Annex B

Quantitative Risk Assessment for High Pressure Town Gas Pipeline

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Quantitative Risk Assessment for High Pressure Town Gas Pipeline

Job number 294065

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1 Introduction

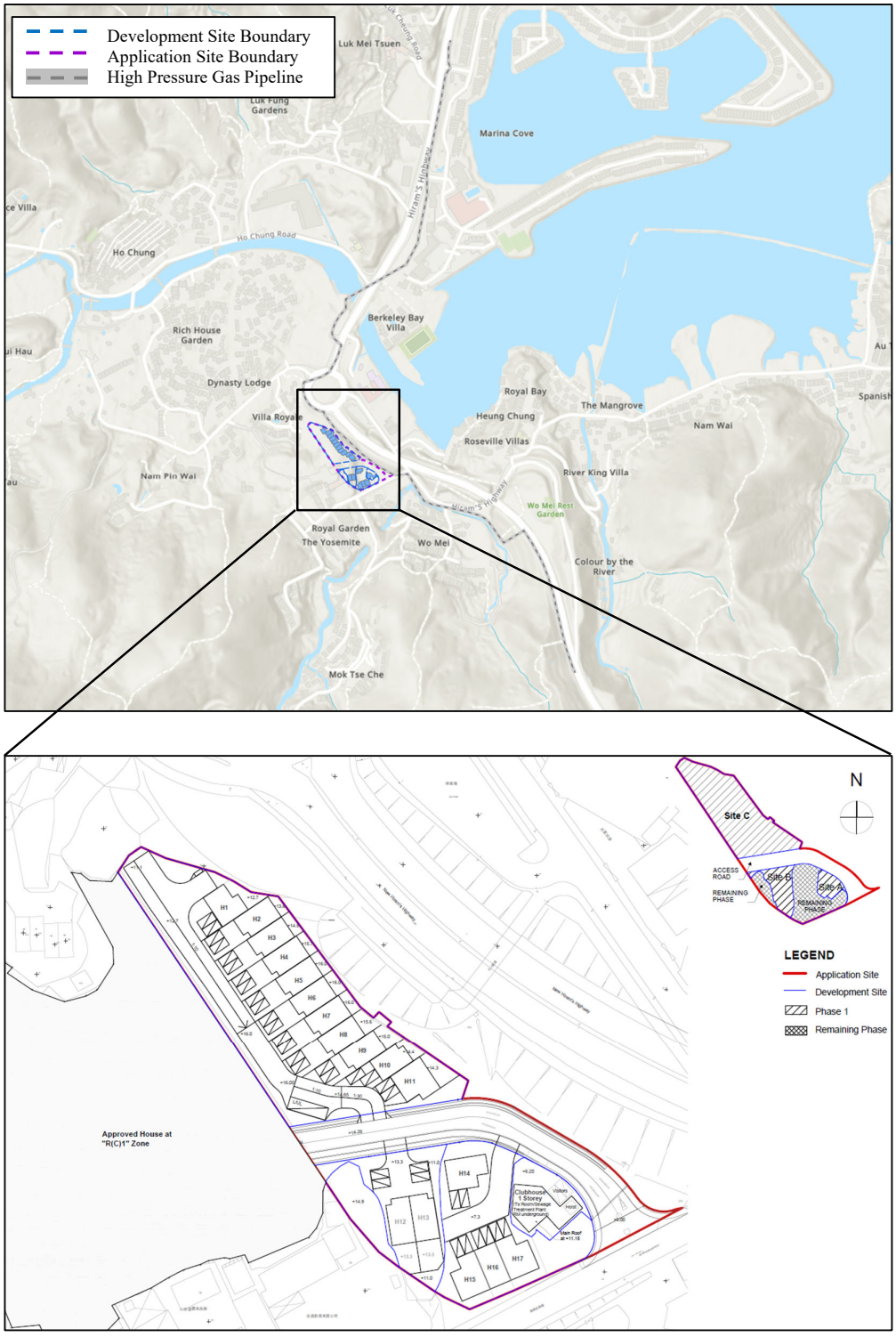
1.1 Background

1.1.1.1 This Quantitative Risk Assessment (QRA) report is prepared in support of the Application for Amendment of Plan Under Section 12A (the "Proposed Amendment") of the Town Planning Ordinance (Cap. 131) to the Approved Ho Chung Outline Zoning Plan (OZP) No. S/SK-HC/11 by rezoning the Application Site from "Green Belt" ("GB") to the same "Residential (Group C)1" ("R(C)1") zone to the immediate west of the Application Site ("the Proposed Amendment").

1.1.1.2 The Application Site is about 6,601m^2, and is located to the west of the New Hiram's Highway. The Application Site is situated in a predominantly residential neighbourhood in Nam Pin Wai area with existing and planned low-dense houses and village settlements. The Application Site is accessible to the Wo Mei Hung Min Road via the approved access road serving the adjoining "R(C)1" development, which further connects to the New Hiram's Highway (a district distributor road) to other parts in Sai Kung, Kowloon East and Tseung Kwan O areas. According to the Approved Ho Chung OZP No. S/SK-HC/11, the Application Site is currently zoned as "GB".

1.1.1.3 The Development Site area of about 5,355m^2 is proposed and defined after excluding the access road located at the central part of the Application Site. A high pressure gas pipeline was identified running along Hiram's highway which is located at the east of the Proposed House Development. **Figure 1.1** shows the location of the Proposed House Development, the high pressure gas pipeline and the master layout plan of the Proposed House Development.

Figure 1.1 Master Layout Plan of the Proposed House Development in Sai Kung



1.2 Objectives of the Study

1.2.1.1 The objective of this report is to conduct a QRA to assess the risks posed by the existing high pressure gas pipeline and any gas installations in the vicinity of the Proposed House Development. Subject to the modelling results, recommendations for mitigation measures, protection works, and other measures and works to be carried out within the Proposed House Development will be proposed to ensure that the risks posed by the high pressure gas pipeline and any gas installations in the vicinity of the Proposed House Development would comply with the risk guidelines as described in Section 4.4, Chapter 12 of the Hong Kong Planning Standards and Guidelines (HKPSG).

1.3 Scope of Work

1.3.1.1 The scope of work for the QRA includes:

- Identifying all potential hazards-to-life, including the population of the Proposed House Development , due to the high pressure gas pipeline.
- Undertaking a hazard assessment to quantify the risk level and to recommend risk mitigation measures to comply with the "risk guidelines in HKPSG".

1.4 Structure of Report

1.4.1.1 The structure of this quantitative risk assessment report is as follows:

Section 1 Provides the background, objectives, and scope of this study

Section 2 Provides the background information of the Proposed House Development and the high pressure gas pipeline.

Section 3 States the legislation, standards and guidelines;

Section 4 Summarizes the population and meteorological data;

Section 5 Identifies the hazard scenarios and provides the frequency analysis

Section 6 Provides the consequence analysis

Section 7 Evaluates the individual risk and societal risk

Section 8 Summarizes the findings

Section 9 Lists the references adopted in this study

2 Background Information

2.1 High Pressure Town Gas Pipeline

2.1.1.1 The Hong Kong and China Gas Limited (HKCG) operates a town gas high pressure gas pipeline near to the Proposed House Development which follows the alignment of Hiram's Highway in Sai Kung. **Figure 2.1** shows the alignment of the pipeline. The closest distance of the pipeline to the site boundary of the Proposed House Development is around 10 – 15m. **Table 2.1** lists the summary of the high pressure gas pipeline technical specification based on communication with HKCG and the reply from HKCG is shown in **Appendix A**.

Figure 2.1 Alignment of the pipeline

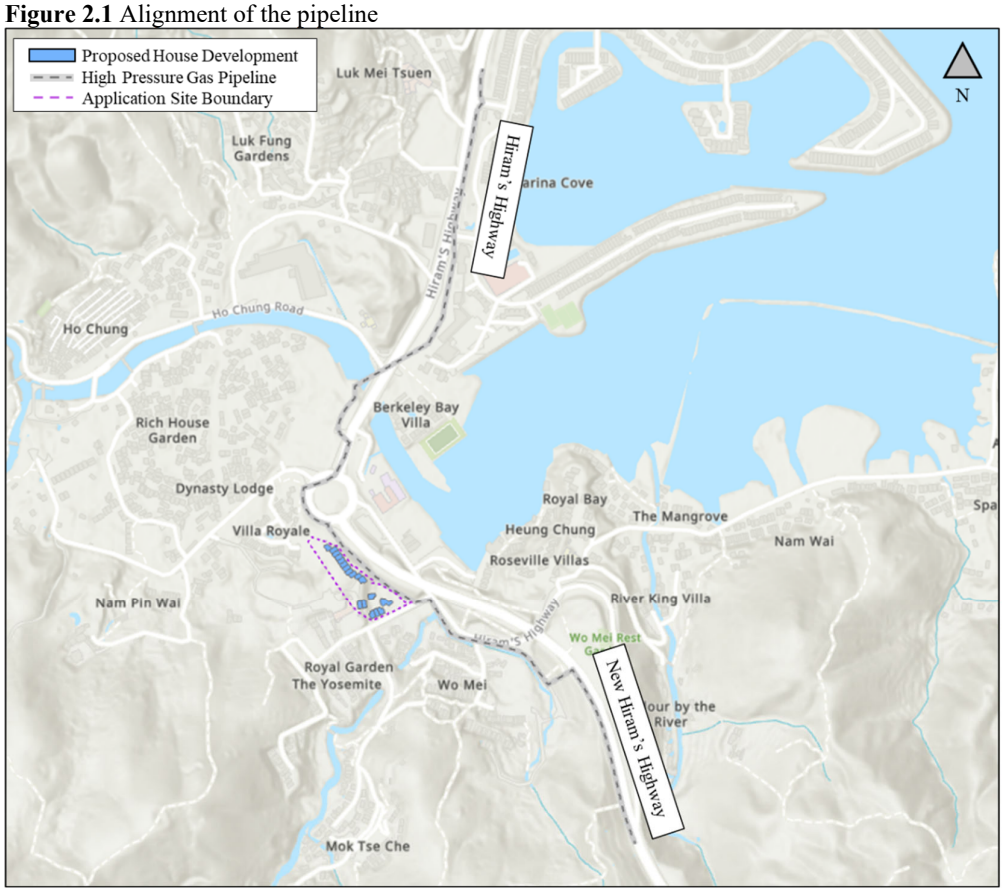


Table 2.1 Technical specification of town gas high pressure pipeline

Parameter	Specification
Pipe Diameter (Nominal)	750 mm
Pipe Wall Thickness	12.7mm
Design Pressure	35 barg
Maximum Operation Pressure	35 barg
Hydraulic Test Pressure	900 psi
Pipe Material	Steel
Minimum Depth	1.lm

Parameter	Specification
Material Grading (Pipe/ Fitting)	API 5L X 52
Jointing Method	Butt Welding
Welding Specification	Welding complied with BS4515 & BGC/PS/P2

2.2 Town Gas Composition

2.2.1.1 Town gas is a mixture of hydrogen, methane, carbon monoxide and carbon dioxides. In Hong Kong, 98% of town gas is produced at the plant located in Tai Po and the rest is produced at the plant located in Ma Tau Kok. The composition of town gas is provided in **Table 2.2**. Town gas, produced from natural gas (60%), naphtha (39%) and landfill gas (1%), is the final product of the gas works. It is a clean, safe and reliable gaseous fuel. With about half the density of air, it rises and will dissipate in the air if leakage occurs. It has neither colour nor odour. Therefore, odouriser has been added to the gas such that it can easily be detected.

Table 2.2 Town gas composition and properties

Parameter	Specification
Hydrogen	49.0% (vol)
Methane	28.5% (vol)
Carbon Dioxide	19.5% (vol)
Carbon Monoxide	3.0% (vol)
Wobbe Index	24
Weaver Flame Speed	35

Notes:
[1] Reference: Section 3.9.2 of EMSD's Guidance Note on Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong.

3 Legislation, Standard and Guideline

3.1.1.1 The high pressure town gas pipeline is classified as Notifiable Gas Installation (NGI) instead under the Gas Safety Ordinance Cap. 51. Hence, a Quantitative Risk Assessment (QRA) report is required to assess the potential risk impact of the high pressure gas pipelines on the populations in their vicinity including the Proposed House Development and ascertain that the risk level is acceptable with the Government Risk Guidelines referred to in Section 3.11 of the EMSD's Guidance Note on Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong (GN).

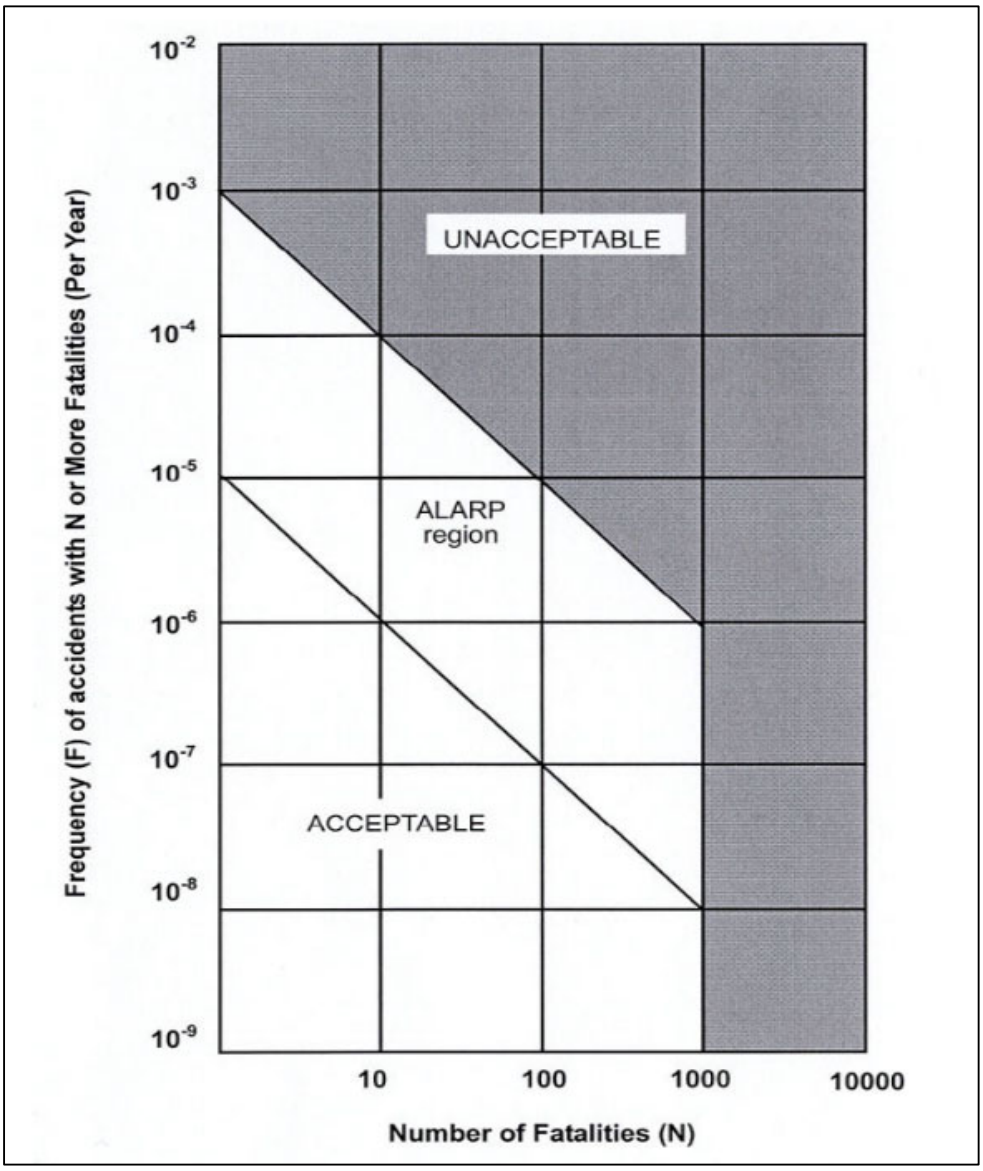
3.2 Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong

3.2.1.1 In accordance with the GN, a set of Risk Guidelines (RG) has been adopted by CCPHI to assess the off-site risk levels of PHIs. These guidelines are expressed in terms of individual and societal risks as shown in **Table 3.1**.

Table 3.1 Criteria for individual and societal risks

Risk	Description
Individual Risk	It is the predicted increase in the chance of death per year to an individual who lives or works near to a PHI. Maximum level of off-site individual risk associated with PHIs should not exceed 1 in 100,000 per year i.e. $1x10^{-5}$/year.
Societal Risk	It expresses the risks to the whole population living near a PHI. With the population increases, the societal risk will be increased. The societal RG is presented graphically in **Figure 3.1**. It is expressed in terms of lines plotting the cumulative frequency (F) of N or more deaths in the population from incidents at the installation. Two F-N risk lines are used in the RG that mark "acceptable" or "unacceptable" societal risks. The intermediate region indicates the acceptability of societal risk is borderline and should be reduced to a level which is "as low as is reasonably practicable" (ALARP). It seeks to ensure that all practicable and cost effective measures that can reduce risk will be considered.

Figure 3.1 Hong Kong Societal Risk Criteria



3.3 Guidance Note on Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong

3.3.1.1 Guidance Note on Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong (GN) covers the methodology of QRA for high pressure town gas installation including high pressure gas pipelines, high pressure town gas regulating station (offtake and/or pigging station) with high pressure gas pipelines connected.

4 Population and Meteorological Data

4.1 Assessment Year

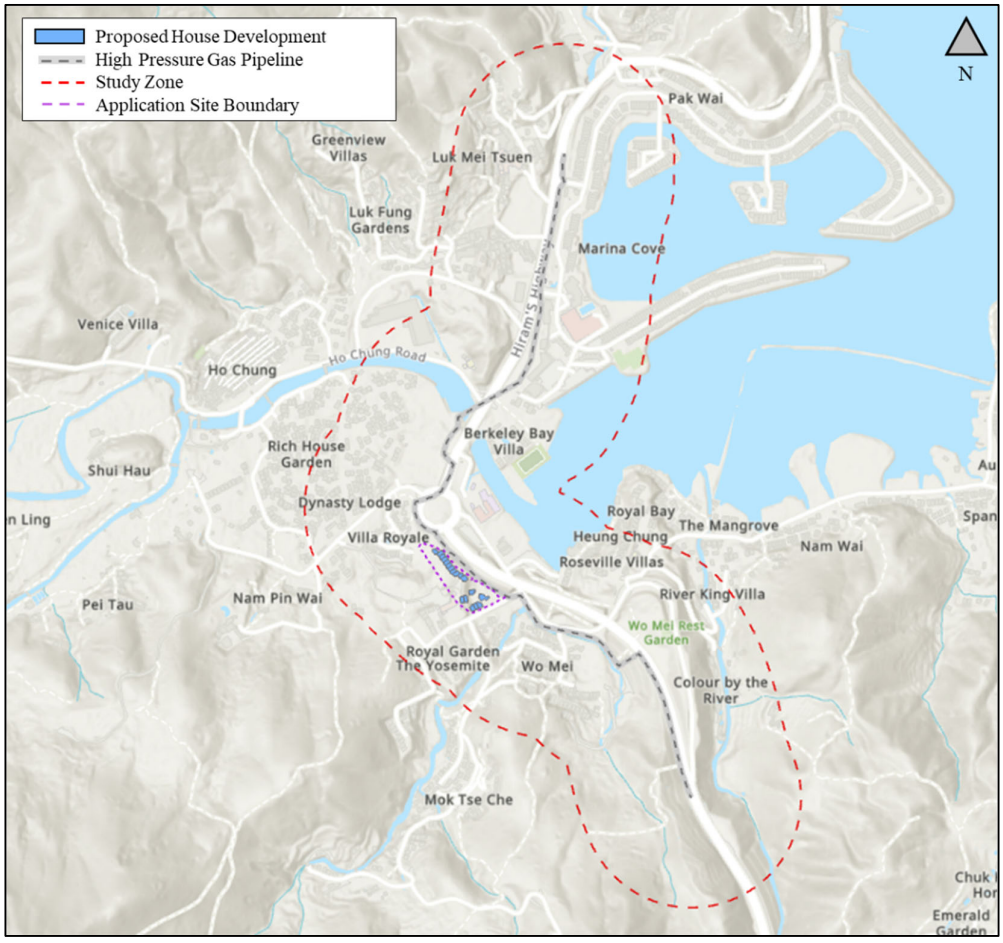
4.1.1.1 By considering the construction and operational stage for this Proposed House Development, as the number of workers for construction phase is assumed to be less than 100 people which is more than the number of population intake, i.e. around 51 people, for this Proposed House Development, the QRA for both phases would be assessed.

4.1.1.2 Based on the current tentative implementation programme, population intake will be in Year 2030. The next TPEDM year, i.e. Year 2031, has been taken as the assessment year for a conservative assessment.

4.2 Study Zone

4.2.1.1 In accordance with GN, the Study Zone (SZ) for this Proposed House Development is the area covering 200 metres from the highest risk of 1.6km high pressure gas pipelines section. The SZ is shown in **Figure 4.1**.

Figure 4.1 Study Zone



4.3 Population Data

4.3.1 Time Variation Mode

The time variation mode reflects the variations of population in each location during working days, peak traffic hour, weekend and night. Detailed description and frequency per year for each time variation mode is presented in **Table 4.1**.

Table 4.1 Definition of time variation mode

Time Variation Mode (TM)	Description	Period	Weighting per week	Frequency per year
TM 1	Weekday Day	Monday to Friday (09:00 to 18:00)	45 hours	0.268
TM 2	Peak Traffic Hours	Monday to Sunday (07:00 to 09:00 and 18:00 to 20:00)	28 hours	0.167
TM 3	Weekend Day	Sunday and Sunday (09:00 to 18:00)	18 hours	0.107
TM 4	Night	Monday to Sunday (20:00 to 07:00)	77 hours	0.458

Notes:
[1] The frequency per year for each time variation mode is calculated as follows:
For example TM1, assuming the week day represents a period from Monday to Friday (09:00 to 18:00), frequency per year = 45 / (24*7) = 0.268

4.3.2 Offsite-population

4.3.2.1 The sources of data and assumption of offsite population data adopted in this study are based on the following sources. The detail of population data by population type is shown in **Appendix B**. **Appendix B** also illustrates the projected number of population and population distribution of the surroundings.

- Planning Department;
- Transport Consultant; and
- Census and Statistics Department; etc.

4.3.2.2 The off-site population in the vicinity of the town gas high pressure gas pipeline has then been projected according to 2019 - based Territorial Population and Employment Data Matrix (2019 – based TPEDM)[1]. According to 2019 – based on TPEDM, population of Southeast New Territories in Year 2019 is 68,900 while in Year 2031 is 59,750, as the result, population growth rate is about -1.18% per year. As the population growth for Southeast New Territories is negative, zero growth rate has been adopted for the population projection to the assessment year for conservative approach.

[1] Planning Department (2021), 2019 - based Territorial Population and Employment Data Matrix (https://www.pland.gov.hk/pland_en/info_serv/statistic/tpedm19.html)

4.3.2.3 The traffic flow adopted in this assessment is the highest traffic flow within 15 years from the population intake and the population per vehicle is according to Station 5017 from the Annual Traffic Censes 2022. The vehicle speed adopted in this study is 50km/hr.

4.3.2.4 The number of population, population density and assumptions adopted in this assessment are illustrated in **Appendix B**.

4.3.3 Time Modes and Occupancy

4.3.3.1 Since population varies in different time periods, the assessment considers 2 categories of days (weekdays and weekends) and 4 time periods for each day (am peak traffic hours, day, pm peak traffic hour and night) as discussed in **Section 4.3.1**. **Table 4.2** shows the temporal population distribution. The indoor ratios for different types of uses are shown in **Table 4.3**.

Table 4.2 Temporal population distribution factor

Type	Weekday Day	Peak Traffic Hour	Weekend Day	Night
Residential	20%	50%	80%	100%
Educational	100%	10%	55%	0%
Road population	100%	100%	100%	20%
Temple	50%	10%	100%	0%
Recreational	70%	10%	100%	0%
Commercial / Administration	100%	10%	100%	10%
Industry	100%	10%	55%	10%
Open Storage	100%	1%	51%	0%
Car Park / Open Space	70%	100%	70%	10%
Government, Institution or Community	100%	10%	55%	10%
Pedestrian population	100%	100%	100%	100%
Construction site	100%	100%	0%	0%

Note:

[1] Reference is made to an approved EIA study on Operation of the Existing Tai Lam Explosives Magazine at Tai Shu Ha, Yuen Long for Liantang / Heung Yuen Wai Boundary Control Point Project (AEIAR-193/2015), which is in the same district.

[2] Reference is made to an approved EIA study on Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link.

Table 4.3 Indoor ratio for different types of uses

Type	Indoor Ratio
Residential / Commercial / Administration / Industrial / Open Storage / Government Institution or Community / Recreational	0.95
Educational	0.9
Temple	0.5
Open Space / Car Park / Road population / Construction Site	0

Note:

[1] Reference is made to an approved EIA study on Operation of the Existing Tai Lam Explosives Magazine at Tai Shu Ha, Yuen Long for Liantang / Heung Yuen Wai Boundary Control Point Project (AEIAR-193/2015), which is in the same district.

