EIA/003.2/95

FINAL REPORT

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

Environmental Protection Department

Centralised Incineration Facility for Special Wastes: *Volume 2* *Environmental Impact Assessment*

February 1995

ERM Hong Kong
5, 10 & 11/F Hecny Tower
9 Chatham Road, Tsimshatsui
Kowloon, Hong Kong
Telephone (852) 722 9700
Facsimile (852) 723 5660

ERM

EIA-055.1/BC

EIA/003.2/95

FINAL REPORT

Environmental Protection Department

Centralised Incineration Facility for Special Wastes: *Volume 2* *Environmental Impact Assessment*

February 1995

Reference C1127b

For and on behalf of ERM Hong Kong

Approved by: [signature]

Position: Technical Director

Date: 15 February 1995

This report has been prepared by ERM Hong Kong, the trading name of ERL (Asia) Limited, with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business 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 scope of the above.

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.

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 PURPOSE OF THE EIA

This Environmental Impact Assessment (EIA) of the proposed Centralised Incineration Facility for Special Wastes (CIF) in Tuen Mun Area 38 has been produced by Environmental Resources Management (ERM) Hong Kong. The Project has been commissioned by the Waste Facilities Planning Group (WFPG) of the Environmental Protection Department (EPD) as part of the ongoing development of a modern incineration facility for special wastes in Hong Kong.

The special wastes will consist of:

- clinical wastes;
- animal carcases collected by USD, RSD, AFD and private bodies; and
- security wastes requiring witnessed destruction by police, customs and excise and other Government departments.

The CIF will improve the current clinical waste disposal practices of either substandard incineration in existing hospital incinerators in urban areas, or landfilling, neither of which is considered acceptable to the Hong Kong Government. It will also provide a facility for the disposal of animal carcases and secure wastes which are currently burnt in other units scheduled for closure due to their lack of gas cleaning equipment.

The CIF EIA is Stage B of Phase II of this process, the overall programme is as follows:

- Phase I – Feasibility Study of the technical and environmental suitability of a CIF at Tuen Mun;
- Phase II – Stage A, Clinical Wastes Arising Survey;
- Phase II – Stage B, Environmental Impact Assessment:
- Phase II – Stage C, Prequalification, Tender Preparation, Tender Evaluation and Contract Award.

The EIA has been commissioned to review the findings of two previous studies, the *Centralised Incineration Facility For Special Wastes – Phase I: Feasibility Report* (FR) and *Key Issue Report – Environmental Review* (ER), and to undertake an assessment of the key issues relating to the potential environmental impacts that may arise from the construction and operation of the CIF.

The findings of the EIA will be used to develop effective mitigation recommendations and to outline an environmental monitoring and audit (EM&A) programme. This will be incorporated in the CIF

Design/Build/Operate (DBO) Tender requirements and Contract as environmental protection clauses, which will ensure that identified impacts are controlled to acceptable levels.

The overall strategy for the development of the CIF requires that the detailed design of plant be undertaken after the award of contract and, therefore, this EIA cannot address the impacts associated with specific designs of incinerator plant and associated structures. The approach that has been adopted is to consider the CIF as a "black box" and to address the "worst case scenario", where emissions are at maximum permissible levels, or to use data obtained from studies of similar construction and operational activities. Outstanding issues will be identified for inclusion in a Detailed Design EIA and included in the tender requirements.

1.2 *Scope of the Study*

The scope of the CIF EIA has been identified in the Study Brief as follows:

a) To identify and evaluate the net and cumulative impacts (including noise and vibration, water and air quality, waste disposal, risks and hazards, visual and landscape impacts) expected to arise during the construction, and operation phases of the development. These include the following issues identified in the Phase I Key Issue Report - Environmental Review as requiring further investigation:

Construction Phase

i) effects on marine water quality of increased suspended solids levels and potential for the release of trace metals caused by marine reclamation works.

Operation Phase

i) levels of fugitive dust and odour emissions during the operation of the CIF;

ii) incinerator stack emissions of particulates, trace metals, inorganic pollutants, dioxins, furans and other organic pollutants;

iii) confirmation of minimum acceptable stack height;

iv) specification of flue gas exit conditions, plume reheat requirements and waste heat utilisation feasibility for heating and/or power generation;

v) water quality of ash quenching and, if appropriate, scrubber output, and specification for the waste treatment facility;

vi) feasibility of seawater utilisation for the flue gas scrubbing and/or cleaning and quenching purposes;

vii) contaminant analysis of ash and water treatment sludges, and assessment of sharps survival to confirm appropriate methods of disposal;

viii) confirmation of operational noise levels;

ix) avoidance of visible steam and smoke emissions from the incinerator stack;

x) specification of exterior design and landscape setting for the facility; and

xi) assessment of health impacts from the incinerator emissions.

b) To minimise pollution and nuisance arising from the development and its operation and environmental disturbance during construction, operation and decommissioning of the project.

c) To identify methods, measures and standards in the design of the facility necessary to mitigate these impacts and reduce them to an acceptable level.

d) To recommend any further monitoring and audit requirements necessary to ensure the effectiveness of the environmental protection measures adopted with regard to predicted impacts, compliance with agreed requirements, policies and standards.

1.3 *STRUCTURE OF THE REPORT*

This report deals with the assessment of air quality, noise, water quality, landuse and visual, and waste handling and disposal impacts from the construction and operation of the CIF. The report is divided into the following sections:

- *Section* 2 outlines the development and operation of the CIF and provides an overview of current incineration design and operation. It discusses the most appropriate forms of incineration technology for Clinical Waste Incineration and considers recent findings on post-combustion waste treatment and disposal.

- *Section* 3 deals with the effects of removing existing incineration facilities from urban areas and the potential for impacts on air quality from the construction and operation of the CIF.

- *Section 4* provides an assessment of the long term health risks associated with atmospheric emissions from the CIF to the local population.

- *Section 5* addresses the noise impacts on the local population that may be generated by the facility and provides recommendations for any necessary noise control.

- *Section 6* investigates the likelihood of the construction or operation of the CIF leading to a deterioration of water quality and its effects on the local waste water systems.

- *Section 7* considers the landscape and visual impacts of the establishment of the CIF in Area 38 and how these may best be mitigated.

- *Section 8* looks at the composition and disposal arrangements of wastes arising from the facility and any impacts they may present to the environment.

- *Section 9* discusses the potential for impacts arising from landfill gas migration.

- *Section 10* describes the programme proposed for the EM&A work and discusses its relationship with the mitigation measures recommended in the EIA, to ensure acceptable levels of environmental protection are achieved.

- *Section 11* reviews the findings of the EIA and identifies those areas which will require further assessment by the successful tenderer once the detailed design of the CIF is established.

1.4 *THE STUDY AREA*

The CIF will be located within Tuen Mun Area 38, on reclaimed land, at Siu Lang Shui to the south of the Castle Peak hills. *Figure 1.4a* shows the site in relation to the overall study area. The nearest villages to the site are about 1.8–2.4 km to the north-west, whilst the nearest housing developments are more than 3.0 km to the north-east. In addition, a low density housing development is tentatively planned in the western part of Area 45C.

Area 38 is being reclaimed from the sea in stages, for industrial and port development, by the Hong Kong Government and private developers. To the west of the CIF site are existing industrial facilities including the China Cement Plant and Castle Peak Power Station. The Siu Wing Steel Mill to the immediate west of the site is under construction. Along the coast to the east there are a number of waterfront developments and the Pillar Point Sewage Treatment Plant. Developments impinging on the hill slopes to the north of Lung Mun Road include water service reservoirs, Pillar Point Valley Landfill and the restored Siu Lang Shui Landfill.

2 *PROPOSED DEVELOPMENT*

2.1 *THE NEED FOR THE CIF*

Clinical wastes are potentially infectious and bio-hazardous and if not properly handled may present health risks to workers and the public. In addition, clinical wastes are aesthetically offensive by nature. During Phase I of the Study, incineration was identified as the most reliable method for reducing the bulk, and completely changing the appearance of all categories of clinical wastes, rendering them harmless in the process.

Currently, local hospitals in Hong Kong segregate clinical wastes and incinerate the more hazardous components in pathological incinerators (PIs) where such facilities are available on site. However, the capacity of these incinerators is insufficient for the quantities of clinical waste produced in the territory. Consequently, about 70% of clinical waste produced within Hong Kong is diverted to landfill and co-disposed with municipal waste. If not managed properly, this may result in potential health risks to employees handling the material and possibly to the public.

All the existing PIs are substandard in performance, failing to meet EPD's air emission standards, and in some cases.do not meet the manufacturer's design specifications. In addition, they are usually of inadequate capacity to deal with the quantities of waste generated as a result of hospital expansion and the increasing use of disposable materials in health care. It is not cost-effective for such incinerators to be retrofitted with gas cleaning systems to meet current air emission standards. Furthermore, in most cases,adequate space is lacking to install gas cleaning systems and the necessary waste storage facilities to meet the required environmental standards.

At present, existing abattoir cremators in the territory also handle animal carcases but are also inadequate in terms of both capacity and technology to deal with animal carcass arisings for disposal. Furthermore, the use of municipal waste incinerators for the disposal of security waste such as confidential and restricted documents and seized narcotics and returned unsuitable goods is also not satisfactory. The only incineration plant currently available for the disposal of security waste is the Kwai Chung Incineration Plant which will be phased out with the commissioning of the West Kowloon Waste Transfer Station in mid-1997.

As part of the Governments waste management strategy, the white paper on *Pollution in Hong Kong - A Time to Act, HK Govt, 1989,* stated the intention to build a centralised incineration facility (CIF) for clinical waste disposal, as well as for the disposal of other special wastes including animal carcasses and security wastes. A single new incineration facility will remove existing sources of pollution from urban areas and significantly reduce emissions to the atmosphere by the use of modern, highly efficient, combustion and gas cleaning systems. Together with proposed legislation, this will provide a cradle-to-grave management system for clinical waste.

A centralised incineration facility is preferred over a number of smaller sub-regional incinerators (such as PIs located at the hospitals) for reasons of economy of scale and ease of control on operational standards. In addition, hospitals are by definition sensitive receivers, therefore the use of a separate centralised facility will reduce potential environmental impacts on the hospitals themselves and their surrounding environment.

2.2 *PROJECT DESCRIPTION*

2.2.1 *Introduction*

The conceptual design of the CIF has already been described in detail in the FR. The following section, therefore, contains a brief description of the project for the purposes of setting the scene for this EIA which has been commissioned to address those areas identified in the FR and the ER as requiring further study. The actual design of the CIF which will be built by the successful tenderer is likely to differ in a number of aspects but will be based on the same general requirements. The main options for incineration and gas cleaning plant are discussed and the major advantages and disadvantages of the different systems are considered.

2.2.2 *Project Timetable*

The project timetable for the development of the CIF is as follows:

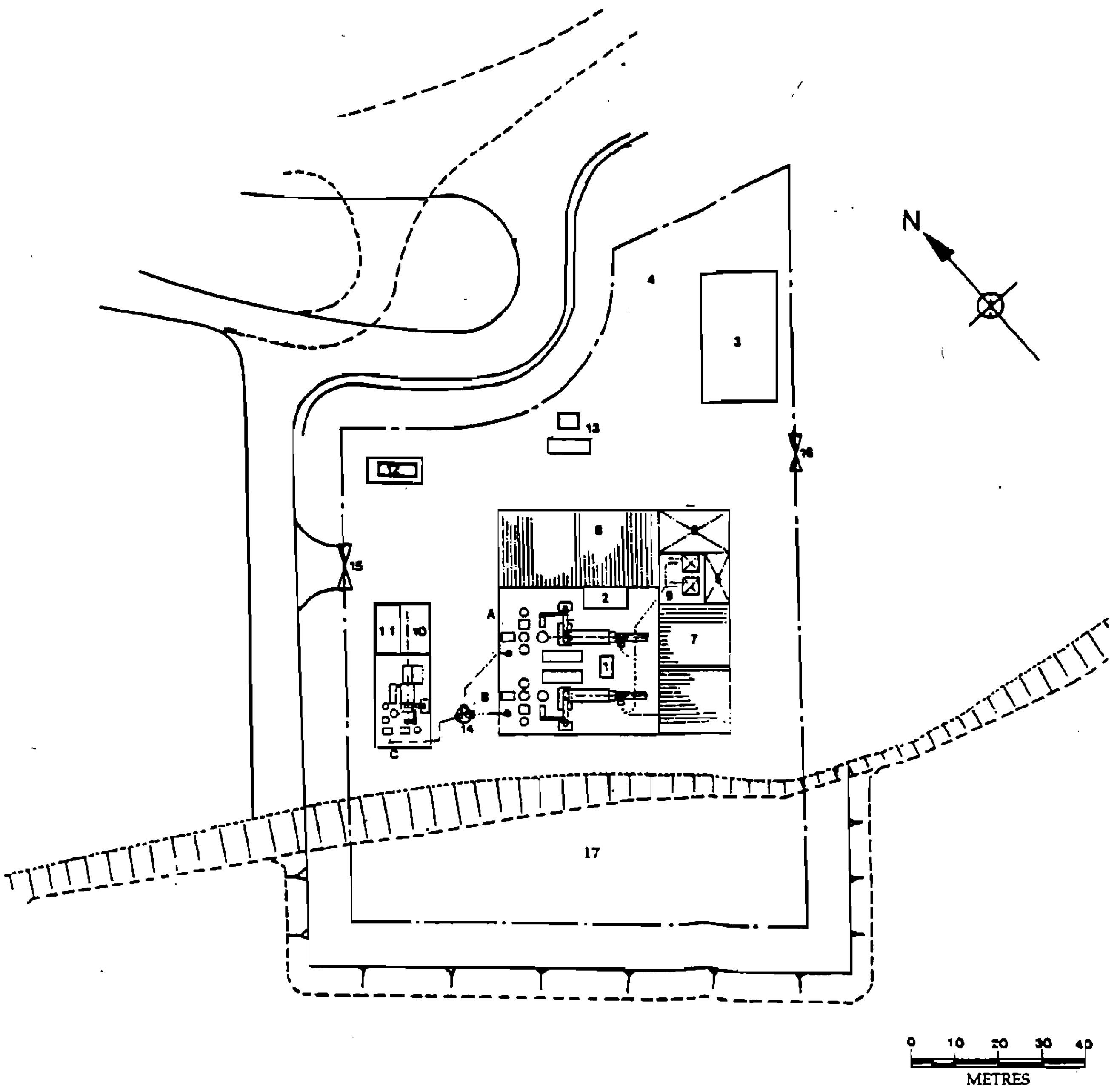
· prequalification procedures	January 1995 - April 1995
· tender period	May 1995 - August 1995
· tender evaluation	September 1995 - December 1995
· construction and commissioning period	January 1996 - mid-1997
· CIF operational	mid-1997

2.2.3 *Site Layout*

The actual layout and design of the facility will not be known until after the award of contract and therefore the Consultants have used the 1992 Feasibility Report as the basis of this EIA. *Figure 2.2a* shows the notional site layout including the access from Lung Mun Road and the southern section of the site which is yet to be reclaimed. The location of the single common stack has been used for the modelling of plume dispersion in assessing air quality impacts.

2.2.4 *Waste Collection and Transportation*

The precise mechanism for the collection and transfer of clinical waste is currently under review as part of the *Clinical Waste Control Scheme*. Clinical waste will be delivered to site in closed containers by dedicated vehicles, animal carcases will be delivered by Government and private vehicles and security waste by the appropriate Government department.



MAIN PLANT

A - CLINICAL WASTE INCINERATOR I
B - CLINICAL WASTE INCINERATOR II
C - ANIMAL CREMATOR

AUXILIARY PLANT

1 - CONTROL ROOM
2 - AMENITY BLOCK
3 - VEHICLE GARAGE AND WORKSHOP
4 - PACKING SPACE
5 - SKIP UNLOADING BAY
6 - SKIP LOADING BAY
7 - FULL SKIP STORAGE AREA
8 - EMPTY SKIP STORAGE AREA
9 - SKIP WASHING BAY
10 - CREMATOR RECEPTION AREA
11 - CREMATOR REFRIGERATED STORAGE AREA
12 - FUEL TANK
13 - WEIGH BRIDGE
14 - CHIMNEY
15 - ACCESS GATE
16 - EMERGENCY ACCESS GATE
17 - SITE FOR FUTURE EXPANSION

FIGURE 2.2a - CONCEPTUAL SITE LAYOUT

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

The findings of previous stages of the *Clinical Wastes Arising Survey* have been used to estimate the quantity of waste requiring incineration in the year 2012 to be as follows:

· clinical waste	23 tonnes per day
· small animal carcases and security waste	6 tonnes per day
· 15% contingencies	4 tonnes per day
· large animal carcases	6–7 tonnes per day
· Total	40 tonnes per day

2.2.5 *Waste Reception and Feeding System*

Deliveries will generally occur during daytime working hours (08.30 – 18.00). Storage facilities will be of sufficient capacity to ensure continuous operation of the plant. Clinical waste will be delivered in closed, wheeled, skips which will be stored under cover, before being moved into the incineration building for loading into the combustion plant. Animal carcases for disposal in the cremator will be held in a separate refrigerated storage unit.

All deliveries of clinical waste will be tracked from source by a ticketing system and load weights will be checked by a weighbridge at the main gates as well as by the weighing of individual skips prior to tipping into the incinerator loading system.

Full skips will be transferred to the incinerator unit where they will be weighed and emptied into the loading unit, the empty skips will be removed, passed through an automated cleaning system and will then be stored awaiting re–loading onto the collection vehicles.

2.2.6 *Incineration Systems*

The incineration plant and air pollution control equipment will be selected to meet the proposed combustion and stack gas emission criteria set out by the Air Management Group EPD. These are discussed in detail in *Section* 3.

Based on the Emergency Rating calculation used in the FR and the estimated waste arisings, indicate that a twin–stream clinical waste incinerator with a capacity of 2 x 1.1 te hr^{-1} continuous operation will be required. The cremation of animal carcases will require a batch operating unit with a capacity of between 0.5–1.0 te hr^{-1}. The cremator must be sized to accept the largest whole carcase likely to be delivered to the facility.

The incineration units will consist of:

- an automated loading system which will ensure safe loading and proper combustion conditions through controlled input;

- a primary combustion chamber where the waste is gassified and separated from non–combustible materials such as sharps; and

- a secondary combustion chamber where high temperature, surplus oxygen and a sufficient residence time will ensure complete combustion of the materials from the primary chamber.

The selection of incineration plant is not known at this stage, however, the choice of plant is likely to be one of the following:

- fixed hearth;
- controlled air/semi-pyrolytic;
- pulsed hearth; or
- rotary kiln.

The general principles and major advantages and disadvantages of these incinerators are discussed below.

Fixed Hearth Incinerators

Waste is fed into the primary chamber where it is over-fired with air. Proper mixing is difficult, requiring careful adjustment of the waste feed and ash removal rates. Pyrolysis and combustion products enter the secondary chamber and are combined with supplementary fuel and excess air.

The main advantages are:

- ability to deal with high water content;
- low carry over of particulates; and
- low cost.

The main disadvantages are:

- unsuitable for some types of waste;
- limited capacity; and
- variable ash burn-out and composition.

Controlled Air/Semi-Pyrolysis Incinerators

Waste in the primary chamber is dried, heated and pyrolysed in stages under starved air conditions with heat provided by the controlled combustion of fixed carbon in the waste. Excess air in the secondary chamber, with support burners if necessary, completes the combustion process.

The main advantages are:

- low carry over of particulates;
- effective with a wide range of wastes; and
- good fuel economy.

The main disadvantages are:

- can develop problems with slag formation;
- moving parts may reduce reliability; and
- good ash burn-out may be difficult to achieve.

Pulsed Hearth Incinerators

This is an excess air type incinerator which uses the pulsed movement of the hearth to move the waste through the incinerator. The system can be designed with integral waste heat recovery.

The main advantages are:

- no moving parts;
- no problems with slag formation; and
- low carry over of particulates.

The main disadvantages are:

- requires careful design to avoid blockages and ensure good mixing of waste and heat distribution.

Rotary Kiln Incinerators

The primary chamber consists of an inclined cylinder with a refactory lining. The controlled rotation of the cylinder mixes and moves the waste through the primary combustion cycle.

The main advantages are:

- no moving parts within the kiln;
- incinerates wide range of wastes; and
- good mixing and temperature control.

The main disadvantages are:

- high capital and operating costs;
- rotary seals difficult to maintain;
- refactory lining vulnerable to harsh operating conditions.

2.2.7 *The Pollution Control Equipment*

The type of gas cleaning equipment to be used will not be specified in the tender requirements but the system selected is likely to be either:

- Venturi Scrubber/Packed Tower; or
- Semi-dry/Dry Chemical Scrubber and Bag Filter; or
- another effective gas cleaning plant.

Flue Gas Cleaning Principles

A series of gas cleaning units is normally required, each performing one or more of the following operations:

- cooling:
- primary particulate removal;
- acid gas removal;
- de-nitrification;
- fine particle removal; and
- demisting.

In the selection and design of equipment, the properties, composition and flow rate of the gas stream, the mass flux and size distribution of particulates, the emission targets and process economics are all key considerations.

Many of these factors cannot be addressed before the detailed design stage and therefore it is only possible for the EIA to consider the general options for pollution control. The main choices available to the designers are discussed below.

Gas Cooling

Gas cooling performs a number of essential functions as well as providing the potential for energy recovery. The major considerations are:

- to minimise dioxin formation;
- to protect materials of construction;
- to alter resistivity of particulates for electrostatic precipitation; and
- to recover energy from the hot exhaust gases.

Particulate Removal

The choice of abatement technology depends on the particle size, distribution range and the removal efficiency required. Removal of large particles upstream will affect the efficiency of some types of fine particle removal systems further downstream. The particulate removal efficiency of wet systems must be considered in the light of the need to treat the aqueous effluent produced before discharge.

- Electrostatic Precipitator

  Wet and dry electrostatic precipitator systems are available and have been used for municipal and industrial incinerators, however, they are expensive and are not generally used on clinical waste incinerators.

- Gas-Atomising Spray Scrubbers

  Gas-atomising spray scrubbers are effective in removing both particulates and acid gases. The production of an aqueous effluent stream is often considered a disadvantage with these systems, other problems include corrosion and the need for downstream mist elimination.

- Filter Fabrics

Filter fabric collectors, also known as baghouses, are one of the most efficient means of separating particulate matter from the gas stream. Fabric filters are limited in their use by temperature, moisture content and corrosive nature of gases and are usually installed at the downstream end of the gas cleaning plant. The use of baghouse cleaning provides an effective capture mechanism for mercury and dioxins.

- High Temperature Ceramic Filters

These are a recent development which has been designed to operate in hot post-combustion environments obviating the need to cool the gases before filtration. The reliability of this system has yet to be proven on a large scale plant.

Acid Gas Removal

- Wet Scrubbing

Wet scrubbing systems will also cool the flue gases and capture condensed metals, however further treatment of the aqueous effluent is needed. The gases at the stack are likely to have a high moisture content and will need re-heating to prevent a visible plume.

The systems available are:

- spray towers;
- packed bed scrubber; and
- semi-dry scrubber.

Semi-dry scrubbers do not produce an aqueous effluent but are generally less efficient than wet systems.

- Dry Scrubber

Dry scrubbing systems tend to be of low cost compared to other methods, however, this is reflected in the lower efficiencies of the system when compared to wet or semi-dry scrubbers.

Removal of Cadmium, Mercury and Dioxins

Most dioxin compounds are formed within a temperature band of 200-450°C. As such, control of post-combustion conditions becomes particularly important given that flue gases are cooled from the high secondary combustion chamber exit temperature of 1000°C to temperatures low enough to not impair the performance of flue gas cleaning plant, below

300°C. It is during this post-combustion stage that the majority of dioxin compounds in the flue gas are formed. The most effective means of controlling dioxin formation at this stage is to ensure that their residence time in the 200-450°C temperature range is minimised. This can be achieved either by rapidly cooling the flue gases by quenching them with water, or, if the plant is designed for heat recovery, through maintaining the boiler outlet temperature in the region of 350°C.

The most effective methods for removal of dioxins, mercury and cadmium are either wet scrubbing under acid conditions or adsorption onto activated carbon. Adsorption onto activated carbon has been demonstrated to be an effective method of achieving the current emission standard of 0.1 ng Nm^{-3}.

System Evaluation

In terms of capital cost, dry scrubbing is the cheapest method. Spray driers require more costly spray chambers. Wet systems need circulation and treatment equipment for the scrubber liquor and also plume abatement systems. Efficiency decreases with a shift from wet to dry scrubbing.

Wet scrubbers operating at the lower temperatures of 60 - 70°C, compared to the 120 - 180°C for dry and semi-dry systems, result in the capture of mercury vapour through condensation.

Residue from a wet scrubber is in the form of slurry, solids from this can often be landfilled as the metals either in the hydroxide form or retained in the liquor. Dry and semi-dry scrubbers produce dry residues which contain leachable heavy metals which may need treatment prior to landfilling.

2.2.8 *Waste Disposal*

Solid and liquid waste will be generated by the plant and will require controlled disposal. Water pollution control equipment in the form of a wastewater treatment plant will be required, the specifications of which will be largely dependent on the choice of wet or dry type gas cleaning equipment. Liquid wastes from the plant will probably be disposed of, after treatment, to sewer or directly to sea under an appropriate discharge licence. Solid waste will be sent to a suitable landfill under the control of licensed waste disposal operatives.

While ash, particularly fly ash, has been considered a possible pollution problem by some, recent findings in the USA have indicated otherwise. A recent US Supreme Court ruling found that combustion ash was not exempt from testing as a hazardous material, and if found to be toxic should be appropriately handled. As yet no ash has failed the toxicity tests, and therefore has not needed to be treated as a hazardous material.

A number of specialised techniques to either use or safely dispose of ash are being employed or tested, including vitrification, use in cement manufacture, road construction, and landfilling in separate cells. However, in the light of the quantity of waste requiring disposal in Hong Kong, these techniques are not considered cost-effective.

2.2.9 *Heat Recovery*

Energy recovery (generating steam or electricity) is a highly desirable adjunct to any incineration facility. The Feasibility Study noted that the plant could generate up to 6000 kg of steam (7 bar gauge) or 1.5 MW of electricity depending on operational conditions. A supply of steam or electricity could be available at all times except for the few days a year when the plant is shutdown for maintenance purposes.

The uptake of the waste heat recovery option will depend heavily on the economics and practicalities of steam or electricity production. The Feasibility Study identified the potential electricity savings to the plant, but also increased capital and operating costs. The design of the incineration plant will be influenced by these factors as well as any need to avoid post-combustion dioxin formation. Steam may be required for plume re-heat, particularly if wet scrubbing is used. The potential for utilising all the steam which will be produced will be dependent on the needs of local industry which may not be identifiable at the detailed design stage.

The decision to utilise heat recovery can only be made at the detailed design stage as it forms an integral part of the plant design and operational procedures.

2.2.10 *Emission Monitoring*

Pollutant and system monitoring will be required to ensure that the incineration plant and the gas cleaning equipment performs to the necessary standards during operation. An operational procedures manual (including safety and emergency procedures), will also be required, together with a satisfactory programme of staff training.

Water quality and aqueous emission standards will require monitoring to ensure compliance with discharge licence limits.

Continuous stack gas monitoring for specified pollutants will be included in discharge licence conditions. Whilst continuous monitoring for dioxins is currently not practicable, the monitoring of process conditions and stack gases can give a good indication of incomplete combustion and as such indicate likely levels of dioxin. Monitoring stack gas conditions and concentrations will be necessary to provide feedback information for effective process control.

3 AIR QUALITY

3.1 INTRODUCTION

This *Section* assesses the potential air quality impacts from the CIF during its construction and operation. The incineration facility is expected to operate continuously, with two parallel streams for clinical waste disposal to maintain flexibility and security of service, the animal carcase incinerator will probably be of intermittent batch operation mode.

The CIF is to be located in Tuen Mun Area 38, an area zoned for industrial purposes. The CIF site is relatively isolated from centres of population, being more than 3 km to the west of Tuen Mun New Town.

Incinerators are classified as a Specified Process and require a licence to operate according to the Air Pollution Control Ordinance (APCO). The CIF is under the licensing controls of the Director of Environmental Protection Department.

3.2 THE SURROUNDING ENVIRONMENT

3.2.1 *Existing and Planned Landuse*

The proposed CIF is planned to be located in the Special Industrial Area (SIA) of Tuen Mun Area 38. The existing environment close to the proposed CIF site is mainly for industrial uses and the site is well away from highly populated areas (i.e. more than 3.0 km from Tuen Mun New Town). Future developments in the vicinity of the proposed CIF site are detailed in various local and strategic planning documents. Air receivers (ARs) are shown in *Figure 3.2a*.

