12. ECOLOGICAL INFORMATION

Ecotoxicity Not available

Persistence / Degradability Not available

Mobility Not available

Environment Protection Do not discharge this material into waterways, drains and sewers.

13. DISPOSAL CONSIDERATIONS

Disposal Considerations Dispose of waste according to applicable local and national regulations. Labels should not be removed from containers until they have been cleaned. Do not cut, puncture or weld on or near containers. Empty containers may contain hazardous residues. Contaminated containers must not be treated as household waste. Containers should be cleaned by appropriate methods and then re-used or disposed of by landfill or incineration as appropriate. Do not incinerate closed containers. Advise flammable nature.

14. TRANSPORT INFORMATION

Transport Information This material is classified as a Class 3 (Flammable Liquids) Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. Class 3 Dangerous Goods are incompatible in a placard load with any of the following:
- Class 1, Explosives
- Class 2.1, Flammable Gases, if both the Class 3 and Class 2.1 dangerous goods are in bulk
- Class 2.3, Toxic Gases
- Class 4.2, Spontaneously Combustible Substances
- Class 5.1, Oxidising Agents
- Class 5.2, Organic Peroxides
- Class 6, Toxic and Infectious Substances, if the Class 3 dangerous goods are nitromethane
- Class 7, Radioactive Substances

U.N. Number 1203

Proper Shipping Name MOTOR SPIRIT

DG Class 3

Hazchem Code 3YE

Packing Group II

EPG Number 3.1.001

IERG Number 14

15. REGULATORY INFORMATION

Regulatory Information	Classified as Hazardous according to criteria of National Occupational Health & Safety Commission (NOHSC), Australia. Not Classified as a Scheduled Poison according to the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).
Poisons Schedule	Not Scheduled
Hazard Category	Toxic,Highly Flammable
AICS (Australia)	All components of this product are listed on the Australian Inventory of Chemical Substances (AICS).

16. OTHER INFORMATION

Date of preparation or last revision of MSDS	MSDS Review: May 2009. MSDS Supersedes: May 2004. Minor change: Flask point correction 21/05/2009
Contact Person/ Point	CHEMICAL EMERGENCIES: 1 800 033 111 TECHNICAL ADVICE: 1300 364 169 Health & Safety Advisor Tel: (02) 9250 5822 and (02) 9250 5734 PLEASE NOTE that although every care has been taken in compiling the above information, it is solely reliant upon data available to us at the date hereof. We believe the data to be correct, however for the reason just stated we are not in a position to warrant its accuracy. With that in mind and given that the full range of possibilities and conditions under which the information may be applied simply cannot be anticipated, YOU ARE CAUTIONED to make your own determinations as to the veracity and the suitability of the information to the particular circumstances that apply, or may apply, to you from time to time. Consistent with that approach it is recommended that

where you have a particular purpose which would necessitate a reliance on information of the nature herein you obtain your own independent expert advice particularly structured to the relevant purpose. If this material is printed, circulated, distributed or copied in any manner, it is not to be modified without prior written permission, and further, it is to include the wording of the above disclaimer.

End of MSDS

Print Date: 11/12/2011 BS: 1.10.9

MATERIAL SAFETY DATA SHEET – LIQUEFIED NATURAL GAS (MSDS #582)

Revision Date: April 7, 2011
Supersedes Date: April 7, 2008

Section 1: PRODUCT AND COMPANY IDENTIFICATION

FortisBC
16705 Fraser Highway
Surrey, BC
V3S 2X7

Company Phone Number: (604) 592-7629
Emergency Phone Number: (604) 946-4818

Product Name: Liquefied Natural Gas
Material Use: Various

Manufacturer:
FortisBC LNG Plant
7651 Hopcott Rd
Delta, BC
V4G 1B7

Supplier:
FortisBC LNG Plant
7651 Hopcott Rd
Delta, BC
V4G 1B7

WHMIS Class: A – Compressed Gas;
B1 – Flammable and Combustible Material – Division 1 Flammable Gases
UN/PIN Number: 1972
TDG Classification: Class 2.1 Flammable Gases