4.3.4 Protection Factors

Indoor Protection

4.3.4.1.1 Protection for indoor population against all fire events (fireball, jet fire and flash fire) is also considered. It is anticipated that only people in the residential unit facing the fire event are fully exposed to the fire zone and radiation hazards, though they are partially protected by walls and closed windows. Residents at the back of the building or of the buildings behind the one facing the fire are to a large degree shielded from the fire effects.

4.3.4.1.2 In accordance with the GN, it is assumed that 90% protection factor is applied for the people indoors for the jet fire and flash fire while 50% protection factor is applied for the people indoors for the fireball.

4.4 Meteorological Conditions

4.4.1.1 Meteorological conditions would affect the dispersion of Towngas. Weather data from the most recent years (Year 2018 to 2022) in HKO Sai Kung Park weather station was adopted and rationalized into 6 categories to represent the range of weather conditions at the site. These categories are classified according to TNO (purple book) (**Table 4.4a**). The probability of occurrence for each combination of wind speed (WS), wind direction (WD) and stability class (PS) are provided in **Table 4.4b** and **Table 4.4c**.

Table 4.4a Allocation of wind observations into six weather classes

Wind Speed	A	B	B/C	C	C/D	D	E	F
< 2.5 ms^{-1}	B medium			D low			F low	
2.5 - 6 ms^{-1}				D medium			E medium	
> 6 ms^{-1}				D high				

Table 4.4b Meteorological data at daytime

WD	2.5B	1.5D	4.5D	7.5D	3E	1F	Total
0°	2.20%	0.81%	4.13%	1.90%	0.53%	1.44%	11.00%
30°	4.01%	1.46%	4.87%	2.47%	0.31%	1.23%	14.35%
60°	2.08%	1.12%	3.45%	2.19%	0.20%	0.84%	9.87%
90°	4.29%	0.97%	4.81%	1.11%	0.30%	0.73%	12.21%
120°	3.90%	0.86%	1.31%	0.26%	0.11%	0.83%	7.27%
150°	6.37%	0.85%	3.98%	1.92%	0.08%	0.60%	13.80%
180°	13.05%	1.81%	4.33%	0.89%	0.15%	0.98%	21.23%
210°	2.26%	1.08%	0.40%	0.00%	0.03%	1.07%	4.85%
240°	0.74%	0.43%	0.18%	0.01%	0.01%	0.60%	1.98%
270°	0.29%	0.20%	0.09%	0.00%	0.02%	0.40%	1.01%
300°	0.22%	0.17%	0.05%	0.01%	0.01%	0.37%	0.82%
330°	0.23%	0.25%	0.27%	0.01%	0.06%	0.77%	1.60%
Total	39.64%	10.02%	27.86%	10.79%	1.82%	9.86%	100.00%

Table 4.4c Meteorological data at nigh-time

WD	0	1D	4D	7.5D	3E	1F	Total
0°	0.00%	0.44%	4.70%	2.26%	2.24%	12.31%	21.95%
30°	0.00%	0.33%	3.43%	1.04%	1.03%	6.07%	11.90%
60°	0.00%	0.18%	4.51%	2.09%	1.64%	4.46%	12.87%
90°	0.00%	0.14%	4.12%	0.71%	1.22%	3.24%	9.42%
120°	0.00%	0.09%	1.26%	0.28%	0.59%	2.30%	4.51%
150°	0.00%	0.05%	1.30%	0.42%	0.41%	1.98%	4.16%
180°	0.00%	0.12%	1.94%	0.12%	0.99%	4.61%	7.78%
210°	0.00%	0.07%	0.30%	0.00%	0.45%	7.10%	7.92%
240°	0.00%	0.06%	0.13%	0.00%	0.12%	4.52%	4.84%
270°	0.00%	0.09%	0.07%	0.00%	0.04%	3.30%	3.51%
300°	0.00%	0.10%	0.06%	0.01%	0.05%	3.61%	3.83%
330°	0.00%	0.23%	0.24%	0.03%	0.25%	6.58%	7.32%
Total	0.00%	1.89%	22.06%	6.95%	9.02%	60.08%	100.00%

5 Hazard Identification and Frequency Analysis

5.1 Hazard Identification

5.1.1.1 The main hazard from the high pressure gas pipeline is due to the loss of containment, which leads to gas leak, fire explosion and toxicity. Town gas is flammable / explosive due to the presence of methane, hydrogen and carbon monoxide.

5.1.1.2 Release in large quantity, if ignited immediately, will produce a fireball. Initially the gas concentration in the mixture will be above the Upper Flammable Limit (UFL). As burning occurs around the edges of the release, this will entrain more air into the mixture and more combustion will take place. The process accelerates until the mixture rises above the ground as a ball of fire.

5.1.1.3 If not ignited immediately, the gas will disperse and dilute. When the gas concentration is between Lower Flammability Limit (LFL) and Upper Flammable Limit (UFL), presence of an ignition source in entire length of the gas cloud movement path may result in a flash fire. In case of continuous release, fire is flashed back to the release source and leads to a jet fire.

5.1.1.4 For continuous releases, immediate ignition will produce a long vigorous jet flame from the point of release.

5.1.1.5 For all sizes of release, town gas will have a toxic effect on nearby population sites if there is no source of ignition and allowed to disperse.

5.1.1.6 Possible hazardous scenarios associated with the operation of the HP underground town gas transmission pipelines are the loss of containment leading to a gas leak, fire explosion and toxicity.

5.2 Pipeline Failure Frequency

5.2.1.1 According to the GN, failure frequency of an underground town gas high pressure pipeline is 1 $\times 10^{-5}$ /km /year. Hole size distribution and its proportion for the pipeline is extracted from the GN and shown in **Table 5.1**. Based on the total failure frequency and **Table 5.1**, the calculated failure frequencies of different hole size leakage and rupture are shown in **Appendix C**.

Table 5.1 Hole size distribution for underground gas pipeline

Category	Hole Size	Proportion
Rupture	Full bore (600mm)	1%
Puncture	100mm	19%
Hole	50mm	30%
Leak	25mm	30%
	10 mm	20%

6 Consequence Analysis

6.1 Hazard Outcome

6.1.1.1 The consequence of town gas release could result in the following hazardous outcomes:

- Fireball;
- Jet fire;
- Flash fire; and
- Toxic gas dispersion

6.2 Source Modelling

6.2.1 Orientation of Release

6.2.1.1 The consequences of town gas release following a pipeline failure are dependent on the release rate and the orientation of release. A common assumption is made to model the orientation of release. Failures that occur on top half portion of the pipeline will result in vertical jet releases (unobstructed) whereas failures that occur on bottom half portion of the pipelines will result in inclined jet releases (obstructed). The unobstructed vertical releases would be governed by momentum jet dispersion / momentum jet fires.

6.2.1.2 The assumption that the orientation of release would be 50% unobstructed and vertical, and 50% obstructed and governed by buoyant plume rise followed by Gaussian dispersion, is assumed to be valid for failure events with hole sizes same as or smaller than 100mm. This assumption is of the release may not be relevant for large failures such as those from full bore failure. Large failures such as ruptures are more likely to result in an upward release following the displacement of any earth cover. In the case of full bore ruptures, it is assumed that 100% of the release would be unobstructed. This assumption is also the same as GN.

6.2.2 Ignition of Release

6.2.2.1 A full bore rupture will be characterized by a very high initial rate followed by a rapid drop. This can cause a larger crater with a significant amount of earth cover being removed. Immediate ignition of such releases may result in a fireball followed by a jet fire. Since the fireball is transient while jet fire continues for a long time, the effect of a jet fire from a rupture area are as significant or have greater damage potential than those compared to fireball effects.

6.2.2.2 For all other release cases, immediate ignition would result in a jet fire. Ignition of release from the top of the pipeline will give rise to a vertical jet flame. It is also likely that releases from the top may be slightly

inclined, such that it may cause damage as a result of direct impingement on structures, buildings and persons in the vicinity

6.2.2.3 The ignition probability for the high pressure gas pipeline release adopted are summarized in Table 6.1 which is made reference to the GN.

Table 6.1 Ignition probability for high pressure town gas pipeline release

Leak size	Immediate Ignition[1]	Delayed Ignition [2]
Minor (<1 kg/s)	0.01	0.4*(1-immediatie ignition probability)
Major (1 to 50 kg/s)	0.07	
Massive (>50 kg/s)	0.30	

6.2.3 Point Sources

6.2.3.1 No major point source is identified in the vicinity of the HP pipeline.

6.2.4 Line Sources

6.2.4.1 Roads are defined as the line sources in *Safeti*. The following assumptions are applied to estimate the presence factor of the line sources and the ignition probability in accordingly with the GN.

(a) Ignition probabilities of 0.4 per vehicle;

(b) Vehicle speed is assumed as 50 km/hr; and

(c) Traffic density is based on the projected traffic flow shown in **Table 6.2**.

Table 6.2 Summary of road ignition sources

Line Source	Peak Traffic Flow (veh / hr)
New Hiram's Highway	2550
Hiram's Highway	2750

6.3 Consequence Modelling

6.3.1.1 The consequence analysis result is determined by *DNV Safeti*. The input parameters and consequence results of fireball, jet fire, flash fire and toxic release are shown in **Appendix D**. Details are discussed in the following sections.

6.3.2 Fireball Effect

6.3.2.1 Immediate ignition of release caused by a rupture in the pipeline may give rise to a fireball. The consequence analysis for fireball scenario was conducted *DNV Safeti*. In accordance with Carter (1991), the size of fireball can be determined at each time step the quantity of fuel that can be consumed in a fireball with the same burning time as the time

since the start of the release. The mass of the fireball is determined by equating these two values. The PHAST model was thus adopted to calculate at each time step the quantity of fuel that can be consumed in a fireball. The mass and duration of fireball is estimated to be 21,800 kg and 11.4s respectively.

6.3.2.2 The fatality rate for thermal radiation is determined from the built-in Probit of *DNV Safeti*:

$$Y = -36.38 + 2.56\ln L$$

where:

Y is the probit;
L is the thermal load = $tI^{4/3}$;
t is the exposure time, second
I is the thermal radiation intensity, kW/m^2.

6.3.2.3 The radiation level corresponding to 1% and 99% fatality is estimated as 12.5kW/m^2 and 37.5kW/m^2 for an exposure time of 20s.

6.3.3 Jet Fire Effect

6.3.3.1 Jet fires will result from ignited releases of pressurized flammable gas or superheated/ pressurized liquid and modelled by DNV Safeti. The momentum of the release carries the materials forward in form of a long plume entraining air to give a flammable mixture. Combustion in a jet fire occurs in the form of a strong turbulent diffusion flame that is strongly influenced by the momentum of the release.

6.3.3.2 Since the release is transient, the release rate to be considered for evaluation of the effects of jet flame will be based on HSE Contract Research Report No. 82/1994. According to the report, for a full bore rupture, the gas flow will reduce to 1/4 of the initial rate for a further hour after the first 30s release. The release rate and consequently the effects of jet fire will ultimately depend on how quickly isolation can be achieved.

6.3.3.3 The fatality rate for thermal radiation is determined from the built-in Probit of *DNV Safeti*:

$$Y = -36.38 + 2.56\ln L$$

where:

Y is the probit;
L is the thermal load = $tI^{4/3}$;
t is the exposure time, second
I is the thermal radiation intensity, kW/m^2.

6.3.3.4 The radiation level corresponding to 1% and 99% fatality is estimated as 12.5kW/m^2 and 37.5kW/m^2 for an exposure time of 20s.

6.3.4 Flash Fire

6.3.4.1 As town gas is pressurized in the transmission network, it is heavier than air at the initial release stage. While the gas expands, it rises rapidly due to the buoyancy nature of the gas under atmospheric conditions. It will propagate and be diluted as a result of air entrainment with the influence of wind.

6.3.4.2 The principal hazard arising from a cloud of dispersing town gas is the delayed ignition of the flammable cloud that cause a flame to flash back to the release location and develop into a stable jet or crater fire.

6.3.4.3 Large scale experiments on the dispersion and ignition of flammable gas clouds show that ignition is unlikely when the average concentration is below the Lower Flammable Limit (LFL) or above the Upper Flammable Limit (UFL). The hazard distance is calculated by the Unified Dispersion Model (UDM) in the *DNV Safeti*. It estimates the profile of a dispersing cloud in segments according to properties of propagating cloud.

6.3.4.4 The fatality rate for flash fires is considered as 100% for persons within the cloud envelope.

6.3.5 Toxic Gas Dispersion

6.3.5.1 Town gas contains carbon monoxide (CO) which is a toxic chemical asphyxiant. When a person is exposed to carbon dioxide, it will prevent the delivery or absorption of oxygen within the body by combining with haemoglobin in the blood. A person exposing to concentrations of 20 to 30% of carbon monoxide will result in unconsciousness and convulsions within 1 minute.

6.3.5.2 Therefore, Town gas has been odourised with Tetrahydrothiophene (THT). As such, population under the exposure of town gas is warned olfactorily, allowing the affected individuals to react and escape from the exposure of Town gas. It is expected that there is a sufficient interval between the start of the exposure and the onset of incapacitation. Therefore, it is practicable that people would have a high success rate in escaping from the affected area.

6.3.5.3 Since town gas is lighter than air, the release will disperse upwards under normal wind conditions until its concentration equilibrates with the surrounding air, where it is then free to move in any direction. Assuming no immediate ignition has occurred, the surrounding population of the HP underground town gas transmission pipelines is unlikely to be fully exposed to the emerging gas cloud. As the gas cloud continues to disperse, its CO2 and CO concentration will begin to dilute, reducing its toxicity significantly over time.

6.3.5.4 The following probit equation for CO, from the built-in database of *DNV Safeti*, is applied to the risk model,

$$Pr = -7.21 + \ln(Ct)$$

where

C is gas concentration in ppm, and t is the exposure time in minute.

6.3.6 Vapour Cloud Explosion

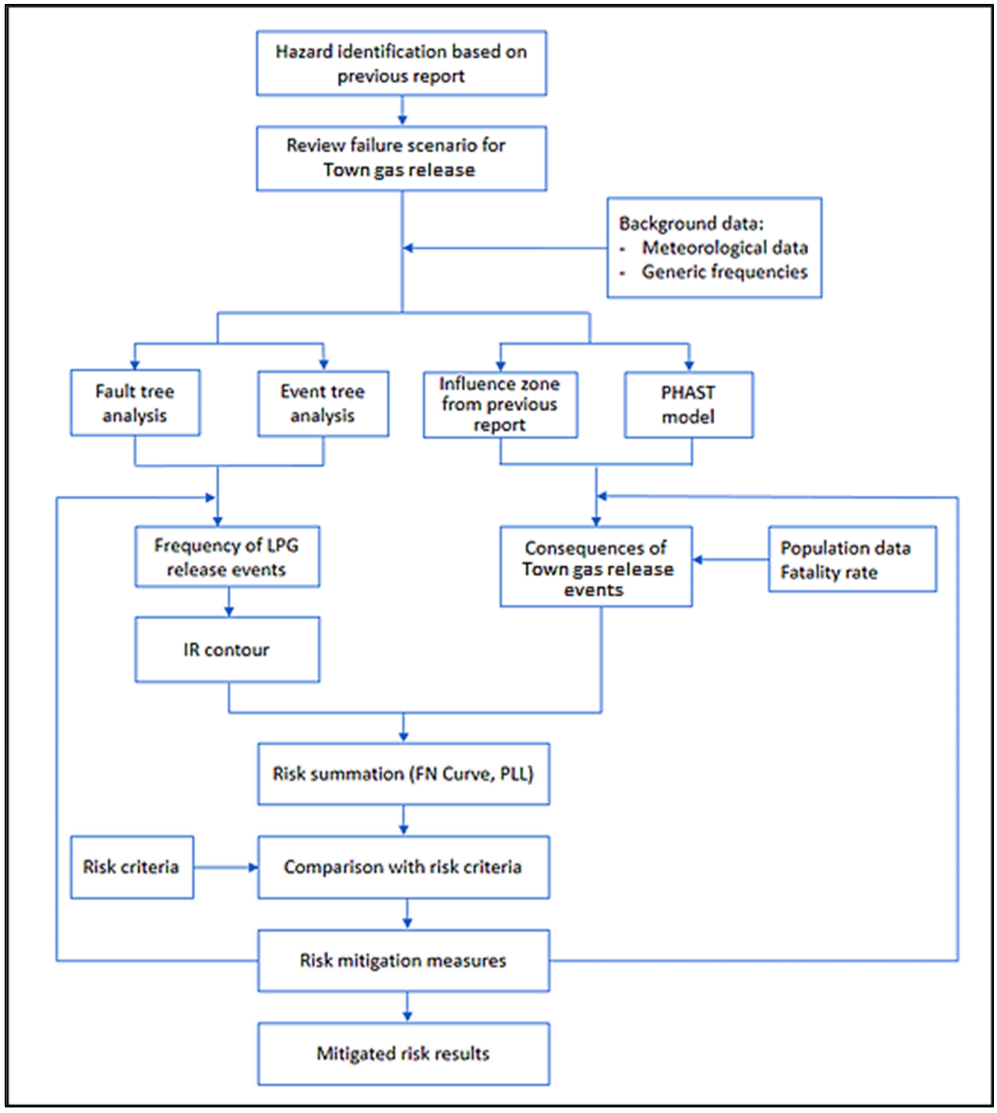
6.3.6.1 To achieve vapour cloud explosion (VCE), a dispersing vapour cloud must accumulate in a confined and/or congested area and subsequently be ignited. The potential for VCE is not considered significant for a buoyant gas plume, like towngas, and thus will not be further considered in this study.

7 Quantitative Risk Assessment

7.1 General Approach

7.1.1.1 A Quantitative Risk Assessment (QRA) is conducted through a process including hazard identification, frequency analysis, consequence modelling and risk summation. The general process of the QRA is shown in **Figure 7.1**.

Figure 7.1 Flowchart of the QRA Process



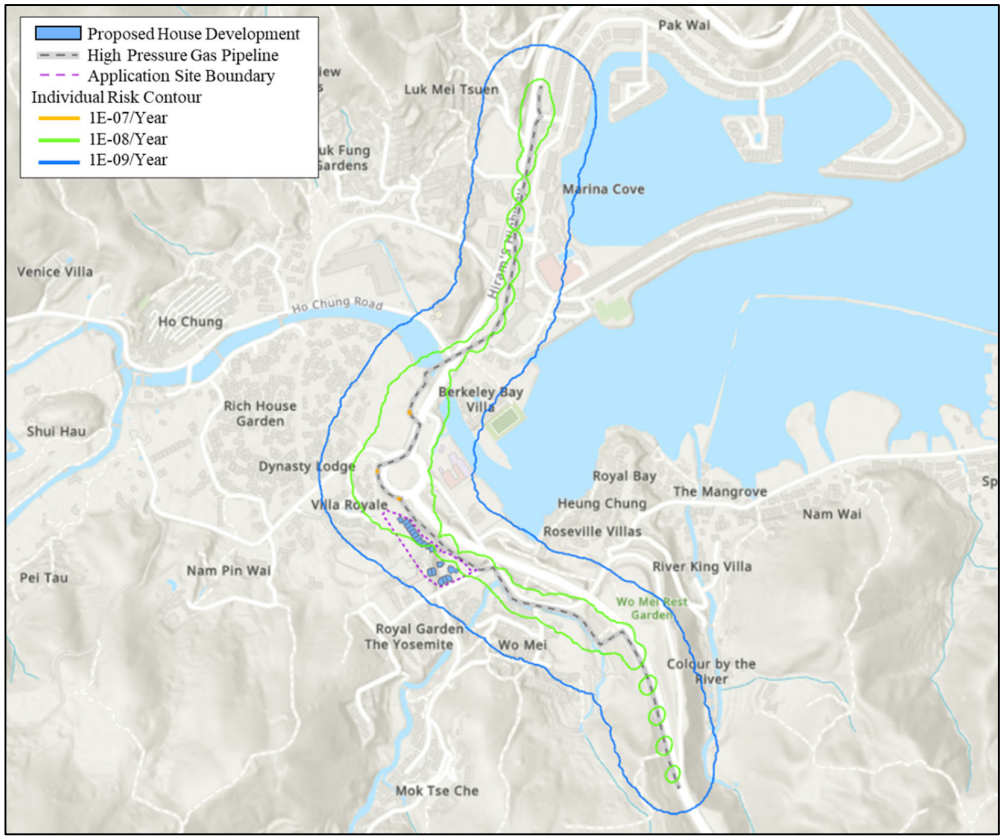
7.1.1.2 Safeti model by DNV GL was developed to undertake risk summation.

7.2 Risk Assessment

7.2.1 Individual Risk

7.2.1.1 The individual risk levels are calculated for a hypothetical person spending 100% of their time outdoors in the study area. Individual risk is independent of the surrounding population levels. The individual risk due to the high pressure gas pipeline is shown in **Figure 7.2**. The maximum level of off-site individual risk associated with the pipelines does not exceed the criterion of 1×10^{-5} per year.

Figure 7.2 Individual Risk Contour for High Pressure Gas Pipeline



7.2.2 Societal Risk

7.2.2.1 The societal risk is expressed in the form of an F-N curve which represents the cumulative frequency (F) of all outcomes leading to N or more fatalities. The F-N curve of the following scenarios are shown in **Figure 7.3** and their F-N pairs are tabulated in **Table 7.1**.

- Base case: Background population, excluding the Proposed House Development ;
- Construction phase case: Base case + population of the construction site of the Proposed House Development; and
- Overall risk case: Base case + Proposed House Development .

Figure 7.3 Societal Risk of Different Cases

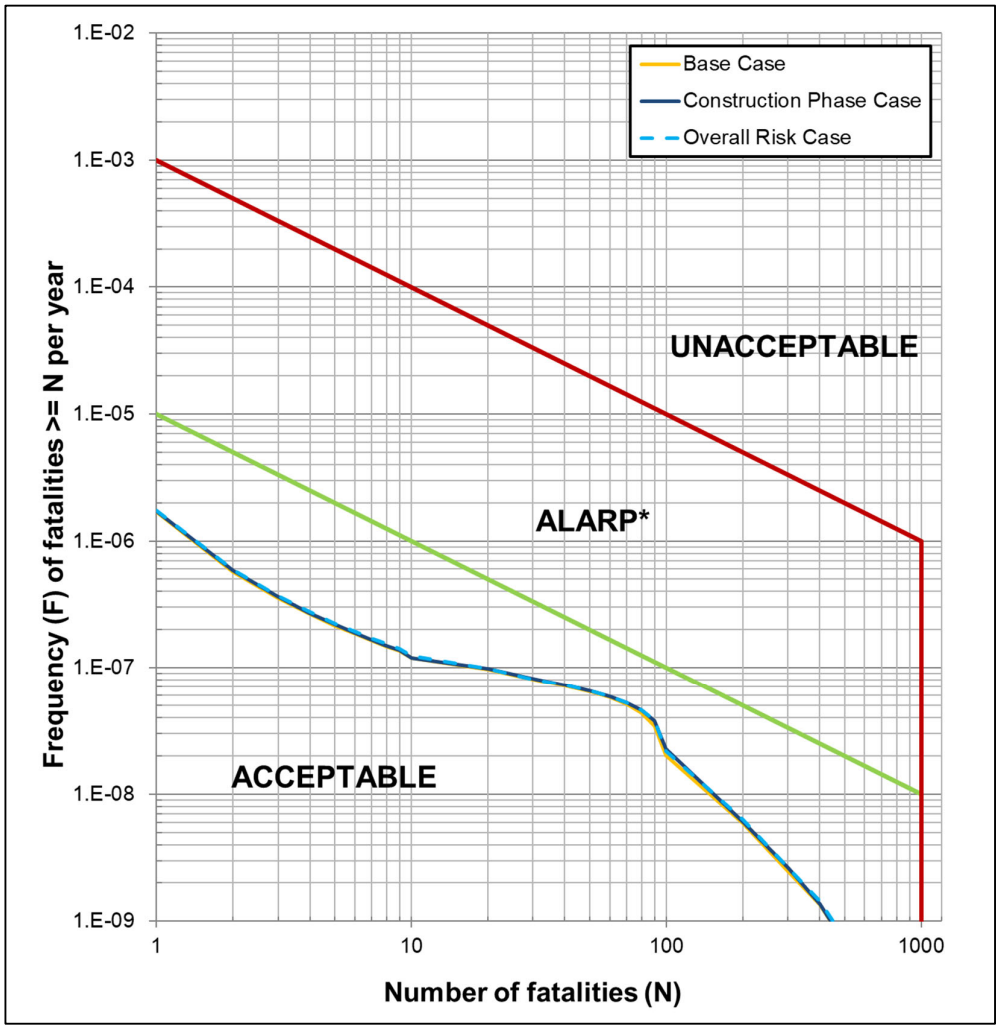


Table 7.1 FN values for Different Scenarios

No. of Fatalities	Base Case	Construction Phase Case	Overall Risk Case
1	1.70E-06	1.72E-06	1.73E-06
2	5.72E-07	5.85E-07	5.91E-07
3	3.55E-07	3.63E-07	3.70E-07
4	2.65E-07	2.71E-07	2.76E-07
5	2.15E-07	2.20E-07	2.25E-07
6	1.86E-07	1.89E-07	1.94E-07
7	1.64E-07	1.67E-07	1.71E-07
8	1.48E-07	1.50E-07	1.55E-07
9	1.37E-07	1.38E-07	1.43E-07
10	1.19E-07	1.20E-07	1.24E-07
20	9.63E-08	9.76E-08	9.83E-08
30	8.04E-08	8.17E-08	8.12E-08
40	7.17E-08	7.24E-08	7.28E-08
50	6.44E-08	6.52E-08	6.56E-08
60	5.80E-08	5.89E-08	5.92E-08
70	5.10E-08	5.21E-08	5.24E-08
80	4.36E-08	4.58E-08	4.60E-08
90	3.45E-08	3.79E-08	3.80E-08
100	2.00E-08	2.25E-08	2.19E-08
200	5.88E-09	6.02E-09	6.23E-09
300	2.46E-09	2.62E-09	2.63E-09
400	1.34E-09	1.37E-09	1.44E-09
500	6.69E-10	6.72E-10	7.33E-10

7.2.2.2

The F-N pairs show that the risks posed by the high pressure gas pipeline on the residents of the Proposed House Development are within Acceptable Region. Hence, no mitigation measure is proposed.

