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Attention:

RE: CLASSIFICATION RECOMMENDATION FOR THE KHANYAZWE FLEXPOWER MALELANE SITE IN TERMS OF THE OHS ACT 85/1993, AS AMENDED, MHI REGULATIONS 2022

Dear Sir/Madam,

1. INTRODUCTION

Ishecon was contracted to provide an MHI classification recommendation for Khanyazwe Flexpower Malelane site, as part of the fulfilment of the Occupational Health and Safety Act 85 of 1993, as amended, Major Hazard Installation Regulations of 2022, as promulgated on 31 January 2023, by the Department of Employment and Labour. The results of this analysis are the subject of this letter.

2. CLASSIFICATION CRITERIA

Based on the Major Hazard Regulations of 2022 and the Occupational Health and Safety Act 85 of 1993, as amended, there are two criteria which need to be considered in the classification of dangerous substance installations.

2.1 CRITERIA 1:

Occupational Health and Safety Act 85 of 1993, as amended, Section 1, definition of "Major Hazard Installation", Part (a):

Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily as per:

MHI Regulations 2022:

a. Annex A, Chapter 1: Named substances and total capacity of each on site
b. Annex A, Chapter 2: Categories of substances as per the table below and total capacity of each on site

H1 Acute Toxic Category 1, all exposure routes
H2 Acute Toxic Cat 2, Cat 3
H3 Specific Target Organ Toxicity: "STOT" SE
P2 Flammable gases, Category 1 or 2
P3a Flammable' aerosols Category 1 or 2, containing flammable gases Category 1 or 2 or flammable liquids Category 1
P3b 'Flammable' aerosols Category 1 or 2, not containing flammable gases Category 1 or 2 nor flammable liquids Category 1
P4 Oxidizing gases, Category 1
P5a Flammable liquids, Category 1, 2, 3 maintained at a temperature above their boiling point
P5b Flammable liquids Category 2 or 3 where particular processing conditions, such as high pressure

or high temperature, may create major accident hazards
P5c Flammable liquids, Categories 2 or 3 not covered by P5a and P5b
P6a Self-reactive substances and mixtures, Type A or B or organic peroxides, Type A or B
P6b Self-reactive substances and mixtures, Type C, D, E or F or organic peroxides, Type C, D, E, or F
P7 Pyrophoric liquids/solids, Category 1
P8 Oxidizing Liquids and Solids
O1 Substances or mixtures that reacts violently with water
O2 Substances and mixtures which in contact with water emit flammable gases, Category 1
O3 Substances or mixtures that liberates toxic gas when in contact with water
Acute toxicity with regards to aquatic life

c. Annex A, Chapter 3: Pipeline criteria
d. Annex A: 2 % rule
e. Annex A: Aggregation rule

The maximum total combined inventories on site are taken as all bulk dangerous goods installations permanently on site, excluding road tankers performing deliveries.

2.2 CRITERIA 2:

2.2.1 Definition

Occupational Health and Safety act no. 85 of 1993, as amended, Section 1, definition of "Major Hazard Installation", Part (b):

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;

"**major incident**" means an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace.

The Department of Employment and Labour and MHI AIA industry adopted an interpretation of a major incident, i.e. a catastrophe, that declares in this context that:

" A catastrophe is a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceeds the ability of affected society to cope using only its own resources."

2.2.2 Implementation

The physical criteria are more likely to be closer to 50% fatalities, or to involve specifically vulnerable groups of persons, e.g., school children. Therefore, if a site does not qualify as a Major Hazard Installation as per Criteria 1 above, then in a sensitive area based on a consequence analysis, the site can be classified as a Low hazard - Major Hazard Installation if the effects below are exceeded in the sensitive populated area around the installation:
Thermal radiation from fires*, blast overpressure from explosions, toxic gas/vapour dose**:

- 50% lethality extends off-site and over developments that would fall within the PADHI Categories (sensitivity levels) 3 and 4 level of vulnerability. (Refer Section 10 Land-use Planning)

***Note 1**: Half the distance of the flash fire LEL extends off site and over developments that would fall within the PADHI Categories (sensitivity levels) 3 and 4 level of vulnerability.