3.2.2 *Residential Developments*

There are five villages, Pak Long, Nam Long, Sha Po Kong, Tuk Mui Chung and Lung Tsai in the Lung Kwu Tan area, located about 1.8–2.4 km north-west of the proposed CIF site. Lung Tsai is the nearest village, 1.8 km to the north-west.

Butterfly Estate, Melody Gardens and Richland Gardens are more than 3.0 km north-east of the CIF site.

3.2.3 *Industrial, Port and Other Uses*

Area 40, about 2.2 km to the east of the CIF site comprises waterfront industries consisting of sawmills, boatyards and warehouses. There are also a number of open container storage areas, operating under short term tenancies in Areas 38, 45C, 46A and 47.

The Siu Wing Steel Mill will be built adjacent to the site, with the existing China Cement Plant about 200 m further to the west. Castle Peak Power Station lies about 500 m north-west of the CIF site.

There are proposals to restore the existing Siu Lang Shui Landfill for recreational use, however the future use of the landfill site is not yet confirmed.

A number of other industrial uses are planned within the proposed 56 ha of the SIA. Under the preferred development scenario proposed by the Tuen Mun Area 38 Study, the following industries are planned to be located in Tuen Mun Area 38 in addition to the CIF:

- Steel Works;
- Chemical Waste Bulking and Transfer;
- Textile, Bleaching, Dyeing and Finishing;
- Styrene Monomer Storage/Delivery Site;
- Acetyl Plant;
- Polyester Plant;
- Polystyrene Resin Plant; and
- Paper Processing Plant.

Under the Ports and Airport Development Strategy (PADS), a River Trade Terminal (RTT) is planned more than 800 m to the east of the CIF site and another deep waterfront and cargo working area is planned to the north of the Castle Peak Power Station, about 1.3 km to the north-west of the CIF site.

3.3 BACKGROUND AIR QUALITY

3.3.1 *Current Conditions*

Tuen Mun

No long term air quality monitoring data are available for Tuen Mun Area 38, the Expanded Development Study noted the 1990 total suspended particulate (TSP) level to be 112 $\mu g\ m^{-3}$. However, the area is predominantly affected by industrial emissions such as from the China Cement Works, Castle Peak Power Station and vehicle emissions from nearby road networks. The air quality in the area is also affected by dust and vehicle emissions from construction activities associated with the extensive construction activities in the area, including Black Point Power Station, and vehicle emissions from refuse delivery vehicles passing through Tuen Mun new town to and from the West New Territories (WENT) landfill.

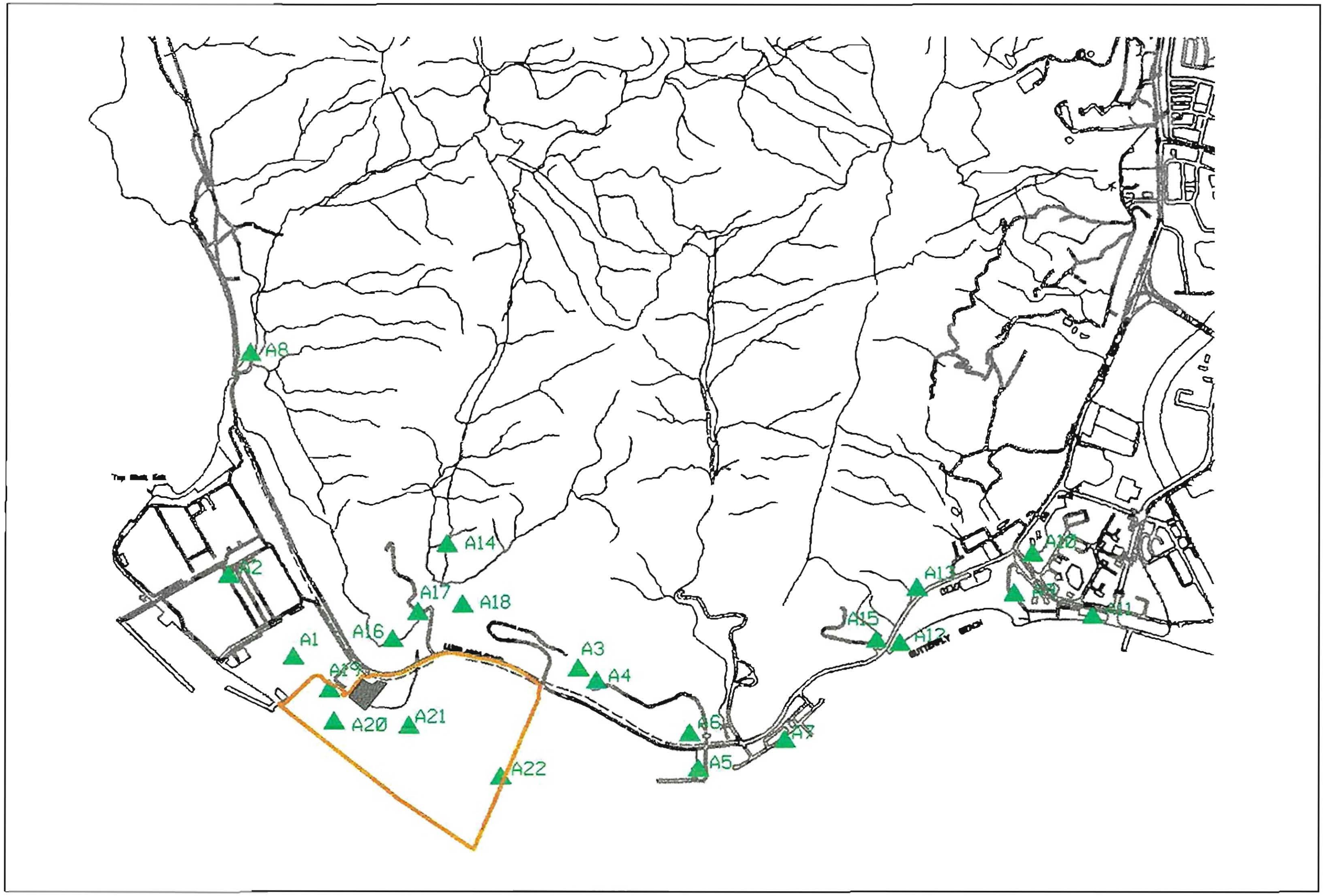


FIGURE 3.2a - AIR SENSITIVE RECEIVERS

Date : 25 October 1994	Drawing No. : ERM/GIS/C1127b/0004
Map prepared by : GIS and Mapping	Base map : 1:20k topo. Lands Dept.

KEY

- RECLAMATION AND CONSTRUCTION SITE FOR S IA N TUEN MUN AREA
- AIR SENSITIVE RECEIVER LOCATION
- CIF SITE

ERM Hong Kong
5, 10-11 th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

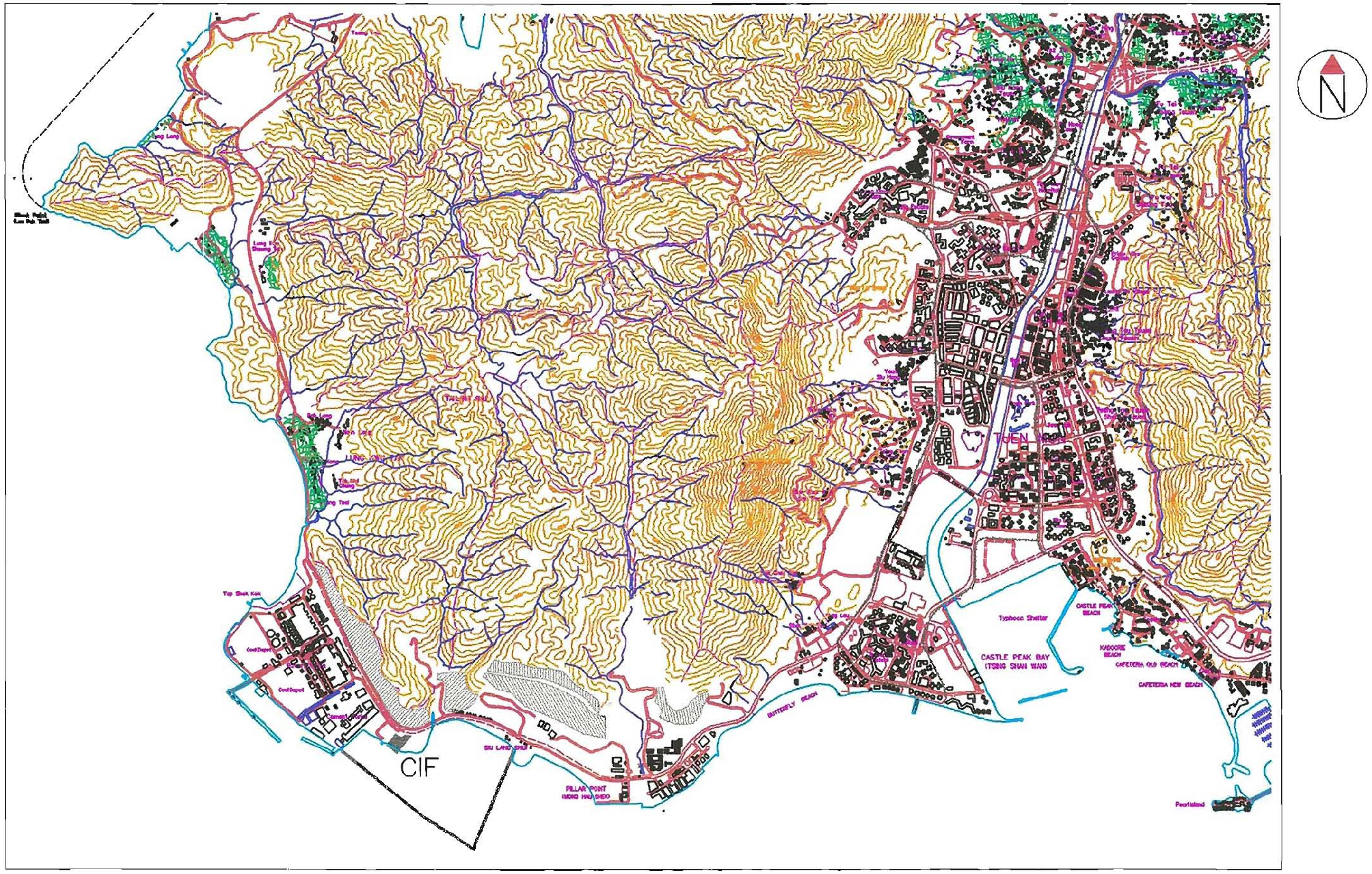


FIGURE 1.4a CENTRALISED INCINERATION FACILITY - SITE LOCATION

Date : 5 JAN 1995	Project No.: c 1127b
Map drawn by GIS and Mapping,ERM	Base map from LANDS DEPT. 1:20k topo

KEY

- CIF site
- SIA reclamation area
- Slope/Cliff

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

Current Incineration Practice

Until March 1994, when the operation of the Queen Elizabeth Hospital was suspended, the known throughput of existing pathological waste incinerators in Hong Kong was 1678 tonnes per year (see *Table 3.3a*), it is currently 1256 tonnes per year. Other operational hospital incinerators are likely to consume up to 550 tonnes of clinical waste per year, but records of their throughput are not available.

Table 3.3a *Major Hong Kong Pathological Waste Incinerators*

Name of Premises	Waste per Year (kg)	Secondary Combustion Chamber
Pamela Youde Nethersole Eastern Hospital	200000	Yes
Yan Chai Hospital	unknown	Yes
Princess Margaret Hospital	192000	Yes
Prince of Wales Hospital	352000	
Tuen Mun Hospital	252000	Yes
Queen Elizabeth Hospital	442000	
Queen Mary Hospital	219000	Yes
Caritas Medical Centre	unknown	Yes
Ruttonjee Hospital	unknown	Yes
Cape Collision Crematorium	3000	
Diamond Hill Crematorium	18000	Yes (1/3 units)
Total waste incineration	**1678000**	

In addition, there is a total of approximately 0.5 tonne per hour capacity at smaller pathological incinerators, which fall outside the definition of Specified Processes, however, their annual consumption of clinical wastes is not known. The capacities of these incinerators is shown in *Table 3.3b* below.

Improvements in incineration technology have lead to significant reductions of emissions to atmosphere. The capture efficiency of gas cleaning plant for many pollutants has increased by at least an order of magnitude and improvements generally range from 75% up to 99.9999% in the case of dioxins and furans. Thus, whilst the CIF will incinerate nearly ten times as much clinical waste as the existing incinerators, the overall emissions to atmosphere on many key pollutants are likely to fall.

Table 3.3b *Other Pathological Waste Incinerators*

Name of Premises	Capacity (kg hr^{-1})	Year of Installation
Yan Oi Polyclinic (not used)	1 x 40	1982
Tai O Jockey Club Clinic	1 x 10	Unknown
North Lamma Clinic	1 x 10	Unknown
Lek Yuen Health Clinic	1 x 40	1981
Shek Wu Hui Jockey Club Clinic	1 x 20	1964
Sha Tau Kok Clinic	1 x 40	1974
Shatin Infirmary & Convalescent Hospital	1 x 32.5	1989
Cheshire Home	1 x 20	1991
Siu Lam Hospital (new unit)	1 x 16	1992
Siu Lam Hospital (old unit)	1 x 36	1973
Tsan Yuk Hospital	1 x 40	1990
Pok Oi Hospital	Unknown	1987
Tseng Siu Kin Hospital	1 x 21	1989
Castle Peak Hospital	1 x 36	1965
Sai Ying Pun Jockey Club Clinic	1 x 45.5	1971
Kowloon Hospital	2 x 30	1970
Wong Tai Sin Infirmary	Unknown	1978
Kwong Wah Hospital	Unknown	1982
Haven of Hope Hospital	Unknown	1986
Institute of Immunology	1 x 30	1971
British Military Hospital	Unknown	1987

3.3.2 *Future Conditions*

During the operation of CIF other activities such as road transport for the operation of the WENT landfill, cement works, steel works and power stations, will also have a direct effect on the air quality in the immediate area.

It is important, therefore, to minimize any additional air quality impacts from the construction and operational phases of the CIF to the surrounding area.

The future air quality of the area has been predicted in the *EA for the Relocation of Two 56 MW Gas Turbines from the Hok Un Power Station to the Castle Peak 'A' Power Station, ERL, November 1992*. The overall NO_2 and SO_2 concentrations for the Tuen Mun Area 38 and Lung Kwu Tan areas were assessed in this report against the relevant air quality objectives (AQOs) and are shown in *Table 3.3c*. In addition to the background air quality of the area, the emissions from Castle Peak Power Station, China Cement Plant, Black Point Power Station, Siu Wing Steel Works and CIF have been addressed.

Table 3.3c ***Likely Future Air Quality from all Sources near Tuen Mun Area 38***

AR	Height (mPD)	Maximum Hourly Concentrations in % AQO	
		NO_2	SO_2
Tuen Mun Area 38	35	51	32
	10	62	30
Lung Kwu Tan Areas	35	62	73
	10	70	62

The data includes the impacts from the Siu Wing Steel Mill and the CIF in Tuen Mun, however emission characteristics of these developments have changed since the Study. The results, therefore, are only presented to provide a general indication of the likely future air quality of the area.

3.4 *LOCAL CLIMATE*

The potential for the dispersion of air pollution is very much dependant on local factors such as wind speed and direction, and atmospheric stability. Although, the Tuen Mun Meteorological Station situated in Tuen Mun new town is the nearest meteorological station to the proposed CIF site, it was recognised in the FR that the meteorological data from this station are not applicable to the study area for the following reasons:

- easterly winds are most frequent in Hong Kong with a slight summer peak of south–westerlies;
- Tuen Mun Meteorological Station is sheltered from easterly and westerly winds by local topography;
- the Tuen Mun Valley will tend to channel winds in a north–south direction; and
- the proposed site is exposed to all wind directions except northerlies.

The meteorological data from the Royal Observatory's Lau Fau Shan Automatic Weather Station have been used in the EIA, as agreed with EPD, to describe the general meteorological conditions of the area.

Local weather conditions are also influenced to a certain extent by local topography, the proximity of water masses and urban/rural characteristics. The following factors have been noted in describing the general meteorological conditions of the study area:

- the CIF site is on the southern coast of Castle Peak where the area is likely to experience a diurnal land/sea breeze circulation, particularly in the summer;

- as a result of the coastal location of the CIF and the ridge to the north, a topographically enhanced land/sea breeze system will introduce more southerly wind components;

- for more than 70% of the time the area is experiencing easterly winds;

- for 42% of the time wind speeds ranged between 2.0–4.0 m s^{-1} and for 37% of the time between 4.0–8.0 m s^{-1}.

- there is a high occurrence (77%) of neutral atmospheric stability (Pasquill Stability Classes D, E and F) with relatively infrequent (23%) unstable events (Classes A, B and C).

3.5 *POTENTIAL SOURCES OF IMPACTS*

3.5.1 *Construction Phase*

Dust and exhaust emissions from construction plant and vehicles can create air quality impacts.

Dust emissions will vary substantially from day to day depending on the level of construction activity and the prevailing weather conditions. Dust will be emitted from construction activities such as site excavation, concrete batching, handling and storage of construction materials, spoil or aggregates and vehicle movements on unpaved haul roads. In general, construction dust particles are larger than 30 μm in diameter, these will settle rapidly within 100 m of the point of emission. As the construction site is to the western side of the Tuen Mun Area, and the nearest ARs, the villages in Lung Kwu Tan, are more than 1.8 km away (Tuen Mun New Town 3.0 km), any dust impacts are expected to be insignificant.

Since the site is well away from any ARs, no significant dust impacts are expected from construction activities. With good on-site management and working practices, and appropriate dust suppression measures such as frequent water spraying, no significant emissions to the surrounding environment and ARs are predicted.

NO_x, SO_2 and particulates will be emitted from diesel powered construction equipment. These may include delivery trucks, excavators, compressors etc. Due to the limited plant which will be used on-site, no significant air quality impacts are expected to result from their operation.

The construction of the CIF will require only limited site formation works as the reclamation will have been undertaken as part of the construction of Area 38 and no significant dust impacts were predicted from these works.

Since the CIF site represents only a fraction of the total area of Area 38, given the distance to the nearest ARs, no significant dust impacts will result from the construction of CIF. Nevertheless, good on-site management and dust suppression measures should be adopted to minimize dust emissions to the surrounding areas which already experience high TSP levels.

3.5.2 *Operational Phase*

The principal potential sources of air emissions from the operation of the CIF were identified in the FR as:

- fugitive emissions of dust from handling and storage of reagents and ash on-site;
- incinerator stack emissions; and
- odours from fugitive sources.

Operational Fugitive Dust Emissions

Operations at the CIF will involve transport, reception, handling, storage and removal of materials, all of which could give rise to significant fugitive particulate emissions if inappropriate handling procedures were adopted.

These materials will consists of:

- scrubber and water treatment (if treatment is required) reagents;
- bottom ash from the incinerator;
- ash and reagents from gas cleaning; and
- dewatered sludge from the water treatment plant.

Fugitive dust emissions during the operational phase of the CIF can be controlled through proper design of the facility, for instance, by enclosing dusty operations and filtering exhaust air. The incineration plant and buildings should be designed to operate under negative pressure so that any odorous air is drawn into the combustion chambers for destruction.

Provided that general good housekeeping measures are maintained, and staff are provided with an appropriate level of training, no significant fugitive dust impacts are predicted during the operation of the CIF.

Incinerator Stack Emissions

The proposed CIF incinerator will produce a heterogeneous waste stream containing a number hazardous air pollutants. Medical wastes contain a wide range of:

- toxic organics (drugs etc);
- hazardous organics (halogenated and sulphonated plastics etc);
- heavy metals; and
- pathogens.

Some of the volatile and semi-volatile organic compounds and metals present in the original feed will not be completely destroyed by the combustion process and others can be created by it. The incinerator will also produce pollutants associated with high temperature combustion processes, namely carbon dioxide, steam, nitrogen oxides (NO_x), carbon monoxide, and fly ash containing heavy metals. Potentially polluting emissions emanating from the stack could include fly ash, halogens, oxides of sulphur, nitrogen and carbon, heavy metals and organics (including dioxins and furans).

All these potentially polluting emissions can have adverse effects on human health if inhaled (and in some cases absorbed through the skin or ingested) and some metals and organics, particularly dioxins and furans, are strongly carcinogenic.

The CIF flue gas cleaning plant will be designed to comply with the Air Pollution Control (Specified Process) Regulations and the proposed emission limits listed in *Table 3.5a*.

According to the proposed limits the efflux velocity must not be less than 15 m s^{-1} at full load condition and the exit temperature should not be less than the acid dew point (approximately 120°C).

This *Section* focuses on those pollutants listed in the Hong Kong AQOs, the effects of other pollutants which are not included in the AQOs are addressed in *Section 4*.

Odours from Fugitive Sources

The handling of clinical wastes and animal carcases can generate fugitive odour emissions unless adequate controls are applied. All wastes should be transported to CIF in sealed containers in order, *inter alia*, to ensure there is no odour nuisance to ARs en-route. Handling of clinical wastes and animal carcases should be carried out within the main plant buildings where a negative pressure can be maintained. The inclusion of these recommendations in the design and operation of the CIF will ensure that no significant off-site odour nuisance to the surrounding environment is caused.

Since fugitive odours and dust impacts from the handling of wastes and other materials can be controlled effectively by proper plant design and procedures, this assessment of potential off-site impacts will concentrate on stack emissions.

Table 3.5a *Centralised Incineration Facility - Proposed Emission Limits*

Pollutant Class	**Concentration ($mg\ m^{-3}$)**
Particulates	50.0
Metals	
Cadmium (Cd) and Thallium (Tl)	0.05
Mercury (Hg)	0.05
Total of Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V) and Tin (Sn).	0.5
Hydrogen sulphide	5.0
Halogen compounds	
Chlorine and its compounds (expressed as hydrogen chloride)	50.0
Hydrogen fluoride	5.0
Fluorine and its compounds (expressed as hydrogen fluoride)	10.0
Hydrogen bromide	5.0
Sulphur dioxide	250.0
Nitrogen oxides (expressed as nitrogen dioxide)	400.0
Carbon monoxide	100.0
Organic compounds (expressed as carbon)	25.0
Phosphorus and its compounds (expressed as phosphorus)	5.0
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans (expressed as TCDD equivalent)	0.1 $ng\ m^{-3}$
Smoke	< Ringelmann 1

Notes:
(1) For metals emission limits are 1/2 hourly average values not to be exceeded at any time during normal operation.
(2) The admission of dilution air after the combustion zone to achieve an emission limit is not permitted.
(3) Emissions shall aim to be colourless, harmless and inoffensive.
(4) Emissions to be free from droplets and persistent mist or fume and visible smoke in normal operation.
(5) All emissions shall be free from odour beyond the process boundary.
(6) All pollutant concentrations are expressed at standard conditions; 273 K, 101.3 kPa and 11% O_2, dry gas and apply to all stages of the process.

3.6 *STACK GAS EMISSIONS*

3.6.1 *Introduction*

The potential short and long term air quality impacts from the combustion processes of the CIF on identified ARs at both ground and elevated levels have been assessed using a Gaussian Dispersion air quality model and methodology agreed with EPD.

3.6.2 *The Dispersion Model*

The Short Term Industrial Source Complex (ISCST2) air quality model was used in the detailed air quality assessment. The model is capable of considering many individual point sources and has options to allow for stack induced downwash, building effects and buoyancy induced dispersion. The model is approved by the US Environmental Protection Agency (EPA) and has been extensively used in Hong Kong.

The worst case hourly, 8-hour, 24-hour, monthly and annual average pollutant concentrations predicted at the ARs were assessed against the Hong Kong Air Quality Objectives (AQOs) shown in *Table 3.6a* and using the model parameters described below.

Table 3.6a *Hong Kong Air Quality Objectives*

Pollutant	HK AQO ($\mu g\ m^{-3}$)[a]
Particulates	180 (RSP[b] - 24 hour average) 55 (RSP - annual average)
Lead	1.5 (3 month average)
Sulphur dioxide	800 (1 hour average) 350 (24 hour average) 80 (annual average)
Nitrogen oxides (NO_2)	300 (1 hour average) 150 (24 hour average) 80 (annual average)
Carbon monoxide	30,000 (1 hour average) 10,000 (8 hour average)

Note: (a) Measured at 298°K (25°C) and 101.325 kPa (one atmosphere).
(b) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 μm and smaller.

Input Parameters

- Climatological Input

1992 and 1993 sequential hourly meteorological data for Lau Fau Shan were used in the detailed assessment.

- Urban Mode

  Urban Mode 3 was used due to the characteristics of the landuses in Tuen Mun Area 38. This urban mode accounts for the enhanced turbulence generated by surface roughness elements, or heat sources, situated in developed areas.

- Emission Data

  The dispersion model requires the flue gas characteristics, stack configurations and pollutant emission rates to generate the impacts from the combustion process, the emission details are presented in *Tables 3.6b* and *3.6c*.

Table 3.6b *Emission Characteristics*

Stack Location (HK Grid) Easting	810600
Stack Location (HK Grid) Northing	825600
Emission Height[(a)] (m PD)	65
Stack Cross Section Area (m^2)	1.39
Stack Diameter (m)	1.33
Efflux Velocity ($m\ s^{-1}$)	15
Exhaust Temperature (K)	393
Volume of Gas ($Nm^3\ hour^{-1}$)	27000

Note: (a) The height of the stack is 60 m above ground and the site datum is taken to be about 5 m PD.

The Feasibility Study, identified a plant capacity of 2 x 1.1 te hr^{-1} for the clinical waste incinerator with continuous operation and a batch operating animal carcase cremator with a capacity of between 0.5–1.0 te hr^{-1}.

The estimated rates of emission are based on the proposed emission limits and are given in *Table 3.6c*. It has been assumed, based on a similar incinerator stream with a capacity of 1 tonne per hour (*Environmental Statement for the Knostrop Clinical Waste Incinerator, ERL, May 1991*), that the gas flow volume would be 9,000 $Nm^3\ hr^{-1}$ per incinerator stream and that the gas exit velocity and gas temperature comply with the proposed emission limits. The maximum volume of gas flow for the two clinical waste incinerator streams and the animal carcase cremator was therefore estimated to be 27,000 $Nm^3\ hr^{-1}$. The stack height is taken to be 60 m, based on the Feasibility Study.

The proposed emission limits represent the maximum concentrations which will be permitted to be present in the flue gas. Assuming this to be a continuous emission rate provides a very conservative assessment of the potential impacts, as not all specified chemicals would be emitted at maximum concentrations at all times.

Table 3.6c *Emission Rates*

Pollutant	Emission Rate (g s^{-1})
Particulates	0.37
Metals and their compounds: (expressed as metals)	
· Total of cadmium & thallium and their compounds	0.0004
· Total of mercury and its compounds	0.0004
· Total metals (antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium and tin) and their compounds	0.0037
Hydrogen sulphide	0.0374
Halogen compounds:	
· Chlorine and its compounds (expressed as hydrogen chloride)	0.3736
· Hydrogen fluoride	0.0374
· Fluorine and its compounds (expressed as hydrogen fluoride)	0.0747
· Hydrogen bromide	0.0374
Sulphur dioxide	1.8681
Nitrogen oxides (expressed as nitrogen dioxide)	2.9890
Carbon monoxide	0.7473
Organic compounds (expressed as carbon)	0.1868
Phosphorus and its compounds (expressed as phosphorus)	0.0374
Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (expressed as TCDD equivalent)	7.47×10^{-10}

3.6.3 *Air Receivers*

Results from the screening assessment show that the maximum pollutant concentrations will occur within 2 km of the CIF. Hypothetical receptors up to 2 km downwind from the CIF, at intervals of 100 m, were generated to map out pollutant concentrations at both 10 m PD (representing near ground level concentrations) and 35 m PD (concentration at elevated level).

The identified discrete ARs are listed in *Table 3.6d*, their locations are shown in *Figure 3.2a*.

Table 3.6d *Identified ARs*

AR No.	ARs	Distance from CIF (km)	Easting	Northing	Height (m PD)
Existing ARs					
A1	China Cement Works	0.2	810215	825775	6.7 - 35
A2	Castle Peak Power Station	0.5	809880	826205	7.3 - 35
A3	Block Making Factory	1.1	811700	825715	58.3
A4	Fresh Water Reservoir	1.2	811790	825650	64
A5	Pillar Point Sewage Treatment Works	1.8	812325	825195	5 - 35
A6	WAHMO Building	1.7	812275	825375	12
A7	Waterfront Industry	2.2	812775	825345	5.7 - 35
A8	Lung Tsai	1.8	809990	827355	4
A9	Melody Garden	3.2	813960	826105	5 - 85
A10	Butterfly Estates	3.5	814060	826310	5 - 85
A11	Richland Garden	3.6	814365	825985	5 - 85
A12	Butterfly Beach	3.7	813370	825855	4.6
A13	Public Recreation & Sports Centre in Area 45 - Horse Riding School	2.8	813455	826135	10
A14	Existing Castle Peak Firing Range (Boundary)	0.8	811015	826360	70
Future ARs					
A15	Developments in Area 45C	2.4	813250	825860	10
A16	Siu Lang Shui Landfill Site for development into a recreational area	0.2	810735	825863	41
A17	As above.	0.4	810865	826005	42
A18	GIC at Siu Lang Shui	0.9	811095	826045	54.2
A19	Proposed Steel Works in Area 38	0.03	810405	825605	5 - 35
A20	Proposed Chemical Waste Bulk Treatment Facility in Area 38	0.06	810430	825435	5 - 35
A21	Proposed Special Industrial Area	Immediately to the east	810820	825420	5 - 35
A22	River Trade Terminal	0.7	810300	825150	5 - 35

The predicted pollutant concentrations were assessed against the AQOs presented in *Table 3.6a*.