7.2.3 Potential Loss of Life

7.2.3.1

The Potential Loss of Life (PLL) value is the summation of the product of each F-N pair. The PLL values for different scenarios of the Proposed House Development are shown in **Table 7.2.**

Table 7.2 Breakdown of PLL values for Different Scenarios

Scenarios	Base case		Construction Phase Case		Overall risk case	
	PLL (per year)	% of Total PLL	PLL (per year)	% of Total PLL	PLL (per year)	% of Total PLL
Fireball	4.69E-06	40%	4.84E-06	40%	4.82E-06	40%
Jetfire-Pipeline (10mm)	1.09E-11	0%	1.10E-11	0%	1.09E-11	0%
Jetfire-Pipeline (25mm)	1.01E-09	0%	1.03E-09	0%	1.05E-09	0%
Jetfire-Pipeline (50mm)	8.38E-09	0%	8.59E-09	0%	9.75E-09	0%
Jetfire-Pipeline (100mm)	4.20E-08	0%	4.29E-08	0%	4.85E-08	0%
Toxicity	4.77E-07	4%	5.10E-07	4%	4.87E-07	4%
Flashfire-Pipeline (10mm)	2.30E-08	0%	2.30E-08	0%	2.30E-08	0%
Flashfire-Pipeline (25mm)	4.31E-07	4%	4.32E-07	4%	4.31E-07	3%
Flashfire-Pipeline (50mm)	8.15E-07	7%	8.26E-07	7%	8.27E-07	7%

Scenarios	Base case		Construction Phase Case		Overall risk case	
	PLL (per year)	% of Total PLL	PLL (per year)	% of Total PLL	PLL (per year)	% of Total PLL
Flashfire-Pipeline (100mm)	1.67E-06	14%	1.72E-06	14%	1.79E-06	15%
Flashfire-Pipeline (Rupture)	3.57E-06	31%	3.68E-06	30%	3.73E-06	31%
Total	*1.17E-05*	*100%*	*1.21E-05*	*100%*	*1.22E-05*	*100%*

8 Conclusion

8.1.1.1 A Quantitative Risk Assessment (QRA) of the risk associated with the HKCG high pressure town gas pipeline has been conducted. The assessment was conducted with the consideration of current mitigating measures imposed by HKCG on the high pressure gas pipeline.

8.1.1.2 The societal risk expressed in the form of FN curves for both construction and operational phase lies within the "Acceptable" region of Hong Kong Risk Guidelines. The tolerable risk is mainly due to the background population instead of the population induced by the Proposed House Development . The maximum offsite individual risk is found to comply with Risk Guidelines for Hong Kong. No specific mitigation measure is therefore required.

8.1.1.3 By comparing the current results with the result without the construction of the Proposed House Development, it shows that the risk induced by the Proposed House Development is insignificant.

9 References

[1] Electrical and Mechanical Services Department, Guidance Note on Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong

[2] 2021 Census data: https://www.census2021.gov.hk/en/index.html

[3] Centamap website: http://hk.centamap.com/gc/home.aspx

[4] School database website: https://www.schooland.hk/

[5] Education Bureau, Student Enrolment Statistics, 2021/22

[6] XRL EIA, Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link, Appendix 13 Hazard to Life Assessment

[7] SIL(E) EIA, South Island Line (East) – EIA Study, 2010

[8] MOS EIA, EIA Study of East Rail Extensions - Tai Wai to Ma On Shan, 2000

[9] EIA Study of Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities, 2009

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[11] TNO, Guideline for Quantitative Risk Assessment, "Purple Book" CPR18E Part 1: Establishments, Ed. Uijt de Haag P.A.M., and Ale, B.J.M., National Institute of Public Health and Environment (RIVM), den Hague, The Netherlands, 2005

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[13] Planning Department, Hong Kong Planning Standards and Guidelines (HKPSG)

[14] Planning Department, 2019 - based Territorial Population and Employment Data Matrix (TPEDM)

[15] Buildings Department, Code of Practice for Fire Safety in Buildings 2011 (version Oct 2015)

[16] EIA study of Operation of the Existing Tai Lam Explosives Magazine at Tai Shu Ha, Yuen Long for Liantang / Heung Yuen Wai Boundary Control Point Project, 2015

[17] Carter, D. A. (1991). Aspects of risk assessment for hazardous pipelines containing flammable substances. *Journal of Loss Prevention in the Process Industries*, *4*(2), 68-72.

Appendix A

Reply from The Hong Kong and China Gas Company Limited

香 港 中 華 煤 氣 有 限 公 司
The Hong Kong and China Gas Company Limited

環保生活每一天
Go Green Every Day

28 December 2023

Your ref:
Our ref: SM/a02/23/00229/MS

Ms. Jane Lau
Arup
Level 5, Festival Walk
80 Tat Chee Avenue
Kowloon Tong, KLN

Dear Ms. Lau

Proposed Housing Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung
Request for Information on High Pressure Gas Pipeline and Offtake stations/ Regulation Stations

Reference is made to your email on 13 December 2023 in relation to the captioned subject.

A copy of technical information and drawings of the existing High Pressure 750mm along Hiram's Highway in the concerned area are enclosed for your action.

You are advised to provide our Company a copy of the Quantitative Risk Assessment report for review and comment.

Should you have any further enquiry, please feel free to contact Ms. Mandy Sin at 9803 8817 or me at 2765 5622.

Thank you for your kind attention.

Yours sincerely

Jacqueline T Y Hui
Senior System Maintenance Manager

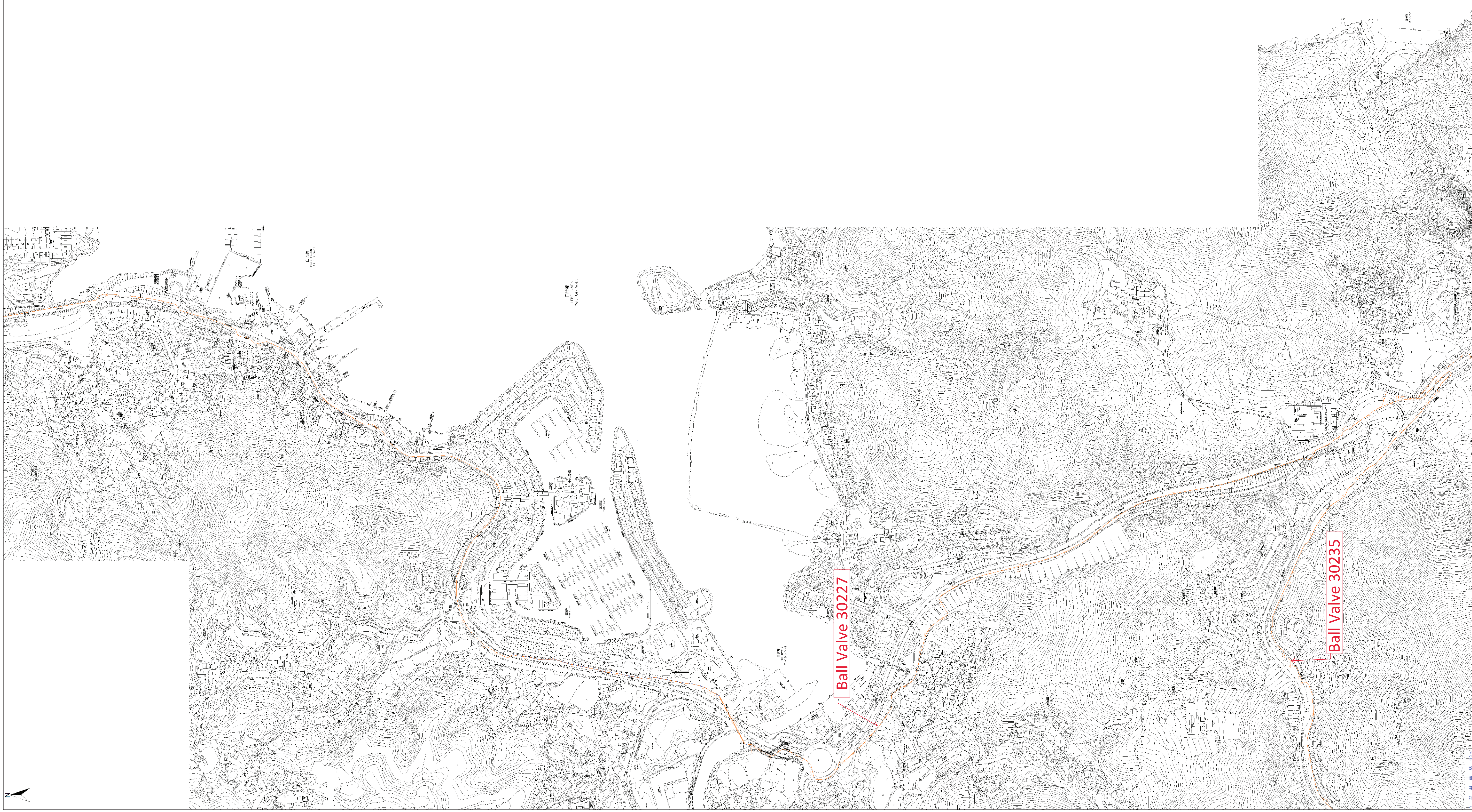
JH/MS/wl

Encl.

System Maintenance Section
Transmission Operation Department
4/F, 100 Tokwawan Road, Kowloon Tel: 2765 5622 Fax: 2392 7801 E-mail: ty.hui@towngas.com

Technical Specification for the existing HPTGP running along Hiram's Highway

Parameter	Specification
Pipe Diameter (Nominal)	750mm
Pipe wall thickness	12.7mm
Design Pressure	35 barg
Maximum Operating Pressure	35 barg
Hydraulic Test Pressure	900 psi
Pipe Material	Steel
External Coating	3000 microns 3 layers polyethlyene coating
Internal Coating	50 micron Two Pack Epoxy
Year of Construction	2004-2007
Backfilling Material	Surrounded by 150mm Thick Zone 2 fresh sand
Cathodic Protection	Cathodic Protection System - Sacrificial Anode at about 300 m Interval
Minimum Depth	1.1m
Material Grading (Pipe/ Fitting)	API 5L X52
Jointing Method	Butt Welding
Welding Specification	Welding complied with BS 4515 & BGC/PS/P2
Non-Destructive Test of Jointing	100% X-Ray
Isolation Valves	Upstream: BV30228 Ta Ho Tun Road Valve near the site boundary: BV30227 New Hiram's Highway Downstream: BV30235 Clear Water Bay Road
Pipe Length between upstream and downstream isolation valves	5.6km



煤氣 Towngas
香港中華煤氣有限公司
The Hong Kong and China Gas Company Limited

輸氣操作部

時間：10:04:21

比例：1 : 3000

坐標 xy (844893,823967)

圖則顯示的管道位置只作參考之用。其實際位置和深度仍須以人手開挖探孔確定。在煤氣管道設施附近施工期間，必須要加倍小心。

檢查日期： Dec 20 2023

Appendix B

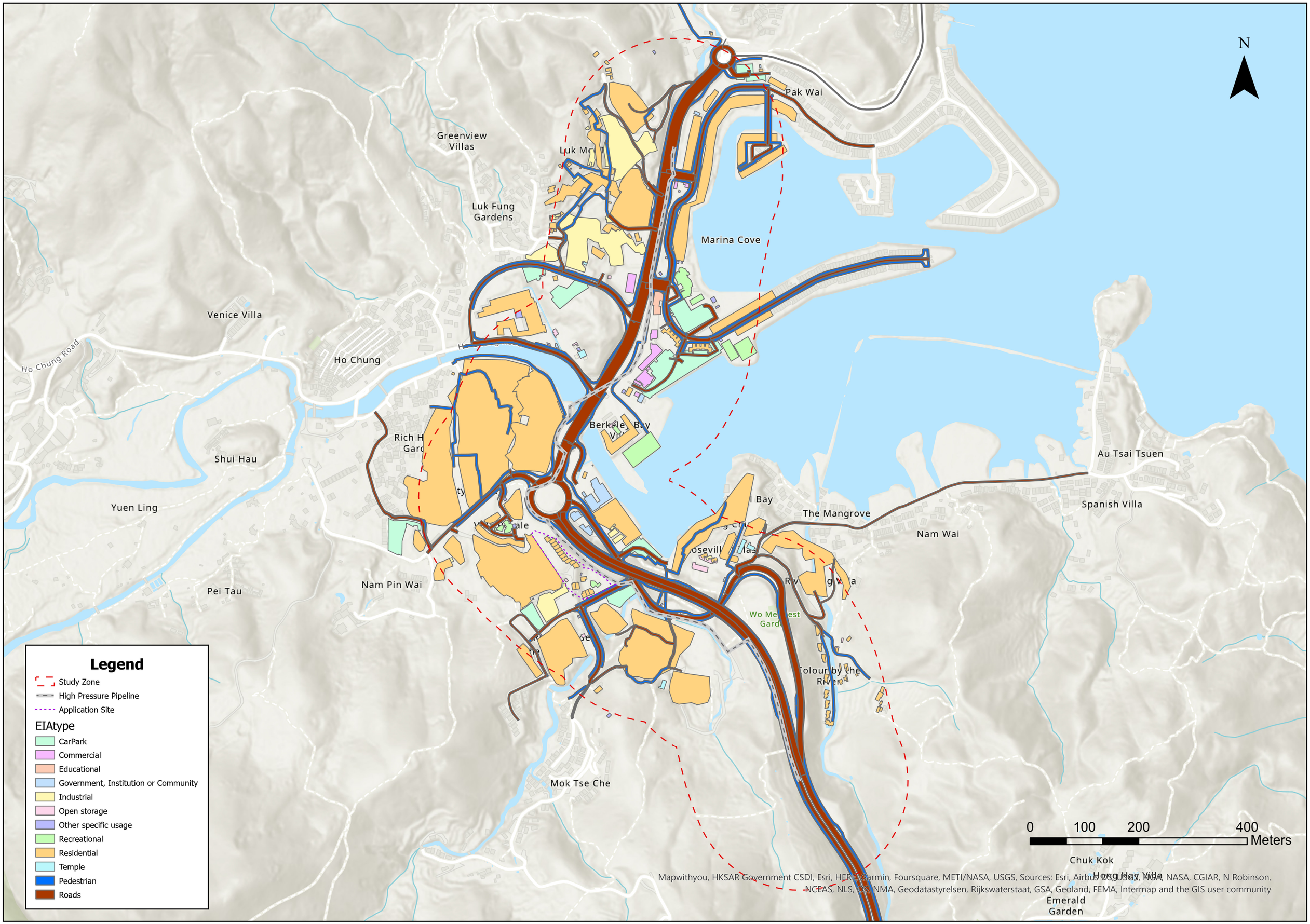
Population Data Adopted

Table 1. Population Assumption

Population Type	Reference
Residential	• Year 2021 Census was adopted, a population of 3.5 per unit in Tertiary Planning Unit 823 is assumed according to the census information. Same assumption is adopted for the population within Sai Kung Central District Council Constituency Area for conservative approach. • For most of the high-rise buildings, the total number of units are made reference to Centamap website. • For population in village house, it is assumed that each floor has one household. The population of each village house is determined by multiplying the number of floors with the average domestic household size.
Educational	• School within the CZ are listed as below: - The Woodland Sai Kung Pre-school • The schools’ population is estimated according to the information from school database website (https://www.schooland.hk/), and school official websites.
Road traffic population	• Road traffic is based on the information provided by Traffic Consultant. • The estimated population is determined by the sum of vehicle type composition at the nearest Annual Traffic Census Station Core Station 5017 multiply by the persons per vehicle (occupancy).
Temple [1]	• Population estimation based on the size of the temple: Large Size: 100 people Medium Size: 50 people Small Size: 10 people
Recreational / Open Space [1]	• Population estimation based on the size and the purpose of the entertainment ground: Large Size: 200 people Medium Size: 100 people Small Size: 50 people Very Small Size: 10 people
Office (Administration) / Commercial /	• Population is determined by assuming 9 m^2 GFA/ person according to Code of Practice for Fire Safety in Buildings 2011 (version Oct 2015) (Class 4a, Offices)
Industry	• Population is determined by assuming 300 workers/ha for Rural-Based Industrial Use (RI) according to HKPSG (Ch5, Table 2)
Open Storage	• Population is determined by assuming 700 m^2/worker for Warehouse according to HKPSG (Ch5, Table 2)
Car Park	• It is assumed that each parking space has 0.2 people. If the number of parking space is not provided, the number of parking space is determined by dividing the area of the car park with the typical parking area of private cars which its length and width are 5m and 2.5m respectively.
Government, Institution or Community	• Population estimation based on the purpose of the station [1]: Central Refuse Station: 5 people Refuse Collection Point: 2 people Sewage Treatment works / Toilet / Electric sub-station / pumping station: No people The population apart from government station is estimated according to the information from their official websites

Population Type	Reference
Pedestrian	• Population estimation is based on number of people in Nam Pin Wai Road, Luk Mei Tsuen Road, Hiram’s Highway, New Hiram’s Highway and Nam Wai Road. • Population density at difference area listed as below: Nam Wai Road: 0.00328 person/m^2 Near Planned Development Area (i.e. New Hiram’s Highway): 0.00821 person/m^2 Ho Chung New Village(i.e. Nam Pin Wai Road): 0.00482 person/m^2 Marina Cove (i.e. Hiram’s Highway): 0.01328 person/m^2 Near Industrial Area (i.e. Luk Mei Tsuen Road): 0.00330 person/m^2

Notes: Reference is made to an approved EIA Study on Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link.


N
Pak Wai
Greenview Villas
Luk Fung Gardens
Marina Cove
Venice Villa
Ho Chung Road
Ho Chung
Shui Hau
Yuen Ling
Pei Tau
Nam Pin Wai
Mok Tse Che
The Mangrove
Nam Wai
Spanish Villa
Au Tsai Tsuen
Chuk Kok
Emerald Garden
Legend
Study Zone
High Pressure Pipeline
Application Site
EIAtype
CarPark
Commercial
Educational
Government, Institution or Community
Industrial
Open storage
Other specific usage
Recreational
Residential
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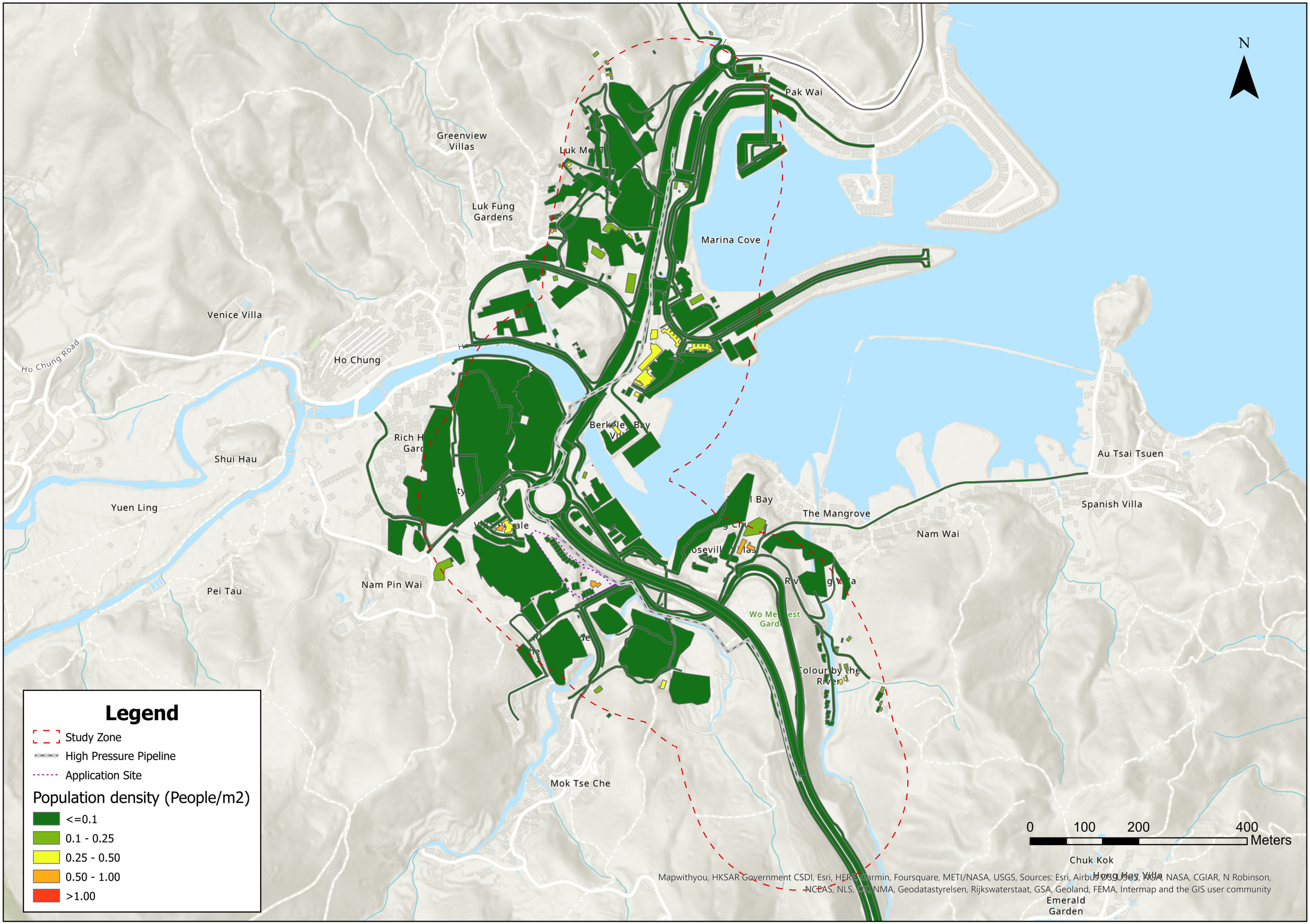
Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community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Venice Villa
Ho Chung Road
Ho Chung
Shui Hau
Yuen Ling
Pei Tau
Nam Pin Wai
Mok Tse Che
Au Tsai Tsuen
Spanish Villa
The Mangrove
Nam Wai
Chuk Kok
Emerald Garden
Legend
Study Zone
High Pressure Pipeline
Application Site
Population density (People/m2)
<=0.1
0.1 - 0.25
0.25 - 0.50
0.50 - 1.00
>1.00
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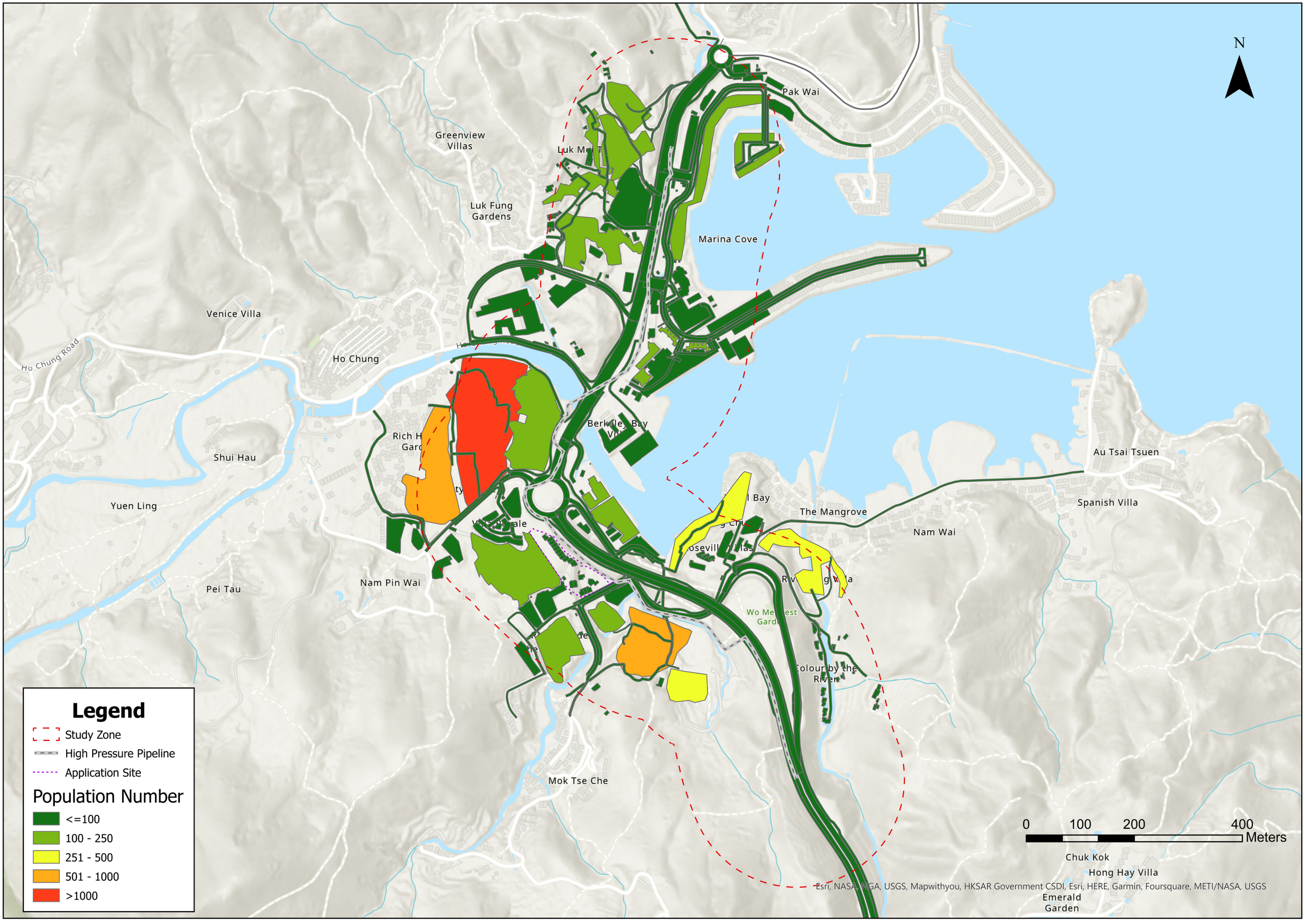
Meters
Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community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Venice Villa
Ho Chung Road
Ho Chung
Berkeley Bay
Shui Hau
Au Tsai Tsuen
Yuen Ling
The Mangrove
Spanish Villa
Nam Wai
Nam Pin Wai
Pei Tau
Mok Tse Che
Chuk Kok
Hong Hay Villa
Emerald Garden
Legend
Study Zone
High Pressure Pipeline
Application Site
Population Number
<=100
100 - 250
251 - 500
501 - 1000
>1000
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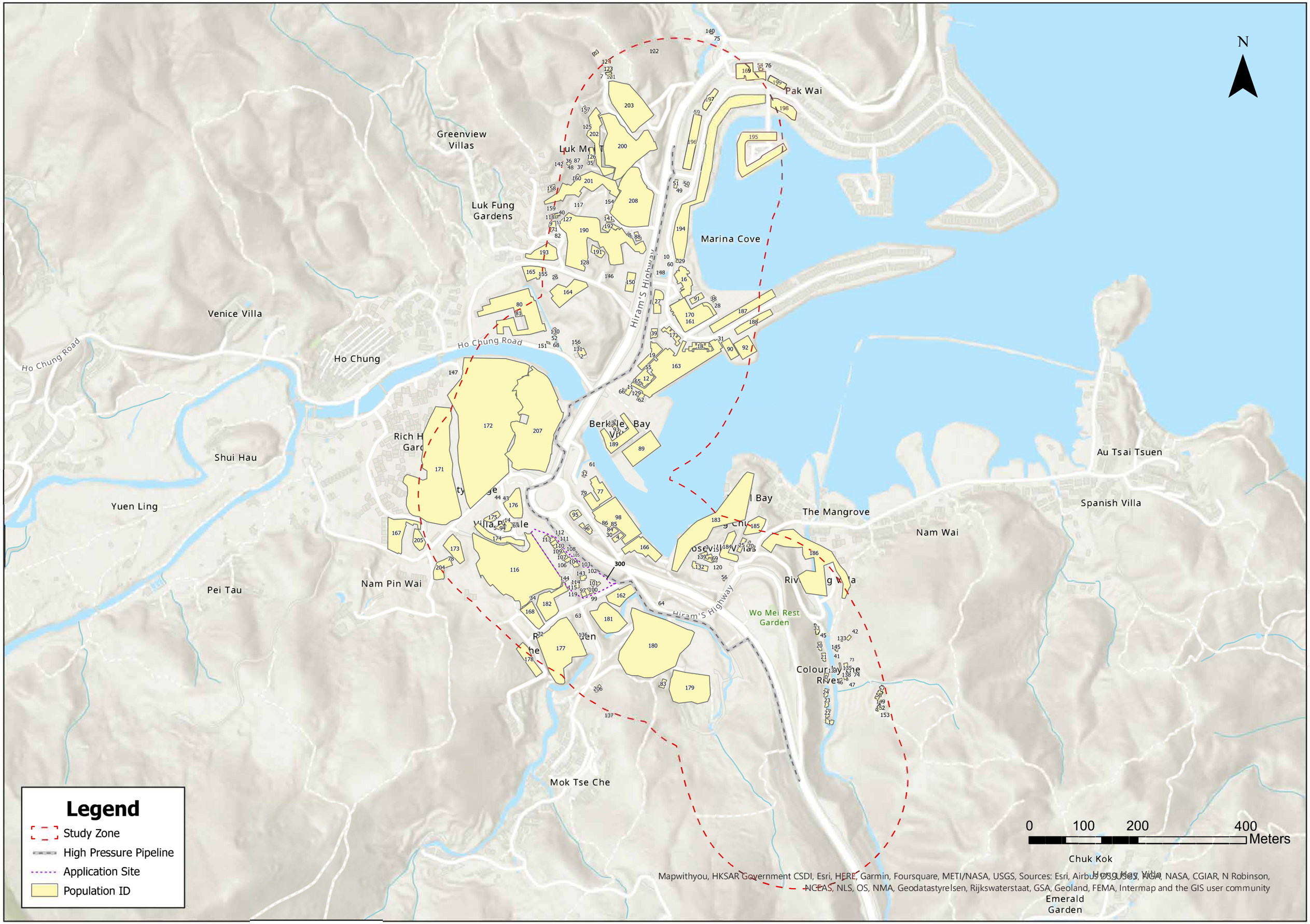
Meters
Esri, NASA, NGA, USGS, Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS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Luk Fung Gardens
Marina Cove
Hiram's Highway
Ho Chung Road
Venice Villa
Ho Chung
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Yuen Ling
Pei Tau
Nam Pin Wai
Mok Tse Che
The Mangrove
Nam Wai
Spanish Villa
Au Tsai Tsuen
Wo Mei Rest Garden
Chuk Kok
Emerald Garden
Legend
Study Zone
High Pressure Pipeline
Application Site
Population ID
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Meters
Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Population Data

