Transnet Pipelines (Pty) Ltd

Major Hazard Installation (MHI)
Risk Assessment Report

Witbank Depot (Existing Site)

Report Reference Number:

Tr02-6-R-MHI-1

Revision 2 (Final)

Report approved by:

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Date of report: 09th February 2024
Site visit date: 29th August 2023

mmrisk

MMRisk (Pty) Ltd is an Approved Inspection Authority for MHIs: CI MHI 0013 (Labour) and MHI0037 (SANAS)

sanas Inspection Body
MHI 0037

CONTROL PAGE

Previous MHI Assessment(s):

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Persons at Client company involved in the assessment

Name	Title / Role
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Papa Moratwe	Fire Manager
Shaun Groenewald	Electrical Fitter

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REPORT SIGNATURE PAGE

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Received by:	Siyabonga Mnikathi	TPL Operations and Technical Risk Manager	22/04/2024	
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Accepted by:	Daniel Noni	TPL Senior Regional Manager Central	24.04.2024	

EXECUTIVE SUMMARY

INTRODUCTION

MMRisk (Pty) Ltd were contracted by Transnet Pipelines (Pty) Ltd ('TPL'), to conduct the Major Hazard Installation (MHI) Risk Assessment of their Witbank Depot ('Site') in Emalahleni, Gauteng Province, South Africa.

The risk assessment is an update of a previous risk assessment completed in August 2018.

The site is a depot receiving and distributing 50 ppm Diesel (D50), 95 Octane Unleaded Petrol (ULP 95) and 93 Octane Unleaded Petrol (ULP 93) to its external customers. The site receives diesel and petrol via pipeline from the TPL Kendal Depot, which passes through a series of pipes and valves in the manifold before being distributed to the nearby external clients, Shell and Engen depots. Any fuel that is intermixed when changing the product in the pipeline is transferred to and stored in bulk intermix tanks. The site also has 5 bulk aboveground clean petroleum products holding tanks.

As per the MHI Regulations of 2022 promulgated on 31st January 2023, the site is classified as a **Medium Hazard establishment**. As such, the following requirements apply:

- An MHI Risk Assessment (this document);
- A Major Incident Prevention Policy (MIPP);
- A Process Safety Management System (PSM) (described in the MIPP but not submitted to the authorities); and
- An Emergency Plan.

MMRisk are accredited by the South African National Accreditation System (SANAS, number MHI0037) and approved by the Department of Employment and Labour to conduct Major Hazard Installation (MHI) Risk Assessments (AIA approval Number CI MHI 0013, approval certificates attached in Appendix A).

SITE ACTIVITIES

The Witbank TPL depot is a deport receiving and distributing petroleum products (Diesel and Unleaded Petrol). The site receives diesel and petrol via 12-inch pipelines from the TPL Kendal Depot at a maximum operating pressure of 8 bar and a flow rate of 11,300 litres/min. The duration of fuel receipt and distribution on site is approximately 2 to 3 days per week.

The diesel and petrol received via pipeline are directed to the pipe manifolds and transferred to the external clients while fuel that is intermixed when changing the product in the pipeline is transferred to and stored in 4 (four) bulk intermix tanks onsite. Any fuel that cannot be received by a client is transferred to and stored in 5 (five) bulk storage tanks.

The fuel that is stored in intermix tanks is then dispatched from site via road tanker and transported to the Tarlton TPL depot for re-fractioning.

A simplified block flow diagram of the processes occurring onsite is shown in Figure 2.2.

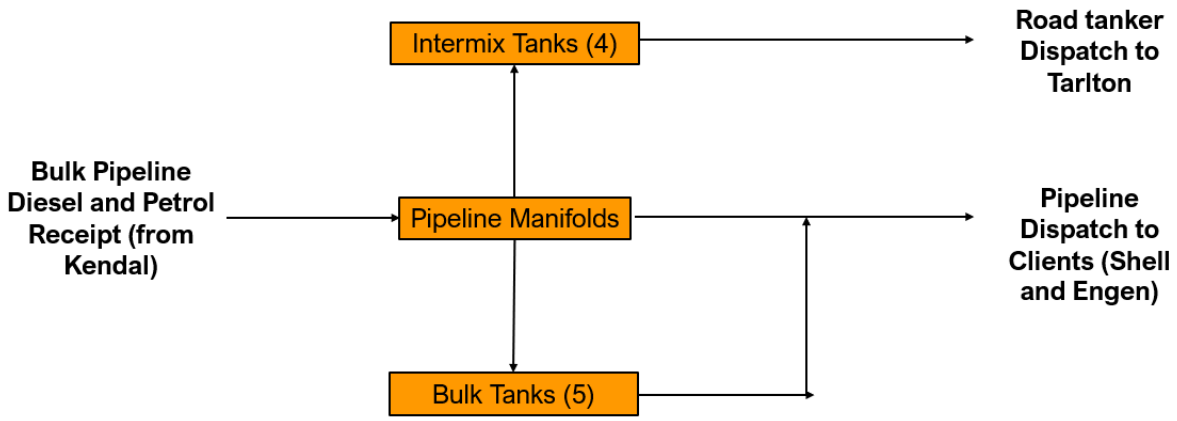

Figure 2.2: Process block flow diagram

INDIVIDUAL RISK RESULTS

The individual risk contours illustrated in the figures below are of the type 'Location Specific Individual Risk (LSIR)' contours. These show the chance of death of a theoretical person if they are positioned at a particular location 24 hours per day, 365 days per year. LSIR is an overstatement of risk which is widely accepted as sufficiently conservative. In reality, workers will spend the length of a shift per day and not the entire day. However, when a worker is off, another worker may replace the worker in performing task(s), therefore, overall, it can be considered that there is an individual at that particular point or area, all of the time.

The risk acceptability criteria are described in Section 3.5.1 and the individual risk profiles for the site are illustrated in Figure 8.1.

Individual risk for those located outdoors

Figure 8.1 illustrates individual risk of death for those located outdoors; being located outdoors implies a lack of shielding for thermal radiation exposure, as would be the case for those located indoors. Only the estimated consequences of a tank overfill event have been included in this report. The frequency of occurrence has been excluded and as a result, the risks associated with this event have not been evaluated and are not included in the figure below. The contours extend as follows:

Individual risk contour	Associated tolerability	Observations
1×10^{-3} / year (blue contour)	Inside these contours risk is intolerable to workers.	This contour is not reached.
1×10^{-4} / year (red contour)	Inside this contour risk is intolerable to members of the public.	The 1×10^{-4} contour envelopes the transfer tanks, the pipe manifold, and the point where the incoming pipeline from Kendal surfaces. This contour appears over these areas due to the relatively high frequency of small pump leaks leading to flammable pools and associated pool fires restricted to the contained areas. This contour does not extend offsite.
1×10^{-5} / year (orange contour)	This contour indicates threshold of tolerability for workers.	The 1×10^{-5} contour envelopes the pipeline manifold, a portion of the road tanker gantry and the intermix tanks pipework. This contour does not extend offsite.
1×10^{-6} / year (yellow contour)	This contour is the threshold for tolerability for members of the public.	The 1×10^{-6} contour extends over the abovementioned areas to a greater degree as well the bulk storage tanks onsite and the control room. This contour does not extend offsite.
3×10^{-7} / year (green contour)	At this level, risk is broadly acceptable, but an indicator of appropriateness of land-use (see Section 8.5)	The 3×10^{-6} extends over the areas mentioned above to a greater degree. The 1×10^{-8} and 1×10^{-9} / year contours also extend over the areas mentioned above to a greater degree than the 3×10^{-6}. These contours extend slightly offsite over the north and eastern site boundaries.

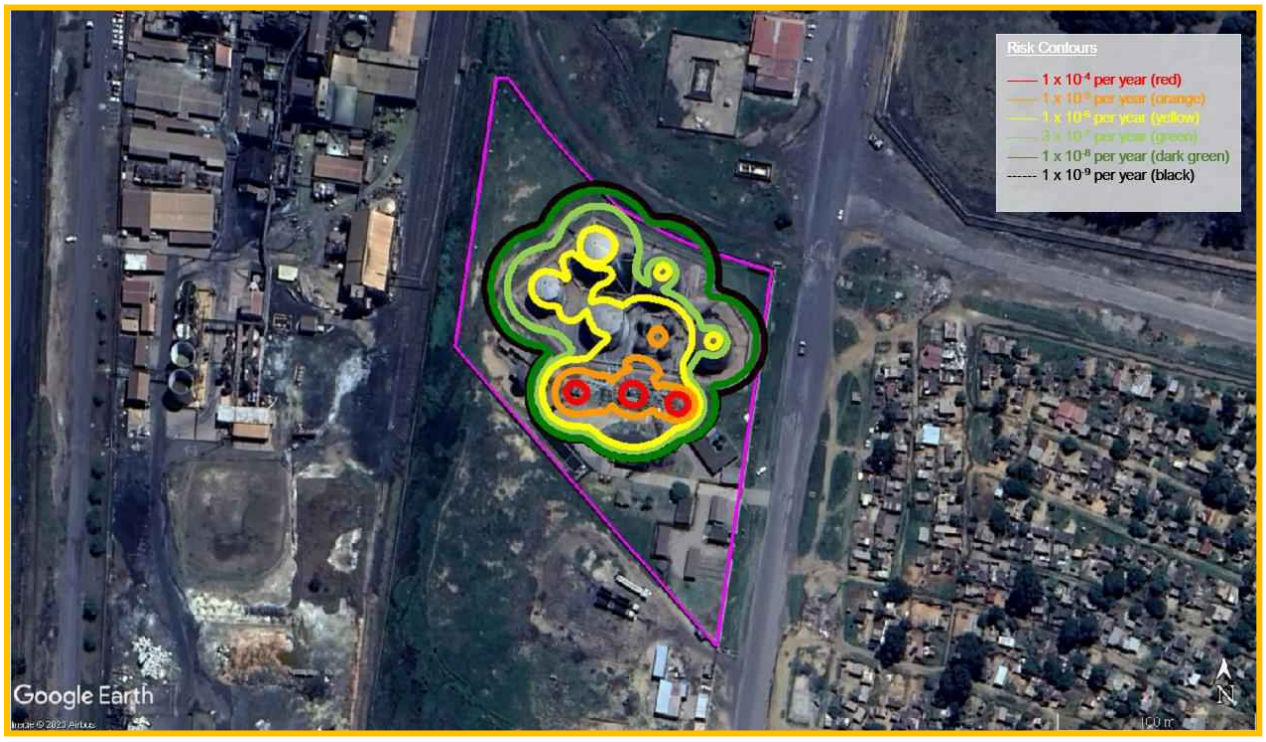

Figure 8.1: Individual risk contours for personnel located outdoors

Conclusion:

Onsite, the risk contours extend such that the risk is considered tolerable if the site can prove that it is As Low As Reasonably Practicable 'ALARP' for personnel especially at the pipe manifold. Offsite, the risk is considered Broadly Acceptable.

Risk Judgement and Treatment are discussed in Section 8.4.

SOCIETAL RISK RESULTS

Societal risk considers populations around the site to determine risk tolerability. In this study, this is presented in the form of an FN-Curve, which illustrates scenarios with the potential to cause death, as well as considers the frequency of each scenario. The frequencies of the scenarios are then summed to show a cumulative risk of death, i.e., the frequency (F) of causing N or more fatalities against the number of fatalities, N.

As illustrated in Figure 8.2 there are tolerability limits as suggested by SANS 1461:2018 (see Section 3.5.2), as illustrated by the red and blue sloped lines. Above the red line is the region where societal risk is intolerable; below the blue line is the region where societal risk is broadly acceptable. Between these lines is the region where risk can be tolerated if it is proven to be ALARP (see Section 3.5.2).

Description of the site's FN curve (societal risk results)

Day time societal risk is based upon activities onsite which take place only during the day and upon day-time population levels, and similarly night time risk is based upon activities taking place at night and also on

populations of people during the night. The FN curve given below is a combination of day time and night time risk.

Figure 8.2 shows that the maximum number of fatalities (on and off site) which can occur from a single event occurring onsite is approximately 1 person; the associated frequency of this one large event is relatively low, at approximately 1 x 10^{-4} / year. This corresponds to one of the high-impact, low-frequency events occurring at the site.

Societal risk for the site lies predominantly below the blue line, indicating risk which is Broadly Acceptable.

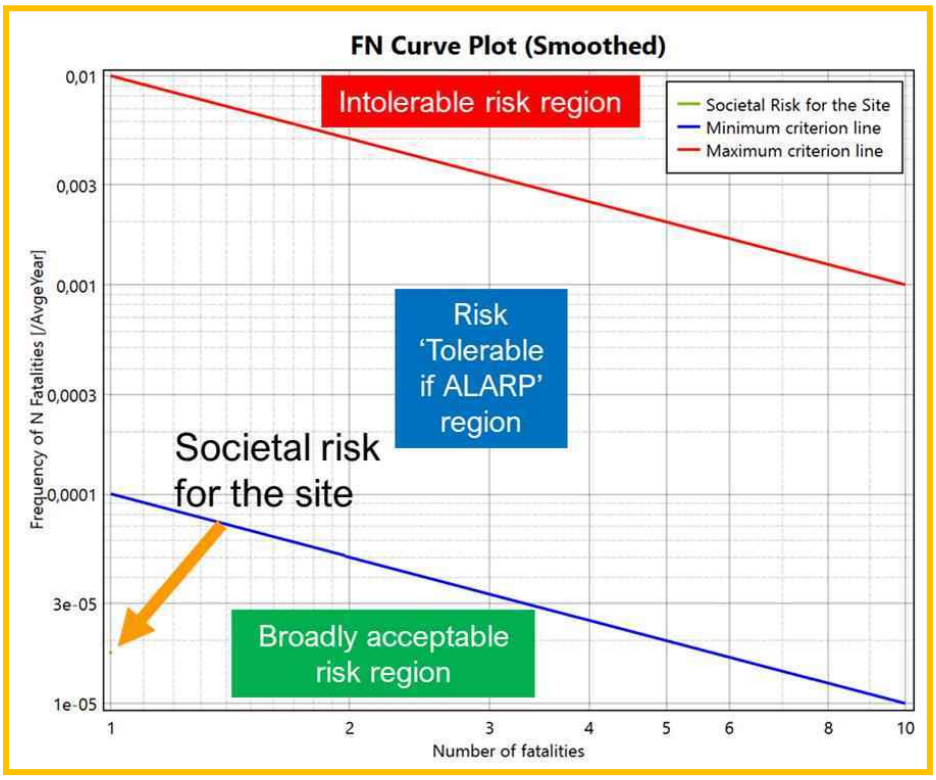

Figure 8.2: FN Curve illustrating societal risk level of the site

Top contributors to societal risk

Because Societal risk was assessed to Broadly Acceptable both to members of the public and personnel the top contributors to societal risk were not analysed further.

Conclusion:

Societal risk was assessed to be Broadly Acceptable.

CONCLUSIONS

The following conclusions were drawn from the analysis, divided into various topics in the table which follows:

Topic	Conclusion(s)
The identification of different hazardous installations within the premises	The following have been identified as potential major hazard installations at the site: Diesel Pipe Manifold, Pumps, Holding Tanks, Loading Road Tankers. Petroleum products are received and distributed onsite such that the site is classified as a **Medium Hazard establishment as per the MHI Regulations promulgated on 31st January 2023.**
The maximum extent of the 1 % consequence-based lethality (effect) zone from major hazards	The 1% fatality probability consequence contours associated with the installations onsite would extend as follows: • Tank T6: 29 metres (pool fire); • Tank T8: 28 metres (pool fire); • Incoming diesel pipeline: 26 metres (pool fire) • Incoming petrol pipeline: 30 metres (pool fire) • Diesel road tanker loading: 18 metres (pool fire) • Petrol road tanker loading: 19 metres (pool fire) • According to the UK HSE Process Safety Leadership Group final report for Safety and Environmental Standards for Fuel Storage Sites[1], the following distances are considered to be a conservative estimate of the hazard zones for tank overfill scenarios (i.e., a Buncefield-type event). - 2 bar overpressure: 250 metres - 250 mbar: 400 metres - Flammable vapour cloud: 437 meters
The level of risk posed by the facility to various populations	The individual risk at the pipe manifold was assessed to be **tolerable** provided that the site can prove that it is 'ALARP' to personnel onsite. and broadly acceptable for members of the public.
The assessment of the risk as acceptable or tolerable provided ALARP or intolerable	Individual risks were assessed to be **tolerable for personnel onsite at the pipe manifold** provided that it is As Low As Reasonably Practicable 'ALARP'. Societal risk was assessed to be **Broadly Acceptable** for both personnel and members of the public.
Suggestions for risk reduction including preventative and mitigative measures	Risk reduction measures are discussed in Section 8.4.2 and the Recommendations / Risk Reduction Measures Section 11.
Any specific technical uncertainties or sensitivities	Only the estimated consequences of a tank overfill event have been included in this report. The frequency of occurrence has been excluded and as a result, the risks associated with this event have not been evaluated.
The suggested land-use planning restricted development distance and the risk zones	Land-use planning restricted development distances are discussed in Section 8.5: Land Use Planning and no incompatible land-uses exist at present. The zones remain within the site boundaries.

[1] UK Health and Safety Executive, Process Safety Leadership Group, Final Report, 2009.

Topic	Conclusion(s)
Any organisational measures that may be required. (MHI Reg 5 (5) (b) (xii))	The Recommendations in Section 11 contains suggestions of organisational measures which may be required.

RECOMMENDATIONS / RISK REDUCTION MEASURES

Based on the risk analysis herein, the following recommendations are made:

Recommendation Number:	1
Recommendation wording:	The site is a Medium Hazard Establishment according to new set of MHI regulations promulgated 31st January 2023.
Rationale:	According to the MHI Regulations of 2022 promulgated on 31st January 2023, due to the overall storage of petroleum products of approximately 14,000 tons (considering Diesel and Petrol densities) the establishment is classified as a **Medium Hazard Establishment**. As such, the following requirements apply: • An MHI Risk Assessment (this document); • A Major Incident Prevention Policy (MIPP); • A Process Safety Management System (PSM) (described in the MIPP but not submitted to the authorities); and • An Emergency Plan. **Carry out advertisement (if not previously advertised) and carry out notification as required by the MHI Regulations.**
Priority:	High

Recommendation Number:	2
Recommendation wording:	Communicate the results of this risk assessment with Local Municipality Emergency Planning to strengthen their emergency planning strategies should an incident occur onsite.
Rationale:	There would be a domino impact which would extend offsite due to elevated thermal radiation emitted from various petrol and diesel installations. Informing the local emergency planning would prepare them in case of an emergency. [This would form part of MHI notification Process).
Priority:	High

Recommendation Number:	3

Recommendation wording:	Confirm with the municipality of Emalahleni if the Dangerous Goods Certificate is not required for such a particular site.
Rationale:	This would ensure that the site remains compliant with the local authorities.
Priority:	High

Recommendation Number:	4
Recommendation wording:	Consider the installation of hydrocarbon gas detectors in the bulk tank bunds.
Rationale:	Installation of this instrumentation may allow for early detection of flammable vapours released thus potentially reducing the impact should ignition occur.
Priority:	Medium

Recommendation Number:	5
Recommendation wording:	Consider the installation of Close Circuit Television (CCTV) at strategic points around the site.
Rationale:	Installation of CCTV may allow for monitoring of areas not frequently patrolled (such as the tank bunds) with may allow for early detection of overfilling events.
Priority:	Medium

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1 INTRODUCTION

1.1 Scope of Risk Assessment

MMRisk (Pty) Ltd were contracted by Transnet Pipelines (Pty) Ltd ('TPL'), to conduct the Major Hazard Installation (MHI) Risk Assessment of their Witbank Depot ('Site') in Emalahleni, Gauteng Province, South Africa.

The risk assessment is an update of a previous risk assessment completed in August 2018.

The site is a depot receiving and distributing 50 ppm Diesel (D50), 95 Octane Unleaded Petrol (ULP 95) and 93 Octane Unleaded Petrol (ULP 93) to its external customers. The site receives diesel and petrol via pipeline from the TPL Kendal Depot, which passes through a series of pipes and valves in the manifold before being distributed to the nearby external clients, Shell and Engen depots. Any fuel that is intermixed when changing the product in the pipeline is transferred to and stored in bulk intermix tanks. The site also has 5 bulk aboveground clean petroleum products holding tanks.

As per the MHI Regulations of 2022 promulgated on 31st January 2023, the site is classified as a **Medium Hazard establishment**. As such, the following requirements apply:

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MMRisk are accredited by the South African National Accreditation System (SANAS, number MHI0037) and approved by the Department of Employment and Labour to conduct Major Hazard Installation (MHI) Risk Assessments (AIA approval Number CI MHI 0013, approval certificates attached in Appendix A).

1.2 The Site Visit

A site visit was conducted on 29th August 2023 for purposes of information gathering. MMRisk representatives, Motlatsi Mabaso, Lesedi Lebea, and Roshuma Mafukaduvha, met with a number of TPL representatives during the site visit. The following TPL representatives were present during the site visit:

Name	Title / Role
Peter Lebono	Mechanical and workshop manager
Siyabonga Mnikathi	TPL – Mechanical Specialist
Papa Moratwe	Senior Fire Specialist
Shaun Groenewald	Electrical Fitter

During the visit, technical information and information on the surroundings was gathered by way of note-taking.

MMRisk staff drove around the site to familiarise themselves with the neighbours, paying particular attention to other potential MHI sites around the site.

Prior to the site visit, several documents detailing depot operations were requested and received.

1.3 Legal Aspects

1.3.1 MHI Regulations of 2022

On 31st January 2023, a new set of MHI Regulations were promulgated via Government Gazette Volume 691 Number 47970. The regulations are called the MHI Regulations of 2022. This MHI Risk Assessment has been completed in line with the requirements of the Major Hazard Installation Regulations of 2022 and in line with the following requirements:

- The South African National Standard (SANS) 1461:2018 'Major Hazard Installation – Risk Assessments'; and
- South African National Accreditation System (SANAS) Technical Requirement document TR54.

1.3.2 MHI Classification According to MHI Regulations 2022

According to the MHI Regulations of 2022, due to the overall storage of petroleum products of approximately 14,000 tons (considering Diesel and Petrol densities) the establishment is classified as a Medium Hazard Facility.

As such, the following requirements apply:

- An MHI Risk Assessment (this document);
- A Major Incident Prevention Policy (MIPP);
- A Process Safety Management System (PSM) (described in the MIPP but not submitted to the authorities); and
- An Emergency Plan.

1.3.3 Definition of MHI in the Occupational Health and Safety Act No. 85, 1993 as a Basis for Declaring MHI Status

MMRisk may also use risk contours as a basis to declare a site as an MHI if dangerous chemicals stored onsite are below the relevant threshold (such that the site would be exempt under the MHI Regulations, 2022).

This is in line with the Definitions Clause 1 (1) (xxvi) (b) of the Occupational Health and Safety Act No. 85, 1993 which defines a major hazard installation as *"… an installation where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident…".*

If the assessment shows that the 1 x 10^{-4} per annum contour (intolerable risk to members of the public) extends beyond the site boundary, then the site will be assessed to be a Major Hazard Installation even if the quantities stored onsite are below the thresholds indicated in the MHI Regulations, 2022.

Furthermore, the following guidelines shall be used to determine whether the site is an MHI or not.

- Toxics – the 50% lethality level, using probits or the UK HSE SLOD values.

- Fires (pool fires, jet fires, fireballs / BLEVE)– the 50% lethality or a radiation level of 20 kW/m^2 with 20 s exposure time.
- Flash fires – the maximum extent of the lower flammable limit (LFL).
- Explosions (VCE)– the 35 kPa (0.35 bar or 5 PSI) overpressure level.

If any of the above criteria extends over Level 3 and 4 sensitivity developments as per Land Use Planning clause 4.10 of SANS 1461:2018, the site will be declared a Major Hazard Installation.

1.4 Methodology of Risk Assessment

The assessment has been conducted in line with the requirements of South African National Standard (SANS) 1461:2018 Major Hazard Installation – Risk Assessments. The standard was published in June 2018; it is now the industry best practice for the compilation of MHI Risk Assessments. All MHI AIAs are now required to perform MHI Risk Assessments according to the requirements of the standard.

The standard provides requirements for the following as part of MHI Risk Assessments:

- Defining the scope of work;
- Gathering relevant data;
- Hazard identification;
- Hazard analysis;
- Consequence analysis;
- Risk calculations (including individual and societal risk);
- Risk judgement criteria;
- Risk treatment;
- Land-use planning;
- Emergency response data (analysing information from the Client);
- Conclusions and recommendations.

2 DESCRIPTIONS

2.1 Site Location

The site is located at 10 Schonland Drive, Ferrobank, Emalahleni, Mpumalanga Province. The GPS coordinates of the site are 25° 51'46.36"S, 29°09'58.74"E.

The site is located in an area which is predominantly industrial with residential areas nearby. Establishments surrounding the site are shown in Figure 2.1 and described below the figure.

1: Shell Witbank Depot	5: Tam Alloys (Beneficiation Plant)
2: Mpumalanga Training Trust (School)	6: Schonland Drive
3: Ackerville Township (Residential Area)	7: Shoping Centre
4: Bushveld Vanchem (Beneficiation Plant)	8: Van Eck Drive

Figure 2.1: The site and its surroundings

2.1.1 Population Estimates for Surrounding Areas

2.1.1.1 Categories of Populations Present around the Site

An important contributor to risk for a site is an estimate of populations both for the site itself, and for surrounding facilities and residential areas. MMRisk used estimates from a combination of sources such as from Statistics South Africa (StatsSA Living Conditions Survey 2014/15[2]) as well as from the TNO Green Book[3].

To illustrate where the various population estimates are applied, MMRisk uses code names, and these are described in Table 2.1.

Table 2.1: Population estimates for surrounding populations

Population categories	People per hectare	MMRisk code
Industrial Areas[4]:		
Low density of personnel	5	IS
Medium density of personnel	40	IM
High density of personnel	80	IL
Remote Area	1	R
Nature Area	0	N
Shopping Centres or Shopping Streets:		
Very small scattered	10 per shop	SV
Small	100	SS
Medium	500	SM
Large	≥1,000	SL
Office:		
Small	10 people	OS
Medium	100 people	OM
Large	1,000 people	OL
Police Station		
Standard	6 people per hectare 86% indoors	PS
Hotel and Catering:		
Small	10 people	HS
Medium	50 people	HM
Large	250 people	HL
Important Auto Routes (50% outdoors day and night, assume 2 people per car)		
Normal circulation	20 cars/km/lane	RN
Heavy Traffic	100 cars/km/lane	RT
Taxi Ranks	Variable depending on time of day. Peak time assume 20 taxis present at a time, with 15 passengers per taxi.	TR
Passenger Train Stations	Assume one full train present at peak time, 12 carriages (1,800 passengers per full train)	TS

[2] StatsSA, Statistics South Africa, Statistical Release P0310, Living Conditions of Households in South Africa, An analysis of household expenditure and income data using the LCS 2014/2015, January 2017.
[3] The Netherlands Organisation (TNO) of Applied Scientific Research, Methods for determination of possible damage to people and objects resulting from release of hazardous materials, CPR 16E, 1992.
[4] At night time MMRisk applied ½ the population density, with the exception of "IL" facilities.

Population categories	People per hectare	MMRisk code
Residential Areas (StatsSA data)[5]		
Urban Informal	5.6 people per household	DI
Urban Formal	5.97 people per household	DF
Busy housing district: low buildings and flats	120 people per hectare (36% indoor during the day, 92% indoor during the night)	DA
Quiet housing district, scattered flats	80 people per hectare (36% indoor during the day, 92% indoor during the night)	DQ
School / University (Advanced Education)		
Small	200 persons	SUS
Medium	500 persons	SUM
Large	1,000 persons	SUL

2.1.1.2 Presence of Persons Indoors and Outdoors

The following have been applied with regards to the presence of persons indoors vs outdoors, based on recommended methodology from the TNO Green Book [3]:

Table 2.2: Presence of persons indoors and outdoors per category

Population category	Persons present during the day			Persons present during the night		
	% of total persons present	*Percentage indoors*	*Percentage outdoors*	*% of total persons present*	*Percentage indoors*	*Percentage outdoors*
Formal residential areas	Assume 50% are children away at school. Remaining adults will be present according to the prevailing unemployment rate.	93%	7%	100%	99%	1%
Informal residential and deprived areas	Assume 50% are children away at school. Remaining adults will be present according to: 100 – prevailing unemployment rate %.	50%	50%	100%	99%	1%
Industrial areas and other places of work	100%	93%	7%	20% if there is a night shift, 0% otherwise.	99%	1%

[5] Presence during the day based on SA's employment rate at the time of writing, as well as an assumption that 50% of residents would be children who would be away at school.

2.1.2 Nearby Residential Areas

Ackerville township is the closest residential area to the site; details are provided in Table 2.3 below.

Table 2.3: Nearby residential areas

Facility/ Area	Illustrated by number	Distance from site (m)	Direction	Population and MMRisk Code (see Table 2.1 for MMRisk Code)
Ackerville Township	3	59	South-east	DI

2.1.3 Nearby Industrial Facilities

The site is located in a residential area but there a few industrial facilities nearby. The surrounding industrial facilities are shown with details given in Table 2.4. For those facilities, the assumed population statistics are also provided in the table.

Table 2.4: Industrial facilities located close to the site

Facility/ Area	Indicated by number:	Distance from site (m)	Direction	MHI facility?	Population and MMRisk code (see Table 2.1 for MMRisk code)
Bushveld Vanchem (Beneficiation Plant)	4	340	North West	Possible MHI	IM
Tam Alloys (Beneficiation Plant)	5	450	North West	Possible MHI	IM
Shell Witbank Depot	1	350	North	Yes	IS

2.1.4 Nearby Major Transportation Routes

Details of the closest major transportation routes to the site are provided in Table 2.5 below.

Table 2.5: Nearby major roads

Facility/ Area	Illustrated by number	Distance from site (m)	Direction	Population and MMRisk Code (see Table 2.1 for MMRisk Code)
Schonland Drive	6	Adjacent to site boundary	East	RN
Van Eck Drive	8	197	West	RN

2.1.5 Nearby Sources of Additional Risk

The Shell depot to the north of the site is a Major Hazard Installation and may pose additional risk to the site. Tam Alloys located north west from the site and Bushveld Vanchem, also located north west from the site are also possible MHIs which may pose possible risk to the site.

2.1.6 Vulnerable Developments / Sensitive Receptors

Details of areas which may be sensitive receptors are provided in table 2.6 below.

Table 2.6: Vulnerable developments

Facility/ Area	Illustrated by number	Distance from site (m)	Direction	Population and MMRisk Code (see Table 2.1 for MMRisk Code)
Ackerville Residential area	3	59	East	DI
Mpumalanga Training Trust (school)	2	197	South	SUS
Shopping Centre	7	87	North	SV

2.2 Company's Main Activities / Non-technical Process Description

The Witbank TPL depot is a deport receiving and distributing petroleum products (Diesel and Unleaded Petrol). The site receives diesel and petrol via 12-inch pipelines from the TPL Kendal Depot at a maximum operating pressure of 8 bar and a flow rate of 11,300 litres/min. The duration of fuel receipt and distribution on site is approximately 2 to 3 days per week.

The diesel and petrol received via pipeline are directed to the pipe manifolds and transferred to the external clients while fuel that is intermixed when changing the product in the pipeline is transferred to and stored in 4 (four) bulk intermix tanks onsite. Any fuel that cannot be received by a client is transferred to and stored in 5 (five) bulk storage tanks.

The fuel that is stored in intermix tanks is then dispatched from site via road tanker and transported to the Tarlton TPL depot for re-fractioning.

A simplified block flow diagram of the processes occurring onsite is shown in Figure 2.2.

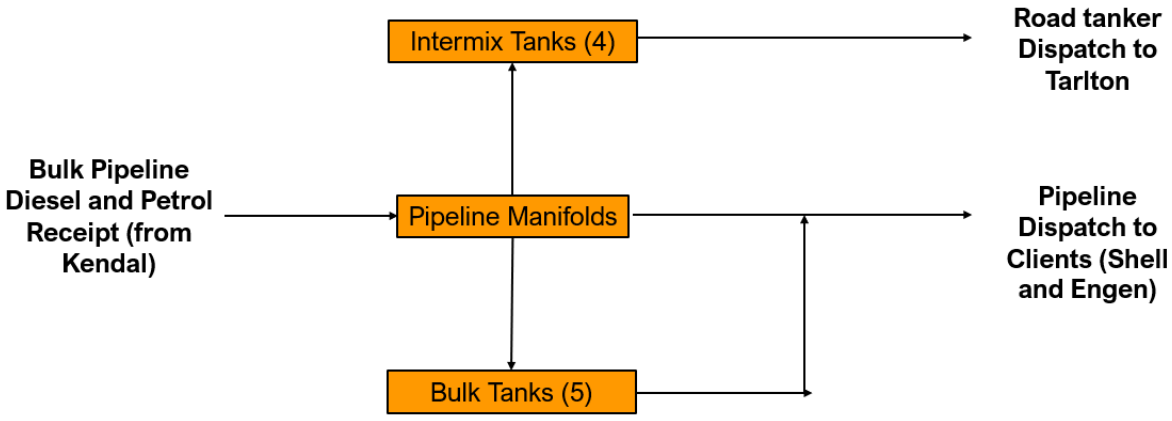

Figure 2.2: Process block flow diagram

A detailed description of the processes taking place onsite is provided in Section 2.3: Detailed Process Description.