3.7 MODELLING RESULTS

3.7.1 *Maximum pollutant concentrations at 10 mPD and 35 mPD*

Table 3.7a summarises the maximum short and long term average pollutant concentrations downwind of the CIF stack at 10 mPD and 35 mPD.

The maximum short and long term pollutants occur at distances close to the CIF at about 200 m - 640 m. The maximum 1-hour average pollutant concentrations occur under Stability B and D (1992 and 1993 respectively) and low wind speeds of less than 2 m s^{-1}. The predicted maximum ground level (10 mPD) and elevated level (35 mPD) pollutant concentrations from the CIF with a 60 m stack under maximum loading are acceptable in terms of the AQOs.

The SO_2 emissions from maximum loading operation of the CIF to the surrounding area at 10 mPD and 35 mPD will be about 1% or less of the 1-hour, 24-hour and annual AQO.

The emissions from the CIF operating at full load with assumed 30% NO2/NO_x conversion represent about 4%, 2% and 1% respectively of the 1-hour, 24-hour and annual AQOs for NO_2.

The predicted levels for all other pollutants will be less than 1% of the respective AQOs (see *Table 3.7a*).

3.7.2 *Predicted maximum pollutant concentrations at ARs*

The predicted maximum 1-hour, 8-hour, 24-hour, 1-month and annual average pollutant concentrations (for 1992 and 1993 respectively) at the identified ARs are presented in *Appendix A*. Receptors at Siu Lang Shui Landfill site and at the boundary of the Castle Peak Firing Range are most affected by the CIF emissions due to their close proximity and elevated nature. The maximum 1-hour and annual average concentrations for 1993, the year of highest impacts, are shown in the form of contour maps in *Figures 3.7a* and *3.7b*.

Maximum short-term pollutant concentrations were predicted at the boundary of the Castle Peak Firing Range, maximum long-term concentrations were predicted at the proposed chemical waste bulking facility in the SIA. All pollutant concentrations are well below the respective AQOs.

It is considered that the CIF operating at full load will not generate significant short and long term air quality impacts to the identified existing and planned landuses in the area, when compared against the appropriate AQOs.

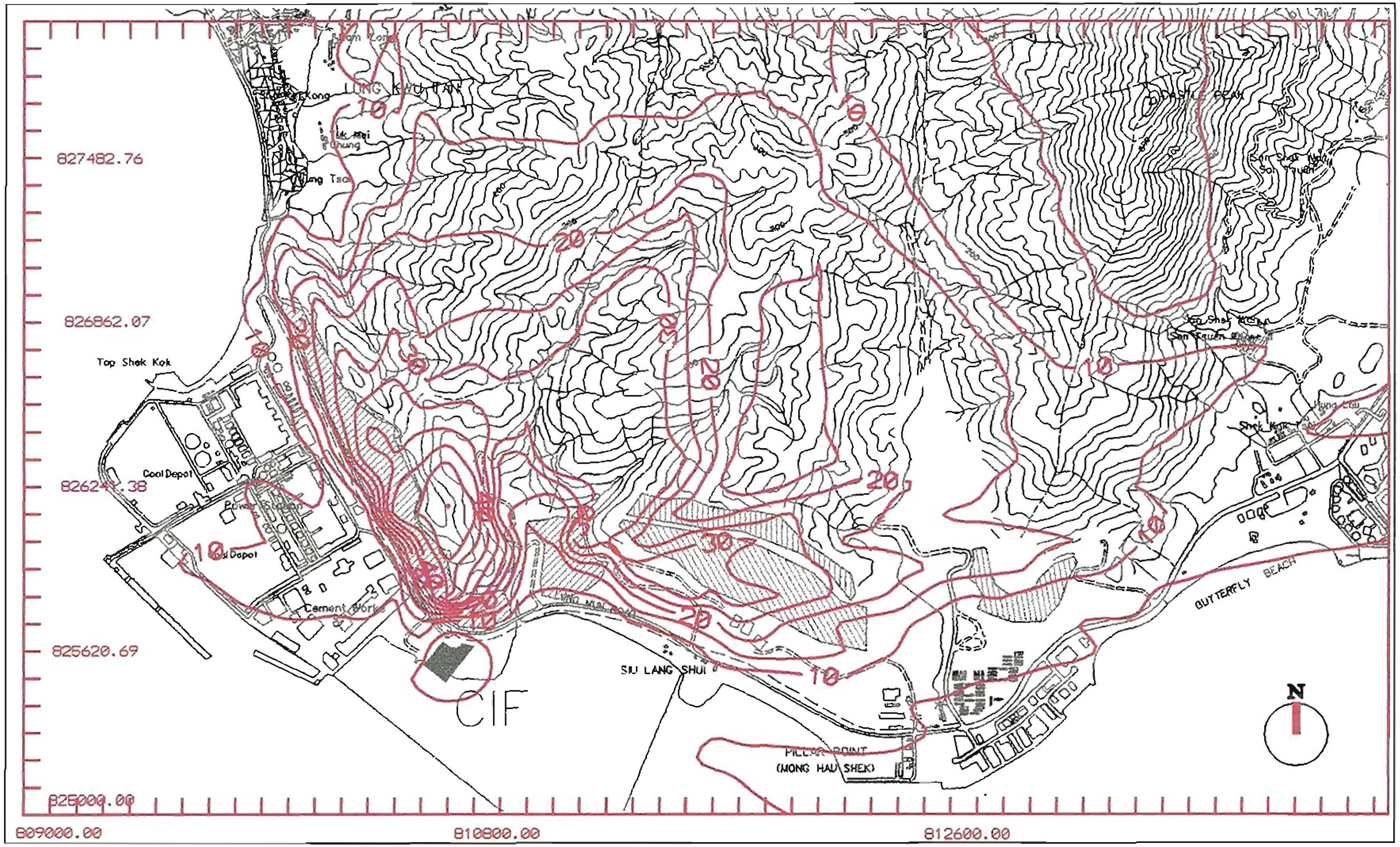


FIGURE 3.7a 1 Hour Averaged Stack Gas Discharge Ground Level Concentration Based on Emission Rate of 1g/s

Date : 13 Jan 1995	Drawing No.: /ermhk/gis/C1127b/006

Sources : Air model - ERM Air & Noise group
Base map - LANDS DEPT. 1:20k topo

Prepared by ERM's GIS & MAPPING group

KEY

- CIF site
- Ground level concentration contour
- Max. conc. lv (micro gram/cubic metre)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

Table 3.7a *Summary of maximum 1-hour, 8-hour, 24-hour, 1 month and annual average pollutant concentrations predicted at 10 mPD and 35 mPD ($\mu g\ m^{-3}$)*

Pollutant	10 mPD					35 mPD				
	1-hour	8-hour	24-hour	1-month	Annual	1-hour	8-hour	24 hour	1-month	Annual
Particulates										
1992	4.4[a]	1.9	0.8	0.2	0.1	4.7[1]	2.5	1.1	0.3	0.2
1993	5.5[b]	1.9	0.8	0.2	0.1	6.2[2]	2.3	1.0	0.3	0.2
AQO			180		55			180		55
Lead										
1992	0.0083[a]	0.0035	0.0015	0.0005	0.0002	0.0088[1]	0.0047	0.0022	0.0006	0.0003
1993	0.0104[b]	0.0035	0.0014	0.0004	0.0002	0.0117[2]	0.0043	0.0019	0.0005	0.0003
AQO				1.5 (3 *months*)					1.5 (3 *months*)	
SO_2										
1992	22.2[a]	9.5	4.0	1.2	0.6	23.5[a]	12.6	5.8	1.6	0.8
1993	27.7[b]	9.4	3.7	1.0	0.5	31.1[b]	11.5	5.0	1.4	0.8
AQO	800		350		80	800		350		80
NO_2										
1992	35.5[a]	15.1	6.4	1.9	0.9	37.6[a]	20.2	9.2	2.6	1.2
1993	44.3[b]	15.0	6.0	1.6	0.9	49.7[b]	18.4	8.1	2.3	1.3
AQO	300		150		80	300		150		80
CO										
1992	8.9[a]	3.8	1.6	0.5	0.2	9.4[a]	5.1	2.3	0.6	0.3
1993	11.1[b]	3.8	1.5	0.4	0.2	12.4[b]	4.6	2.0	0.6	0.3
AQO	30,000	10,000				30,000	10,000			
Distance from the CIF main stack (m)										
1992	316	300	412	316	412	316	200	224	224	316
1993	632	361	316	300	447	539	224	224	200	224

Note: (a) The maximum 1-hour average pollutant concentrations were predicted under 100° wind direction, 1.7 $m\ s^{-1}$ wind and stability B.
(b) The maximum 1-hour average pollutant concentrations were predicted under 290° wind direction, 1.4 $m\ s^{-1}$ wind and stability D.

3.7.3 *Discussion of Results*

The maximum short term average pollutant concentrations at 10 mPD and 35 mPD were predicted between 200 m to 640 m from the CIF main stack under stability D and wind speeds less than 2 m s^{-1}.

For all pollutants, the predicted maximum short and long term average concentrations at 10 mPD and 35 mPD are within the AQO limits.

The maximum 1-hour pollutant concentrations will be at the Castle Peak Firing Range Boundary predicted at night-time, under Stability F and 1 m s^{-1} wind speed. The actual night-time air quality impacts from the CIF are likely to be less than 70% of the predicted maximum hourly pollutant concentrations, as the cremator unit is not planned to be in operation at night.

The maximum annual concentrations were predicted at the proposed chemical waste bulking facility in the SIA. The data presented in *Appendix A* shows that the predicted short and long term pollutant concentrations are well below the respective AQOs.

The percentages of the 1-hour AQO attributable to the CIF for NO_2 and SO_2 at 10 mPD and 35 mPD are given in *Table 3.7b*. The percentage of 1-hour AQOs for SO_2 and NO_2 at Siu Lang Shui, Lung Tsai and at the boundary of the Castle Peak Firing Range is given in *Table 3.7c*.

Table 3.7b *Air Quality Impacts (% of 1-hour AQO) from CIF at 10 mPD and 35 mPD*

Elevation (mPD)	SO_2	NO_2
10	3.5	4.5
35	3.9	5.0

Table 3.7c *Air Quality Impacts (% of 1-hour AQO) from CIF at ARs*

Location	SO_2	NO_2
Siu Lang Shui	7.1	10.7
Lung Tsai	2.2	2.8
Firing Range Boundary	9.0	11.5

By comparing *Tables 3.7b* and *3.7c* with *Table 3.3c* for Tuen Mun Area 38, it is clear that the contribution from the CIF is very low when compared with other existing and planned sources in the area.

The modelling results show that the CIF, with a stack of 60 m, will not present adverse short or long term air quality impacts to the surrounding area. Emissions are acceptable in terms of the HK AQO and will not lead to constraints on existing and future landuses.

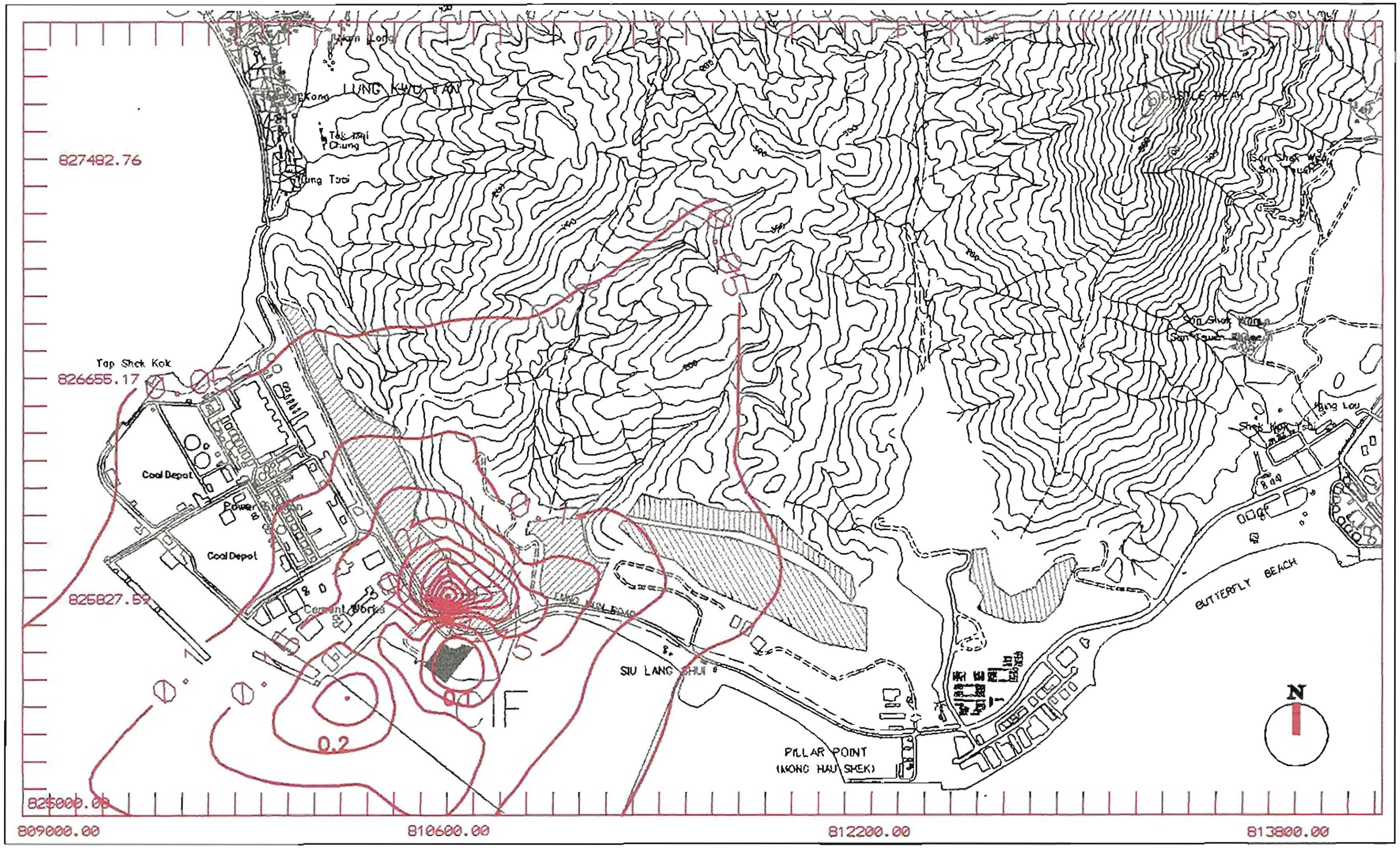


FIGURE 3.7b Annual Averaged Stack Gas Discharge Ground Level Concentration Based on Emission Rate of 1g/s

Date : 13 Jan 1995

Drawing No.: /ermhk/gis/C1127b/007

Sources : Air model - ERM Air & Noise group
Base map - LANDS DEPT. 1:20k topo

Prepared by ERM's GIS & MAPPING group

KEY

- CIF site
- Ground level concentration contour
- Max. conc. lv (micro gram/cubic metre)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

3.8 CONCLUSIONS AND RECOMMENDATIONS

3.8.1 *Conclusions*

Dust impacts from the construction of the CIF are predicted to be within the AQOs, the nearest ARs are at least 1.8 km from the site.

The potential short and long term air quality impacts from the CIF during its operational phase to the surrounding environment were predicted using 1992 and 1993 sequential hourly meteorological data obtained for Lau Fau Shan. The modelling results show that, for the substances covered by the AQOs, the CIF with 60 m stack and operating at full load and at the proposed emission limits will not lead to air quality impacts to the surrounding environment or to the identified ARs which exceed the established standards.

Area 38 has been designated for special industries and aerial emissions will be generated, *inter alia*, from a power station, a cement works and a steel works within a few hundred metres of the CIF. The close proximity of several other sources will make effective ambient air quality monitoring difficult due to the problem of identifying the origin of emissions.

However, ambient monitoring would still provide a valid indication of deteriorating air quality in the area and could be used to record levels of identified pollutants at residential sites.

Operations at the CIF will involve transport, reception, handling, storage and removal of materials that could give rise to significant fugitive particulate emissions. These materials will consist of scrubber and water treatment reagents, bottom ash from the incinerator and dewatered sludge from the wastewater treatment plant.

During the transport and handling of clinical wastes and animal carcases, odour nuisance to the surrounding area is possible if adequate controls are not applied.

3.8.2 *Recommendations*

As the existing air quality in the vicinity of the CIF site is already poor due to high dust levels, it is recommended that:

- **good on-site management and dust suppression measures should be adopted to minimize additional dust emissions to the surrounding area during the construction of the CIF.**

In addition, to control fugitive emissions during the operation of the CIF, it is also recommended that:

- **the wastewater treatment plant and the potential incinerator dust sources of the CIF should be enclosed and these areas operated under a negative pressure to ensure all exhaust air is either filtered before**

discharge to atmosphere or drawn through the incinerators before being emitted to the surrounding area via the stack.

To prevent odour nuisance from incoming wastes, it is recommended that:

- **all wastes should be transported to the CIF in sealed containers in order to ensure no odour nuisance to ARs en-route. All clinical wastes and animal carcases should be handled within the main incinerator buildings where a negative pressure is maintained to prevent fugitive emissions.**

An EM&A programme should be developed which can be applied to:

- **construction dust, ambient air quality (for stack gas emissions) and operational odours.**

4 *LONG TERM HEALTH RISK*

4.1 *INTRODUCTION*

This *Section* provides an evaluation of potential health risks associated with atmospheric emissions from the proposed CIF not covered by the AQOs. The evaluation is linked to the air quality assessment and is based upon the maximum long–term annual average and maximum hourly average concentrations of a range of substances.

4.2 *RISK ASSESSMENT – THEORY*

4.2.1 *Basic Concepts and Definitions*

Risk assessment is the means of evaluating the toxic properties of a substance and the human exposure to it in order to ascertain the likelihood that exposed humans will be adversely affected, and to characterise the nature of the effects. Risk is the probability of injury, disease, or death under specific exposure circumstances. It may be expressed in quantitative terms, taking values from zero (certainty that harm will not occur) to one (certainty that it will). In many cases risk can only be described qualitatively, as "high", "low", "trivial", etc.

Almost all human activities carry some degree of risk. Many risks are known with a relatively high degree of accuracy, because data have been collected on their historical occurrence. *Table 4.2a* lists the risks of some common activities. The risks associated with many other activities, including the exposure to various chemical substances, cannot be precisely assessed and quantified. Although there are considerable historical data on the risks of exposure to high doses of chemicals and some types of exposure (*eg* the annual risk of death from intentional overdoses or accidental exposures to drugs, pesticides, and industrial chemicals), such data are generally restricted to those situations in which an exposure resulted in an observable form of injury. Assessment of the risks of levels of chemical exposure that do not cause an immediately observable form of injury or disease, (or only minor forms such as transient eye or skin irritation) is far more complex, irrespective of whether the exposure may have been brief, extended but intermittent, or extended and continuous. It is the latter type of risk assessment activity that is considered in this *Section*.

Risk statistics are given here as the average over the whole population of Great Britain, except where there is a specific small group exposed (eg rock climbers). The figures are given as the chance in a million that a person will die from that cause in any one year, averaged over a whole lifetime (except where otherwise stated).

Table 4.2a *Examples of Individual Risks*

Causes	Risk per million per year
All causes (mainly illness from natural causes)	11,900
Cancer	2,800
(These figures vary greatly with age)	
All violent causes (accident, homicide, suicide etc)	396
Road accidents	100
Accidents in private homes (average for occupants only)*	93
Fire or flame (all types)*	15
Drowning*	6
Gas incident (fire, explosion or carbon monoxide poisoning)	1.8
Excessive cold*	8
Lightning	0.1
Accidents at work - risks to employees	
Deep-sea fishing (UK vessels)	880
Coal extraction and manufacture of solid fuels	106
Construction	92
All manufacturing industry	23
Offices, shops, warehouses etc inspected by local authorities	4.5
Leisure-risks to participants during active years	
Rock climbing (assumes 200 hours climbing per	8,000
year)	2,000
Canoeing (assumes 200 hours per year)	1,500
Hang-gliding (average participant)	

Source: *The Tolerability of Risk from Nuclear Power Stations, Health and Safety Executive (HSE)* (excerpt * *OPS Monitor series DH4 No 11, 1985, and Registrar-General for Scotland, Annual Report, 1985*).

The term "safe", in its common usage, means "without risk". In technical terms this common usage is misleading because science cannot ascertain the conditions under which a given chemical exposure is likely to be absolutely without a risk of any type. The latter condition, zero risk, is immeasurable. Science can however, describe the conditions under which risks are so low that they would generally be considered to be of no practical consequence to members of a population. As a technical matter, the safety of chemical substances, whether in food, drinking water, air, or the workplace, has always been defined as a condition of exposure under which there is a "practical certainty" that no harm will result in exposed individuals.

These conditions usually incorporate large safety factors, so that even more intense exposures than those defined as safe may also carry extremely low risks. We note that most "safe" exposure levels established in this manner are probably risk-free, but science has no tools to prove the existence of what is essentially a negative condition.

Another concept concerns classification of chemical substances as either "safe" or "unsafe" (or as "toxic" and "non-toxic"). This type of classification, while common, is highly problematic and potentially misleading. All substances, even those which we consume in high amounts every day, may be made to produce a toxic response under some conditions of exposure. In this sense, many substances are toxic. The important question is not simply that of toxicity, but rather that of risk ie, the probability that the toxic properties of a chemical will be realised under actual or anticipated conditions of human exposure. To answer the latter question requires far more extensive data and evaluation than the characterisation of toxicity.

4.2.2 *The Components of Risk Assessment*

Risk assessment can be divided into four major steps:

- hazard identification;
- dose–response evaluation;
- exposure assessment;
- risk characterisation.

Each is discussed in the following sections.

Hazard Identification

Hazard identification is the process of determining whether human exposure to a chemical could cause an increase in adverse health conditions. It involves characterising the nature and strength of emissions, selecting a set of "indicator" chemicals, gathering and evaluating data on types or health injury or disease that may be produced by a chemical and on the conditions of exposure under which injury or disease is produced.

Dose–Response Evaluation

Dose–response evaluation involves quantifying the relationship between the degree of exposure to a substance and the extent of toxic injury or disease. Data is derived from animal studies or, less frequently, from studies in exposed human populations. There may be many different dose–response relationships for a substance if it produces different toxic effects under different conditions of exposure. The risks of a substance cannot be ascertained with any degree of confidence unless dose–response relations are quantified, even if the substance is known to be "toxic".

Exposure Assessment

The purpose of an exposure evaluation is to determine the intake of each indicator chemical by potentially exposed populations. This involves characterisation of the major pathways of contaminant transport leading from the stack to the points of exposure. Exposure evaluation considers various routes of chemical release and migration of contaminants from the site to targeted populations by:

- evaluating fate and transport processes for the indicator chemicals;

- establishing likely exposure scenarios for each medium (eg air, diet, etc);
- determining the concentrations of the indicator chemicals in each medium;
- determining exposures to potentially affected populations;
- calculating maximum short-term or average lifetime doses and resultant intakes.

The resultant doses to and intakes by potentially exposed populations are calculated once exposure concentrations in all relevant media have been determined. Dose is defined as the amount of chemical contacting body boundaries (skin, lungs, or gastrointestinal tract) and intake is the amount of chemical absorbed by the body. When the extent of intake from a dose is unknown, or cannot be estimated, dose and intake are taken to be same (100% absorption from contact).

Risk Characterisation

Risk characterisation generally involves the integration of the information and analysis of the first three steps. Risk is generally characterised as follows.

- For non-carcinogens, and for the non-carcinogenic effects of carcinogens, the margin of exposure is estimated by dividing a derived "safe" dose by the estimated daily human dose.
- For carcinogens, risk is estimated against the human dose by multiplying the actual human dose by the risk per unit of dose projected from the dose-response modelling. A range of risks might be produced, using different models and assumptions about dose-response curves and the relative susceptibilities of humans and animals.

Although this step can be more complex than is indicated above, especially if issues of timing and duration of exposure are introduced, the margin of exposure and the carcinogenic risk are the ultimate measures of the likelihood of human injury or disease from a given exposure or range of exposures.

4.3 *HAZARD IDENTIFICATION*

4.3.1 *Introduction*

This *Section* presents a framework for the evaluation of the potential human health effects associated with exposure to atmospheric emissions from the CIF. Substances of concern are first classified into two groups, based on their toxicological properties, ie, whether or not they are considered to be carcinogenic. Assessment criteria are then developed for each type of toxicological effect.

4.3.2 *Substances of Concern*

The CIF will be designed to meet the proposed atmospheric emission limits, this involves compliance with proposed emission standards for the substances listed previously in *Table 3.5a*.

The impacts of total particulates, CO, NO_x, SO_2 and lead have already been assessed in *Section 3* in relation to the AQOs. The impacts of the remaining substances are assessed in this *Section*.

4.3.3 *Categorisation of Health Effects*

Introduction

For the purpose of the assessment, the substances of concern were classed within two categories, depending on whether they exhibited carcinogenic or non-carcinogenic behaviour. Some substances were included within both categories.

A carcinogenic health effect can be produced through the mechanisms of initiation or promotion. Genotoxic substances induce cancers by causing mutations in DNA, whereas non-genotoxic substances cause initiated cells to proliferate or differentiate. The two mechanisms differ in that their modes of action lead to fundamentally different techniques for risk assessment. On the one hand, genotoxic substances are generally treated as carcinogens for which there is no threshold below which carcinogenic effects are not manifested; in other words, zero risk is associated with zero exposure. However, non-genotoxic substances are treated as substances which can be tolerated by the receptor up to some finite concentration or dose, beyond which toxic effects are then manifested. In this study, we have assumed a non-threshold approach for all carcinogens, ie, all carcinogens are considered to be genotoxic.

Non-carcinogens are also believed to operate as threshold substances, in that a physiological reserve capacity exists within the receptor (represented, for example, by a large number of cells performing the same function) which must be depleted before clinical manifestations occur. Thus the receptor can tolerate doses below a certain finite value, with only a limited chance of the expression of toxic effects.

The dose-response relationship presented above is discussed further below.

Dose Response Relationships

One of the fundamental principles of toxicology is the dose response relationship. For virtually all substances, there is a direct relationship between the exposure levels (and duration) and the severity of the toxic effects produced. As the exposure level (and/or duration period) is lowered, for the great majority of toxic effects, normally a point is reached at which no detectable effect occurs. This is termed the threshold dose, no effect level or "Reference Dose" (RfD). Not all biological changes produced by a chemical are of relevance to human health, and therefore it is often helpful to distinguish between a no effect level and a no significant effect level. Toxicity studies often permit the direct identification of the no effect and/or the no significant effect level, or, on extrapolation of the data produced from such studies to lower doses, there appears to be a probable no effect level. A safety factor is then normally introduced to allow for uncertainties in the extrapolation process.

For genotoxic substances, there are theoretical grounds for presuming that there may not be a true no effect level. For these carcinogens a virtually safe dose must be calculated instead. Many authorities have taken the virtually safe dose to be that level of a substance which will produce not more than one cancer death per one hundred thousand or one million of the human population per annum. This may also be expressed as an individual's lifetime excess cancer risk.

Where a no effect level cannot be demonstrated experimentally, mathematical models have been developed, particularly in the USA, to enable a worst case extrapolation from high doses to much lower exposures to be made. Using such calculations, the USEPA has also ranked substances causing cancer in animals using so called potency factors. As shown in *Section 4.5.1*, there is a discrepancy between the results from different mathematical models and often the results seem to be at variance with mechanistic and epidemiological findings. Consequently, these models have not so far found favour among legislative authorities in Europe, where safety factors are still the preferred alternative approach for allowing for uncertainties in extrapolation.

Concern is often expressed about the hazard to health from exposure to mixtures of substances, rather than individual substances. There is no agreed procedure among toxicologists for estimating such a hazard. The toxic effects of two substances in combination may be the sum of the individual toxicities, ie additive; more than the sum, ie synergistic or less than the sum, ie antagonistic. Synergism appears to be, in practice, a very much less common phenomenon than a noticeable combined effect or an additive effect. However, since there is a lack of direct data on most chemical combinations, the most reasonable strategy is to assume that chemicals which affect the same target organ, in a similar manner, will have additive toxicities.