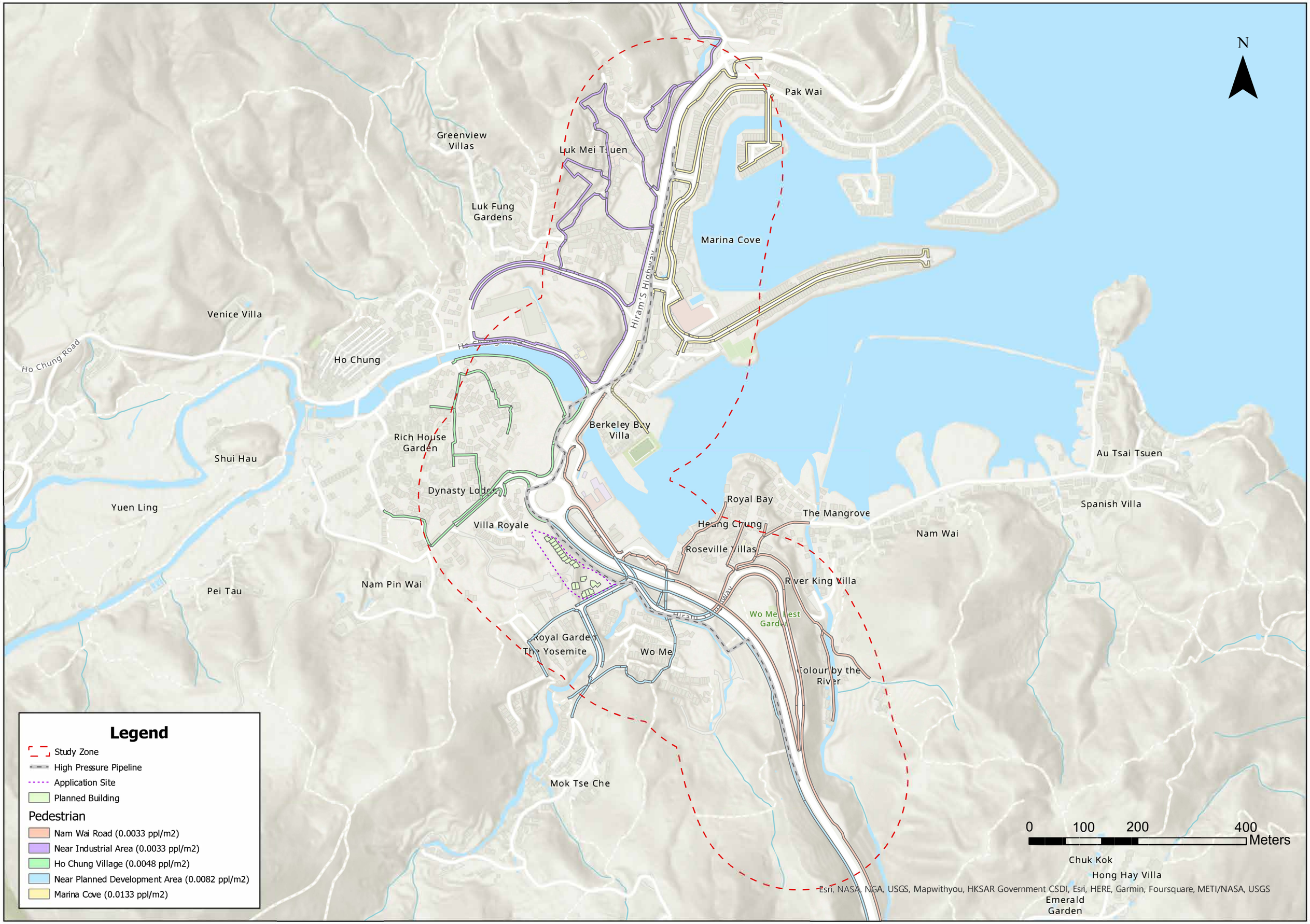
ID	Name	Type	Floor	Unit	Projected Population	Population Density
0	Colour by the River House 3	Residential	1	1	4	0.0409
1	Colour by the River House 7	Residential	1	1	4	0.0329
2	Ho Chung Che Kung Temple	Temple	1	1	10	0.0625
3	Roseville Villas Block 1	Residential	1	1	4	0.0589
4	Winfield Paint LTD	Industrial	1	1	6	0.0332
5	Villa Royale Club House	Recreational	1	1	10	0.5761
6	Residential Area Near Luk Cheung Road	Residential	3	3	11	0.1721
7	Residential Area Near Luk Cheung Road	Residential	3	3	11	0.2455
8	Residential Area Near Wing Tai Hin	Residential	3	3	11	0.2748
9	Residential Area Near Luk Fung Garden	Residential	3	3	11	0.0826
10		Other specific usage	1	1	0	0.0000
11	Residential Area Near Marina Cove Shopping Centre	Residential	3	3	11	0.0785
12		Commercial	1	1	167	0.2873
13	Open Storage	Open storage	1	1	1	0.0191
14	Villa Royale Club House	Recreational	1	1	100	0.3807
15	Roseville Villas Block 2	Industrial	1	1	3	0.0440
16	Club Marina Cove	Recreational	1	1	100	0.0902
17	Panoramic Rise	Residential	6	36	126	0.3250
18	Diaramic Rise	Residential	6	36	126	0.3153
19	Marina Cove Shopping Centre	Commercial	1	1	212	0.2879
20	Colour by the River House 1	Residential	1	1	4	0.0409
21	Colour by the River House 2	Residential	1	1	4	0.0409
22	Colour by the River House 6	Residential	1	1	4	0.0395
23	Colour by the River House 5	Residential	1	1	4	0.0395
24	Colour by the River House 4	Residential	1	1	4	0.0395
25	Wo Mei Tsung Tsin Church	Temple	2	2	100	0.5029
26	Residential Area Near Ho Chung North Road Carpark	Residential	3	3	11	0.1650
27	The Woodland Sai Kung Pre-school	Educational	1	1	40	0.0653
28		Other specific usage	1	1	0	0.0000
29		Other specific usage	1	1	0	0.0000
30	Winfield Paint LTD	Industrial	1	1	6	0.0358
31		Other specific usage	1	1	0	0.0000
32	Residential Area Near Haven of Hope Christian Association Ho Chung Welfare Facilities Building	Residential	3	3	11	0.1617
33	Colour By The River House 1	Residential	3	3	11	0.0990
34	Pump House	Government, Institution or Community	1	1	0	0.0000
35	Industrial Area	Industrial	1	1	1	0.0414
36	Residential Area Near Greenview Villas	Residential	3	3	11	1.2988
37	Residential Area Near Greenview Villas	Residential	3	3	11	2.1909
38		Other specific usage	1	1	0	0.0000
39		Commercial	1	1	59	0.2901
40	Residential Area Near Greenview Villas	Residential	3	3	11	0.4085
41	Residential Area Near Colour By the River	Residential	1	1	4	0.1143
42	Residential Area Near Colour By the River	Residential	3	3	11	0.2292
43		Other specific usage	1	1	0	0.0000
44		Other specific usage	1	1	0	0.0000
45	Residential Area Near Colour By the River	Residential	3	3	11	2.4735
46	Residential Area Near Colour By the River	Residential	3	3	11	0.2585

ID	Name	Type	Floor	Unit	Projected Population	Population Density
47	Residential Area Near Colour By the River	Residential	3	3	11	0.3056
48	Residential Area Near Greenview Villas	Residential	3	3	11	2.1360
49		Other specific usage	1	1	0	0.0000
50	Office	Commercial	1	1	9	0.1120
51	Office	Commercial	1	1	10	0.1184
52		Other specific usage	1	1	0	0.0000
53	Industrial Area	Industrial	1	1	3	0.0321
54	Public Toilet	Government, Institution or Community	1	1	0	0.0000
55	Public Toilet	Commercial	1	1	9	0.2922
56	Public Toilet	Government, Institution or Community	1	1	0	0.0000
57	Residential Area Near Colour By the River	Residential	3	3	11	0.1821
58	Residential Area Near Colour By the River	Residential	3	3	11	0.0802
59	Electric Substation	Government, Institution or Community	1	1	0	0.0000
60		Other specific usage	1	1	0	0.0000
61		Other specific usage	1	1	0	0.0000
62	Electric Substation	Government, Institution or Community	1	1	0	0.0000
63		Other specific usage	1	1	0	0.0000
64		Other specific usage	1	1	0	0.0000
65		Commercial	1	1	23	0.2979
66		Other specific usage	1	1	0	0.0000
67		Other specific usage	1	1	0	0.0000
68	Electric Substation	Government, Institution or Community	1	1	0	0.0000
69	Roseville Villas Block 3	Residential	1	1	4	0.0603
70	Wo Mei Tsung Tsin Church	Temple	2	2	100	0.8766
71	Residential Area Near Greenview Villas	Residential	3	3	11	0.5967
72		Other specific usage	1	1	0	0.0000
73	Residential Area Near Colour By the River	Residential	3	3	11	0.2342
74	Residential Area Near Colour By the River	Residential	3	3	11	0.6668
75	Residential Area Near Hing Keng Shek Road	Residential	1	1	4	0.1771
76	Residential Area Near Pak Wai	Residential	3	3	11	0.3262
77	Sai Kung Central Primary School	Government, Institution or Community	1	1	0	0.0000
78	Industrial Area	Industrial	1	1	2	0.0504
79	Electric Substation	Government, Institution or Community	1	1	0	0.0000
80	A/SK-HC/131 Planned Area	Residential	2	19	70	0.0132
81		Other specific usage	1	1	0	0.0000
82	Residential Area Near Greenview Villas	Residential	3	3	11	0.4118
83	Immaculate Conception Chapel	Temple	2	2	50	0.3914
84	Industrial Area	Industrial	1	1	1	0.1832
85	Industrial Area	Industrial	1	1	1	0.0607
86	Industrial Area	Industrial	1	1	1	0.0312
87	Residential Area Near Greenview Villas	Residential	3	3	11	0.2589
88	Residential Area Near Luk Mei Tsuen Road	Residential	1	1	4	0.0299
89	Soccer Pit	Recreational	1	1	50	0.0224
90	Tennis Court	Recreational	1	1	10	0.0159
91	Swimming Pool	Recreational	1	1	50	0.1893
92	Tennis Court	Recreational	1	1	10	0.0097
93	Swimming Pool	Recreational	1	1	50	0.4112
94	Swimming Pool	Recreational	1	1	10	0.1022
95	Planned Public Untility Installation	Government, Institution or Community	1	1	0	0.0000

ID	Name	Type	Floor	Unit	Projected Population	Population Density
96	Planned Public Untility Installation	Government, Institution or Community	1	1	0	0.0000
97	Planned Development House 15	Residential	3	1	4	0.0457
98	DD214 1003 Planned Development	Residential	6	40	140	0.0417
99	Planned Development House 16	Residential	3	1	4	0.0560
100	Planned Development House 17	Residential	3	1	4	0.0456
101	Planned Development Clubhouse	Recreational	3	1	200	1.3292
102	Planned Development House 14	Residential	3	1	4	0.0457
103	Planned Development House 11	Residential	3	1	4	0.0423
104	Planned Development House 10	Residential	3	1	4	0.0614
105	Planned Development House 9	Residential	3	1	4	0.0536
106	Planned Development House 8	Residential	3	1	4	0.0536
107	Planned Development House 7	Residential	3	1	4	0.0536
108	Planned Development House 6	Residential	3	1	4	0.0536
109	Planned Development House 5	Residential	3	1	4	0.0536
110	Planned Development House 4	Residential	3	1	4	0.0536
111	Planned Development House 3	Residential	3	1	4	0.0536
112	Planned Development House 2	Residential	3	1	4	0.0536
113	Planned Development House 1	Residential	3	1	4	0.0535
114	Planned Development House 13	Residential	3	1	4	0.0484
115	Planned Development House 12	Residential	3	1	4	0.0484
116	A/DPA/SK-HC/30 Planned Area	Residential	3	51	179	0.0141
117	Residential Area Near Greenview Villas	Residential	1	1	4	0.7486
118	Industrial Area	Industrial	1	1	1	0.0794
119	Open Storage	Open storage	1	1	1	0.1433
120	Open Storage	Open storage	1	1	1	0.0081
121	Residential Area Near Luk Cheung Road	Residential	1	1	4	0.1518
122		Other specific usage	1	1	0	0.0000
123	Residential Area Near Luk Cheung Road	Residential	1	1	4	0.0612
124	Residential Area Near Luk Cheung Road	Residential	1	1	4	0.1011
125	Industrial Area	Industrial	1	1	1	0.0307
126	Industrial Area	Industrial	1	1	9	0.0311
127	Industrial Area	Industrial	1	1	1	0.0439
128	Grand Marshal Temple	Temple	1	1	10	0.3116
129		Commercial	1	1	20	0.2957
130	Open Storage	Open storage	1	1	1	0.0107
131		Other specific usage	1	1	0	0.0000
132	Open Storage	Open storage	1	1	1	0.0034
133	Open Storage	Open storage	1	1	1	0.0433
134	Residential Area Near Colour By the River	Residential	1	1	4	0.1290
135	Residential Area Near Colour By the River	Residential	1	1	4	0.1307
136	Open Storage	Open storage	1	1	1	0.0265
137		Other specific usage	1	1	0	0.0000
138	Residential Area Near Colour By the River	Residential	1	1	4	0.2354
139	Open Storage	Open storage	1	1	1	0.0190
140	Open Storage	Open storage	1	1	1	0.0807
141	Industrial Area	Industrial	1	1	4	0.0301
142	Residential Area Near Greenview Villas	Residential	1	1	4	0.1671
143		Other specific usage	1	1	0	0.0000
144	Open Storage	Open storage	1	1	1	0.0327

ID	Name	Type	Floor	Unit	Projected Population	Population Density
145	Open Storage	Open storage	1	1	1	0.0343
146	Open Storage	Open storage	1	1	1	0.0317
147	Residential Area Near Ho Chung New Village	Residential	1	1	4	0.1969
148		Other specific usage	1	1	0	0.0000
149	Residential Area Near Colour By the River	Residential	1	1	4	0.1524
150	Kin Hing Plant Nursery Engineering Office	Commercial	1	1	59	0.1117
151		Other specific usage	1	1	0	0.0000
152	Residential Area Near Colour By the River	Residential	1	1	4	0.1469
153	Residential Area Near Colour By the River	Residential	1	1	4	0.0743
154	Residential Area Near Luk Mei Tsuen Road	Residential	1	1	4	0.2920
155	Open Storage	Open storage	1	1	1	0.0518
156	Open Storage	Open storage	1	1	1	0.0269
157	Residential Area Near Greenview Villas	Residential	1	1	4	0.0441
158	Residential Area Near Greenview Villas	Residential	1	1	4	0.0314
159	Industrial Area	Industrial	1	1	1	0.0301
160	Industrial Area	Industrial	1	1	3	0.0375
161	Marina Cove Outdoor Car Park	CarPark	1	1	45	0.0161
162	Wo Mei Public Parking	CarPark	1	1	19	0.0163
163	Marina Cove Car Park	CarPark	1	1	97	0.0161
164	Carpark	CarPark	1	1	29	0.0164
165	LM Auto Carpark	CarPark	1	1	13	0.0160
166	Heung Chung Road Carpark	CarPark	1	1	25	0.0162
167	Carpark	CarPark	1	1	32	0.0162
168	Carpark	CarPark	1	1	17	0.0169
169	Pak Wai Village Carpark	CarPark	1	1	20	0.0163
170	Marina Cove Outdoor Car Park	CarPark	1	1	43	0.0162
171	Residential Area Near Ho Chung New Village	Residential	3	211	739	0.0547
172	Residential Area Near Ho Chung New Village	Residential	3	344	1204	0.0461
173	Residential Area Near Villa Royale	Residential	3	19	67	0.0612
174	Villa Royale	Residential	1	20	70	0.0645
175	Residential Area Near Villa Royale	Residential	1	7	25	0.0790
176	Residential Area Near Villa Royale	Residential	3	21	74	0.0580
177	Royal Garden	Residential	3	64	224	0.0375
178	Residential Area Near Royal Garden	Residential	3	16	56	0.0547
179	Residential Area Near Mok Tse Che Road	Residential	3	94	329	0.0846
180	Residential Area Near Mok Tse Che Road	Residential	3	195	683	0.0608
181	Residential Area Near Wo Mei Public Parking	Residential	3	40	140	0.0611
182	Industrial Area	Industrial	1	9	55	0.0305
183	Residential Area Near Greenville	Residential	3	105	368	0.0521
184	Roseville Villas	Residential	3	12	42	0.0434
185	Residential Area Near Nam Wai Road	Residential	3	26	91	0.1040
186	King River Villa	Residential	3	89	312	0.0462
187	Marina Cove	Residential	1	24	84	0.0418
188	Marina Cove	Residential	1	13	46	0.0497
189	Berkeley Bay Villa	Residential	1	17	60	0.0358
190	Industrial Area	Industrial	1	44	234	0.0300
191	Residential Area Near Luk Mei Tsuen Road	Residential	3	10	35	0.1065
192	Residential Area Near Luk Mei Tsuen Industrial Area	Residential	1	9	32	0.1094
193	Industrial Area	Industrial	1	5	36	0.0303