2.3 Detailed Process Description

Details of the main activities onsite is provided in this section; this section makes reference to the site layout diagram in appendix F. For each process / equipment, the associated safety systems are described in tabular form.

2.3.1 Material Receipt – Pipeline

Diesel and petrol onsite are received via pipeline from the TPL Kendal Depot and routed to manifolds. The details of the feed pipeline are provided in the table blow.

Table 2.7: Fuel receipt via pipeline

Pipeline Source	Delivery frequency	Flowrate (L/min)	Line diameter	% time hazard onsite	Feed pressure	Limited area
Kendal	24 hours, 2-3 days a week	11, 300	12 inches	43	8 bar	Pipe manifold area
Safety Systems						
System	**Implication on modelling**				**Probability of failure (SANS 1461)**	
Bunding	Limits sizes of pools formed				-	
Control room intervention (SCADA – Offsite and onsite control)	Estimated maximum 10-minute release duration				0.01	

2.3.2 Bulk Tanks

Details of the bulk tanks on site are summarised in the table below.

Table 2.8: Tank listing

Tank number	Product	Gross capacity	Tank height
		m^3	m
T1	Intermix	169	6
T2	Intermix	169	6
T3	Intermix	169	6
T4	Intermix	169	6
T5	ULP 93	2200	13
T6	ULP 93	3700	12
T7	ULP 95	3700	12
T8	Diesel	3700	12
T9	Diesel	3700	12

The following safety systems apply for the main product storage tanks:

Table 2.9: Safety system descriptions for product tanks

System	Sub-system	Present?	Description of operation
Level control	Detection only		
	Detection and alarm (with control room intervention)		
	Full Level control (High and Hi-Hi)	YES	Radar level transmitters with indication, high-high level automatic feed shut off on tanks to reduce risks from overfilling. Overflow switch associated with ESD.
Overflow vent	-	YES	Pressure and vacuum relief vents are present. These vents are located at the top of the tanks and are of a 'goose-neck' configuration. During overflow, liquid would flow out onto the roof of the respective tank and then cascade to the bund floor.
Inlet and outlet valves	-	YES	Automated valves for inlet and outlet isolation.
Bunds	-	YES	All bulk tanks are contained within a bunded area.
Fire protection systems	-	YES	Refer to Section 4.5.

2.3.3 Main Pumps

Details of the pumps are found below.

Table 2.10: Main pumps details

Numbering	Type of pump	Discharge Pressure (bar)	Discharge flowrate (m^3/hr)
Transfer Pumps	Centrifugal (3 pumps)	1.5	Variable
Intermix Pumps	Centrifugal (4 pumps)	1.5	
Accumulation Tanks Pumps	Centrifugal (2 pump)	1.5	
Road Tanker Loading Pump	Centrifugal (1 pump)	1	
Safety Systems			
System		**Implication on modelling**	**Probability of failure (SANS 1461)**
Bunding		Limits sizes of pools formed	-
Control Room intervention		Estimated maximum 10-minute release duration	0.01

2.3.4 Material Dispatch from Site - Pipeline

Products are dispatched from the site via pipeline to the external clients (Engen and Shell).

Details of pipeline dispatch from site to the clients are contained in the table which follows.

Table 2.11: Details of pipeline dispatch

Dispatch to	Flowrate (L/min)	Line diameter	Estimated % time in use
Shell and Engen	11,300	8 inches	43
Safety Systems			
System	**Implication on modelling**		**Probability of failure (SANS 1461)**
Control Room intervention	Estimated maximum 10-minute release duration		0.01

2.3.5 Material Dispatch from Site – Road Tanker

Products from the intermix tanks are dispatched to the Tarlton TPL depot for re-fractionation. This is described in the table which follows:

Table 2.12: Details of road tanker loading

Products	Time to fill truck	% Hazards present	Truck size
Petrol and Diesel	45 minutes	The site reports an average of: 3 road tankers quarterly	42 m^3
Safety Systems			
System		**Implication on modelling**	**Probability of failure (SANS 1461)**
Hand brakes and chocks to prevent tanker rollaway		-	-
Earthing couplings		-	-
Driver presence during filling (manual intervention)		Estimated 2 minute release duration	0.1
Breakaway couplings (standard installation)		Limits release duration to approximately 5 seconds	0.06
Kerbed area – with a drainage		Limit the size of a pool fire	-

2.4 Staff Complement and Shift Patterns

The site operates 24 hours per day and 7 days per week throughout the year with the shift patterns and staff distributions shown below.

Table 2.13: Staff locations and number of employees per location

Staff complement and shift pattern	
Operating hours:	24 hours, 7 days per week
Number of shifts:	3
Shift 1:	10h00 to 18h00
Shift 2	18h00 to 02h00
Shift 3:	02h00 to 10h00

Admin Staff hours:	07h00 to 16h00
Staff Distribution	
Locations:	Number of personnel:
1. Mechanical	3
2. Admin	1
3. Depot manager	1
4. Cleaning	3
5. Security	2 + (2 offsite)
6. Control room operator	2

2.5 Meteorological Tendencies

The weather conditions around the site, which are used for risk analysis, were obtained from South African Weather Service data, as analysed and summarised in the websites: meteoblue.com and weatherbase.com. The closest Weather station to the site, and its SA Weather Service reference number are: Witbank, Reference: 05153208. The distance of the weather station from site is approximately 3.46 kilometres north-east.

2.5.1 Ambient Temperature, Pressure, Humidity and Rainfall

Ambient Temperature and Pressure

- On average, the warmest months are October to March (22 to 25°C average high temperatures).
- On average, the coolest months are April to September (10 to 16°C average low temperatures).
- Average annual maximum temperature: 23.5°C.
- Average annual minimum temperature: 9.4°C.
- Average annual temperature: 16.2°C.
- Air Pressure was calculated based on the site's elevation above sea level, using the webpage: www.mide.com/pages/air-pressure-at-altitude-calculator.
  Based on the site's elevation above sea level (1,627 m) the ambient pressure was taken to be = 0.82 atm.

Humidity

Humidity is of interest because it affects the rate at which thermal radiation transfers from a flame to a target, such as a person, building or piece of equipment. The more humid the conditions, the more radiation is absorbed by the water vapour and the less radiation is felt by the target.

- On average, November to April are the most humid months (Ave. 57 to 69 % humidity).
- On average, May to October are the least humid months (Ave. 50 to 59 % humidity).
- The average annual percentage of humidity is: 60.3 %.

Rainfall

Similar to humidity, the presence of rain is of interest because water droplets absorb some radiation.

- On average, October to April are the wettest months, with average precipitation of between 48 and 121 mm.
- On average, May to September are the driest months with some months having no precipitation and others having an average of between 5 to 24 mm precipitation.
- Average total annual precipitation is 691 mm.

2.5.2 Wind Statistics

Wind statistics were based on observations over a 30-year period of hourly weather model simulations, recorded at Witbank weather station. Wind statistics were obtained from https://www.meteoblue.com.

Wind statistics were taken into account in the risk modelling. Considering the yearly average wind direction distribution, the majority of wind tends to blow from south to north. The wind rose is shown in Figure 2.3.

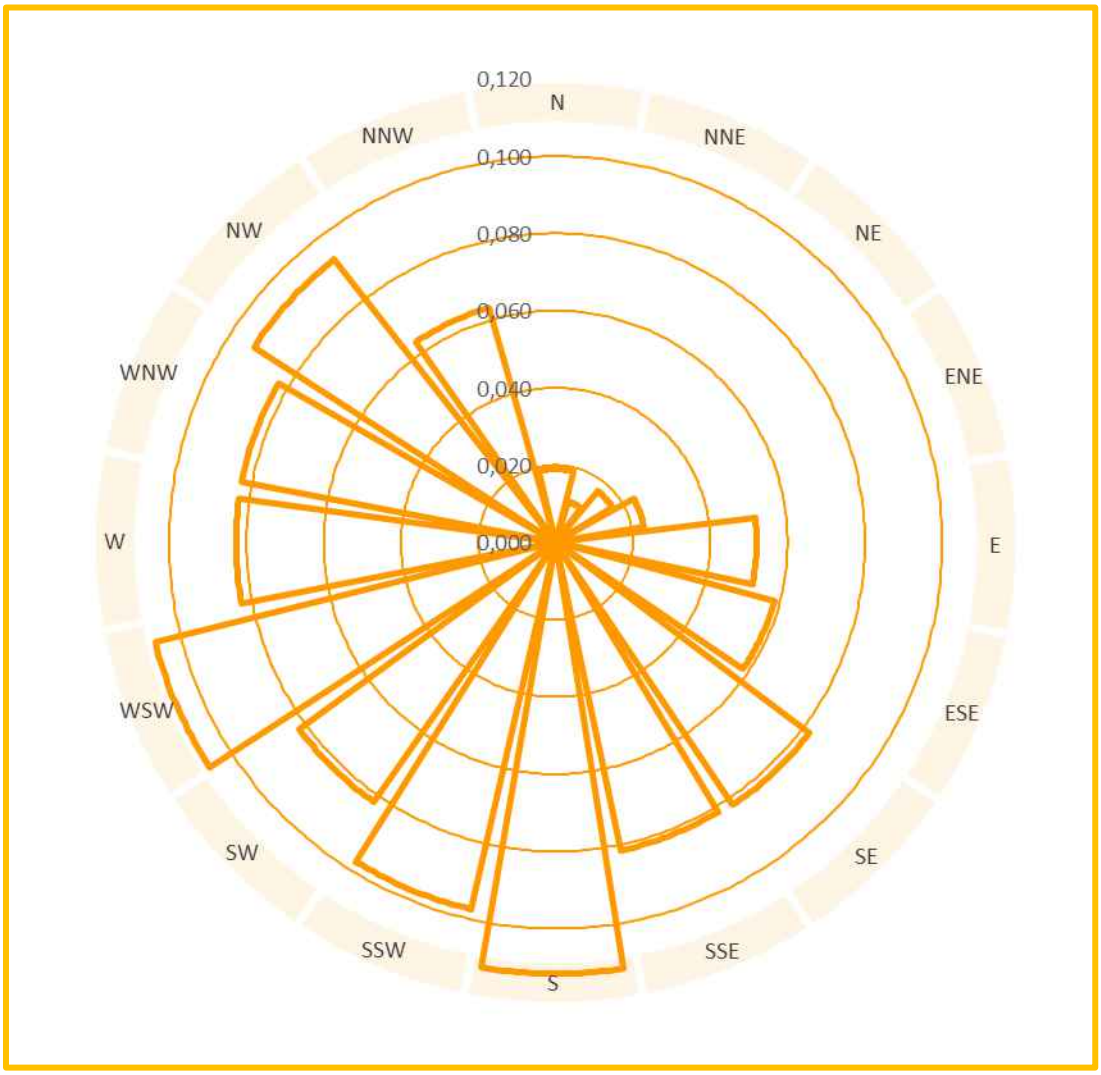

Figure 2.3: Wind statistics at site

2.5.3 Weather Conditions Used for Modelling in this Assessment

2.5.3.1 Introduction to Weather Stability Classes

As required in SANS 1461:2018, several weather conditions have been used in the modelling of consequence and risk in this assessment. The choice of weather conditions is in the form of so-called 'Pasquill stabilities'; Pasquill stabilities are measures of 'the tendency of the atmosphere to resist or enhance vertical motion' [6]. Stability is a function of the vertical change in temperature of the air, the wind speed and the type of surface over the area of interest. Stabilities are characterised into the following categories:

[6] AirWare Online Reference Manual: Pasquill Stability Classes, Release Date 2007 06, Revision Level 1.1. Retrieved from http://www.ess.co.at/MANUALS/AIRWARE/stability_class.html on 23 March 2018.

- Neutral: mechanical turbulence is neither enhanced nor inhibited;
- Unstable: Where turbulence is enhanced; and
- Stable: Where the atmosphere inhibits mechanical turbulence.

Stability classes (Pasquill classes) can be defined for various meteorological instances, as functions of wind speed and solar radiation. Commonly, six Pasquill stability classes are defined:

Table 2.14: Pasquill Stability Classes and descriptions

	Stability class	Description of stability
1.	A	Very Unstable
2.	B	Unstable
3.	C	Slightly unstable
4.	D	Neutral
5.	E	Stable
6.	F	Very stable

The stability classes can be related to several driving forces: wind speed, solar radiation and cloud cover as follows:

Table 2.15: Relating stability classes to wind speed, cloud cover and solar radiation

Wind speed (m/s)	DAY Incoming solar radiation			NIGHT	
	Strong	Moderate	Slight	> 4/8 cloud	< 3/8 cloud
< 2	A	A - B	B		
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

2.5.3.2 Stability Classes and Wind Speeds Used in this Assessment

To represent a range of weather conditions possible at the site, and in accordance with SANS 1461:2018, the several stability classes and wind speeds were used in this assessment along with the corresponding time of day.

Wind speed distribution per year was found to be as follows:

Table 2.16: Wind speed and fraction distribution at the site

Wind speed (km/h)	Wind speed (m/s)	Fraction per year
1 to 5 (>1)	0.83	0.31

Wind speed (km/h)	Wind speed (m/s)	Fraction per year
5 to 12 (> 5)	2.36	0.46
12 to 19 (> 12)	4.31	0.17
19 to 28 (> 19)	6.53	0.05
28 to 38 (> 28)	9.17	0.00
38 to 50 (> 38)	12.22	0.00
50 to 61 (> 50)	15.42	0.00
>61	16.94	0.00

From the table above and as per the methodology described SANS 1461:2018 Table C.3 the following weather stabilities and corresponding wind speeds were used for the analysis:

Table 2.17: Pasquill stabilities and wind speeds used for the assessment

Day weathers	Night weathers
B 1	F 1
C 2.36	E 2.36

2.6 Special Features Around Site

Close to the site is a Shell depot which is a confirmed MHI site and Bushveld Vanchem and Tam Alloys which are also possible MHIs and may impact the site. This was described in more detail in Section 2.1: Site Location.

Furthermore, there is Witbank Airport located approximately 3 km north-east. The airport handles small aircrafts and a sky-diving school. It is possible that the site is located underneath the flight path, and incidents onsite could result in smoke dispersion which may affect flying into and out of the airport.

2.7 Relevant Topography of the Area

The area around the facility was noted to be generally flat (comprising mainly of industrial land) and geologically featureless.

3 METHODOLOGY FOR RISK ANALYSIS AND ASSESSMENT

"Risk is a combination of consequence and likelihood of occurrence."

The MHI Risk Assessment was conducted using the methodology described in Figure 3.1. The SANS 1461:2018 standard (Major Hazard Installation – Risk Assessments) was used as a basis for calculation. The standard prescribes the methodology to be followed when conducting MHI Risk Assessments, including methods for identifying hazards, conducting consequence and frequency analysis, performing risk summation, assessing risk outcome (the standard provides risk tolerability criteria), demonstrating that risk is As Low As Reasonably Practicable (ALARP) and types of Risk to be communicated in the MHI Risk Assessment report.

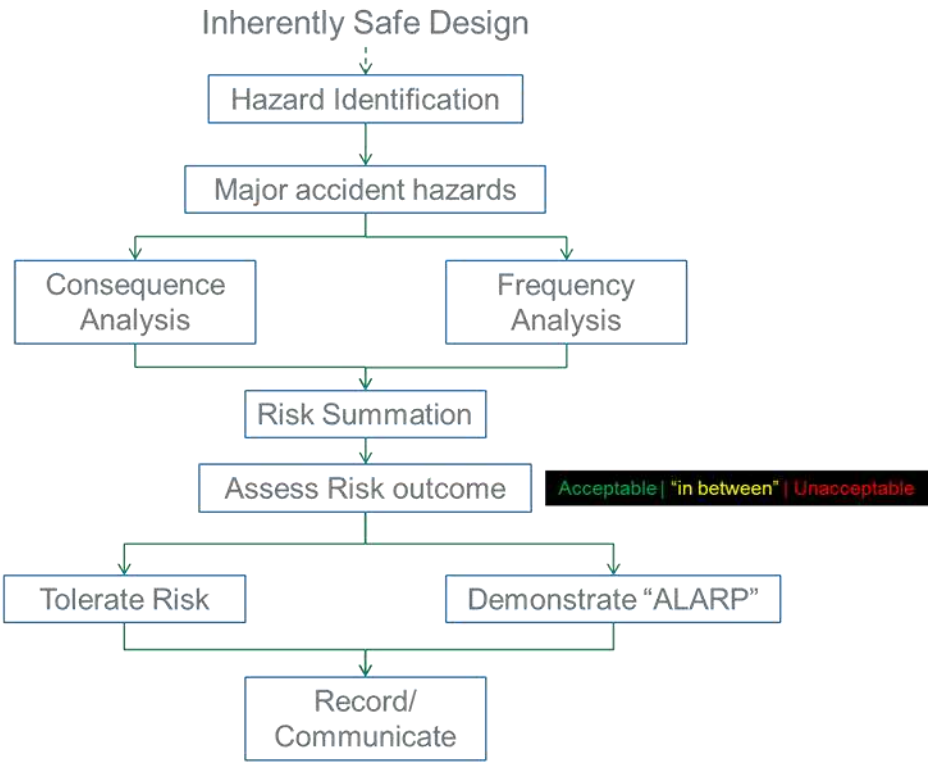

Figure 3.1 Risk assessment methodology

3.1 Methodology for Inherently Safer Operation

"Are there opportunities to make the process safer by design, free of hazards as much as possible?"

Using the concept of Inherently Safe Design and Operation, MMRisk observed operations, information and descriptions as given at the site visit and formed an opinion on possible areas of change which may lead to operations which are inherently safe. The Inherently Safer review included looking for opportunities to:

- Minimise: Finding opportunities to reduce inventories of hazardous materials;
- Substitute: Finding opportunities to substitute hazardous materials with less hazardous ones;
- Moderate: Where appropriate, finding opportunities to operate at less hazardous conditions which are far from equilibrium for the materials handled, e.g., less pressure, less temperature.
- Simplify: Simplify activities where possible to reduce the opportunities for failure.

This review of operations was performed by MMRisk remotely and outcomes communicated with the Depot Manager where any were found.

3.2 Methodology for Hazard Identification

"What major hazards exist on site? What can go wrong?"

Hazard Identification (HAZID) followed the widely used methodology involving the segregation of the process into nodes or constituents parts or individual installations and investigating each node/ part/ installation to identify hazards which are inherent in the process as well as their causes, consequences and possible mitigation measures. This is a high-level review described in SANS 1461:2018 "Major Hazard Installation Risk Assessments".

A desktop HAZID was performed remotely by MMRisk and the results are communicated in Section 4 of this study.

3.3 Methodology for Consequence Analysis

"Were hazards to be realised, what would be effects of major incidents occurring?"

This section details the major incidents associated with the types of installations and/or hazardous materials present onsite, potential incidents and the consequences of those incidents.

3.3.1 Methodology for Pool Fire Modelling

The petrol and diesel handled onsite present pool fire hazards and as such modelling was performed to determine which of the installations would present a significant risk to members of the public and employees.

Pool fires occur when a pool of flammable liquid is formed on the ground and ignited. Drained or kerbed areas must be taken into account to determine the size of the pool and the effects. For the petrol handled onsite, a relatively low amount of smoke is expected to be dispersed were a pool fire to occur, due to the relatively low number of carbon atoms in the hydrocarbon materials. For diesel, a high amount of smoke would be expected. This difference has been taken into account in the modelling.

https://iffmag.mdmpublishing.com/xtreme-fire-training-with-the-best-in-the-business-2/

Figure 3.2: Illustration of pool fire (also showing smoke dispersion)

The following endpoints were modelled in line with SANS 1461:2018:

- 37.5 kW/m^2 representing a 100% fatality probability for those exposed and ignition of wood, textiles, fibreboard, hardboard and plastics. This also corresponds with severe damage to process equipment, possible domino effects and large numbers of fatalities.
- 12.5 kW/m^2 representing minor damage to process equipment and less than 1 % fatalities; and
- 6.3 kW/m^2 representing a radiation level useful for emergency response planning. People exposed to this radiation level or more for more than 2 minutes may encounter problems with escape and evacuation and therefore be at risk of injury and death.

Pool fire modelling was conducted using DNVGL Phast and Safeti version 8.23.

3.3.2 Methodology for Overfilling Generating Flammable Vapour Cloud

Tank overfill was considered a possibility due to pipeline feed of petrol. When a tank is overfilled there is the potential to generate a flammable vapour cloud which disperses over the surrounding area. The mechanism of flammable vapour generation and the size of the vapour cloud in such a case is significantly dependant on the surface tension of the fluid being overfilled (in this case petrol was considered), the circumference over which overfilling takes place, the rate of filling and the time over which the overfill takes place.

An overfill event was modelled in this study taking into account guidance from the FABIG Technical Note 12[7]. The publication presents a technique to calculate the generation of vapour from an overfill event, based on the Buncefield incident of 2005 in the UK, as well as experiments conducted afterwards. When an overfill takes place, petrol droplets may evaporate forming a flammable vapour; there will likely be entrainment of air into the flammable vapour and the extent of entrainment will depend upon:

- The liquid surface tension
- The liquid mass flow
- The cross sectional area of the cascade(s)
- The height of free fall.

The following endpoints are of interest when considering the effects of ignition of a flammable cloud:

Flash Fire Effects [8,9]

Flash fires result when ignition of a flammable cloud occurs in the absence of a significant level of confinement and/or congestion and the effects are dominated by thermal radiation. Two concentration levels: the lower flammability limit (LFL) as well as half (1/2) of the LFL are considered important for risk calculation. For those exposed in the event of a flash fire, the effects would differ depending upon their location indoors or outdoors:

Impact on people located outdoors:

- Those located within the LFL contour would develop deep burns over a major part of their body, especially if no personal protective equipment (PPE) is worn. Those exposed would almost certainly suffer fatal injury due to the superheating effect of a flash fire and the generation of toxic and superheated combustion products (100% fatality probability);

- Those located between the LFL and ½ LFL contours would still be at risk of fatal injury due to the presence of flammable pockets of gas and would be considered to have a 20% probability of suffering fatal injury (20% fatality probability).

Impact on people located indoors:

- For those located within the LFL contour indoors, the thermal impact on buildings may result in parts of the building catching alight. The generation of combustion products indoors is also important, and as a result, those indoors would have a 30% probability of fatality;

- For those between the LFL and ½ LFL contours the probability of death for those indoors is considered negligible.

[7] Fire and Blast Information Group (FABIG), Technical Note 12: Vapour cloud development in overfilling incidents, April 2013.
[8] The Netherlands Organisation for Applied Scientific Research (TNO), Green Book, Methods for determination of possible damage, CPR16E, Den Haag, 1992.
[9] Mannan, Sam. (2012). Lees' Loss Prevention in the Process Industries, Volumes 1-3 - Hazard Identification, Assessment and Control (4th Edition). Elsevier. Retrieved from https://app.knovel.com/hotlink/toc/id:kpLLPPIVH2/lees-loss-prevention/lees-loss-prevention

Effects of Vapour Cloud Explosions

When a flammable vapour cloud ignites in the presence of significant confinement, the rapid release of combustion gases results in a rapid build-up of pressure which results in the generation of a blast wave. When a flammable vapour ignited in the presence of significant or congestion, the obstacles causing the congestion result in flame acceleration which results the generation of a pressure wave, resulting in a vapour cloud explosion.

Table 3.1 presents the effects of explosion overpressure, based on observations from previous incidents.

Table 3.1: Explosion overpressure effects (TNO Green Book [8])

Description of damage	Peak overpressure (kPa)
The roof of a storage tank has collapsed.	7
Connections between steel or aluminium undulated plates have failed. Minor damage to process equipment and less than 1% fatalities.	7 – 14
Minor damage to steel frames.	8 – 10
Walls made of concrete blocks have collapsed.	15 – 20
Collapse of steel frames and displacement of foundation.	20
Industrial steel self-framing structure collapsed. Cracking in empty oil storage tanks. Slight deformation of a pipe bridge.	20 – 30
Large trees have fallen.	20 – 40
Cladding of light industry building ripped-off.	30
Plating of cars and trucks pressed inwards. Breakage of wooden telephone poles. Severe damage to process equipment, possible domino effects, large numbers of fatalities.	35
Displacement of a pipe bridge, breakage of piping.	35 – 40
Collapse of a pipe bridge.	40 – 55
Brick stone walls, 20 – 30 cm, have collapsed. Loaded train carriages turned over.	50
Displacement of a cylindrical storage tank, failure of connecting pipes.	50 – 100
The supporting structure of a round storage tank has collapsed.	100

3.4 Methodology for Frequency Analysis

"What is the likelihood that the hazards identified, will be realised?"

Frequency analysis relates to the likelihood that an event will occur. This likelihood is based upon previous accidents for similar materials and equipment, and the manner of failure. Often such previous accident data is summarised in the form of frequency databases. In this study, the likelihood of events occurring was based on frequency information from the BEVI publication [10].

The table below summarises the scenarios considered as well as the associated frequencies of occurrence.

Table 3.2: Release scenarios and associated frequencies of occurrence

Type of equipment	System onsite	Scenario	Base frequency
Fixed storage or processing units at atmospheric pressure or lower (for example, tanks, blending vessels) and atmospheric transport units (for example, standard road tankers, intermediate bulk containers (IBCs)	Petrol and diesel atmospheric tanks, and road tankers	1a) Catastrophic rupture (with bund overtopping if necessary).	5.00E-06
		1b) Road tanker instantaneous release of contents (Each compartment is considered a tank so frequency is divided by the number of compartments).	1.00E-05
		2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5.00E-06
		2b) Atmospheric transport units – release of entire contents from the largest connection.	5.00E-07
		3a) Small hole in vessel (leak typically 10 mm diameter).	1.00E-04
Additional scenarios: Loading unloading into / out of tankers	Petrol and diesel road tanker loading	1) Rupture of loading/unloading arm or loading/unloading hose (per hour).	4.00E-06
		2) Leak in loading/unloading arm or loading/ unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour).	4.00E-05
Pipe, hose, arm (onsite pipelines, including cylinder filling operations) per metre per year	All pipework	1) Pipeline full bore rupture.	1.00E-06
		2) Small hole in pipeline (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5.00E-06
Pumps and Compressors	All pumps	Pump / Compressor Catastrophic failure.	1.00E-04
		Pump / Compressor Leak (10 % diameter).	4.40E-03

[10] Dutch National Institute of Public Health and the Environment (RIVM), Centre for External Safety in their publication Reference Manual Bevi Risk Assessments version 3.2 of July 2009.

Furthermore, frequency data published is often generic and several facility-specific factors have to be taken into account. This was done in this study by way of event tree analysis. Frequency modelling was carried out in DNVGL Safeti version 8.23, including Event Tree Analysis to determine the likelihood of the various events.

Details of frequencies used in the study are provided in Section 7.

3.5 Methodology for Risk Summation and Assessment

"The combination of consequence and likelihood are combined and reported here."

Risk summation was carried out using DNV Safeti version 8.23 and individual risk and societal risk were reported. Once risk is calculated, it has to be assessed against standing criteria. In this study, assessment was performed against the acceptability criteria defined by SANS 1461:2018 as follows.

3.5.1 Individual Risk Acceptability Criteria

Individual Risk represents the chance that an individual will experience fatal injury as a result of major accidents emanating from site. The risk can be 'acceptable' or 'unacceptable' depending on its magnitude. Individual Risk tolerability or acceptability is based upon data from SANS 1461:2018. Individual Risk can be categorised into various regions as illustrated in Figure 3.3.

3.5.1.1 Intolerable Risk for Workers

Individual Risk calculated to be at or above the 1 x 10^{-3} /year level is considered intolerable for all individuals, including workers at industrial sites. Workers at industrial sites are able to withstand a higher level of risk than members of the general public because they tend to be organised and drilled in emergency response, generally healthier and mobile and tend to be equipped with personal protective equipment (PPE).

3.5.1.2 Intolerable Risk for Members of the Public

Individual Risk calculated to be at or above the 1 x 10^{-4} /year level is considered intolerable for members of the general public. This level assumes a theoretical individual present for 24 hours per day and 365 days per annum at a location.

3.5.1.3 Risk Tolerable if ALARP

Risk calculated to be between the 1 x 10^{-6} /year and either the 1 x 10^{-4} /year (general public) or the 1 x 10^{-3} /year levels (workers), can be tolerated if proven to be 'ALARP'. The phrase 'ALARP' stands for As Low As Reasonably Practicable. In this region, illustrated in Figure 3.3, risk can be tolerated if it can be proven by site that it has considered options for reducing the risk further that the costs of any measures to further reduce risk are grossly disproportionate to the risk reduction benefits gained.

3.5.1.4 Broadly Acceptable Risk

Risk calculated to be below the 1 x 10^{-5} / year is considered broadly acceptable for workers, while risk below 1 x 10^{-6} / year is considered broadly acceptable for members of the general public.

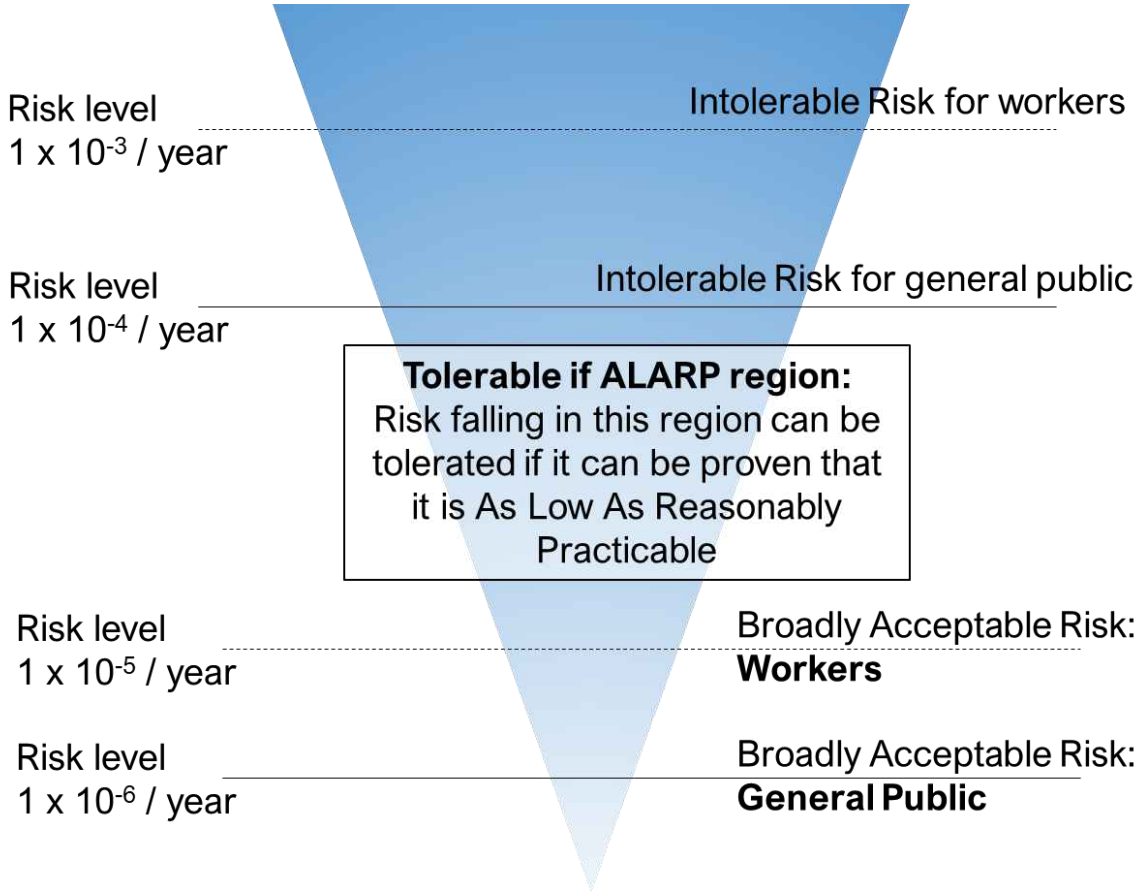

Figure 3.3: Individual risk acceptability criteria (SANS 1461:2018)

3.5.2 Societal Risk Acceptability

Societal Risk has been presented in this report in the form of an FN Curve. FN Curves are defined in the CMPT publication [11] as plots showing frequency of events vs the number of fatalities arising from those events. They display cumulative frequencies (F) of events involving N or more fatalities. They are useful illustrations of the relationship between frequency and size of the accident.