Chemical Family: Hydrocarbon Liquid
Chemical Formula: CH_4 (methane)
Molecular Weight: 16.04 (methane)
CAS Number: 74-82-8
Trade Names / Synonyms: Liquefied Methane / LNG

Section 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance/Odour: Odourless, colourless liquid. This product is not odourized.
Flammable: Very flammable after vapourization to gaseous phase.
Potential Health Effects: See Section 11 for more information
Potential Environmental Effects: See Section 12 for more information.
Likely Routes of Exposure: Eye and skin contact, acute inhalation

Acute - Eye, Skin and Inhalation: Liquid or cold gas contact with skin or eyes could cause freezing or severe cryogenic burns. After vapourization, contact with burning gas may cause burns. CNS depression and cardiac sensitization may occur at high gaseous concentrations approaching the lower flammability limit.
Chronic- Inhalation None
Ingestion: None
Skin Adsorption: None

Section 3: FIRST AID MEASURES

Skin Contact: Cryogenic burns. Remove constricting clothing. Do not thaw too rapidly. Transport to hospital immediately.
Eye contact: Get medical attention immediately.
Inhalation: Move to fresh air. Give artificial respiration if breathing has stopped. Call a physician.
Ingestion: Unlikely route of exposure as this is a gas at normal room temperature and pressure.

General Advise: Use extreme care in handling due to high flammability and risk of cryogenic burns.

Section 4: COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	% by Wt.	Exposure Limits [NOTE 1]
Methane	74-82-8	95	Simple asphyxiant
Ethane	74-84-0	3	Simple asphyxiant
Propane	74-98-6	1	Simple asphyxiant
Nitrogen	7727-37-9	1	Simple asphyxiant

NOTE 1. See Section 8 for additional exposure limit information for C_1 to C_4 Aliphatic Hydrocarbon Gases.

Section 5: FIRE FIGHTING MEASURES

Flammability: Flammable gas

Suitable Extinguishing Media: Dry Chemical (Purple-K). To suppress or contain, use water fog or high expansion foam.

Unsuitable Extinguishing Media: Do not direct water spray directly at LNG pool; this will only increase rate of vapourization. Cold vapour is heavier than air and will not readily disperse until warmed up. High expansion foam may be used to help control the vapourization rate.

Products of Combustion: Carbon dioxide and carbon monoxide

Protection of Firefighters: Very flammable after vapourization to gaseous phase. Firefighters should wear self-contained breathing apparatus (SCBA) in case of oxygen deficient atmosphere. Use Combustible Gas Indicator to determine the extent of vapour cloud.

Sensitivity to Static Discharge: Ignitable by static

Sensitivity to Mechanical Impact: None

Explosive Power: Not known

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Use personal protection recommended in Section 8.

Environmental Precautions: Not applicable

Methods for Containment: Evacuate area for 2000 foot (600 m) radius. Stay out of vapour cloud.

Methods for Clean-Up: Wear all protective equipment recommended in Section 8. Eliminate source of ignition.

Other Information: Allow to vapourize and disperse to atmosphere.

In case of an emergency and no response at LNG plant, call SERVICE CENTER: 1 (800) 663-9911.

Section 7: HANDLING AND STORAGE

Handling: To be handled by trained personnel only, using equipment specifically designed for LNG, and following approved operating procedures.

Storage: Store only in vessels designed for LNG storage, and follow approved operating procedures.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits: Simple asphxiant - Maintain 19.5% oxygen level (below 19.5% oxygen is considered to be oxygen deficient).