ID	Name	Type	Floor	Unit	Projected Population	Population Density
194	Marina Cove	Residential	1	58	203	0.0290
195	Marina Cove	Residential	1	33	116	0.0364
196	Marina Cove	Residential	1	18	63	0.0392
197	Marine Cove	Residential	1	5	18	0.0398
198	Marine Cove	Residential	1	7	25	0.0257
199	Residential Area Near Pak Wai	Residential	1	5	18	0.0486
200	Industrial Area	Industrial	1	18	190	0.0300
201	Residential Area Near Luk Mei Lane	Residential	3	30	105	0.0339
202	Residential Area Near Luk Mei Lane	Residential	3	42	147	0.0780
203	Residential Area Near Luk Cheung Road	Residential	3	31	109	0.0252
204	Residential Area Near Villa Royale	Residential	3	24	84	0.1050
205	Dynasty Lodge	Residential	3	13	46	0.0759
206	Residential Area Near Mok Tse Che Road	Residential	3	6	21	0.1795
207	A/SK-HC/340 Planned Area	Residential	6	48	168	0.0132
208	A/SK-HC/316 Planned Area	Residential	3	15	53	0.0089
300	Construction Site of Planned Development	Construction Site	1	1	100	0.0152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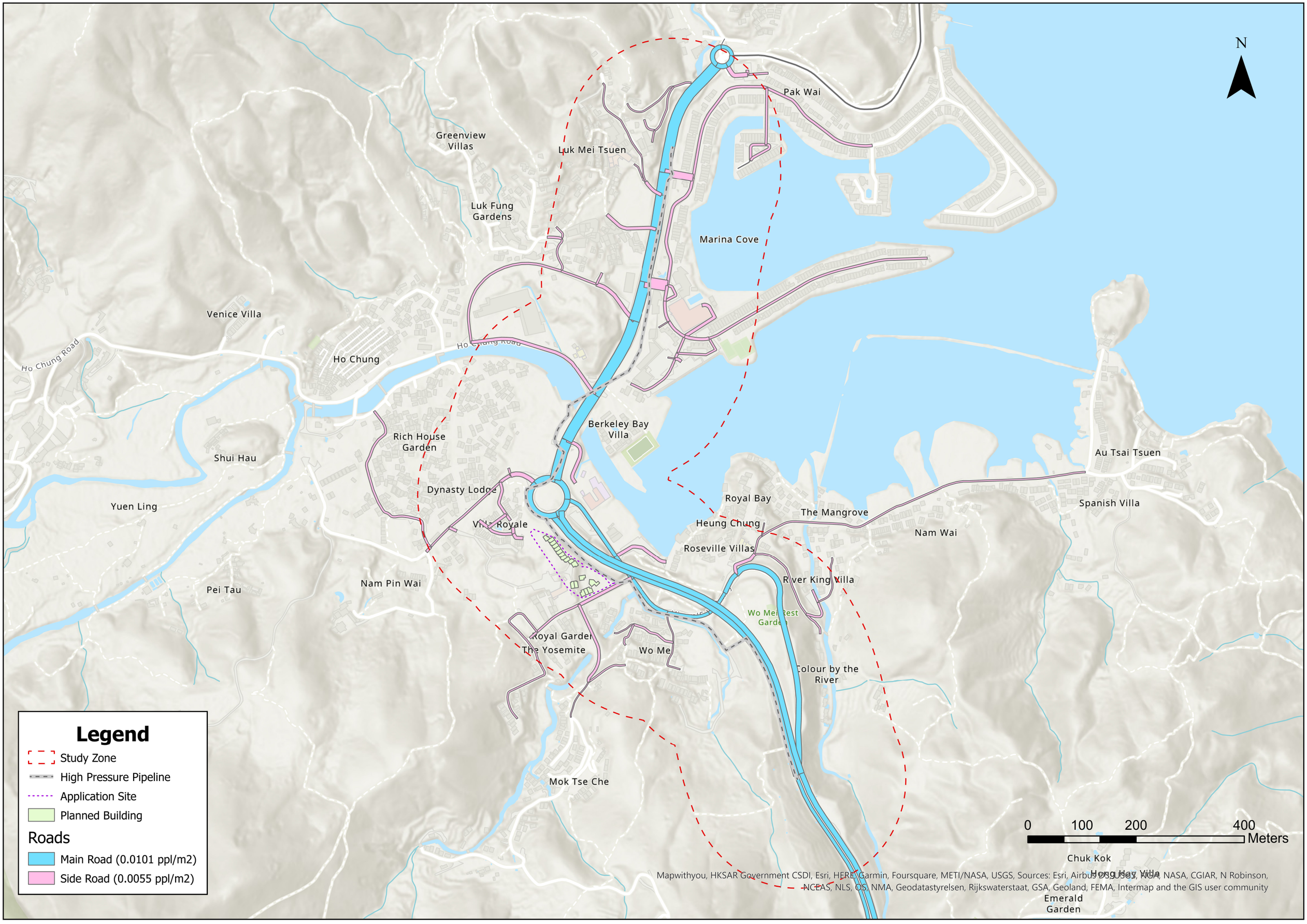
Greenview Villas
Luk Mei Tsuen
Pak Wai
Luk Fung Gardens
Marina Cove
Hiram's Highway
Venice Villa
Ho Chung Road
Ho Chung
Rich House Garden
Berkeley Bay Villa
Au Tsai Tsuen
Shui Hau
Dynasty Lodge
Royal Bay
The Mangrove
Spanish Villa
Yuen Ling
Villa Royale
Heung Chung
Nam Wai
Roseville Villas
River King Villa
Pei Tau
Nam Pin Wai
Wo Me West Garden
Royal Garden
The Yosemite
Wo Me
Colour by the River
Mok Tse Che
Chuk Kok
Hong Hay Villa
Emerald Garden
Legend
Study Zone
High Pressure Pipeline
Application Site
Planned Building
Pedestrian
Nam Wai Road (0.0033 ppl/m2)
Near Industrial Area (0.0033 ppl/m2)
Ho Chung Village (0.0048 ppl/m2)
Near Planned Development Area (0.0082 ppl/m2)
Marina Cove (0.0133 ppl/m2)
0 100 200 400
Meters
Esri, NASA, NGA, USGS, Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS


N
Pak Wai
Greenview Villas
Luk Mei Tsuen
Luk Fung Gardens
Marina Cove
Venice Villa
Ho Chung Road
Ho Chung
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Berkeley Bay Villa
Shui Hau
Dynasty Lodge
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Heung Chung
Au Tsai Tsuen
Spanish Villa
Nam Wai
Roseville Villas
River King Villa
Nam Pin Wai
Pei Tau
Royal Garden
The Yosemite
Wo Mei
Colour by the River
Mok Tse Che
Chuk Kok
Emerald Garden
0
100
200
400
Meters
Legend
Study Zone
High Pressure Pipeline
Application Site
Planned Building
Roads
Main Road (0.0101 ppl/m2)
Side Road (0.0055 ppl/m2)
Mapwithyou, HKSAR Government CSDI, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

5017 - Clear Water Bay Rd (from On Sau Road to Hiram's Highway)

Design Speed 50 km/hr

	East Bound	West Bound	Total
A.A.D.T	13800	13920	27720
AM Peak Hour	720	1070	1790
% of vehicle at AM Peak			

Weighted average 3.1455 ppl/veh

	MC	PC	Taxi	PrivateLB	PLB	LGV	HGV	Non-Fr. Bus	SD	DD
0800-0900 Peak Hour	Motor cycle	Private Car	Taxi	Private LB	PLB	Light Goods vehicle	M&H Goods vehicle	Non Fr. Bus	Fr. Bus (SD)	Fr. Bus (DD)
Pro (%)	6.9	58.9	9.4	0.6	5.7	14.1	1.8	1.5	0	1.2
Ocp	1.1	1.3	2	3.5	16.4	1.8	1.5	24.3	0	42.9

TPEDM 2019

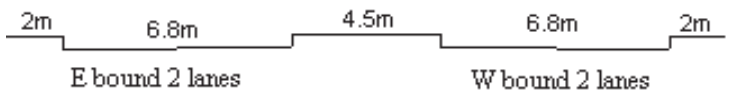
Year	2019		2026		2031	
	Population	Employment	Population	Employment	Population	Employment
Summary By Sub-Region:						
Southeast New Territories	68900	27250	65800	27750	59750	28100

Growth rate: **-1.18** %

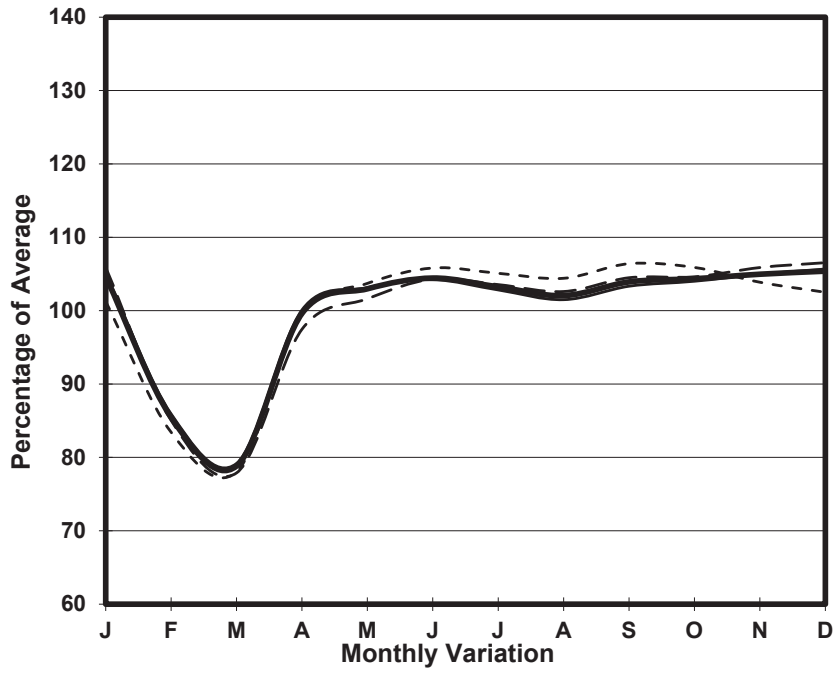
YEAR 2022

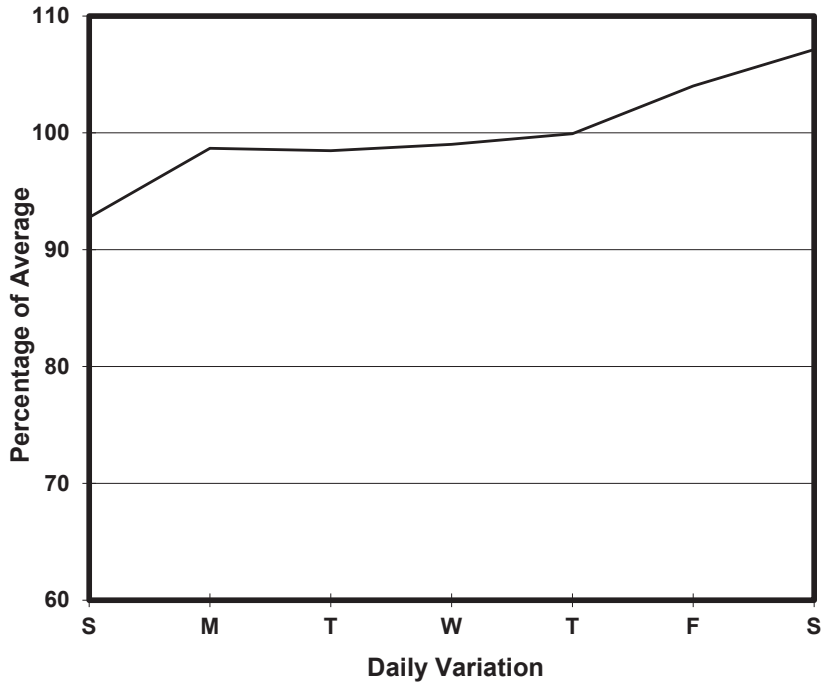
LINK CLEAR WATER BAY RD (from ON SAU RD to HIRAM'S HIGHWAY)

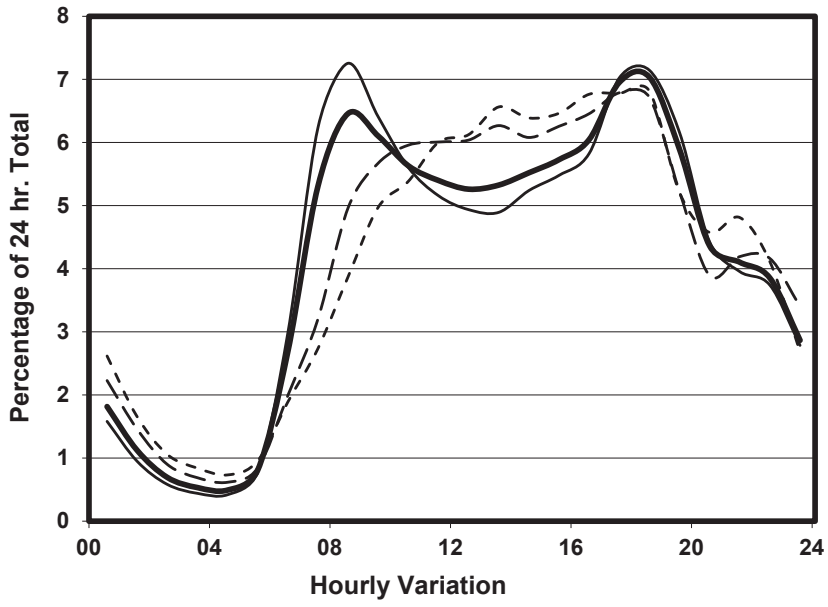
CORE STATION 5017
ROAD NETWORK MAJOR
ROAD TYPE RURAL ROAD

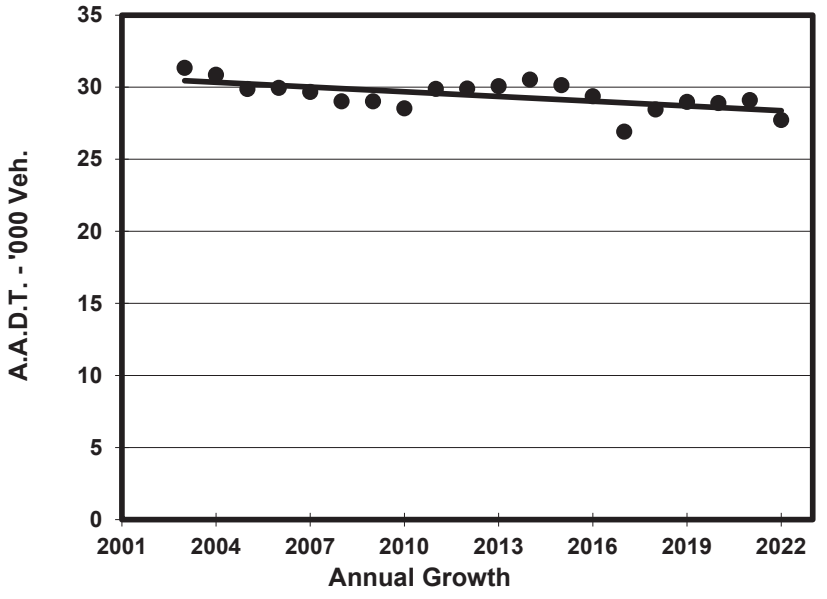


1. TRAFFIC FLOW VARIATION AND GROWTH









All day Mon.- Fri. Sat. Sun.

2. TRAFFIC CHARACTERISTICS (BY DIRECTION)

Parameter	All - Day	Mon. - Fri.	Sat.	Sun.
EAST BOUND				
A.A.D.T.	13800	13840	14780	12960
R 12 / 24 - %	66.5	66.1	67.5	67.5
R 16 / 24 - %	88.7	89.4	87.2	87
AM Peak Hour	0800-0900	0800-0900	0900-1000	0900-1000
One-way flow at AM peak hour	720	780	740	590
T - % (AM)	-	5.9	-	-
PM Peak Hour	1800-1900	1800-1900	1800-1900	1600-1700
One-way flow at PM peak hour	1050	1130	970	880
T - % (PM)	-	2.7	-	-
Prop.of commercial vehicles - 16 hr.	-	5	-	-
WEST BOUND				
A.A.D.T.	13920	13980	15070	12860
R 12 / 24 - %	75	76.3	73.3	70.3
R 16 / 24 - %	89.2	89.6	88.5	88.2
AM Peak Hour	0800-0900	0800-0900	0900-1000	0900-1000
One-way flow at AM peak hour	1070	1240	950	700
T - % (AM)	-	3.1	-	-
PM Peak Hour	1700-1800	1700-1800	1700-1800	1800-1900
One-way flow at PM peak hour	1000	1010	1070	980
T - % (PM)	-	4	-	-
Prop.of commercial vehicles - 16 hr.	-	4	-	-

3. OTHER INFORMATION AND COMMENT

4. Vehicle classification and occupancy - Monday to Friday

Time		Class of vehicle									
		Motor Cycle	Private Car	Taxi	Private LB	PLB	Goods veh.		Non Fr. Bus	Fr. Bus	
							Light	M & H		SD	DD
0700-0800	Pro	5.5	66.3	7.6	1.3	6.9	8.4	1.3	1.7	0.0	0.9
	Ocp	1.2	1.5	1.8	6.4	17.2	1.4	1.0	16.3	0.0	44.5
0800-0900	Pro	6.9	58.9	9.4	0.6	5.7	14.1	1.8	1.5	0.0	1.2
Peak hour	Ocp	1.1	1.3	2.0	3.5	16.4	1.8	1.5	24.3	0.0	42.9
0900-1000	Pro	2.7	62.2	10.2	0.2	6.2	11.8	3.8	2.0	0.0	1.0
	Ocp	1.1	1.4	2.0	1.0	16.8	1.5	1.1	5.5	0.0	38.0
1000-1100	Pro	4.3	52.4	10.7	1.0	8.1	18.6	2.9	1.2	0.0	1.0
	Ocp	1.0	1.4	1.9	2.8	13.5	1.4	1.1	1.4	0.0	37.3
1100-1200	Pro	3.0	54.0	10.0	1.9	7.8	17.8	2.4	1.9	0.0	1.1
	Ocp	1.0	1.5	2.1	1.4	11.7	1.4	1.0	1.0	0.0	40.1
1200-1300	Pro	2.6	51.7	11.8	1.8	9.0	18.8	2.1	1.0	0.0	1.3
	Ocp	1.2	1.3	1.9	6.4	11.1	1.5	1.3	20.5	0.0	32.3
1300-1400	Pro	4.9	50.4	12.6	1.5	6.7	19.0	3.1	0.5	0.0	1.2
	Ocp	1.1	1.5	1.8	9.3	12.5	1.7	1.2	3.0	0.0	41.3
1400-1500	Pro	4.3	48.4	13.3	1.7	5.8	18.6	4.6	1.7	0.0	1.5
	Ocp	1.1	1.4	1.9	1.7	14.2	1.4	1.3	1.5	0.0	31.4
1500-1600	Pro	5.1	52.5	12.5	1.4	6.0	16.1	4.3	0.7	0.0	1.2
	Ocp	1.0	1.3	2.0	4.0	14.8	1.5	1.4	8.0	0.0	36.9
1600-1700	Pro	2.0	56.0	16.6	1.1	6.1	13.4	2.9	0.7	0.0	1.2
	Ocp	1.1	1.4	1.6	2.0	14.7	1.6	1.4	14.7	0.0	50.9
1700-1800	Pro	8.6	56.7	9.9	1.8	5.4	13.5	1.0	2.0	0.0	1.1
	Ocp	1.1	1.5	2.0	2.0	17.4	1.4	1.0	2.6	0.0	51.6
1800-1900	Pro	5.2	67.7	9.2	0.0	6.5	7.7	1.0	1.5	0.0	1.2
	Ocp	1.1	1.5	2.1	0.0	18.4	1.1	1.0	33.6	0.0	51.4
1900-2000	Pro	9.7	61.5	10.8	0.0	8.2	7.1	1.1	0.4	0.0	1.2
	Ocp	1.1	1.4	1.9	0.0	13.5	1.5	1.2	6.5	0.0	39.1
2000-2100	Pro	5.9	60.7	18.4	0.0	7.4	5.0	0.6	0.6	0.0	1.4
	Ocp	1.2	1.3	1.9	0.0	11.2	1.5	2.0	3.5	0.0	18.8
2100-2200	Pro	3.8	60.5	18.1	0.0	8.5	6.5	0.3	1.0	0.0	1.2
	Ocp	1.2	1.5	1.9	0.0	13.3	1.3	1.0	1.3	0.0	19.6
2200-2300	Pro	4.9	59.5	18.8	0.0	6.8	8.0	0.0	0.6	0.0	1.4
	Ocp	1.3	1.6	1.9	0.0	12.0	1.5	0.0	2.5	0.0	23.6
16 hours	Pro	5.1	58.0	12.0	0.9	6.8	12.8	2.1	1.2	0.0	1.2
	Ocp	1.1	1.4	1.9	3.9	14.4	1.5	1.2	10.8	0.0	38.5

Legend: Pro. Proportion of vehicles in % (Sum may not add up to 100% due to figure rounding)*
Ocp. Average occupancy of vehicles including both driver and passengers*
M&H Medium and Heavy
* All traffic data are collected from combined bounds

Appendix C

Failure Frequencies

Failure	Hole Size	Orientation	Immediate Ignition	Delayed Ignition	Consequence	Proportion	Event Frequency
1.00E-05	Leak - 100 mm	Vertical	Yes		Vertical Jet Fire	0.0067	6.65E-08
	0.19	0.5	0.07				
			No	Yes	Flash Fire	0.0329	3.29E-07
			0.93	0.372			
				No	Toxic Release	0.0555	5.55E-07
				0.628			
		Inclined	Yes		Inclined Jet Fire	0.0067	6.65E-08
		0.5	0.07				
			No	Yes	Flash Fire	0.0329	3.29E-07
			0.93	0.372			
				No	Toxic Release	0.0555	5.55E-07
				0.628			
	Leak - 50 mm	Vertical	Yes		Vertical Jet Fire	0.0105	1.05E-07
	0.30	0.5	0.07				
			No	Yes	Flash Fire	0.0519	5.19E-07
			0.93	0.372			
				No	Toxic Release	0.0876	8.76E-07
				0.628			
		Inclined	Yes		Inclined Jet Fire	0.0105	1.05E-07
		0.5	0.07				
			No	Yes	Flash Fire	0.0519	5.19E-07
			0.93	0.372			
				No	Toxic Release	0.0876	8.76E-07
				0.628			
	Leak -25 mm	Vertical	Yes		Vertical Jet Fire	0.0105	1.05E-07
	0.30	0.5	0.07				
			No	Yes	Flash Fire	0.0519	5.19E-07
			0.93	0.372			
				No	Toxic Release	0.0876	8.76E-07
				0.628			
		Inclined	Yes		Inclined Jet Fire	0.0105	1.05E-07
		0.5	0.07				
			No	Yes	Flash Fire	0.0519	5.19E-07
			0.93	0.372			
				No	Toxic Release	0.0876	8.76E-07
				0.628			
	Leak -10 mm	Vertical	Yes		Vertical Jet Fire	0.0010	1.00E-08
	0.20	0.5	0.01				
			No	Yes	Flash Fire	0.0392	3.92E-07
			0.99	0.396			
				No	Toxic Release	0.0598	5.98E-07
				0.604			
		Inclined	Yes		Inclined Jet Fire	0.0010	1.00E-08
		0.5	0.01				
			No	Yes	Flash Fire	0.0392	3.92E-07
			0.99	0.396			
				No	Toxic Release	0.0598	5.98E-07
				0.604			
	Full Bore		Yes		Fireball	0.0030	3.00E-08
	0.01		0.3				
			No	Yes	Flash Fire	0.0020	1.96E-08
			0.7	0.28			
				No	Toxic Release	0.0050	5.04E-08
				0.72			

Appendix D

Input Parameters and
Consequence Results

Audit Number: 74777
Date: 12/7/2023 Time: 12:01 PM

Input Report

Workspace: NPW_Safeti_pipeline_20231207_consequence data

Study

Study
NPW_Safeti_pipeline_20231207_consequence data

Tab	Group	Field	Value	Units
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
Dispersion	Distances of interest	Distances of interest		m

Scenario group

Scenario group
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline

Tab	Group	Field	Value	Units
Scenario group	Sum of probabilities for the scenario group	Probability	1.0032	fraction

CO Toxicity Vertical

Pressure vessel
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value	Units
Material	Material	Material	CARBON MONOXIDE	
		Specify volume inventory?	No	
		Mass inventory	26403	kg
		Volume inventory	650.826	m3
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
	Phase	Specified condition	Pressure/temperature	

Tab	Group	Field	Value	Units
		Temperature	25	degC
		Pressure (gauge)	35	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Risk	Type of risk effects to model	Jet fire modelling for horizontal releases	Horizontal jet only	
		Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Fraction of ignition probability for immediate ignition	0.3	
		Release type for CLA / UKOOA		
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m

Tab	Group	Field	Value	Units
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	650.826	m3
		Tank vapour volume	650.826	m3
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0.1	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	None	
		Wind or release angle from North	0	deg
		Handling of droplets	Trapped	

Tab	Group	Field	Value	Units
		Indoor mass modification factor	3	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
	Threshold concentration (N.B. Concentrations based on mixture rather than toxic component(s))	Threshold concentration	1E+06	ppm
		Minimum fatality if threshold concentration reached	0	fraction
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC

Tab	Group	Field	Value	Units
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.023 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	

Tab	Group	Field	Value	Units
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.023, 0.023	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0598	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	

| Tab | Group | Field | Value | Units |

Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
Tab	**Group**	**Field**	**Value**	**Units**
		Fireball maximum exposure duration	30	s

	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.144 kg/s Release Rate

User defined source

NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.144, 0.144	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0876	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units

	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
Tab	**Group**	**Field**	**Value**	**Units**
		Intensity levels	4, 12.5, 37.5	kW/m2

		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.576 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.576, 0.576	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0876	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	

		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	

Tab	Group	Field	Value	Units
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction

	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

2.3 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	2.3, 2.3	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius	0.5, 0.5	m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0555	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
Tab	Group	Field	Value	Units

		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

20.72 kg/s Release Rate_No direction

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Catastrophic rupture	
		The number of release observers	1	
	Release observers	Release time	0	s
		Release phase	Vapour	
		Mass flow	26403	kg/s
		Final velocity	330	m/s
		Final temperature	25	degC
		Liquid fraction	0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.005	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
Tab	Group	Field	Value	Units

		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

CO Toxicity Inclined

Pressure vessel
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value	Units
Material	Material	Material	CARBON MONOXIDE	
		Specify volume inventory?	No	
		Mass inventory	26403	kg
		Volume inventory	650.826	m3
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
	Phase	Specified condition	Pressure/temperature	
		Temperature	25	degC
		Pressure (gauge)	35	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Risk	Type of risk effects to model	Jet fire modelling for horizontal releases	Horizontal jet only	
		Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Fraction of ignition probability for immediate ignition	0.3	
		Release type for CLA / UKOOA		
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	1	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
Tab	**Group**	**Field**	**Value**	**Units**

		Outdoor release angle	45	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	650.826	m3
		Tank vapour volume	650.826	m3
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
Tab	**Group**	**Field**	**Value**	**Units**