4.3.4 *Health Criteria for Non-Carcinogens*

Introduction

The USEPA has published Reference Concentrations (RfC) for a variety of substances. The RfCs are a provisional estimate of the daily exposure to the population (including sensitive subgroups) that is likely to be without an appreciable risk of adverse effects during a lifetime. The RfC is typically a

No-Observed-Adverse-Effect-Level (NOAEL) or a Lowest-Observed-Adverse-Effect-Level (LOAEL), with an adjustment to account for possible areas of uncertainty. RfCs will be used, wherever possible, for all substances of concern and are listed in *Table 4.3a*.

Table 4.3a *Chronic Reference Concentrations*

Substance	RfC (mg m^{-3})
Hydrogen Chloride	7×10^{-3}
Mercury	3×10^{-4}
Lead	1.5×10^{-3} (a)

Note: (a) National Ambient Air Quality Standard. Quarterly average.

Long-term Air Quality Standards

Where chronic RfCs are not available, occupational exposure limits provide a reasonable basis for calculating safe air concentration standards, called Long-term Air Quality Standards or LAQS in this *Section*.

There is an important consideration with respect to this approach, the key toxicity data used for determining an occupational exposure limit may be either actual data on workers (where exposure is normally not greater than 50 hours per week) or animal toxicity data. In the latter case the exposure to the chemical is usually in the diet seven days per week, as it is intended typically, to simulate continual daily exposure to the chemical (albeit not by the inhalation route).

Information on the effects of workers regularly exposed to a substance, if reliable, are highly valid; consequently, a relatively small safety factor may be introduced in setting a workplace standard. There may be difficulties, however, in extrapolating such findings to a 24 hour per day, 7 days per week, 52 weeks in the year exposure. As a consequence, the findings from the continuous exposure of animals may be more directly relevant.

As a result of the deliberations of the national committees (in the UK, the WATCH and ACTS Committees) on the precise criteria which have been used to set occupational exposure limits, the basis for the decision on the level to be used for a particular chemical usually cannot be identified. Thus it is not possible to establish, for each chemical of interest, the legitimacy of using the occupational exposure limit to calculate an LAQS.

A solution to this problem is to take the occupational exposure limit figure and divide by a safety factor allowing for the following factors. The duration of exposure per week could be as much as 168 hours (7 x 24 hours) rather than 40 hours (5 x 8 hours). Moreover exposure might extend to 52 weeks in the year as opposed to an average working year of 44 weeks (but see below). On these grounds the minimum safety factor would be 4.96 (ie 168/40 x 52/44) although, on the basis that in principle there may be no recovery period between exposure sessions, a safety factor of 10 might be considered more reasonable.

Secondly, a complete spectrum of the population (eg children, the elderly, those with diseases, such as asthmatics) could be exposed rather than just healthy workers between the ages of 16 and 65. A safety factor of 10 should be introduced to allow for possible variability in human response to individual chemicals in other spheres of toxicological safety calculations, eg establishing safe residues of additives, pesticides and drugs in food for human consumption.

Combining the two sets of safety factors from the above (ie 10 x 10), we get an environmental LAQS which is 1/100th of the OEL. In the UK two types of "shift" OELs are distinguished: occupational exposure standards (OESs) and maximum exposure limits (MELs). The requirements for compliance are more stringent for MELs, ie: it is a legal offence to exceed the MEL at any time (*COSHH Regulations 1989*). MELs are set for those chemicals where the nature of the toxicity is of particular concern and/or there is some doubt about the actual no effect level. The effect of setting an MEL is to increase the emphasis on the control in the workplace of the airborne levels of a chemical. In practice this produces an additional safety factor of up to 5 for chemicals which have MELs over those which have OES values. It can be argued therefore that in calculating environmental LAQSs for substances with MELs, a safety factor more than 100 should be employed. As effectively an additional factor of up to 5 is achieved in the workplace by setting an MEL, this factor has been used in this assessment in determining an environmental LAQS for those chemicals listed as having MELs in HSE Guidance Note EH 40/92 (ie a safety factor of 500 (10 x 10 x 5) is used to set the LAQS). Such an approach to setting LAQS, although admittedly somewhat arbitrary, errs strongly on the side of conservatism, which infers that should air concentrations meet the LAQSs, it is safe to assume that no health effects would occur.

Calculating LAQSs in this way meets an important practical need in that it allows a guideline level to be identified very simply for the great majority of substances of concern. It is worth emphasising the OELs from which such LAQS values are derived are based on the extensive deliberations of experienced toxicologists.

Applying the above approach for setting LAQSs (ie for substances with occupational exposure standards LAQS = OEL/100 and for those substances with maximum exposure limits LAQS = MEL/500) to the substances of concern, it is possible to make an assessment of the likelihood of any human hazard arising from atmospheric emissions from the proposed CIF (see *Table 4.3b*). It should be noted in considering this data, that in the case of metals the assumption has been made, in the absence of definitive data to the contrary, that the worst case situation pertains, namely that they occur in air as their most toxic inorganic salts. In reality most are likely to exist as the metal itself or the metal oxide or metal chloride.

Table 4.3b Long-term Air Quality Standards Based on Occupational Exposure Limits

Substance	OEL (mg m^{-3})	LAQS (μg m^{-3})
Carbon monoxide	55.00	550
Total particulates	5.00	50
Oxides of nitrogen	5.00	50
Sulphur dioxide	5.00	50
Lead [(a)]	0.15	0.3
Hydrogen bromide	-	-
Hydrogen fluoride	-	-
Copper	0.20	2.0
Manganese	1.00	10.0
Nickel [(a)]	0.50	1.0
Arsenic [(a)]	0.10	0.2
Hydrogen sulphide	-	0.66[(c)]
Cadmium [(a)]	0.05	0.1
Mercury	0.05	0.5
Chlorine	1.5	15
Antimony	0.50	5.0
Fluorine	-	-
Zinc[(b)]	5.0	50
Chromium III	0.50	5.0
Chromium VI[(a)]	0.01	0.02

Notes: (a) Substances have an MEL.
(b) As zinc oxide.
(c) Odour Threshold

Other Air Quality Standards Used by Non-HK Authorities

The US EPA has laid down a number of ambient air quality standards and these are set out in *Table 4.3c*, alongside the Air Quality Guidelines of the World Health Organisation (WHO) for Europe (*Air Quality Guidelines for Europe, WHO Regional Publications, European Series No. 23, 1987*). The WHO Guidelines are intended to be used both for risk management decisions on existing emission sources and in the planning process. Compliance with the guideline value "will not have adverse effects on human health and, in the case of odorous compounds will not create a nuisance of indirect health significance". Nonetheless, "highly sensitive groups, especially impaired by concurrent disease or other physiological limitations may be affected at or near concentrations referred to in the guideline values".

It can be seen that the US EPA values are higher than the calculated LAQS values. The WHO guideline values are comparable to the LAQS values for the majority of substances, but substantially lower for cadmium.

Table 4.3c *Comparison of Calculated LAQS with International Guideline Values*

Substance	**LAQS ($\mu g\ m^{-3}$)**	**WHO Air Quality Guideline Value ($\mu g\ m^{-3}$)**	**US EPA Air Quality Standards ($\mu g\ m^{-3}$)**
Carbon monoxide	550	–	–
Total particulates	50	–	–
Oxides of nitrogen	50	150	100
Sulphur dioxide	50	50[(a)]	80
Hydrogen chloride	–	–	7.0[(c)]
Lead	0.3	0.5	1.5
Hydrogen bromide	–	–	–
Hydrogen fluoride	–	–	–
Copper	2.0	–	–
Manganese	10.0	1.0	–
Nickel	1.0	–	–
Arsenic	0.2	–	–
Hydrogen sulphide	0.66	–	–
Cadmium	0.1	1.0×10^{-3}	–
Mercury	0.5	1.0[(b)]	0.3[(c)]
Chlorine	15	–	–
Antimony	5.0	–	–
Fluorine	–	–	–
Zinc	50	–	–
Chromium III	5.0	–	–
Chromium VI	0.02	–	–

Note: (a) Assumes combination with particulates.
(b) Indoor air only.
(c) Chronic RfC.

Short-term Air Quality Standards (SAQS)

The US EPA has published subchronic RfCs for a variety of substances. These are presented in *Table 4.3d* and will be used wherever possible.

Table 4.3d *Subchronic RfCs*

Substance	**RfC ($mg\ m^{-3}$)**
Hydrogen Sulphide	9×10^{-3}
Manganese	4×10^{-4}
Mercury	3×10^{-4}

Short-term exposure limits (STELs) have been published by the HSE for a number of substances. For the purposes of this assessment, STELs have been used to calculate short-term air quality standard (SAQSs) against which peak hourly average concentrations can be compared. STELs include a margin of safety to take into account differences in individual sensitivities to exposure; therefore it is proposed to use STEL/10 as the SAQS (*Bridges, J W, Consideration of the Possible Impact on Human Health Vol. 1, Proof of Evidence, Refuse to Energy Plant, Belvedere, Bexley, 1992*) where subchronic

RfCs are not available. A summary of STEL and SAQs values for the substances of concern is presented in *Table 4.3e*.

Table 4.3e *SAQS Values*

Substance	STEL ($mg\ m^{-3}$)	SAQS ($\mu g\ m^{-3}$)
Chlorine	3	300
Fluorine	1.5	150
Zinc	10	1,000
Carbon monoxide	330	33,000
Oxides of nitrogen	9	900
Sulphur dioxide	13	1,300
Hydrogen chloride	7	700
Hydrogen fluoride	2.5	250
Manganese	3	300
Tin	4	400
Mercury	0.15	15
Hydrogen bromide	10	1,000
Hydrogen sulphide	21	2,100

4.3.5 *Health Criteria for Carcinogens*

Cancer Potency Factors

For chemicals exhibiting carcinogenic effects, US EPA's Carcinogen Assessment Group (CAG) has developed cancer potency factors to estimate the excess lifetime cancer risks associated with various levels of exposure to potential human carcinogens. The cancer potency factor (CPF) is a number which when multiplied by the lifetime average dose of a potential carcinogen, yields the lifetime cancer risk resulting from exposure at that dose.

In practice, cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays. The data from animal studies are fitted to the linearised multistage model and a dose-response curve is obtained. The low-dose slope of the dose-response curve is subjected to various adjustments, and an interspecies scaling factor is applied to derive the cancer potency factor for humans.

Dose-Response Models

If a particular type of damage occurs to the genetic material (DNA) of a cell, that cell may undergo a series of changes that eventually result in the production of a tumour; however, the time required for all the necessary transitions that culminate in cancer may be a substantial portion of an animal's or human's lifetime. Carcinogens may also affect any number of the transitions from one stage of cancer development to the next. Some carcinogens appear capable only of initiating the process. Others act only at later stages, the natures of which are not well known (so-called promoters may act at one or more of these later stages) and some carcinogens may act at several stages.

Several mathematical models have been developed to estimate low dose risks from high dose risks. Such models describe the expected quantitative relationship between risk at the dose of interest. The accuracy of the projected risk is a function of how accurately the mathematical model describes the true, but immeasurable, relationship between dose and risk at the low dose levels.

Various models may lead to very different estimations of risk. None is chemical-specific; that is, each is based on general theories of carcinogenesis rather than on data for a specific chemical. None can be proved or disproved by current scientific data, although future results of research may increase our understanding of carcinogenesis and help in refining these models. Regulatory agencies currently use one-hit, multistage, and probit models, although regulatory decisions are usually based on results of the one-hit or multistage models. Multihit, Weibull, and logic models for risk assessment, have also been used.

If these models are applied to the data for a hypothetical chemical, the following estimates of lifetime risk for male rats at the dose of 1.0 mg kg^{-1} day^{-1} are derived.

Model Applied	*Lifetime Risk at 1.0 mg kg^{-1} day^{-1}*
Onehit	6.0×10^{-05} (one in 17,000)
Multistage	6.0×10^{-06} (one in 167,000)
Multihit	4.4×10^{-07} (one in 230,000
Weibull	1.7×10^{-08} (one in 59 million)
Probit	1.9×10^{-10} (one in 5.2 billion)

There may be no experimental basis for deciding which estimate is closest to the truth. Nevertheless, it is possible to show that the true risk, at least to animals, is very unlikely to be higher than the highest risk predicted by the various models.

In cases where relevant data exist on biological mechanisms of action, the selection of a model should be consistent with the data. However, in many cases such data are very limited, resulting in great uncertainty in the selection of a model for low dose extrapolation. Understanding of the mechanism of the process of carcinogenesis is currently quite limited. Biological evidence, does indicate the linearity of tumour initiation, consequently linear models are frequently used by regulatory agencies.

The one-hit model always yields the highest estimate of low dose risk. This model is based on the biological theory that a single "hit" of some minimum critical amount of a carcinogen at a cellular target, namely DNA, can initiate an irreversible series of events that eventually lead to a tumour.

The multistage model, which yields risk estimates either equal to or less than the one-hit model, is based on the same theory of cancer initiation. However, this model can be more flexible, allowing consideration of the data in the observable range to influence the extrapolated risk at low dose. It is also based on the multistage theory of the carcinogenic process and thus has a plausible scientific basis. The US EPA generally uses the linearised multistage model for low dose extrapolation because its scientific basis, although limited, is considered the strongest of the currently available extrapolation models. This model yields estimates of risk that are conservative, representing a plausible upper limit for the risk. In other words, it is unlikely that the "actual" risk is higher than the risk predicted using this model.

Thus, cancer potency factors based on extrapolation and fitting of dose–response data using the linearised multistage model provide plausible estimates for the upper limits on lifetime risk. While the actual risk is unlikely to be higher than the estimated risk, it could be considerably lower.

Assessment Values

A summary of the CPFs used in the assessment in presented in *Table 4.3f.*

Table 4.3f *Inhalation Cancer Potency Factors*

Substance	CPF ((mg kg^{-1} day^{-1})$^{-1}$)
PCDD/PCDF [(a)]	$1.56 \times 10^{+05}$
Nickel[(b)]	8.40×10^{-01}
Arsenic[(c)]	$5.00 \times 10^{+01}$
Cadmium	$6.10 \times 10^{+00}$
Chromium VI	$4.10 \times 10^{+01}$

Notes: (a) For 2,3,7,8–TCDD.
(b) Assumes Ni present as a refinery dust, Class A carcinogen, IRIS.
(c) Class B1 carcinogen, Integrated Risk Information System database.

4.4 EXPOSURE AND RISK ASSESSMENT METHODOLOGY

4.4.1 *Assumptions Concerning Exposure*

For each significant exposure pathway identified, the magnitude of potential exposures to individuals was estimated. Environmental concentrations of each chemical of concern at the point of exposure were quantified and the amount of exposure to potential receptors estimated. Prediction of environmental concentrations at the exposure points involved the quantification of the amounts of chemicals that may be released into the environment by the proposed CIF, evaluation of the transport and fate of each chemical in the identified medium, and the derivation of concentrations at the point of exposure. Thus for each substance and each significant exposure pathway, the assessment estimated environmental concentrations at the selected exposure points.

For each exposure pathway, it is important to identify the Maximum Exposed Individual (MEI). The MEI is a hypothetical individual whose identity will vary with each pathway. In this assessment a conservative assumption is made that the MEI is a permanent resident in the area of maximum concentration. The MEI is therefore that individual who would be expected to experience the greatest risk and, therefore, require the greatest protection.

4.4.2 *Inhalation*

Non-Carcinogenic Health Effects

As described in *Section 4.4*, the criteria for characterising non-carcinogenic health effects is taken as OEL/100 or MEL/500 for long-term exposures and STEL/10 for short-term exposures. For this assessment, the concentration of the emitted substances, at the point of maximum impact, was in each case compared against the appropriate standard and, where appropriate, against other air quality standards.

Carcinogenic Health Effects

The equations used for the calculation of unit carcinogenic risk are taken from *Risk Assessment Guidance for Superfund Human Health Evaluation Manual Part A, USEPA, 1989* and are as follows:

$$Risk = Potency \times Inhalation\ Exposure$$

$$Inhalation\ Exposure = \frac{Total\ Dose}{Body\ Weight \times Lifetime}$$

and

$$D_{inh} = C_a \times IR \times ED \times EF \times LF$$

Where:

D_{inh} = total dose (mg);
C_a = concentration in air (mg m^{-3});
IR = inhalation rate (m^3 day^{-1});
ED = exposure duration (a);
EF = outdoor exposure factor (dimensionless).
LF = lung absorbtion factor (dimensionless)

The input data for the calculations were as follows:

Outdoor exposure factor	=	0.7
Average human lifetime	=	70 years
Average adult body weight	=	70 kg
Volume inhaled daily	=	20 m^3 $person^{-1}$ day^{-1}
Exposure duration	=	70 years
Cancer potency factor:		See *Table 4.3f*

Lung absorption factor:

Arsenic	=	0.30
Cadmium	=	0.40
Nickel	=	0.75
Chromium VI	=	0.25
PCDD/F	=	0.35

The outdoor exposure factor takes account of the fact that an individual spends at least as much time indoors as out of doors and is therefore exposed to lower concentrations of chemicals via the inhalation route. This assessment follows the US EPA recommendation for a value of 0.7 for the outdoor exposure factor.

4.5 *RISK CHARACTERISATION*

4.5.1 *Introduction*

This *Section* examines and quantifies exposures due to inhalation. Conservative assumptions were used for these calculations, for example the point of the maximum impact of the CIF continuously operating at the maximum emission rate permissable. This is the worst case scenario, thus maximising the dose received by an individual. The methodology used for risk derivation has been presented in *Section 4*.

4.5.2 *Exposure by Inhalation*

Non–Carcinogens

- Long–Term

Predicted long–term concentrations are compared with the air quality standards presented and discussed in *Section 4.4.1* (OEL/100 or MEL/500). *Table 4.5a* presents a comparison of the maximum concentrations and LAQSs.

The ratio of the maximum concentration to the LAQS is an indication of the relative risk of adverse non–carcinogenic health effects. In all cases, the ratio is significantly less than unity, indicating an additional margin of safety on top of that introduced by the LAQS.

Table 4.5a *Comparison of Predicted Concentrations with LAQSs/RfCs*

Substance	Concentration ($\mu g\ m^{-3}$) Max. Predicted Concentration	LAQS (RfC)	Conc./LAQS
Carbon monoxide	0.3	550	0.6×10^{-3}
Total particulates	0.2	50	4.0×10^{-3}
Oxides of nitrogen	1.3	50	26.0×10^{-3}
Sulphur dioxide	0.8	50	16.0×10^{-3}
Lead	0.30×10^{-3}	0.3	1.0×10^{-3}
Hydrogen Chloride (RfC)	6.2	7.0	0.9
Hydrogen bromide	0.02	-	-
Hydrogen fluoride	0.02	-	-
Copper	0.30×10^{-3}	2.0	0.15×10^{-3}
Manganese	0.30×10^{-3}	10	0.03×10^{-3}
Nickel	0.30×10^{-3}	1.0	0.3×10^{-3}
Arsenic	0.30×10^{-3}	0.2	1.5×10^{-3}
Hydrogen sulphide	0.02	0.66	30.0×10^{-3}
Cadmium	0.20×10^{-3}	0.1	2.0×10^{-2}
Mercury (RfC)	0.20×10^{-3}	0.3	0.6×10^{-3}
Chlorine	0.2	15	1.3×10^{-2}
Antinomy	0.30×10^{-3}	5.0	0.06×10^{-3}
Fluorine	0.03	-	-
Zinc	0.30×10^{-3}	50	0.006×10^{-3}
Chromium III	0.297×10^{-3}	5.0	0.06×10^{-3}
Chromium VI	0.003×10^{-3}	0.02	0.15×10^{-3}

- Short-Term

Predicted short-term concentrations are compared with the assessment criteria discussed previously in *Section 4.3.4* and the modelling results shown in *Table 4.5b*. For all substances the short-term concentration was below the respective criterion, implying that no adverse short-term effects should arise.

Table 4.5b *Short-term Effects*

Substance	Max. Predicted Concentration(ug m^{-3})	Criterion ($\mu g\ m^{-3}$)
Chlorine	6.20	300
Fluorine	1.24	150
Zinc	0.01	1,000
Hydrogen chloride	6.20	700
Hydrogen fluoride	0.62	250
Manganese[a]	0.01	0.4
Tin	0.01	400
Mercury[a]	0.007	0.3
Hydrogen bromide	0.62	1,000
Hydrogen sulphide[a]	0.62	9

Note: (a) Subchronic RfC

Carcinogens

The previously outlined carcinogenic risk assessment methodology was applied to PCDD/PCDF, nickel, arsenic, cadmium and chromium. The emission levels were based on the proposed emission limits with each individual metal assumed to make up 20% of the total metals emission. The results of these calculations are presented in *Table 4.5c*.

Table 4.5c *Carcinogenic Risk via Inhalation Exposure*

Substance	**Inhalation Exposure ($mg\ kg^{-1}day^{-1}$)**	**Lifetime Risk[a]**	**Lifetime Risk[b]**
PCDD/PCDF	2.26×10^{-14}	3.53×10^{-9}	3.53×10^{-9}
Nickel	4.50×10^{-8}	3.78×10^{-8}	0
Arsenic	1.80×10^{-8}	9.00×10^{-7}	4.50×10^{-6}
Cadmium	1.60×10^{-8}	9.76×10^{-8}	0
Chromium VI	1.50×10^{-10}	6.15×10^{-9}	0
	Total	1.04×10^{-6}	4.50×10^{-6}

Notes: (a) Assumes all metals emitted at 0.1 mg m^{-3} (20% of total permissible emission).
(b) Assumes arsenic emitted at 0.5 mg m^{-3} (100% of total permissible emission).

Under the worst case scenario and worst case exposure assumptions, where arsenic is assumed to be emitted at 0.5 mg m^{-3}, the carcinogenic risk due to inhalation is predicted to be 4.50×10^{-6} or less than 1 in 200,000.

Possible Additive Effects

The interaction, if it exists, between substances may take one of three forms, it may be additive, antagonistic or synergistic.

The available literature on such effects is very limited and, where it does exist, is largely restricted to the behaviour of metals in experimental animals. The application of such data to human studies is, at best, questionable. In the absence of any reasonable scientific basis for predicting antagonistic or synergistic reactions in complex mixtures, only examination of an additive model of toxicity is considered to be justified here.

There are two related methods of making some quantitative assessment of the toxic impact of a mixture. The first, that recommended by the HSE, is to use the following equation:

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} + \frac{C_3}{L_3} + \frac{C_n}{L_n} = X$$

Where C_1, C_2, C_3....C_n= the airborne concentrations of each chemical and L_1, L_2, L_3....L_n = the "safe levels" of each. If the total X is less than one the mixture is considered not to represent a health hazard; whereas if X is greater than one steps should be taken to reduce the concentrations of one or more of the chemicals involved.

For carcinogens, a conservative additive evaluation is achieved using the "response-addition" process, which simply sums the individual lifetime risks linearly to reflect the combined potential of cancer should a person be exposed to all of the substances over a lifetime.

Total Excess Cancer Risk = Risk 1 + Risk 2 + Risk 3 +...Risk" n"

Where:

Risk 1 = Individual excess cancer risk from a lifetime exposure from the first pollutant;

Risk "n" = Individual risk of additional carcinogens

While the "response-addition" process is encouraged as a "first-cut" or screen to indicate that a stochastic bioeffect or cancer may occur from the exposure to multiple substances, it should be remembered that cancer risk coefficients are often exaggerated in severity by at least one to two orders of magnitude. Most scientists believe that the linear relationship between dose and effect is very conservative in most cases and that calculating risk always on the 95% confidence level, based only on positive data and ignoring negative data, and always assuming lifetime exposures will result in risk coefficients that are overly conservative.

4.6 INTERPRETATION OF RISK

4.6.1 Levels of Risk

Criteria

There is considerable debate with respect to what level of risk is considered to be "acceptable". The Royal Commission on Environmental Pollution (RCEP) has recently stated (*Seventeenth Report: Incineration of Waste, RCEP, 1993*):

> "There is a consensus among regulatory authorities in the UK and USA that incremental risks of death greater than 1 in 10,000 (10^{-4}) are too high to be acceptable; and that a risk of 1 in 1,000,000 (10^{-6}) represents a reasonable upper bound beyond which measures to achieve a further reduction in the risk would not be justified in terms of the benefit gained."

Her Majesty's Inspectorate of Pollution (HMIP) has set a target risk value of 1×10^{-6} per annum for members of the general public, which is equivalent to a lifetime risk of 7×10^{-5} or 1 in 14,300 (*Board Statement on Radiological Protection Objectives for Land-based Disposal of Solid Radioactive Wastes,* *National Radiological Protection Board, 1992*). For the purposes of this assessment a target lifetime risk of 1×10^{-5} or 1 in 100,000 has been adopted. This lies at the midpoint of the range in the USA and stated by the RCEP and is seven times more stringent than that used by HMIP.

Evaluation

Prior to the evaluation of the risk assessment with respect to the adopted criteria, it should be emphasised that the risks presented in *Section 4* relate to carcinogenesis rather than fatality. Therefore, assuming a 50% probability of death following carcinogenesis, the risks presented in *Section 4* may be divided by two prior to comparison with the criteria.

4.6.2 *Dealing with Uncertainty*

The precise level of risk determined by the risk assessment methodology is strongly dependent upon model selection, parameter selection and pathway specification. The sensitivity of the calculated risk to model parameters is very variable, with some parameters having a more profound effect than others. The approach used in this assessment has been very conservative in terms of the model specification and parameters adopted. This conservatism arises from a number of areas; including:

- the assumption that this individual spends all of his/her life in the area of maximum concentration; and

- the assessment of risk under the maximum emission scenario, 24 hours per day, 365 days per year.

By applying this conservative approach, the precise risk/exposure value is not critical as it only represents the upper limit of a range whose median value is probably considerably lower. For an assessment such as this, in which substances arise from a single source, the source term specification, emission scenario and predicted dispersion pattern, are important. Despite these observations and assumptions, the assessment demonstrates that emissions from the CIF will not result in significant health effects.

4.6.3 *Risk Perception*

The outcome of a risk assessment is usually a single value which is then open to interpretation. The interpretation of a risk value will determine the acceptability or otherwise of the activity creating the risk. Two factors determine the acceptability of a risk;

- the probability of an undesirable occurrence;
- the perceived severity and benefits of that occurrence.

The significance of a risk may be assessed by several means including:

- the zero risk concept;

- define a level of acceptable risk, in which a regulatory body provides an arbitrary value that acts as a reference point;

- comparison with prevailing risks, *Table 4.1a* presents the risks encountered in everyday life; however, it should be borne in mind that some of these activities are voluntary.

4.7 CONCLUSIONS AND RECOMMENDATIONS

4.7.1 *Conclusions*

The risks arising from substances emitted from the proposed CIF have been assessed under the worst-case scenario, in which the proposed plant would be continually operating at the maximum permissible emission limits.

For inhalation, the non-carcinogenic hazards were assessed relative to standards for long-term air quality. These standards used were either US EPA RfCs or were derived from OELs and MELs published by the UK HSE and included an additional margin of safety of at least two orders of magnitude. For all substances, the maximum predicted concentrations were within their respective LAQS. Predicted concentrations were also compared with air quality criteria issued by the WHO and the US EPA. For all substances, the predicted concentrations fell within the standards.

Non-carcinogenic hazards associated with maximum hourly average concentrations were assessed with reference to SAQSs. SAQSs were derived from the UK HSE STELs and include a margin of safety of one order of magnitude. All substances fell within the SAQSs.

Carcinogenic risk arising from inhalation was assessed, resulting in a worst case estimate of 4.50×10^{-6} (or less than 1 in 200,000) at the highest concentration. The highest predicted concentrations at a residential receiver results in a level of risk of less than 10% of the worst case estimate, that is to say less than 1 in a million.

A comparison of the maximum level of risk posed by emissions from the CIF with commonplace involuntary risks, indicates that they are of a similar magnitude to the risk of being struck by lightning.

4.7.2 *Recommendations*

The findings of this assessment show that, within the parameters established in *Sections 3 and 4*, the level of risk to health from the CIF is within established limits.

However, the Contractor should still be required to show that:

- **the chosen design of the CIF will be capable of achieving a similar standard within the identified limits.**

This should be acieved through:

- **modelling during the detailed design stage and by monitoring of stack gas emissions and ambient air quality during the commissioning and operation of the plant.**

5 NOISE IMPACTS

5.1 INTRODUCTION

The construction and operation of the CIF may lead to noise impacts. This *Section* addresses potential sources of impacts, assesses their significance and where necessary, makes recommendations for suitable mitigation measures to reduce impacts to acceptable levels.

5.2 CONSTRUCTION NOISE ASSESSMENT

Due to the relatively remote location of the CIF, away from major Noise Sensitive Receivers (NSRs), noise from construction activities on the CIF site is unlikely to lead to significant impacts. The assessment has, therefore, concentrated on the worst-case scenario, night-time activities.