FN Curves often contain risk tolerability criteria; the criteria used in this study was derived from SANS 1461:2018 and is illustrated in Figure 3.4. The tolerability criteria are illustrated here using two straight lines (red and blue). The region above the red line indicates a region of intolerable risk, the area below the blue line indicates an area of broadly acceptable risk. Societal risk located between these lines can be tolerated if it is ALARP.

[11] Spouge J, Centre for Marine and Petroleum Technology (CMPT), A Guide To Quantitative Risk Assessment for Offshore Installations, 1999.

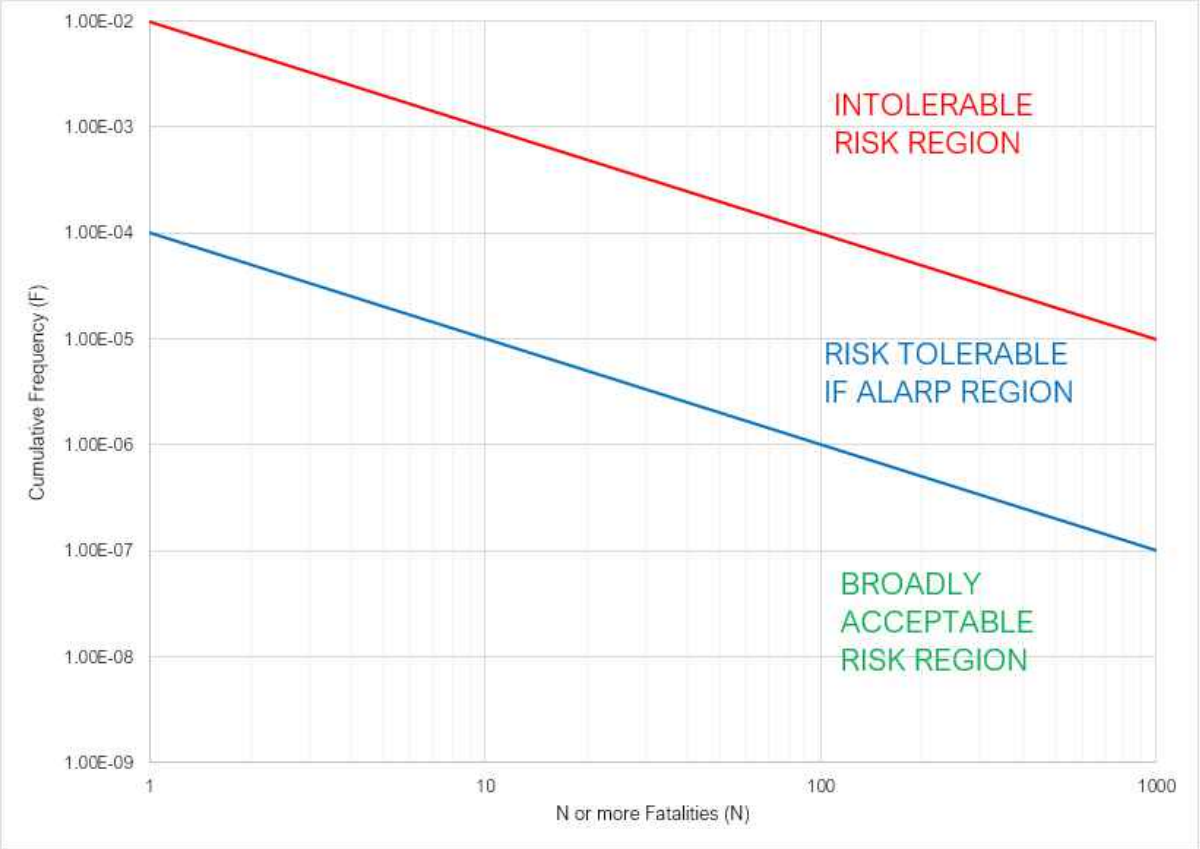

Figure 3.4: An example of an FN curve showing societal risk acceptability limits

3.5.3 Methodology for Land Use Planning

Risk was used in this study as a basis for making land use judgments and providing land use advice. The approach is based on the approach defined in SANS 1461:2018 to land use planning which summarises as follows.

3.5.3.1 STEP 1: Consultation Zones

The standard defines three consultation zones: an outer zone, middle zone and inner zone, illustrated in Figure 3.5. Each of the zones is defined according to an individual risk level, as shown in the figure. Once the zones are determined, the appropriateness of land uses or potential land uses in each zone can be determined through a classification of types of land uses.

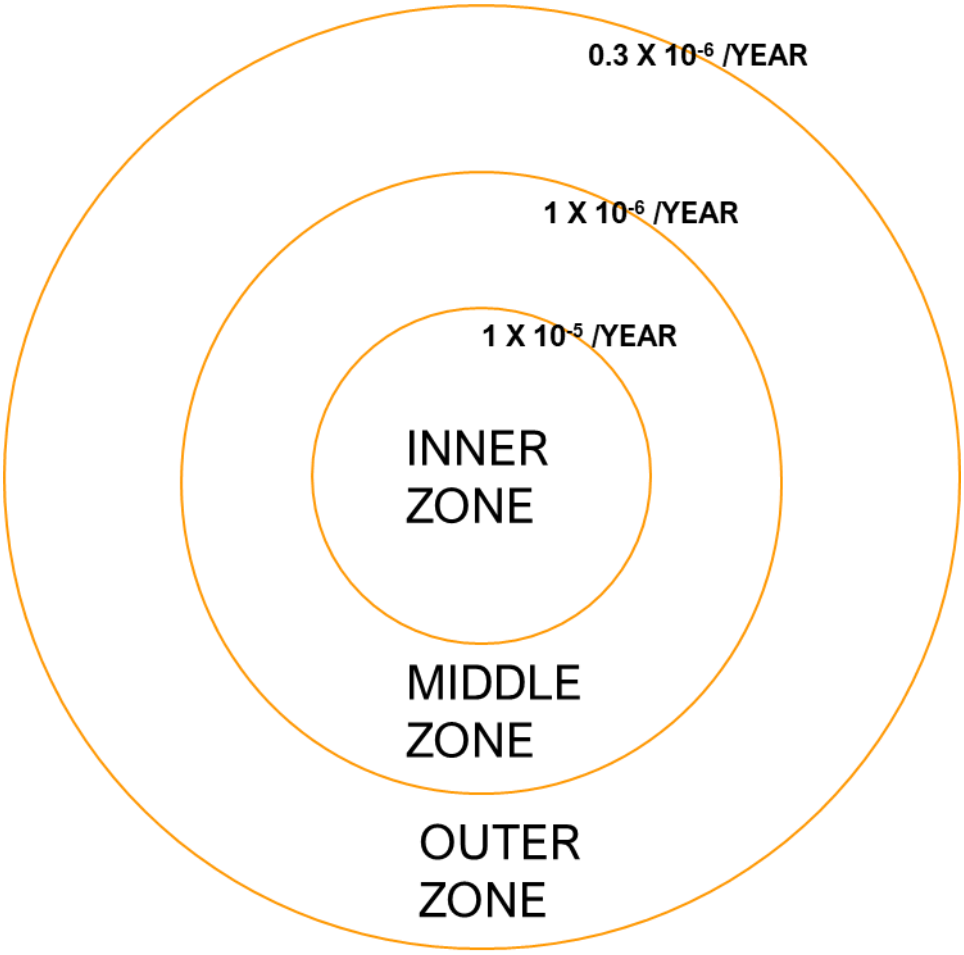

Figure 3.5: SANS 1461:2018 land use planning consultation zones

3.5.3.2 STEP 2: SANS 1461:2018 Classification of Land Uses

Land uses can be separated on the basis of their sensitivity to major incidents, as follows:

Table 3.3: Land use sensitivity levels and descriptions

Sensitivity level	Type of land use
Level 1	Based on normal working population
Level 2	Based on the general public – at home and involved in normal activities
Level 3	Based on vulnerable members of the public (children, those with mobility difficulties or those unable to recognize physical danger)
Level 4	Large examples of Level 3 and outdoor examples of Level 2

3.5.3.3 STEP 3: Land Use Advice Based on Sensitivity and Consultation Zones

Once the consultation zones and sensitivity levels have been determined, one can provide advice as to whether a type of development can go ahead based on the following guidance:

Sensitivity level	Development in inner zone	Development in middle zone	Development in outer zone
Level 1	Do Not Advise Against (DAA)	Do Not Advise Against (DAA)	Do Not Advise Against (DAA)
Level 2	Advise Against (AA)	Do Not Advise Against (DAA)	Do Not Advise Against (DAA)
Level 3	Advise Against (AA)	Advise Against (AA)	Do Not Advise Against (DAA)
Level 4	Advise Against (AA)	Advise Against (AA)	Advise Against (AA)

3.6 Methodology for Risk Treatment

"The major risk issues are highlighted and methods for reducing risk are suggested and assessed."

Following the risk assessment stage, all scenarios resulting in intolerable risk and risk which can be tolerable if proven to be ALARP, were analysed further in the Demonstration of ALARP stage. In this stage, options for risk reduction were considered, criteria for deciding between these options (which may include cost) as well as the resulting decrease in risk if each option is applied.

Should the client require a detailed comparison between options including a cost benefit analysis, this shall be conducted separately.

4 HAZARD IDENTIFICATION

"What major hazards exist on site? What can go wrong?"

4.1 Hazardous Materials Onsite

The site handles a number of materials, whose properties are summarised in the table below. The table provides a description of each, including CASRN numbers to identify individual components, the throughput or storage capacities, hazardous material classifications as well physical characteristics. Further details of these materials can be found in the Safety Data Sheets (SDSs) found in the Appendix B.

Table 4.1: Hazardous materials onsite

Name	UN/ CASRN number	Maximum capacity*	Maximum release quantity	SANS 10228 category	Physical, chemical and toxicological characteristics of the materials		Key reactions		Licence restrictions
					Normal conditions	Foreseeable abnormal conditions	Normal conditions	Foreseeable abnormal conditions	
Unleaded Petrol (ULP95 & ULP93)	Petrol: 649-261-00-8 (>90% of mixture)	Combined onsite storage capacity: 17,676 m^3 (approx. 14,000 tons)	Continuous flow up to 3 days / week.	Class 3	Flammable liquid (low flash point)	Flammable liquid (low flash point) or flammable vapour (Buncefield incident)	-	-	- The site does not have a dangerous goods certificate.
Diesel	Diesel: 68334-30-5 (>80% of mixture)			Class 3	Flammable liquid (high flash point)	Flammable liquid	-	-	

* Under the recently promulgated MHI Regulations (31st January 2023) the site would be classified as a Medium Hazard Facility.

The hazardous locations, main occupied buildings, tank farms and bunds and the main site entrance are illustrated in the site's layout plan (MMRisk was prohibited from reproducing the site layout diagrams but the diagrams are available from the site upon request).

4.2 Any Significant Incidents which have Happened in the Past at the Site and Lessons Learned

No significant incidents reported by the Depot onsite. However, there has been several veldfires and pipeline incidents around the area.

4.3 Major Accidents at Related Facilities

Major accidents occurring at facilities similar to the site would include:

Table 4.2: Diesel previous incidents in industry

Company	Country, date	Short description of event
Delta	USA, 2020	While refueling a diesel tank from a fuel truck, a spark inside the tank ignited the fuel when the working employee turned the pump on. The explosion that resulted from the diesel tank, killed the employee.
Sunburst Transportation	USA, 2019	An employee was pumping fuel from a portable tank bank into a tanker truck by top-loading. The fuel was a mixture of diesel and gasoline. The employee was on top of the pump truck checking tank-3 when vapours from this tank ignited into flames. The employee was instantly caught on fire. This led to him being thrown from the top of the truck. The flash fire spread to tank-4, which had been open. Tank-4 then ignited and an explosion followed. The explosion ruptured the side of tank-4 to release its contents which spilled out onto the employee. He died from third degree burns to his face and hands, second degree burns on the rest of his body.
Hensen's Quality Jerseys, LLC	USA, 2014	An employee was welding a diesel fuel tank that had a small amount of diesel fuel left in it. During welding, the tank exploded and killed the employee.

Table 4.3: Petrol (gasoline) previous incidents in industry

Company	Country, date	Short description of event
Giant Industries Refinery	Gallup, New Mexico, 2005	Four workers were seriously injured when highly flammable gasoline components were released and ignited at the refinery. The release occurred as maintenance workers were removing a malfunctioning pump from the refinery's hydrofluoric acid alkylation unit. Unknown to personnel, a shut-off valve connecting the pump to a distillation column was apparently in the position, leading to the release and subsequent explosions.
Sunburst Transportation	USA, 2019	An employee was pumping fuel from a portable tank bank into a tanker truck by top-loading. The fuel was a mixture of diesel and gasoline. The employee was on top of the pump truck checking tank-3, when vapours from this tank ignited into flames. The employee was instantly caught on fire. This led to him being thrown from the top of the truck. The flash fire spread to tank-4, which had been open. Tank-4 then ignited and an explosion followed. The explosion ruptured the side of tank-4 to release its contents which spilled out onto the employee. He died from third degree burns to his face and hands, second degree burns on the rest of his body.

The extent of the dispersion of pool fire thermal radiation and flammable vapour thermal radiation are described in Section 6: Consequence Analysis.

4.4 Containment Systems for Analysis

Certain equipment and operational areas on site are contained within bunds and kerbed/ drained areas. The table below describes the containment areas on the site and these are illustrated on the site layout, which is included in Appendix F.

Table 4.4: Containment areas

Containment area	Type of containment	Containment area	Containment height (Assumed)
		m^2	m
Bund A (T5)	Tank Bund	443	1
Bund B (T7)	Tank Bund	590	1
Bund C (T6)	Tank Bund	376	1
Bund D (T8)	Tank Bund	572	1
Bund E (T1, T2, T3, T4)	Tank Bund	349	1
Bund F (T9)	Tank Bund	431	1
Fuel Manifold	Low Bund	450	0.1
Intermix Pumps Bund	Low Bund	30	0.1
Loading Area	Kerbed/Drained	3	1

Although some pipelines are not bunded, any releases in these areas will be contained by kerbs, buildings, etc.

4.5 Description of Safety Systems

Safety systems are described in Section 2.3: Detailed Process Description.

In addition, the site has the following firefighting equipment / systems:

- Diesel fire engine
- Foam (approximately 10 kL tank) with a foam pump (can be started from the SCADA)
- Firewater (approximately 530 kL tank) – Diesel pumps
- Tanks – Foam base injection with plans to have top pourers in the future
- Foam bund pourers
- Fire hydrants
- Diesel generator
- Office of Emergency Management
- Foam cannons (manual system)
- Cooling cannons
- Fire extinguishers
- Evacuation alarm unit
- Underground sump tanks
- Cooling rings on tanks
- Assistance from Witbank Fire Brigade
- Fire suppression system inside buildings
- Control room – Shatter Proof Window

Further details of the firefighting equipment/ systems are provided in the site's Emergency Response Plan (ERP) included in Appendix D.

4.6 Isolation Systems and Associated Release Durations

Modelling performed in this assessment has taken advantage of the isolation systems present onsite as listed in Section 2.3. Each safety [isolation] system has a probability of failure, described in SANS 1461:2018 and summarised in the table below.

Depending upon the part of the system analysed, various isolation systems and associated durations of release can be expected as highlighted in yellow in the table below.

Table 4.5: Isolation systems and associated release durations

System	Release duration	Probability of failure
Automatic shut off system (e.g., ASOV)	2 minutes	0.001
Semi-automatic: Requires operator control room intervention	10 minutes	0.01
Non-Automated system	30 minutes	0.1
Excess flow valves	5 seconds	Take 0.06
Non Return Valves (consider if tested regularly)	5 seconds	0.06
Breakaway couplings	5 seconds	0.06
Operator intervention (ESD) (supervised activities)	2 minutes	0.1

5 HAZARD ANALYSIS

5.1 List of Scenarios Modelled for each Containment System

The scenarios modelled were in line with the requirements of the SANS 1461:2018 standard. These scenarios are based on previous accidents in industry and they range in terms of probability of occurrence. A full treatment of all the scenarios modelled as well as associated frequency data for each scenario is elaborated further in Appendix C.

5.2 Description of Causes, Consequences, Preventive and Mitigative Measures

This section summarises the release scenarios possible at the site, and analyses the probable causes, preventive measures, as well as mitigative measures and end consequences. This provides an illustration of the prevention and mitigation measures available onsite which contribute to risk reduction.

Table 5.1: Illustration of causes, consequences, preventive and mitigative measures

Cause	Prevention measures	Top event/ scenario	Mitigation measures	End consequence(s)
• Corrosion • Impact (equipment or other)	• Design of equipment • Maintenance regime (including cathodic protection) • Access restrictions (barriers)	**Leak through incoming and outgoing pipelines**	• Operator supervision • Contact control centre to cut feed	Spill of flammable liquid – possible pool fire and ground contamination.
• Corrosion • Impact (equipment or other)	• Maintenance regime • Access restrictions (barriers) including bunding	**Tank/ vessel leaks**	• ESD to cut feed • Bunding	Spill of flammable liquid – possible pool fire and ground contamination.
• Incorrect tank level reporting	• Level control system • Tank inlet valve	**Tank overflow incidents**	• Operator supervision • ESD to cut feed on high-high level • Contact control centre to cut feed • Bunding	Spill of flammable liquid and potential for producing a flammable vapour cloud.
• Loading decoupling corrosion impact (equipment or tankers)	• Maintenance of road tanker • loading procedures (to prevent decoupling)	**Leaks involving road tanker loading**	• Road tanker ESD to cut feed	Spill of flammable liquid – possible pool fire and ground contamination.

5.3 Organisational Measures in Place at the Site

The site runs a number of management systems:

- Transnet Integrated Management System
- ISO 14001 (Environmental Management)
- ISO 9001 (Quality Management and Quality Assurance)
- ISO 45000 (Occupational Health and Safety)
- Engineering Procurement Construction Management (EPCM)
- Change Control
- IEC
- AIP - Tanks

All equipment on site also undergoes periodic (monthly) maintenance. This is controlled through the maintenance management system on SAP. Monitoring and reporting of maintenance activities takes place monthly.

MMRisk considers that the organisational measures, specifically the management systems in place at site are sufficient for the site's operations.

5.4 Requirements in Terms of Environmental Conservation Act, 1989

The Environment Conservation Act of 1989 has been largely replaced by the National Environmental Management Act, 1998 (NEMA) (however, MMRisk understands that several provisions still stand).

No projects are underway requiring environmental authorisation. The normal NEMA Section 30 type processes (releases of hazardous materials) may be triggered in line with any releases which may occur from time to time.

6 CONSEQUENCE ANALYSIS

"If things do go wrong onsite, what is the extent of the potential damage?"

6.1 Scenarios Included in Risk Analysis

The scenarios listed in Section 5.1: List of Scenarios Modelled were included in the risk calculations with no exceptions.

6.2 Key Process Data for Major Scenarios

Key process data was compiled for each system, as shown in Section 2.3: Detailed Process Description, through information from the site visit as well as engineering information obtained from the site.

6.3 Consequence Analysis of Materials at the Witbank Depot

In the consequence modelling software used, DNVGL Phast version 8.23, the various substances handled onsite were modelled differently as follows:

- Diesel was modelled as **n-nonane**, with a 'smoky' flame. 'Smoky' implies that the flames would burn with a significant amount of smoke and soot which would act to absorb the thermal radiation emitted and thus result in pool flames of less intense radiation as a function of distance as compared to lighter hydrocarbon fuels with less carbon atoms, which would burn with less smoky flames.

- Petrol and intermix fuel were modelled as **n-hexane** with a mostly 'luminous' flame. 'Luminous' implies that the flames burn hotter with less smoke emitted than with diesel. The result is more pronounced consequence effects; the maximum surface emissive power of all petrol flames was calculated in the modelling software as approximately 140 kW/m^2.

6.4 Worst Case Effects at the Depot

The contours shown in the following figures show potential worst-case impact from losses of containment of petrol and diesel and **do not take into account the frequencies of occurrence of the various releases**. It is further assumed that wind could be blowing in any direction and therefore shows maximum impact of each release. In reality, wind would be blowing in a particular direction with impact concentrated over one of the areas covered by the contours shown.

6.4.1 Tank Overfill Incidents Leading to Buncefield-type Events

As discussed previously, any fuel that cannot be received by a client or fuel that is intermixed when changing the product in the pipeline is transferred to and stored in bulk intermix tanks. For the purposes of this risk assessment, it was conservatively assumed that the tanks are filled with petrol.

Overfilling of one of the petrol tanks could result in the generation of a flammable vapour cloud due to the evaporation of petrol running down the side of the tank and encountering obstacles such as the wind girder,

instruments and ladders and other objects. The extent of the vapour cloud is influenced by the circumference over which overfilling take place, which would in turn be influenced by the number of overflow vents which are located on top of the tank.

Tank T6 was considered as an example to illustrate the potential effects of overfilling due to its relative proximity to the site boundary.

The incoming pipeline flow rate was taken as 11,300 litres per minute and the density approximately 748 kg/m^3 and the ambient temperature at 9.4 ^{o}C (taking into account that nighttime conditions may result in the worst case dispersion conditions).

There is both high level detection instrumentation as well as independent high-high level detection instrumentation installed on the storage tanks. MMRisk understands that upon high level, an alarm will be activated and the tank inlet valves will automatically divert flow to another tank to prevent an overfill. As a result, the minimum response time can be considered as 2 minutes.

According to the UK HSE Process Safety Leadership Group final report for Safety and Environmental Standards for Fuel Storage Sites[12], the following distances are considered to be a conservative estimate of the hazard zones for tank overfill scenarios (i.e., a Buncefield-type event).

- 2 bar overpressure: 250 metres
- 250 mbar: 400 metres
- Flammable vapour cloud: 437 meters

These distances are illustrated on Figure 6.1. The results shown are those related to low wind speed conditions which may result in dispersion of vapour over relatively large distances.

The extent of the contours associated with the period of time over which overfilling has taken place should inform communication with neighbours on potential impact (with a view, where possible, of neighbours temporarily ceasing operations or taking mitigative action to avoid further escalation). The extent of contours would also inform the Emalahleni Municipality of the extent for road closures in the area if these are considered necessary.

[12] UK Health and Safety Executive, Process Safety Leadership Group, Final Report, 2009.

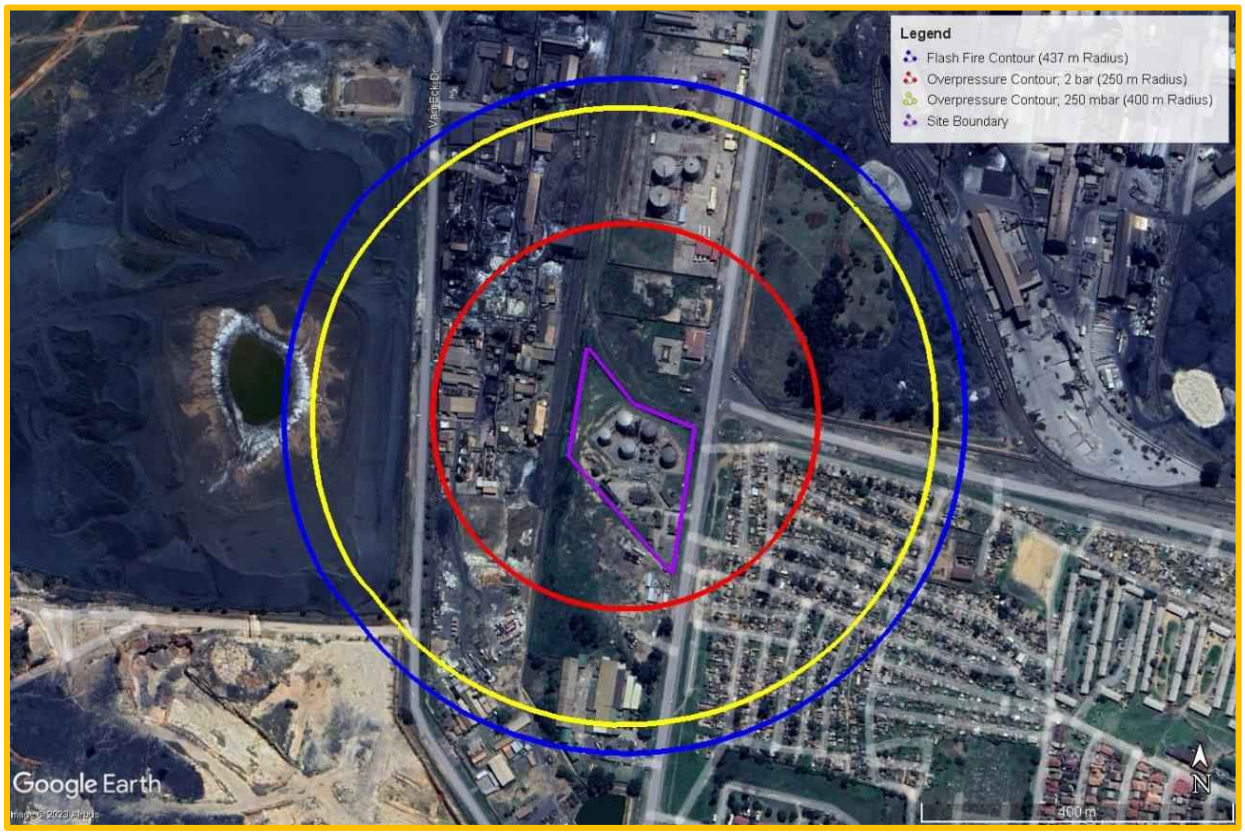

Figure 6.1: Tank T6 (example) overfill with vapour cloud formation (low wind speed conditions)

6.4.2 Effects of Incoming Pipelines Rupture – Failures Leading to Pool Fires

Petrol and diesel are received onsite via pipelines from the Kendal depot. A detailed description of the pipelines is provided in Section 2.3. These pipelines were modelled as a potential leak point (or series of leak points and line rupture). If the pipelines were to catastrophically rupture or a major leak were to occur releasing the flammable liquid, a flammable liquid pool would form and if ignited could result in a pool fire. The worst-case consequences associated with incoming pipelines failures are in this sub-section; associated consequences are presented in Figure 6.2 and Figure 6.3, and described in the table below.

Table 6.1: Incoming pipeline failure – description of thermal radiation impact

Thermal radiation level (kW/m^2)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
37.5 (red contour)	Petrol: 21 Diesel: 18	Represents a 100% fatality probability for those exposed and ignition of wood, textiles, fibreboard, hardboard and plastics. This also corresponds with severe damage to process equipment,	The contour extends over the tank bunds, as well as the control room (the building to the south of the pipe manifold). Therefore, an incident at the incoming pipeline would have an impact which will cause material fatigue to most of the equipment within this contour's radius. This would be the

Thermal radiation level (kW/m²)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
		possible domino effects and large numbers of fatalities.	case if the primary isolation control intervention fails. It is understood that all tanks are fitted with tank cooling rings. The presence of tank cooling rings for all tanks onsite mitigates against this impact. Flow from the Kendal depot to the affected pipeline should be shut at the source to limit the amount of fuel involved in the fire. Continuous feed of the fuel to the pool fires would cause further damage and domino impacts to other connected equipment. A 100% fatality of personnel within this contour is expected together with the significant equipment damage. This contour does not extend off site.
12.5 (yellow contour)	Petrol: 30 Diesel: 26	Minor damage to process equipment and less than 1 % fatalities for those exposed.	This contour extends over to above-mentioned areas to a greater extent as well as the intermix tanks, tank T7, and the intermix pumps. Minor equipment damage would be expected within this thermal radiation contour. This contour does not extend off site.
6.3 (blue contour)	Petrol: 40 Diesel: 36	A radiation level useful for emergency response planning. People exposed to this radiation level or more for more than 2 minutes may encounter problems with escape and evacuation and therefore be at risk of injury and death.	In addition to the areas mentioned above, this contour extends over loading gantry as well as the admin/security building. For any personnel located in the abovementioned areas when an incident occurs, evacuation should be beyond the blue contour to ensure their safety. This contour does not extend offsite.

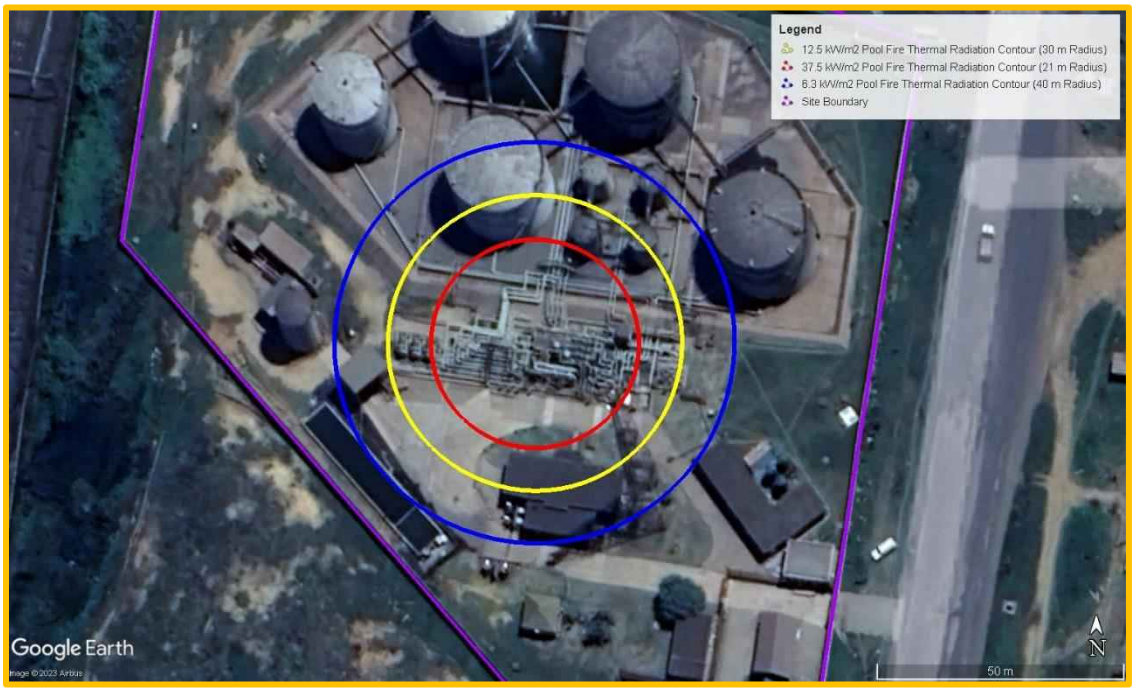

Figure 6.2: Incoming petrol pipeline failure pool fire thermal radiation contours (high wind speed conditions)

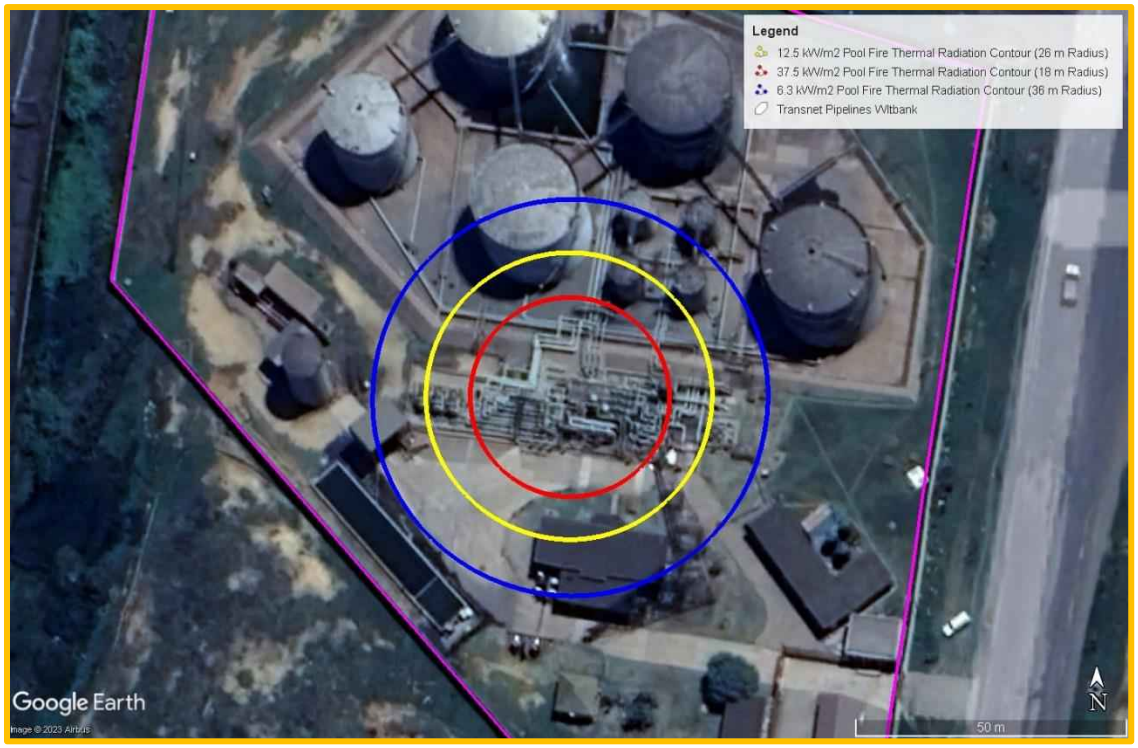

Figure 6.3: Incoming diesel pipeline failure pool fire thermal radiation contours (high wind speed conditions)

6.4.3 Effects of Catastrophic Tank Rupture Resulting in Pool Fires

The worst-case consequences associated with tank failures are detailed in this sub-section; associated consequences are presented in Figure 6.4 for tank T8 and Figure 6.5 for tank T6. If one of the tanks were to fail releasing the flammable liquid, a flammable liquid pool would form and if ignited could result in a pool fire. Thermal radiation emitted from the pool fire would extend as shown by the contours in the figure below and described in the following tables.