	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	None	
		Wind or release angle from North	0	deg
		Handling of droplets	Trapped	
		Indoor mass modification factor	3	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
	Threshold concentration (N.B. Concentrations based on mixture rather than toxic component(s))	Threshold concentration	1E+06	ppm
		Minimum fatality if threshold concentration reached	0	fraction
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
Tab	**Group**	**Field**	**Value**	**Units**

		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
Tab	**Group**	**Field**	**Value**	**Units**

Pool fire maximum exposure duration	20		s

0.023 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.023, 0.023	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0598	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	
		Immediate ignition probability		fraction

Tab	Group	Field	Value	Units
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
Tab	**Group**	**Field**	**Value**	**Units**
	Vapour liquid method	Use explosion mass modification factor	Yes	

		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2

Tab	Group	Field	Value	Units
		Probit levels	2.73, 3.72, 7.5	

		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.144 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.144, 0.144	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0876	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
Tab	**Group**	**Field**	**Value**	**Units**
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	

		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	

Tab	Group	Field	Value	Units
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	

		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	

Tab	Group	Field	Value	Units
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	

		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.576 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.576, 0.576	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0876	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
Tab	**Group**	**Field**	**Value**	**Units**
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	

		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
Tab	**Group**	**Field**	**Value**	**Units**
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	

		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	

Tab	Group	Field	Value	Units
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	

		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

2.3 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\CO Toxicity Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	2.3, 2.3	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius	0.5, 0.5	m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0555	fraction
Tab	**Group**	**Field**	**Value**	**Units**
	Type of risk effects to model	Reduce risks for mounded / underground tanks	No	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Stationary - use material reactivity	

		Immediate ignition probability		fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Calculate minimum probability of delayed ignition	
		Minimum probability of delayed ignition		fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	CARBON MONOXIDE	
		Type of risk effects to model	Toxic and flammable	
Dispersion	Dispersion scope	Concentration of interest	3696	ppm
		Averaging time for concentration of interest	Toxic	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
Tab	**Group**	**Field**	**Value**	**Units**
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	

		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Tab	**Group**	**Field**	**Value**	**Units**
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	

		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

Underground Pipe Flashfire Vertical

Pressure vessel
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value	Units
Material	Material	Material	TOWNGAS	
		Specify volume inventory?	No	
		Mass inventory	26403	kg
		Volume inventory	1351.68	m3
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
	Phase	Specified condition	Pressure/temperature	
		Temperature	25	degC
		Pressure (gauge)	35	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Risk	Type of risk effects to model	Jet fire modelling for horizontal releases	Horizontal jet only	
		Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
Tab	**Group**	**Field**	**Value**	**Units**
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition	Fraction of ignition probability for	0.3	

	modelling	immediate ignition		
		Release type for CLA / UKOOA		
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	1351.68	m3
		Tank vapour volume	1351.68	m3
Tab	**Group**	**Field**	**Value**	**Units**
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	

Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	None	
		Wind or release angle from North	0	deg
		Handling of droplets	Trapped	
		Indoor mass modification factor	3	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction

Tab	Group	Field	Value	Units
	Threshold concentration (N.B. Concentrations based on mixture rather than toxic component(s))	Threshold concentration	1E+06	ppm
		Minimum fatality if threshold concentration reached	0	fraction
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	

		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	

Tab	Group	Field	Value	Units
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	

	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.41 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.41, 0.41	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
Tab	**Group**	**Field**	**Value**	**Units**
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0392	fraction
	Type of risk effects to model	Reduce risks for mounded / underground	Yes	

		tanks		
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
Tab	**Group**	**Field**	**Value**	**Units**
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction

Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
Tab	**Group**	**Field**	**Value**	**Units**
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	

		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

2.59 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	2.59, 2.59	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
Tab	**Group**	**Field**	**Value**	**Units**
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0519	fraction

	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Use conditional probability	
		Conditional explosion probability	1	fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	

Tab	Group	Field	Value	Units
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	

		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
Tab	**Group**	**Field**	**Value**	**Units**
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	

		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

10.36 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	10.36, 10.36	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
Tab	**Group**	**Field**	**Value**	**Units**
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in	Event probability	0.0519	fraction

	this group)			
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	

Tab	Group	Field	Value	Units
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	

		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
Tab	**Group**	**Field**	**Value**	**Units**
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction

Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

41.4 kg/s Release rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
	Release observers	The number of release observers	2	
		Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	41.4, 41.4	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
Tab	**Group**	**Field**	**Value**	**Units**
		Droplet diameter	5, 5	um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of	Event probability	0.0329	fraction

	this event compared with others in this group)			
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time	30	s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
Tab	**Group**	**Field**	**Value**	**Units**
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	

		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	

Tab	Group	Field	Value	Units
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2

		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

372.95 kg/s Release rate_no direction

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Vertical

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Catastrophic rupture	
		The number of release observers	1	
	Release observers	Release time	0	s
		Release phase	Vapour	
		Mass flow	26403	kg/s
		Final velocity	435.31	m/s
Tab	**Group**	**Field**	**Value**	**Units**
		Final temperature	25	degC
		Liquid fraction	0	fraction
		Droplet diameter	5	um
		Pool radius		m
		Pre-dilution air rate	0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	90	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm

Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.005	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time	30	s
Tab	**Group**	**Field**	**Value**	**Units**
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction

	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	

Tab	Group	Field	Value	Units
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	

		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

Underground Pipe Flashfire Inclined

Pressure vessel
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value	Units
Material	Material	Material	TOWNGAS	
		Specify volume inventory?	No	
		Mass inventory	26403	kg
		Volume inventory	1351.68	m3
Tab	**Group**	**Field**	**Value**	**Units**
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
	Phase	Specified condition	Pressure/temperature	
		Temperature	25	degC
		Pressure (gauge)	35	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Risk	Type of risk effects to model	Jet fire modelling for horizontal releases	Horizontal jet only	
		Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	

		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Fraction of ignition probability for immediate ignition	0.3	
		Release type for CLA / UKOOA		
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
Tab	**Group**	**Field**	**Value**	**Units**
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	1351.68	m3

		Tank vapour volume	1351.68	m3
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	None	
Tab	**Group**	**Field**	**Value**	**Units**
		Wind or release angle from North	0	deg
		Handling of droplets	Trapped	
		Indoor mass modification factor	3	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction

	Threshold concentration (N.B. Concentrations based on mixture rather than toxic component(s))	Threshold concentration	1E+06	ppm
		Minimum fatality if threshold concentration reached	0	fraction
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s

Tab	Group	Field	Value	Units
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	

	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

0.41 kg/s Release Rate

User defined source

NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	0.41, 0.41	kg/s
		Final velocity	330, 330	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg

	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0392	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	

Tab	Group	Field	Value	Units
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure	0.05	fraction

		time calculation		
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction

Tab	Group	Field	Value	Units
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	

		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

2.59 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	2.59, 2.59	kg/s
		Final velocity	435.31, 435.31	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	

	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0519	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Use conditional probability	
		Conditional explosion probability	1	fraction
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	

		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	

Tab	Group	Field	Value	Units
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction

	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

10.36 kg/s Release Rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	10.36, 10.36	kg/s
		Final velocity	435.31, 435.31	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter		um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0519	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
Tab	Group	Field	Value	Units

		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

41.4 kg/s Release rate

User defined source
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Underground Pipe Flashfire Inclined

Tab	Group	Field	Value	Units
Scenario	Release scenario	Release scenario	Leak	
		The number of release observers	2	
	Release observers	Release time	0, 1800	s
		Release phase	Vapour, Vapour	
		Mass flow	41.4, 41.4	kg/s
		Final velocity	435.31, 435.31	m/s
		Final temperature	25, 25	degC
		Liquid fraction	0, 0	fraction
		Droplet diameter	5, 5	um
		Pool radius		m
		Pre-dilution air rate	0, 0	kg/s
		Downstream calculation status	No errors detected	
	Release location	Elevation	0	m
		Tank head	0	m
	Direction	Outdoor release direction	Angled from horizontal impinged	
		Outdoor release angle	45	deg
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
	Jet fire Miller model hole size	Orifice diameter	0	mm
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0329	fraction
	Type of risk effects to model	Reduce risks for mounded / underground tanks	Yes	
	Non-ignition probabilities	Specify probability of non-ignition	Calculate non-ignition probability	
		Non-ignition probability		fraction
	Immediate ignition probabilities	Probability of immediate ignition	Specify directly	
		Immediate ignition probability	0	fraction
	Delayed ignition probabilities	Specify minimum probability of delayed ignition	Use minimum probability of delayed ignition	
		Minimum probability of delayed ignition	1	fraction
		Specify conditional explosion probability	Calculate conditional probability	
		Conditional explosion probability		fraction

Tab	Group	Field	Value	Units
	Cox-Lees-Ang and UKOOA ignition modelling	Release type for CLA / UKOOA		
Material	Material	Material characteristics	Toxic and flammable	
		Material to track	TOWNGAS	
		Type of risk effects to model	Flammable only	
Dispersion	Dispersion scope	Concentration of interest	1200	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time	30	s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
	Exposure time data	Set averaging time equal to exposure time	Use a fixed averaging time	
		Cut-off fraction of toxic load for exposure time calculation	0.05	fraction
		Cut-off concentration for exposure time calculations	0	fraction
	Toxic contours	Number of toxic levels	1	
		Dose levels	1.3E+07	
		Probit levels	3	
		Lethality levels	0.1	fraction
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
Tab	**Group**	**Field**	**Value**	**Units**

		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.0001, 0.01, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	30	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

10mm leak (Jet Fire) vertical

Standalones
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value
Material	Material	Material	TOWNGAS

10mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\10mm leak (Jet Fire) vertical

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	90	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	0.41439	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.0536558	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.001	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	

		Flame-shape adjustment if grounded	Yes	
Tab	**Group**	**Field**	**Value**	**Units**
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Cross-section (YZ plane)	
	Contour footprint	Height above origin	2	m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis	0	m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

25mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\10mm leak (Jet Fire) vertical

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	90	deg
		Jet direction	Vertical	

		Rotation about the z-axis (anti-clockwise from the east)	0	deg
Tab	**Group**	**Field**	**Value**	**Units**
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	2.58991	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.134139	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0105	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Cross-section (YZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
Tab	**Group**	**Field**	**Value**	**Units**

	Contour cross-section	Distance along the x-axis	0	m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

50mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\10mm leak (Jet Fire) vertical

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	90	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	10.3596	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.268277	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0105	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Tab	**Group**	**Field**	**Value**	**Units**

Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Side view (XZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis		m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

100mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\10mm leak (Jet Fire) vertical

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m

	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	90	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	41.4	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.536305	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0067	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
Tab	**Group**	**Field**	**Value**	**Units**
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Side view (XZ plane)	

	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis		m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

Full bore

Standalones
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value
Material	Material	Material	TOWNGAS

Fireball

Fireball
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Full bore

Tab	Group	Field	Value	Units
Fireball	Released mass	Released mass	11000	kg
		Vapour mass fraction	1	fraction
	Burst pressure	Supply burst pressure - gauge	Yes	
		Burst pressure - gauge	35	bar
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame surface emissive power		kW/m2
	Flame shape definition	Fireball radius		m
Tab	**Group**	**Field**	**Value**	**Units**
		Fireball duration		s
		Use shape correlation	Use Correlation	

Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.003	fraction
Fireball parameters	Radiation levels	Number of input radiation levels	3	
		Intensity levels	38.6, 26.5	kW/m2
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	9.34	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Side view (XZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis	0	m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

Jet Fire inclined

Standalones
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group

Tab	Group	Field	Value
Material	Material	Material	TOWNGAS

10mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Jet Fire inclined

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	45	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	0.41439	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.0536558	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.001	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg

Tab	Group	Field	Value	Units
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	

		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Cross-section (YZ plane)	
	Contour footprint	Height above origin	2	m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis	0	m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

25mm leak (Jet Fire) - Jet fire

Jet fire

NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Jet Fire inclined

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	45	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	2.58991	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
Tab	**Group**	**Field**	**Value**	**Units**
		Expanded diameter	0.134139	m
		Orifice diameter	0	mm
		Flame length	0	m

		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0105	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Cross-section (YZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis	0	m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
Tab	**Group**	**Field**	**Value**	**Units**
		Y		m
		Z		m

50mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Jet Fire inclined

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	45	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
		Mass discharge rate	10.36	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC
		Jet velocity	330	m/s
		Expanded diameter	0.268282	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0105	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
Tab	**Group**	**Field**	**Value**	**Units**
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg

		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Side view (XZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis		m
	User-defined contour plane origin	X		m
		Y		m
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m
		Y		m
		Z		m

100mm leak (Jet Fire) - Jet fire

Jet fire
NPW_Safeti_pipeline_20231207_consequence data\Study\Underground Pipeline\Scenario group\Jet Fire inclined

Tab	Group	Field	Value	Units
Jet fire	Release location	Elevation of discharge point	0	m
	Jet fire model	Jet fire method	Cone model	
	Release orientation	Inclination of jet from horizontal	45	deg
		Jet direction	Vertical	
		Rotation about the z-axis (anti-clockwise from the east)	0	deg
	Release characteristics	Calculate jet velocity?	Given jet velocity	
Tab	**Group**	**Field**	**Value**	**Units**
		Mass discharge rate	41.4	kg/s
		Two-phase release?	No	
		Post-expansion liquid fraction	0	fraction
		Post-expansion jet temperature	25	degC

		Jet velocity	330	m/s
		Expanded diameter	0.536305	m
		Orifice diameter	0	mm
		Flame length	0	m
		Use flame length correlation?	Do not calculate flame length	
		Calculate the expanded diameter?	Calculate expanded diameter	
Risk	Event probability (probability of this event compared with others in this group)	Event probability	0.0067	fraction
	Directional probabilities for risk	Directional probabilities for risk and 3D effects	Use wind rose probabilities	
Jet fire parameters	Radiation levels	Number of input radiation levels	5	
		Intensity levels	38.6, 26.5	kW/m2
	Cone model data	Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
	Exposure duration	Jet fire maximum exposure duration	20	s
Wind direction	Wind direction	Wind direction	270	deg
		Wind orientation about the z-axis (anti-clockwise from the East)	0	deg
Calculations	Type of results required	Radiation at a point	No	
		Radiation vs distance	No	
		Radiation ellipse	No	
		Radiation contours	Yes	
Radiation contours	Display	Chart type being plotted	Side view (XZ plane)	
	Contour footprint	Height above origin		m
	Contour side view	Distance along the y-axis	0	m
	Contour cross-section	Distance along the x-axis		m
	User-defined contour plane origin	X		m
		Y		m
Tab	**Group**	**Field**	**Value**	**Units**
		Z		m
	User-defined contour plane X axis	X		m
		Y		m
		Z		m
	User-defined contour plane Y axis	X		m

