



# Quantitative Risk Assessment of Ma Tau Kok Gas Production Plant for the Proposed Development at 33 Sheung Heung Road Quantitative Risk Assessment Study

PREPARED FOR



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The Hong Kong and China Gas Company Limited



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# Quantitative Risk Assessment of Ma Tau Kok Gas Production Plant for the Proposed Development at 33 Sheung Heung Road

Quantitative Risk Assessment Study  
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## INTRODUCTION

### 1.1 BACKGROUND

Ma Tau Kok Gas Production Plant (MTK Plant) is classified as a Potentially Hazardous Installations (PHIs) in accordance with Chapter 12 of Hong Kong Planning Standards and Guidelines (HKPSG). Accordingly, a consultation zone (CZ) of Ma Tau Kok Gas Works in accordance with PHI Register is delineated for the purpose of land-use planning and control.

Any new development within the CZ of any PHI, which may lead to an increase in population, is required to conduct a Quantitative Risk Assessment (QRA) to demonstrate that the risk levels associated with the existing MTK Plant is still in compliance with Hong Kong Risk Guidelines (HKRG) as stipulated in Chapter 12 of Hong Kong Planning Standards and Guidelines (HKPSG).

The Project Proponent intends to develop a proposed development within the CZ of the MTK Plant, which is operated by Hong Kong and China Gas Company Limited (HKCG).

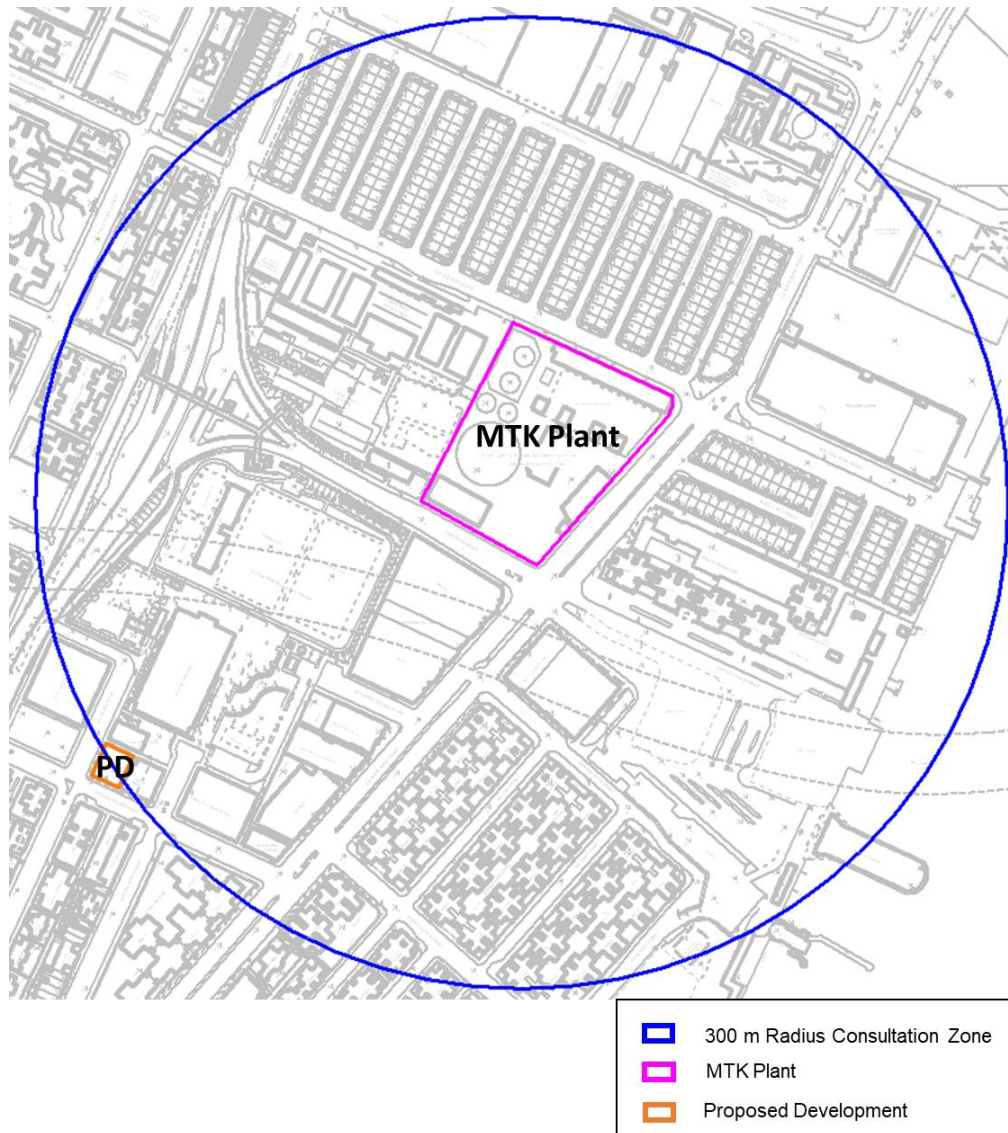
P-Tech, as a fully subsidiary of Hong Kong and China Gas Company, on behalf of the Project Proponent, has commissioned Environmental Resources Management, an independent health, environment, safety (HES) consultant, to conduct the QRA Study to evaluate the risk levels associated with the existing MTK Plant with consideration of an additional population introduced from the proposed development, and assess if the associated risks are still in compliance with HKRG in terms of individual risk and societal risk.