Table 6.2: Catastrophic diesel tank failure – tank T8 – description of thermal radiation impact

Thermal radiation level (kW/m^2)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
37.5 (red contour)	20	Represents a 100% fatality probability for those exposed and ignition of wood, textiles, fibreboard, hardboard and plastics. This also corresponds with severe damage to process equipment, possible domino effects and some injuries and possible fatalities.	The contour extends over the some of the tank bunds and pipework associated with the other tanks. Exposure of adjacent tanks to high thermal radiation eventually leads to material fatigue which can lead to failure after an extended period of exposure. It is understood that all tanks are fitted with tank cooling rings. The presence of tank cooling rings for all tanks onsite mitigates against this impact. This contour extends to the northern site boundary.
12.5 (yellow contour)	28	Minor damage to process equipment and less than 1 % fatalities for those exposed.	In addition to the adjacent bunds, this contour extends to the adjacent tanks. Exposure to thermal radiation in these areas would result in minor equipment damage. This contour extends offsite over the northern site boundary.
6.3 (blue contour)	37	A radiation level useful for emergency response planning. People exposed to this radiation level or more for more than 2 minutes may encounter problems with escape and evacuation and therefore be at risk of injury and death.	This contour extends to the areas mentioned above to a greater degree. For any personnel located in the abovementioned areas when an incident occurs, evacuation should be beyond the blue contour to ensure their safety. This contour extends over the northern site boundary.

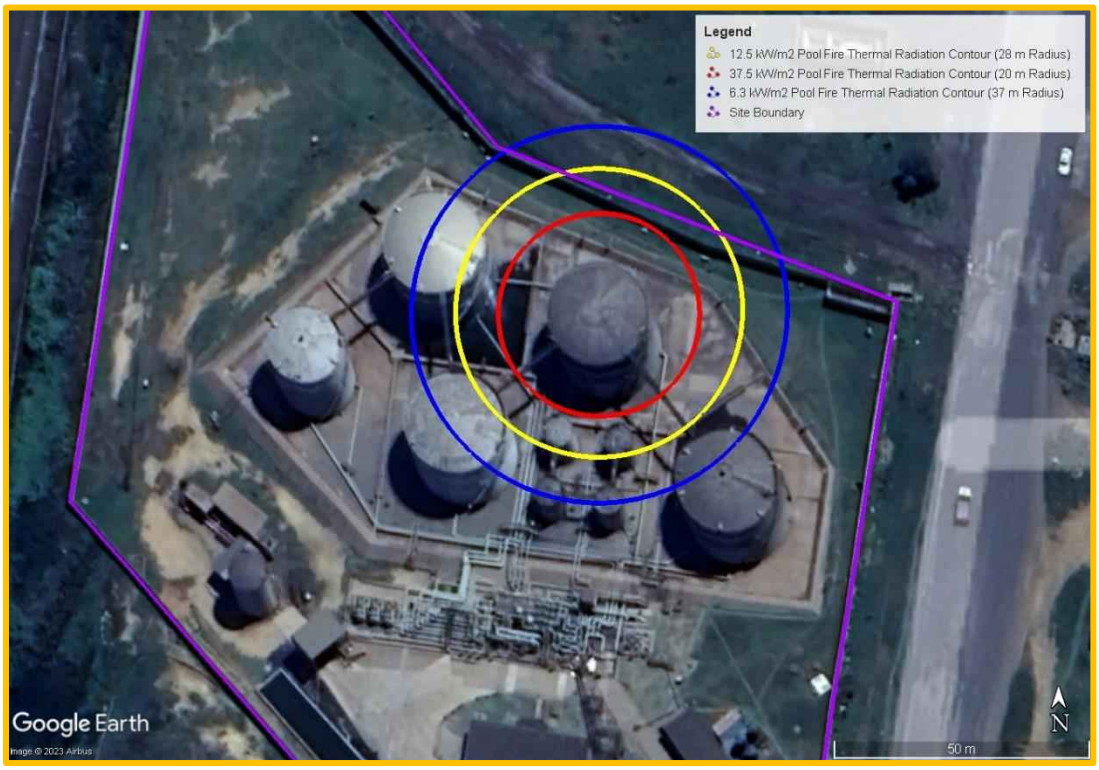

Figure 6.4: Diesel tank T8 failure pool fire thermal radiation contours (high wind speed conditions)

Table 6.3: Catastrophic petrol tank failure – tank T6 – description of thermal radiation impact

Thermal radiation level (kW/m^2)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
37.5 (red contour)	19	Represents a 100% fatality probability for those exposed and ignition of wood, textiles, fibreboard, hardboard and plastics. This also corresponds with severe damage to process equipment, possible domino effects and some injuries and possible fatalities.	The contour extends over its bund and pipework associated with adjacent tanks. Exposure of adjacent pipework to high thermal radiation eventually leads to material fatigue which can lead to failure after an extended period of exposure. It is understood that all tanks are fitted with tank cooling rings. The presence of tank cooling rings for all tanks onsite mitigates against this impact. This contour does not extend offsite.
12.5 (yellow contour)	29	Minor damage to process equipment and less than 1 % fatalities for those exposed.	This contour extends over to the adjacent tanks and pipework. Exposure to thermal radiation in these areas would result in minor equipment and building damage.

Thermal radiation level (kW/m^2)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
			This contour extends over north-eastern site boundary.
6.3 (blue contour)	38	A radiation level useful for emergency response planning. People exposed to this radiation level or more for more than 2 minutes may encounter problems with escape and evacuation and therefore be at risk of injury and death.	This contour extends over to the above-mentioned areas to a greater degree. For any personnel located in the abovementioned areas when an incident occurs, evacuation should be beyond the blue contour to ensure their safety. This contour extends over the site boundary to the north-east.

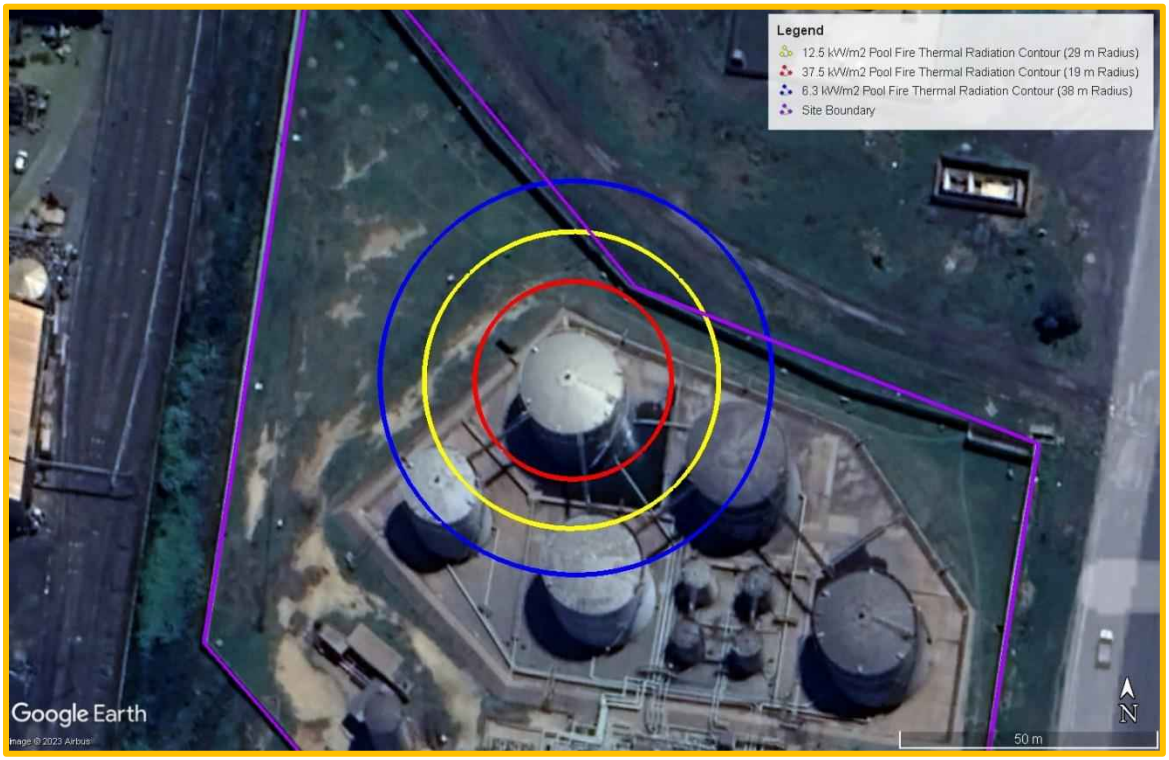

Figure 6.5: Petrol tank T6 failure pool fire thermal radiation contours (high wind speed conditions)

6.4.4 Road Tanker Gantry Worst Case Consequences Resulting in Pool Fires

Road tanker loading losses of containment would result in the spill of fuel which would accumulate and be isolated in the kerbed / drained area. If a spilled flammable pool were to ignite the thermal radiation contours would extend as shown in Figure 6.6 and Figure 6.7 and described in the table.

Table 6.4: Fires at the tanker loading area – description of thermal radiation impact

Thermal radiation level (kW/m^2)	Maximum distance downwind (metres)	Impact of radiation	Description of contour
37.5 (red contour)	Petrol: 9 Diesel: 8	Represents a 100% fatality probability for those exposed and ignition of wood, textiles, fibreboard, hardboard and plastics. This also corresponds with severe damage to process equipment, possible domino effects and some injuries and possible fatalities.	The contour encompasses the road tanker gantry as well as a portion of the transfer tanks area. Therefore, an incident at the road tanker loading area would have an impact which will cause material fatigue to most of the equipment within this contour's radius. This would be the case if the primary isolation control intervention fails. A 100% fatality of personnel within this contour is expected together with the significant equipment damage. This contour does not extend off site.
12.5 (yellow contour)	Petrol: 19 Diesel: 18	Minor damage to process equipment and less than 1 % fatalities for those exposed.	The contour encompasses the road tanker gantry as well as the transfer tanks and a portion of the product pipe manifold. Minor equipment damage would be expected within this thermal radiation contour. This contour does not extend off site.
6.3 (blue contour)	Petrol: 28 Diesel: 25	A radiation level useful for emergency response planning. People exposed to this radiation level or more for more than 2 minutes may encounter problems with escape and evacuation and therefore be at risk of injury and death.	This contour extends over the abovementioned areas to a greater extends as well as tank T7, tank bund north east from the loading area. For any personnel located in the abovementioned areas when an incident occurs, evacuation should be beyond the blue contour to ensure their safety. This contour extends offsite to the south-western site boundary.

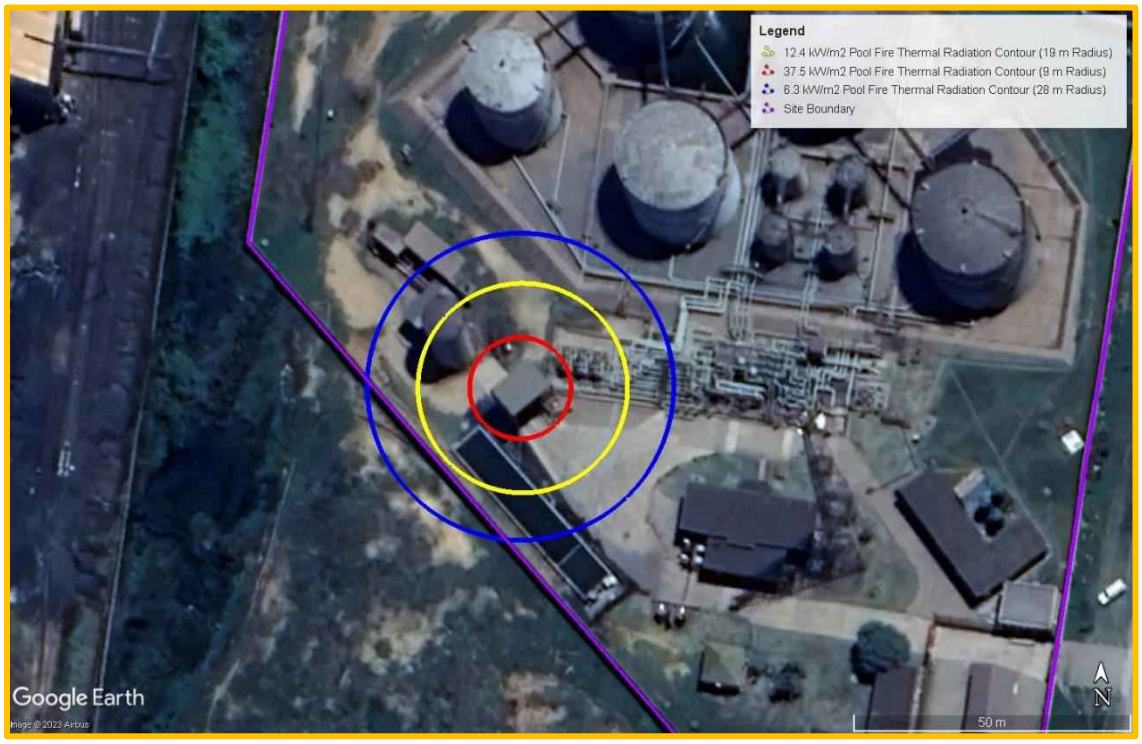

Figure 6.6: Road tanker gantry – petrol loading – pool fire thermal radiation contours (high wind speed conditions)

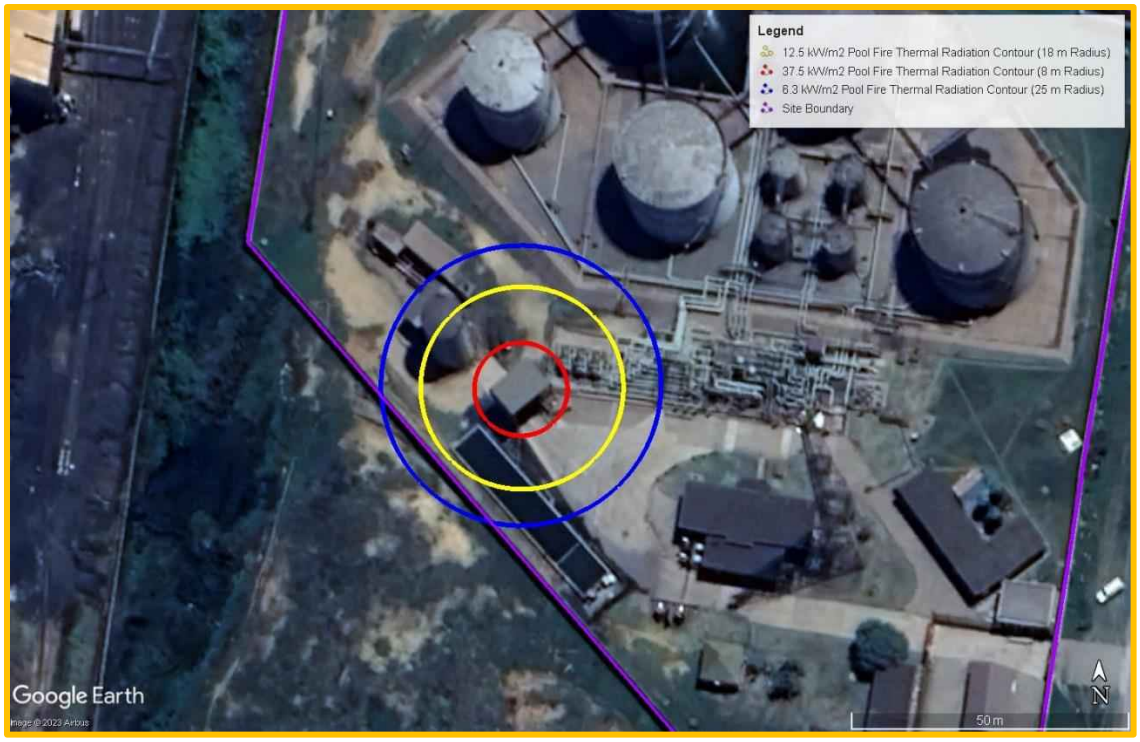

Figure 6.7: Road tanker gantry – diesel loading – pool fire thermal radiation contours (high wind speed conditions)

7 FREQUENCY ANALYSIS

"The likelihood of things going wrong is analysed in this section."

Frequency analysis means the analysis of the likelihood that an event will occur. There are several techniques possible to determine the likelihood of events taking place. The technique used in this report is based on previous accidents. Scenarios are based on previous losses of containment and have been summarised in the SANS 1461:2018 standard. Frequencies of failure published in the BEVI publication [10] (Module C Section 3 of that publication) were applied.

This likelihood is based upon previous accidents for similar materials and equipment, and the manner of failure.

Furthermore, frequency data published is often generic and several facility-specific factors have to be taken into account. This has been done in this study by way of event tree analysis, which will be elaborated further in this section.

7.1 Failure Data Used, Final Frequency and Estimation of the Probability of a Major Incident

The failure data, final frequency, estimation of probability of major incident data applied in the study are described in detail in Appendix C.

8 RISK RESULTS

In this study, risk has been calculated and presented in three forms:

- Individual Risk – the risk of death or serious injury based on the location of an individual, illustrated by risk contours around an installation. This calculation does not consider the actual population in an area but quantifies risk of death and injury were a person to be located at various points around the site.

- Societal Risk – the risk of death or serious injury of a population, illustrated by an 'FN-Curve'. Societal risk considers populations around a facility and determines the maximum possible number of fatalities, the scenarios and associated frequencies of each scenario, expressed cumulatively on an FN-Curve. This will be illustrated in Section 8.3.

- Land-use Planning – Individual risk can also be used to determine the appropriateness of land uses around MHI facilities. To this end, the risk levels of: 1×10^{-5}, 1×10^{-6} and 3×10^{-7} have been used as a basis for judging the appropriateness of land use around site.

Day and Night – the risk calculations consider the operations that occur mainly during the day and those that occur mainly during the night, as well as population distribution during the day and during the night.

8.1 Interpreting the Risk Results

Refer to Section 3.5 for a full description of the methodology used and the criteria for assessing risk as broadly acceptable, intolerable, or tolerable if it can be proven to be As Low As Reasonably Practicable (ALARP).

8.2 Individual Risk Results

The individual risk contours illustrated in the figures below are of the type 'Location Specific Individual Risk (LSIR)' contours. These show the chance of death of a theoretical person if they are positioned at a particular location 24 hours per day, 365 days per year. LSIR is an overstatement of risk which is widely accepted as sufficiently conservative. In reality, workers will spend the length of a shift per day and not the entire day. However, when a worker is off, another worker may replace the worker in performing task(s), therefore, overall, it can be considered that there is an individual at that particular point or area, all of the time.

The risk acceptability criteria are described in Section 3.5.1 and the individual risk profiles for the site are illustrated in Figure 8.1.

Individual risk for those located outdoors

Figure 8.1 illustrates individual risk of death for those located outdoors; being located outdoors implies a lack of shielding for thermal radiation exposure, as would be the case for those located indoors. Only the estimated consequences of a tank overfill event have been included in this report. The frequency of occurrence has been excluded and as a result, the risks associated with this event have not been evaluated and are not included in the figure below. The contours extend as follows:

Individual risk contour	Associated tolerability	Observations
1×10^{-3} / year (blue contour)	Inside these contours risk is intolerable to workers.	This contour is not reached.
1×10^{-4} / year (red contour)	Inside this contour risk is intolerable to members of the public.	The 1×10^{-4} contour envelopes the transfer tanks, the pipe manifold, and the point where the incoming pipeline from Kendal surfaces. This contour appears over these areas due to the relatively high frequency of small pump and pipe leaks leading to flammable pools and associated pool fires restricted to the contained areas. This contour does not extend offsite.
1×10^{-5} / year (orange contour)	This contour indicates threshold of tolerability for workers.	The 1×10^{-5} contour envelopes the pipeline manifold, a portion of the road tanker gantry and the intermix tanks pipework. This contour does not extend offsite.
1×10^{-6} / year (yellow contour)	This contour is the threshold for tolerability for members of the public.	The 1×10^{-6} contour extends over the abovementioned areas to a greater degree as well the bulk storage tanks onsite and the control room. This contour does not extend offsite.
3×10^{-7} / year (green contour)	At this level, risk is broadly acceptable, but an indicator of appropriateness of land-use (see Section 0)	The 3×10^{-7} extends over the areas mentioned above to a greater degree. This contour extends slightly offsite over the northern site boundary.

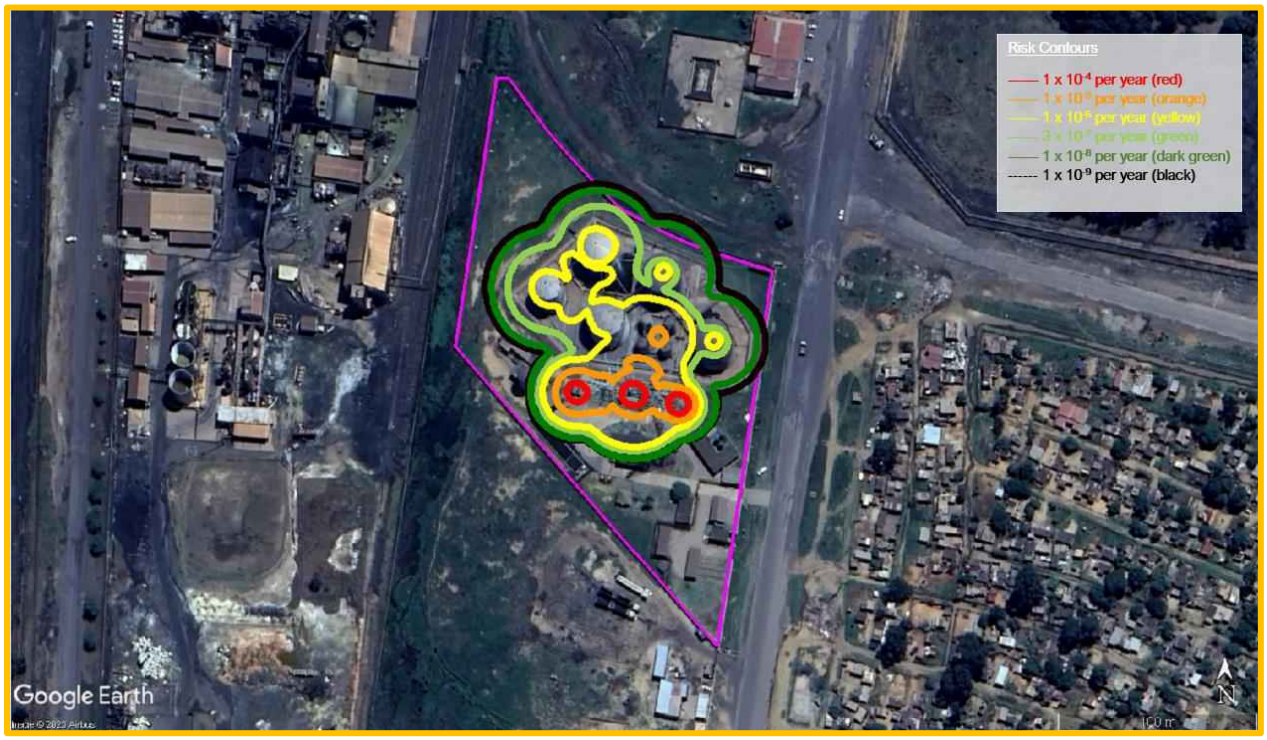

Figure 8.1: Individual risk contours for personnel located outdoors

Conclusion:

Onsite, the risk contours extend such that the risk is considered tolerable if the site can prove that it is As Low As Reasonably Practicable 'ALARP' for personnel especially at the pipe manifold. Offsite, the risk is considered Broadly Acceptable.

Risk Judgement and Treatment are discussed in Section 8.4.

8.2.1 Individual Risk Ranking

Because the risk offsite (vulnerable members of the public) is Broadly Acceptable. The top contributors of the individual risk were not considered further.

8.3 Societal Risk Results

Societal risk considers populations around the site to determine risk tolerability. In this study, this is presented in the form of an FN-Curve, which illustrates scenarios with the potential to cause death, as well as considers the frequency of each scenario. The frequencies of the scenarios are then summed to show a cumulative risk of death, i.e., the frequency (F) of causing N or more fatalities against the number of fatalities, N.

As illustrated in Figure 8.2 there are tolerability limits as suggested by SANS 1461:2018 (see Section 3.5.2), as illustrated by the red and blue sloped lines. Above the red line is the region where societal risk is intolerable;

below the blue line is the region where societal risk is broadly acceptable. Between these lines is the region where risk can be tolerated if it is proven to be ALARP (see Section 3.5.2).

Description of the site's FN curve (societal risk results)

Day time societal risk is based upon activities onsite which take place only during the day and upon day-time population levels, and similarly night time risk is based upon activities taking place at night and also on populations of people during the night. The FN curve given below is a combination of day time and night time risk.

Figure 8.2 shows that the maximum number of fatalities (on and off site) which can occur from a single event occurring onsite is approximately 1 person; the associated frequency of this one large event is relatively low, at approximately 1 x 10^{-4} / year. This corresponds to one of the high-impact, low-frequency events occurring at the site.

Societal risk for the site lies predominantly below the blue line, indicating risk which is Broadly Acceptable.

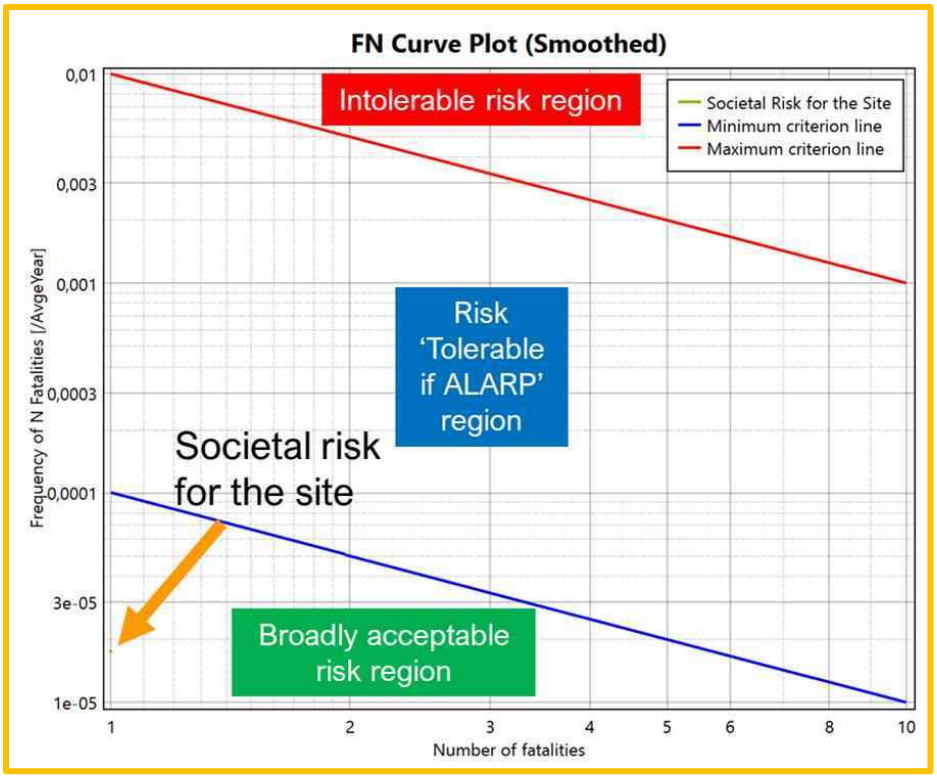

Figure 8.2: FN Curve illustrating societal risk level of the site

Top contributors to societal risk

Because Societal risk was assessed to Broadly Acceptable both to members of the public and personnel the top contributors to societal risk were not analysed further.

Conclusion:

Societal risk was assessed to be Broadly Acceptable.

8.4 Risk Judgement and Treatment

8.4.1 Risk Judgement

This section provides a judgement of the risk results shown in Sections 8.2 and 8.3 as well as for the results shown in the Consequences Section 6.

8.4.1.1 Judgement of Consequences

From the consequence analysis undertaken the following observations and judgements were made:

- Tank overfill scenarios were found to have the potential for extensive flammable vapour dispersion over the surroundings with potential damage if ignition occurred.
- Pool fire radiation associated with tank incidents as well as incidents associated with failure of the road tankers extend offsite.

Possible mitigation measures are discussed in Section 8.4.2.1

8.4.1.2 Judgement of Risk Levels

8.4.1.2.1 Risk on the Public

Individual risks (Section 8.2) were assessed to be **Broadly Acceptable to members of the public**.

Societal Risks (Section8.3) were assessed to be **Broadly Acceptable for both members of the public and personnel.**

8.4.1.2.2 Risk on Personnel

Individual Risk on personnel was found to be **tolerable if the site can prove that the risk is As Low As Reasonably Acceptable 'ALARP'** particularly at the pipe manifold. However, it must be noted that the site runs numerous firefighting systems which would mitigate any impact onsite.

8.4.2 Risk Treatment

This section provides options for risk treatment while also considering existing safeguards.

8.4.2.1 Further Risk Reduction Options

Based on the consequence and individual risk results, it would be recommended to find ways to reduce risk and/or manage / maintain risk at a level which is ALARP or lower. Options for reducing risk may include the following:

- **Communicate the results of this risk assessment with Local Municipality Emergency Planning to strengthen their emergency planning strategies should an incident occur onsite:** There would be domino impacts onsite due to elevated thermal radiation emitted from incidents associated with various petrol and diesel installations. Informing the local emergency planning would prepare them in case of an emergency (This would far part of MHI notification Process).

- **Confirm with the municipality of Emalahleni if the Dangerous Goods Certificate is not required for such a particular site:** This would ensure that the site remains compliant with the local authorities.

- **Consider the installation of hydrocarbon gas detectors in the bulk tank bunds and strategic locations in the IRP.** Installation of this instrumentation will allow for early detection of flammable vapours released thus potentially reducing the impact should ignition occur.

- **Consider the installation of Close Circuit Television (CCTV) at strategic points around the site.** Installation of CCTV may allow for monitoring of areas not frequently patrolled (such as the tank bunds) with may allow for early detection of overfilling events.

8.4.2.2 Conclusions on ALARP Risk

Individual risks (Section 8.2) were assessed to be **tolerable to personnel at the pipe manifold if the site can prove that it is As Low As Reasonably Practicable 'ALARP'**. Societal Risks (Section 8.3) were assessed to be **Broadly Acceptable for members of the public and personnel**.

Recommendations to reduce risk are provided in Section 8.4.2.1 as well as the Recommendations / Risk Reduction Measures Section 11.

8.5 Land Use Planning

The concept of Land-Use Planning is discussed in Section 3.5.3; the purpose of Land-Use Planning section is to inform future land use around the site and to provide a basis for opposing (if necessary) future developments around the site. The Inner, Middle and Outer Zones are illustrated in Figure 8.3 and described briefly as follows:

- Outer Zone: The zone between the $1x10^{-6}$ and $3x10^{-7}$ / year individual risk contours;
- Middle Zone: The zone between the $1x10^{-5}$ and $1x10^{-6}$ / year individual risk contours;
- Inner Zone: Inside the $1x10^{-5}$ / year individual risk contour.

