# APPENDIX 9A

# RISK ASSESSMENT FOR MA TAU KOK GAS WORKS
# - BACKGROUND DATA

# Contents

# A9A BACKGROUND DATA

## A9A.1 INTRODUCTION

This appendix provides a summary of the background data used in this study. The various sources of the data are quoted and the manner in which the data was processed prior to input into the SAFETI package is described.

Two time periods have been used in this study. These are referred to as D (Day) and N (Night). This is to reflect the differences in population distributions between different times of the day.

## A9A.2 GEOGRAPHICAL DATA

This section describes the parameters used for the onsite and offsite terrain and the grid reference system used for the study.

### A9A.2.1 Terrain

The surface roughness parameter (SRP) is a measure of the root mean square (R.M.S.) fluctuating velocity as a fraction of the mean velocity 10 m above ground. Typical values for the surface roughness parameter are shown in **Table A9A.1.**

**Table A9A.1 Typical Surface Roughness Parameters**

| Surface Category | SRP |
|---|---|
| Sea surface | 0.06 |
| Flat land, few trees | 0.06 |
| Open farmland | 0.09 |
| Open countryside | 0.11 |
| Wood, rural area or industrial site | 0.17 |
| Urban area | 0.33 |

The Ma Tau Kok gas production plant is located in the North East of the Kowloon peninsula. As the surrounding area is urban area, a surface roughness parameter of 0.33 is used in this study.

### A9A.2.2 Grid Reference System

Within the SAFETI package, the option to define the study in terms of National or Plant coordinates is provided. In the interest of flexibility, national coordinates have been used throughout this study. The location of the map origin, to which all coordinates have been referenced, is chosen as 37787 East and 20088 North.

## A9A.3 METEOROLOGY

### A9A.3.1 Data Requirements

Meteorological data are required at two stages of the risk assessment. First, various parts of the consequence modelling require specification of wind speed and atmospheric stability. Second, the impact (risk) calculations require wind-rose frequencies for each combination of wind speed and stability class used.

For the dispersion modelling, representative combinations of wind speed and stability class are chosen. These combinations must reflect the full range of observed variations in these quantities; at the same time it is neither necessary nor computationally efficient to consider every combination observed. The procedure used is, therefore, to group the observed combinations of wind speed and stability into representative weather classes which together cover all conditions observed. The classes chosen must be sufficiently different to reflect variations in dispersion for different weather conditions. In particular, the conditions most likely to give rise to large effect distances (and hence the possibility of significant offsite risk) must not be grouped with those leading to shorter effect distances. The wind speeds in these classes are also used by the jet fire and pool fire consequence models.

Once the weather classes have been chosen, frequencies for each wind direction associated with each of the selected weather classes are calculated by summing the frequencies in the appropriate speed-stability classes.

### A9A.3.2 Data Sources

The current study has used the same meteorological data as used by the previous study (DNV, 1996) based on the Hong Kong Airport weather data.

**Table A9A.2** shows the processed wind / weather data for the site in the defined weather categories distributed between 16 directions. Each category is represented by the Stability Class followed by the characteristic wind speed in metres per second. In this case the characteristic wind speed was calculated for each weather category as the weighted average of the category members. This data was used in the SAFETI modelling.

**Table A9A.2 Meteorological Data**

| Direction | Meteorological Category | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 3.0B | 1.0D | 4.0D | 7.0D | 3.0E | 1.0F | |
| 349-011 | 0.120 | 0.150 | 0.390 | 0.560 | 0.330 | 0.140 | 1.69 |
| 012-033 | 0.150 | 0.230 | 0.690 | 0.320 | 0.630 | 0.310 | 2.33 |
| 034-056 | 0.300 | 0.380 | 1.540 | 0.430 | 0.800 | 0.570 | 4.02 |
| 057-078 | 0.750 | 0.660 | 2.930 | 3.450 | 1.260 | 0.920 | 9.97 |
| 079-101 | 1.360 | 1.180 | 7.860 | 10.860 | 3.400 | 2.300 | 26.96 |
| 102-123 | 1.230 | 1.680 | 4.970 | 2.840 | 1.740 | 2.740 | 15.2 |
| 124-146 | 2.140 | 1.590 | 3.690 | 1.920 | 0.880 | 2.010 | 12.23 |
| 147-168 | 0.420 | 0.470 | 0.620 | 0.190 | 0.150 | 0.490 | 2.34 |
| 169-191 | 0.220 | 0.300 | 0.310 | 0.150 | 0.150 | 0.430 | 1.56 |
| 192-213 | 0.330 | 0.360 | 0.800 | 0.390 | 0.330 | 0.430 | 2.64 |
| 214-236 | 0.850 | 0.560 | 1.210 | 0.650 | 0.470 | 0.600 | 4.34 |
| 237-258 | 1.190 | 0.720 | 1.340 | 1.190 | 0.640 | 0.860 | 5.94 |
| 259-281 | 0.400 | 0.400 | 0.760 | 0.500 | 0.330 | 0.470 | 2.86 |
| 282-303 | 0.150 | 0.410 | 0.610 | 0.280 | 0.320 | 0.370 | 2.14 |
| 304-326 | 0.140 | 0.390 | 1.170 | 0.480 | 0.430 | 0.380 | 2.99 |
| 327-348 | 0.150 | 0.240 | 0.970 | 0.830 | 0.360 | 0.240 | 2.79 |
| TOTAL | 10.9 | 13.72 | 36.86 | 25.04 | 13.22 | 13.26 | 100 |