Constituent	ACGIH (8-hour TWA)	WorkSafeBC (8-hour TWA)
Methane	1000 ppm	1000 ppm
Ethane	1000 ppm	1000 ppm

Propane	1000 ppm	1000 ppm
Nitrogen	None listed	None listed

Personal Protection Equipment: Ensure use of proper PPE at all times when handling this product.
Eye/face: Face shield with other eye protection (safety glasses)
Skin: Insulated gloves, safety work boots, Nomex coveralls.
Respiratory: Supplied air respiratory protection to be used (airline or self-contained breathing apparatus) in cases of oxygen deficient atmospheres
Other Considerations: Use extreme care in handling due to high flammability and risk of cryogenic burns.
Engineering Controls: Provide electrical ground for all parts of handling system. Provide adequate ventilation to maintain more than 19.5% oxygen, less than 1% methane (20% of the lower explosive limit). Use of CGI is mandatory since product is odourless.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Colour: Colourless.
Odour: Odourless
Odour Threshold (ppm): Not available
Physical State: Liquid.
pH: Not applicable
Freezing Point (°C): -182.5
Boiling Point (°C): -161.5
Flash Point (°C): -187.8
Evaporation Rate: Rapid
Flammability (solid, gas): Flammable gas
Lower Explosion Limit: 5% (by volume, gas phase)
Upper Explosion Limit: 15% (by volume, gas phase)
Vapour Pressure: Container rating
Vapour Density: >1 @-112 degrees C (Air = 1)
Specific Gravity: 0.45 (water = 1)
Solubility in water (20°C): 24.4 parts per millions (wt)
Partition Coefficient: Octanol/water - 1.09 $LogK_{ow}$
Auto-ignition Temperature: 537 °C (Gas Phase)
Percent Volatile (by volume): 99%
Density (g/ml): 0.45 at boiling point

Section 10: STABILITY AND REACTIVITY

Chemical Stability: Yes
Compatible Materials: Air, oxidizers, halides
Hazardous Decomposition Products: None known
Reactivity (and Under What Conditions): None known

Section 11: TOXICOLOGICAL INFORMATION

LD50: Not available
LC50: Not available
Acute Effects: Liquid or cold gas contact with skin or eyes could cause freezing or severe cryogenic burns. After vapourization, contact with burning gas may cause burns. Inhalation produces weak depressant effects on the CNS at high gaseous concentrations approaching the lower flammability limit.
Chronic Effects: Not available
Carcinogenicity: Not considered carcinogenic by IARC, NTP, ACGIH or OSHA.
Reproductive Effects: Not available
Teratogenicity: Not available
Mutagenicity: Not available

Irritant: Not available
Sensitizer: Not available
Synergistic Effects: Not available

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Not applicable
Persistence/ Degradability: Not applicable
Bioaccumulation/ Accumulation: Not applicable

Section 13: DISPOSAL CONSIDERATIONS

Disposal: Allow to vapourize and disperse to the atmosphere.

Section 14: TRANSPORTATION INFORMATION

TDG Classification: 2.1 Flammable Gases
UN/PIN Number: 1972
Shipping Name: Methane, Refrigerated Liquid, or Natural Gas, Refrigerated Liquid with high methane content
Special Shipping Information: Transport only in shipping container designed for LNG and follow approved operating procedures.

Section 15: REGULATORY INFORMATION

DSL (Canada): This product is on the DSL list.
WHMIS Class: A – Compressed Gas;
B1 – Flammable and Combustible Material – Division 1 Flammable Gases

Section 16: OTHER INFORMATION

National Fire Protection Association (NFPA 704) Ratings:

Health	2	LEGEND	0 = minimal hazard
Flammability	4		1 = slight hazard
Instability	0		2 = moderate hazard
(For methane from NFPA 325)			3 = severe hazard
			4 = extreme hazard

Prepared by: AMEC Earth & Environmental
Occupational Hygiene and Safety Group
Phone Number: (604) 294-3811
Preparation Date: April 7, 2011

Additional Information and Comments: This MSDS has been revised and updated from the last revision date of April 7, 2008. All sections and the order that which they appear have been documented as per American National Standard – *For Hazardous Industrial Chemicals – Material Safety Data Sheets Preparation* (ANSI Z400.1-2004).

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

Information Sources: Various