## 2. DESCRIPTION OF THE PROPOSED DEVELOPMENT AND SURROUNDING

### 2.1 PROPOSED DEVELOPMENT

The proposed development will be on 33 Sheung Heung Road. The location is depicted in **Figure 2.1**.

FIGURE 2.1 LOCATION OF MTK PLANT, PROPOSED DEVELOPMENT AND PROPOSED STUDY ZONE



The finalised population estimated for the operation phase as well as the population distribution breakdown for the proposed development are given by PP and are summarised at **Table 2.1**.

The indoor fraction for the proposed development was assumed as 90% at day time and 95% at night time respectively for this QRA Study.



**TABLE 2.1 MANNING DISTRIBUTION BREAKDOWN OF BUILDING POPULATION ASSOCIATED WITH PROPOSED DEVELOPMENT DURING OPERATION PHASE**

Site No.	Population Category	Time Category	Time Period	Population
PD	Residential	Day time	0600 to 1800	48
		Night time 1	1800 to 0000	192
		Night time 2	0000 to 0600	192
PD	Commercial/ Non-domestic	Day time	0600 to 1800	140
		Night time 1	1800 to 0000	140
		Night time 2	0000 to 0600	3

## 2.2 MA TAU KOK PRODUCTION PLANT

The location of MTK Plant is also depicted in **Figure 2.1**.

## 2.3 POPULATION CONSIDERED IN THIS QRA STUDY

The off-site surrounding population in the vicinity of the MTK Plant and within its CZ consists of pedestrian, building and traffic population. A consultation zone of Ma Tau Kok Gas Works in accordance with PHI Register, depicted at **Figure 2.1**, is delineated as 300 m radius from the mid-point between two (2) gasholders of the North Works for the purpose of land-use planning and control. The summary of the population change from Base Case, to Construction Phase and Operation Phase, as well as the time period of maximum building population have been summarised in **Table 2.2** with 2% pedestrian growth compared with the overall population.

**TABLE 2.2 ESTIMATED BUILDING POPULATION FOR THE PROPOSED DEVELOPMENT DURING BASE CASE, CONSTRUCTION PHASE AND OPERATION PHASE**

Site Item	Base Case	Operation Phase	Time Period
PD	82	188	Day time (0600 – 1800)
	188	332	Night time 1 (1800 – 0000)
	188	195	Night time 2 (0000 – 0600)

## 3. QUANTITATIVE RISK ASSESSMENT RESULTS AND DISCUSSION

### 3.1 HONG KONG RISK GUIDELINES

The Hong Kong Planning Standards and Guidelines (HKPSG), Chapter 12 requires that Potentially Hazardous Installations (PHIs) comply with Hong Kong Risk Guidelines (HKRG). Two (2) types of risk measures to be considered in this QRA Study are individual risk and societal risk.

- Individual risk criterion specifies that the risk of fatality on an off-site individual should not exceed  $10^{-5}$  per year.
- The societal risk associated with a PHI should comply the F-N diagram (Figure 3 in HKPSG, Chapter 12).

### 3.2 STUDY FINDINGS

The QRA study findings from MTK Plant are presented in the categories as follow:

- Base Case;
- Operation Phase

#### 3.2.1 INDIVIDUAL RISK

In order to consider the time exposure factor to all off-site public population, an exposure factor of 30% was taken into consideration and the derivation for exposure factor are summarised as follows:

