

APPENDIX 9


JUSTIFICATION REVIEW OF QUANTITATIVE RISK ASSESSMENT
REVIOUSLY SUBMITTED FOR THE SECOND PLANNING APPLICATION (A/YL/289)

Project:	SECTION 16 PLANNING APPLICATION FOR PROPOSED CONSERVATION OF HISTORIC BUILDING AND MINOR RELAXATION OF BUILDING HEIGHT RESTRICTION FOR PERMITTED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) AT LOT NOS.1695 S.E SS. 1 RP, 1695 S.F SS.1, 1695 S.H RP (PART) AND ADJOINING GOVERNMENT LAND IN D.D. 120, TAI KEI LENG, YUEN LONG, NEW TERRITORIES JUSTIFICATION REVIEW OF QUANTITATIVE RISK ASSESSMENT FOR CALTEX PETROL FILLING STATION
-----------------	--

Report No.:	RT21220-QRA-01
--------------------	----------------

Revision	Issue Date	Description	Author	Checker	Approver
0	08/12/21	Issued for Comment	BW	YS	HM

Prepared by:



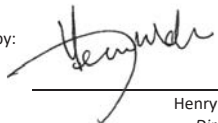
 Ben Wong
 Consultant

Checked by:



 Sui Hang Yan
 Technical Director

Approved by:



 Henry Mak
 Director

Disclaimer:

- This report is prepared and submitted by BeeXergy Consulting Limited with all reasonable skill to the best of our knowledge, incorporating our Terms and Conditions and taking account of the resources devoted to it by agreement with the client.
- We disclaim any responsibility to the client and others in respect of any matters outside the project scope.
- This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

Table of Contents

1. Introduction 4

2. Justification of Surrounding Population and Meteorological Data 4

2.1 Pedestrian Population 4

2.2 Road Traffic Population 4

2.3 Land and Building Population 5

2.4 Meteorological Data 6

3. Justification of Hazard Identification 6

4. Justification of Frequency Analysis 7

4.1 Overview 7

4.2 Road Tanker Unloading / Vehicle Refueling Operation 7

5. No Significant Adverse Consequence 8

6. No Insurmountable Risk 8

6.1 Risk Criteria 8

6.2 Review of Risk Assessment Results 8

7. Conclusions 9

8. References 10

Abbreviation

AADT	Annual Average Daily Traffic
ATC 2020	Annual Traffic Census 2020
ETA	Event tree analysis
GIS	Geographic Information System
HAD	Home Affairs Department
HKPSG	Hong Kong Planning Standards and Guidelines
PFS	Petrol Filling Station
QRA	Quantitative Risk Assessment
VCE	Vapour Cloud Explosion

1. Introduction

A social welfare facility for residential care home for the elderly (RCHE) has been proposed at Lot Nos.1695 S.E ss. 1 RP, 1695 S.F SS.1 and 1695 S.H RP (Part) in D.D. 120, Tai Kei Leng, Yuen Long, New Territories (the proposed Site), which is located at Tai Tong Road, Yuen Long and is adjacent to the Caltex Petrol Filling Station (here referred as 'Caltex PFS').

With reference to the Hong Kong Planning Standards and Guidelines^[1] (HKPSG) *Chapter 12 Section 3.7.1*, the development of Petrol Filling Station (PFS) without LPG filling facilities is governed under the Dangerous Goods Ordinance, Cap. 295, as well as other relevant ordinances

A Quantitative Risk Assessment Report conducted by Cundall Hong Kong Limited was previously submitted and approved by the EPD and Town Planning Board (hereafter called as approved QRA). Since the applicant would apply for a minor relaxation of height restriction and thus the commencement of construction period would be rescheduled from 2021 to 2022 and the operation period would be changed from 2023 to 2025. A justification review is conducted to evaluate if any changes in the key assessment parameters and thus the major risk levels associated with Caltex PFS compared with the approved QRA Study.

2. Justification of Surrounding Population and Meteorological Data

2.1 Pedestrian Population

Based on the approved QRA for the same site, pedestrian flow was assessed by site survey in March 2019 and it is anticipated that pedestrian population will be reduced due to the pandemic situation during 2021. As such the result of the pedestrian population in the approved QRA will be adopted and shall be considered as a conservative approach. As such, no update will be made on the pedestrian population.

2.2 Road Traffic Population

The traffic population was estimated using the average vehicle occupancy from Core Station 5016 "San Tin Highway Castle Peak Rd & San Tam Rd (from Kam Tin Rd to Fairview Park Boulevard)" of ATC 2020^[3]. Based on the approved QRA, the AADT in 2020 was 81,870 which is less than the data in 2017 with 90,650. There is a 9.6% decrease in the traffic population.