****Note 2**: Toxic dose lethality calculated using a probit equation for a typical healthy population.

2.2.3 PADHI Category definitions in practice

Consultation zones

Inner zone (IZ - Orange): $1 * 10^{-5}$ chance of a fatality per person per year

- **Inside the Orange Inner zone**: There can be no residential developments in this area. Industrial developments should be with buildings of less than 3 storeys and less than 100 occupants.

Middle zone (MZ - Yellow): $1 * 10^{-6}$ chance of a fatality per person per year

- **Inside the Orange Inner and Yellow Middle zone**: Restrictions on vulnerable developments would apply. There can be housing in this area, but it should be low density, i.e. developments of less than 30 dwellings and a density of less than 40 dwellings per hectare. There should be no vulnerable facilities, e.g. schools, hospitals etc.

Outer zone (OZ - Green): $3 * 10^{-7}$ chance of a fatality per person per year

- **Inside the Yellow Middle and Green Outer most zone**: There can be housing but no large vulnerable developments, e.g. no stadiums, no large hospitals or shopping malls etc.

Beyond these three zones no specific restrictions are advised (i.e. risks less than 0.3 in a million).

Sensitivity levels

There are four sensitivity levels:

- Level 1 – Normal working population.
- Level 2 – General public – at home and involved in normal activities.
- Level 3 – Vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger).
- Level 4 – Large examples of Level 3 and very large outdoor examples of Level 2.

Specify developments that may be allowed or disallowed in the three consultation zones (IZ, MZ, OZ) based on the population sensitivity using the reasoning below:

Sensitivity level 1	Allowed in all zones	IZ	MZ	OZ	Local authority may not advise against
Sensitivity level 2	Allowed in zones		MZ	OZ	Local authority may not advise against
Sensitivity level 3	Allowed in zones			OZ	Local authority may not advise against
Sensitivity level 4	Not allowed in any zones	IZ,	MZ	OZ	Local authority should advise against

Where there is a new specific development intended around or near a Major Hazard Installation, then it is necessary to in detail assess and advise on allowable developments as described below.

Based on the type of development, the authorities can allow certain developments to be implemented. When applied to flammable risks, the approval guideline below can be used, as per the United Kingdom's Health and Safety Executive first published document *HSE (1989)* and a later discussion document *HSE (2001)*.

Use the Table 1.2.3-1 below and the zone determined, specify the development allowed (or to advise against) by referring to the Sensitivity Level Tables 3 and 4 further down.

Table 1.2.3-1 Development approval guideline

Population Category	Description	Zone allowed in	Sensitivity Level	Allowable developments
People at work, parking	Normal working population	IZ, MZ, OZ	1	DT1
General public	General public at home or involved in normal activities	MZ, OZ	2	DT2
Vulnerable people	Vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger)	OZ	3	DT3
Very large number of people and sensitive	Large examples of Level 3 and large outdoor examples of Level 2	Outside OZ	4	DT4

Sensitivity Level Table 3 - Development type: Developments for use by vulnerable people
DT3.1 - Institutional accommodation and education
DT3.2 - Prisons

Development type	Examples	Development detail and size	Justification
DT3.1-Institutional accommodation and education	Hospitals, convalescent homes, nursing homes. Old people's homes with warden on site or 'on call', sheltered housing. Nurseries, crèches. Schools and academies for children up to school leaving age	Institutional, educational and special accommodation for vulnerable people, or that provides a protective environment - **Level 3**	Places providing an element of care or protection. Because of age, infirmity or state of health the occupants may be especially vulnerable to injury from hazardous events. Emergency action and evacuation may be very difficult
	Exclusions		
	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	**DT3.1 x1** 24-hour care where the site on the planning application being developed is larger than 0.25 hectares - **Level 4**	Substantial increase in numbers of vulnerable people at risk

	Nurseries, crèches, schools for children up to school leaving age	**DT3.1 x2** Day care where the site on the planning application being developed is larger than 1.4 hectares - **Level 4**	Substantial increase in numbers of vulnerable people at risk
DT3.2 - Prisons	Prisons, remand centers	Secure accommodation for those sentenced by court, or awaiting trial, etc. - **Level 3**	Places providing detention. Emergency action and evacuation may be very difficult