Traffic noise on the surrounding road network generated by CIF traffic may affect nearby NSRs during both the construction of the plant.

5.2.1 *Assessment Criteria*

Construction Noise

In Hong Kong the control of construction noise outside of daytime, weekday working hours (0700-1900, Monday through Saturday) is governed by the Noise Control Ordinance (NCO) and the subsidiary *Technical Memoranda on Noise from Construction Work Other Than Percussive Piling* (TM). The TM establishes the permitted noise levels for construction work depending upon working hours and the classification of the noise sensitivity of the existing area.

The NCO criteria for the control of noise from powered mechanical equipment (PME) are dependant upon the type of area containing the NSR, rather than the measured background noise level. As the NSRs surrounding the CIF fall into rural and urban fringe areas, the Area Sensitivity Ratings (ASRs) for these NSRs, according to the TM, are specified as 'A' and 'B', respectively. The NCO requires that noise levels from construction at affected NSRs be less than a certain Acceptable Noise Level (ANL) which is determined by the ASR.

It is intended that the construction activities of the proposed developments should be planned and controlled in accordance with the NCO. Works requiring the use of PME during restricted hours (i.e. outside of 0700-1900 Monday through Saturday and during public holidays) and particularly at night, will require a Construction Noise Permit (CNP) and will need to achieve the applicable ANL. The ANL is derived from the Basic Noise Levels (BNL) by applying corrections for the duration of the works and the effect of any other nearby sites operating under a CNP. As the precise details of construction activities are not available for this assessment, these corrections have been assumed to be zero making the ANLs equal to the BNLs. These are shown in *Table 5.1a* below.

Table 5.1a *Acceptable Noise Levels (ANL, $L_{Aeq,30\ min}$ dB)*

Time Period	ASR-A	ASR - B
All days during the evening (1900–2300) and general holidays (including Sundays) during the day and evening (0700–2300)	60	65
All days during the night–time (2300–0700)	45	50

Although the NCO does not provide for the control of construction activities during normal working hours (0700–1900), a limit of $L_{Aeq,\ 30\ min}$ 75 dB is proposed in the *Practice Note For Professional Persons, PN2/93, Professional Persons Environmental Consultative Committee (ProPECC), June 1993*. This limit has been applied on major construction projects in recent months, and is now generally accepted in Hong Kong. It will therefore be adopted in this study in order to protect NSRs to an appropriate extent.

Traffic Noise

Construction traffic noise impacts will be assessed by considering two different scenarios to determine if the CIF will generate significant cumulative noise impacts at potential NSRs. These scenarios are as follows:

- 1996 traffic levels without the CIF construction; and
- 1996 traffic levels with the CIF construction.

Impacts from road traffic noise are generally assessed against the *Hong Kong Planning Standards and Guidelines* (HKPSG) criterion for road traffic noise. Traffic noise standards are stipulated in the HKPSG to limit noise levels at affected NSRs to below $L_{10,peak\ hour}$ 70 dB(A). This criterion controls the maximum noise exposure from accumulated road vehicle pass-by noise, to ensure that nearby NSRs are not exposed to excessive noise levels. Although this standard is not achieved in many existing areas of Hong Kong, it is enforced in the planning of new noise sensitive developments and new developments generating increased traffic flows that could impact existing residences.

In the latter case, impacts are referred to as cumulative impacts and are assessed on a relative rather than an absolute scale. As this assessment addresses the impacts associated with the addition of traffic to existing roads, an impact, or more correctly a cumulative impact, will be defined as an increase in noise levels at affected NSRs over those which would have prevailed had the development not existed. In keeping with current EPD policy, a cumulative impact will be defined as an increase in noise levels at NSRs of 1 dB(A) over those which would have prevailed had the development not existed. Should this criterion be satisfied, it can then be concluded that the development has the potential to generate significant cumulative impacts at nearby receivers. Cumulative impacts need to be addressed, in terms of noise mitigation measures, only if the resulting noise level is in excess of the HKPSG noise criterion of $L_{A10,peak\ hour}$ 70 dB.

5.2.2 *Baseline Conditions*

Existing conditions

The landuses surrounding the CIF at Tuen Mun Area 38 are mainly industrial, yet, as the region has not been developed for commercial or residential usage it is not considered urban; hence the ASR classification of 'A' and 'B'.

The CIF site is currently used as a container storage area with Castle Peak Power Station and the Shiu Wing Steel Mill site, located to the west and the Pillar Point Sewage Treatment Works and the Pillar Point Landfill are to the east of the site. The main road in the region, Lung Mun/Lung Kwu Tan Road (changes to Nim Wan road near Pak Long Village), runs through mostly industrial areas in the south and undeveloped and rural surroundings in the north-west containing village-type settlements.

As a result, the noise environment near the CIF site is dominated by industrial and road traffic noise, while to the north-west of the site at Lung Kwu Tan the noise environment is typical of a quiet rural setting. To the east of the site, near Tuen Mun New Town, the noise environment can be characterised as urban fringe. In the region near Tuen Mun New Town the noise environment is dominated by road traffic noise, however, there is little industrial development and ambient noise levels are not high.

Future conditions

The future environment will include additional development in the form of new industrial facilities and the widening of the existing road system. To the west of the SIA, extensive development in the form of the Tuen Mun Port Development (TMPD) project is anticipated; while further north development will take the form of the Black Point Power Station and the Western New Territories (WENT) Landfill. As a result, increased road traffic and industrial activity is anticipated for the region. This increased activity will probably lead to an increase in the ambient noise levels in the region. Therefore, it is anticipated that in the future, the noise environment will continue to be dominated by traffic noise and noise associated with industrial activities.

5.2.3 *Noise Sensitive Receivers*

NSRs, as defined by the HKPSG and the NCO, have been identified with reference to previous environmental studies and updated by reference to survey sheets and development plans. The major NSRs, which may be affected by the construction of the CIF, are listed in *Table 5.1b*. The locations of these NSRs are shown on *Figure 5.1a*.

Table 5.1b *Distances to Nearest NSRs*

Noise Sensitive Receiver	Approximate Distance (km)	ASR	Sensitive Use
Lung Tsai Village	2.0	A	Village/Residential
Pillar Point Refugee Camp	1.75	A	Residential
Melody Garden	3.0	B	Residential
Sun Tuen Mun Centre	>4.0	B	Residential
Yau Oi Estate	>4.0	B	Residential

The villages and refugee camp have been allocated an ASR of 'A' as they are located in a rural area and are not affected by nearby roads and/or industrial areas. Sun Tuen Mun Centre and Yau Oi Estate, although most likely not affected by construction activities on-site, may be affected by road traffic generated by CIF construction operations.

As all of the nearest NSRs to the CIF site are at least 1.5 km away, there is little potential for the generation of significant construction noise impacts during daytime hours. As a result, this study has adopted a "worst case" approach and assessed the potential effects of night-time (2300-0700) impacts at the nearest NSRs.

5.2.4 *Potential Sources of Impact*

There are two principal potential sources of impact from the construction of the CIF. The first is construction traffic along Lung Mun Road and in Tuen Mun New Town and the second is on-site PME associated with the CIF construction works.

Construction traffic associated with the CIF will travel along Lung Mun Road and may, therefore, affect NSRs near the road.

On-site construction operations associated with the CIF will include site formation, building excavation, foundation piling and building superstructure construction. Taking into account the construction activities that will take place and based of previous similar studies, a worst case total site sound power level (SWL) has been 125 dB(A) assumed.

5.2.5 *Assessment Methodology*

On-site Construction Operations

The methodology for assessing noise from the construction activities associated with the CIF was developed based on the *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling*. Percussive piling operations were not assessed as restricted hour operations are not permissible under the NCO (as the nearest NSRs are nearly 2.0 km from the CIF, the daytime noise benchmark of 85 dB(A) is not likely to be exceeded at any NSR). In general, the methodology is as follows:

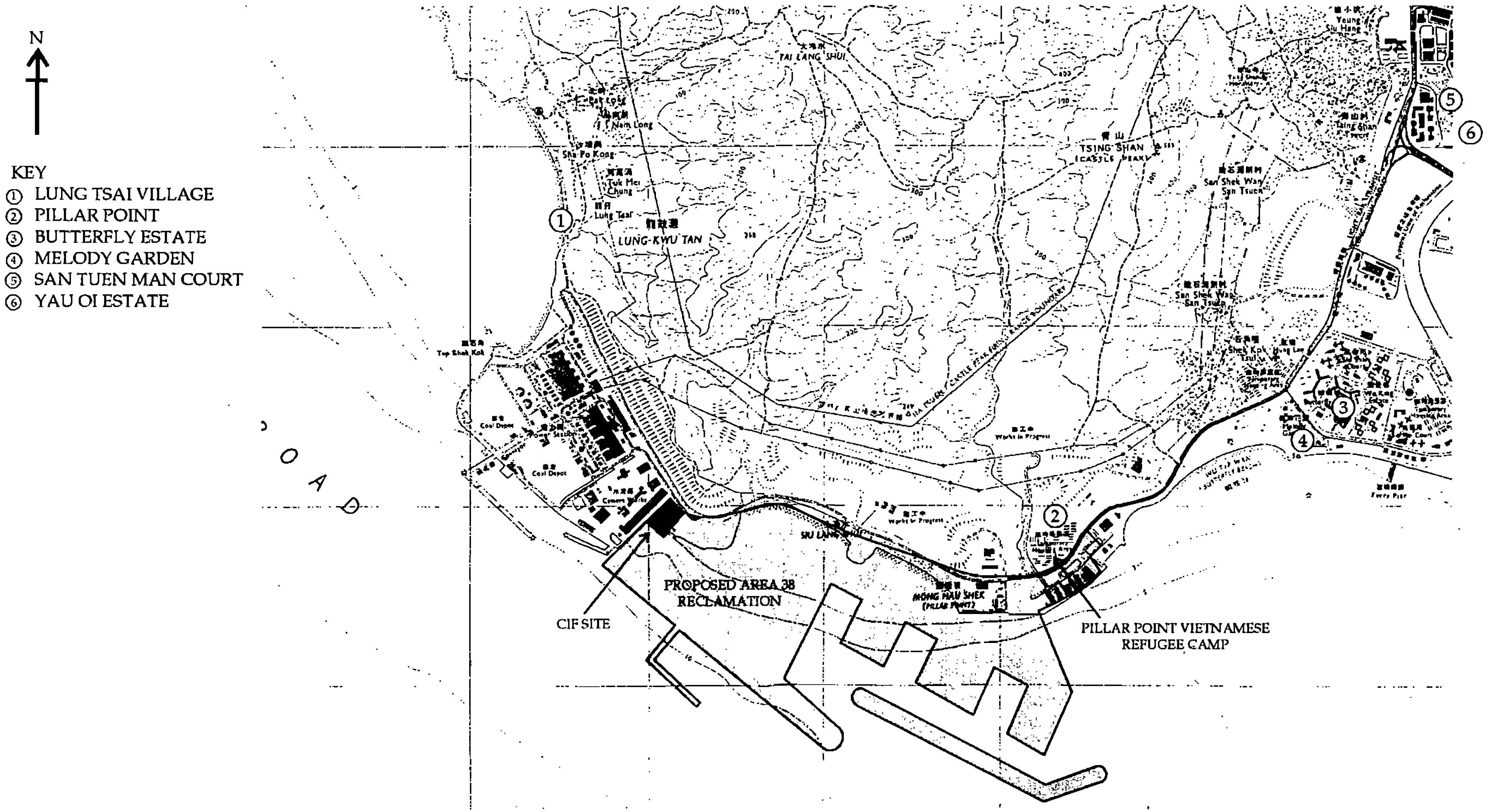


FIGURE 5.1a - LOCATION OF NOISE SENSITIVE RECEIVERS NEAR CIF

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

- locate NSRs for the worksite;
- calculate distance attenuation and screening effects to NSRs from worksite notional noise source point;
- predict construction noise levels at NSRs in the absence of any mitigation measures; and
- calculate the maximum total site SWL for unmitigated construction activities such that $L_{Aeq,30min}$ noise levels at NSRs comply with appropriate noise criteria.

The practicability of achieving the aforementioned maximum total site SWL is then considered in the light of viable options since this "performance specification" might offer a preferred form of mitigation. Other mitigation measures are then considered and recommended as appropriate.

It should be noted that in line with current Hong Kong practice, this methodology does not consider air and ground absorption effects, which can be significant over the distances involved in this study. As a result, this study should be considered as a worst case assessment of the probable operational impacts at the nearest NSRs.

Construction Traffic Noise

The assessment of construction traffic noise impacts was based on identifying differences in impact between two different scenarios:

- impacts without the CIF; and
- impacts with the CIF.

The assessment considered both the absolute value of the impact (the predicted $L_{A10,peak\ hour}$ dB level) as well as the relative value of the impact (the difference between the two scenarios modelled). This approach makes possible the determination of not only the level of the exceedance (compared with the HKPSG noise criterion), if applicable, but if the exceedance is a cumulative impact and so due to the CIF.

5.2.6 *Evaluation of Impacts*

On-Site Construction Activities

Due to the relatively remote location of the CIF site, on-site construction activities will not create noticeable disturbance at nearby NSRs during daytime hours (0700-1900). The total non-percussive site construction SWL would need to exceed 145 dB(A) to produce significant impacts at the nearest NSR to the site, the Pillar Point Refugee Camp (approximately 1.75 km distant) during daytime hours. As site construction total SWLs normally average 120-125 dB(A) for typical construction activities, noise levels at the nearest NSRs are not expected to be higher than about

55 dB(A). As a result, it is clear that daytime activities will be able to proceed without mitigation measures.

Should the Contractor propose to carry out construction activities during restricted hours, night-time hours (2300-0700) it may be necessary to employ some mitigation measures to reduce noise levels by 5-10 dB(A) in order to obtain a CNP. As the total site SWL would need to exceed 130 dB(A) to cause disturbance to the nearest receivers during evening periods (1900-2300), and it is not considered that such high noise levels are justified for the types of construction activities associated with the CIF, no mitigation is recommended for construction operations during evening hours.

As noted before, percussive piling activities are allowed only during normal, daytime (0700-1900) working hours. If the Contractor intends to carry out percussive piling activities for the CIF, then it will be necessary to apply for a CNP. As predictions indicate that noise impacts at the nearest NSRs will be lower than 50 dB(A) even for the 'noisiest' (SWL of 135 dB(A)) piling rig available in Hong Kong, no restrictions on daytime activities or mitigation measures are foreseen.

Construction Traffic Noise

At this stage, the details of the number and frequency of construction vehicles associated with the CIF are not known, however, it is reasonable to assume that the traffic flows from the CIF will be less than the existing container vehicle flows of about 100 to 200 daily vehicle movements (DVM) per hectare (the CIF design capacity identified in the Feasibility Study is 135 DVM). Therefore, the replacement of the existing container storage site with the CIF construction site will lead to a small net decrease in road traffic noise levels along Lung Mun Road. It is assumed that this small net decrease will also persist into the Tuen Mun New Town region. As a result, no significant noise impacts are anticipated at nearby NSRs from CIF-generated construction traffic.

It should be noted that previous noise modelling for the Tuen Mun Area 38 EIA has indicated that the HKPSG noise criterion of $L_{A10,\ peak\ hour}$ 70 dB will be exceeded at all of the NSRs assessed in this study as a result of general traffic flows. However, the analysis above has indicated that the traffic generated by the CIF construction will not lead to cumulative impacts at any of these NSRs, future impacts can be attributed to the general traffic in each region.

5.2.7 *Mitigation Measures*

On-Site Construction Activities

The foregoing analysis has indicated that daytime and evening construction activities will be able to proceed without the need for mitigation measures.

However, construction during the night-time period will require a CNP and mitigation measures will most probably need to be employed.

Should the Contractor propose to carry out construction activities during restricted hours there are two issues to consider, as the refugee camp is scheduled for closure at the beginning of 1996. The maximum allowable SWL for the CIF site prior to closure of the camp is 130 dB(A) for evening hours (1900–2300) and 115 dB(A) for night-time hours (2300–0700).

The villages along Lung Mun Road are effectively screened from the site by hills up to 100 m high which will reduce noise levels by about 15 dB(A) and therefore, after closure of the camp, the maximum acceptable SWL for the site would be 139 dB(A) for evening hours and 124 dB(A) for night-time hours to prevent NCO exceedances at the NSRs in the residential areas to the east.

The site SWLs identified are unlikely to be exceeded by normal construction plant and levels at NSRs are not expected to exceed acceptable levels by more than 5–10 dB(A). If any NSRs are predicted to be exposed to unacceptable levels, effective noise control can probably be achieved simply through the careful planning of PME activities to ensure that all equipment is not operating simultaneously.

However, if necessary, the use of quiet plant, the use of noise barriers and other screening structures and the reduction of the size of plant teams during restricted hours will be effective in limiting noise levels.

Construction Traffic Noise

This assessment has indicated that no cumulative impacts are predicted to be generated at nearby NSRs due to the traffic associated with the construction of the CIF in Tuen Mun Area 38. As a result, no mitigation measures are recommended for this aspect of the construction phase of the CIF.

It should be noted, however, that previous modelling for the Tuen Mun Area 38 EIA has indicated that exceedances of the HKPSG noise criterion will occur due to the predicted traffic levels and it is recommended that Contractor's vehicles are operated in accordance with HK Vehicle Construction and Use Regulations to minimise nuisance to NSRs.

5.3 *OPERATIONAL NOISE ASSESSMENT*

The CIF site is located almost 2.0 km from the nearest NSR, effectively 3.0 km after the closure of Pillar Point Refugee Camp, since the villages to the north are screened from the site. Operational noise impacts, are not therefore, expected to generate impacts in excess of the NCO at any NSRs. Consequently, the assessment has focused on the worst case only, night-time operations.

Road traffic noise impacts associated with the operation of the Tuen Mun Area 38 SIA have been assessed with respect to two different scenarios, to determine if the operation of the CIF will generate exceedances of the HKPSG at affected NSRs. These scenarios are as follows:

- traffic levels without either the CIF or the TMPD; and,
- traffic levels with the CIF and without the TMPD.

This assessment is considered a worst case analysis, since the inclusion of the TMPD would lead to higher ambient traffic levels and so smaller future percentage increases in traffic flow due solely to the operation of the CIF.

As a further consideration, noise and worker exposure to noise within the facility from operational activities was also assessed.

5.3.1 *Assessment Criteria*

On-site operational activities have been assessed with respect to the criteria set out by the NCO and the HKPSG. In Hong Kong the control of operational noise is governed by the NCO and the subsidiary *Technical Memoranda for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (TM). The TM establishes the permitted noise levels for facility operation depending upon working hours and the existing noise climate.

The NCO criteria for the control of noise from on-site facility operations are dependant upon the type of area containing the NSR rather than the measured background noise level. As the NSRs surrounding the CIF fall into rural and urban fringe areas, the ASRs for these NSRs, according to the TM, are specified as 'A' and 'B', respectively. The NCO requires that noise levels from construction at affected NSRs be less than a certain ANL that depends on the ASR.

In line with current EPD practice, the operational noise of new developments should be planned and controlled in accordance with the HKPSG noise criteria, effectively the ANL -5 dB(A). As a result, this planning constraint is 5 dB(A) more stringent than the NCO noise limit. It is intended that the operational activities of the proposed developments will meet the HKPSG criteria. The ANLs for the area immediately affected by the CIF are shown in *Table 5.2a* below.

Table 5.2a *Acceptable Noise Levels (ANL, $L_{Aeq,30min}$ dB)*

Time Period	ASR - A	ASR - B
All days during the evening (1900-2300) and general holidays (including Sundays) during the day and evening (0700-2300)	60	65
All days during the night-time (2300-0700)	50	55

This assessment has analysed all noise impacts with respect to the HKPSG criteria of ANL -5 dB(A).

The statutory criteria for worker exposure to noise are as follows:

- $L_{AEP,d}$ 85 dB (equates to an 8-hour L_{Aeq} of 85 dB); and
- a maximum daily noise peak of 140 dB(A).

Off site traffic noise impacts have been investigated using the same assessment criteria as were used in the CIF construction noise assessment (see *Section 5.1*).

5.3.2 *Baseline Conditions*

The existing and future noise environment are as discussed in the construction noise assessment (see *Section 5.1*).

5.3.3 *Noise Sensitive Receivers*

NSRs have been identified with reference to previous environmental studies, updated from current survey sheets and development plans. The location of these NSRs are shown on *Figure 5.1a*.

Table 5.2b *Distances to Nearest NSRs*

Noise Sensitive Receiver	Distance (km)	ASR	Sensitive Use
Lung Tsai Village	2.0	A	Residential
Melody Garden	3.0	B	Residential
Sun Tuen Mun Centre	>4.0	B	Residential
Yau Oi Estate	>4.0	B	Residential

Lung Tsai Village has been given an ASR of 'A' as it is located in a rural area and is not affected by nearby roads and/or industrial areas. Sun Tuen Mun Centre and Yau Oi Estate have the potential to be affected by road traffic generated by CIF operational activities.

5.3.4 *Potential Sources of Impact*

There are likely to be two primary potential sources of noise impact from the operation of the CIF. The first will be plant noise associated with the CIF's operational activities, while the second is road traffic generated on Lung Mun Road by the CIF development .

Operational noise from plant and machinery within the CIF development is not expected to lead to significant noise impacts at the nearest NSRs during daytime hours (0700-1900), because the nearest NSRs are at least 2.0 km from the development.

Calculations indicate that the CIF would need to generate daytime SWLs in excess of 133 dB(A) in order to generate a significant noise impact at Melody Garden, the NSR which will be most affected. As such high noise SWLs are highly unlikely daytime operational impacts from CIF operations will not be assessed further in this study. Night–time operations, however, may have the potential to create impacts and are, therefore, considered further.

Although no specific design information is available at this stage, the major noise sources during the operation of the facility are expected to be:

- loading/unloading of waste skips;
- the incinerator burners;
- the gas treatment module: gas fans, slurry circulation pumps and scrubbers;
- slurry dewatering, if a centrifuge is used in the final design; and,
- stack noise emission.

These sources will be assessed with reference to other similar facilities with known noise levels.

As stated in the introduction, two cases were investigated to assess traffic impacts:

- traffic levels without the CIF and without the TMPD; and,
- traffic levels with the CIF but without the TMPD.

5.3.5 *Assessment Methodology*

On–site Operations

The methodology for assessing noise from the operational activities associated with the CIF was developed based on the TM. In general, the methodology is as follows:

- locate NSRs for the facility;

- calculate distance attenuation and screening effects for NSRs from facility notional noise source points;

- predict operational noise levels at NSRs in the absence of any mitigation measures; and

- calculate maximum permissible SWLs for major facility noise sources for unmitigated operational activities such that $L_{Aeq,30min}$ noise levels at NSRs comply with appropriate 'ANL –5 dB(A)' noise criteria.

The practicability of achieving the aforementioned maximum SWLs are then considered in the light of viable designs and the noise levels achieved at similar existing facilities. Mitigation measures are then considered and recommended as appropriate.

It should be noted that in line with current Hong Kong practice, this methodology does not consider air and ground absorption effects, which can be significant over the distances of concern in this study. As a result, this study should be considered as a worst case assessment of the probable operational impacts at the nearest NSRs.

Internal Operational Noise

Hong Kong statutes require that occupied areas of the facility should be designed to achieve the following noise levels:

- maximum limit of $L_{Aeq,5min}$ 85 dB at 1 m from a single source operating alone with all facility equipment in full operation; and,

- a maximum daily noise peak of 140 dB(A).

If one or both of these limiting levels are found to be exceeded, appropriate mitigation measures should be recommended to reduce the impact to an acceptable level.

An assessment of internal noise levels will only be possible when detailed design information is available and therefore cannot be undertaken at this stage.

Operational Traffic Noise

The assessment of operational traffic noise impacts was based on identifying differences in impact between two different scenarios:

- impacts without the CIF and without the TMPD; and
- impacts with the CIF and without the TMPD.

The calculation process was carried out in accordance with the requirements of EPD, using the *Calculation of Road Traffic Noise, UK Department of Transport, 1988* (CRTN) procedures. CRTN requires that traffic noise assessments be carried out for the predicted conditions 15 years after the opening of a development, therefore, the traffic flow for the year 2011 were assessed. The road surface type was assumed to remain same as the existing road surface.

The assessment considered both the absolute value of the impact (the predicted $L_{A10,peak\ hour}$ dB level) as well as the relative value of the impact (the difference between the two scenarios modelled). This approach makes possible the determination of not only the level of the exceedance (compared with the HKPSG noise criterion), if applicable, but if the exceedance is a cumulative impact due to the CIF.

5.3.6 *Evaluation of Impacts*

On-site Operations

5.3.6 *Evaluation of Impacts*

On-site Operations

As the CIF facility will be 3.0 km from the most affected NSR, it is deemed highly improbable that daytime and evening operations will be capable of creating significant impacts at nearby NSR as a total site SWL of 135 dB(A) for more than 30 minutes would be required. Consequently, no mitigation measures are recommended for daytime operations.

At night (2300–0700), however, CIF operations could cause significant disturbance at nearby NSRs if operations are capable of producing a total sound power level above 124 dB(A). The single loudest noise source is expected to be the stack top (*Environmental Statement for the Knostrop Clinical Waste Incinerator, ERL, 1991*). At the predicted level of about 100 dB(A), there is effectively no potential for the total SWL to approach 124 dB(A) and, therefore, no noise impacts in excess of the NCO are predicted to arise from the operation of the CIF.

Internal Operational Noise

There is little detailed data available at this time to indicate the noise generating characteristics of plant within the facility; however, previous studies have indicated that unmitigated operations can generate levels in excess of the applicable, statutory employee daytime exposure limits. Therefore, it is recommended that further work be carried out at the detailed design stage to ensure that facility employees will not be exposed to noise levels above the statutory limits.

Traffic Noise

Traffic predictions have indicated that the CIF should, at its peak, generate 56 DVM. As a worst case assumption it has been assumed that ten vehicle movements will be generated in the peak hour all of which can be classified as heavy vehicles.

Table 5.2c below gives the traffic impacts at the NSRs noted in the previous section. As traffic flows for the year 2011 are not currently available, the year 1996, for which values are available, was used as a benchmark calculation. The existing road surface, impervious concrete, was assumed to remain the same.

Table 5.2c *Traffic Conditions on Lung Mun Road and Wong Chu Road Under Different Scenarios (1996)*

Road	Location	Scenario	AM peak hour flow	% Heavy Vehicles	Speed
Lung Mun	Melody Garden	Without CIF With CIF	1070 1080	55.1 55.6	70
Lung Mun	Butterfly Estate	Without CIF With CIF	1850 1860	41.1 41.4	70
Lung Mun	Sun Tuen Mun Centre	Without CIF With CIF	1810[a] 1820	68.3[a] 68.5	50
Wong Chu	Yau Oi Estate	Without CIF With CIF	2400[b] 2410	50.0[b] 50.5	50

Notes: (a) 1996 Forecast from Scott Wilson Kirkpatrick.
(b) Extrapolated to 1996 from *The Annual Traffic Census, 1992.*

The figures for Wong Chu Road were extrapolated from current figures assuming 30,000 vehicles per day for 1996 and that the peak hour should contain approximately 8% of the daily flow. The percentage of heavy vehicles was chosen such that it was slightly lower than Lung Mun Road (reflecting more residential traffic).

These figures indicate that the CIF will add 0.4–0.9% to the prevailing traffic flows during the operational phase. In particular the breakdown of the increase by location is predicted as follows:

- Melody Garden 0.9%;
- Butterfly Estate 0.6%;
- Sun Tuen Mun Centre 0.6%; and
- Yau Oi Estate: 0.4%.

These figures indicate that the maximum increase in traffic flow due to the operation of the CIF is 0.9% at 70 kph (near Melody Garden) and 0.6% at 50 kph (near Sun Tuen Mun Centre). Reference to Chart 2 in the CRTN manual indicates that an increase of 0.9% will lead to an increase in the basic noise level of 0.04 dB(A), while an increase of 0.6% will lead to an increase in the basic noise level of 0.03 dB(A).

The largest increases in heavy vehicle percentage, (see *Table 5.2c*) is 0.5% (55.1–55.6%) at 70 kph and 0.2% (55.0–55.2%) at 50 kph. According to Chart 4 in the CRTN manual, the increase in heavy vehicles at 70 kph translates to an increase in the basic noise level of 0.03 dB(A) while the increase at 50 kph translates to an increase in the basic noise level of approximately 0.01 dB(A).