In comparison to the latest 5-year annual traffic census (from 2013 to 2017) mentioned in the approved QRA, the latest 5-year annual traffic censuses (from 2016 to 2020) for the public traffic roads (Shap Pat Heung Road Station No.: 5711) within the proposed study zone was:

Table 1 Average Annual Growth Rate from 2013 to 2017 of Shap Pat Heung Road Station No.:5711

Year	2013	2017
AADT	17540	21810
Avg. Annual Growth Rate	5.6%	

Table 2 Average Annual Growth Rate from 2016 to 2020 of Shap Pat Heung Road Station No.:5711

Year	2016	2020
AADT	21960	26860
Avg. Annual Growth Rate	5.2%	

Based on the approved QRA, the estimated average annual growth rate from 2013 to 2017 was 5.6% (**Table 1**) while the average annual growth rate from 2016 to 2020 was 5.2% (**Table 2**). The decrease of growth rate from 2016 to 2020 will be adopted in the estimation of the traffic population within the proposed study zone in construction phase in and operation phase. Due to the slight decrease in the average annual growth rate, there will be no significant change in the risk assessment.

2.3 Land and Building Population

The population updated within the proposed study zone on the following data:

- Projections of Population Distribution 2021 — 2029

According to latest Projections of Population Distribution 2021 — 2029 issued by Planning Department ^[4], the population of tertiary planning unit 524 is summarised in **Table 3**.

According to the latest Project of Population Distribution 2021 — 2029 ^[20], the projected population up to year 2020 is available.

Table 3 Population Growth Factor for Residential of Tertiary Planning Unit 524

Year	2019	2020	2021	2022	2023	2024	2025
Population	77,300	76,300	76,000	76,200	77,000	78,400	78,300

According to the approved QRA, the used population is 83,007 in 2023, which was projected linearly from data of 2014 – 2020. By using the updated population of 78,300 in 2025 would not violate the simulation result.

2.4 Meteorological Data

In comparison to the latest 5-year Weather Observation (from 2010 to 2014) mentioned in the approved QRA, the latest 5-year Weather Observation (from 2016 to 2020) of the Wetland Park Weather Station is used for Justification and provided in **Table 4** and **Table 5** respectively.

Table 4 Weather Observation by Year from 2010-2014 (Hong Kong Observatory)

Year	2010	2011	2012	2013	2014
Prevailing Wind Direction (degrees)	160	60	60	60	160
Mean Wind Speed (km/h)	7.1	6.9	6.9	6.8	6.2

Table 5 Weather Observation by Year from 2016-2020 (Hong Kong Observatory)

Year	2010	2011	2012	2013	2014
Prevailing Wind Direction (degrees)	60	60	60	60	60
Mean Wind Speed (km/h)	6	5.8	6	5.8	5.5

Weather observation data in 2016-2020 showed a lower average wind speed (5.82km/h) comparing to data in 2010-2014 (6.78km/h) with similar wind direction. Wind speed, wind stability and direction data taken and adopted for the approved QRA report still valid. Therefore, no adverse meteorological factors were identified due to the updated weather data.

3. Justification of Hazard Identification

Hazard of PFS is not further identified in this Justification as the CALTEX PFS has no new installation or change of equipment. No significant Hazard causing the increase of risk is found in this report.

4. Justification of Frequency Analysis

4.1 Overview

In frequency analysis, the probability of an accidental petrol release was assessed depending on the likelihood of containment failure. Base failure frequencies and Ignition and Explosion Probability were remaining constant, which were retrieved from historical data from other QRA studies, as such the only adjustment of the road traffic accident statistics was reviewed.

4.2 Road Tanker Unloading / Vehicle Refueling Operation

Road traffic accident statistics (Table 4) from the Transport Department showed that 84% of all road accidents in Hong Kong was under slight collision, 15% (take 20% in the aforementioned calculation) was under serious collision and less than 1% was under fatal collision. Referring to the approved QRA report, there was only minimal change in percentage and the amount of traffic accident per year. The proposed change of traffic accident data used in the simulation is in humble scale and is recessive and acceptable. Detailed road traffic accidents by severity are provided in Table 6.