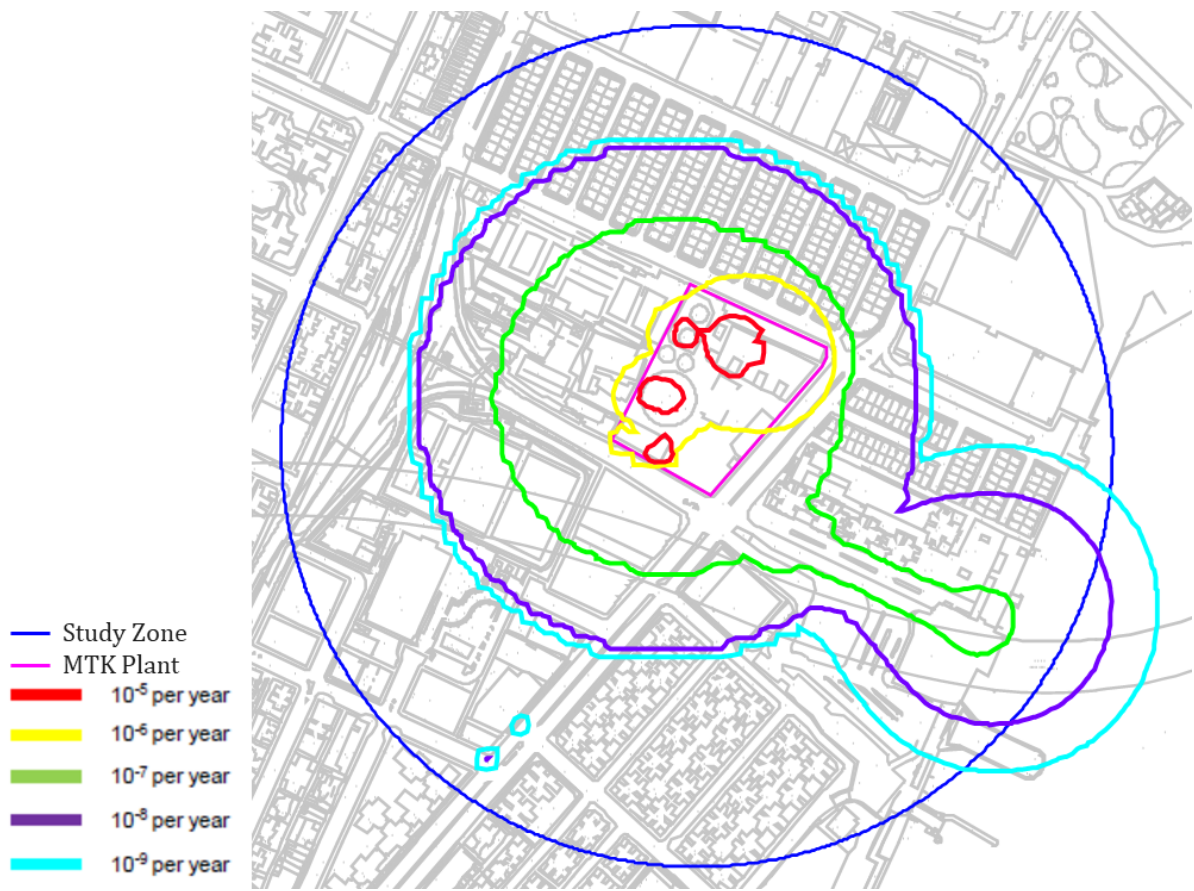
- Forty four working hours per worker for each working personnel at the surrounding occupied buildings, assumed eight working hours per day for 5.5 days per week
- Vehicles take about 130 seconds to move through the adjacent public roads of the MTK Plant
- Pedestrians take about 1,800 seconds to move through the adjacent public roads of the MTK Plant

Therefore, 30% exposure factor was conservatively applied for the surrounding population of the MTK Plant in this QRA Study.

The individual risk contours from  $1E-05$  per year are depicted at **Figure 3.1** for MTK Plant. The individual risk contour of  $1E-05$  per year with consideration of exposure factor of 30% is marginally confined within the MTK Plant. It could be concluded that the individual risk of the MTK Plant is still in compliance with Hong Kong Risk Guidelines.