Hence the total increases associated with these largest increases in traffic flow and percentage heavy vehicles are 0.07 dB(A) and 0.04 dB(A) at 70 and

50 kph, respectively. As the maximum increase at any of the NSRs from CIF operational traffic is less than 1.0 dB(A) (actually negligible), the minimum increase for the determination of a cumulative impact has not been met, and so no significant impact is predicted at the NSRs due to the operation of the CIF. As it is anticipated that prevailing (i.e. excluding the CIF) traffic flows in the year 2011 will be much higher than the 1996 figures, impacts from the CIF for the year 2011 are anticipated to be even smaller than have been calculated above.

It should be noted that noise modelling has indicated that the HKPSG noise criterion of $L_{A10,\ peak\ hour}$ 70 dB will be exceeded at all of the NSRs assessed in this study as a result of general traffic flow. However, the previous analysis has indicated that the traffic generated by the CIF operation will not lead to significant cumulative impacts at any of these NSRs. As a result, future impacts will be due solely to the prevailing traffic in each region.

5.3.7 *Mitigation Measures*

On-site Operational Noise

This assessment has clearly shown that it is highly unlikely that the operation of the CIF will have any impact on NSRs. Unless, after the detailed design stage, it can be shown that noise levels in excess of those discussed above will be produced by the plant, no mitigation measures will be necessary.

It is recommended that an assessment be carried out during the detailed design stage to consider all major noise sources and design all noise sources to meet the appropriate night-time HKPSG criterion. This study should consider air absorption, ground absorption and topographical screening effects due to the distances involved.

The mitigation measures that may be considered, if required, include the use of low noise, plant directing noise sources away from NSRs, locating noisy plant within suitably designed plant rooms or semi-enclosed areas and silencing, such as fan attenuators, at source.

Internal Operational Noise

Reference to previous studies of similar facilities has indicated that unmitigated facility operations have the potential to generate an environment in which worker noise exposure levels will exceed the applicable, statutory noise exposure limits. As a result, it is recommended that further work be carried out at the detailed design stage to ensure that an acceptable noise environment is maintained in the facility at all times.

The facility should be designed to achieve the statutory noise exposure levels, set by the *Factories and Industrial Undertakings (Noise at Work) Regulation* which should be obtainable through the use of standard mitigation measures. These measures include the use of facility noise management (placing and operating particularly 'noisy' equipment in different parts of the facility rather than in a single location), silencing of equipment, the use of quiet equipment and the placement of 'noisy' equipment in acoustic rooms. If in certain areas, these standards cannot be achieved, and the second action level of 90 dB is exceeded, it will be necessary to establish ear protection zones and to issue protective equipment to employees (such as ear defenders or ear plugs).

Operational Traffic Noise

The foregoing analysis has indicated that no cumulative impacts are predicted to be generated at nearby NSRs due to traffic generated by the operation of the CIF. As a result, no mitigation other than general measures (proper vehicle maintenance, use of mufflers, considerate driving, etc.) are recommended for this aspect of the operational phase of the CIF. It should be noted, however, that previous modelling for the Tuen Mun Area 38 EIA has indicated that exceedances of the HKPSG noise criterion will occur due to the prevailing traffic levels at the affected NSRs.

5.4 *CONCLUSIONS AND RECOMMENDATIONS*

The findings of the noise assessment show that no adverse impacts are anticipated from the construction or operation of the CIF. However, due to the lack of detailed design information, the assessment has been based on a number of assumptions concerning the noise levels that may be generated. These assumptions have been on the cautious side, to ensure that the worst case is considered, but until the design of the CIF has been finalised it will not be possible to confirm the predictions.

It is recommended that:

- **a noise assessment be undertaken during the detailed design stage to confirm the maximum noise levels during construction and operation of the CIF and to check the status of NSRs.**

If the outcome of the detailed design stage assessment confirms the predictions of the present assessment, no specific mitigation measures will be required. However the Contractor should be aware of his responsibility to meet the environmental requirements of the HKPSG and NCO and also the internal noise limits of the Noise at Work Regulation.

6 *WATER QUALITY*

6.1 *INTRODUCTION*

Potential water quality impacts may arise from the construction and operation of the CIF. This section describes the potential sources of impacts, assesses their significance and recommends appropriate mitigation measures to minimise the impacts to acceptable levels.

6.2 *POTENTIAL SOURCES OF IMPACTS*

6.2.1 *Construction Phase*

The proposed CIF will be built on reclaimed land formed as part of the Area 38 Reclamation Project and handed over to EPD. The major sources of water quality impacts that can potentially arise from the construction of the CIF will include:

- construction run-off and surface water drainage;
- general construction activities; and
- sewage from on-site construction workforce.

Potential impacts on water quality during the construction of the CIF and their significance are discussed in *Section 6.5*.

6.2.2 *Operational Phase*

Discharges arising during the operation of the CIF will include the following:

- water from gas scrubbing unit if wet scrubbing is used;
- washwater from container washing;
- overflows from ash quencher;
- hose-down water and drainage from process areas;
- stormwater run-off; and
- domestic sewage.

Potential impacts on water quality during the operation of the CIF and their significance are discussed in *Section 6.5*.

6.3 *BASELINE CONDITIONS*

6.3.1 *Existing Conditions*

The waters to the north of Lantau fall within the transition zone between oceanic and estuarine conditions. Silt and pollutant loads are brought into

Hong Kong waters from the Pearl River creating seasonal variations in water quality.

The off-shore water quality near Area 38 is well documented by the EPD marine water quality monitoring programme (*Marine Water Quality in Hong Kong for 1992, EPD*). The monitoring locations in the vicinity of the site are shown on *Figure 6.3a* and a summary of EPD monitoring data (for 1992) is given in *Table 6.3a* for three monitoring sites, Tuen Mun NM3, Urmston Road NM5 and Urmston Road NM6.

The water quality in the North Western Water Control Zone (WCZ) is generally in compliance with the Water Quality Objectives (WQO) of the Water Pollution Control Ordinance (WCPO). The exception is a slight exceedance in the mean inorganic nitrogen (N) concentration of 0.51 mg l^{-1} (the WQO for inorganic N is 0.5 mg l^{-1}). This is probably attributable to organic pollution from Deep Bay and the Pearl River. The North Western WCZ waters are well oxygenated in both surface and bottom layers, and the *E Coli* level is within the WQO level, that is not to exceed a geometric mean of 610 100 ml^{-1}.

Ongoing reclamation and construction activities for Chep Lap Kok Airport are likely to increase the suspended solids (SS) concentration in the water in the vicinity. The levels of SS in the water varies with the season and tide, as well as the flow and depth. The SS concentrations for nearby routine EPD monitoring stations for 1992 ranges from 2.8–29.0 mg l^{-1}. The currents in the Urmston Road area south of the proposed CIF site, are fast moving offshore with velocities as high as 1 m s^{-1}.

Water quality of beaches along the shoreline of Castle Peak Road is generally poor (Butterfly, Castle Peak, Kadoorie and New Cafeteria beaches) and Old Cafeteria is ranked very poor (*Bacterial Water Quality of Bathing Beaches in Hong Kong, EPD, 1993*) as a result of sewage discharge from the Pearl River and Sham Tseng and Tuen Mun nullahs.

6.3.2 *Future Conditions*

The implementation of the Livestock Waste Control Scheme (LWCS), the Waste Disposal (Chemical Waste)(General) Regulation and the declaration of the North Western WCZ under the WPCO, suggests that the water quality will gradually improve with the reduced pollution loading from the surrounding environment. However, it should be noted that the pollutant loads transported by the Pearl River, part of which flows into Hong Kong via the Ma Wan Channel during the wet season, will still influence the quality of Hong Kong waters.

Table 6.3a *Summary Statistics (Mean and Range) of 1992 Water Quality of North–Western WCZ*

Determinand	Depth	Tuen Mun NM3	Urmston Road NM5	Urmston Road NM6
Temperature (° C)	Surface	21.6 (12.4 – 28.6)	21.9 (12.3 – 28.5)	21.9 (12.3 – 28.4)
	Bottom	21.0 (12.1 – 28.1)	21.1 (12.1 – 28.2)	21.3 (12.0 – 28.2)
Salinity (ppt)	Surface	27.5 (18.6 – 32.9)	24.4 (13.8 – 32.7)	25.0 (12.2 – 32.2)
	Bottom	29.8 (24.3 – 32.9)	29.2 (25.5 – 32.7)	28.8 (24.0 – 32.6)
D.O. (% saturation)	Surface	91 (75 – 115)	95 (83 – 126)	97 (86 – 110)
	Bottom	83 (60 – 106)	87 (60 – 110)	87 (66 – 106)
pH value		8.0 (7.8 – 8.2)	8.0 (7.8 – 8.2)	8.1 (7.8 – 8.2)
Secchi disc (m)		1.4 (0.9 – 2.4)	1.3 (0.5 – 2.4)	1.3 (0.9 – 2.0)
Turbidity (NTU)		12.9 (3.1 – 28.3)	10.9 (2.6 – 20.7)	11.8 (2.5 – 21.7)
Suspended Solid (mg l^{-1})		13.8 (2.8 – 29.0)	12.9 (2.2 – 13.7)	9.4 (2.5 – 16.8)
BOD (mg l^{-1})		1.2 (0.7 – 2.47)	1.4 (1.0 – 2.8)	1.5 (1.1 – 2.5)
Inorganic N (mg l^{-1})		0.34 (0.11 – 0.67)	0.50 (0.20 – 0.81)	0.51 (0.16 – 1.05)
Total N (mg l^{-1})		0.66 (0.21– 1.24)	0.86 (0.40 – 1.39)	0.89 (0.46 – 1.51)
PO_4 – P (mg l^{-1})		0.04 (0.03 – 0.04)	0.03 (0.02 – 0.04)	0.04 (0.03 – 0.06)
Total P (mg l^{-1})		0.13 (0.10 – 0.2)	0.11 (0.07 – 0.15)	0.13 (0.08 – 0.21)
Chlorophyll – a (μg l^{-1})		0.70 (0.23 – 1.77)	0.97 (0.27 – 2.83)	0.81 (0.30 – 2.13)
E. Coli (No. 100 ml^{-1})		319 (180 – 560)	96 (23 – 232)	32 (9 – 93)

6.4 *Sensitive Receivers*

The potential water sensitive receivers likely to be affected by the CIF construction and operation comprise local gazetted bathing beaches, nearby seawater intakes and remote sensitive water bodies. These include the following:

- Castle Peak Power Station (CPPS) Cooling Water Intake 1 (approximately 1.0 km to the west);
- CPPS Cooling Water Intake 2 (approximately 1.3 km to the west); and
- Fishing grounds – these extend between North Lantau and Castle Peak.

Other remote sensitive receivers include gazetted beaches, which are situated over 4 km away from the site. These include Butterfly Beach, Castle Peak Beach, Kadoorie Beach, and Cafeteria Beaches (New and Old). Deep Bay is over 7 km to the north-west. The nearest mariculture zone is at Ma Wan which is over 13 km to the east. *Figure 6.3a* also shows the locations of potential water sensitive receivers.

6.5 *Assessment of Impacts*

6.5.1 *Methodology*

Construction Phase

Water quality impacts from the CIF construction will be assessed with respect to the North Western WCZ WQO, and in relation to the baseline data collated from the EPD monitoring records. The determining factor is that construction activities shall not cause non-compliance with the WQO. In addition, the site is within the 5 km radius of the CPPS water intakes in which a threshold SS limit of 100 mg l^{-1} above the background level is required for the cooling water supply.

Under the WPCO, all discharges from the works area or plant within a WCZ will have to meet the discharge standards stipulated in the *Technical Memorandum on Standards for Discharges into Drainage and Sewerage Systems, Inland and Coastal Waters, EPD, January 1991,* (TM) issued under Section 21 of the WPCO. The TM defines acceptable discharge limits to different types of receiving waters such as the foul sewer, inshore and marine waters. Under the TM, wastewaters discharged into the sewer, inshore and marine waters of the WCZ are subject to standards for particular volumes of discharge. These are defined by EPD and specified in licence conditions for any new discharge within a WCZ. *Table 6.5a* shows the standards for discharges to inshore marine waters and to the foul sewerage system stipulated in the TM. In addition, a number of substances are not allowed in discharges to foul sewers or coastal waters, these prohibited substances are listed in *Table 6.5b*.

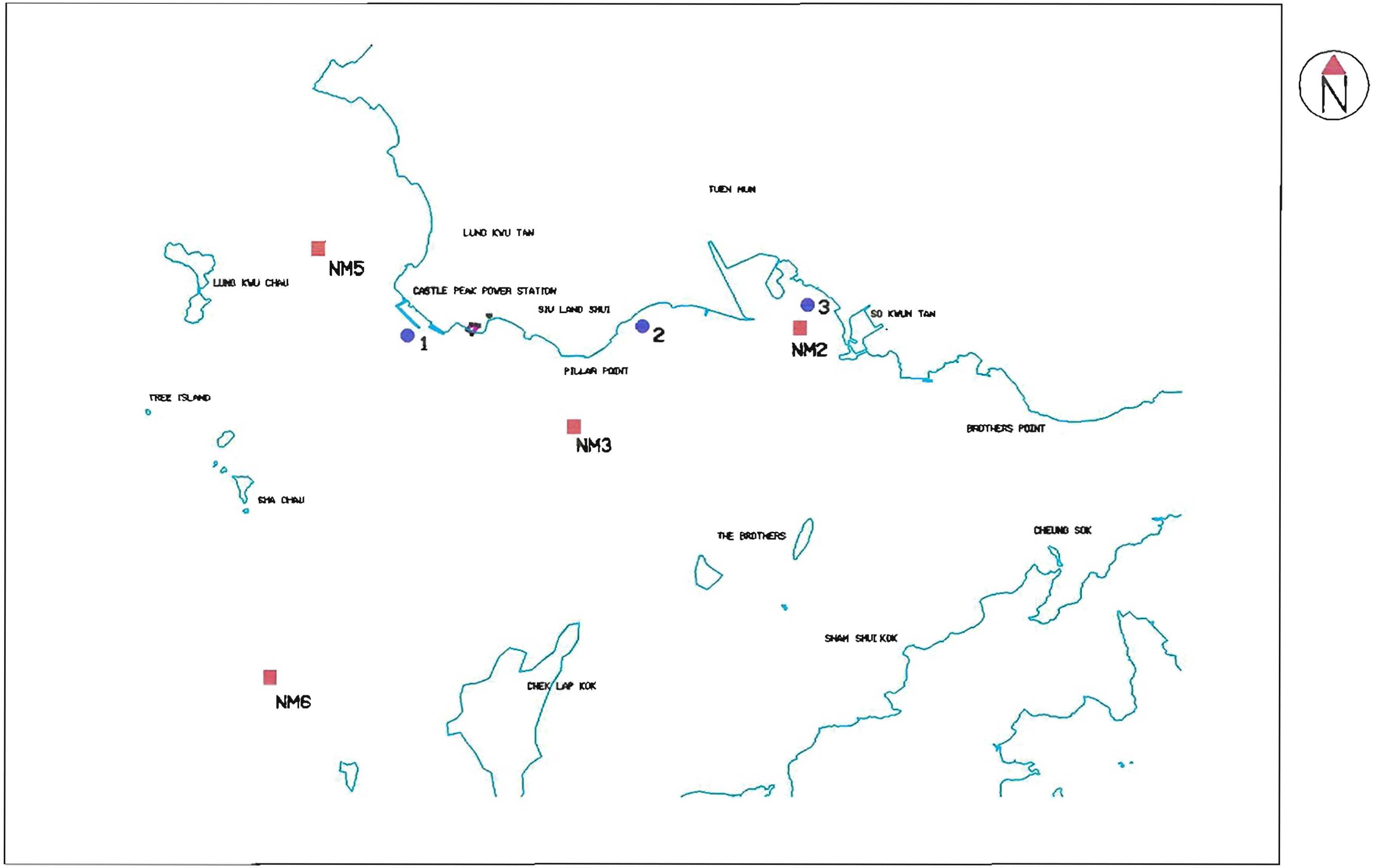


FIGURE 6.3a EPD Water Quality Monitoring Stations and Water Sensitive Receivers	
Date : 12 October 1994	Drawing No. : ERM/GIS/C1127b/003
Prepared by : GIS and Mapping	Base map : 1 : 20k topo. Lands Dept.

KEY

- ● WATER SENSITIVE RECEIVERS
- ■ WATER QUALITY MONITORING STATIONS

ERM Hong Kong
5, 10-11 th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

Table 6.5a *TM Discharge Standards (mg l^{-1} unless stated otherwise)*

Determinand		Discharge to North Western WCZ		Discharge to Foul Sewer	
	Flow rate (m^3 day^{-1})	>10 and ≤100	>100 and ≤200	>10 and ≤200	>200 and ≤400
pH (pH units)		6–9	6–9	6–10	6–10
Temperature (°C)		40	40	43	43
Colour (lovibond units, 25 mm cell length)		1	1	–	–
Suspended solids		30	30	1000	900
Settleable solids		–	–	100	100
BOD		20	20	1000	900
COD		80	80	2500	2200
Oil & Grease		20	20	100	50
Iron		10	10	25	25
Boron		4	3	7	6
Barium		4	3	7	6
Mercury		0.001	0.001	0.15	0.1
Cadmium		0.001	0.001	0.15	0.1
Copper		–	–	4	4
Nickel		–	–	3	3
Chromium		–	–	2	2
Zinc		–	–	5	4
Silver		–	–	3	3
Other toxic metals individually		1	0.8	2.2	2
Total toxic metals		2	1.6	10	8
Cyanide		0.1	0.1	2	2
Phenols		0.5	0.5	1	1
Sulphide		5	5	10	10
Sulphate		–	–	1000	1000
Total residual chlorine		1	1	–	–
Total nitrogen		100	80	200	200
Total phosphorus		10	8	50	50
Surfactants (total)		15	15	150	50
E. coli (count 100 ml^{-1})		1000	1000	–	–

Operational Phase

The WQO and TM evaluation criteria are also applicable to the operation phase. Daily wastewater discharges from the CIF are predicted to be up to 25.5 m^3 if wet scrubbing is used. The discharges will be required to comply with the TM discharge limits and given the small discharge volume, should not lead to any exceedances of the WQO. *Table 6.5a* shows the predicted discharges, based on the TM limits, in relation to the existing water quality for North Western Waters. Substances prohibited in discharges to foul sewers or coastal waters are listed in *Table 6.5b*.

Table 6.5b ***Prohibited Substances – Foul Sewers and Coastal Waters***

Foul Sewer	Coastal Waters
Polychlorinated Biphenyls (PCBs)	Polychlorinated Biphenyls (PCBs)
Polyaromatic Hydrocarbons (PAHs)	Polyaromatic Hydrocarbons (PAHs)
Fumigants or Pesticides	Fumigants, Pesticides or Toxicants
Radioactive Substances	Radioactive Substances
Chlorinated Hydrocarbons	Chlorinated Hydrocarbons
Flammable or Toxic Solvents	Flammable or Toxic Solvents
Petroleum Oil or Tar	Petroleum Oil or Tar
Calcium Carbide	Calcium Carbide
Wastes liable to form scum or deposits in any part of the public sewer	Wastes liable to form scum, deposits or discolouration
Any substance of a nature and quantity likely to damage the sewer or interfere with any of the treatment processes.	Sludge, floatable substances or solids larger than 10 mm

6.5.2 *Construction Impacts*

Construction run–off and drainage

Run–off and drainage from construction sites may contain SS and contaminants. Potential sources of pollution from site drainage include:

- run–off and erosion from site surfaces, drainage channels, earthworking and stockpiles;
- bentonite slurries and other grouting materials;
- concrete batching plant washout and drainage from dust suppression sprays; and
- fuel and lubricants from construction vehicles.

Construction run–off and drainage may cause both physical and biological effects. The physical effects may include:

- blockage of drainage channels; and
- increase of contaminant concentrations in receiving waters.

Possible biological effects which may affect marine life include:

- eutrophication caused by the nutrient content of the eroded soil;
- toxicity caused by mixtures of hydrocarbons and grouting materials; and
- reduction in DO levels caused by high SS concentrations.

In view of the close proximity of the CIF to marine waters, it is important that good site management practices be strictly followed to prevent high levels of suspended solids entering surrounding waters. It is unlikely however, that run-off from the construction site, provided that it meets the discharge requirements, will have any significant impact on the water quality of the receiving waters

General Construction Activities

On-going site construction activities may cause water pollution from the following:

- debris and rubbish such as packaging, used construction materials and floating refuse; and
- spillages of liquids such as oil, diesel and solvents are likely to affect water quality if they enter surrounding water bodies.

The effects on water quality from construction activities is likely to be minimal. Site boundary security will need to be maintained and good construction practice should be observed to ensure that floating refuse, fuels and solvents do not gain access to the stormwater system in the area.

Sewage

Sewage will arise from sanitary facilities and the works canteen provided for the construction workforce. Based on the scale of the construction work, it is estimated that around 100-200 workers will probably be employed generating in the range of 5.5-11.0 m^3 of sewage per day. However, this will greatly depend on the construction activities on-site and will vary throughout the construction period.

Sewage arising from the on-site construction workforce have the potential to.cause water pollution. In general, sewage should be discharged to the public sewerage system near the works site. However, the Civil Engineering Department have indicated that the drainage for Area 38 will not be ready until mid-1998. Interim sewage treatment facilities such as chemical toilets, septic tanks or packaged sewage treatment facilities will be necessary to pretreat the sewage before discharge to inshore waters.

6.5.3 *Operational Impacts*

The discharge wastewater quality will depend on the detailed design for the facility. Whilst details of the design are not available at this stage, it is anticipated that there will be two main streams of wastewater discharged from the CIF. These are wastewater streams which will require treatment prior to discharge and wastewater which can readily be discharged to the public sewers or marine waters.

Whilst the CIF will be designed for direct discharge to the local sewerage system, it is presently understood that this will not be ready until mid-1998 and therefore during the first year of operation, wastewaters will have to be treated on site to a discharge quality that will be acceptable to marine waters, i.e. the TM standard and discharged through a dedicated outfall. Alternatively the Contractor may chose to tanker wastewaters off-site for treatment and disposal at an existing sewage treatment plant.

Wastewater streams that may require treatment will include the following.

Wet Scrubber Discharges

Acid gas removal can be achieved with spray drying and wet or dry scrubbing. Spray dryers and dry scrubbers do not produce any liquid discharge, however, with a wet scrubber system, the exhaust gases are cleaned using a recirculating liquor. Small quantities of water are continuously bled-off and replaced, to control the build up of solids and salts in the circulating liquor. These discharges are likely to contain SS or insoluble metal hydroxides. A high percentage of the metals in the waste gas stream can be captured in the scrubber water as shown in *Table 6.5c*.

Table 6.5c ***Estimate of the Fate of Particulate Emissions, Solid Waste Incinerator with a Scrubber***

Metal	% In Bottom Ash	% In Scrubber Water	% Stack Discharge
Aluminum	57	42	1
Antimony	45	54	1
Arsenic	30	62	8
Barium	39	60	1
Beryllium	40	59	1
Cadmium	31	62	7
Chromium	31	59	10
Cobalt	45	52	3
Copper	47	51	2
Iron	53	46	1
Lead	16	82	2
Magnesium	33	66	1
Manganese	20	78	2
Mercury	0	10	90
Molybdenum	58	2	40
Nickel	30	66	4
Selenium	1	19	80
Titanium	45	54	1
Vanadium	18	79	3
Zinc	20	76	4

Source: Bruner C, Handbook of Hazardous Waste Incineration, 1989

Aside from heavy metals and SS, the scrubber water will also contain small quantities of fly ash, halogens (from acid gas absorption of sulphates and nitrates) and trace organics absorbed from the flue gas (including dioxins and furans). The FR identified that scrubber water will require further treatment before discharge. *Table 6.5d*, taken from the FR, indicates the typical concentrations and quantities of contaminants that may be expected from a wet scrubber compared with the TM limits. Details of mitigation measures are discussed in *Section 6.6.2*.

Table 6.5d ***Analysis of Typical Scrubber Effluent (Predicted Volume 15 m^3 per day)***

Parameter	**Effluent Concentration ($mg\ l^{-1}$)**	**TM Discharge Standard for Foul Sewer ($mg\ l^{-1}$)**	**TM Discharge Standard for Inshore Waters ($mg\ l^{-1}$)**
pH	7.5	6–10	6–9
Suspended Solids	50	1000	30
Chlorides	1500	–	–
Sulphates	1400	1000	–
Zinc	3.0	5.0	1.0
Lead	0.5	2.2	1.0
Chromium	1.0	2.0	–
Cadmium	0.1	0.15	0.001
Mercury	0.01	0.15	0.001

Container Wash Water

Clinical waste will be collected in standardised containers. After emptying of waste, the containers will be washed and disinfected before they are returned to service. It is anticipated that a packaged waste container washing system will be installed for cleaning the containers. Wash water will be recirculated with occasional overflow and bleeding of the system. The wastewater will contain traces of detergent, disinfectant, grit and organic matter and it is likely to require treatment to achieve the discharge limits for marine waters as shown in *Tables 6.5a* and *6.5b*. Mitigation measures are addressed in *Section 6.6.2*.

Ash Quencher Overflow

Bottom ash and fly ash from the incinerator will be quenched at the quench baths. The quench baths are fully evaporative systems with no overflow during normal operations, however, occasional overflows may occur. The quench water will contain traces of heavy metals, organics and other materials from the ash. It is likely to require further treatment as discussed in *Section 6.6.2*.

Hose-down Water and Drainage from the Process Areas

The process areas will require regular cleaning with detergents and disinfectant to maintain a hygienic working environment. These areas include the clinical waste incinerator house, carcase cremator house, full container storage area, empty container storage area, carcase storage and reception area, garage/workshop area and weighbridge. Hose down water will carry similar contaminants to the container wash water and will need similar treatment as discussed in *Section 6.6.2*.

Table 6.5e gives an estimate of the approximate daily discharge volumes and discharge frequencies, taken from the FR, for wastewaters which may require treatment.

Table 6.5e ***Estimated Daily Discharges***

Source	Discharge frequencies	Volume (m^3)
Scrubber water		
· Clinical waste	Continuous	11
· Animal Carcases	Continuous	4
Container Washing	Intermittent	1
Overflow from ash quencher	Intermittent	1
Hose down water	Intermittent	5
Sewage	70 l $head^{-1}$ day^{-1}	3.5
Total		**25.5**

Scrubber tanks, container washing water tanks and quench baths will have to be drained for regular maintenance. This maintenance will probably take place around ten times a year. The volumes of discharges from the different systems are given in *Table 6.5f*. The total annual discharge from maintenance would be approximately 540 m^3 per year, the equivalent of a further 1.5 m^3 per day.

Table 6.5f ***Estimated Tank Volumes***

Source of Discharges	Volume (m^3)
Container washing	8
Quench baths	10
Scrubber tanks	36

Sewage

The operation of the CIF will employ around 40 personnel. It is presently understood that the sewerage system for Area 38 will not be ready until mid-1998. Interim sewage treatment facilities such as septic tanks or packaged sewage treatment facilities will be necessary to pretreat the sewage before discharging to the adjacent coastal waters in order to achieve the TM discharge standards.

When the system is in place, the sewage from the plant can be diverted to the local foul sewer and sent to the Pillar Point Sewage Treatment Plant.

Storm Water Run-off

Run-off arising from "clean" areas such as the roof of the administration building, carparks, pathway, and pavement is considered to be relatively uncontaminated. However, it may contain suspended solids and grit, particularly during the initial "first flush" of rainfall following periods of dry weather.

Storm water should be well segregated from the process equipment area by bunding or other physical barriers and the "first flush" collected and treated to TM standards in dedicated settlement tanks or lagoons before discharge to the storm water drain. It should be noted that only storm water is permitted to be discharged to storm water drains.

The Use of Sea Water at the CIF

The proximity of the site to marine waters has led to the consideration of the practicality of using sea water for gas scrubbing and general cleaning operations to reduce the requirements for fresh water. However the use of sea water creates other problems, including contamination and corrosion, which may adversely affect the operation of the plant.

Whilst the alkaline nature of seawater would indicate that it might provide a suitable medium for acid scrubbing, there are also concerns that the make-up of the scrubber liquor would be less easy to control and that contaminants may reduce the efficacy of gas cleaning operations.

Salt water can be highly corrosive, and the plant design would need to take this factor into account. This may well result in the need to use more resistant, and possibly expensive materials for the gas cleaning plant and increase maintenance and replacement frequencies, all of which would increase the cost of the establishment and operation of the CIF.

Without pre-treatment, the sea water will be contaminated with, *inter alia*, SS, dissolved salts and faecal materials, which may also reduce the operational efficiency of the gas cleaning system as well as rendering it unsuitable for general cleaning activities. Sea water, if used, will also require treatment prior to discharge to meet the TM. In addition it should be noted that seawater may require a greater level of treatment prior to discharge compared to the use of mains water.

Conservation of mains water can best be achieved by good operational practices and, where practicable, the reuse of water from the on-site treatment plant before discharge. Increasing the cost and complexity of the CIF water treatment system to include conditioning of incoming sea water is unlikely to be the most attractive option. In addition, no seawater intake has been provided for the CIF in the design of the SIA waterfront and therefore, additional works would be required to provide a supply.