For other key meteorological parameters, annual averages are used. The data used were:

- Ambient Temperature: 25°C, 298K
- Relative Humidity: 75%
- Ground Temperature: 20°C, 293K

## A9A.4 POPULATION

The population data considered only offsite populations for the 2 time periods day (D) and night (N). Maps showing all the population locations defined in this study are shown in **Figure A9A.1**.

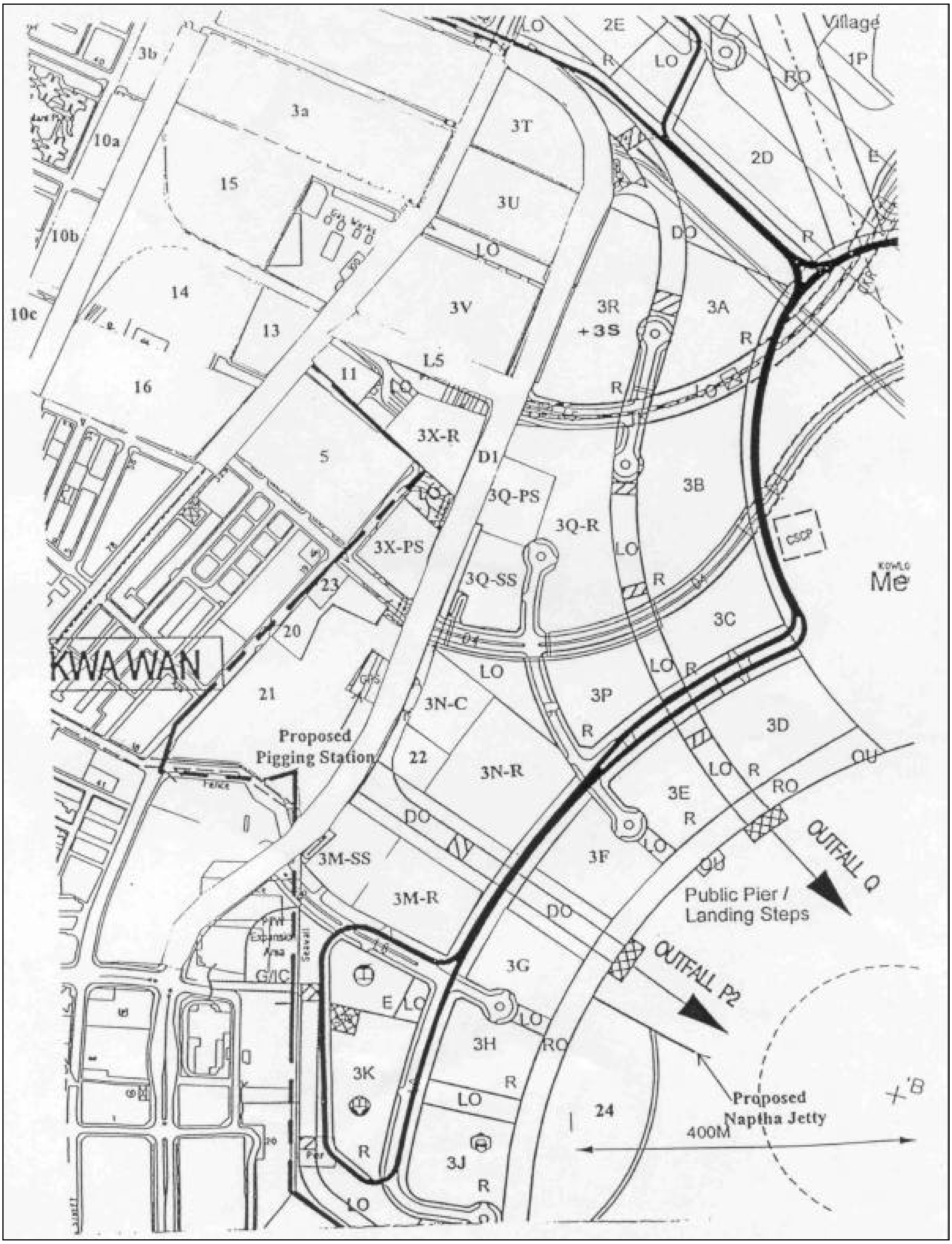
### A9A.4.1 Existing Offsite Population around the MTK Gas Works

The offsite population considered in this study for the Ma Tau Kok gas production plant is listed in **Table A9A.1**. The existing population data has been taken from the previous study (DNV, 2000) and the data for the proposed South East Development has been provided by Environmental Management Limited.