Sensitivity Level Table 4 Development type: Very large and sensitive developments **DT4.1** - Institutional accommodation **DT4.2 -** Very large outdoor use by public			
Development type	**Examples**	**Development detail and size**	**Justification**
DT4.1 - Institutional accommodation	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where 24-hour care is provided and where the site on the planning application being developed is larger than 0.25 hectare -**Level** 4	Places providing an element of care or protection. Because of age or state of health, occupants may be especially vulnerable to injury from hazardous events. Emergency action and evacuation may be very difficult. The risk to an individual may be small but there is a larger societal concern
	Nurseries, crèches. Schools for children up to school leaving age	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where day care (not 24-hour care) is provided and where the site on the planning application being developed is larger than 1.4 hectare - **Level 4**	Places providing an element of care or protection. Because of age the occupants may be especially vulnerable to injury from hazardous events. Emergency action and evacuation may be very difficult. The risk to an individual may be small but there is a larger societal concern
DT4.2-Very large outdoor use by public	Theme parks, large sports stadia and events, open air markets, outdoor concerts, and pop festivals	Predominantly open air developments where there could be more than 1000 people present at any one time - **Level 4**	People in the open air may be more exposed to toxic fumes and thermal radiation than if they were in buildings. Large numbers make emergency action and evacuation difficult. The risk to an individual may be small but there is a larger societal concern

3. CLASSIFICATION ANALYSIS

3.1 CRITERIA 1

Table 3.1 below outlines the outcomes of the classification process in more detail:

MATERIAL NAME	CAS or UN No	MHI CATEGORY	INDIVIDUAL QUANTITIES	TOTAL INVENTORY	2% THRESHOLD	LOWER THRESHOLD	MEDIUM THRESHOLD	HIGH THRESHOLD	EXCEEDS THRESHOLD	MHI CLASSIFICATION CRITERIA 1
				tons		tons	tons	tons		
Explosives, flammables, oxidisers										
Natural Gas	1971	P2	1.5	1.5	>2%	2.5	10	50	No	Not MHI
Diesel	1202	Named	1.008	7.7	>2%	250	2500	25000	No	Not MHI
Sodium hypochlorite	7681-52-91	None	0.03	0.1	NA	NA	NA	NA	NA	NA
Sulphuric acid 98%	7664-93-9	None	0.025	0.2	NA	NA	NA	NA	NA	NA
Aggregation rule	**Flammable, oxidiser, explosive**					**0.630912**	**NA**	**NA**	**Not MHI**	**Not MHI**
Toxics										
Sodium hypochlorite	7681-52-91	None	0.5	0.5	NA	NA	NA	NA	NA	NA
Sulphuric acid 98%	7664-93-9	None			NA	NA	NA	NA	NA	NA
Aggregation rule	**Toxic**					**NA**	**NA**	**NA**	**Not MHI**	**Not MHI**

The analysis was performed based on the maximum total inventories of the materials stored on a site and does not include road tankers performing deliveries or materials between points of departure and arrival.

3.2 CRITERIA 2

The nearest sensitivity level 3 or 4 population is a school 1.34 km NW of the proposed site boundary – Figure 3.2.1 below.