		Y		m
		Z		m

Path	Scenario	Weather	Material	Material to track	Height of interest (coming from parameters) (m)	Averaging time (s)	Distance to LFL fraction (m)	Distance to LFL (m)	Distance to UFL (m)	Maximum distance (at height of interest) to LFL fraction (m)	Minimum distance (at height of interest) to LFL fraction (m)	Maximum width (at height of interest) to LFL fraction (m)	Downwind distance (at height of interest) to max width for LFL	Maximum distance (at height of interest) to LFL (m)	Minimum distance (at height of interest) to LFL) (m)	Maximum width (at height of interest) to LFL (m)	Downwind distance (at height of interest) to max width for LFL (m)	Maximum distance (at height of interest) to UFL (m)	Minimum distance (at height of interest) to UFL (m)	Maximum width (at height of interest) to UFL (m)	Downwind distance (at height of interest) to max width for UFL	Max flash fire distance for all heights (m)	Height at max flash fire distance for all heights (m)	Max flash fire width for all heights (m)	Downwind distance at max flash fire width for all heights (m)	Height at max flash fire width for all heights (m)	Min flash fire distance for all heights (m)	Height at min flash fire distance for all heights (m)	Max flash fire height (m)	Min flash fire height (m)	Max flash fire flammable mass (kg)	Max flash fire stoichiometric volume (m3)	Max flash fire depth (m)
Study\Underground Pip	0.023 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0806388	0.125873	0.0582019	0.0065209	0.125873		0.125873	0.346667	0	0.000142929	0.000400455	0.346667
Study\Underground Pip	0.023 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0982506	0.0358253	0.0361114	0.0037994	0.0358253		0.0358253	0.270584	0	0.000102199	0.00028634	0.270584
Study\Underground Pip	0.023 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0829406	0.0353722	0.0389879	0.00183534	0.0353722		0.0353722	0.188993	0	4.45611E-05	0.000124851	0.188993
Study\Underground Pip	0.023 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0985466	0.0884301	0.0515044	0.00249739	0.0884301		0.0884301	0.322277	0	0.000123165	0.000345081	0.322277
Study\Underground Pip	0.023 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0547587	0.185547	0.0666655	0.00357686	0.185547		0.185547	0.403798	0	0.000183669	0.000514601	0.403798
Study\Underground Pip	0.144 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0141614	0.223453	0.12099	0.0141614	0.223453		0.223453	0.49742	0	0.000385724	0.00108072	0.49742
Study\Underground Pip	0.144 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0407886	0.106083	0.0981998	0.0137392	0.106083		0.106083	0.378331	0	0.000707499	0.00198226	0.378331
Study\Underground Pip	0.576 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.221774	1.76875	0.298982	0.0727129	1.50803		0.921412	1.9936	0.611077	0.0222313	0.0622873	0.620671
Study\Underground Pip	0.576 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.258884	1.27698	0.298725	0.0788602	1.11847		0.431586	1.59163	0.0694558	0.0164282	0.0460282	0.724261
Study\Underground Pip	0.576 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.309313	1.01502	0.294059	0.103976	0.87782		0.329023	1.2561	0.121882	0.0125437	0.0351446	0.573635
Study\Underground Pip	0.576 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.237213	1.48361	0.300251	0.065985	1.30665		0.775766	1.86445	0.44412	0.0204923	0.0574149	0.761687
Study\Underground Pip	0.576 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.213747	1.80047	0.299091	0.0467566	1.59375		1.18033	2.28621	0.938618	0.0271428	0.0760483	0.971489
Study\Underground Pip	2.3 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.464722	3.55621	0.44303	0.330179	2.80351		1.83576	4.10339	0	0.175588	0.491959	4.10339
Study\Underground Pip	2.3 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.553683	2.69278	0.488584	0.370084	2.18934		1.09856	3.08895	0	0.128081	0.358854	2.95674
Study\Underground Pip	2.3 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.650397	2.10594	0.527107	0.405717	1.75625		0.567293	2.41967	0	0.0999431	0.280019	2.2382
Study\Underground Pip	2.3 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.5097	3.0143	0.499475	0.332851	2.45059		1.51108	3.52121	0	0.157658	0.441724	3.48579
Study\Underground Pip	2.3 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.453642	3.738	0.444763	0.351344	3.28588		2.26858	4.5103	0	0.207973	0.582696	4.5103
Study\Underground Pip	20.72 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	29.8783	29.8783	11.0527	29.8783	-29.8479	59.7209	0.173285	29.8783	-29.8479	59.7209	0.173285	11.0527	-11.0527			29.8783	0	59.7209	-0.0788626	0	-29.8479	0	29.7956	0	17713.2	49628.6	29.7956
Study\Underground Pip	20.72 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	29.9023	29.9023	11.0527	29.9023	-29.8251	59.7209	0.202752	29.9023	-29.8251	59.7209	0.202752	11.0527	-11.0527			29.9023	0	59.7209	-0.0493949	0	-29.8251	0	29.7956	0	17713.6	49629.7	29.7956
Study\Underground Pip	20.72 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	29.9367	29.9367	11.0527	29.9367	-29.7942	59.7208	0.244006	29.9367	-29.7942	59.7208	0.244006	11.0527	-11.0527			29.9367	0	59.7208	-0.00814011	0	-29.7942	0	29.7956	0	17713.5	49629.4	29.7956
Study\Underground Pip	20.72 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	29.8856	29.8856	11.0484	29.8856	-29.8127	59.6917	0.199668	29.8856	-29.8127	59.6917	0.199668	11.0484	-11.0484			29.8856	0	59.6917	-0.0513712	0	-29.8127	0	30.1602	0	17482.5	48982.2	30.1602
Study\Underground Pip	20.72 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	29.8899	29.8899	11.0542	29.8899	-29.8438	59.7281	0.182758	29.8899	-29.8438	59.7281	0.182758	11.0542	-11.0542			29.8899	0	59.7281	-0.0696465	0	-29.8438	0	29.6682	0	17813.4	49909.2	29.6682
Study\Underground Pip	0.023 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0806388	0.125873	0.0582019	0.0065209	0.125873		0.125873	0.346667	0	0.000142929	0.000400455	0.346667
Study\Underground Pip	0.023 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0982506	0.0358253	0.0361114	0.0037994	0.0358253		0.0358253	0.270584	0	0.000102199	0.00028634	0.270584
Study\Underground Pip	0.023 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0829406	0.0353722	0.0389879	0.00183534	0.0353722		0.0353722	0.188993	0	4.45611E-05	0.000124851	0.188993
Study\Underground Pip	0.023 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0985466	0.0884301	0.0515044	0.00249739	0.0884301		0.0884301	0.322277	0	0.000123165	0.000345081	0.322277
Study\Underground Pip	0.023 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0547587	0.185547	0.0666655	0.00357686	0.185547		0.185547	0.403798	0	0.000183669	0.000514601	0.403798
Study\Underground Pip	0.144 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0141614	0.223453	0.12099	0.0141614	0.223453		0.223453	0.49742	0	0.000385724	0.00108072	0.49742
Study\Underground Pip	0.144 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	n/a	n/a	n/a													0.0407886	0.106083	0.0981998	0.0137392	0.106083		0.106083	0.378331	0	0.000707499	0.00198226	0.378331
Study\Underground Pip	0.576 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.103572	0.103572	0.0408645	0.103572	0.000975275	0.164611	0.0306569	0.103572	0.000975275	0.164611	0.0306569	0.0408645	0.00114334	0.0418808	0.0306569	1.36517	1.25366	0.292831	0.92748	0.926621	-0.0937999	0.0545071	1.38486	0	0.0217609	0.0609692	0.44799
Study\Underground Pip	0.576 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.103812	0.103812	0.0408785	0.103812	0.000205318	0.174106	0.0131786	0.103812	0.000205318	0.174106	0.0131786	0.0408785	0.000342233	0.0617489	0.0131786	1.29268	1.1007	0.288495	0.853705	0.779662	0.000205318	0.137587	1.14641	0	0.0178548	0.0500254	0.438686
Study\Underground Pip	0.576 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.104174	0.104174	0.040913	0.104174	0.000248226	0.177774	0.00466459	0.104174	0.000248226	0.177774	0.00466459	0.040913	0.000369976	0.066171	0.00466459	1.11485	0.833595	0.274763	0.723524	0.595425	-0.00321549	0.15878	0.918532	0	0.013706	0.0384012	0.400845
Study\Underground Pip	0.576 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.100372	0.100372	0.0435385	0.100372	0.000327191	0.176085	0.00936932	0.100372	0.000327191	0.176085	0.00936932	0.0435385	0.000515689	0.0645944	0.00936932	1.17122	1.00677	0.29069	0.980718	0.906096	-0.0987808	0.0503387	1.11943	0	0.0191358	0.0536143	0.4306
Study\Underground Pip	0.576 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.0974496	0.0974496	n/a	0.0974496	0.00291726	0.148951	0.0518699	0.0974496	0.00291726	0.148951	0.0518699					1.12191	0.988101	0.294528	0.941449	0.929978	-0.0810172	0.0581236	1.18208	0.0103319	0.0200888	0.0562843	0.504205
Study\Underground Pip	2.3 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.20703	0.20703	0.0816583	0.20703	0.00147302	0.33231	0.0550255	0.20703	0.00147302	0.33231	0.0550255	0.0816583	0.00179774	0.0943586	0.0550255	2.86321	2.69627	0.497953	1.5556	1.56558	-0.0425974	0.0869764	2.69627	0	0.180019	0.504375	0.897048
Study\Underground Pip	2.3 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.207684	0.207684	0.0816674	0.207684	0.000374863	0.350515	0.0225372	0.207684	0.000374863	0.350515	0.0225372	0.0816674	0.00064169	0.126781	0.0225372	2.4766	2.09588	0.50774	1.57318	1.46712	-0.104605	0.139726	2.24372	0	0.13929	0.390262	0.868046
Study\Underground Pip	2.3 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.208644	0.208644	0.0817204	0.208644	0.000936129	0.34178	0.0405279	0.208644	0.000936129	0.34178	0.0405279	0.0817204	0.00116029	0.111879	0.0405279	2.19089	1.64464	0.500775	1.49174	1.23348	-0.139601	0.117474	1.7825	0	0.108997	0.305385	0.822515
Study\Underground Pip	2.3 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.200798	0.200798	0.0869318	0.200798	0.0035778	0.354974	0.0124255	0.200798	0.0035778	0.354974	0.0124255	0.0869318	0.00393788	0.132541	0.0124255	2.2835	2.10529	0.482397	0.997204	0.935686	-0.0551887	0.155948	2.14511	0	0.149011	0.417496	0.956
Study\Underground Pip	2.3 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Flammable (18.75)	0.195067	0.195067	n/a	0.195067	0.00210049	0.304407	0.0971214	0.195067	0.00210049	0.304407	0.0971214					1.63811	1.48283	0.474208	0.903521	0.926766	0.00210049	0.0926766	1.67993	0	0.108971	0.305313	0.920225
Study\Underground Pip	0.41 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													1.23105	4.06001	0.969117	0.70765	3.15965		1.92166	4.61887	0	0.128773	1.13423	4.18686
Study\Underground Pip	0.41 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													1.46109	2.50894	0.952381	0.722582	1.8838		1.10239	2.80957	0	0.072141	0.635414	2.40417
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													1.66631	1.72873	0.855499	1.03287	1.48297		0.438489	2.00808	0	0.0480169	0.42293	1.62491
Study\Underground Pip	0.41 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													1.29201	3.06353	0.995828	0.760003	2.50807		1.48973	3.54257	0	0.0979458	0.862702	3.17443
Study\Underground Pip	0.41 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													1.0438	4.53436	1.00425	0.638671	3.65434		2.64861	5.29369	0	0.161138	1.41929	5.16664
Study\Underground Pip	2.59 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													3.02318	9.52426	2.37131	1.90199	7.85857		4.28922	10.9399	0	1.83703	16.1805	9.90619
Study\Underground Pip	2.59 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													3.84939	5.95879	2.34301	1.71182	4.39227		2.19913	6.67048	0	1.05211	9.26696	5.36996
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													4.44599	4.12256	2.08316	2.04774	3.29925		1.06454	4.75596	0	0.709518	6.2494	3.46552
Study\Underground Pip	2.59 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													3.34017	6.84177	2.42768	1.6055	5.36381		3.33162	8.09153	0	1.30548	11.4986	6.94041
Study\Underground Pip	2.59 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													2.46883	9.38673	2.36146	1.31952	7.41192		5.19026	11.8565	0	2.00583	17.6673	10.9373
Study\Underground Pip	10.36 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													6.04999	18.8636	4.7305	3.15939	13.9237		8.08554	21.0268	0	13.2183	116.426	18.7764
Study\Underground Pip	10.36 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													8.02529	10.1834	4.58055	3.41321	8.48651		3.11298	12.8741	0	7.67646	67.6139	10.0365
Study\Underground Pip	10.36 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													9.44045	7.8524	4.00873	3.86898	6.19968		1.8613	9.11209	0	5.36162	47.2249	6.51276
Study\Underground Pip	10.36 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													6.95712	11.0446	4.67068	3.33892	10.0703		5.8483	14.9742	0	9.19093	80.9533	12.8783
Study\Underground Pip	10.36 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	n/a	n/a	n/a													5.12308	14.1353	4.40548	2.58495	13.2788		8.56793	20.5386	0	12.8338	113.039	19.9131
Study\Underground Pip	41.4 kg/s Release rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.807673	0.807673	0.470119	0.807673	0.00984017	1.25721	0.124153	0.807673	0.00984017	1.25721	0.124153	0.470119	0.0129826	0.70825	0.124153	27.5724	22.8693	4.70565	17.7315	17.152	-0.221667	0.635259	26.0114	0	30.4826	268.489	8.96152
Study\Underground Pip	41.4 kg/s Release rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.810059	0.810059	0.470602	0.810059	0.0213553	1.01427	0.452478	0.810059	0.0213553	1.01427	0.452478	0.470602	0.0238121	0.195035	0.452478	23.2121	18.2268	4.79906	14.6598	12.8921	-0.458338	0.444555	19.629	0	20.9629	184.641	7.95609
Study\Underground Pip	41.4 kg/s Release rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.813653	0.813653	0.471349	0.813653	0.0156124	1.1217	0.346105	0.813653	0.0156124	1.1217	0.346105	0.471349	0.0177819	0.486673	0.346105	20.4441	13.7398	4.67973	12.1028	9.71838	-0.326741	0.335116	14.9125	0	15.073	132.762	6.81359
Study\Underground Pip	41.4 kg/s Release rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.755987	0.755987	0.471255	0.755987	0.0233644	1.23616	0.182944	0.755987	0.0233644	1.23616	0.182944	0.471255	0.026692	0.681612	0.182944	21.758	18.505	4.0646	13.6457	12.6613	-0.361897	0.486973	19.4622	0	22.4318	197.578	8.89294
Study\Underground Pip	41.4 kg/s Release rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.723336	0.723336	n/a	0.723336	0.031613	0.952078	0.495784	0.723336	0.031613	0.952078	0.495784					16.3387	15.0601	2.67119	9.72781	9.63848	-0.183667	0.602405	16.2929	0	17.7001	155.902	10.3272
Study\Underground Pip	372.95 kg/s Release rat	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	50.185	50.185	25.5167	50.185	-49.7676	99.9277	0.47133	50.185	-49.7676	99.9277	0.47133	25.5167	-25.5167	51.0248	0.47133	50.185	0	99.9344	0.0386001	0	-49.7676	0	49.9113	0	19207.3	169177	49.9113
Study\Underground Pip	372.95 kg/s Release rat	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	50.5822	50.5822	25.5167	50.5822	-49.4703	99.9275	0.82561	50.5822	-49.4703	99.9275	0.82561	25.5167	-25.5167	51.032	-0.193443	50.5822	0	99.9343	0.377694	0	-49.4703	0	49.9114	0	19207.5	169179	49.9114
Study\Underground Pip	372.95 kg/s Release rat	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	51.2581	51.2581	25.5167	51.2581	-49.1052	99.9261	1.35954	51.2581	-49.1052	99.9261	1.35954	25.5167	-25.5167	51.029	0.337278	51.2581	0	99.9342	0.851259	0	-49.1052	0	49.9124	0	19207.4	169178	49.9124
Study\Underground Pip	372.95 kg/s Release rat	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	50.4504	50.4504	25.5033	50.4504	-49.4915	99.8486	0.747842	50.4504	-49.4915	99.8486	0.747842	25.5033	-25.5032	51.0036	-0.270073	50.4504	0	99.8552	0.306818	0	-49.4915	0	50.7589	0	18913.1	166586	50.7589
Study\Underground Pip	372.95 kg/s Release rat	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	50.2724	50.2724	25.5197	50.2724	-49.7027	99.9363	0.548788	50.2724	-49.7027	99.9363	0.548788	25.5197	-25.5196	51.0307	-0.469458	50.2724	0	99.9426	0.113858	0	-49.7027	0	49.7613	0	19262.3	169662	49.7613
Study\Underground Pip	0.41 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.161205	0.161205	0.0936443	0.161205	0.00275553	0.215285	0.0772254	0.161205	0.00275553	0.215285	0.0772254	0.0936443	0.0032098	0.0808422	0.0772254	4.19605	3.3231	0.94327	2.90853	2.54119	-0.0888022	0.0977381	3.6328	0	0.146357	1.28911	1.60354
Study\Underground Pip	0.41 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.162975	0.162975	0.0940192	0.162975	0.000737857	0.247474	0.0321362	0.162975	0.000737857	0.247474	0.0321362	0.0940192	0.00107051	0.137073	0.0321362	3.38127	2.02281	0.894756	2.02572	1.4834	-0.00757938	0.134854	2.25796	0	0.0829554	0.730667	1.22403
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.166298	0.166298	0.0946789	0.166298	0.000248122	0.254581	0.0138469	0.166298	0.000248122	0.254581	0.0138469	0.0946789	0.00053149	0.145512	0.0138469	2.86118	1.31873	0.805597	1.68986	1.00224	-0.06711	0.105499	1.55516	0	0.0529011	0.465951	0.973127
Study\Underground Pip	0.41 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.150579	0.150579	0.0940381	0.150579	0.00230164	0.212675	0.0816968	0.150579	0.00230164	0.212675	0.0816968	0.0940381	0.0027539	0.0731959	0.0816968	3.50074	2.49778	0.862046	2.40848	1.93377	-0.116081	0.0805735	2.71914	0	0.111543	0.982469	1.53926
Study\Underground Pip	0.41 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.143456	0.143456	0.0935224	0.143456	0.00201154	0.225083	0.0698247	0.143456	0.00201154	0.225083	0.0698247	0.0935224	0.00283085	0.101457	0.0698247	3.09295	2.77197	0.577736	0.917798	0.88703	-0.013327	0.110879	3.02955	0	0.131019	1.15401	1.98424
Study\Underground Pip	2.59 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.352647	0.352647	0.204927	0.352647	0.00442138	0.473888	0.166115	0.352647	0.00442138	0.473888	0.166115	0.204927	0.0054076	0.182128	0.166115	9.49239	8.00972	2.04935	6.10279	5.54519	-0.192173	0.205378	8.49835	0	1.64596	14.4975	3.50451
Study\Underground Pip	2.59 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.355703	0.355703	0.20565	0.355703	0.00033801	0.521433	0.107224	0.355703	0.00033801	0.521433	0.107224	0.20565	0.00116533	0.269292	0.107224	7.85049	4.98482	1.97319	5.05348	3.7723	-0.0990848	0	5.44595	0	0.972298	8.56396	2.8442
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.361042	0.361042	0.206831	0.361042	0.00199478	0.553858	0.0406002	0.361042	0.00199478	0.553858	0.0406002	0.206831	0.00264268	0.315493	0.0406002	6.77738	3.318	1.79321	3.98679	2.51363	-0.198929	0.201091	3.86097	0	0.641428	5.64967	2.26893
Study\Underground Pip	2.59 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.329906	0.329906	0.205694	0.329906	0.00817993	0.562613	0.00987517	0.329906	0.00817993	0.562613	0.00987517	0.205694	0.00925035	0.3256	0.00987517	7.93326	5.75079	1.84855	4.99721	4.15335	-0.0832788	0	6.27407	0	1.22479	10.7879	3.40303
Study\Underground Pip	2.59 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.314628	0.314628	0.204403	0.314628	0.00973211	0.51211	0.128049	0.314628	0.00973211	0.51211	0.128049	0.204403	0.011395	0.25811	0.128049	6.85378	6.07954	1.22736	4.06234	3.90828	-0.123213	0	6.58368	0	1.35757	11.9574	4.28939
Study\Underground Pip	10.36 kg/s Release Rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.705315	0.705315	0.409907	0.705315	0.00859037	0.948476	0.331779	0.705315	0.00859037	0.948476	0.331779	0.409907	0.0105616	0.365343	0.331779	18.0412	11.392	3.97395	11.6371	10.6325	-0.255731	0.379733	16.3755	0	12.0395	106.043	6.85451
Study\Underground Pip	10.36 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.712116	0.712116	0.411606	0.712116	7.74374E-05	1.07304	0.159878	0.712116	7.74374E-05	1.07304	0.159878	0.411606	0.00158505	0.585267	0.159878	15.3227	9.6302	3.83081	9.85879	7.22265	-0.288379	0.240755	10.5107	0	7.21104	63.5145	5.43313
Study\Underground Pip	10.36 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.723121	0.723121	0.414284	0.723121	0.0113632	1.08966	0.12938	0.723121	0.0113632	1.08966	0.12938	0.414284	0.0127892	0.606711	0.12938	13.557	6.43299	3.47557	7.89561	4.86821	-0.28355	0.173865	7.41552	0	4.80249	42.3001	4.40675
Study\Underground Pip	10.36 kg/s Release Rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.662078	0.662078	0.41154	0.662078	0.00825574	0.933944	0.355076	0.662078	0.00825574	0.933944	0.355076	0.41154	0.0102312	0.32823	0.355076	15.0826	10.6754	3.58931	9.71483	7.86609	-0.253547	0.280932	11.7515	0	8.61633	75.8922	6.44596
Study\Underground Pip	10.36 kg/s Release Rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	0.631233	0.631233	0.408998	0.631233	0.0247667	1.0561	0.207982	0.631233	0.0247667	1.0561	0.207982	0.408998	0.0278437	0.564304	0.207982	12.9981	10.1895	2.44742	8.01003	7.54781	-0.342697	0.37739	12.3693	0	9.54748	84.0938	8.32285
Study\Underground Pip	41.4 kg/s Release rate	1D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	1.43111	1.43111	0.818588	1.43111	0.0318879	2.00052	0.539688	1.43111	0.0318879	2.00052	0.539688	0.818588	0.0354964	0.940644	0.539688	33.2671	15.998	7.51432	21.2591	19.6339	-0.635112	0.727182	31.7645	0	85.3728	751.96	14.2331
Study\Underground Pip	41.4 kg/s Release rate	4D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	1.44278	1.44278	0.820731	1.44278	0.025555	2.12475	0.355145	1.44278	0.025555	2.12475	0.355145	0.820731	0.0286658	1.14105	0.355145	29.4979	18.6296	7.37372	18.9256	13.7504	-0.679795	0.887125	20.2956	0	52.3409	461.016	10.4829
Study\Underground Pip	41.4 kg/s Release rate	7.5D	TOWNGAS	TOWNGAS	0	Flammable (18.75)	1.46292	1.46292	0.824392	1.46292	0.0204364	2.20758	0.177164	1.46292	0.0204364	2.20758	0.177164	0.824392	0.0230673	1.25402	0.177164	27.0157	12.6178	6.67682	15.9473	9.46338	-0.655202	0.630892	14.287	0	35.7233	314.649	8.31883
Study\Underground Pip	41.4 kg/s Release rate	3E	TOWNGAS	TOWNGAS	0	Flammable (18.75)	1.41459	1.41459	0.820806	1.41459	0.00652756	1.95794	0.611991	1.41459	0.00652756	1.95794	0.611991	0.820806	0.0102197	0.860302	0.611991	28.3552	13.6079	6.89894	18.1509	14.6159	-0.432562	0.503995	21.8651	0	58.9933	519.61	12.4314
Study\Underground Pip	41.4 kg/s Release rate	1F	TOWNGAS	TOWNGAS	0	Flammable (18.75)	1.53846	1.53846	0.815537	1.53846	0.00044607	2.14409	0.346563	1.53846	0.00044607	2.14409	0.346563	0.815537	0.00625454	1.17754	0.346563	24.4962	15.5724	4.82678	14.446	13.5412	-0.575756	0.677062	23.1118	0	65.514	577.045	16.0466

Path	Scenario	Weather	Material	Material to track	Height of interest (coming from parameters) (m)	Averaging time used for concentration of interest (s)	Maximum distance (at height of interest) to conc of interest (m)	Minimum distance (at height of interest) to conc of interest (m)	Maximum width (at height of interest) to conc of interest (m)	Downwind distance to max width (at height of interest) for conc of interest	Maximum distance (at height of interest) to ERPG1 (3600 s)	Minimum distance (at height of interest) to ERPG 1 (3600 s)	Maximum width (at height of interest) to ERPG1 (3600 s) (m)	Downwind distance (at height of interest) to max width for ERPG1	Maximum distance (at height of interest) to ERPG2 (3600 s)	Minimum distance (at height of interest) to ERPG2 (3600 s)	Maximum width (at height of interest) to ERPG2 (3600 s) (m)	Downwind distance (at height of interest) to max width (at height of interest) for ERPG2 (3600 s)	Maximum distance (at height of interest) to ERPG3 (3600 s)	Minimum distance (at height of interest) to ERPG3 (3600 s)	Maximum width (at height of interest) to ERPG3 (3600 s) (m)	Downwind distance (at height of interest) to max width for ERPG3	Maximum distance (at height of interest) to IDLH of interest (1800	Minimum distance (at height of interest) to IDLH (1800 s) (m)	Maximum width (at height of interest) to IDLH (1800 s) (m)	Downwind distance (at height of interest) to max width for IDLH	Maximum distance (at height of interest) to STEL (900 s) (m)	Minimum distance (at height of interest) to STEL (900 s) (m)	Maximum width (at height of interest) to STEL (900 s) (m)	Downwind distance (at height of interest) to max width for STEL
Study\Underground Pip	20.72 kg/s Release Rate	1D	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	108.493	-89.9276	191.151	7.90654																				
Study\Underground Pip	20.72 kg/s Release Rate	4D	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	184.46	-84.4221	191.149	18.457																				
Study\Underground Pip	20.72 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	321.439	-79.6968	191.145	37.2505																				
Study\Underground Pip	20.72 kg/s Release Rate	3E	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	174.591	-85.2526	190.935	16.1982																				
Study\Underground Pip	20.72 kg/s Release Rate	1F	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	133.948	-88.1478	191.151	12.3716																				
Study\Underground Pip	0.576 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	0.195603	-0.00237684	0.16135	0.136773																				
Study\Underground Pip	2.3 kg/s Release Rate	7.5D	CARBON MONOXIDE	CARBON MONOXIDE	0	Toxic (60)	0.387225	0.0163331	0.252842	0.323073																				
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	372.95 kg/s Release rate	1D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	372.95 kg/s Release rate	4D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	372.95 kg/s Release rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	372.95 kg/s Release rate	3E	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	372.95 kg/s Release rate	1F	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	0.41 kg/s Release Rate	4D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	10.36 kg/s Release Rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								
Study\Underground Pip	41.4 kg/s Release rate	7.5D	TOWNGAS	TOWNGAS	0	Toxic (60)																								