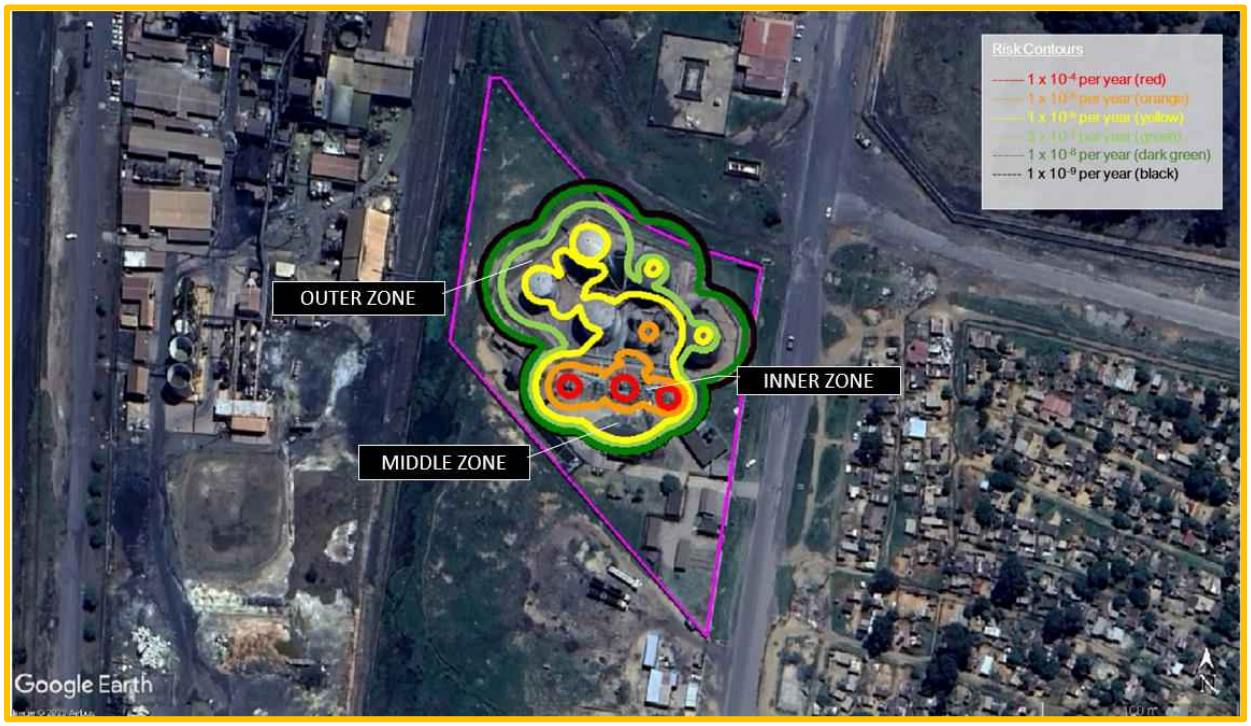

Figure 8.3: Land use planning zones around the site

Based on land-use planning guidance described above, if redevelopment happens in the area, based on risk due to the site's activities, MMRisk would recommend that **the following categories of developments be challenged, where applicable:**

Table 8.1: Current land-use planning compatibility around the site

Development zone	Maximum zone extent (metres)	Type of developments which should be challenged	Currently incompatible land-uses
Inner Zone	NA – Does not extend offsite.	• Developments where members of the public are at home or involved in normal activities. Examples: residential developments, shopping malls, etc. • Vulnerable members of the public: schools, hospitals, old age homes, etc.	No incompatible land-uses at present.
Middle Zone		• Vulnerable members of the public: schools, hospitals, old age homes, etc.	No incompatible land-uses at present.
Outer Zone		• Large examples of developments involving vulnerable members of the public: schools, hospitals, old age homes, etc. • Outdoor examples of developments where members of the public are involved in normal activities. Examples: outdoor shopping malls, outdoor concert venues, etc.	No incompatible land-uses at present.

9 EMERGENCY RESPONSE DATA

9.1 Emergency Response Management at the Site

MMRisk understands that the emergency response plan (ERP) is managed onsite as follows:

- Training for emergency responders takes place, particularly firefighting staff and first aiders. Training follows Occupational Health and Safety Act requirements. Advance training is considered by a site in the future.
- Evacuation drills are conducted monthly with Shell.
- The Emergency Response Plan / procedures have been shared with the emergency services.
- Meetings are held quarterly to review an emergency response and security

9.2 Suitability of ERP against Risk Assessment Results

Appendix E of the contains a full evaluation of the site's ERP, along with an assessment of its suitability against the risk assessment results.

9.3 Emergency Response Plan Evaluation

The site's ERP was assessed against:

- The requirements of MHI Regulations of 2022; and
- The South African National Standard (SANS) 1514: Emergency Response Planning for Major Hazard Installations.

10 CONCLUSIONS

The following conclusions were drawn from the analysis, divided into various topics in the table which follows:

Topic	Conclusion(s)
The identification of different hazardous installations within the premises	The following have been identified as potential major hazard installations at the site: Diesel Pipe Manifold, Pumps, Holding Tanks, Loading Road Tankers. Petroleum products are received and distributed onsite such that the site is classified as a **Medium Hazard establishment as per the MHI Regulations promulgated on 31st January 2023.**
The maximum extent of the 1 % consequence-based lethality (effect) zone from major hazards	The 1% fatality probability consequence contours associated with the installations onsite would extend as follows: • Tank T6: 29 metres (pool fire); • Tank T8: 28 metres (pool fire); • Incoming diesel pipeline: 26 metres (pool fire) • Incoming petrol pipeline: 30 metres (pool fire) • Diesel road tanker loading: 18 metres (pool fire) • Petrol road tanker loading: 19 metres (pool fire) • According to the UK HSE Process Safety Leadership Group final report for Safety and Environmental Standards for Fuel Storage Sites[13], the following distances are considered to be a conservative estimate of the hazard zones for tank overfill scenarios (i.e., a Buncefield-type event). - 2 bar overpressure: 250 metres - 250 mbar: 400 metres - Flammable vapour cloud: 437 meters
The level of risk posed by the facility to various populations	The individual risk at the pipe manifold was assessed to be **tolerable** provided that the site can prove that it is 'ALARP' to personnel onsite. and broadly acceptable for members of the public.
The assessment of the risk as acceptable or tolerable provided ALARP or intolerable	Individual risks were assessed to be **tolerable for personnel onsite at the pipe manifold** provided that it is As Low As Reasonably Practicable 'ALARP'. Societal risk was assessed to be **Broadly Acceptable** for both personnel and members of the public.
Suggestions for risk reduction including preventative and mitigative measures	Risk reduction measures are discussed in Section 8.4.2 and the Recommendations / Risk Reduction Measures Section 11.
Any specific technical uncertainties or sensitivities	Only the estimated consequences of a tank overfill event have been included in this report. The frequency of occurrence has been excluded and as a result, the risks associated with this event have not been evaluated.
The suggested land-use planning restricted development distance and the risk zones	Land-use planning restricted development distances are discussed in Section 0: Land Use Planning and no incompatible land-uses exist at present. The zones remain within the site boundaries.

[13] UK Health and Safety Executive, Process Safety Leadership Group, Final Report, 2009.

Topic	Conclusion(s)
Any organisational measures that may be required. (MHI Reg 5 (5) (b) (xii))	The Recommendations in Section 11 contains suggestions of organisational measures which may be required.

11 RECOMMENDATIONS / RISK REDUCTION MEASURES

Based on the risk analysis herein, the following recommendations are made:

Recommendation Number:	1
Recommendation wording:	The site is a Medium Hazard Establishment according to new set of MHI regulations promulgated 31st January 2023.
Rationale:	According to the MHI Regulations of 2022 promulgated on 31st January 2023, due to the overall storage of petroleum products of approximately 14,000 tons (considering Diesel and Petrol densities) the establishment is classified as a **Medium Hazard Establishment**. As such, the following requirements apply: • An MHI Risk Assessment (this document); • A Major Incident Prevention Policy (MIPP); • A Process Safety Management System (PSM) (described in the MIPP but not submitted to the authorities); and • An Emergency Plan. Carry out advertisement (if not previously advertised) and carry out notification as required by the MHI Regulations.
Priority:	High

Recommendation Number:	2
Recommendation wording:	Communicate the results of this risk assessment with Local Municipality Emergency Planning to strengthen their emergency planning strategies should an incident occur onsite.
Rationale:	There would be a domino impact which would extend offsite due to elevated thermal radiation emitted from various petrol and diesel installations. Informing the local emergency planning would prepare them in case of an emergency. [This would form part of MHI notification Process).
Priority:	High

Recommendation Number:	3
Recommendation wording:	Confirm with the municipality of Emalahleni if the Dangerous Goods Certificate is not required for such a particular site.
Rationale:	This would ensure that the site remains compliant with the local authorities.
Priority:	High

Recommendation Number:	4
Recommendation wording:	Consider the installation of hydrocarbon gas detectors in the bulk tank bunds.
Rationale:	Installation of this instrumentation may allow for early detection of flammable vapours released thus potentially reducing the impact should ignition occur.
Priority:	Medium

Recommendation Number:	5
Recommendation wording:	Consider the installation of Close Circuit Television (CCTV) at strategic points around the site.
Rationale:	Installation of CCTV may allow for monitoring of areas not frequently patrolled (such as the tank bunds) with may allow for early detection of overfilling events.
Priority:	Medium

12 REFERENCES

1	StatsSA, Statistics South Africa, Statistical Release P0310, Living Conditions of Households in South Africa, An analysis of household expenditure and income data using the LCS 2014/2015, January 2017.
2	The Netherlands Organisation (TNO) of Applied Scientific Research, Methods for determination of possible damage to people and objects resulting from release of hazardous materials, CPR 16E, 1992.
5	AirWare Online Reference Manual: Pasquill Stability Classes, Release Date 2007 06, Revision Level 1.1. Retrieved from http://www.ess.co.at/MANUALS/AIRWARE/stability_class.html on 23 March 2018.
6	Fire and Blast Information Group (FABIG), Technical Note 12: Vapour cloud development in overfilling incidents, April 2013.
7	The Netherlands Organisation for Applied Scientific Research (TNO), Green Book, Methods for determination of possible damage, CPR16E, Den Haag, 1992.
8	Mannan, Sam. (2012). Lees' Loss Prevention in the Process Industries, Volumes 1-3 - Hazard Identification, Assessment and Control (4th Edition). Elsevier. Retrieved from https://app.knovel.com/hotlink/toc/id:kpLLPPIVH2/lees-loss-prevention/lees-loss-prevention
9	Dutch National Institute of Public Health and the Environment (RIVM), Centre for External Safety in their publication Reference Manual Bevi Risk Assessments version 3.2 of July 2009.
10	Spouge J, Centre for Marine and Petroleum Technology (CMPT), A Guide To Quantitative Risk Assessment for Offshore Installations, 1999.
11, 12	UK Health and Safety Executive, Process Safety Leadership Group, Final Report, 2009.

- END OF MAIN REPORT BODY -

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APPENDICES

A: Proof of Competency

B: Safety Data Sheets (SDSs)

C: List of scenarios modelled

D: Emergency Response Plan

E: Evaluation Table for Emergency Response Plan

APPENDIX A:

Proof of Competency

labour

Department:
Labour
REPUBLIC OF SOUTH AFRICA

National Department of Labour
Republic of South Africa

APPROVED INSPECTION AUTHORITY

Registered in accordance with the provisions of the Occupational Health and Safety Act, Act 85 of 1993, as amended and the Major Hazard Installation Regulations.

This is to certify that:

MMRISK (PTY) LTD

has been temporary registered by the Department of Labour as an Approved Inspection Authority: Type A, to conduct Major Hazard Installation Risk Assessment, in terms of Regulation 5(5)(a), of the Major Hazard Installation Regulations.

CONDITIONS OF REGISTRATION:

- The AIA must at all time comply with the requirements of the Occupational Health and Safety Act, Act 85 of 1993, as amended.
- This registration certificate is not transferable.
- This registration will lapse if there is a name change of the AIA or change in ownership.

CHIEF INSPECTOR

Valid from. **12 October 2022**
Expires: **11 September 2026**
Certificate Number: **CI MHI 0013**

CERTIFICATE OF ACCREDITATION

In terms of section 22(2)(b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that -

MMRISK (PTY) LTD
Co. Reg. No.: 2016/516497/07
CENTURION

Accreditation Number **MHI0037**

is a South African National Accreditation System Accredited Inspection Body to undertake **TYPE A** inspection provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation, Annexure "A", bearing the above accreditation number for

THE ASSESSMENT OF RISK ON MAJOR HAZARD INSTALLATIONS

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17020:2012 AND SANS 1461:2018

The accreditation demonstrates technical competency for a defined scope and the operation of a management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant SANAS accreditation symbol to issue facility reports and/or certificates

Ms FS Radebe
Acting Chief Executive Officer

Effective Date: 12 October 2022
Certificate Expires: 11 October 2026

This certificate does not on its own confer authority to act as an Approved Inspection Authority as contemplated in the Major Hazard Installation Regulations. Approval to inspect within the regulatory domain is granted by the Department of Employment and Labour

ANNEXURE A

SCOPE OF ACCREDITATION

Accreditation Number: MHI0037

TYPE A

Permanent Address: MMRisk (Pty) Ltd 1234 Sand Hills Close Copperleaf Centurion 0149 Cell: 072 596 3181 E-mail: motlatsimabaso@gmail.com	**Postal Address:** P O Box 89228 Heuweloord Centurion 0173 Issue No 04 Date of issue 10 August 2022 Expiry date 11 October 2026	
Nominated Representative: Mr M Mabaso **Quality Manager:** Mr M Mabaso	**Technical Manager:** Mr M Mabaso	**Technical Signatory:** Mr M Mabaso

Field of Inspection	Service Rendered	Codes and Regulations
Regulatory: The supply of services as an Inspection Authority for Major Hazard Risk Installation as defined in the Major Hazard Risk Installation Regulations, Government Notice No R692 of 30 July 2001	Major Hazard Installation Risk Assessments for the following material categories: 2) Gases: i) Flammable Gases ii) Non-flammable, non-toxic gases (asphyxiants) iii) Toxic gases 3) Flammable liquids 4) Flammable solids, substances liable to spontaneous combustion, substances that on contact with water release flammable gases 5) Oxidizing substances and organic peroxides 6) Toxic liquids and solids	MHI Regulation par. 5 (5) (b) i) Frequency/Probability Analysis ii) Consequence Modelling iii) Hazard Identification and Analysis vi) Emergency planning reviews SANS 1461 2018

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Accreditation Manager

APPENDIX B:

Safety Data Sheet (SDS)

22(a) 5

HESS

MATERIAL SAFETY DATA SHEET

Gasoline, All Grades **MSDS No. 9950**

EMERGENCY OVERVIEW

DANGER!

EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732)750-6000
MSDS (Environment, Health, Safety) Internet Website www.hess.com

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

- See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS *

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME).

Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION

EYES
Moderate irritant. Contact with liquid or vapor may cause irritation.

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

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

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

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

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

CHRONIC EFFECTS and CARCINOGENICITY
Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

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

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

INGESTION

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

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

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

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

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

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

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

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

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

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

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

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

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

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

7. HANDLING and STORAGE

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******
******DO NOT SIPHON BY MOUTH******

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

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

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

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

WORK/HYGIENIC PRACTICES

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

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Component (CAS No.)	Source	TWA (ppm)	STEL (ppm)	Exposure Limits Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	1000	--	Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	--	
	ACGIH	1000	--	A4
Ethyl benzene (100-41-4)	OSHA	100	--	
	ACGIH	100	125	A3
n-Hexane (110-54-3)	OSHA	500	--	
	ACGIH	50	--	Skin
Methyl-tertiary butyl ether [MTBE] (1634-04-4)	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	20	--	A4
1,2,4- Trimethylbenzene (95-63-6)	ACGIH	25	--	
Xylene, mixed isomers (1330-20-7)	OSHA	100	--	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

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

EYE/FACE PROTECTION

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

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

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

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

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR
A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS
Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute Dermal LD50 (rabbits): > 5 ml/kg
Acute Oral LD50 (rat): 18.75 ml/kg
Primary dermal irritation (rabbits): slightly irritating
Draize eye irritation (rabbits): non-irritating
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION

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

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

CLEAN WATER ACT (OIL SPILLS)

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

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

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

SARA SECTION 311/312 - HAZARD CLASSES

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

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3

n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CALIFORNIA PROPOSITION 65 LIST OF CHEMICALS

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

INGREDIENT NAME (CAS NUMBER)	Date Listed
Benzene	2/27/1987
Ethyl benzene	6/11/2004
Toluene	1/1/1991

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	PHYSICAL:	0	Minimal
			* CHRONIC

SUPERSEDES MSDS DATED: 07/01/06

ABBREVIATIONS:

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

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists	CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
AIHA	American Industrial Hygiene Association	DOT	U.S. Department of Transportation [General Info: (800)467-4922]
ANSI	American National Standards Institute (212)642-4900	EPA	U.S. Environmental Protection Agency
API	American Petroleum Institute (202)682-8000	HMIS	Hazardous Materials Information System

IARC	International Agency For Research On Cancer	REL	Recommended Exposure Limit (NIOSH)
MSHA	Mine Safety and Health Administration	SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
NFPA	National Fire Protection Association (617)770-3000	SCBA	Self-Contained Breathing Apparatus
NIOSH	National Institute of Occupational Safety and Health	SPCC	Spill Prevention, Control, and Countermeasures
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)	STEL	Short-Term Exposure Limit (generally 15 minutes)
NTP	National Toxicology Program	TLV	Threshold Limit Value (ACGIH)
OPA	Oil Pollution Act of 1990	TSCA	Toxic Substances Control Act
OSHA	U.S. Occupational Safety & Health Administration	TWA	Time Weighted Average (8 hr.)
PEL	Permissible Exposure Limit (OSHA)	WEEL	Workplace Environmental Exposure Level (AIHA)
RCRA	Resource Conservation and Recovery Act	WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

1. IDENTIFICATION

Trade name(s):	Light Diesel Component	
Chemical name(s):		
Synonyms:	Gasoil, Sasol Diesel , Automotive Diesel fuel	
Chemical formula:	Complex combination of hydrocarbons C12-C30	
Registration numbers:	***CAS:***	68476-30-2
	UN:	1202

Manufacturer:	Natref PO BOX 234 Sasolburg 9570	SSF, Secunda Private Bag x1000 Secunda 2302
Telephone Number:	(016) 940 9111	(017) 610 1111
Facsimile number:	(016) 940 0330	(017) 610 4014
Supplier:	Sasol Fuel Oil PO BOX 123961 Alrode 1451	
Telephone Number:	(011) 864 3960/908 1010	
Facsimile number:	(011) 864-4614	

Emergency Number:
SSF, Secunda **0800 11 28 90**

2. COMPOSITION

Product is blended from different refinery components. They consist of iso- and normal paraffins, olefins, naphthenes and aromatics of the C12 to C30 carbon range. Additives are added to improve the flow properties, cetane number and, in the case of Light Diesel Component, to improve lubricity.

Dangerous substance	***% (m/m)***	***Risk phrase***
Aromatics	5 - 30	Carcinogen

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

3. HAZARDS IDENTIFICATION

To man	*To the environment*
R45 - may cause tumours in lab animals (systematic toxicity) R38 - irritating to the skin R23/25 - toxic if swallowed - acute oral toxicity	R12 - extremely flammable May contaminate ground water

4. FIRST AID MEASURES

SYMPTOMS AND EFFECTS

Inhalation	Excessive exposure may cause respiratory tract irritation. Repeated and/or prolonged exposure to high concentrations may result in central nervous system (brain) effects, headaches, nausea, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure and death. Elevated temperatures or mechanical action may form vapours, mist or fumes which may irritate eyes, nose, throat and lungs.
Eye	Contact with eyes may cause redness, lachrymation, blurred vision and a moderate irritation.
Ingestion	Do not induce vomiting. Harmful or fatal if swallowed. Ingestion of this material may cause central nervous system (brain) effects, pulmonary aspiration hazard if swallowed and/or vomiting may occur. Effects are similar to those described under inhalation.
Skin	Prolong and repeated contact with skin may cause severe irritation. Toxic if dermally absorbed. Product contains a material which may cause skin cancer with prolonged and repeated contact.

FIRST AID

Product inhalation	Move person to fresh air. If not breathing give artificial respiration. Obtain medical aid as soon as possible.
Product in eye	Immediately flush with large amounts of water for at least 10 minutes. Obtain medical assistance if irritation persists.
Product ingestion	If victim is conscious and alert give water to drink. NEVER GIVE ANYTHING BY MOUTH IF A VICTIM IS LOSING CONSCIOUSNESS OR CONVULSING. Milk or pharmaceutical grade Liquid Paraffin may slow gastric absorption. Obtain emergency medical attention as soon as possible. Small amounts which accidentally enter mouth should be rinsed out until taste disappears.
Product on skin	Remove and destroy contaminated clothing. Wash with soap and water until no odour remains.

Advice to physicians

Due to the possibility of sensitization of the myocardium following extreme acute overexposures, cardiorespiratory support should be available.

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Small fire
Use CO_2, foam or dry chemical.

Large fire
Use CO_2, foam or dry chemical to extinguish the fire. Use water to cool fire-exposed containers/structures and to protect personnel.

HAZARDS
When heated vapours/decomposition products may be released to form flammable/ explosive mixtures in the air. Toxic vapours may be given off in a fire. Heavy, irritating black smoke is formed.

PROTECTIVE EQUIPMENT
Wear self-contained breathing (eye and respiratory protection) apparatus for indoor and significant outdoor fires. Wear structural fire-fighters protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Personal protection	Wear splash proof chemical goggles or full face shield recommended to protect against splash of product. Protective gloves are recommended to protect against contact with product. The following glove materials are acceptable: Polyvinyl chloride (PVC), Neoprene, Nitrile, Polyvinyl Alcohol, Viton.
Small spillage	Seal leak if possible without causing further risk. Contain leaking liquid with sand or earth.
Large spillage	Stop leak if there is no risk. Stay upwind. Remove all ignition sources. Dike large spills for later disposal. Prevent entry into sewers and waterways. Dispose of in an approved hazardous waste disposal site or burn in an incinerator.
Environmental precautions	Prevent entry into surface waters and sewers.

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

7. HANDLING AND STORAGE

Handling

When handling the product, safety goggles, face mask, protective gloves and overalls should be worn. Observe good personal hygiene practices. Application of protective hand creams before working may be beneficial.

The distribution, storage and dispensing of bulk product must comply with national legislation and recognized codes of practice. Small containers of approved design, properly sealed and labelled, should be stored in well ventilated surroundings and kept out of reach of children. Eliminate all sources of ignition from the storage and handling area. Instruct personnel in correct handling procedures and the necessary precautions and warn them of the dangers of malpractice's, such as sniffing, siphoning and misuse as a solvent.

Handling temperature

Avoid extreme temperatures.

Storage

Store away from strong oxidizers. Incompatible with sulphuric acid, nitric acid, caustics, aliphatic amines and amides. Keep containers closed. Handle and open containers with care. Store in a cool, well ventilated place away from incompatible materials. In keeping with good personal hygiene practices, wash hands thoroughly after handling the material. Do not handle or store near an open flame, sources of heat, or sources of ignition. Material will accumulate static charges which may cause a spark. Static charge build-up could become an ignition source. Use proper earthing procedures. Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not re-use empty containers without commercial cleaning or reconditioning.

Storage conditions

Storage installations should comply with SABS Code 0131 Part II (1979). Installations should comprise bulk storage tanks with bund walls. Product should be stored in a well ventilated area. Sparks, flames and other sources of ignition near the product should be avoided. Do not eat, drink or smoke in storage area.

8. PERSONAL PROTECTION / EXPOSURE CONTROLS

OCCUPATIONAL EXPOSURE STANDARDS

OSHA:	0,2 mg/m3	PEL
HSE:	Not applicable	
ACGIH:	0,2 mg/m3	TLV
MAK:	Not appliçable	

ENGINEERING CONTROL MEASURES

The best protection is to enclose operations and/or provide local exhaust ventilation at the site of release. Where possible pump product directly from storage container to process containers. The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fume hood.

8. PERSONAL PROTECTION / EXPOSURE CONTROLS (Continued)	
PERSONAL PROTECTION	
Respiratory	Concentration-in-air determines protection needed. Half-mask air purifying respirator with organic vapor cartridges is acceptable to 10 times the exposure limit. Full-face air purifying respirator with organic vapour cartridges is acceptable to 50 times the exposure limit not to exceed the cartridge limit of 1000 PPM.
Hand	Protective gloves are recommended to protect against contact with product. Application of certain protective creams may be beneficial.
Eye	Splash proof chemical goggles or full face shield are recommended to protect against splash of product.
Skin	Wear chemical resistant clothing such as head/neck cover, aprons, jackets, pants overalls, boots, etc. To be used depending on exposure to the product. Application of certain protective creams may be beneficial.

9. PHYSICAL AND CHEMICAL PROPERTIES	
Appearance	Light waxy oil
Odour	Characteristic odour
pH	Not applicable
Boiling point/range	Not available
Melting point/range	Not available
Flash point at 101, 325 kPa, °C	71
Flammable limits	Not available
Explosive properties	Not available
Oxidising properties	None
Vapour pressure	Not available
Density at 40°C, kg/ℓ	0,82 - 0,86
Solubility - water	Slight
Solubility - solvents	Not available
Partition coefficient	Not available
Relative vapour density (air = 1)	Not available
Viscosity at 40°C	2,3 - 3,4
Relative molecular mass	Mixture C12 - C30

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

10. STABILITY AND REACTIVITY

Conditions to avoid
Heat sources, open flames and other ignition sources.

Incompatible materials
Strong oxidants/liquid chlorine and concentrated oxygen.

Hazardous decomposition products
Product does not decompose at ambient temperature. Combustion will produce carbon monoxide, carbon dioxide and other asphyxiants.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Oral	Not available
Dermal	Not available
Inhalation	Not available

CHRONIC TOXICITY
Product expected to be carcinogenic.

IRRITATION

Skin	Due to defatting nature, skin irritation will result.
Eyes	Slight irritation - no permanent damage.
Respiratory	In high concentrations and/or at elevated temperatures, vapour or mist is irritating to mucous membranes, may cause headaches and dizziness, may be anaesthetic and may cause other central nervous system effects. Causes suffocation (asphyxiant) if allowed to accumulate to a concentration that reduces oxygen below safe breathing levels. Avoid breathing vapours, mists or fumes.

CARCINOGENICITY
Product contains aromatics, which may cause skin cancer.
Light Diesel Component engine exhaust emissions are regarded as a probable carcinogen.

MUTAGENICITY
Unknown

REPRODUCTIVE HAZARDS
Can cause reproductive damage.

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

12. ECOLOGICAL INFORMATION

ECOTOXICITY
Harmful to aquatic habitats.

PERSISTENCE

Biodegradation
Not available

Bioaccumulation
Not available

Mobility
Not available

13. DISPOSAL CONSIDERATIONS

Disposal methods
Incinerate highly contaminated materials. Less contaminated soil may be acceptable for authorised land fill sites. Contaminated soil may be treatable by land farming.

Classification
Flammable liquid 3,3

14. TRANSPORT INFORMATION

UN no.	1202
Emergency action code	3YE
ADR/RID - class	3 - Marginal 2301 - 1
ADR/RID - item no.	3 - Marginal 2301 - 1
ADR/RID - hazard identity no.	3 - Marginal 2301 - 1
IMDG - shipping name	Light Diesel Component/gasoil
IMDG - class	3,1
IMDG - packaging group	307 III
IMDG - marine pollutant	Yes
IMDG - EMS no.	Not applicable
IMDG - MFAG no.	Not applicable
IATA - shipping name	Not applicable
IATA - class	3
IATA - subsidiary risk(s)	Not applicable
ADNR - class	3
Tremcard no.	Not applicable

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

15. REGULATORY INFORMATION

National legislation
Not applicable.

EEC hazard classification	T, F+, Xi
Risk phrases	R45, R12, R38 (See paragraph 3)
Safety phrases	S2, S16, S23, S29, S45 S2 - Keep out of reach of children, S16 - Keep away from sources of ignition - No Smoking, S23 - Do not breath gas/fumes/vapours/spray, S29 - Do not empty into drains, S45 - In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

16. OTHER INFORMATION

APPLICATION OR USE OF PRODUCT
Automotive or heating fuel
Danger : Keep out of reach of children. Do not use in agricultural sprays.

EEC annex 1 no.	Not available
MITI no.	Not available
FDA list no.	Not available
Listing - TCSA	Not available
Listing - ACOIN	Not available
Listing - Canadian DSL/NDSL	Not available
Notification - EEC	Not available
Notification - USA	Not available
MSDS updated	11/00
MSDS serial no.	3/95
Updated by	R Goosen

REFERENCES

1. Chemical Hazards Response Information System, US CG, February 1995, Record No 233.
2. CHEMINFO, February 1995, Record No 2094.
3. Hazardous Substance Fact Sheet, New Jersey Department of Health, July 1986, RTK No 0517.
4. Canadian Centre for Occupational Health and Safety, Issue : 95-3 (August 1995,)
   Record no 967814 and record no 916102.

MATERIAL SAFETY DATA SHEET
LIGHT DIESEL COMPONENT

EXCLUSION OF LIABILITY

The information given in this document is based on knowledge at the date of preparation and is offered in good faith. Responsibility cannot be accepted for error or omission therein, or damage which may result.

THE ORIGINAL MSDS FOR LIGHT DIESEL COMPONENT WAS APPROVED AND SIGNED BY, THE MANAGER, FUELS AND LUBRICANTS APPLICATIONS AND THE TECHNICAL MANAGER.