**Table A9A.1 Existing Offsite Population of Ma Tau Kok Gas Production Plant**

| Location's Description | Predominant Land Use | Total Population | | Population Density | |
|---|---|---|---|---|---|
| | | Day | Night | Day | Night |
| 3a | Residential | 1890 | 10440 | 0.07 | 0.36 |
| 3b | Residential | 170 | 990 | 0.05 | 0.29 |
| 5 | Residential | 1620 | 11350 | 0.08 | 0.54 |
| 10a | Residential | 780 | 1590 | 0.16 | 0.33 |
| 10b | Residential | 790 | 1550 | 0.18 | 0.35 |
| 10c | Residential | 630 | 820 | 0.15 | 0.20 |
| 11 | Substation | 5 | 1 | 0.002 | 0.0004 |
| 13 | Industrial | 3030 | 0 | 0.55 | 0 |
| 14 | Recreation Ground | 100 | 0 | 0.01 | 0 |
| 15 | Cattle Depot | 50 | 0 | 0.003 | 0 |
| 16 | Industrial | 4100 | 0 | 0.19 | 0 |
| 18 | Industrial | 4780 | 160 | 0.16 | 0.01 |
| 3T | Commercial | 7318 | 732 | 0.67 | 0.067 |
| 3U | Residential | 916 | 3663 | 0.07 | 0.29 |
| 3V | Residential | 2443 | 5056 | 0.12 | 0.25 |
| 3X-R | School | 1019 | 10 | 0.13 | 0.001 |
| 3Q-R | Residential | 2027 | 3656 | 0.10 | 0.18 |
| 3Q-PS | School | 1423 | 10 | 0.23 | 0.002 |
| 3Q-SS | School | 1019 | 10 | 0.15 | 0.001 |
| 3X-PS | School | 1423 | 10 | 0.23 | 0.002 |
| 20 | Schools | 2038 | 20 | 0.5 | 0.005 |
| 21 | Park | 200 | 20 | 0.007 | 0.0007 |
| 3N-R | Residential | 1860 | 3368 | 0.11 | 0.20 |
| 3N-C | Community Facilities | 481 | 48 | 0.07 | 0.007 |
| 22 | Pump Station | 5 | 1 | 0.002 | 0.0003 |
| 3M-SS | School | 1019 | 10 | 0.14 | 0.001 |
| 3M-R | Residential | 1204 | 2195 | 0.10 | 0.19 |
| 3F | Residential | 783 | 1497 | 0.08 | 0.15 |
| 3G | Residential | 588 | 1125 | 0.06 | 0.12 |
| 23 | Substation | 5 | 1 | 0.004 | 0.0009 |
| Road "D1" | Traffic | 282 | 28 | 0.006 | 0.0006 |
| Road "L5" | Traffic | 282 | 28 | 0.006 | 0.0006 |
| To Kwa Wan Road | Traffic | 338 | 33 | 0.02 | 0.002 |
| Ma Tau Kok Road | Traffic | 97 | 10 | 0.02 | 0.002 |
| San Shan Road | Traffic | 191 | 19 | 0.02 | 0.002 |
| Kowloon City Road | Traffic | 294 | 29 | 0.02 | 0.002 |
| 24 | Marina | 50 | 5 | 0.002 | 0.0002 |

**Figure A9A.1 Population around the MTK Gas Works within Study Area**



## A9A.5 IGNITION SOURCES

### A9A.5.1 Data Required

In order to calculate the risk from flammable materials, information is required on the ignition sources which are present in the area over which a flammable cloud may drift. For each ignition source considered the following factors need to be specified:

- Presence Factor

  This is the probability that an ignition source is active at a particular location. For example, the fire fighting training ground is only in use for 1 hour per week (during normal working hours) which equates to a presence factor of 0.025.

- Ignition Factor

  This defines the "strength" of an ignition source. It is derived from the probability that a source will ignite a cloud if the cloud is present over the source for a particular length of time.

- Location

  The location of each ignition source must be specified on the grid system used. This allows the position of the source relative to the location of each release to be calculated. The results of the dispersion calculations for each flammable release are then used to determine the size and mass of the cloud when it reaches the source of ignition.

If these three factors are known for each source of ignition considered, then the probability of a flammable cloud being ignited as it moves downwind over the sources can be calculated.

The data is entered into SAFETI data-files for each source rather than by grid squares (as are used for population data). The risk calculation program (MPACT) calculates equivalent combined ignition factors and presence factors for all sources in each square.

Ignition sources in the SAFETI package may be of 3 types:

- Point sources: Known specific sources such as flares, workshops, etc.
- Line sources: Roads, railways, electrical transmission lines.
- Area sources: Population, industrial sites where location of individual sources is unknown.

### A9A.5.2 Identification of Sources

The ignition sources inputs in SAFETI are consistent with previous studies (Technica, 1991). The most significant ignition sources are:

- On-site:
  - Naphtha vaporisers.
  - Heaters.
  - Boilers
- Off-site:
  - Road vehicle.
  - Surrounding population.