FIGURE 3.1 INDIVIDUAL RISK CONTOURS FOR MA TAU KOK GAS PRODUCTION PLANT

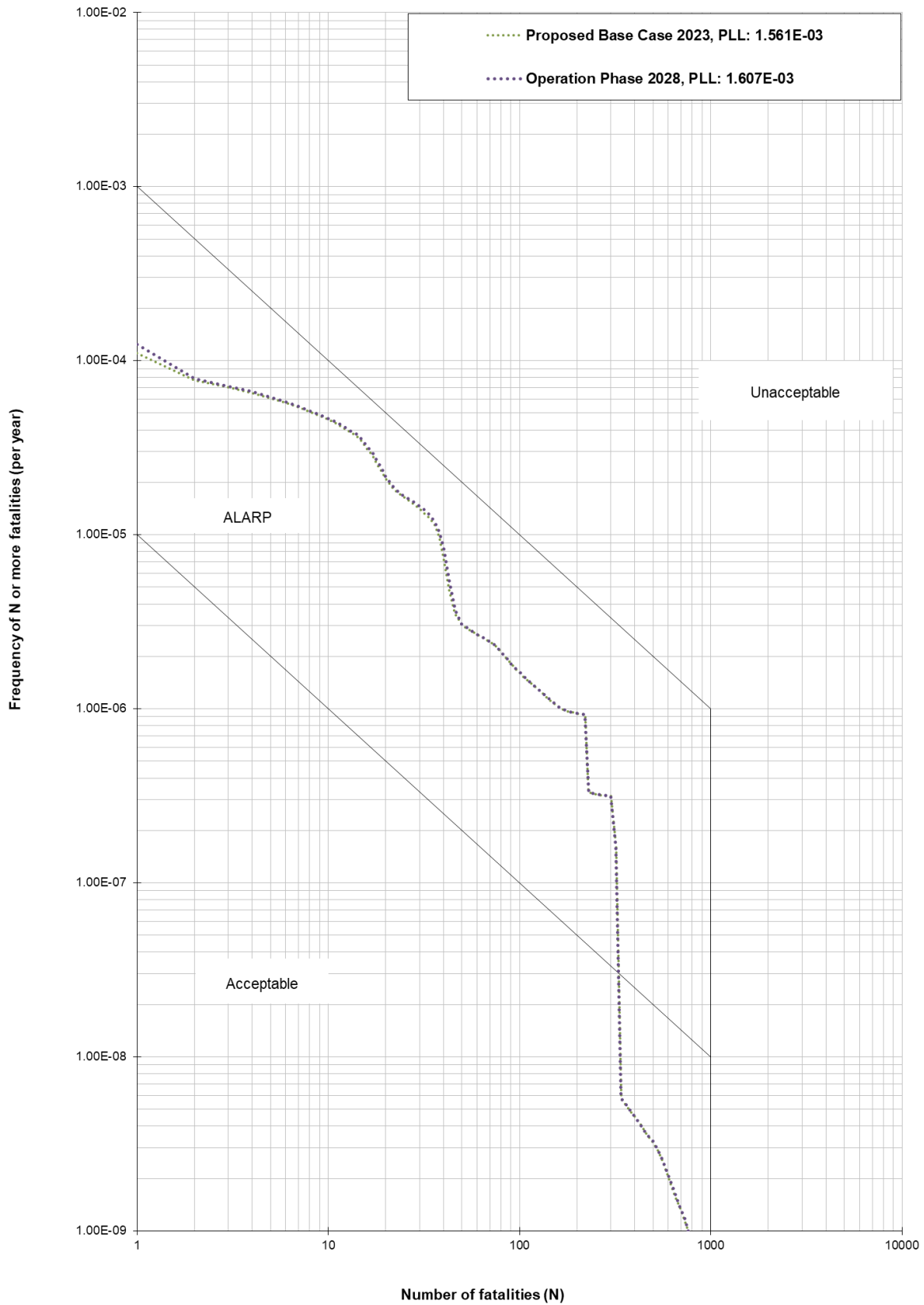


### 3.2.2 SOCIETAL RISK

The F-N curves of Operational Phase are depicted at **Figure 3.2**, and all are within "ALARP" region.

Societal risk can be also presented in the form of total rate of harm which is expressed in potential loss of life (PLL) values. The identified PLL values for Base Case and Operation Case were 1.561E-03 and 1.607E-03 respectively, the difference in terms of PLL between Base Case and Operation Phase of the proposed commercial development is about 3%.

FIGURE 3.2 F-N CURVES FOR BASE CASE AND OPERATION CASE (2028)



## 4. CONCLUSION AND RECOMMENDATION

A QRA Study has been conducted to evaluate the risk levels associated with the existing Ma Tau Kok Gas Production Plant with consideration of the surrounding population including the proposed development during Base Case (2023) and Operation Phase (2028), assess if the associated risks are still in compliance with Hong Kong Risk Guidelines in terms of individual risk and societal risk

The key findings are summarised as follow:

### **Individual Risk**

The individual risk contour of  $10^{-5}$  per year with consideration of exposure factor of 30% is marginally confined within the site boundary of the MTK Plant.

### **Societal Risk**

The societal risk, in terms of F-N curves, for Base Case (2023) and Operation Phase (2028) of the proposed commercial development are within "ALARP" region, while the difference in terms of PLL between Base Case and Operation Phase of the proposed commercial development is about 3%.

### **Conclusion**

Based on the above study findings, it could be concluded that the risks associated with the MTK Plant with the consideration of the surrounding population including the proposed development during Operation Phases are in compliance with Hong Kong Risk Guidelines in terms of individual risk and societal risk.



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