Table 6 Road Traffic Accidents by Severity (2000-2020) ^[5]

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Fatal	162	167	162	173	160	139	135	153	143
Serious	2,838	3,165	3,118	2,674	2,519	2,504	2,315	2,376	2,096
Slight	11,949	12,299	12,296	11,589	12,347	12,419	12,399	12,786	12,337
Total	14,949	15,631	15,576	14,436	15,026	15,062	14,849	15,315	14,576

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fatal	126	114	128	116	128	99	117	129	104
Serious	1,943	2,052	2,190	2,385	2,476	2,508	2,510	2,379	2,070
Slight	12,247	12,777	13,223	13,393	13,485	13,183	13,543	13,591	13,551
Total	14,316	14,943	15,541	15,894	16,089	15,790	16,170	16,099	15,725

Year	2018	2019	2020	Total
Fatal	107	107	96	2,765
Serious	1,682	1,831	1,912	49,543
Slight	14,146	14,164	13,290	271,014
Total	15,935	16,102	15,298	323,322

5. No Significant Adverse Consequence

Based on a constant physical effect model and consequence end-point criteria, the hazardous release and effects zones on the surrounding population were predicted to remain unchanged. There is no further adverse impact of the hazardous outcomes on the surrounding population.

6. No Insurmountable Risk

6.1 Risk Criteria

The off-site risk levels of hazardous installations were still in line with Hong Kong Risk Guidelines stipulated in Chapter 12 of the HKPSG by the Planning Department to determine the acceptability ^[1].

Individual Risk

The maximum level of off-site Individual Risk associated with the hazardous installations in Hong Kong should not exceed 1 in 100,000 years, i.e. 10^{-5} per year.

Societal Risk

The societal risk guideline is expressed in terms of lines plotting the frequency (F) of N or more fatalities in the estimated off-site population from hazardous scenarios at the facility of concern.

6.2 Review of Risk Assessment Results

The individual risk contour (10^{-5} per year with consideration of exposure factor 10%) remains unchanged as the site boundary of Caltex PFS does not change compared with the approved QRA studies; thus, the individual risks of Caltex PFS are in compliance with the Hong Kong Risk Guidelines.

The societal risks of Caltex PFS during Construction and Operation Phases of the Development in 2025 was considered with the updated traffic and population data. It is evaluated that Caltex PFS for Construction Phase (2021) and Operation Phase (2025) should reside in the "Acceptable" region.

The risk review was conducted and the outcome results in terms of individual risk, and societal risk should be found no significant conflict with the approved QRA due to the insignificant changes in the assessment parameters.

7. Conclusions

This Justification review has been conducted to review if risks associated with Caltex PFS are in compliance with Hong Kong Risk Guidelines in 2025 after an introduction of an additional population from the Proposed Development in vicinity of Caltex PFS during Construction and Operation Phases. Most likely the updated data in this review include the Projection of Population, AADT, Road Traffic Accidents would not bring significant adverse risk in 2025.

Individual Risk

The individual risk contour according to the approved report ^[2] of 10^{-5} per year with consideration of exposure factor of 10% was unchanged and confined within the unchanged site boundary of Caltex PFS. Therefore, the individual risks of Caltex PFS are still in compliance with the Hong Kong Risk Guidelines.

Societal Risk

Comparing the data for 2025 and that for 2023, the two set of data was with high resemblance that the result had proven to be effective. Therefore, it could be concluded that the additional information in the review would not incur significant impact to the simulation result on the exiting risk. The societal risks associated with Caltex PFS during both Construction and Operation Phases are in compliance with Hong Kong Risk Guidelines in terms of societal risk.

Conclusions

The qualitative review for QRA was conducted regarding to the operation stage in 2025, as such the risks are in compliance with Hong Kong Risk Guidelines in terms of the individual risk and societal risk, and no particular mitigation measures are required to manage the risks. This justification review supported that the QRA report is still acceptable and valid for the operation phase of PFS by 2025.

8. References

[1] Planning Department, The Government of the Hong Kong Special Administrative Region of the People's Republic of China, Hong Kong Planning Standards & Guidelines Chapter 12, Section 4.4, Hong Kong Risk Guidelines for Potential Hazardous Installations.

[2] Proposed Heritage Conversation of Siu Lo Cum Elderly Care Home Development at Lot DD123, Tai Tong Road, Yuen Long, Cundall, 2019

[3] Transport Department, The Annual Traffic Census 2020, September 2021

[4] Planning Department, Projections of Population Distribution 2021-2029, https://www.pland.gov.hk/pland_en/info_serv/statistic/wgpd21.html

[5] Transport Department, Road Traffic Accident Statistics, 2000-2020, https://www.td.gov.hk/en/road_safety/road_traffic_accident_statistics/index.html