Aerial Discharges

As has been discussed in *Section 3*, the aerial emissions from the CIF represent only a small fraction of the total industrial discharges and at these levels have not been considered likely to lead to adverse impacts in the previous Area 38 studies.

The predicted impacts of stack gas emissions on sensitive receivers has been discussed in detail in *Sections 3* and *4* in terms of air quality and human health. Substances may also enter the environment through contact with surface waters and affect marine and fresh water quality. However, the potential magnitude of such impacts is less than those quantified earlier, and they are, therefore, not considered further.

There are a number of existing and planned service reservoirs in the vicinity of the CIF. The reservoirs are covered and vented to the atmosphere and there is limited potential for gaseous exchange between the water bodies and the discharge from the CIF. Therefore, the discharges from the CIF will not contaminate the reservoirs and will have no adverse effects on water quality.

6.6 MITIGATION MEASURES

6.6.1 *Construction Phase*

Although construction activities are not expected to result in adverse water quality impacts, it is important that appropriate measures be implemented to minimise the cumulative impacts associated with other ongoing construction work at Area 38. Proper site management is essential to minimise wash-off during the rainy season and "good housekeeping" practices to ensure that debris and rubbish cannot gain access to nearby stormwater systems should be implemented. Construction site discharges into the North Western WCZ are controlled under the WPCO and thus valid WPCO licenses are required. Standard measures which would be appropriate in this case are described below. The Contractor should also refer to *Practice Notes for Professional Persons - Construction Site Drainage, EPD, 1994* (ProPECC PN 1/94) and note that only stormwater may be discharged to stormwater drains.

Site Run-off

All site construction run-off should be controlled and treated to prevent run-off with high level of SS using the following measures:

- **the boundaries of earthworks should be marked and surrounded by dykes or embankments for flood protection as necessary;**
- **temporary ditches such as channels, earth bunds or sand bag barriers, should be provided to facilitate run-off discharge into the stormwater drain via a silt retention pond;**
- **permanent drainage channels should also incorporate sediment basins or traps and baffles to enhance deposition;**
- **sediment traps and channels must be regularly cleaned and maintained by the Contractor, daily inspections of such facilities should be required;**

- perimeter channels should be provided at the site boundary to intercept storm run-off from offsite, these channels should be constructed in advance of site formation works and earthworks;

- all traps (temporary or permanent) should also incorporate oil and grease removal facilities;

- manholes should be adequately covered or temporarily sealed;

- all drainage facilities must be adequate for the controlled release of storm flows;

- open stockpiles should be covered with tarpaulin or similar fabric to prevent washing away;

- minimising of exposed soil areas to reduce the potential for increased siltation and contamination of run-off;

- earthwork final surfaces should be well compacted and subsequent permanent work should be immediately performed;

- excavation work should be scheduled between September and April whenever possible to minimize soil erosion during rainy season;

- bentonite slurry should be reconditioned and reused wherever practicable;

- collection of spent bentonite or other grouts in a separate slurry collection system either for reuse or disposal to landfill;

- used bentonite slurry can only be disposed of to the local sewer upon treatment to the TM limits;

- water used for water testing, boring, drilling works, concrete batching and precast concrete casting should be recirculated/reused as far as practicable;

- EPD should be consulted with regard to disposal of chlorinated water (sterilised water);

- on-line standby sump pumps should be provided to prevent wastewater overflow from water recycling systems;

- wastewater from concrete batching and precast concrete casting should be treated for pH adjustment and silt removal prior to discharge;

- washwater from wheel washing facilities should have sand or silt removed before discharge;

- the section between site exit and public road should be paved, with backfall, to prevent site run-off from entering the public road; and

- **extracted groundwater should be discharged into stormwater drains after removal of silt in silt removal facilities.**

Debris and Litter

In order to comply with the aesthetic criteria for the proposed North Western WCZ WQO:

- **the Contractor should ensure that site management is optimised and that any solid materials, litter or wastes should not be permitted to block drains or enter surface and marine waters.**

Oils and Solvents

To prevent the accidental release of oils and solvents the Contractor should ensure that:

- **all leaks or spills should be contained and cleaned up immediately;**

- **all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank;**

- **bund drains should be kept locked to prevent accidental discharges;**

- **rainwater trapped within bunds should be discharged via the wastewater treatment plant; and**

- **vehicle and plant servicing areas, vehicle wash bays and lubrication bays should be located under cover where possible and the drainage should be connected to the wastewater treatment plant via a petrol interceptor.**

Sewage

Sewage plans should ensure that:

- **grease traps should be installed for discharges from canteens to include drainage from basins, sinks and floor drains;**

- **as it is presently understood that a public sewer connection to the CIF will not be available until mid 1998, sewage from toilets and works canteens should be treated prior to discharge to marine waters; interim sewerage treatment facilities such as a septic tank and soakaway system should be installed and the treated wastewater can subsequently be tankered off-site or discharged providing it complies with the TM for North Western inshore waters.**

6.6.2 *Operational Phase*

The CIF is part of the Tuen Mun Area 38 development which will be served by the public sewerage network. Current schedules for the development indicate that the public sewerage network will not be ready by the time that the CIF is in operation and will only be available from mid-1998. Wastewaters from the plant can only be discharged to nearby marine waters during the initial year of operation provided that the discharges are in compliance with appropriate discharge standards. It should also be noted that only stormwater may be discharged to stormwater drains.

Whilst specific details of the CIF design are not available at this stage, preliminary investigations indicate that, if a wet scrubber system is chosen, the packaged unit will usually come with its own wastewater treatment unit comprising of neutralisation, precipitation, flocculation and settlement with sludge dewatered, probably using a filter press. Other wastewater sources include container washing, process area hosedown and maintenance clean-up, these waters will contain traces of contaminants and it is likely that an on-site wastewater treatment plant will have to be installed to treat these discharges to the required TM limits for discharge to North Western waters.

Many of the specific mitigation measures identified for the control of construction impacts are applicable to the operational phase. In general, it is recommended that:

- **channelling and bunding be provided to separate and control storm water run-off so that it is discharged into the stormwater drain, via a silt retention pond adequate for the controlled release of storm flows;**

- **channels should be provided at the site boundary to intercept off-site storm run-off;**

- **drainage channels should also incorporate sediment basins or traps, with oil and grease removal facilities, which must be cleaned and maintained on a regular basis, preferably daily;**

- **the procedures for the CIF are designed to ensure that spillages, both on and off-site, are effectively contained and washdown water from clean-up operations is directed for appropriate treatment before discharge;**

- **any temporary facilities for the treatment and disposal of wastewaters, prior to the completion of the sewerage infrastructure, be included in the detailed design of the CIF and addressed in the detailed EIA; and**

- **the acceptability of wastewater discharges to the marine waters, and subsequently to sewer, be confirmed at the detailed design stage when details of wastewater quality are available and a detailed assessment of aqueous waste arisings and the plant required to treat them to acceptable standards can be undertaken.**

6.7 *CONCLUSIONS AND RECOMMENDATIONS*

6.7.1 *Construction*

Water quality impacts from the construction of the CIF will arise from typical land based construction activities which involve construction run-off and drainage; litter and debris; and spillages. If proper site management and good construction practices are implemented, it is unlikely that construction activities would result in non-compliance with the WQO. Recommended mitigation measures, as described in *Section 6.6.1* should be incorporated in the contract specification.

6.7.2 *Operation*

The implementation of recommended mitigation measures will ensure that storm water run-off will be effectively controlled and treated to TM standards before discharge to the stormwater drain.

The operation of the CIF is not envisaged to generate any wastewater discharge likely to cause adverse water quality impacts providing adequate treatment is employed before discharge. Major wastewater streams will include:

- scrubber water (15 m^3 per day), if wet scrubbing is used;
- drainage from process areas including container washing (1 m^3 per day), ash quench overflow (1 m^3 per day) and hosedown water (5 m^3 per day);
- sanitary sewage (3.5 m^3 per day); and
- surface run-off.

Aerial emissions from the CIF are not considered to be a source of adverse impacts in terms of water quality.

The effective containment and clean-up of spillages both within the site and on the public highway can be achieved by including the recommended mitigation measures in the detailed design and operational procedures of the CIF.

If a wet gas scrubbing unit is chosen, a scrubbing water treatment unit will be required. The complexity of the wet scrubbing system is likely to increase the treatment and monitoring costs when compared to alternative gas cleaning systems. Therefore, wet scrubbing will probably not be the preferred option selected by the Contractor. The use of seawater for gas scrubbing is not recommended.

In view of the unavailability of the public sewerage system in the first year stage of operation, it will be necessary to treat wastewater from the plant to discharge limits acceptable to inshore waters. Alternatively, if acceptable, the wastewater may be tankered off-site to a suitable treatment facility with the capability to treat industrial wastewater.

The Contractor should ensure that a detailed design stage assessment will be undertaken, when more information on wastewater quality is available, to confirm that the effluent streams from the site will be capable of compliance with the relevant TM standards before discharge into the marine waters. This may require the inclusion in the CIF detailed design of an appropriate wastewater treatment facility.

Monitoring wastewater quality will be required under the discharge licence conditions. These requirements will be included in the Tender Specifications and should include consideration of plant layout and design to facilitate discharge monitoring and sampling.

7 LANDUSE AND VISUAL IMPACTS

7.1 INTRODUCTION

Following the recommendations of the FR and the ER, this *Section* focuses on examining the potential visual impacts associated with the visible stack emissions and architectural design of the CIF, taking into account the current and planned landuses in the area. Local planning policy for the area is covered by the statutory Outline Zone Plan (OZP)(S/TM/8). The strategic level of planning in the area can be identified with reference to the Sub-Regional Land Use Plan, Port and Airport Development Study (PADS) and the Expanded Development Study of Tuen Mun Area 38.

Since the CIF will be built in a planned industrial area to be reclaimed from the sea, direct landuse impacts such as severance and landtake are not anticipated.

7.2 BASELINE CONDITIONS

7.2.1 *Existing Conditions*

The CIF will be located within Tuen Mun Area 38 on reclaimed land at Siu Lang Shui immediately to the south of the southern slopes of the Castle Peak hill range, which provides a significant natural backdrop to the area. However, the lower and medium slopes of the hill ranges have been largely disturbed and replaced by engineered slopes with varying degrees of restoration.

The coastal area adjacent to the CIF site has been developed predominantly for industrial use as shown in *Figure 7.2a*. To the west of the site are existing industrial establishments including the China Cement Plant and Castle Peak Power Station. The Siu Wing Steel Mill to the immediate west of the site is under construction. Along the coastal area to the east there are: a government depot, a number of fishermen's graves, the Pillar Point Sewage Treatment Plant and waterfront industries. Developments impinging on the hill slopes to the north of Lung Mun Road include two covered fresh and salt water service reservoirs, the restored Siu Lang Shui Landfill, a block making factory, the WAHMO Physical Model Laboratory, Pillar Point Vietnamese Refugee Camp and the Pillar Point Valley Controlled Landfill.

As described above, the natural landscape of the CIF site and its surroundings have been extensively disturbed by the industrial developments and is therefore considered to have a low landscape value.

7.2.2 *Future Conditions*

With the planned Tuen Mun Area 38 development involving special industry and a river trade terminal on reclaimed land (see *Figure 7.2a*), the industrial area stretching from the Castle Peak Power Station to the north will be extended all the way to the existing waterfront industries at Pillar Point to the south.

The Pillar Point Vietnamese Refugee Camp is scheduled to be vacated in early 1996. As shown in *Figure 7.2a*, a crematorium, columbarium and funeral services centre has been proposed, however, this has met with considerable objections from District Board members. Proposed as part of the Tuen Mun Port Development, a dual 3-lane road alignment crossing the adjacent area may be constructed.

It is expected that the area surrounding the CIF site would become more industrialised and have an even lower landscape value than present.

7.2.3 *Sensitive Receptors*

Visually sensitive receptors of the CIF development are identified in this assessment as residential and recreational areas. Various institutions, and commercial and industrial areas are considered to be less sensitive.

The CIF site is in a relatively remote location within the Castle Peak hill spurs and is well screened from residential areas including small villages to the northwest beyond Castle Peak Power Station, major parts of Tuen Mun New Town, and recreational areas in Area 45C.

As discussed in the Feasibility Study, distant viewers from North Lantau and transient viewers from adjacent road and marine traffic are not considered to receive significant visual impact from the CIF development.

The nearest sensitive receptors (over 3 km away) that are likely to be able to view the CIF and may be significantly affected are upper floor residents of high-rise buildings near the Tuen Mun Ferry Pier area, which include:

- Melody Garden;
- Butterfly Estate;
- Richman Garden; and
- Pierhead Garden.

These sensitive receptors will have a middle-ground view of the CIF.

Since the adjacent Pillar Point Vietnamese Refugee Camp is a temporary use and is expected to be vacated in early 1996, it is not considered to be affected by the development.

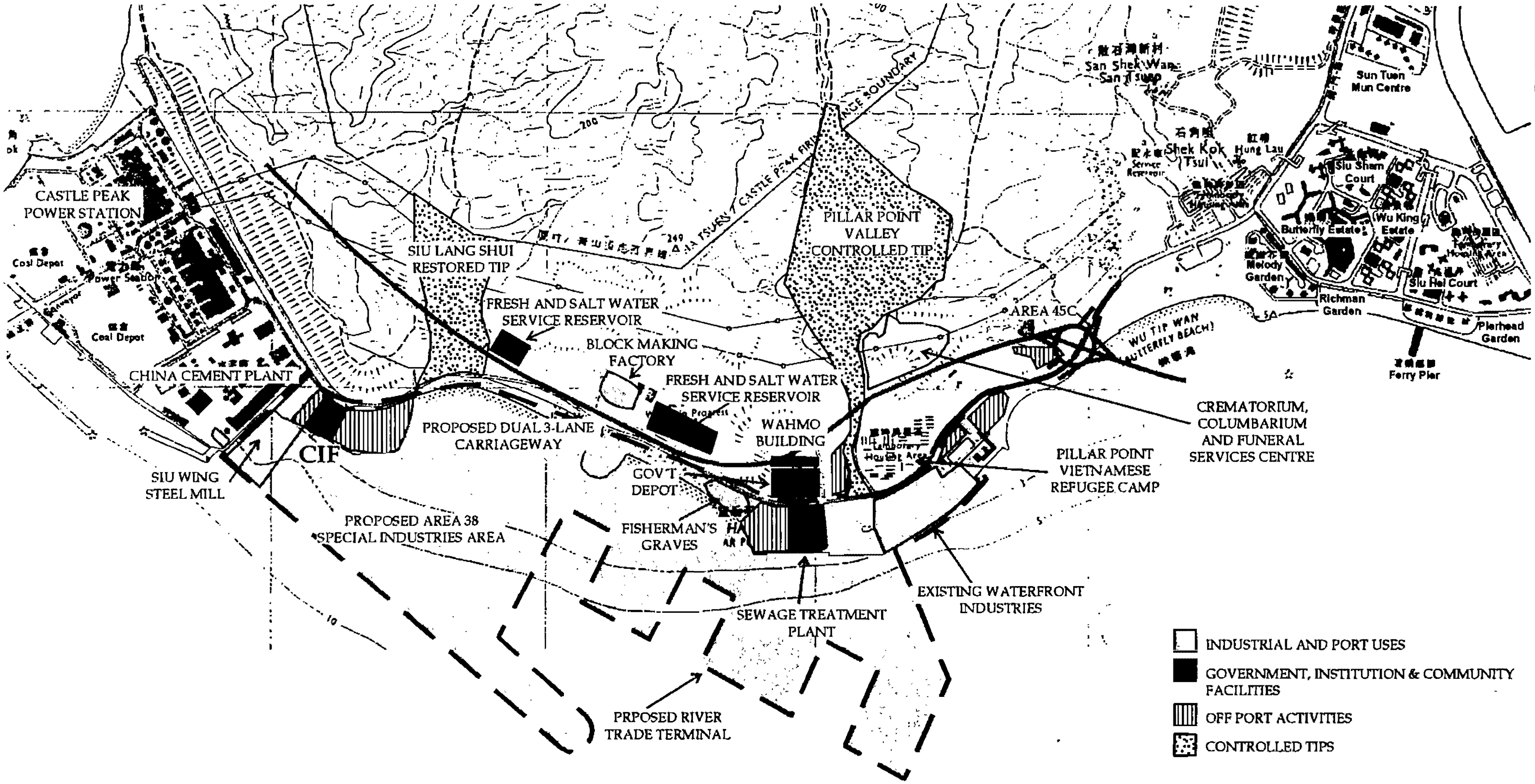


FIGURE 7.2a - EXISTING AND COMMITTED LANDUSES ADJACENT TO THE CIF

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

7.3 ASSESSMENT OF IMPACTS

7.3.1 *Construction Impacts*

The site will be made available for the CIF as a small part of the reclamation of the Tuen Mun Area 38 development. The construction work for the CIF will be on the newly reclaimed land farthest away from the sensitive receptors compared to the other developments on the reclamation and is expected to have low visual impact on the sensitive receptors.

7.3.2 *Operational Impacts*

The CIF is expected to comprise the main incinerator building and animal cremator which will be approximately 10–15 m high with an approximately 60 m high stack, the scale of which would be similar if not smaller than neighbouring facilities such as the steel and cement plants. It was concluded in the FR that, overall the CIF would not result in high visual impact, however the incinerator stack and its plume, and the appearance of the facility might be a concern to sensitive receptors.

Visible Stack Emissions

There is also the potential for steam to be emitted from the CIF stack. As indicated in the Feasibility Study, the amount of steam produced and its visibility will be a function of the emission gas moisture content and temperature difference from the ambient air temperature. If a wet scrubber is to be used to clean the stack gas, the exhaust gas temperature from the CIF is expected to be around 50°C and a visible steam plume is likely to result due to the relatively small temperature difference from the ambient air temperature of 21–26°C (*Monthly Normals of the Meteorological Elements for the 30 Years 1961–1990 for HK, Royal Observatory, 1992*).

Experience of a similar incinerator (Knostrop, UK) indicates that by raising the temperature of the emission gases to around 100°C, a steam free emission plume from the stack can be ensured under normal weather conditions. As the ambient air temperature in the UK should be lower than that of HK and presents a more favourable condition for the formation of steam plumes from this kind of incinerator stack, it is expected that a temperature requirement of 100°C for the emission gases from the CIF stack should be adequate to ensure a steam free emission under normal weather conditions. The proposed emission limits specify the stack gas temperature to be above the acid gas dew point. This will require an emission temperature of around 120°C which should also ensure no visible plume is produced.

Smoke emissions from the CIF stack, in compliance with the proposed emission limits, will be less than the Ringelmann Chart Shade No.1 and not visible.

Exterior Design of the Facility

The design of the CIF will not be determined until after the contract is awarded although the design is somewhat limited by operational considerations. However, architectural treatments which could enhance the appearance of the facility are possible.

As part of the Area 38 development, the exterior design of the CIF should consider the overall design guidelines (*Expanded Development Study of Tuen Mun area 38 – Final Report, Territory Development Department, 1990*) recommended for Area 38 so as to maintain a modern, pleasant and attractive environment in the area. The guidelines are summarised as follows:

- building coverage should not exceed 60% of the net site area;
- a non–buildable land reserve along all frontages facing major roads of 7.6 m depth, and a similar reserve of 4.6 m depth along all common site boundaries adjacent to other plots; and
- low rise building heights.

In addition, a commonality in the architectural design should be adopted for all building structures on site. Common colour themes should run throughout the site, from the stack and roofs to equipment, and where possible, the site should be enlivened through the use of attractive bold colour schemes, strong signage and the detailing of specific features of buildings (eg stairways, access points etc).

The site boundary should be permanently fenced to enhance a tidy and compact image of the CIF, if necessary the fencing material could be chosen to provide direct visual and noise screening. However, an open structure fence may be preferred as landscaping of the site will be able to enhance the design features and improve the overall condition of the site, such as by the selective use of trees and shrubs.

7.4 CONCLUSIONS AND RECOMMENDATIONS

From the above discussion, it is concluded that the CIF development will not lead to significant landuse or visual impacts. However, the following recommendations should be considered by the CIF Contractor:

- **subject to a test period, the design of the heating system of the emission gases should be flexible to allow for higher temperature if required; and**

- **the external design of the CIF should meet the recommendations of the Tuen Mun Area 38 Final Report.**

8 *WASTE IMPACTS*

8.1 *INTRODUCTION*

This section addresses the potential for impacts from the generation, handling and disposal of all wastes arising during the construction and operation of the CIF, other than wastewaters which are discussed in *Section 6*. The collection and delivery of wastes is addressed in relation to the responsibilities of the Contractor to collect clinical waste. The collection and delivery of other types of waste is outside the control of the Contractor and therefore, the scope of this EIA.

8.2 *POTENTIAL SOURCES OF IMPACTS*

8.2.1 *Main Sources of Waste*

Activities during the construction of the CIF will result in the generation of a variety of wastes which can be divided into distinct categories based on their nature and ultimate disposal sites. These include:

- excavated and inert material suitable for reclamation and fill;
- general construction waste;
- chemical waste; and
- general refuse.

Waste categories likely to be generated during the operation of the CIF include:

- post-combustion wastes;
- industrial wastes;
- chemical wastes; and
- general refuse.

The main sources of impacts associated with post-combustion, domestic and commercial wastes arising during the operation of the CIF are the possible effects of the quantities generated on disposal capacity and the proposed arrangements for handling and disposal of these wastes.

The potential impacts which may result from the collection, transfer, storage and disposal of clinical wastes are also addressed here, the environmental impacts which may arise from the treatment of clinical wastes have been considered in the previous sections.

The definitions for each of these categories and the nature of their arisings and potential impacts are discussed in detail below.

8.2.2 *Construction Wastes*

Excavated Material

Excavated material from the works will comprise primarily rock and marine sand which has been used as reclamation fill. Given the likely inert nature of this material, reuse on-site or at reclamations is not likely to have any significant environmental impact. The main impacts associated with the excavated material are related to air quality and dust generation during excavation, stockpiling and transportation. These have been discussed in detail in *Section 3*.

It is expected that the CIF construction will not generate significant quantities of excavated material during the initial earthwork activities and digging of foundations.

Construction Waste

Waste will arise from a number of different activities carried out by the Contractor during construction, operation and maintenance activities and may include:

- wood from formwork;
- equipment and vehicle maintenance parts;
- materials and equipment wrappings;
- unusable cement/grouting mixes; and
- damaged or contaminated construction materials.

The volume of construction waste generated will be dependant on the Contractor's operating procedures and site practices, and hence cannot be quantified at this stage.

Due to the inert nature of most construction waste, disposal is not likely to raise long term environmental concerns. Construction waste must not be disposed of at a landfill site if it contains more that 20% inert material by volume, and therefore the Government encourages segregation of wastes at construction sites. Inert materials may be disposed of at a public dump, while putrescible materials (eg wood) must be disposed of at a landfill. However, the storage and stockpiling of construction waste prior to utilisation on site or disposal can lead to the generation of dust and the contamination of run-off and may be visually intrusive. In addition, disposal of these materials at landfill will consume valuable void space which is required for domestic and industrial wastes.

A Dumping Licence issued by the Civil Engineering Department, under the Crown Land Ordinance, must be obtained by the Contractor before disposing of construction wastes at a public dump.

The main impacts resulting from the disposal of construction wastes are expected to come from their transport to the various disposal sites. These potential impacts may result in additional noise impacts, possible congestion due to increased traffic loadings and dust and exhaust emissions from the haul vehicles. These impacts have been addressed in *Section 3*.

Chemical Waste

Chemical Waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the Regulations. A complete list of such substances is provided under the Regulations. Substances likely to be generated during the construction of the CIF will for the most part arise from the maintenance of plant and equipment. These may include, but need not be limited to the following:

- spent filter cartridges containing heavy metals;
- scrap batteries or spent acid from their maintenance;
- brake clutch linings containing asbestos materials;
- oil retrofitting;
- mechanical machining producing spent mineral oils/cleaning fluids; and
- equipment cleaning activities producing spent solvents/solutions which may be halogenated.

Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation*. Hazards include:

- toxic effects on workers;
- adverse effects on water quality from spills;
- odour;
- fire hazards;
- disruption of sewage treatment works where waste enters the sewage system; and
- the contamination of underlying soil and groundwater.

8.2.3 *Waste Arisings During Operation*

During the operation of the CIF waste arisings will typically consist of:

- post-combustion waste;
- industrial waste;
- chemical waste; and
- general refuse.

Post-Combustion Waste

The quantity of incinerator residuals produced each day is derived from the bottom furnace ash produced in the incinerator and the filter cake produced from the particulates removed in the wet gas cleaning process. Based on the Knostrop EIA, the quantity of incinerator dry ash is assumed to be 12% by weight of the incoming waste quantity, and after quenching will absorb a further 50% moisture. The quantity of filter cake produced per day is assumed to be 5% by weight of the incinerator burning rate, including moisture. The quantities and likely hazardous composition of residual wastes from the plant are shown in *Table 8.2a* below.

Table 8.2a *Residual Waste Arisings (tonnes per day)*

Waste Type	Estimated Quantity	Potentially Hazardous Constituents
Clinical Waste Incinerator		
• Bottom Ash	6.8	Trace metals, sharps, metal
• Filter Cake	1.9	hydroxides and trace organics
Animal Carcase Incinerator		
• Bottom Ash	2.4	Trace metals
• Filter Cake	0.7	
Sewage	negligible	Trace metals, BOD
TOTAL	12.0	

Source: Centralised Incineration Facility For Special Wastes – Phase I: Feasibility Report

In general, bottom ash from the animal carcase incinerator will contain mainly carboniferous material and trace metals while those from clinical waste incinerators will contain silicon oxides, carboniferous material, sharps (eg. needles, scalpel, glass), metal oxides, trace metals and trace organics. Filter cake will be mainly fly ash from gas streams and will usually have high levels of trace metals from dewatered hydroxides, sulphates and sulphites of metals.

It is not envisaged that the chemical constituents of the bottom ash or filter cake will present any environmental impact, above that normally associated with landfill operations, through leachate or landfill gas emissions following disposal at the West New Territories Landfill (WENT).

The WENT landfill is being engineered and operated in accordance with the highest international standards. The landfill has been designed and constructed as a containment site with full provision for leachate collection and treatment and landfill gas collection and utilisation.

Industrial Wastes

Industrial wastes include processing wastes (but not post combustion wastes) arising from the operation and maintenance of the CIF. These wastes would include scrap metals, rags and materials arising from the maintenance works.

Waste Storage

Industrial waste storage is unlikely to have adverse environmental impacts, however, it may pose a visual impact and should be removed from site for recycling or disposal if not reused. Chemical waste, as noted above, can pose environmental and health and safety risks if not stored and disposed of correctly. General waste issues are discussed below.

8.2.4 *General Waste*

General wastes arising during construction site may include, *inter alia*, newspapers, food wastes, packaging and waste paper. These will generally be disposed of to landfill.

General refuse includes any waste that does not fit into an construction, industrial or a post-combustion waste category or any of the categories previously described.

During the operation of the CIF, the general refuse generated will include office wastes, consisting of mainly waste paper and packaging, food wastes, glass bottles, aluminium and tin cans. These materials should be separated and recycled, wherever practicable, or if this is not possible disposed of at landfill.

The storage of general refuse has the potential to give rise to adverse environmental impacts including:

- odour if the waste is not collected frequently (eg. daily);
- presence of pests and vermin if the waste storage area is not well maintained and cleaned regularly;
- windblown litter; and
- visual impact.

Disposal at sites other than approved landfills can result in the following:

- odour impacts at the disposal point since appropriate odour control measures would not be provided, such as daily cover;

- presence of pests, vermin and scavengers at the disposal sites;

- deterioration of water quality in the area surrounding the disposal site due to the production of leachate, and the absence of adequate leachate collection and treatment facilities; and

- visual impact.

8.2.5 *Collection, Transfer, Storage and Disposal of Clinical Wastes*

Clinical waste arises at a number of sources, including Government and private hospitals and clinics, doctors and dentist surgeries, veterinary practices, medical and veterinary teaching establishments, research laboratories, alternative medical practices, morticians and private homes. Clinical wastes consists of human or animal tissue, blood or body fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, syringes, needles or other sharp instruments and cytotoxic wastes. The clinical wastes have a potential health risk to those personnel who come into contact with it and are generally regarded to be offensive. The collection, transfer, storage and disposal of clinical waste must therefore be undertaken in a safe manner which eliminates direct contact and minimises risk to staff involved in each of these operations.

8.3 *RECYCLING, TREATMENT, STORAGE, COLLECTION, TRANSPORT AND DISPOSAL OPTIONS*

8.3.1 *Excavated Material*

It is likely that disposal of this material would be by covered truck to nearby construction works where it could be used as backfill. Given the limited quantity of material to be exported and its suitability for use in reclamation or nearby developments with a material deficit, the material should be exported to such nearby sites. The material excavated from reclaimed areas may require de–watering prior to disposal.