THIS MSDS FOR LIGHT DIESEL COMPONENT WAS PREAPRED BY, TECHNICAL SERVICES, SASOL OIL (PTY) LTD, RANDBURG.
FOR FURTHER INFORMATION CONTACT:
THE MANAGER, FUELS AND LUBRICANTS APPLICATIONS,
P O BOX 4211,
RANDBURG.
2125
TELEPHONE : (011) 889 7600

APPROVED

DATE _____ _____

SIGNATURE _____ _____

MANAGER FUELS AND LUBRICANTS APPLICATIONS **TECHNICAL MANAGER**

APPENDIX C:

List of Scenarios Modelled

Equipment per system	Types of releases per equipment	Base frequency	Frequency unit	Frequency multiplier	Probabilities to be applied			Release duration (s)	Final frequency	Inventory (kg)	Tank Head (m)	Release Height (m)	Temperature (deg C)	Pressure (bar)	Line Length (if pipe) (m)	Line diameter (mm)
					Isolated probability (i)	Secondary isolation prob (s)	Unisolated probability (x)									
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429	0,99			600	1,70E-07	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429	0,99			600	1,70E-07	2,68E+07	0	0	9,4	8	12	300
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,68E+07	0	0	9,4	8	12	300
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429			0,01	1800	1,71E-09	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429			0,01	1800	1,71E-09	2,68E+07	0	0	9,4	8	12	300
DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429	0,99			600	8,49E-07	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429	0,99			600	8,49E-07	2,68E+07	0	0	9,4	8	12	300

DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,68E+07	0	0	9,4	8	12	300
DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429			0,01	1800	8,57E-09	2,68E+07	0	0	23,5	8	12	300
DSL Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429			0,01	1800	8,57E-09	2,68E+07	0	0	9,4	8	12	300
ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429	0,99			600	1,70E-07	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429	0,99			600	1,70E-07	2,43E+07	0	0	9,4	8	12	300
ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,43E+07	0	0	9,4	8	12	300

ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429			0,01	1800	1,71E-09	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	3,428571429			0,01	1800	1,71E-09	2,43E+07	0	0	9,4	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429	0,99			600	8,49E-07	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429	0,99			600	8,49E-07	2,43E+07	0	0	9,4	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429		0		1800	0,00E+00	2,43E+07	0	0	9,4	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429			0,01	1800	8,57E-09	2,43E+07	0	0	23,5	8	12	300
ULP Incoming 12" PW (from Kendal)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	3,428571429			0,01	1800	8,57E-09	2,43E+07	0	0	9,4	8	12	300
DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143	0,99			600	2,55E-07	2,68E+07	0	0	23,5	1,5	18	200
DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143	0,99			600	2,55E-07	2,68E+07	0	0	9,4	1,5	18	200

DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	18	200
DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	18	200
DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143			0,01	1800	2,57E-09	2,68E+07	0	0	23,5	1,5	18	200
DSL Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143			0,01	1800	2,57E-09	2,68E+07	0	0	9,4	1,5	18	200
DSL Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143	0,99			600	1,27E-06	2,68E+07	0	0	23,5	1,5	18	200
DSL Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143	0,99			600	1,27E-06	2,68E+07	0	0	9,4	1,5	18	200
DSL Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143			0,01	1800	1,29E-08	2,68E+07	0	0	23,5	1,5	18	200

DSL Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143			0,01	1800	1,29E-08	2,68E+07	0	0	9,4	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143	0,99			600	2,55E-07	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143	0,99			600	2,55E-07	2,43E+07	0	0	9,4	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143			0,01	1800	2,57E-09	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	5,142857143			0,01	1800	2,57E-09	2,43E+07	0	0	9,4	1,5	18	200
ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143	0,99			600	1,27E-06	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143	0,99			600	1,27E-06	2,43E+07	0	0	9,4	1,5	18	200

ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	18	200
ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143			0,01	1800	1,29E-08	2,43E+07	0	0	23,5	1,5	18	200
ULP Incoming 8" PW (After PRV)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	5,142857143			0,01	1800	1,29E-08	2,43E+07	0	0	9,4	1,5	18	200
DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857	0,99			600	3,39E-07	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857	0,99			600	3,39E-07	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	24	200

DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857			0,01	1800	3,43E-09	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857			0,01	1800	3,43E-09	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857	0,99			600	1,70E-06	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857	0,99			600	1,70E-06	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	24	200

DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857			0,01	1800	1,71E-08	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857			0,01	1800	1,71E-08	2,68E+07	0	0	9,4	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857	0,99			600	3,39E-07	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857	0,99			600	3,39E-07	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857			0,01	1800	3,43E-09	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	6,857142857			0,01	1800	3,43E-09	2,43E+07	0	0	9,4	1,5	24	200

ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857	0,99			600	1,70E-06	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857	0,99			600	1,70E-06	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857			0,01	1800	1,71E-08	2,43E+07	0	0	23,5	1,5	24	200

ULP Incoming 8" PW (to Intermix Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	6,857142857			0,01	1800	1,71E-08	2,43E+07	0	0	9,4	1,5	24	200
DSL Intermix Tanks T3 & T4	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	1,39E+05	6	0	23,5	1		
DSL Intermix Tanks T3 & T4	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	1,39E+05	6	0	9,4	1		
DSL Intermix Tanks T3 & T4	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	1,39E+05	6	0	23,5	1		
DSL Intermix Tanks T3 & T4	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	1,39E+05	6	0	9,4	1		
DSL Intermix Tanks T3 & T4	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	1,39E+05	6	0	23,5	1		

DSL Intermix Tanks T3 & T4	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	1,39E+05	6	0	9,4	1		
ULP Intermix Tanks T1 & T2	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	1,26E+05	6	0	23,5	1		
ULP Intermix Tanks T1 & T2	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	1,26E+05	6	0	9,4	1		
ULP Intermix Tanks T1 & T2	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	1,26E+05	6	0	23,5	1		
ULP Intermix Tanks T1 & T2	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	1,26E+05	6	0	9,4	1		
ULP Intermix Tanks T1 & T2	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	1,26E+05	6	0	23,5	1		
ULP Intermix Tanks T1 & T2	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	1,26E+05	6	0	9,4	1		
DSL T3 & T4 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	24			1	1800	1,20E-06	1,39E+05	6	0	23,5	1	24	200

DSL T3 & T4 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	24			1	1800	1,20E-06	1,39E+05	6	0	9,4	1	24	200
DSL T3 & T4 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	24			1	1800	6,00E-06	1,39E+05	6	0	23,5	1	24	200
DSL T3 & T4 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	24			1	1800	6,00E-06	1,39E+05	6	0	9,4	1	24	200
ULP T1 & T2 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	24			1	1800	1,20E-06	1,26E+05	6	0	23,5	1	24	200
ULP T1 & T2 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	24			1	1800	1,20E-06	1,26E+05	6	0	9,4	1	24	200
ULP T1 & T2 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	24			1	1800	6,00E-06	1,26E+05	6	0	23,5	1	24	200
ULP T1 & T2 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	24			1	1800	6,00E-06	1,26E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	1,39E+05	6	0	23,5	1	24	200

DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	1,39E+05	6	0	9,4	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	1,26E+05	6	0	9,4	1	24	200

ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pumps (X05 &X06)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	1,26E+05	6	0	9,4	1	24	200
DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	1,39E+05	0	0	23,5	1,5	36	200
DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	1,39E+05	0	0	9,4	1,5	36	200
DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	1,39E+05	0	0	23,5	1,5	36	200
DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	1,39E+05	0	0	9,4	1,5	36	200

DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	1,39E+05	0	0	23,5	1,5	36	200
DSL Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	1,39E+05	0	0	9,4	1,5	36	200
DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	1,39E+05	0	0	23,5	1,5	36	200
DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	1,39E+05	0	0	9,4	1,5	36	200
DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	1,39E+05	0	0	23,5	1,5	36	200
DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	1,39E+05	0	0	9,4	1,5	36	200
DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	1,39E+05	0	0	23,5	1,5	36	200

DSL Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	1,39E+05	0	0	9,4	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	1,26E+05	0	0	9,4	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	1,26E+05	0	0	9,4	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	1,26E+05	0	0	9,4	1,5	36	200
ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	1,26E+05	0	0	9,4	1,5	36	200

ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	1,26E+05	0	0	9,4	1,5	36	200
ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	1,26E+05	0	0	23,5	1,5	36	200
ULP Intermix Pumps Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	1,26E+05	0	0	9,4	1,5	36	200
DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466	0,99			600	1,70E-08	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466	0,99			600	1,70E-08	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466		0		1800	0,00E+00	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466		0		1800	0,00E+00	1,39E+05	6	0	9,4	1	24	200

DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466			0,01	1800	1,71E-10	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466			0,01	1800	1,71E-10	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466	0,99			600	7,46E-07	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466	0,99			600	7,46E-07	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466		0		1800	0,00E+00	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466		0		1800	0,00E+00	1,39E+05	6	0	9,4	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466			0,01	1800	7,53E-09	1,39E+05	6	0	23,5	1	24	200
DSL Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466			0,01	1800	7,53E-09	1,39E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466	0,99			600	1,70E-08	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466	0,99			600	1,70E-08	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466		0		1800	0,00E+00	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466		0		1800	0,00E+00	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466			0,01	1800	1,71E-10	1,26E+05	6	0	23,5	1	24	200

ULP Intermix Pump (X07)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	0,000342466			0,01	1800	1,71E-10	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466	0,99			600	7,46E-07	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466	0,99			600	7,46E-07	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466		0		1800	0,00E+00	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466		0		1800	0,00E+00	1,26E+05	6	0	9,4	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466			0,01	1800	7,53E-09	1,26E+05	6	0	23,5	1	24	200
ULP Intermix Pump (X07)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	0,000342466			0,01	1800	7,53E-09	1,26E+05	6	0	9,4	1	24	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534	0,99			600	1,22E-09	1,39E+05	0	0	23,5	8	72	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534	0,99			600	1,22E-09	1,39E+05	0	0	9,4	8	72	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,39E+05	0	0	23,5	8	72	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,39E+05	0	0	9,4	8	72	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534			0,01	1800	1,23E-11	1,39E+05	0	0	23,5	8	72	200
DSL Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534			0,01	1800	1,23E-11	1,39E+05	0	0	9,4	8	72	200
DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534	0,99			600	6,10E-09	1,39E+05	0	0	23,5	8	72	200

DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534	0,99			600	6,10E-09	1,39E+05	0	0	9,4	8	72	200
DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,39E+05	0	0	23,5	8	72	200
DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,39E+05	0	0	9,4	8	72	200
DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534			0,01	1800	6,16E-11	1,39E+05	0	0	23,5	8	72	200
DSL Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534			0,01	1800	6,16E-11	1,39E+05	0	0	9,4	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534	0,99			600	1,22E-09	1,26E+05	0	0	23,5	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534	0,99			600	1,22E-09	1,26E+05	0	0	9,4	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,26E+05	0	0	23,5	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,26E+05	0	0	9,4	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534			0,01	1800	1,23E-11	1,26E+05	0	0	23,5	8	72	200
ULP Intermix X07 Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	0,024657534			0,01	1800	1,23E-11	1,26E+05	0	0	9,4	8	72	200

ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534	0,99			600	6,10E-09	1,26E+05	0	0	23,5	8	72	200
ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534	0,99			600	6,10E-09	1,26E+05	0	0	9,4	8	72	200
ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,26E+05	0	0	23,5	8	72	200
ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534		0		1800	0,00E+00	1,26E+05	0	0	9,4	8	72	200
ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534			0,01	1800	6,16E-11	1,26E+05	0	0	23,5	8	72	200

ULP Intermix X07 Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	0,024657534			0,01	1800	6,16E-11	1,26E+05	0	0	9,4	8	72	200
ULP Loading Road Tanker	1b) ROAD TANKER Instantaneous release of contents (Each compartment is considered a tank so frequency is divided by the number of compartments)	1,67E-06	/ year	0,000342466			1	1	2,85E-10	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	1b) ROAD TANKER Instantaneous release of contents (Each compartment is considered a tank so frequency is divided by the number of compartments)	1,67E-06	/ year	0,000342466			1	1	2,85E-10	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	2b) Atmospheric transport units – release of entire contents from the largest connection	5,00E-07	/ year	0,000342466			1	1	8,56E-11	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	2b) Atmospheric transport units – release of entire contents from the largest connection	5,00E-07	/ year	0,000342466			1	1	8,56E-11	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6	0,94			5	8,46E-08	3,47E+04	3	0	23,5	1		

ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6	0,94			5	8,46E-08	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6		0,054		120	4,86E-09	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6		0,054		120	4,86E-09	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6			0,006	1800	5,40E-10	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6			0,006	1800	5,40E-10	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6	0,94			5	8,46E-07	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6	0,94			5	8,46E-07	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6		0,054		120	4,86E-08	3,47E+04	3	0	23,5	1		

ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6		0,054		120	4,86E-08	3,47E+04	3	0	9,4	1		
ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6			0,006	1800	5,40E-09	3,47E+04	3	0	23,5	1		
ULP Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6			0,006	1800	5,40E-09	3,47E+04	3	0	9,4	1		
DSL Loading Road Tanker	1b) ROAD TANKER Instantaneous release of contents (Each compartment is considered a tank so frequency is divided by the number of compartments)	1,67E-06	/ year	0,000342466			1	1	2,85E-10	3,14E+04	3	0	23,5	1		
DSL Loading Road Tanker	1b) ROAD TANKER Instantaneous release of contents (Each compartment is considered a tank so frequency is divided by the number of compartments)	1,67E-06	/ year	0,000342466			1	1	2,85E-10	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	2b) Atmospheric transport units – release of entire contents from the largest connection	5,00E-07	/ year	0,000342466			1	1	8,56E-11	3,14E+04	3	0	23,5	1		

DSL Loading Road Tanker	2b) Atmospheric transport units – release of entire contents from the largest connection	5,00E-07	/ year	0,000342466			1	1	8,56E-11	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6	0,94			5	8,46E-08	3,14E+04	3	0	23,5	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6	0,94			5	8,46E-08	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6		0,054		120	4,86E-09	3,14E+04	3	0	23,5	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6		0,054		120	4,86E-09	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6			0,006	1800	5,40E-10	3,14E+04	3	0	23,5	1		
DSL Loading Road Tanker	1) Rupture of loading/unloading arm or loading/unloading hose (per hour)	3,00E-08	/ hour	6			0,006	1800	5,40E-10	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6	0,94			5	8,46E-07	3,14E+04	3	0	23,5	1		

DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6	0,94			5	8,46E-07	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6		0,054		120	4,86E-08	3,14E+04	3	0	23,5	1		
DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6		0,054		120	4,86E-08	3,14E+04	3	0	9,4	1		
DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6			0,006	1800	5,40E-09	3,14E+04	3	0	23,5	1		

DSL Loading Road Tanker	2) Leak in loading/unloading arm or loading/unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm. (per hour)	3,00E-07	/ hour	6			0,006	1800	5,40E-09	3,14E+04	3	0	9,4	1		
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429	0,99			600	5,09E-07	2,68E+07	0	0	23,5	1,5	36	200
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429	0,99			600	5,09E-07	2,68E+07	0	0	9,4	1,5	36	200
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	36	200
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	36	200
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429			0,01	1800	5,14E-09	2,68E+07	0	0	23,5	1,5	36	200
DSL Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429			0,01	1800	5,14E-09	2,68E+07	0	0	9,4	1,5	36	200
DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429	0,99			600	2,55E-06	2,68E+07	0	0	23,5	1,5	36	200
DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429	0,99			600	2,55E-06	2,68E+07	0	0	9,4	1,5	36	200
DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	36	200

DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	36	200
DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429			0,01	1800	2,57E-08	2,68E+07	0	0	23,5	1,5	36	200
DSL Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429			0,01	1800	2,57E-08	2,68E+07	0	0	9,4	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429	0,99			600	5,09E-07	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429	0,99			600	5,09E-07	2,43E+07	0	0	9,4	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429			0,01	1800	5,14E-09	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	10,28571429			0,01	1800	5,14E-09	2,43E+07	0	0	9,4	1,5	36	200
ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429	0,99			600	2,55E-06	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429	0,99			600	2,55E-06	2,43E+07	0	0	9,4	1,5	36	200

ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	36	200
ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429			0,01	1800	2,57E-08	2,43E+07	0	0	23,5	1,5	36	200
ULP Outgoing 8" PW (To Clients)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	10,28571429			0,01	1800	2,57E-08	2,43E+07	0	0	9,4	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	7,43E+03	0	0	9,4	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	7,43E+03	0	0	9,4	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	7,43E+03	0	0	9,4	1,5	36	200

DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	7,43E+03	0	0	9,4	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	7,43E+03	0	0	9,4	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	7,43E+03	0	0	23,5	1,5	36	200
DSL PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	7,43E+03	0	0	9,4	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	6,73E+03	0	0	23,5	1,5	36	200

ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	6,73E+03	0	0	9,4	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	6,73E+03	0	0	23,5	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	6,73E+03	0	0	9,4	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	6,73E+03	0	0	23,5	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	6,73E+03	0	0	9,4	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	6,73E+03	0	0	23,5	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	6,73E+03	0	0	9,4	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	6,73E+03	0	0	23,5	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	6,73E+03	0	0	9,4	1,5	36	200

ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	6,73E+03	0	0	23,5	1,5	36	200
ULP PW (Prover) to / from Transfer Tanks	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	6,73E+03	0	0	9,4	1,5	36	200
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	7,43E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	7,43E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	7,43E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	7,43E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	7,43E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	7,43E+03	1,5	0	23,5	1	1,2	100
Diesel Transfer Pump (X03)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	7,43E+03	1,5	0	9,4	1	1,2	100

ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2	0,99			600	9,90E-05	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2	0,99			600	9,90E-05	6,73E+03	1,5	0	9,4	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2		0		1800	0,00E+00	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2		0		1800	0,00E+00	6,73E+03	1,5	0	9,4	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2			0,01	1800	1,00E-06	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	2			0,01	1800	1,00E-06	6,73E+03	1,5	0	9,4	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2	0,99			600	4,36E-03	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2	0,99			600	4,36E-03	6,73E+03	1,5	0	9,4	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2		0		1800	0,00E+00	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2		0		1800	0,00E+00	6,73E+03	1,5	0	9,4	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2			0,01	1800	4,40E-05	6,73E+03	1,5	0	23,5	1	1,2	100
ULP Transfer pump (X02 & X04)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	2			0,01	1800	4,40E-05	6,73E+03	1,5	0	9,4	1	1,2	100
Diesel Transfer Tank (F03)	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	7,43E+03	1,5	0	23,5	1		
Diesel Transfer Tank (F03)	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	7,43E+03	1,5	0	9,4	1		

Diesel Transfer Tank (F03)	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	7,43E+03	1,5	0	23,5	1		
Diesel Transfer Tank (F03)	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	7,43E+03	1,5	0	9,4	1		
Diesel Transfer Tank (F03)	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	7,43E+03	1,5	0	23,5	1		
Diesel Transfer Tank (F03)	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	7,43E+03	1,5	0	9,4	1		
ULP Transfer Tanks (F01 & F05)	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	6,73E+03	1,5	0	23,5	1		
ULP Transfer Tanks (F01 & F05)	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	2			1	1	5,00E-06	6,73E+03	1,5	0	9,4	1		
ULP Transfer Tanks (F01 & F05)	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	6,73E+03	1,5	0	23,5	1		

ULP Transfer Tanks (F01 & F05)	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	2			1	600	5,00E-06	6,73E+03	1,5	0	9,4	1		
ULP Transfer Tanks (F01 & F05)	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	6,73E+03	1,5	0	23,5	1		
ULP Transfer Tanks (F01 & F05)	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	2			1	1800	1,00E-04	6,73E+03	1,5	0	9,4	1		
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143	0,99			600	1,36E-07	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143	0,99			600	1,36E-07	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143			0,01	1800	1,37E-09	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143			0,01	1800	1,37E-09	2,68E+07	0	0	9,4	1,5	24	200

DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143	0,99			600	6,79E-07	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143	0,99			600	6,79E-07	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,68E+07	0	0	23,5	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,68E+07	0	0	9,4	1,5	24	200
DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143			0,01	1800	6,86E-09	2,68E+07	0	0	23,5	1,5	24	200

DSL Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143			0,01	1800	6,86E-09	2,68E+07	0	0	9,4	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143	0,99			600	1,36E-07	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143	0,99			600	1,36E-07	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143			0,01	1800	1,37E-09	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	2,742857143			0,01	1800	1,37E-09	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143	0,99			600	6,79E-07	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143	0,99			600	6,79E-07	2,43E+07	0	0	9,4	1,5	24	200

ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143		0		1800	0,00E+00	2,43E+07	0	0	9,4	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143			0,01	1800	6,86E-09	2,43E+07	0	0	23,5	1,5	24	200
ULP Incoming PW (to Accumulation Tanks)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	2,742857143			0,01	1800	6,86E-09	2,43E+07	0	0	9,4	1,5	24	200
T8 - DSL Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	3,05E+06	12	0	23,5	1		
T8 - DSL Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	3,05E+06	12	0	9,4	1		
T8 - DSL Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	3,05E+06	12	0	23,5	1		
T8 - DSL Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	3,05E+06	12	0	9,4	1		
T8 - DSL Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	3,05E+06	12	0	23,5	1		

T8 - DSL Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	3,05E+06	12	0	9,4	1		
T9 - DSL Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	3,05E+06	12	0	23,5	1		
T9 - DSL Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	3,05E+06	12	0	9,4	1		
T9 - DSL Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	3,05E+06	12	0	23,5	1		
T9 - DSL Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	3,05E+06	12	0	9,4	1		
T9 - DSL Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	3,05E+06	12	0	23,5	1		
T9 - DSL Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	3,05E+06	12	0	9,4	1		
T5 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	1,65E+06	13	0	23,5	1		
T5 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	1,65E+06	13	0	9,4	1		

T5 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	1,65E+06	13	0	**23,5**	**1**		
T5 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	1,65E+06	13	0	**9,4**	**1**		
T5 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	1,65E+06	13	0	**23,5**	**1**		
T5 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	1,65E+06	13	0	**9,4**	**1**		
T6 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	2,77E+06	12	0	**23,5**	**1**		
T6 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	2,77E+06	12	0	**9,4**	**1**		

T6 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	2,77E+06	12	0	23,5	1		
T6 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	2,77E+06	12	0	9,4	1		
T6 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	2,77E+06	12	0	23,5	1		
T6 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	2,77E+06	12	0	9,4	1		
T7 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	2,77E+06	12	0	23,5	1		
T7 - ULP Tank	1a) Catastrophic rupture (with bund overtopping if necessary).	5,00E-06	/ year	1			1	1	2,50E-06	2,77E+06	12	0	9,4	1		

T7 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	2,77E+06	12	0	23,5	1		
T7 - ULP Tank	2a) Entire contents released in 10 min or large hole in the processing unit (a large hole is typically the size of the largest appurtenance on the processing unit).	5,00E-06	/ year	1			1	600	2,50E-06	2,77E+06	12	0	9,4	1		
T7 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	2,77E+06	12	0	23,5	1		
T7 - ULP Tank	3a) Small hole in vessel (leak typically 10 mm diameter).	1,00E-04	/ year	1			1	1800	5,00E-05	2,77E+06	12	0	9,4	1		
DSL T8 & T9 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			1	1800	1,80E-06	3,05E+06	12	0	23,5	1	36	200
DSL T8 & T9 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			1	1800	1,80E-06	3,05E+06	12	0	9,4	1	36	200
DSL T8 & T9 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			1	1800	9,00E-06	3,05E+06	12	0	23,5	1	36	200

DSL T8 & T9 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			1	1800	9,00E-06	3,05E+06	12	0	9,4	1	36	200
ULP T5, T6, T7 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			1	1800	1,80E-06	2,77E+06	12	0	23,5	1	36	200
ULP T5, T6, T7 Outlets (to Pumps)	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			1	1800	1,80E-06	2,77E+06	12	0	9,4	1	36	200
ULP T5, T6, T7 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			1	1800	9,00E-06	2,77E+06	12	0	23,5	1	36	200
ULP T5, T6, T7 Outlets (to Pumps)	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			1	1800	9,00E-06	2,77E+06	12	0	9,4	1	36	200
DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	3,05E+06	12	0	9,4	1	36	200
DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	3,05E+06	12	0	9,4	1	36	200

DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	3,05E+06	12	0	9,4	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	3,05E+06	12	0	9,4	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	3,05E+06	12	0	9,4	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	3,05E+06	12	0	23,5	1	36	200
DSL Pump (A02)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	3,05E+06	12	0	9,4	1	36	200
ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	2,77E+06	12	0	23,5	1	36	200
ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1	0,99			600	4,95E-05	2,77E+06	12	0	9,4	1	36	200
ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	2,77E+06	12	0	23,5	1	36	200
ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1		0		1800	0,00E+00	2,77E+06	12	0	9,4	1	36	200
ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	2,77E+06	12	0	23,5	1	36	200

ULP Pump (A01)	Pump / Compressor Catastrophic failure	1,00E-04	/ year	1			0,01	1800	5,00E-07	2,77E+06	12	0	9,4	1	36	200
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	2,77E+06	12	0	23,5	1	36	200
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1	0,99			600	2,18E-03	2,77E+06	12	0	**9,4**	**1**	**36**	**200**
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	2,77E+06	12	0	**23,5**	**1**	**36**	**200**
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1		0		1800	0,00E+00	2,77E+06	12	0	**9,4**	**1**	**36**	**200**
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	2,77E+06	12	0	**23,5**	**1**	**36**	**200**
ULP Pump (A01)	Pump / Compressor Leak (10 % diameter)	4,40E-03	/ year	1			0,01	1800	2,20E-05	2,77E+06	12	0	**9,4**	**1**	**36**	**200**
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	3,05E+06	0	0	**23,5**	**1,5**	**36**	**200**
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	3,05E+06	0	0	**9,4**	**1,5**	**36**	**200**
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	3,05E+06	0	0	**23,5**	**1,5**	**36**	**200**
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	3,05E+06	0	0	9,4	1,5	36	200
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	3,05E+06	0	0	23,5	1,5	36	200
DSL Pump (A02) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	3,05E+06	0	0	9,4	1,5	36	200
DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	3,05E+06	0	0	23,5	1,5	36	200

DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	3,05E+06	0	0	9,4	1,5	36	200
DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	3,05E+06	0	0	23,5	1,5	36	200
DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	3,05E+06	0	0	9,4	1,5	36	200
DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	3,05E+06	0	0	23,5	1,5	36	200
DSL Pump (A02) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	3,05E+06	0	0	9,4	1,5	36	200
ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	2,77E+06	0	0	23,5	1,5	36	200
ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36	0,99			600	1,78E-06	2,77E+06	0	0	**9,4**	**1,5**	**36**	**200**

ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	2,77E+06	0	0	23,5	1,5	36	200
ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36		0		1800	0,00E+00	2,77E+06	0	0	9,4	1,5	36	200
ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	2,77E+06	0	0	23,5	1,5	36	200
ULP Pump (A01) Discharge	1) Pipeline, hose, arm full bore rupture.	1,00E-07	/ metre / year	36			0,01	1800	1,80E-08	2,77E+06	0	0	9,4	1,5	36	200
ULP Pump (A01) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	2,77E+06	0	0	23,5	1,5	36	200
ULP Pump (A01) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36	0,99			600	8,91E-06	2,77E+06	0	0	9,4	1,5	36	200
ULP Pump (A01) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36		0		1800	0,00E+00	2,77E+06	0	0	23,5	1,5	36	200
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ULP Pump (A01) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	2,77E+06	0	0	23,5	1,5	36	200

ULP Pump (A01) Discharge	2) Small hole in pipeline, hose, arm (typically a leak with effective diameter of 10 % to 50 % of the pipeline diameter).	5,00E-07	/ metre / year	36			0,01	1800	9,00E-08	2,77E+06	0	0	9,4	1,5	36	200

APPENDIX D:

The Emergency Response Plan (ERP)

BUSINESS CONTINUITY MANAGEMENT

WITBANK OPERATIONS

EMERGENCY RESPONSE PLAN

Document Number	TRN-IMS-TP-PLN-016.35
Business Name	Transnet Pipelines
Version Number	3.0
Classification	Unclassified
Effective Date	
Review Date	December 2022

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1. SUMMARY VERSION CONTROL

Version Number	Nature of Amendment	Page Number	Date Revised
1.0			
2.0			
3.0	Reformatting in TIMS format	All	September 2021

2. DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approved this Business Continuity Management Plan.

ROLE	CAPACITY/FUNCTION	SIGNATURE	DATE
Process Owner:	Gideon Khasi		04.08.2023
Approval Committee:	Papa Moratwe		21.08.2023

3. INTRODUCTION AND SCOPE

Transnet Pipeline is committed to ensure that adequate and effective emergency preparedness prevails in any area where the internal or external environment is exposed to risks originating from company planning and or operating processes.
Witbank is a pure delivery depot. There are no main line pumps at this depot. Product such diesel and unleaded petrol is pumped in an 12" line from Secunda and Jamieson-park via Kendal to Witbank.
Transnet Pipelines major clients in Witbank are Shell and Engen.

There is no human activity that is free from hazards, dangers and catastrophes. There will always be certain risks which pose a direct and immediate threat to human life and property, and which may have a disrupting effect on operations or any other impact that will have an adverse effect to Transnet Pipelines. While many of these threats are virtually impossible to avoid or eliminate, most of the effects can be reduced by means of risk control techniques. Typical threats, which are open to risk reduction, are civil commotion, fire, environmental pollution and industrial accidents resulting from human error. Short of complete relocation, various natural perils such as floods, storms and earthquakes cannot be avoided. These also fall within the category of emergency risks.

This emergency plan is applicable to all emergencies in the Witbank Depot

4. OBJECTIVES

The objective of the Emergency plan is to set guidelines to save lives, protect property and provide maintenance of essential services. This document provides procedures for employees and all stakeholders in Witbank to react in the event of fire, explosion, medical emergency, bomb threat, unrest, large spillage, power failure and major equipment failure (e.g., generators, lifts, escalators, pumps, chillers).

To co-ordinate all actions of role players effectively and efficiently to deal with any incident occurring in the Pipeline network to achieve safety of the public and employees, protection of property, and protection of the environment.

To provide a pre-determined and coordinated response to deal with any situation that may occur within the perimeter of the depot, and which has a potential to spread to, or adversely affect adjacent sites, areas and the public.

To provide emergency evacuation training drill

The purpose of conducting an emergency evacuation training drill is to assist employees to know their roles and responsibilities in an emergency in accordance with the emergency plans and procedures, and to test their response to an emergency. The training is conducted monthly as per planned schedule.

CONTINUAL IMPROVEMENT

Suggestions or recommendations for alterations or improvements to this standard should be forwarded to the: - Operations Manager.

5. RESPONSIBILITIES

POSITION TITLE	DESCRIPTION OF TASK
Operations Manager Witbank	• Ensure compliance to the emergency plan and procedure. • Ensure participation of subordinates in the emergency evacuation drill training • Plan the emergency evacuation drills and make the schedule available to the SHEQ committee and depot employees. • Take charge of the emergency scenario at Witbank. • Responsible for updating this Emergency Plan •
Operations Supervisor Witbank	• Assist Operations manager in executing emergency drills and plans • Report all non-conformances related to emergency response conditions. • Arranging simulated exercises to ensure a state of preparedness and a status report. • Responsible for updating this Emergency Plan.
First Aiders	• Responsible for coordinating the activities of First Aiders on the scene during an emergency and to ensure that the medical components of these procedures are in a state of preparedness.

POSITION TITLE	DESCRIPTION OF TASK
SHE Representatives	• Responsible for assisting Operations management with the review and training of this procedure on on-going basis.
Security Personnel – Main gate	• Responsible for acquainting themselves fully with the emergency and evacuation procedure. • Report any incident to the operations manager/Supervisor or Depot staff on duty. • If the depot is unmanned at the time of the incident the security on duty is responsible to activate the system.
Depot Controllers	• Responsible for acquainting themselves fully with the emergency and evacuation procedure. • Activate alarm in case of an emergency. • Are responsible for adhering to these procedures during an emergency incident. • To co-operate during drills • Close the control room door. • Shut the line down. • Close all remote/isolation valves. • The controller on duty is to start the Fire engine on the relevant area to cover the area with foam. • All actions to be written into the handover book against the time it occurred • To evacuate via the shortest route which is indicated by means of signage. • To ensure the fixed fire system and standby generator has enough diesel at all times for emergencies. • First phase firefighting to be applied. • Support the Fire department.
Technical Employees	• Responsible for ensuring that the equipment is safe before any person proceeds with any action on, or near such apparatus during an emergency incident. • Activate alarm in case of an emergency. • To evacuate via the shortest route which is indicated by means of signage. • First phase firefighting to be applied. • Support the Fire department.

POSITION TITLE	DESCRIPTION OF TASK
Section 16(2) Appointees	• Responsible for ensuring that these procedures are adhered to.
Employees, visitors and Contractors	• Adherence to this procedure (Mandatory).

PROCEDURE STATEMENTS

All incidents to be reported to Master Control Centre: **(031) 361 1500**

6. FIRE

6.1 FIRE LOCATION: Manifolds and Tank Farms -Witbank

Locations and Capacities of all substances in Witbank Depot

(a) Manifolds: There is only one main refined products manifold at this depot. This manifold then splits into a diesel manifold and a ULP manifolds. The pipe volume within the station isolation block-valves is 9000 litres.

(b) The depot has one sump tank, which is situated below ground level. The volume of the sump tank is 8000 litres.

(c) The delivery station is also equipped with one separator tank which is on the edge of the manifold with a capacity of 10 000 litres.

(d) The depot has a large spill basin and has adequate bunding around the tank and manifold areas. The bunding has been so designed that in the event of tank leakage or pipe leaks in the manifold, the bunding will be able to contain the spill.

(e) The depot is fed from the local municipality with an incoming supply of 380V.

Envisaged maximum quantity of primary substances held on site

(a) The average maximum delivery rate is 7 500 litres per minute.

(b) The maximum volume that the sump tank can hold is 8000 litres

(c) **TANK DETAILS**

Tank Number	Capacity	Product
T1	169 271	Diesel intermixture
T2	169 271	ULP intermixture
T3	169 271	Diesel intermixture
T4	169 271	ULP intermixture
T5	2 000 000	ULP 95
T6	3 140 000	ULP 93
T7	3 140 000	ULP 93
T8	3 455 000	Diesel D50
T9	3 455 000	Diesel D50

a) Fire: Employees

Employees will:

- Notify the Controller on duty, MCC, Operation Manager and Operation supervisor at the Depot and Security guard and inform them of location of the fire on the premises, manifold and tank farm.
- All personnel to be evacuated.
- The pipeline has to be stopped if in operation and isolation valves to be closed.
- The Fire department and other Emergency services have to be notified.
- Contain the fire(note "staff actions on the premises)
- All other personnel to report to the Assembly point outside the Operations Managers' office.
- Security to conduct a roll call at the assembly point using the main-gate access book.
- All actions are to be remitted in chronological order.
- Damage to depot/pipeline has to be assessed and repaired.