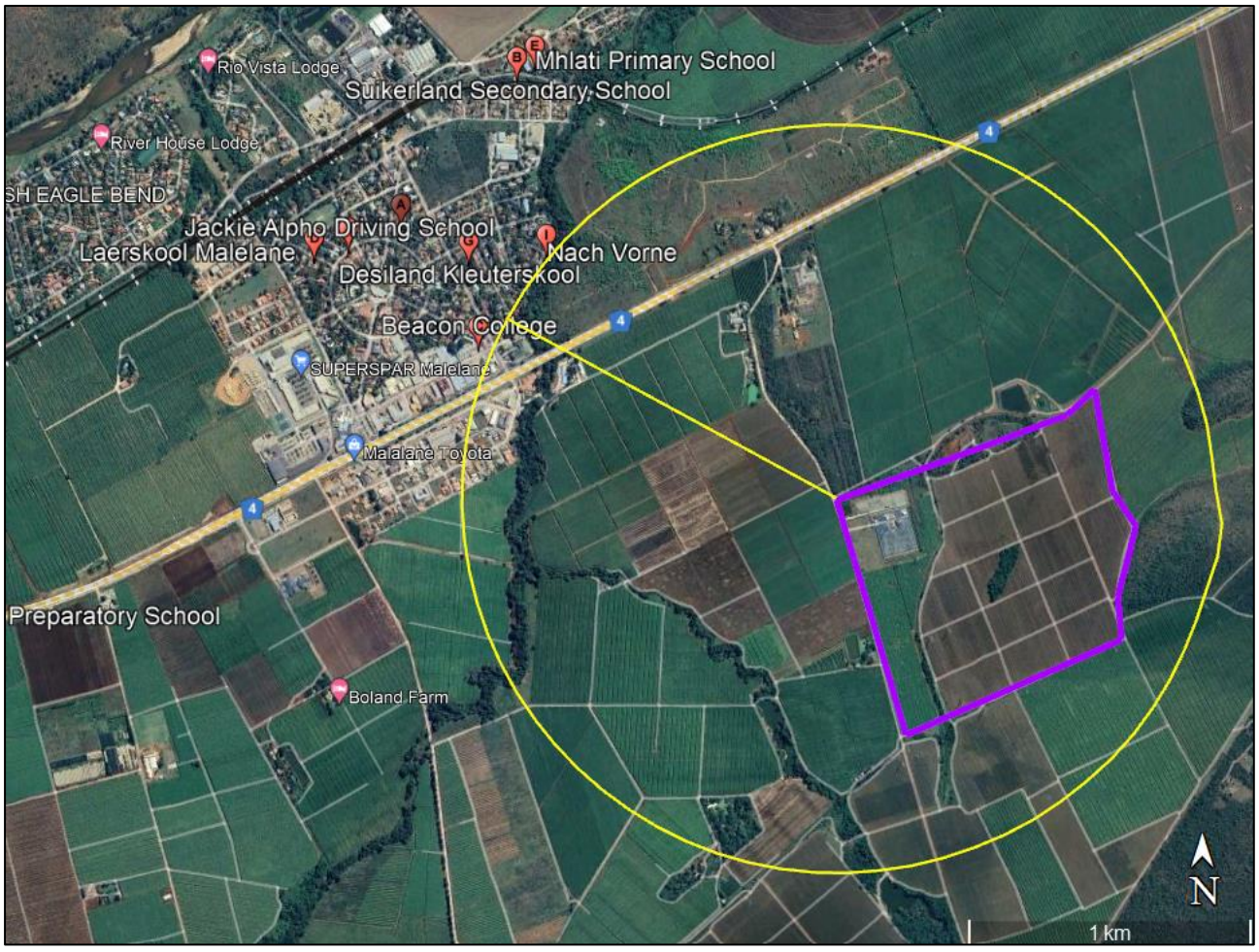

Figure 3.2.1 Map with the nearest sensitivity level 3 and 4 populations

3.2.1 FLAMMABLE GAS

Based on the analysis with DNV Phast V 9.0, the worst case would be a 35 kPa vapour cloud explosion overpressure - 50 % lethality hazardous zone which could extend up to 300 m from the source for a 1.5 tonne natural gas (taken as pure methane) release and is not expected to affect Sensitivity Levels 3 or 4 populations.

Note: Natural gas is not stored on site. The 1.5 tonne (70 m^3) estimation is based on the approximate quantity of gas in the piping on the site at any moment in time. Assumptions: compressed gas at room temperature, pipeline pressure at 30 bar, pipe diameter 300 mm on average.

4. CONCLUSIONS

Considering the classification analysis in section 3, the site does not satisfy the classification requirements for a Major Hazard Establishment**,** based on the quantities of dangerous goods stored on site and the worst-case consequences envisaged.

5. RECOMMENDATIONS

1. According to Ishecon's analysis of the criteria for MHI classification as per the Occupation Health and Safety Act 85 of 1993, as amended and the Major Hazard Installation Regulations of 2022 promulgated on 31 January 2023 by the Department of Employment and Labour, applied to the Khanyazwe Flexpower Malelane site, it is recommended that the site not be classified as a Major Hazard Establishment.

2. It is the responsibility of the duty holder – Khanyazwe Flexpower – to determine and document their decision on the MHI classification of the Malelane site and to maintain records at the site indicating the decision and the basis for the decision. It is recommended that a copy of this letter be stored, along with the ratification records by the site management, as evidence of the rationale to classify the site.

Derek Botha