Path	Scenario	Weather	Material	Height of interest (coming from parameters) (m)	Flame length (m)	Flame emissive power (kW/m2)	Jet fire radiation intensity level 1	Jet fire radiation intensity level 2	Jet fire radiation intensity level 3	Distance downwind to intensity level 1 (4 kW/m2) (m)	Distance downwind to intensity level 2 (12.5 kW/m2) (m)	Distance downwind to intensity level 3 (37.5 kW/m2) (m)	Ellipse area at intensity level 1 (4 kW/m2) (m2)	Ellipse area at intensity level 2 (12.5 kW/m2) (m2)	Ellipse area at intensity level 3 (37.5 kW/m2) (m2)	Ellipse half-length to intensity level 1 (4 kW/m2) (m)	Ellipse half-length to intensity level 2 (12.5 kW/m2) (m)	Ellipse half-length to intensity level 3 (37.5 kW/m2) (m)	Ellipse half-width to intensity level 1 (4 kW/m2) (m)	Ellipse half-width to intensity level 2 (12.5 kW/m2) (m)	Ellipse half-width to intensity level 3 (37.5 kW/m2) (m)	Ellipse centre downwind distance to intensity level 1 (4 kW/m2) (m)	Ellipse centre downwind distance to intensity level 2 (12.5 kW/m2)	Ellipse centre downwind distance to intensity level 3 (37.5 kW/m2)
Study\Underground Pip	0.023 kg/s Release Rate	1D	CARBON MONOXIDE	0	2.9708	10.6807	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	4D	CARBON MONOXIDE	0	2.28809	14.4603	Parameter value	Parameter value	Parameter value	1.40797	n/a	n/a	0.376669	n/a	n/a	0.548006	n/a	n/a	0.218789	n/a	n/a	0.859962	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	1.98875	17.8422	Parameter value	Parameter value	Parameter value	2.5355	2.20599	n/a	3.91052	0.720405	n/a	1.23183	0.745542	n/a	1.0105	0.307578	n/a	1.30367	1.46045	n/a
Study\Underground Pip	0.023 kg/s Release Rate	3E	CARBON MONOXIDE	0	2.4835	12.7926	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	1F	CARBON MONOXIDE	0	2.9708	10.6807	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	1D	CARBON MONOXIDE	0	6.55592	13.4477	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	4D	CARBON MONOXIDE	0	5.04932	18.1669	Parameter value	Parameter value	Parameter value	2.74621	n/a	n/a	2.78795	n/a	n/a	1.27917	n/a	n/a	0.693755	n/a	n/a	1.46704	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	4.38874	22.9308	Parameter value	Parameter value	Parameter value	5.30425	3.62273	n/a	19.8992	0.676631	n/a	2.63266	0.762954	n/a	2.40597	0.282295	n/a	2.67159	2.85977	n/a
Study\Underground Pip	0.144 kg/s Release Rate	3E	CARBON MONOXIDE	0	5.48056	16.043	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	1F	CARBON MONOXIDE	0	6.55592	13.4477	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	1D	CARBON MONOXIDE	0	11.8705	16.1047	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	4D	CARBON MONOXIDE	0	9.14256	21.6539	Parameter value	Parameter value	Parameter value	5.28776	n/a	n/a	15.7949	n/a	n/a	2.69405	n/a	n/a	1.86621	n/a	n/a	2.5937	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	7.94647	27.8046	Parameter value	Parameter value	Parameter value	8.68583	n/a	n/a	62.4583	n/a	n/a	4.41782	n/a	n/a	4.50021	n/a	n/a	4.26801	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	3E	CARBON MONOXIDE	0	9.92337	19.1727	Parameter value	Parameter value	Parameter value	0.942307	n/a	n/a	0.488114	n/a	n/a	0.31435	n/a	n/a	0.494262	n/a	n/a	0.627957	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	1F	CARBON MONOXIDE	0	11.8705	16.1047	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	1D	CARBON MONOXIDE	0	21.4015	19.3649	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	4D	CARBON MONOXIDE	0	16.4833	25.8827	Parameter value	Parameter value	Parameter value	10.3996	n/a	n/a	83.1969	n/a	n/a	5.7739	n/a	n/a	4.58657	n/a	n/a	4.62573	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	14.3268	33.7763	Parameter value	Parameter value	Parameter value	15.5122	n/a	n/a	217.039	n/a	n/a	7.98867	n/a	n/a	8.64795	n/a	n/a	7.52351	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	3E	CARBON MONOXIDE	0	17.891	23.0382	Parameter value	Parameter value	Parameter value	4.3675	n/a	n/a	18.5612	n/a	n/a	2.6725	n/a	n/a	2.21075	n/a	n/a	1.695	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	1F	CARBON MONOXIDE	0	21.4015	19.3649	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	1D	CARBON MONOXIDE	0	2.9708	10.6807	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	4D	CARBON MONOXIDE	0	2.28809	14.4603	Parameter value	Parameter value	Parameter value	1.40797	n/a	n/a	0.376669	n/a	n/a	0.548006	n/a	n/a	0.218789	n/a	n/a	0.859962	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	1.98875	17.8422	Parameter value	Parameter value	Parameter value	2.5355	2.20599	n/a	3.91052	0.720405	n/a	1.23183	0.745542	n/a	1.0105	0.307578	n/a	1.30367	1.46045	n/a
Study\Underground Pip	0.023 kg/s Release Rate	3E	CARBON MONOXIDE	0	2.4835	12.7926	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.023 kg/s Release Rate	1F	CARBON MONOXIDE	0	2.9708	10.6807	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	1D	CARBON MONOXIDE	0	6.55592	13.4477	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	4D	CARBON MONOXIDE	0	5.04932	18.1669	Parameter value	Parameter value	Parameter value	2.74621	n/a	n/a	2.78795	n/a	n/a	1.27917	n/a	n/a	0.693755	n/a	n/a	1.46704	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	4.38874	22.9308	Parameter value	Parameter value	Parameter value	5.30425	3.62273	n/a	19.8992	0.676631	n/a	2.63266	0.762954	n/a	2.40597	0.282295	n/a	2.67159	2.85977	n/a
Study\Underground Pip	0.144 kg/s Release Rate	3E	CARBON MONOXIDE	0	5.48056	16.043	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.144 kg/s Release Rate	1F	CARBON MONOXIDE	0	6.55592	13.4477	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	1D	CARBON MONOXIDE	0	15.1129	10.4174	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	4D	CARBON MONOXIDE	0	11.6398	13.9626	Parameter value	Parameter value	Parameter value	7.56446	n/a	n/a	16.7683	n/a	n/a	3.43151	n/a	n/a	1.55544	n/a	n/a	4.13295	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	10.117	17.5803	Parameter value	Parameter value	Parameter value	10.4815	n/a	n/a	64.0087	n/a	n/a	5.0927	n/a	n/a	4.00075	n/a	n/a	5.38883	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	3E	CARBON MONOXIDE	0	12.6339	12.4256	Parameter value	Parameter value	Parameter value	2.64443	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.576 kg/s Release Rate	1F	CARBON MONOXIDE	0	15.1129	10.4174	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	1D	CARBON MONOXIDE	0	27.2473	12.5722	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	4D	CARBON MONOXIDE	0	20.9857	16.7524	Parameter value	Parameter value	Parameter value	13.7968	n/a	n/a	78.3877	n/a	n/a	6.53718	n/a	n/a	3.81687	n/a	n/a	7.25965	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	18.2402	21.3662	Parameter value	Parameter value	Parameter value	18.4694	n/a	n/a	214.675	n/a	n/a	9.08254	n/a	n/a	7.52357	n/a	n/a	9.38689	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	3E	CARBON MONOXIDE	0	22.7779	14.9756	Parameter value	Parameter value	Parameter value	7.87552	n/a	n/a	18.8804	n/a	n/a	3.08228	n/a	n/a	1.9498	n/a	n/a	4.79325	n/a	n/a
Study\Underground Pip	2.3 kg/s Release Rate	1F	CARBON MONOXIDE	0	27.2473	12.5722	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	1D	TOWNGAS	0	10.7582	40.4054	Parameter value	Parameter value	Parameter value	2.87683	n/a	n/a	8.28828	n/a	n/a	1.32	n/a	n/a	1.99866	n/a	n/a	1.5537	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	4D	TOWNGAS	0	8.28592	54.2351	Parameter value	Parameter value	Parameter value	9.40832	1.67629	n/a	100.994	n/a	n/a	5.10575	n/a	n/a	6.29629	n/a	n/a	4.30257	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	0	7.2019	68.9186	Parameter value	Parameter value	Parameter value	11.2922	7.34982	n/a	131.804	37.3066	n/a	5.8803	3.66321	n/a	7.13477	3.2417	n/a	5.41192	3.68661	n/a
Study\Underground Pip	0.41 kg/s Release Rate	3E	TOWNGAS	0	8.99357	48.1003	Parameter value	Parameter value	Parameter value	8.29476	n/a	n/a	76.3844	n/a	n/a	4.67916	n/a	n/a	5.19621	n/a	n/a	3.6156	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	1F	TOWNGAS	0	10.7582	40.4054	Parameter value	Parameter value	Parameter value	2.87683	n/a	n/a	8.28828	n/a	n/a	1.32	n/a	n/a	1.99866	n/a	n/a	1.5537	n/a	n/a
Study\Underground Pip	2.59 kg/s Release Rate	1D	TOWNGAS	0	23.5496	51.8276	Parameter value	Parameter value	Parameter value	10.7489	n/a	n/a	212.478	n/a	n/a	8.12383	n/a	n/a	8.32537	n/a	n/a	2.6251	n/a	n/a
Study\Underground Pip	2.59 kg/s Release Rate	4D	TOWNGAS	0	18.1377	69.0727	Parameter value	Parameter value	Parameter value	21.8398	7.65375	n/a	707.89	38.1169	n/a	14.1735	4.23111	n/a	15.8979	2.86757	n/a	7.66631	3.42264	n/a
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	0	15.7648	89.5712	Parameter value	Parameter value	Parameter value	24.8275	15.7627	n/a	788.161	196.333	n/a	14.2231	8.07096	n/a	17.6389	7.74315	n/a	10.6045	7.69177	n/a
Study\Underground Pip	2.59 kg/s Release Rate	3E	TOWNGAS	0	19.6868	61.6392	Parameter value	Parameter value	Parameter value	19.8369	2.21237	n/a	586.591	3.58841	n/a	13.4924	0.842683	n/a	13.8387	1.35546	n/a	6.34444	1.36969	n/a
Study\Underground Pip	2.59 kg/s Release Rate	1F	TOWNGAS	0	23.5496	51.8276	Parameter value	Parameter value	Parameter value	10.7489	n/a	n/a	212.478	n/a	n/a	8.12383	n/a	n/a	8.32537	n/a	n/a	2.6251	n/a	n/a
Study\Underground Pip	10.36 kg/s Release Rate	1D	TOWNGAS	0	42.2946	62.7422	Parameter value	Parameter value	Parameter value	25.3383	n/a	n/a	1301.48	n/a	n/a	20.5499	n/a	n/a	20.1593	n/a	n/a	4.78837	n/a	n/a
Study\Underground Pip	10.36 kg/s Release Rate	4D	TOWNGAS	0	32.575	83.1732	Parameter value	Parameter value	Parameter value	41.4503	17.0646	n/a	2929.99	251.449	n/a	29.3393	10.0485	n/a	31.7883	7.96524	n/a	12.111	7.01613	n/a
Study\Underground Pip	10.36 kg/s Release Rate	7.5D	TOWNGAS	0	28.3133	109.247	Parameter value	Parameter value	Parameter value	45.4149	28.3971	n/a	3191.65	716.781	n/a	29.1348	14.8762	n/a	34.8702	15.3372	n/a	16.2801	13.5209	n/a
Study\Underground Pip	10.36 kg/s Release Rate	3E	TOWNGAS	0	35.3571	74.6737	Parameter value	Parameter value	Parameter value	38.344	6.52047	n/a	2532.04	76.3373	n/a	28.1879	4.56909	n/a	28.593	5.3181	n/a	10.1561	1.95138	n/a
Study\Underground Pip	10.36 kg/s Release Rate	1F	TOWNGAS	0	42.2946	62.7422	Parameter value	Parameter value	Parameter value	25.3383	n/a	n/a	1301.48	n/a	n/a	20.5499	n/a	n/a	20.1593	n/a	n/a	4.78837	n/a	n/a
Study\Underground Pip	41.4 kg/s Release rate	1D	TOWNGAS	0	81.1461	63.9429	Parameter value	Parameter value	Parameter value	82.6538	n/a	n/a	5029.85	n/a	n/a	38.184	n/a	n/a	41.9299	n/a	n/a	44.4698	n/a	n/a
Study\Underground Pip	41.4 kg/s Release rate	4D	TOWNGAS	0	62.4982	90.5888	Parameter value	Parameter value	Parameter value	78.642	42.3067	n/a	6471.72	720.938	n/a	39.913	17.8855	n/a	51.6125	12.8306	n/a	38.7289	24.4213	n/a
Study\Underground Pip	41.4 kg/s Release rate	7.5D	TOWNGAS	0	54.3218	103.154	Parameter value	Parameter value	Parameter value	78.7259	50.1323	n/a	7741.64	1651.04	n/a	44.7308	24.0283	n/a	55.0904	21.8718	n/a	33.9951	26.104	n/a
Study\Underground Pip	41.4 kg/s Release rate	3E	TOWNGAS	0	67.8358	81.7367	Parameter value	Parameter value	Parameter value	80.3609	31.348	n/a	6101.1	167.198	n/a	39.4161	10.2675	n/a	49.2702	5.18343	n/a	40.9448	21.0806	n/a
Study\Underground Pip	41.4 kg/s Release rate	1F	TOWNGAS	0	81.1461	63.9429	Parameter value	Parameter value	Parameter value	82.6538	n/a	n/a	5029.85	n/a	n/a	38.184	n/a	n/a	41.9299	n/a	n/a	44.4698	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	1D	TOWNGAS	0	13.6968	26.061	Parameter value	Parameter value	Parameter value	9.49007	n/a	n/a	37.4149	n/a	n/a	4.0801	n/a	n/a	2.91893	n/a	n/a	5.40997	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	4D	TOWNGAS	0	10.5492	34.8734	Parameter value	Parameter value	Parameter value	11.5398	1.95603	n/a	113.613	0.112773	n/a	5.74867	0.404057	n/a	6.29085	0.0888408	n/a	5.79111	1.55197	n/a
Study\Underground Pip	0.41 kg/s Release Rate	7.5D	TOWNGAS	0	9.1691	43.5453	Parameter value	Parameter value	Parameter value	12.9334	9.01405	n/a	145.608	35.9254	n/a	6.47585	4.29874	n/a	7.15711	2.66018	n/a	6.45753	4.71531	n/a
Study\Underground Pip	0.41 kg/s Release Rate	3E	TOWNGAS	0	11.4502	31.0788	Parameter value	Parameter value	Parameter value	11.244	n/a	n/a	93.3114	n/a	n/a	5.53137	n/a	n/a	5.36973	n/a	n/a	5.71261	n/a	n/a
Study\Underground Pip	0.41 kg/s Release Rate	1F	TOWNGAS	0	13.6968	26.061	Parameter value	Parameter value	Parameter value	9.49007	n/a	n/a	37.4149	n/a	n/a	4.0801	n/a	n/a	2.91893	n/a	n/a	5.40997	n/a	n/a
Study\Underground Pip	2.59 kg/s Release Rate	1D	TOWNGAS	0	28.9767	36.8208	Parameter value	Parameter value	Parameter value	25.1172	n/a	n/a	378.832	n/a	n/a	11.4618	n/a	n/a	10.5207	n/a	n/a	13.6554	n/a	n/a
Study\Underground Pip	2.59 kg/s Release Rate	4D	TOWNGAS	0	22.3177	48.1861	Parameter value	Parameter value	Parameter value	25.3955	8.99969	n/a	629.738	25.192	n/a	13.1162	3.67435	n/a	15.2827	2.18239	n/a	12.2792	5.32535	n/a
Study\Underground Pip	2.59 kg/s Release Rate	7.5D	TOWNGAS	0	19.3979	59.9011	Parameter value	Parameter value	Parameter value	27.4907	18.4018	n/a	734.643	176.451	n/a	13.8475	8.85314	n/a	16.887	6.34421	n/a	13.6431	9.54865	n/a
Study\Underground Pip	2.59 kg/s Release Rate	3E	TOWNGAS	0	24.2237	44.0815	Parameter value	Parameter value	Parameter value	25.3887	n/a	n/a	557.822	n/a	n/a	12.7835	n/a	n/a	13.8898	n/a	n/a	12.6052	n/a	n/a
Study\Underground Pip	2.59 kg/s Release Rate	1F	TOWNGAS	0	28.9767	36.8208	Parameter value	Parameter value	Parameter value	25.1172	n/a	n/a	378.832	n/a	n/a	11.4618	n/a	n/a	10.5207	n/a	n/a	13.6554	n/a	n/a
Study\Underground Pip	10.36 kg/s Release Rate	1D	TOWNGAS	0	52.2037	44.5392	Parameter value	Parameter value	Parameter value	49.7845	n/a	n/a	1775.65	n/a	n/a	23.5966	n/a	n/a	23.9529	n/a	n/a	26.1879	n/a	n/a
Study\Underground Pip	10.36 kg/s Release Rate	4D	TOWNGAS	0	40.207	58.1997	Parameter value	Parameter value	Parameter value	47.6491	21.0762	n/a	2524.4	198.596	n/a	26.3162	9.91374	n/a	30.5341	6.3765	n/a	21.3329	11.1625	n/a
Study\Underground Pip	10.36 kg/s Release Rate	7.5D	TOWNGAS	0	34.9468	72.6303	Parameter value	Parameter value	Parameter value	49.3837	32.2155	n/a	2745.48	612.393	n/a	26.4297	15.7208	n/a	33.0656	12.3995	n/a	22.954	16.4947	n/a
Study\Underground Pip	10.36 kg/s Release Rate	3E	TOWNGAS	0	43.6408	53.3412	Parameter value	Parameter value	Parameter value	48.7486	15.2325	n/a	2299.3	58.0142	n/a	25.2673	5.61704	n/a	28.9659	3.28759	n/a	23.4813	9.61549	n/a
Study\Underground Pip	10.36 kg/s Release Rate	1F	TOWNGAS	0	52.2037	44.5392	Parameter value	Parameter value	Parameter value	49.7845	n/a	n/a	1775.65	n/a	n/a	23.5966	n/a	n/a	23.9529	n/a	n/a	26.1879	n/a	n/a
Study\Underground Pip	41.4 kg/s Release rate	1D	TOWNGAS	0	93.7185	54.0701	Parameter value	Parameter value	Parameter value	96.605	n/a	n/a	7776.42	n/a	n/a	47.9855	n/a	n/a	51.5846	n/a	n/a	48.6196	n/a	n/a
Study\Underground Pip	41.4 kg/s Release rate	4D	TOWNGAS	0	72.1814	70.6361	Parameter value	Parameter value	Parameter value	90.4381	49.3399	n/a	10259.1	1389.95	n/a	52.9066	24.8058	n/a	61.7235	17.836	n/a	37.5315	24.5341	n/a
Study\Underground Pip	41.4 kg/s Release rate	7.5D	TOWNGAS	0	62.7381	88.1877	Parameter value	Parameter value	Parameter value	89.9496	57.5671	n/a	10822.2	2284.78	n/a	53.1425	29.0258	n/a	64.8224	25.056	n/a	36.807	28.5413	n/a
Study\Underground Pip	41.4 kg/s Release rate	3E	TOWNGAS	0	78.3459	64.7932	Parameter value	Parameter value	Parameter value	92.9124	42.2613	n/a	9524.43	789.26	n/a	51.1436	19.3136	n/a	59.2787	13.0079	n/a	41.7688	22.9477	n/a
Study\Underground Pip	41.4 kg/s Release rate	1F	TOWNGAS	0	93.7185	54.0701	Parameter value	Parameter value	Parameter value	96.605	n/a	n/a	7776.42	n/a	n/a	47.9855	n/a	n/a	51.5846	n/a	n/a	48.6196	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	1D	TOWNGAS		8.5438	58.5882	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	4D	TOWNGAS		6.58038	82.3902	Parameter value	Parameter value	Parameter value	6.07276	n/a	n/a	53.8178	n/a	n/a	4.05792	n/a	n/a	4.22155	n/a	n/a	2.01484	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	7.5D	TOWNGAS		5.71949	93.5868	Parameter value	Parameter value	Parameter value	7.38039	3.25131	n/a	69.3055	5.45973	n/a	3.99731	1.5515	n/a	5.51887	1.12013	n/a	3.37864	1.69981	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	3E	TOWNGAS		7.14237	74.4795	Parameter value	Parameter value	Parameter value	4.86288	n/a	n/a	22.9522	n/a	n/a	2.42995	n/a	n/a	3.00661	n/a	n/a	2.43293	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	1F	TOWNGAS		8.5438	58.5882	Parameter value	Parameter value	Parameter value	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	1D	TOWNGAS		19.1278	71.3883	Parameter value	Parameter value	Parameter value	6.5114	n/a	n/a	32.8859	n/a	n/a	2.38245	n/a	n/a	4.39377	n/a	n/a	4.03774	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	4D	TOWNGAS		14.7321	100.563	Parameter value	Parameter value	Parameter value	14.736	n/a	n/a	395.196	n/a	n/a	11.2651	n/a	n/a	11.1667	n/a	n/a	3.47082	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	7.5D	TOWNGAS		12.8048	114.211	Parameter value	Parameter value	Parameter value	17.361	7.70273	n/a	529.017	42.1771	n/a	12.237	3.93582	n/a	13.7608	3.41108	n/a	5.12403	3.76691	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	3E	TOWNGAS		15.9903	90.8895	Parameter value	Parameter value	Parameter value	12.5677	n/a	n/a	298.397	n/a	n/a	9.83078	n/a	n/a	9.66176	n/a	n/a	2.73691	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	1F	TOWNGAS		19.1278	71.3883	Parameter value	Parameter value	Parameter value	6.5114	n/a	n/a	32.8859	n/a	n/a	2.38245	n/a	n/a	4.39377	n/a	n/a	4.03774	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	1D	TOWNGAS		34.9994	83.7527	Parameter value	Parameter value	Parameter value	16.0767	n/a	n/a	617.507	n/a	n/a	13.8626	n/a	n/a	14.1791	n/a	n/a	2.21415	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	4D	TOWNGAS		26.9563	118.01	Parameter value	Parameter value	Parameter value	28.8752	n/a	n/a	1707.98	n/a	n/a	23.4835	n/a	n/a	23.1511	n/a	n/a	5.39167	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	7.5D	TOWNGAS		23.4297	134.011	Parameter value	Parameter value	Parameter value	33.2363	15.1648	n/a	2152.44	202.899	n/a	25.2054	8.25469	n/a	27.1823	7.82401	n/a	8.03087	6.9101	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	3E	TOWNGAS		29.2585	106.66	Parameter value	Parameter value	Parameter value	25.4848	n/a	n/a	1395.05	n/a	n/a	21.2373	n/a	n/a	20.9094	n/a	n/a	4.24751	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	1F	TOWNGAS		34.9994	83.7527	Parameter value	Parameter value	Parameter value	16.0767	n/a	n/a	617.507	n/a	n/a	13.8626	n/a	n/a	14.1791	n/a	n/a	2.21415	n/a	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	1D	TOWNGAS		63.7365	98.977	Parameter value	Parameter value	Parameter value	36.5398	n/a	n/a	3501.78	n/a	n/a	33.2722	n/a	n/a	33.501	n/a	n/a	3.2676	n/a	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	4D	TOWNGAS		49.0894	139.373	Parameter value	Parameter value	Parameter value	56.4911	12.1432	n/a	7166.51	139.825	n/a	48.1044	5.24659	n/a	47.4213	8.48315	n/a	8.38667	6.82764	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	7.5D	TOWNGAS		42.6672	158.345	Parameter value	Parameter value	Parameter value	63.6415	29.9985	n/a	8591.63	966.517	n/a	51.0444	17.5617	n/a	53.5769	17.5184	n/a	12.5971	12.4369	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	3E	TOWNGAS		53.2818	125.984	Parameter value	Parameter value	Parameter value	51.1878	n/a	n/a	6160.53	n/a	n/a	44.5541	n/a	n/a	44.013	n/a	n/a	6.63376	n/a	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	1F	TOWNGAS		63.7365	98.977	Parameter value	Parameter value	Parameter value	36.5398	n/a	n/a	3501.78	n/a	n/a	33.2722	n/a	n/a	33.501	n/a	n/a	3.2676	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	1D	TOWNGAS		10.8775	37.413	Parameter value	Parameter value	Parameter value	8.98343	n/a	n/a	34.744	n/a	n/a	3.62835	n/a	n/a	3.04804	n/a	n/a	5.35508	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	4D	TOWNGAS		8.37781	53.0249	Parameter value	Parameter value	Parameter value	9.40533	n/a	n/a	74.6361	n/a	n/a	4.49748	n/a	n/a	5.28238	n/a	n/a	4.90785	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	7.5D	TOWNGAS		7.28177	60.5274	Parameter value	Parameter value	Parameter value	10.1523	6.86577	n/a	94.8593	20.8355	n/a	5.09756	3.02056	n/a	5.92335	2.19567	n/a	5.05472	3.84521	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	3E	TOWNGAS		9.09331	47.8138	Parameter value	Parameter value	Parameter value	9.50918	n/a	n/a	66.1422	n/a	n/a	4.40396	n/a	n/a	4.78063	n/a	n/a	5.10522	n/a	n/a
Study\Underground Pip	10mm leak (Jet Fire) - Je	1F	TOWNGAS		10.8775	37.413	Parameter value	Parameter value	Parameter value	8.98343	n/a	n/a	34.744	n/a	n/a	3.62835	n/a	n/a	3.04804	n/a	n/a	5.35508	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	1D	TOWNGAS		24.3526	45.7893	Parameter value	Parameter value	Parameter value	22.0398	n/a	n/a	273.197	n/a	n/a	9.56301	n/a	n/a	9.09352	n/a	n/a	12.4768	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	4D	TOWNGAS		18.7562	64.9432	Parameter value	Parameter value	Parameter value	21.8702	7.76109	n/a	437.87	4.02822	n/a	10.6312	2.12342	n/a	13.1103	0.603847	n/a	11.239	5.63767	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	7.5D	TOWNGAS		16.3024	74.034	Parameter value	Parameter value	Parameter value	22.7003	14.8253	n/a	517.197	99.0965	n/a	11.5046	5.88553	n/a	14.3098	5.35948	n/a	11.1957	8.93979	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	3E	TOWNGAS		20.358	58.5689	Parameter value	Parameter value	Parameter value	22.2446	n/a	n/a	403.033	n/a	n/a	10.5346	n/a	n/a	12.1779	n/a	n/a	11.71	n/a	n/a
Study\Underground Pip	25mm leak (Jet Fire) - Je	1F	TOWNGAS		24.3526	45.7893	Parameter value	Parameter value	Parameter value	22.0398	n/a	n/a	273.197	n/a	n/a	9.56301	n/a	n/a	9.09352	n/a	n/a	12.4768	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	1D	TOWNGAS		44.5603	53.9071	Parameter value	Parameter value	Parameter value	42.8257	n/a	n/a	1198.49	n/a	n/a	19.2485	n/a	n/a	19.8193	n/a	n/a	23.5772	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	4D	TOWNGAS		34.32	76.4391	Parameter value	Parameter value	Parameter value	41.4607	19.8822	n/a	1673.8	107.06	n/a	20.4533	7.52335	n/a	26.049	4.52965	n/a	21.0074	12.3589	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	7.5D	TOWNGAS		29.8301	87.0655	Parameter value	Parameter value	Parameter value	42.1607	27.0695	n/a	1914.93	423.947	n/a	21.8011	12.674	n/a	27.9592	10.6475	n/a	20.3595	14.3954	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	3E	TOWNGAS		37.2511	68.9507	Parameter value	Parameter value	Parameter value	42.3143	n/a	n/a	1572.18	n/a	n/a	20.3584	n/a	n/a	24.5816	n/a	n/a	21.9559	n/a	n/a
Study\Underground Pip	50mm leak (Jet Fire) - Je	1F	TOWNGAS		44.5603	53.9071	Parameter value	Parameter value	Parameter value	42.8257	n/a	n/a	1198.49	n/a	n/a	19.2485	n/a	n/a	19.8193	n/a	n/a	23.5772	n/a	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	1D	TOWNGAS		81.1461	63.9429	Parameter value	Parameter value	Parameter value	82.6538	n/a	n/a	5029.85	n/a	n/a	38.184	n/a	n/a	41.9299	n/a	n/a	44.4698	n/a	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	4D	TOWNGAS		62.4982	90.5888	Parameter value	Parameter value	Parameter value	78.642	42.3067	n/a	6471.72	720.938	n/a	39.913	17.8855	n/a	51.6125	12.8306	n/a	38.7289	24.4213	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	7.5D	TOWNGAS		54.3218	103.154	Parameter value	Parameter value	Parameter value	78.7259	50.1323	n/a	7741.64	1651.04	n/a	44.7308	24.0283	n/a	55.0904	21.8718	n/a	33.9951	26.104	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	3E	TOWNGAS		67.8358	81.7367	Parameter value	Parameter value	Parameter value	80.3609	31.348	n/a	6101.1	167.198	n/a	39.4161	10.2675	n/a	49.2702	5.18343	n/a	40.9448	21.0806	n/a
Study\Underground Pip	100mm leak (Jet Fire) - J	1F	TOWNGAS		81.1461	63.9429	Parameter value	Parameter value	Parameter value	82.6538	n/a	n/a	5029.85	n/a	n/a	38.184	n/a	n/a	41.9299	n/a	n/a	44.4698	n/a	n/a

Path	Scenario	Weather	Material	Height of interest (coming from parameters) (m)	Actual flammable mass (kg)	Fireball diameter (m)	Flame emissive power (kW/m2)	Fireball radiation intensity level 1	Fireball radiation intensity level 2	Fireball radiation intensity level 3	Distance downwind to intensity level 1 (4 kW/m2) (m)	Distance downwind to intensity level 2 (12.5 kW/m2) (m)	Distance downwind to intensity level 3 (37.5 kW/m2) (m)	Ellipse half-length to intensity level 1 (4 kW/m2) (m)	Ellipse half-length to intensity level 2 (12.5 kW/m2) (m)	Ellipse half-length to intensity level 3 (37.5 kW/m2) (m)	Ellipse half-width to intensity level 1 (4 kW/m2) (m)	Ellipse half-width to intensity level 2 (12.5 kW/m2) (m)	Ellipse half-width to intensity level 3 (37.5 kW/m2) (m)	Ellipse centre downwind distance to intensity level 1 (4 kW/m2) (m)	Ellipse centre downwind distance to intensity level 2 (12.5 kW/m2)	Ellipse centre downwind distance to intensity level 3 (37.5 kW/m2)
Study\Underground Pip	20.72 kg/s Release Rate	1D	CARBON MONOXIDE	0	26403	172.708	36.2276	Parameter value	Parameter value	Parameter value	198.832	95.8477	n/a	198.832	95.8477	n/a	198.832	95.8477	n/a	0	0	n/a
Study\Underground Pip	20.72 kg/s Release Rate	4D	CARBON MONOXIDE	0	26403	172.708	36.2276	Parameter value	Parameter value	Parameter value	198.832	95.8477	n/a	198.832	95.8477	n/a	198.832	95.8477	n/a	0	0	n/a
Study\Underground Pip	20.72 kg/s Release Rate	7.5D	CARBON MONOXIDE	0	26403	172.708	36.2276	Parameter value	Parameter value	Parameter value	198.832	95.8477	n/a	198.832	95.8477	n/a	198.832	95.8477	n/a	0	0	n/a
Study\Underground Pip	20.72 kg/s Release Rate	3E	CARBON MONOXIDE	0	26403	172.708	36.2276	Parameter value	Parameter value	Parameter value	198.832	95.8477	n/a	198.832	95.8477	n/a	198.832	95.8477	n/a	0	0	n/a
Study\Underground Pip	20.72 kg/s Release Rate	1F	CARBON MONOXIDE	0	26403	172.708	36.2276	Parameter value	Parameter value	Parameter value	198.832	95.8477	n/a	198.832	95.8477	n/a	198.832	95.8477	n/a	0	0	n/a
Study\Underground Pip	372.95 kg/s Release rate	1D	TOWNGAS	0	26403	172.708	103.397	Parameter value	Parameter value	Parameter value	341.169	189.797	92.004	341.169	189.797	92.004	341.169	189.797	92.004	0	0	0
Study\Underground Pip	372.95 kg/s Release rate	4D	TOWNGAS	0	26403	172.708	103.397	Parameter value	Parameter value	Parameter value	341.169	189.797	92.004	341.169	189.797	92.004	341.169	189.797	92.004	0	0	0
Study\Underground Pip	372.95 kg/s Release rate	7.5D	TOWNGAS	0	26403	172.708	103.397	Parameter value	Parameter value	Parameter value	341.169	189.797	92.004	341.169	189.797	92.004	341.169	189.797	92.004	0	0	0
Study\Underground Pip	372.95 kg/s Release rate	3E	TOWNGAS	0	26403	172.708	103.397	Parameter value	Parameter value	Parameter value	341.169	189.797	92.004	341.169	189.797	92.004	341.169	189.797	92.004	0	0	0
Study\Underground Pip	372.95 kg/s Release rate	1F	TOWNGAS	0	26403	172.708	103.397	Parameter value	Parameter value	Parameter value	341.169	189.797	92.004	341.169	189.797	92.004	341.169	189.797	92.004	0	0	0
Study\Underground Pip	Fireball	1D	TOWNGAS			128.991	301.341															
Study\Underground Pip	Fireball	4D	TOWNGAS			128.991	301.341															
Study\Underground Pip	Fireball	7.5D	TOWNGAS			128.991	301.341															
Study\Underground Pip	Fireball	3E	TOWNGAS			128.991	301.341															
Study\Underground Pip	Fireball	1F	TOWNGAS			128.991	301.341															