Controllers on duty will:

- Close the control room door.
- Close all remote/isolation valves.
- The controller on duty is to start the fixed fire engine for the correct location (Example: manifold, Tank Farm Bund A e.t.c) and cover the area with foam.
- All actions to be written into the handover book against the time it occurred.
- All staff to assist in fire prevention.

b) Fire: Security Personnel – Main gate

Protection/Security Officials will:

- Ensure all private visitors are requested to leave the site.
- Access gates are opened to allow free entry of emergency services.
- All the actions are recorded with time in his/her pocket book.
- Assist with the evacuation on the affected areas.
- Assist with extinguishing the fire.
- Cordon off the affected area.
- Provide the fire brigade and ambulance, upon their arrival, with directions to the scene of to the scene.
- Remain calm and not create panic.
- The security on duty should provide the following information when reporting the incident
  - i. Name: Transnet Pipelines Witbank
  - ii. Telephone number: 011 978 2831
  - iii. Incident Address: 9 Schonland Drive, Ferrobank, Witbank
  - iv. Nearest entrance to fire: 9 Schonland Drive, Ferrobank, Witbank
  - v. Location of fire and explain what is burning (e.g Petrol Tanks with capacity of 157 271 L)
  - vi. Trapped persons and/or casualties if you know.

Important contacts

Institution	Telephone numbers
Fire & Rescue	013 690 6222/ 072 824 9274
Operations Manager	011 978 2752/ 083 303 6679
Operations Supervisor	011 978 1806/ 083 286 0160
SAPS - VOSMAN	079 891 8422 - 10111
Traffic department	083 711 1867
SRM - Central	016 815 5410/ 083 284 2133
NOC (MCC)	031 361 1500/064 660 6166/0800 203 843
Disaster Management	072 251 5380

- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media.

c) Fire: Service Provider, Protection/Security Manager

Protection/Security Manager will:

- Ensure that security staff cordons off and guard the affected area.
- Ensure that no unauthorised persons enter the scene of the incident.
- Ensure that nothing is removed before permission has been granted.

- Ensure that Security Personnel assist with the investigation and the taking of statements.
- Perform a general assessment of the damage and/or document all relevant details for insurance purposes.
- Take photographs of the scene to assist in the investigation of the incident.
- Ensure that personnel prevent looting of the premises.

d) Fire: Transnet Fire Marshals

Fire Marshals will:

- Respond quickly to the affected area and commence firefighting as soon as possible.
- Report to Head of the Department.
- Strive to extinguish or control the fire to be best of their ability.
- Take note, not to use water in electrical hazards and/or flammable liquids if present. Will not place themself at risk.
- After the fire has been extinguished, replace all used fire extinguishers with filled and sealed fire extinguishers; roll up fire reel hoses, and fire hydrant hoses.

e) Fire: First Aiders

First Aiders will to the best of their ability:

- Render first aid to injured patients.
- Assist with the evacuation of patients if required
- Provide ambulance personnel with information with regard to medical treatment rendered to the patient i.e. handover patient to ambulance personnel
- Assist the ambulance team where possible at the scene.
- Record the items used from the first aid box and replenish the stock.

f) Fire: Health and Safety Representatives

SHE Representative will:

- Assist with the calming and evacuating employees.
- Ensure that the scene of the incident is made and kept safe with the assistance of other employees.
- Assist with the investigation of the incident and also with the provision of recommendations to prevent a recurrence.
- Assist with knowledge of equipment in their area.

g) Fire: Technical Department Witbank

The Technical qualified staff:

- Isolate the power supply to the area.
- Isolate all machinery involved or that may be a risk for the fire fighters.
- Assist to make the area safe.
- Assist to get the area back to normal as soon as possible.

h) Fire: Witbank Emergency Management Services

The Emalahleni Disater Management services will:

- The fire department takes control of the area.
- The SAPS assist the Fire department to investigate.
- Traffic department to assist by controlling the traffic.
- Clearance to continue with repairs or operations has to be given by the TPL Central Senor Regional Manager after approval from the relevant Emergency services.

6.2. FIRE: Location : Control Room

The Depot Control room consists of the following infrastructure and equipment posing fire hazard

a. Laboratory equipment with various test apparatus and adjoining sample store.
b. Computers, printers and Kitchen appliances.

Controllers on duty will:

- Access the situation and see if he/she can extinguish the fire using a fire extinguisher.
- Vacate everybody from the ops room and testing centre.
- Close all door and windows if possible and switch the FM 200 on to auto and then report to the assembly point and continue with the normal emergency procedure.

FIRE FIGHTING HINTS – Attack the fire with a suitable firefighting equipment, if it is safe to do so or to clear an evacuation route.

TYPE OF FIRE	TYPE OF EQUIPMENT
CLASS A Wood/Paper/Material	Red White Fire extinguisher (Water) or Red water hose reel
CLASS B Oil, Petrol, Wax, Flammable Liquids	Red Blue fire extinguisher (Foam)
CLASS C Fire occurring in the presence of live electrical Installations	Black horn fire extinguisher (CO_2) or Red Fire extinguisher (Powder)

Emergency evacuation training drill

- Emergency drills will be exercised to ensure all staff knows what to do in the case of Fire as per Depot emergency drills plan.

7. Major Emergency Evacuation Actions For A Hazardous Vapor/Product Leak, Fire or Explosion At Neighboring Companies and Depots

PURPOSE

To provide for a Command and Control Procedure to deal with any fire and emergency situation that imposes a threat to Transnet pipelines in order to protect lives, property and the environment.
In response to any incident a Forward Control Post (FCP) will be set up immediately which will be manned by the responding personnel. In the event that the most senior Transnet Pipeline official on site at the incident (FCP) is of the opinion that the incident should be regarded as a disaster or potential disaster, Master Control Centre must be informed of the circumstances and will place the Pipeline Business Continuity Management Team Leader on alert. The Business Continuity Management Team Leader will order the activation of the Business Continuity.

a) Explosion: Employees

Employees :

The senior person on duty must implement the following procedures in the event of a major vapour release or leak, fire or explosion at **neighbouring companies, Siyandisa Truck Stop (South side of the Depot – next door), Vanchem Vanadium (West side of the Depot-back opposite), Shop and Reclam (North Side), Residential. Ackerville across Schonland drive –(East side of the depot-Front Opposite)**

1. WARNING OF DANGER

- A warning of the danger in either the form of a fire or explosion will be sounded by one of the following: -
  - Identification by employees on Siyandisa **Truck Stop** sounding the alarm and informing the Depot Control Room Staff or the Depot Liaison with the Company Representative; or
- Upon notice of the warning from either of the above sources TPL employees must sound the Depot emergency siren (for a continuous blast, approximately 3 minutes), indicating to all that the emergency is related to a vapor cloud release, product leak, fire or explosion in the neighboring truck stop, and there is a risk its approaching the Depot. Truck Stop is just few meters from TPL fence at the Southern side, all personnel need to be proactive and take safe appropriate steps to prevent any explosion.
- Inform Master Control Centre on telephone number **(031) 361 1500** of the situation that Depot operation maybe impeded and that control is to be handed over to MCC or to prepare for emergency shutdown.
- **Shell** and **Engen** still pose threats during emergencies due to valves underneath ground connected from TPL site to their tanks.

b) Explosion: Protection/Security Officials Control Room

Protection/Security Officials will:

- Depot Security Personnel or Staff identifying the incident must activate an emergency siren / alarm. Lone worker can activate the system electrically and manually. In case of tank explosion

at both Shell and Engen check direction of wind and consider the smoke direction, if the emergency assembly on site is not safe evacuate at the second assembly point at laydown area.

- Man the Control Room and not leave the Control Room unmanned during the incident
- Activate the response of the North West Emergency Services and provide details.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media.

c) Explosion: Service Provider, Protection/Security Manager

Protection/Security Manager will:

- Ensure that security staff cordons the affected area off.
- Ensure that no unauthorized persons enter the scene of the incident.
- Ensure that nothing is removed before permission has been granted.
- Ensure that Security Personnel assist with the investigation and the taking of statements.
- Perform a general assessment of the damage and/or document all relevant details for insurance purposes.
- Obtain a copy of the Matlosana Emergency Services Department (ESD) detailed incident investigation report.
- Take photographs of the scene to assist in the investigation of the incident.
- Ensure that personnel prevent looting of the premises.

d) Explosion: Protection/Security Officials

Protection/Security Officials will:

- Assist with the evacuation of the affected areas.
- Cordon off the affected area.
- Take roll call of all the employees present and take note of all employees that were not at the assembly point.
- Provide the fire brigade and ambulance, upon their arrival, with directions to the scene of the incident.
- Ensure that there is no tampering with any evidence relating to the cause of the explosion
- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media

e) Explosion: Witbank Fire Marshals

Fire Marshals will:

- Upon the discovery of fire , respond quickly to the affected area and commence with fire
  fighting as soon as possible if needed.
- Assist with the evacuation, if needed.
- Assist the First Aiders.
- Safeguard the area during evacuation until every person is in a safe area.
- With the help of the Emergency Response Team, the Depot management, Risk Manager TPL, evaluate the situation and assist with the immediate action necessary to save lives and property

f) Explosion: First Aiders

First Aiders will to the best of their ability:

- Render first aid to injured patients.
- Assist with the evacuation of patients if required
- Provide ambulance personnel with information with regard to medical treatment rendered to the patient i.e. handover patient to ambulance personnel
- Assist the ambulance team where possible at the scene.
- Record the items used from the first aid box and replenish the stock.

g) Explosion: Health and Safety Representatives

SHE Representative will:

- Assist with the calming and evacuating employees.
- Ensure that the scene of the incident is made and kept safe with the assistance of other employees.
- Assist with the investigation of the incident and also with the provision of recommendations to prevent a recurrence.
- Assist with knowledge of equipment in their area.

h) Explosion: Technical Staff (Witbank)

The Technical Manager and technical employees will ensure that qualified staff:

- Isolate the power supply to the area.
- Isolate all machinery involved or that may be a risk for the fire fighters.
- Assist to make the area safe.
- Assist to get the area back to normal as soon as possible.

i) Explosion: Emalahleni Disaster Management Emergency Services Department.

The EDMS will:

- Upon notification of an explosion, Emalahleni Disaster Management will respond to the location of the incident.
- Coordinate the activities of the Fire Marshals.
    - Make contact with the Regional Manager, Witbank Operations Manager his delegated person to assess the situation and to take appropriate action without endangering any person or property.

- Establish in conjunction with the First Aiders a central assembly point for all injured persons.
- Take note of all relevant particulars of the incident that could be used during the subsequent investigation.
- Ensure that the necessary documentation is completed to record the facts pertaining to the incident.
- Once it is established that the building is safe for entry, hand over the building to the Witbank Operations Manager

8. Internal Large Spillages

Large Spillages at Witbank

The potential for major pollution incidents occurring is on the increase, taking into account the amount and types of dangerous Flammable petroleum products that are handled daily at Witbank. This is increasing by the year, there must, therefore, be some preplanning and contingency plans put into place, not only by Transnet Pipelines, but also by the companies handling these products.

With the increasing pressure on the environment and the obvious danger caused by pollution (oil, chemical, etc.) it becomes imperative that any pollution must be stopped or contained as quickly as possible in order minimize the damage or to avoid further damage to the area where the spillage occurred.

a) Internal Spillages: Employees

Employees will:

- Provide the type of product spilled
- The amount involved
- The wind and other weather conditions
- Be alert for fire ignition
- Check the available equipment
- The type of area, location and accessibility.

b) **Internal Large Spillages**: Controllers on duty

Controllers on duty will:

- Ensure the section of the pipe is isolated to stop the spillage.
- In the presence of fire danger cover the area with foam.

- Ensure the area is cleaned and spilled product is reclaimed.
- Pump the water that is used into the separator tank and close the valve when completed .
- When a fire danger is present in the area in which the spillage took place it has to be covered with foam.

- All actions, volumes, and information to be recorded in the relevant book with corresponding times of recording the information.

c) **Internal Large Spillages**: **Security Main gate**

Protection/Security Officials will:

- Man the Control Room and not leave the Control Room unmanned during the incident.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Immediately notify the controller and the Operations Manager (If on duty) upon noticing the spillage.
- Ensure adequate access to the Depot for spill cleaning contractors.
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media.

The Technical Manager and technical employees will:

- Ensure that valves to area are isolated.
- Arrange for the necessary repairs.
- Inform Depot manager, Depot Supervisor and controllers once repairs are completed.

9. INTERNAL UNREST

a. Internal Unrest (Unrest occurring inside the premises)

a) Employees

Employees will:

- Raise the alarm, by using the button on the panel in the control room which is situated at the emergency exit or call Security who will contact the Emalahleni **Emergency Services i.e. Fire, SAPS and Ambulance.**
- Inform immediate Supervisor.
- Give details about what is going on.
- Not get involved in arguments or fights.
- Not place themselves at risk.
- If prevented from leaving the premises, remain in a secure place until it is considered safe by the Regional Manager.
- Report to the Departmental Head if any person has been left behind or been taken hostage.

- Not evacuate to the usual demarcated emergency assembly areas but rather to a safe area as stipulated by the Transnet Pipelines Risk Manager.

b) Internal Unrest: Protection/Security Control Room

Protection/Security Officials will:

- Man the Control Room and not leave the Control Room unmanned during the incident.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Immediately notify the following persons/sections and/or organizations in the order mentioned below:-
    - Inform Fire Marshals to be on alert.
    - Inform First Aiders to be on alert
    - Security Manager (to control access at the incident scene).
    - Regional Manager, Transnet Pipelines (Landlord).
    - Risk Manager, Transnet Pipelines.
    - Technical Manager, Transnet Pipelines
    - Activate Emergency Response Team only if requested by Senior Regional Manager.
- Other persons/organizations as required by the Senior Regional Manager: Transnet Pipelines (Transnet Property – Landlord) or his delegated official.
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media

c) Internal Unrest: Service Provider, Protection/Security Management

Protection/Security Manager will:

- Inform Regional Manager and Risk Manager, Transnet Pipelines.
- Take measures to prevent the unrest crowd from entering the offices
- Take measures to deviate the unrest crowd to an open area
- Take measures to prevent the unrest crowd from injuring persons and damaging property
- Take measures to prevent the unrest crowd from intimidating other workers

d) Internal Unrest: Protection/Security Officials

Protection/Security Officials will:

- Assist by preventing the unrest crowd from entering the offices
- Assist by preventing the unrest crowd from injuring persons and damaging property

- Assist by preventing the unrest crowd from intimidating other workers
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media

e) Internal Unrest: Emergency Response Team

The Emergency Response Team will:

- Convene at the discretion of the Chairman (Regional Manager: Transnet Pipelines (Transnet Property).
- Coordinate the emergency activities.
- Decide on what action to take to deal with incident.
- Issue instructions and feedback to employees.
- Provide information to the media spokesperson if needed.

b. External Unrest (Unrest Occurring Outside the Premises)

a. External Unrest: Employees

Employees will:

- Not attempt to enter the Transnet Pipelines premises and avoid getting caught in the unrest crowd.
- Proceed to a place to be announced by Risk Manager, Transnet Pipelines if prevented from entering building.
- Assemble at a place to be announced where a plan of action will be formulated by the Emergency Response Committee.
- Not get involved in arguments or fights.

b. External Unrest: Protection/Security Control

Protection/Security Officials in Control Room will:

- Man the Guard house and not leave the Guard house unmanned during the incident.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Immediately notify the following persons/sections and/or organizations in the order mentioned below:-

- Security Manager (to control access at the incident scene).
- Operation , Witbank
- Operations Supervisor, Witbank.

- Other persons/organizations as required by the Operations Manager or his delegated official.
- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media

c. External Unrest: Service Provider, Protection/Security Management

Protection/Security Manager will:

- Inform Regional Manager Security, and Risk Manager, Operations Manager.
- Take measures to prevent the unrest crowd from entering the Property
- Take measures to deviate the unrest crowd to an open area
- Take measures to prevent the unrest crowd from injuring persons and damaging property
- Take measures to prevent the unrest crowd from intimidating other workers

d. External Unrest: Protection/Security Officials

Protection/Security Officials will:

- Assist with the evacuation of the affected areas.
- Cordon off the affected area.
- Lock entrances where unrest crowd have congregated or are passing by
- Prevent unrest crowd from entering/damaging the premises
- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media

e. External Unrest: Emergency Response Team

The Emergency Response Team will:

- Convene at the discretion of the Chairman (Senior Regional Manager, Central)
- Coordinate the emergency activities.
- Decide on what action to take to deal with incident.
- Issue instructions and feedback to employees.
- Provide information to the media spokesperson if needed.

10. Power Failure / Load shedding

a. Power Failure: Employees

Employees will:

- Raise the alarm, informing of Emalahleni Electrical Department on 013 690 6418
- Inform them of details of the power failure.
- Notify the Head of Department
- Remain calm at their workstations & not attempt to exit the floor
- If instructed, to evacuate pay attention to and obey **all** instructions given over the Public Address system whereafter you may evacuate using the stairs in an orderly manner and as quickly as possible.
- Assist visitors and contractors to a safe area.

b) Power Failure: Protection/Security Control

Protection/Security Officials in Control Room will:

- Man the Control Room and not leave the Control Room unmanned during the incident.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Immediately notify the following persons/sections and/or organizations in the order mentioned below:-

    - Security Manager (to control access at the incident scene).
    - Regional Manager, Transnet Pipelines (Landlord).
    - Risk Manager, Transnet Pipelines.
    - Technical Manager, Transnet Pipelines
    - Technical Service Provider

- Other persons/organisations as required by the Regional Manager (Transnet Pipelines) or his delegated official.
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media.

c) Power Failure: Service Provider Protection/Security Management

Security Management will:

- Ensure that the area is evacuated when requested to do so by Regional Manager, Transnet Pipelines (Landlord) or his delegated person.
- Ensure that no one enters the area and that the area is cordoned off.
- Ensure that nothing is removed before permission had been granted.

- Assist with the investigation of the incident.

d) Power Failure: Protection/Security Officials

The Security Official will:

- Assist in safeguarding the area and employees during the power failure and restoration of power.
- Assist persons in accessing exit routes or vehicles should emergency lighting not function or be inadequate
- Assist to evacuate the area if needed.
- Assist to cordon the area off if needed.
- Remain calm and not create panic.
- Not spread rumors or give any comments to anyone from the public or media

e) Power Failure: Transnet Fire Marshals

Fire Marshals will:

- Ensure that employees remain calm at their workstations
- Evacuate persons only if the instruction is given to the relevant floor to do so
- Only leave the floor once all the persons have evacuated
- Use torches stored in the emergency red boxes in the Fireman's lift lobby on each floor

f) Power Failure: First Aiders

First Aiders will:

- Render first aid to injured patients
- Assist with the evacuation of patients if required
- Provide ambulance personnel with information with regard to medical treatment rendered to the patient i.e. handover patient to ambulance personnel
- Assist the ambulance team where possible at the scene

g) Power Failure: Technical Manager, Transnet Pipelines

The Technical Manager will:

- Contact Service Provider and Emalahleni Electrical to determine the reason for the power failure as well as the anticipated duration to restore power
- Inform the Regional Manager and Risk Manager
- Arrange for the necessary repairs if any.
- Inform Regional Manager & Risk Manager, Transnet Pipelines once repairs are completed.

h) Power Failure: Technical Service Provider

The Technical Service Provider will:

- Take steps to ensure that the generator functions and if applicable take steps to restore power
- Ensure Risk Manager is made aware of the hazards affected by the power failure
- Effect necessary repairs if applicable
- Inform Technical Manager

i) Power Failure: Department Manager of the affected area

The Department Manager will:

- Remain calm, adopt a positive attitude and reassure all staff.
- Ensure that **all** staff obey any instructions given over the PA system
- Take reasonable measures to ensure that the affected area is back in operation as soon as possible.

j) Power Failure: Emergency Response Team

The Emergency Response Team will:

- Convene at the discretion of the Chairman (Regional Manager: Transnet Pipelines).
- Coordinate the emergency activities.
- Decide on what action to take to deal with incident.
- Issue instructions and feedback to employees.
- Provide information to the media spokesperson if needed.

k) Power Failure: Emalahleni Municipality

Emalahleni Municipality will:

- Provide the Technical Manager and Risk Manager with reasons for the power failure as well as the anticipated duration of the power failure
- Ensure that power is restored as soon as possible

11. EVACUATION

Emergency alarm, activating the public address (P.A.) systems

If the severity of an incident is of such a nature that it warrants an evacuation, then the following actions will be applicable regardless of the type of incident (unless specified). Witbank Depot , will activate the emergency evacuation alarm

Evacuation: Employees

Employees will:

- Ensure that computer or other electrical appliances are switched off at the plugs ie carry out shutdown procedures.
- Leave your work areas immediately and follow the Fire Marshal's instructions/the instructions given over the PA system.
- Follow the predetermined evacuation routes to the nearest emergency exit, avoiding the area where the fire/spillage/source of incident, is located.
- Keep as low as possible to the floor and crawl alongside the wall if passages are filled with smoke and precede to the exit areas.
- Do not use the lifts but use the exit staircases
- Assist others, especially those with disabilities, medical conditions and the elderly; ***Do not put yourself at risk!!***
- Remain calm and do not panic.
- Ensure the evacuation is orderly, i.e. ***Do Not Run, Shout or Push past other persons evacuating!***
- In the event of a fire, not stop en-route to collect personal belongings and only return to their work area if requested to do so by the Risk Manager, Transnet Pipelines
- In the event of a bomb threat/suspicious parcel Employees must leave office doors open and take with them personal belongings eg handbags & briefcases provided that no delay will be occasioned by collecting them after making sure they contain no suspicious packages or articles
- Not spread rumours
- Not give any comments to any person from the public or media
- Follow instructions when given by the Fire Marshals, First Aiders, SAPS, Security Officials, Risk Manager
- Proceed as directed to the Assembly Point
- At the assembly point, locate your Fire Marshal, who will take a roll call.
- Do not re-enter the building until all clear sign has been given by the Depot manager, Depot supervisor and Risk Manager

a) Evacuation: Protection/Security Officials

The Protection/Security Official will:

- Assist in safeguarding the employees and directing them to the nearest fire exit
- Assist to evacuate the area if needed.
- Direct evacuees to the assembly point.
- Assist to cordon the area off if needed.

- Ensure that no looting takes place.
- Ensure that no person returns to the area that is evacuated until the all clear has been given by the Operations Manager or Operations Supervisor or Risk Manager, Witbank
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media.
- At the Assembly point take a roll call and inform the Operations manager or Operations Supervisor of persons that remained on the floor or are unaccounted for.

b) Evacuation: Fire Marshals

Fire Marshals will:

- Assist with the evacuation of the area when requested and ensure that all persons have evacuated.
- Close all doors as they leave the building in the event of fire.
- Keep all doors open as they leave the building in the event on a bomb threat.
- Try to safeguard the area as indicated in the sections dealing with fires, explosions, natural disasters and bomb threats
- Ensure that the floor is vacated by all persons before exiting to the Assembly point.
- Assist with crowd control when the all clear is given for persons to re-enter the building

c) Evacuation: First Aiders

First Aiders will:

- Render first aid to patients injured.
- Assist with the evacuation of patients if required
- Handover to the ambulance team
- Assist the ambulance team where possible at the scene.
- Record the items used from the first aid box and replenish the stock.

d) Evacuation: Health and Safety Representatives

SHE Representative will:

- Assist with the calming and evacuating employees.
- Ensure that the scene of the incident is made and kept safe with the assistance of other employees.
- Assist with the investigation of the incident and with the provision of recommendations to prevent a re-occurrence.

e) Evacuation: Operations Manager

The Operations Manager will:

- Ensure that staff do evacuate the area if when instructed to do so
- Remain calm, adopt a positive attitude and reassure all staff.
- Take reasonable measures to ensure that the affected area is back in operation as soon as possible.
- Assist with post mortem i.e. informing next of kin

12. MEDICAL EMERGENCIES

a) Medical Emergencies: Employees

Employees will:

- Raise the alarm, by using the Red emergency panel which is situated at the emergency exits and/or call Security 011 978 2770 who will contact the **Emalahleni Emergency i.e. Fire, SAPS and Ambulance.**
- Contact a trained First Aider.
- Not move the injured person or persons unless the patient's life is threatened by risks in the area.

b) Medical Emergencies: First Aiders

First Aiders will:

- Render first aid to patients injured.
- Assist with the evacuation of patients if required
- Handover to the ambulance team
- Assist the ambulance team where possible at the scene.
- Record the items used from the first aid box and replenish the stock.

c) Medical Emergencies: Protection/Security Officers Control

Protection/Security Officials will:

- Attend to the telephones at all times.
- Request the patients details ie name, surname, age and sex of patient, suspected medical condition, room number, telephone number where the patient is as well as whether the ER24 ambulance or ambulance should be called. In the event that the ER24 ambulance is preferred the patients medical aid scheme name and membership number must be provided before the call is made to ER24.

- Inform Siqobile Security to dispatch a First Aider with a wheelchair and first aid kit to attend to the patient and transport the patient to the first aid room. In the event that the patient cannot be moved, provide portable screens around the patient to obstruct the view of the patient from passers by.
- Prevent persons from gathering around the patient.
- Notify the ambulance services (during office hours and after hours).
- Notify the Risk Manager, Transnet Pipelines.
- Ensure unobstructed access for external emergency services by Security.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of message, from whom the message was received and/or to whom message was transmitted).
- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media.

d) Medical Emergencies: Health and Safety Representatives

SHE representatives will:

- Ensure that the scene of the incident is made and kept safe with the assistance of other employees.
- Assist with the investigation of the incident and with the provision of recommendations to prevent a reoccurrence.
- With the help of Security Officials, ensure that the area is not disturbed (or is subject to as little disturbance as possible) for investigator purposes.
- Ensure that an IOD form is completed if the patient is a Transnet Employee.
- Report to the Departmental Head and Risk Manager, Transnet Pipelines for all injuries.

13. MAJOR MACHINERY FAILURE e.g. WATER PUMP FAILURE OR GENERATOR FAILURE

a) Machinery Failure: Employees

Employees will:

- Make the area as safe as reasonably possible
- Inform the Departmental Head about the machinery failure.
- The Departmental Head will give command for staff to evacuate if needed.
- Follow instructions given by the Departmental Head.

b) Machinery Failure: Protection/Security Control Room

Protection/Security Officials will:

- Man the Control Room and not leave the Control Room unmanned during the incident.
- Keep a full chronological record of all messages received and transmitted either by radio, telephone, or verbally in the occurrence book (time, detail of messages, from whom the message was received and/or to whom messages was transmitted).
- Immediately notify the following persons/sections and/or organizations in the order mentioned below:-

    - Technical Department
    - Master Control Center
    - Operation Manager

- Remain calm and not create panic.
- Not spread rumours or give any comments to anyone from the public or media.

14. BOMB THREAT

a) Bomb threat: Employees

Employees will:

STEP 1

- On receiving the bomb threat phone call prolong it to extract as much information as possible from the caller.
- Keep in mind that the phone call can be the only contact with the caller ensure all information is collected correctly, assess, and decide whether it is a real threat or prank.
- Raise the alarm.
- Inform the Master Control and Fire brigade and Clients where possible.
- Shut down the line.
- Be sure to inform Fire Coordinator (who will initiate the evacuation procedure).

Evacuation will be initiate with the sounding of alarm

BOMB = A CONTINOUS RINGING OF THE ALARM

STEP 2

- **Leave the building or work area immediately,** do not panic, remain calm and where necessary assist the elderly and the frail.
- Remove all personal items.
- Time permitting; ensure electrical appliances are switched off and helium gas bottles are closed and disconnected from test center.

Step 3

- Report to the **assembly point** outside at the **main gate.**
- **Do not re-enter** the building until instructed to do so.
- **Security** to perform **access control.**

b. Bomb threat: Protection/Security Officials

Protection/Security Officials will:

- Request all visitors to leave the premises.
- Take cover.
- Observe; the area; the premises and the access gate to allow entry to the SAPS
- All actions, observations and instructions record in his pocketbook next to the time it happened.

c. Bomb threat: Controllers o duty

Controllers on duty will:

- If the Depot is in operation: Lock all the control room doors.
- Switch all the lights off.
- Notify the MCC and shut the line down.
- Close all isolation / remote valves.

- After the pipeline has been shut, down he must leave the control room; take safe cover from where he should await the arrival of the SAPS.

- If the Depot is not in operation: Lock all the control room doors. Switch all the lights off. Notify the MCC and Depot manager.

- All actions, reactions, observations and instructions record in the handover book.

- The Operations Manager:

- Phone the SAPS / 10111/ 079 891 8422
- Phone the Operations Manager 083 303 6679 / 011 978 2752
- Phone the MCC (031) 361 1500
- All possible instructions relay to the relevant people.

- All actions, reactions, information and instructions given and received record in the handover book against the time it happened.

Emergency evacuation training drill

- **Emergency evacuation drill for bomb threat will be exercised as per Depot training schedule which can be accessed on Witbank shared drive and TIMS.**

BOMB THREAT CHECKLIST

LISTEN CAREFULLY – BE COURTEOUS – DO NOT INTERRUPT – DO NOT TRANSFER
KEEP THE CALLER TALKING – ASK QUESTIONS

What time will the bomb go off? _____

What does the bomb look like? _____

Where is the bomb? _____

Why was the bomb planted? _____

How many devices are there? _____

Where are you calling from? _____

Who are you/What is your name? _____

Please tick the following if applicable:

Origin of call	**Caller**	**Language Used**	**Accent**
Local	Male	English	English (SA)
Pay Phone	Female	Afrikaans	English (UK)
Long Distance	Teenager	African Specify:	Afrikaans
Internal	Young Adult	European	African
Cell phone	Mature	Other	Asian
Other			Other

Voice Characteristics	**Speech**	**Manner**	**Background Noises**
Loud	Fast	Calm	Street traffic
Soft	Slow	Angry	Trains
High-pitched	Clear	Rational	Aircraft
Deep	Stutter	Irrational	Factory

Pleasant	Distorted	Coherent	Office Machines/Fax
Raspy	Nasal	Incoherent	Voices
Flat	Lisp	Deliberate	Music
Muffled	Intoxicated	Emotional	Animals
Slurred	Educated	Laughing	Party noises
Other	Other	Agitated	Bedlam
		Abusive	Quiet
		Foul language	Siren
			Other

Is the caller familiar with the premises and the layout thereof? YES / NO / DON'T KNOW

Name: _____. Signature: _____

Time call received: _____. Date: _____

Duration of call: _____. which line did the call come in on: _____

15. DEFINITION AND ABBREVIATIONS

TERM	DESCRIPTION
Contingency planning	An event that is regarded as future possibility. It is used for risk management on exceptional risk , though unlikely, would have a catastrophic consequences. In the context of emergency planning it may be used to describe a plan for A. Alternate resources in events where resources that are initially relied upon during emergency are suddenly not available (i.e breakdowns, theft of equipment etc) B. Other consequent incidents that may occur during handling of an incident (i.e fire explosions, toxic release of pollution or pipe burst)
Disaster/Crisis	A sudden great catastrophe or misfortune. It describes incidents of great impact and magnitude that could not be handled with readily available resources such as earthquakes, floods, e.t.c
Emergency Plan	A structured plan to deal with sudden and unexpected incidents. It is a plan that is periodically developed, implemented, rehearsed, monitored and updated accordingly after all emergencies that are likely to occur have been identified and evaluated. It ensures efficient and effective implementation of adequate resources immediately to render the emergency safe and to minimize mortality, property loss, environmental damage and business disruption.
Standard Operating Procedure (SOP)	A systematic procedure that must be followed accordingly and safely. Usually presented in a written form indicating a systematic

	instructions that need to be followed. The generic emergency plan includes specific procedures to address handling of hazardous materials or processes.
Hazard	A source of or exposure to danger.
Flammable substances	Substances that will ignite and continue to burn when they are brought into contact with an ignition source.
Assembly Point	A safe point where all persons must report to; which will enable roll call
Controller	Pipeline personnel trained to work in the Depot Control room
MCC	Master Control Centre
Spillage	the action of spilling a liquid, or the fact of a liquid being spilled
Hazmat	Hazardous material.
CPR	Cardiopulmonary Resuscitation
FCP	Forward Control Post
BCM	Business Continuity
TPL	Transnet Pipelines
SAPS	South African Police Services.
Sections 16.2 Assignee	Chief Executive officer charged with certain duties under Section 16 of the Occupational Health and Safety Act 85 of 1993.
ULP 93	Unleaded petrol Octane 93 , 95
T1,T2,T3,T4,T5,T6,T7,T8,T9	Tank numbers
Act 85 of 1993	Occupational Health and Safety Act, Act 85 of 1993.
Act 99 of 1987	Fire Services Act, Act 99 of 1987.
MSDs	Material Safety Data Sheet

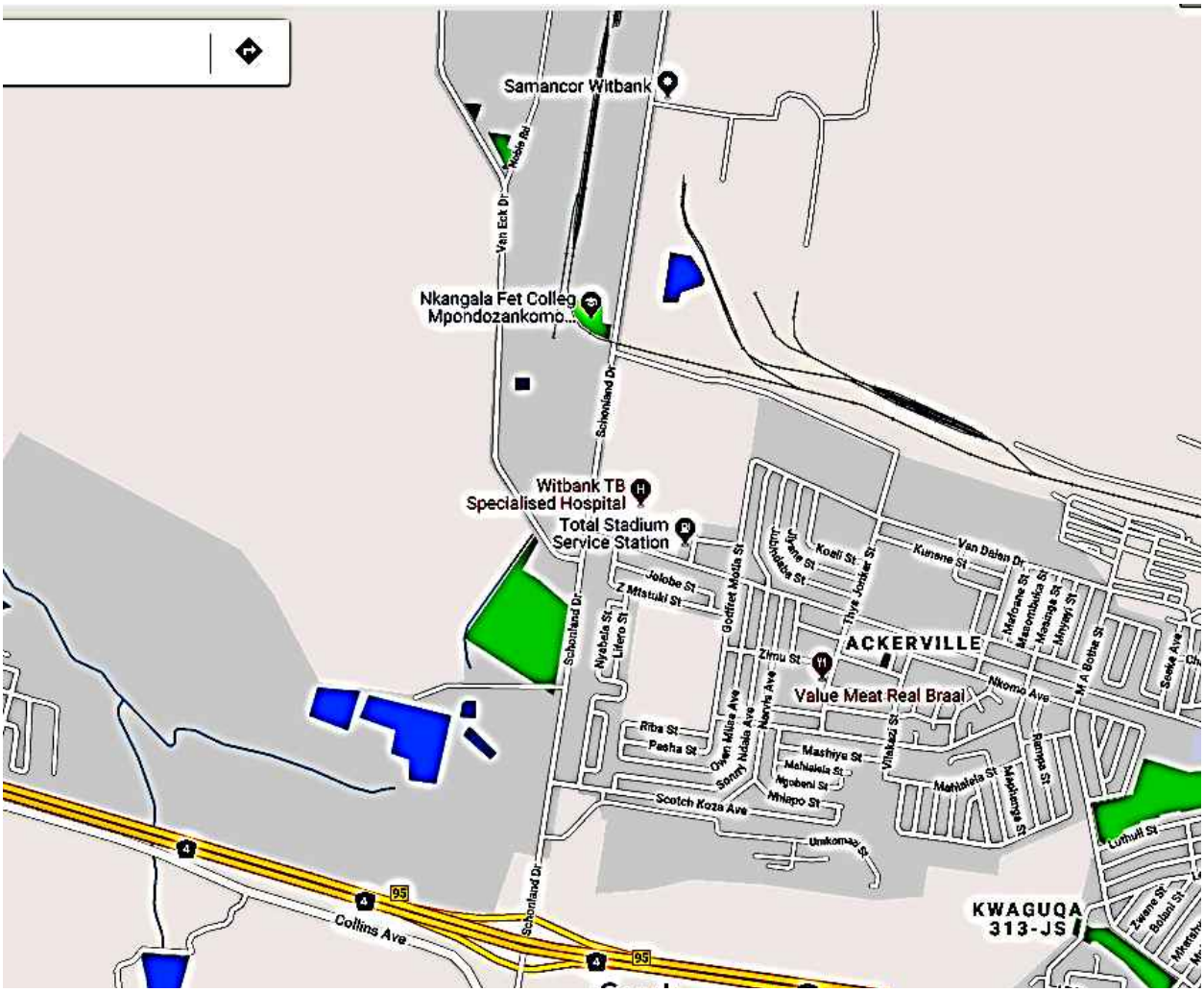
16. EMERGENCY RESPONSE TEAM - Witbank

WITBANK DEPOT	TELEPHONE / LAND LINE	CELL PHONE
TRANSNET PIPELINE		
Master Control - Office (Manned 24 hours)	(031) 361 1500	
Manager Master Control Centre (Carel. Muller)	(031) 361 1426	083 284 2127
General Manager-OPSTECH (Sibongiseni Khathi)	031 361 1144	060 520 1771
Senior Regional Manager, Central (Daniel Noni)	016 815 5410	083 284 2133
Act. Environment Manager – Philisiwe Selwane	031 361 1253	084 381 6379
Witbank Operations Manager (Douglas Mthimkhulu.)	011 978 2752	083 303 6679
Fire Maintenance Manager (Papa Moratwe)	031 361 1598	060 571 3907
Fire specialist (Peter Jacobs)	031 361 1313	060 583 5346
Witbank Ops Supervisor (Gideon Khasi)	(011) 978 1806	083 286 0160
EMERGENCY AGENCIES		
SAPS – Vosman	079 891 8422	10111
Sinqobile Security Service	011 978 2770	072 511 7697
Local Council Chief Fire Officer	013 690 6222/333	072 824 9274
Security Services – Manager	072 511 7697	
Fire brigade / traffic	072 824 9274/ 083 711 1867	
Department of Health	066 202 2037	
Spill-Tech	0861000366	
Ambulance (Provincial)	013 690 6222	
Hospital-Witbank Hospital	013 653 2000	
Hospital- Life Midmed Hospital	013 653 8000	
Regional Security Supervisor (Sanele Mpanza)	011 978 2826	081 035 1156

EMERGENCY CONTACT NUMBERS cont.

WITBANK DEPOT	TELEPHONE / LAND LINE	CELL PHONE
SHEQ		
Field Risk Manager (Reginald Motloung)		083 286 3084
Fire brigade / traffic	013 690 6222/083 711 1867	
Hospital Emalahleni	013 655 3000	
Local Council Chief Fire Officer	013 690 6222/333	082 330 1359
Department of Health	018 487 8167	
Spill-Tech	0861000366	083 283 6618
Ambulance/ ER 24	013 656 5000	072 344 2344
Emalahleni Electricity Department	013 60 6418	
INFRASTRUCTURE		
Electrical Control	(031) 361 2916	
Manager Insurance	(031) 361 1489 (031) 361 1284	
Electrical Manager (Dhani Sigh, Act)	034 989 9512	083 289 6887
Mechanical Manager (Tershini Pillay))		083 643 0651
Radiation Protection Officer (Peter Leibold)	(011) 978 2799	083 284 2143
Clients at Witbank	Address	Telephone numbers
Shell (Manager Rashid Choonara Cell: 083 678 6393)	17 Schonland Drive , Ferrobank, Witbank	083 678 6369/ 071 481 8985
Engen (Manager Sandile Phakathi Cell: 081 791 6257/076 010 3251)	Plot 17 Moses Kotane Street , Ferrobank, Witbank	081 791 6257/ 076 010 3251
NEIGHBOURS		
Siyandiza Truck Stop(Next door) Mpho Ntuli Cell: 082 257 7628	10-11 Schonland Drive Ferrobank, Witbank, 1035	082 257 7628
Bushveld Vanchem Vanadium(Back Opposite) Mauritz Laubser Cell: 083 440 8236	Van Eck Road , Ferrobank, Witbank	083 440 8236/ 072 385 6996

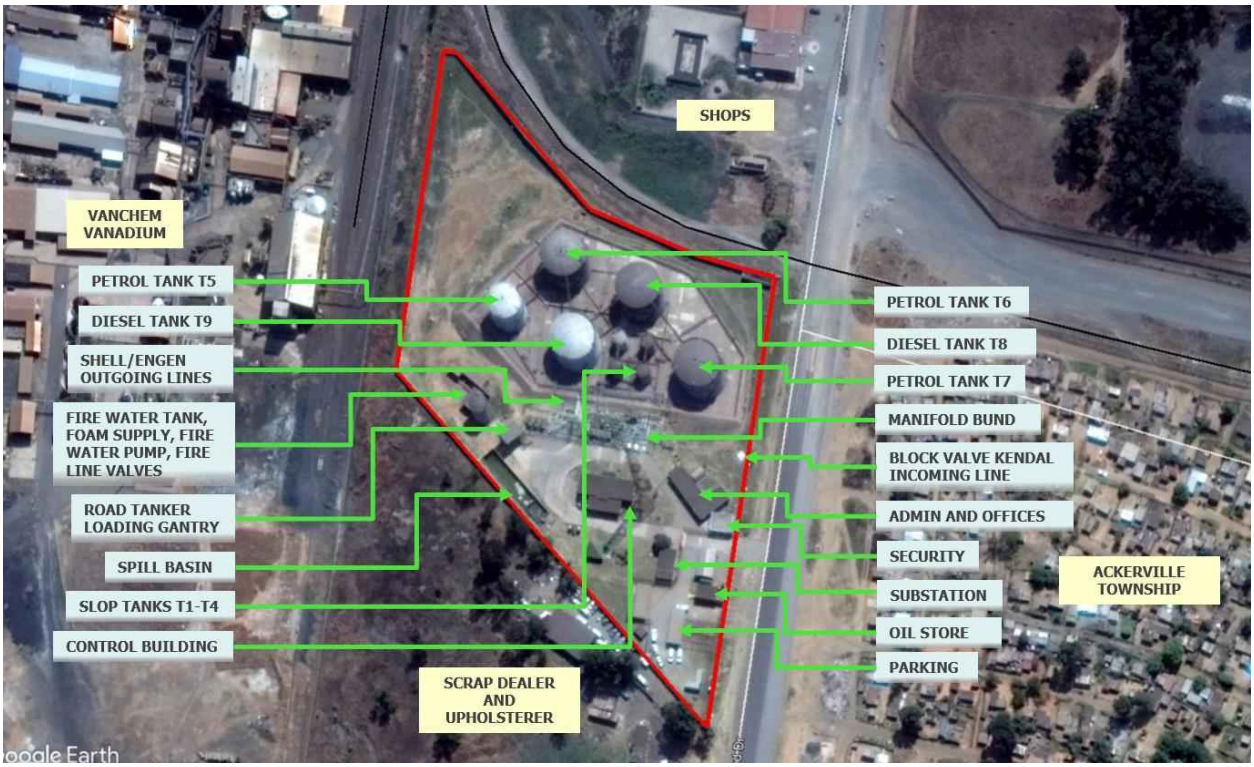
WITBANK DEPOT SITE LOCATION



PHYSICAL ADDRESS

Road Name : 9 Schonland Drive
Suburb: Ferrobank
Town/City : Witbank
Province : Mpumalang

Witbank Depot site overview



APPENDIX E:

The Evaluation table for the Emergency Response Plan

mmrisk	Emergency Response Plan Evaluation Table

Client Name:	Transnet Pipelines	Site Name:	Transnet Pipelines Witbank Terminal
Project Number:	Tr02-6	This document Revision:	0
Client Document Number:	TRN-IMS-TP-PLN-016.35	Client Document Revision Number:	3
Evaluated by:	Lesedi Lebea 18/01/2024	Checked and Approved by:	Motlatsi Mabaso

Clause	Requirement	Currently Addressed? (Yes or No)	Notes
MHI Regulations promulgated 31st January 2023			
15 (4) (a)	A duty holder must ensure that the manner in which employees, visitors and neighbours will be warned of major incidents is included in the plan	Yes	
15 (4) (b)	A duty holder must sign a copy of the on-site emergency plan in the presence of at least two witnesses who have knowledge in emergency planning and who must be satisfied with the content of the emergency plan and attest to the signature of the duty holder	Yes	Page 3 of the ERP document shows that the document has been signed and approved by the “Approval cpmmittee”.
15 (4) (c)	A duty holder must obtain approval of the on-site emergency plan from the relevant local government	Yes	
15 (4) (d)	A duty holder must ensure that the on-site emergency plan is readily available at all times for implementation and use	No	. This is not specifically detailed in the document.
15 (4) (e)	The duty holder must cause the on-site emergency plan to be tested or exercised in practice at least once a year and	Partly	Page 5 of the ERP documents details that evacuation drills and training take place every month, but it is not clarified if the local government is participating in these.

	take the necessary steps to arrange for the local government to participate in such tests		
15 (4) (f)	A duty holder must give an early warning to affected or interested parties in case a major incident is likely to go beyond the borders of the establishment.	Yes	
15 (5)	The duty holder and the relevant local government must take reasonable steps to activate the on-site emergency plan in case of an incident which may result in– (a) a major incident; or (b) an uncontrolled event which may reasonably be expected to lead to a major incident; or (c) a near miss that could reasonably be expected to have resulted in a major incident.	Yes	
15 (6)	The duty holder must review the on-site emergency plan at least once every three years and, if necessary, revise the plan.	Partly	The plan was last reviewed in December 2022, but it is not clearly specified if the plan is reviewed every three years. MMRisk recommends that the plan be reviewed every three years, at least, and the details be included in the ERP document.
15 (7)	The duty holder and the local government must jointly ensure that all first responders at the scene of a major incident have the necessary skill to deal with the dangerous substances and are dressed in the appropriate emergency personal protective equipment as required in their respective emergency plans.	No	MMRisk recommends that these details be included in the ERP document.
SANS 1514:2018			

5.1.1 / 5.1.2	The emergency plans shall indicate the emergency organisational structure which shall include all emergency functions identified both off-site and on-site in their allocated areas of responsibilities involved in managing an emergency.	Yes	Refer to section 5
5.1.4	The roles, responsibilities, functions and needs of all key stakeholders shall be clearly identified.	Yes	Refer to section 5
5.1.5	The establishment shall make every reasonable effort to ensure coordination between on-site and off-site emergency planning.	Yes	
5.2.1.1	Each establishment shall establish and maintain an emergency coordinating and planning committee.	Yes	Refer to section 5
5.2.1.2	The establishment shall nominate an Establishment Emergency Controller, as head of the Emergency Coordinating and Planning Committee, with a sound knowledge of at least a) the establishment and its processes, b) materials and equipment relating to the hazards, c) materials and equipment used for emergency response, d) the potential impact of emergencies on people, property and the environment, e) the waste management requirements of the establishment including waste related to site emergencies, and f) the content of the on-site emergency plan.	Yes	Refer to section 5

5.2.1.3 / 5.2.1.4	An establishment shall nominate at least the following functional representatives for at least the responsibilities related to: Emergency Coordination, Firefighting, First Aid, Evacuation and Communication, whom shall be part of the emergency coordinating and planning committee. The functional representatives shall be part of the emergency coordinating and planning committee, and shall be responsible for firefighting, first aid, evacuation and communication functions.	Yes	Refer to section 5
5.2.2	Responsibilities of the Emergency Coordinating and Planning Committee The emergency coordinating and planning committee shall a) establish and determine the documented plan of the establishment for preparing and responding to emergencies relating to fire, explosions or the release of toxic substances or any other emergencies that can escalate into a major incident, b) develop a site specific procedure and organisational diagram indicating the incident management or emergency plan and command system, and c) define responsibilities for the emergency controller of the establishment, emergency team leaders, emergency team, all employees and visitors.	Yes	Refer to section 5
5.2.3	Responsibilities of the establishment emergency controller The establishment emergency controller shall a) be in charge of developing and managing an on-site emergency plan for the establishment and	Yes	Refer to section 5 – The Operations Manager plays this role

	shall have overall accountability for all functions performed by the on-site emergency teams during an emergency, b) be accountable for the implementation and review of the on-site emergency plan, c) be accountable for the management of all site emergencies by the assigned people, and d) assign people with accountability for allocated responsibilities for the execution of emergency functions identified.		
5.2.4	Responsibilities of the Team Leaders and Teams 5.2.4.1 Emergency preparedness (EP) team leaders shall be responsible for coordinating the emergency response procedures within their teams. 5.2.4.2 Team members shall be responsible for all emergency response in accordance with the emergency plan, as relevant to the establishment, until the arrival of the emergency services.	Yes	Refer to section 5
6			
6.1.1	Risk management shall be undertaken to prevent incidents and to minimize their impact if they do occur.	Yes	
6.1.2	Risk management shall be linked to emergency planning as a component in order to mitigate risks in conjunction with the process safety management provisions of the establishment.	Yes	
6.1.3	During the risk management process, the local authority shall take into consideration all adjacent impacting major	Yes	This is typically detailed in the MHI risk assessment.

	hazard establishments for purposes of compiling the off-site emergency plan.		
6.1.4	Risk management shall comprise information from a) hazard identification, b) hazard analysis, c) AIA risk assessment, and d) other documents on the hazards.	Yes	
6.1.5	The results from the risk management process shall be used as the basis of determining scenarios for emergency preparedness and response plans.	Yes	
6.2.1	The establishment shall identify and document all hazards in the on-site MHI EP plan based on available risk assessments and other documents on the hazards, where such hazards could initiate or contribute to a major emergency which would require the activation of the MHI EP plans.	Yes	MMRisk recommends that the emergency response plan be updated to reflect the incidents which have been identified in the current MHI Risk Assessment.
6.2.2	At least the following hazards shall be considered: a) the hazards arising from the hazardous substances, based on their physical and chemical properties, associated with the establishment, b) the hazards arising from activities or equipment associated with the establishment (for example, cranes, plant, machinery, transport and electrical), c) the hazards arising from processes (for example, high pressure, high temperature), and	Yes	MMRisk recommends that the emergency response plan be updated to reflect the incidents which have been identified in the current MHI Risk Assessment.

	d) natural hazards (for example, floods, lightning strike) that could impact upon the safe operation of the establishment.		
6.2.3	The hazard identification step shall reveal a spectrum of incidents that can significantly impact on people, property and the environment including but not limited to a) fire: jet, pool and tank, b) explosions, c) dispersion of toxic, corrosive or explosive chemicals, d) violent exothermic reaction- polymerisation or decomposition, and e) heat radiation.	Yes	
7.1.1	A summary of the outputs of the emergency planning process shall be documented in the emergency plan of the establishment and in the off-site emergency plan of the local government.	Yes	
7.1.2	The plan shall define areas such as the functions of the establishment and organisational structure, emergency procedures, equipment, reporting and communication channels, and the type of reporting required.	Yes	
7.1.3	The MHI establishment shall keep a copy of the plan at the establishment and provide a copy of the plan to the local emergency services with whom the plan was prepared and any other relevant emergency services.	Partly	It was established during the site visit that a copy of the ERP document has been shared with the local authorities. But it is not specified whether a physical copy is available at the establishment.
7.2.2.1	The introductory section of the plan shall define all situations that constitute MHI related emergencies expected at the	No	MMRisk recommends that these details be included in the ERP document.

	facility and an outline of the levels of emergencies identified in accordance with 7.2.7		
7.2.2.2	The plan should clearly identify a) the name of the establishment and the owner or operator or occupier, b) the location of the establishment, c) a brief summary of the process followed to prepare emergency plan, d) authorisation details (person(s) responsible), e) contact details – on-site responsible persons, emergency services and neighbouring facilities, and f) document control information.	Yes	
7.2.6.1	Details of the MHI related hazards identified as having a significant impact shall be provided in the plan. This should cover MHI hazardous substances and other hazards.	Partly	Hazards are detailed. However, the significant impacts should be detailed.
7.2.6.2	Details of all hazardous substances under the control of the establishment sufficient to initiate MHI emergencies or to contribute to an initial MHI incident, shall be provided in the plan. The relevant quantities will depend upon the form and properties of these materials. The significance of the problem posed by these materials should be discussed and the way in which the plan addresses any problems identified.	Yes	
7.2.7.1.1	LEVELS AND TYPES OF EMERGENCIES The establishment shall define what constitutes an emergency (i.e. a situation that activates and deactivates the emergency plan).	Yes	Refer to section 6 to 14

EXAMPLE An emergency for a facility and its operations may be described as a hazardous situation (or threat of a hazardous situation) which requires action to control, correct and return the facility to a safe condition and also requires timely action to protect people, property and the environment from harm.

Table 1 — Examples of levels of emergency

1	2
Description	Emergency services
Confined location An emergency where the impacts on people, property and the environment: are expected to be confined to a specific location within the facility and no escalation is expected	May be required Examples: ruptured drum in warehouse, leaking flange or seal, small fire in a bag store
Site An emergency where the impacts on people, property and the environment:	Should be required Examples: tank or bund fire, pipe rupture

	are expected to spread to or affect all parts of the facility, but not off-site			
	External An emergency where the impacts on people, property and the environment: are expected to impact both within the facility and beyond the boundary of the facility	Will be required Examples: a bomb threat, large tank bund fire, boiling liquid expanding vapour explosion (BLEVE) of large liquefied gas storage toxic gas release, transport incident		
7.2.7.2.1 / 7.2.7.2.2	Emergencies can vary in scale. For this reason, it is required that different levels of emergency are defined for the facility and for the local government. Information obtained during the risk management process shall be utilized in determining the level of emergency for a particular type of incident.		No	MMRisk recommends that this details be included
7.2.7.3.1	Emergencies shall be defined according to type on the basis of the materials and activities involved.		Yes	
7.2.7.3.3	Types of emergencies may include, but are not limited to a) fire (including the generation of toxic combustion products)		Partly	Emergencies which may arise from natural events are not included.

	b) explosion (including BLEVE), c) spill (of hazardous solids and (or both) liquids), d) gas leak (flammable, toxic, asphyxiant, pressurised or refrigerated liquid), e) structural failure, f) natural event (including flood, earthquake, storms, storm tides, etc.), g) impact event (road vehicles, railways, aircraft, ships), h) subversive activities (bomb threat, vandalism, sabotage, etc.), and i) transport incident.		
7.2.7.3.4	These types of emergencies shall be considered for: a) an incident within the facility, b) an incident occurring outside the facility where a hazardous material is the responsibility of the facility (for example off-site pipeline)	Yes	
7.2.8.1	The functions nominated for the facility and the local government, in the on and off site plans respectively, shall be listed in the plans, including associated roles, responsibilities and duties of personnel assigned to these functions, and arrangements for appropriate backup shall be recorded.	Yes	

7.2.8.2	The roles, responsibilities, functions and needs of all key stakeholders (for example. industry, the community, affected and interested parties) shall be clearly identified.	Yes	
7.2.8.3	The emergency plan shall provide details of the command system, structure and people to be activated in an emergency, so that it is clear what actions will be taken, who will take these actions, and how, when and where they will be taken.	Yes	This defined in section 6 and described in detail in the subsequent sections.
7.2.9.1	The functions nominated for the facility and the local government, in the on an off-site plans respectively shall be listed in the plans together with assigned roles, responsibilities and duties. Arrangements for appropriate backup shall be recorded.	Yes	
7.2.9.2	The people performing duties within the organisational emergency preparedness structure or conducting assigned functions shall require clear methods of identification.	No	Visual identification of the various parties is not mentioned. If it is not in practice, MMrisk recommends that a method of visually distinguishing members of the committee be adopted. This can be headgear, apparel etc.
7.2.9.3	The method of identification shall be described in the on and off site emergency plans	No	Distinguishing apparel worn by the emergency team not detailed in the document.
7.2.10.1	EMERGENCY PROCEDURES The procedures shall describe at least the following: a) steps to be undertaken; b) the precautions; c) personal protective clothing to be used during the emergency; d) equipment to be used during the emergency;	Partly	c) not included

	e) Special conditions;		
7.2.10.2	At least the following emergency response procedures shall be included in the on-site emergency plan of the establishment and the off-site emergency plan of the local government: a) raising the alarm; b) receiving and responding to the alarm; c) activating the emergency plan; d) notifying and interaction with the emergency services and stake holders; e) the safe evacuation and (or both) sheltering of affected persons, and accounting for all people, including visitors and contractors; f) control points and actions for utilities including for example gas supply, water and electricity; g) decontamination following an incident; h) health and safety functions such as first aid, fire-fighting, roll call and search and rescue; and i) terminating the emergency.	Yes	
7.3	Raising the on-site alarm The procedure shall at least indicate a) types of warning devices used on the site, their location and area covered.	Yes	

	b) the operation and function of the warning devices and circumstances for the activation. b) activation methods for initiation of the alarm. c) method of establishing that there is an emergency and confirmation of its level. d) persons authorised to activate the emergency plan after alarm initiation. e) where different alarms are deployed for different actions. f) ability of the public warning system to be effective throughout the community information area (where necessary). g) method, and frequency and recording of testing. h) Need for back-up systems for the alarm. i) method of activating alarm if the facility is not staffed.		
7.4	Receiving and responding to the alarm The procedure shall at least indicate a) appropriate actions to be taken on hearing or observing the alarms and b) emergency plans and procedures activated by off-site emergency responders in relation to the alarms and notification received.	Yes	
7.5	Activation of the on-site or off-site emergency plan	Yes	

	The procedure shall at least indicate a) the circumstances under which the emergency plan (s) is or are to be activated, b) the method of activation (including all designated methods for raising the initial warning and sounding the alarm), c) the means of alerting all relevant stakeholders, d) the arrangements for activation when the facility is not staffed (such as maintaining a regular list of emergency contact numbers), and e) The means of addressing communication issues with the relevant emergency services and other stakeholders.		
7.6	Notifying the Emergency services 7.6.1 The on-site emergency procedure shall indicate the role, responsibility and duties of the persons nominated to advise the emergency services of the emergency. 7.6.2 Applicable information relevant to the establishment and the emergency shall be supplied to the emergency services including at least the following: a) name and location of the facility (suburb, street, nearest cross street to relevant site entry); b) number of injured persons or casualties and the nature of injuries; c) the type and scale of emergency, including a brief description;	Yes	

	d) hazards involved (including details of substances, namely UN Numbers, names of substances and quantities involved); e) telephone contact number (for any return messages); f) name of person making the call; and g) any other useful information (for example, wind speed and wind direction). 7.6.3 The absence of any of the information listed in 7.6.2 , except the location of the emergency, shall not become a hindrance to informing the emergency services of an incident. 7.6.4 The off-site emergency procedure shall indicate at least the following: a) form of notification from an establishment; b) emergency agencies that will be required to respond; c) the role, responsibility and duties of the responding agencies; and d) inter-agency notification and communication.		
7.7	Termination of an emergency The procedure for terminating an emergency and bringing the emergency incident to a safe, orderly and organised conclusion should include, as applicable:	No	This is not detailed in the ERP document

	a) On-site debriefing by all on and off site responder command representatives, b) On-site Incident critique by all on and off site responder command representatives, c) The identification of immediate emergency plant equipment repairs, replacements and re-supply, which includes reinstatement of protection systems and related equipment, d) Contact person for follow up activity before emergency responders leave the area, and e) Termination of contact with any remote incident command centres.		
7.8	Emergency resources 7.8.1 Resources include manpower, consumables and equipment required to successfully mitigate emergencies. This can be the same for on and off-site. EXAMPLES Gas detectors, wind velocity detectors, sand, lime, neutralising agents, absorbents, spill bins and decontamination equipment. 7.8.2 Off-site emergency resources may also include arrangements for obtaining additional external resources (specific to the likely major incidents) to assist the control of major incidents and major incident hazards.	Yes	
8	Administration and control of the emergency plan 8.1 The emergency plan shall be properly managed.	Yes	

	8.2 The on-site and the off-site plan shall describe how the organization will address the following: a) continual training and awareness; b) operational control; c) maintenance of equipment; d) documentation and record keeping; e) exercises and testing of the plan; f) monitoring and review; and g) updating of the plan.		
9.2	The supporting information (see annex C) shall be prepared in consultation with the emergency services to ensure that it meets their needs. Information required to support the plan includes: a) safety, health and environmental information, b) the location map, c) the site layout plan, d) a list of emergency contact phone numbers, and e) other relevant supporting information.	Yes	
10.1	Training and awareness The general training and awareness programmes on the EP plan shall comply with the requirements of the relevant national legislation (see foreword).	Yes	

10.3	Training and awareness shall enable all responding personnel to develop and demonstrate skills in the use of emergency equipment and a working knowledge of emergency procedures. Areas to be covered should include at least: a) general duties, roles and responsibilities in terms of the on-site and off-site plans respectively, b) emergency functions of the Emergency Coordinating and Planning Committee and teams, c) emergency procedures, and d) emergency resources.	Yes	It was established during the site visit that all personnel onsite are to undergo training in basic firefighting skills.
10.4	The on-site and off-site emergency plans shall make provision for the dissemination of information and awareness, to affected parties including neighbouring businesses and communities They shall be informed of the appropriate actions to be taken during an emergency and the means by which they will be warned of an emergency, and kept informed during and after an emergency	Partly	Dissemination of emergency plans to offsite parties is not discussed.
11.1.2	Emergency equipment, operational control and readiness Facilities and local authorities shall establish and maintain controls to ensure that the on-site and off-site emergency plans, respectively, shall be effectively maintained and can be executed. This shall include ensuring that all equipment and resources are available, fully maintained and in a state of operational readiness at all times.	Partly	Section 5 shows that technical employees are responsible for ensuring that equipment is safe and that the depot manager and supervisor are responsible for ensuring that the emergency plans are effectively maintained and can be executed. Information on equipment maintenance and availability is not included in the ERP document.
11.2	Examples of control elements	No	This is not sufficiently detailed in the document; however, this may be included under other documentation.

	11.2.1 Inspection, testing, servicing and maintenance actions to be conducted daily, weekly, monthly, yearly or such other intervals as required. 11.2.2 Emergency resources are accessible and generally not located in the hazard zone. 11.2.3 Emergency equipment (for example, batteries, detection systems, fixed installations) are functional and required spares are available. 11.2.4 Materials that have been consumed have been replaced (e.g. foam, neutralising agents). 11.2.5 New staff are also issued with emergency protective equipment. NOTE This is not an extensive list of control elements. These elements will be defined through the hazard identification and mitigation action determination process.		
11.3	Safe emergency shut down 11.3.1 Control and shutdown facilities shall be provided and shall address, as applicable: a) Automatic closure at loading facilities, b) Automatic pump stoppage at pumps, c) Overflow control d) Surge control e) Sage gas release facilities, and f) Disconnection facilities	No	This is not sufficiently detailed in the ERP document provided. MMRisk recommends that this information be included in the ERP document.

	11.3.2 Consideration should be given in terms of operating shutdown facilities from both local and remote locations, and 11.3.3 These safe emergency shutdown procedures should be tested/ practised on scheduled intervals and whenever changes to procedures have been made.		
11.4	Maintenance of equipment 11.4.1 A maintenance plan shall be developed and should identify tasks and schedules, troubleshooting, corrective maintenance (repair), and spare parts identification, stock (quantity), and any unique storage requirements. 11.4.2 Where any maintenance or break down results in the unavailability of emergency equipment the contingency preparations for such an event shall be addressed in the on-site and off-site emergency plan.	No	This is not discussed in this document; however, this may be included under other documentation.
12	Documentation and record keeping 12.1 Records should be retained by the on-site and off-site committees to verify the adequacy of the system.	Yes	Section 5 of the document details that the depot manager and supervisor are responsible for updating the ERP, but no mention of documentation and record keeping is made.
12.2	Circumstances for which records should be kept include, but are not limited to: a) all induction programs and ongoing training, including details of personnel trained, b) desktop simulations and practical exercises at the facility, c) testing of the plan, including the dates of testing, methods, personnel responsible and the results of testing, d) equipment maintenance records, and	No	This is not discussed in this document; however, this may be included under other documentation.

	e) training and awareness events including communication with affected and involved parties.		
12.3	The management system should control the distribution, presentation, revision and accessibility of the plan, and any supplementary information. The system should ensure that all official copies of the document are the latest version. All superseded copies should be accounted for and filed or disposed of, as appropriate.	No	This is not sufficiently detailed in the document; however, this may be included under other documentation.
13	Testing of the emergency plan 13.1 The on-site and off-site emergency plan should be tested when first developed, and then in terms of relevant legislation (see foreword) to enable deficiencies to be identified and corrected, 13.2 The two usual methods of testing are desktop simulations and practical exercises or drills, 13.3 Testing should consider all components of the plan, including the effectiveness of training, and 13.4 Consultation between the off-site and on-site committees during planning exercises and testing is required.	Yes	It was established during the site visit that emergency evacuation drills take place every month together with Shell.
14	Review and updating the emergency plan 14.1 The emergency plan shall be reviewed in terms of relevant national legislation to ensure its continued suitability and effectiveness. 14.2 Reviews may be initiated by: a) changes in legislation,	Yes	Section 5 shows that the depot manager and supervisor are responsible for updating and reviewing the emergency plan.

	b) advances in technology and equipment, c) lessons learned from: 1) incidents or near miss at the establishment or similar establishments, 2) emergency plan activation, whether real incidents or during testing, that highlighted shortcoming, 3) research and development information, and 4) findings of audits, reporting and communication d) modifications or alterations occurring at the facility, e) the type and quantities of hazardous materials on-site change significantly, f) changes to surrounding land use impact upon the emergency plan, and g) changes occur that will impact on the execution of the plan, such as resources, safety systems, personnel and contact numbers. 14.3 The plan shall be updated based on the outcomes of the review process. NOTE Temporary modifications to the plan shall may be considered when undertaking non-routine activities at the hazardous facility, such as maintenance, construction and start-up or shut-down		