8.3.2 *Construction Waste*

A number of design and management measures can be introduced during the construction period which will minimise the generation of general construction wastes.

The design could maximise the use of standard wooden panels in formwork so that the maximum reuse of panels can be achieved. The need to cut panels could also be minimised. Alternatives such as the use of steel formwork or plastic facing could be considered to increase the potential for reuse. It is important that wood wastes are stored separately from other general construction wastes to minimise any contamination which would render the wastes unsuitable for disposal at public dumps.

Careful planning and good site management could be employed to minimise the over ordering or mixing of concrete, mortars and cement grouts. In addition proper storage and site practices will minimise the damage or contamination of construction materials.

In accordance, with the *New Disposal Arrangements for Construction Waste, EPD and the Civil Engineering Department (CED), 1992* disposal of construction waste can either be at a specified landfill, or at a public dump. Depending on the nature of the construction wastes generated, surplus construction waste not suitable for reuse on–site will be collected by a waste collector under arrangement with the Contractor and deposited at a suitable public dump or designated landfill. The Contractor should ensure that the necessary waste disposal permits are obtained prior to the collection of the waste.

The only available landfill site designated for mixed construction waste will be at Pillar Point Valley landfill after the exhaustion of Shuen Wan and Tseung Kwan O landfills. Construction waste with only a small amount of inert materials (not more than 20% by volume) will be allowed for disposal at landfills. Many PADS related contracts, reclamations or other public dumps have a requirement to import fill material. In addition, due to the limited void space at landfills for disposal of domestic and industrial waste in Hong Kong, disposal at these reclamation sites or an approved public dump would be the preferred method provided that the Contractor complies with the acceptance criteria for public dumps.

The handling and disposal of bentonite slurries should follow the requirements as set out in the *Practice Note For Professional Persons ProPECC PN 1/94 – Construction Site Drainage.*

As far as possible it would advantageous for the Contractor to recycle as much as possible of the construction waste on–site, in order to reduce the requirement to import additional materials. Recycling would also reduce the collection, transportation and disposal of construction waste and any associated charges by the transport contractor. At the present time, Government has not implemented a charging policy for the disposal of wastes to landfill, although it is understood that this is currently under consideration and may be implemented for all wastes, including construction wastes, in 1995.

8.3.3 *Chemical Wastes*

Chemical wastes will arise principally as a result of maintenance activities. Again, it is difficult to quantify the amount of chemical waste which will arise from the construction and operation activities since it will be highly dependant on the Contractor's on–site maintenance requirements and the number of plant and vehicles utilised.

The Chemical Waste Treatment Facility (CWTF) located at Tsing Yi was opened in June 1993 and is the point of disposal for most chemical wastes in the territory. The contractor operating the chemical waste treatment facility also operates a collection service for chemical waste producers. Disposal of chemical wastes in this manner will ensure that environmental and health and safety risks are reduced to a minimum, provided that correct storage procedures are instigated on–site and that the collection vehicles are operated by licensed carriers.

8.3.4 *General Refuse*

The amount of general refuse which is likely to arise cannot be quantified at this time as it will be largely dependant on workforce size and site practices.

General refuse generated on–site should be stored and collected separately from other construction, industrial and chemical wastes. The Contractor may arrange for the collection and disposal of the refuse by an approved carrier. The removal of waste from the site should be arranged on a daily basis by the Contractor to minimise any potential odour impacts, minimise the presence of pests, vermin and other scavengers and prevent unsightly accumulation of waste.

8.3.5 *Collection, Transfer and Storage of Clinical Waste*

The Contractor will be responsible for the design provision and operation of the clinical waste collection service from hospitals, clinics, private practitioners, auxiliary medical services, veterinary clinics and other clinical waste producers to the CIF. A total of 21 tonnes per day (tpd) of clinical waste will be collected of which 18.5 tpd will be collected from hospitals and clinics and 2.1 tpd from private medical practitioners. Clinical waste should be separated from other wastes by the waste producer at source and packaged in distinctively coloured containers designed to prevent tearing, breaking or leaking during transfer and transport to the CIF. This will minimise the health risk to waste producers and will protect those personnel involved in the collection, transfer and storage of clinical waste.

The Clinical Waste Control Scheme and Code of Practice for the Management of Clinical Wastes will set out the requirements for the collection, transfer and storage of clinical wastes from each of the clinical waste sources. These are currently under development, but the general provisions are expected to be as follows.

The clinical waste packages should be marked to identify the source of wastes. The specified tracking system using consignment notes should be followed which allows the wastes to be traced from the waste producer, through each of the stages of collection, transfer, storage and treatment. Any problems with the waste can, therefore, be traced to the point of arising, thereby enabling appropriate action to be taken.

Specially designed lockable transit skips should be used for the collection of clinical wastes. Wastes that are stored at hospitals or clinics in transit skips will not undergo any secondary transfer. Wastes collected from private medical practitioners should be transferred in the prescribed containers and placed in transit skips. These skips should be kept securely locked at all times the wastes are in transit.

Staff management and training will play an important role in ensuring wastes are collected and transferred safely. All staff should be trained in collection, transfer, storage and disposal procedures and where appropriate use protective clothing.

Special arrangements should be made and emergency procedures documented for dealing with accidental spillages on the public highway. The Authority should be informed immediately and measures should be taken that ensure that the wastes are quickly removed and the area cleaned without presenting a hazard to the general public or those involved in the cleaning operation.

A special full container storage area should be provided at the clinical waste incinerator. The storage area will act as a short term backup for times when the incinerator is undergoing maintenance or repair and therefore a capacity equivalent to at least the total waste inputs to the clinical waste incinerator for a period of 48 hours should be provided. In order to prevent odour and minimise health risks the storage area should be maintained at a temperature of 7°C or less. Wastes should not be stored at the CIF for a period in excess of 48 hours.

8.3.6 *Disposal of Post Combustion Wastes*

Approximately 12 tonnes of ash will be generated at the CIF daily. Ash from the plant is expected to be acceptable at WENT which has been in operation since mid-1993. The average daily intake at the WENT landfill is currently below 4000 tonnes per day. In terms of waste quantities, the waste input from CIF is low when compared with daily intake capacity of the landfill site, and sufficient disposal capacity exists for long term disposal of CIF solid waste at the site.

It is currently envisaged that waste residues from incinerators will be discharged automatically and transferred to skips which will be loaded and unloaded by handling units for transport and disposal. The skip will be covered in transit between the CIF and landfill. No manual handling of waste is anticipated, with any spillages being collected by a vacuum cleaner with a filter or wet system; dry sweeping will not be permitted.

It is unlikely in normal operations that post-combustion wastes would be handled but during maintenance or repair activities some handling or clearing of these wastes may be necessary. Sharps may remain physically unchanged but would be sterilised by the incineration process. Precautionary measures during handling should be considered and operators should be equipped with suitable protective gloves and clothing.

8.3.7 *Waste Disposal During Non-Standard Operating Conditions*

If the incinerator ceases to function for a period longer than could be absorbed within the on-site skip queuing system, an alternative means of disposal of the clinical wastes will be required. It is anticipated that in such an event, the clinical wastes would be disposed of to landfill, as is current practice for such wastes. Disposal of clinical wastes by this means requires measures to be taken to minimise health and safety risks to landfill personnel, the general public and the environment.

In emergency circumstances when the landfill disposal route is required, clinical waste will continue to be brought to the CIF, where it can be subsequently transferred to refuse collection vehicles equipped with appropriate loading equipment for discharge of the transit skips. The waste disposal system should be operated independently from the clinical waste collection service.

Those materials which can be classified as chemical waste, such as laboratory preparations, including solvents and cytotoxic drugs may be suitable for disposal at CWTF if they can be separated from the other components of the clinical waste. This could only be undertaken at source by producing two separate waste streams and would only be practicable if the CIF were to be out of action for a considerable period.

8.4 *MITIGATION MEASURES*

8.4.1 *Introduction*

This section sets out ERM's recommended storage, transportation and disposal measures to avoid potentially significant environmental impacts associated with waste arisings from the construction and operation of the CIF or to reduce these to acceptable levels. These should be included in the environmental protection clauses in the CIF contract documents.

8.4.2 *Segregation of Wastes*

In order to ensure that all waste is disposed of in an appropriate manner, waste should be separated by category on-site by the Contractor. The criteria for sorting solid waste is described in *New Disposal Arrangements for Construction Waste* issued in 1992 by the EPD and the CED. Waste containing in excess of 20% by volume of inerts should be segregated from waste with a larger proportion of putrescibles. Inerts are described as material being soil, rock, asphalt, concrete, brick, cement/plaster, building debris and aggregates, and any other general materials which would not bio-degrade.

The Consultants recommend that all waste, be segregated into the following categories:

- **excavated material or construction waste suitable for reclamation or fill;**
- **construction waste for disposal at public dump or landfill;**
- **chemical waste;**
- **industrial wastes;**
- **general refuse; and**
- **post-combustion wastes (which must be stored and handled separately from other wastes).**

The different categories of wastes should be segregated, recycled, treated, stored, transported and disposed in the manner described in *Section 8.3*. Further segregation of the wastes such as wood, paper and metals should be undertaken, wherever possible, to facilitate reuse and recycling.

8.4.3 *Waste Minimisation*

Construction materials and materials generated during operation should be recycled or reused wherever possible. The waste management strategy to be employed should be waste minimisation at source. Where waste generation is unavoidable, the potential for recycling or reuse should explored and opportunities taken wherever practicable. If wastes cannot be recycled then the recommended disposal routes should be followed.

Waste reduction measures should be introduced at the design stage and carried through the construction activities, wherever possible, by careful purchasing control, reuse of formwork and good site management.

Recycling of wastes generated through administrative and maintenance activities during the operation should be encouraged as long as it does not interfere with the operation of the CIF. No recycling of clinical waste or bottom ash should be permitted. The Contractor should:

- **where practicable, recycle waste paper generated at the Contractor's administrative offices; and**

- **where practicable, recycle scrap metal and other recyclable materials.**

Training and instruction of the Contractor's staff should be given to increase awareness and draw attention to waste management issues and the need to minimise waste generation.

8.4.4 *Storage, Collection, Transport and Disposal of Waste*

In circumstances where wastes cannot be recycled it is recommended that the Contractor should segregate the waste materials and dispose of them as follows:

- **inert construction waste material when deemed suitable for reclamation or land formation should be disposed of at public dump;**

- **inert material deemed unsuitable for reclamation or land formation and non–inert construction waste material should be disposed of at public landfills;**

- **chemical waste as defined under *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be packed, labelled, stored and disposed of in full compliance with the requirements as stipulated under the Regulation and, where appropriate, disposed of at the Chemical Waste Treatment Facility located at Tsing Yi through the engagement of licensed waste collectors;**

- **general refuse should be disposed of at public landfill; and**

- **post–combustion waste should be collected and stored separately from other wastes in closed containers and whenever practicable manual handling of the waste should be avoided, the waste should then be transferred to an approved landfill in closed skips to ensure no fugitive dust emissions occur.**

The Contractor is required to consult with the Waste Disposal Authority on the final disposal of these wastes.

The CIF contract documents should include instructions which ensure that approved waste collectors are used and that appropriate measures to minimise adverse impacts including windblown litter and dust from the transportation of these wastes are instigated.

It is recommended that:

- **wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;**

- **only approved waste collectors authorised to collect the specific category of waste concerned should be employed;**

- **appropriate measures should be implemented to minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;**

- **the necessary waste disposal permits need be obtained from the appropriate authorities should they be required in accordance with the Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) and the Crown Land Ordinance;**

- **collection of general refuse should be carried out frequently, preferably daily; and**

- **wastes should only be disposed of at licensed sites and the Contractor should develop procedures to ensure that illegal disposal of wastes does not occur;**

- **waste storage areas should be well maintained and cleaned regularly.**

8.4.5 *Waste Arisings During Operation*

Provisions for the transfer of CIF wastes to landfill without incineration of the wastes have to be made for circumstances when the incinerator cannot be used. The Contractor should:

- **design, and implement as necessary, emergency procedures for transferring wastes directly to landfill.**

Controls for the analysis and recording wastes for disposal should be placed on the Contractor, he should:

- **record the quantity of waste for disposal, determined by weighing each load or similar method;**

- **undertake contaminant analyses of the bottom ash and filter cake upon the commencement of the Operation and at least annually thereafter.**

In order to ensure safety, the Contractor should:

- **follow the instructions of the WENT Contractor when undertaking disposal operations.**

8.4.6 *Collection, Transfer and Storage of Clinical Wastes*

The Contractor shall ensure that:

- **clinical wastes are managed in accordance with the requirements of the Clinical Waste Control Scheme and Code of Practice for the Management of Clinical Wastes;**

- **a full container storage area should be provided, having a capacity equivalent to at least the total waste inputs for clinical waste incineration for a period of 48 hours; and**

- **the full container storage area shall be refrigerated at a temperature of 7°C or less.**

- **wastes should not be stored at the CIF for a period in excess of 48 hours.**

8.5 *CONCLUSIONS AND RECOMMENDATIONS*

No significant impacts upon the environment have been identified arising from the disposal of waste from the CIF. In most cases, construction waste can be reused on other sites or disposed of to landfill. Some small quantities of high value waste such as aluminium and paper can also be recycled.

Studies in the UK and US clearly show that the chemical composition of post-combustion waste is acceptable for disposal at landfill and the quantities of bottom ash and filter cake that will be produced by the CIF will have a negligible effect on the disposal capacity at the WENT Landfill.

The effective application of the mitigation measures recommended in the previous section will ensure that environmental nuisance will not arise from the storage, transport and disposal of the various types of waste arisings from the CIF.

9 *LANDFILL GAS HAZARDS AND PRECAUTIONARY MEASURES*

9.1 *INTRODUCTION*

A small part of the CIF site falls within the 250 m consultation zone surrounding the Siu Lang Shui Landfill (SLSL), therefore it is considered necessary to assess the potential risk of migration of landfill gas and leachate which may affect the proposed development. The position of the consultation zone boundary in relation to the CIF site is shown in *Figure 9.1a*.

This assessment is based on the findings of the ongoing *Northwest New Territories Landfills Restoration Study, Scott Wilson Kirkpatrick* (NWNTLRS), and the draft *Tuen Mun Area 38 for Special Industries Environmental Impact Assessment, ERM* (Area 38 EIA).

The major constituents of landfill gas are methane and carbon dioxide with various minor constituents being present at low concentrations. Methane is flammable in the range of 5–15% by volume when mixed with air and when ignited in a confined space, such as a building, can result in an explosion. Elevated carbon dioxide levels can affect human respiration.

Geological strata, utility services and leachate movement can all provide potential migration pathways for landfill gas.

9.2 *SIU LANG SHUI LANDFILL*

SLSL is located south of the Castle Peak Firing Range, off the Lung Mun Road and 1.5 km west of the Pillar Point Valley Landfill. At its closest point SLSL lies approximately 50 m north of the Area 38 SIA reclamation. The site occupies a total area of 12 ha and was operated from November 1978 to December 1983 during which time approximately 1.2 million tonnes of domestic and industrial wastes were deposited. The site has now been restored through the placement of a cap comprising compacted gravely silty sand and subsequent tree planting.

9.3 *PLANNED AND EXISTING LANDFILL GAS CONTROL MEASURES AT SLSL*

9.3.1 *Existing Landfill Gas and Control Measures*

The existing gas control measures at the SLSL include:

- a capping layer in excess of 1 m thickness of compacted fill materials placed over the landfilled wastes;
- a gas management system comprising passive gas vents linked to gravel areas;

- monitoring drillholes and probes placed within the landfill area and in the surrounding strata beyond the southern boundary of the landfill.

The monitoring of the probes and drillholes at the southern boundary has revealed only trace concentrations of methane gas but there is some evidence of elevated carbon dioxide concentrations and depleted oxygen levels.

9.3.2 *Proposed Landfill Gas Control Measures*

The NWNTLRS report proposes the following priorities for landfill gas control:

- undertake a detailed inspection of existing gas vent pipes, and make good any which are damaged or blocked;
- establish the effectiveness of existing membrane liners and rock face coatings in controlling off-site gas migration;
- if necessary, to design and install additional perimeter gas control; and
- design and install gas control systems to prevent gas migration from the southern boundary;

The proposed gas control measure at the southern boundary incorporates the installation of a venting trench and membrane barrier. If additional control is required, the venting trench would be extended around the boundary of the site. To facilitate venting from depth the gas vents would be constructed through the trench into the underlying natural strata and linked into the venting trench.

It is not proposed to utilise landfill gas at SLSL because of the declining gas yields and the undesirable effect a positive gas collection system might have in drawing air into the waste.

9.4 *ASSESSMENT OF THE POTENTIAL FOR LANDFILL GAS MIGRATION FROM SLSL*

9.4.1 *Gas Generation*

It has been estimated that 50% of the 1.2 million tonnes of wastes deposited at SLSL are biodegradable and therefore could decompose anaerobically to produce landfill gas. The NWNTLRS suggested a gas yield of 285 m^3 per hour.

9.4.2 *Geological Strata*

The fractures and joints typical of granitic bedrock present migration pathways for landfill gas while the alluvium deposits, marine deposits and

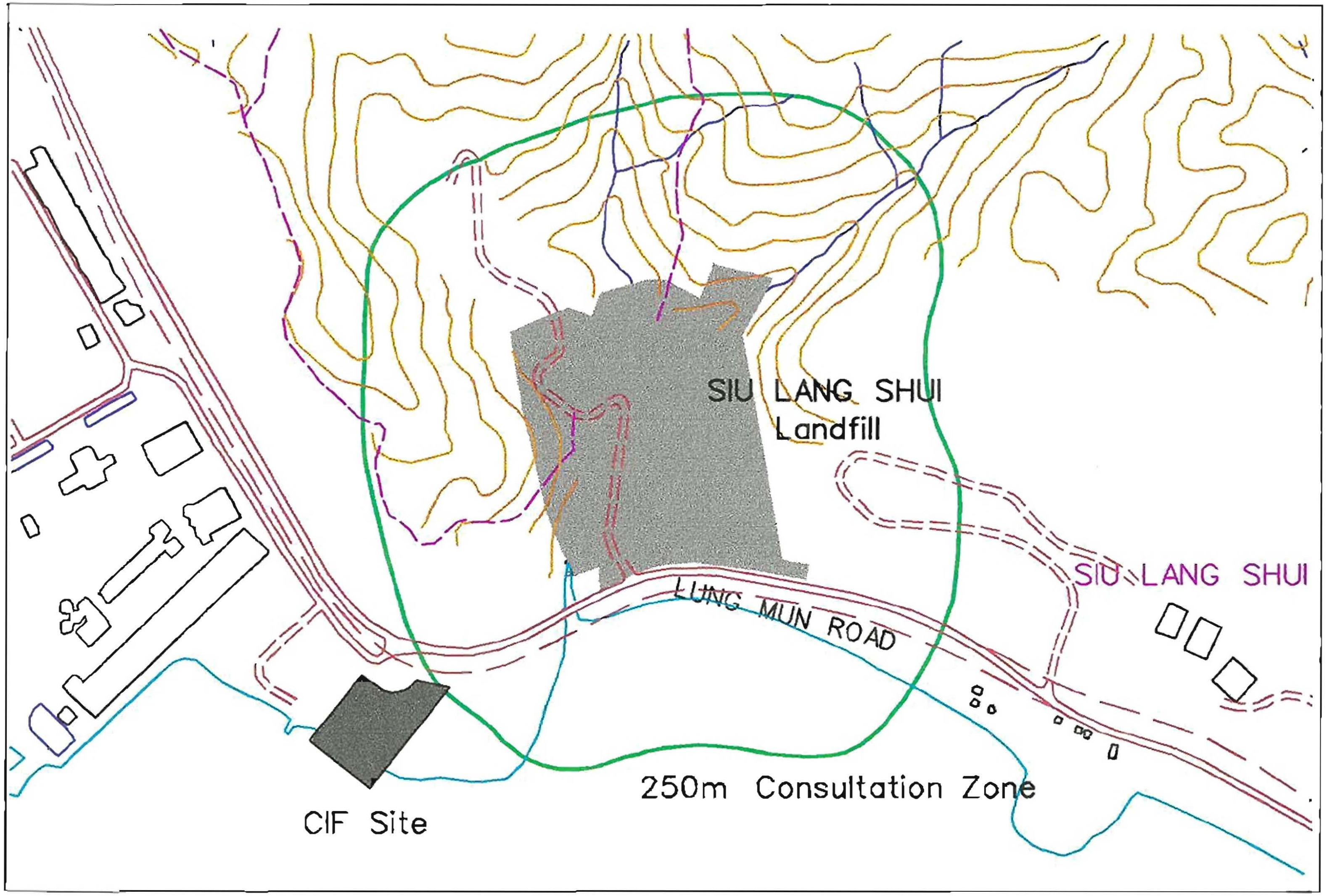


FIGURE 9.1a SIU LANG SHUI LANDFILL GAS CONSULTATION ZONE	
Date: 10 September 1994	Drawing ERM/GIS/C1127b/002
Prepared by: GIS and Mapping	Base map source: 1:20k topo. Lands Dept.

KEY

- LANDFILL SITE
- 250 m CONSULTATION ZONE
- CIF SITE

ERM Hong Kong
5, 10-11 th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

completely decomposed granites will allow migration of gas through intergranular movement.

9.4.3 *Landfill Engineering*

The SLSL site was engineered as a containment site to prevent leachate migration and groundwater ingress but the extent and standards of this engineering are unknown. It can therefore be assumed that the engineering will only partially inhibit landfill gas migration.

9.4.4 *Landfill Gas Control Measures*

A passive venting system of landfill gas control is in place at SLSL. The site has been investigated by the NWNTLRS consultants and recommendations for the repair of the existing system and for additional gas control measures have been made. These additional works are scheduled for the first half of 1996 and will significantly lower the hazards associated with landfill gas migration.

9.4.5 *Utilities*

The services for the SIA are likely to lie close to the SLSL area, either alongside the Lung Mun Road or within the SIA area itself, and well within the 250 m consultation zone boundary. There is therefore a strong possibility of landfill gas migration along utility pathways and appropriate precautionary and mitigating measures may be necessary in utilities constructed close to the SLSL. It is not known how these utilities will connect to the CIF site.

New migration pathways may be opened up due to development excavations or trenching etc.

9.4.6 *Leachate*

Groundwater contamination has been monitored at three down-gradient boreholes close to the Development Area where relatively high concentrations of BOD (26-66 mg l^{-1}), COD (290-690 mg l^{-1}) and NH_3-N (420-640 mg l^{-1}) have been found in drillholes DH201, DH202 and DH204.

These levels of contamination are such that there is a danger that landfill gas may be generated from groundwater beyond the landfill boundary.

Mitigation measures, mentioned earlier in this report, have been proposed in the NWNTLRS to minimise the levels of contamination of groundwaters and surface waters.

9.5 CONCLUSIONS AND RECOMMENDATIONS

9.5.1 *Conclusions*

A significant proportion of the SIA lies within the 250 m consultation zone around the boundary of SLSL and when the waste volumes, characteristics and the existing site engineering are considered it can be concluded that there is a significant potential for landfill gas migration into the SIA. The CIF site is close to the boundary of the 250 m consultation zone and therefore the potential for migration into this site is greatly reduced.

The conclusion of the NWNTLRS was that there is a high potential for off-site migration at SLSL although there is no evidence to date of significant migration. It was considered that the greatest potential for migration is at the southern boundary, where the closest feature is the Lung Mun Road. They considered that the potential for migration will increase following the reclamation and development of Tuen Mun Area 38.

It should however be noted that the combination of existing cap and landfill gas control measures appears to be preventing significant off-site migration south of the site and that the additional recommended measures will, when implemented, provide a further level of migration control around the landfill boundary.

A more complete assessment can only be made when the referenced landfill gas control measures have been installed and monitored for a twelve month period.

It should be noted that short or long term failure of gas control measures, through breakdown, poor maintenance or poor operation could lead to increases in landfill gas migration.

9.5.2 *Recommendations*

The restoration of SLSL is at an early stage and the proposed measures for landfill gas and leachate control when installed and proven to be effective will have a considerable influence on any hazards and corresponding precautionary measures that need to be incorporated into the construction and operation of the SIA development.

It is therefore recommended that:

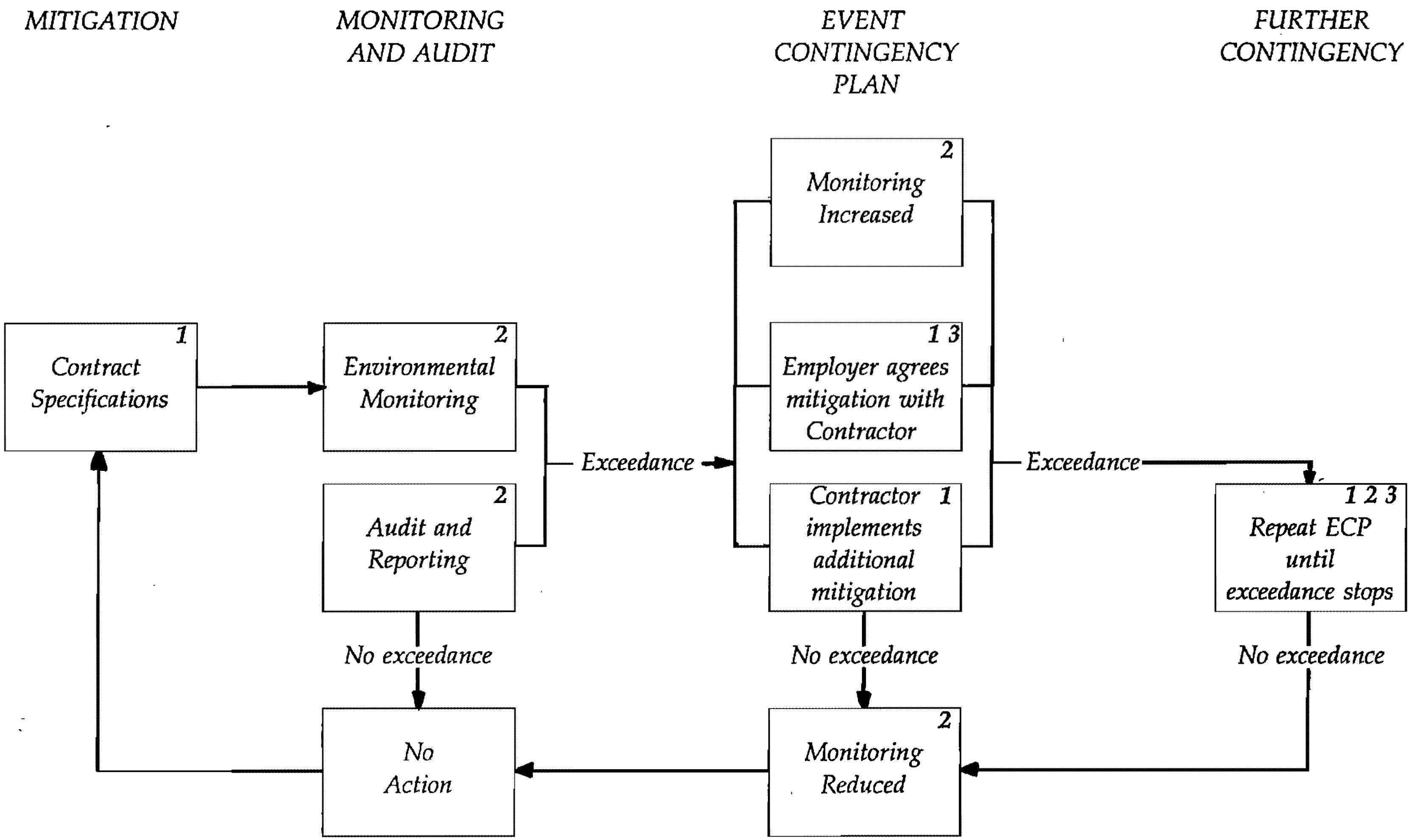
- **the situation be reviewed by an appropriate specialist, during the detailed design of the CIF and appropriate measures be developed to deal with any identified risk.**

The location of the CIF with almost all of the site falling outside the 250 m consultation zone means that it is unlikely that any precautionary measures against landfill gas ingress will be required to be incorporated specifically into the CIF design in addition to those measures required for the SIA as a whole. Therefore:

Therefore, it is recommended that:

- **the area inside the 250 m consultation zone should be monitored during the CIF construction in accordance with the monitoring scheme developed as part of Area 38 EIA.**

Figure 10.1a Implementation of Mitigation Measures and Environmental Monitoring and Audit



(Responsibilities for tasks are denoted thus: 1 – Contractor, 2 – Contractor's Consultants, 3 – Employer)

10 ENVIRONMENTAL MONITORING AND AUDIT

10.1 INTRODUCTION

In this *Section*, the basic requirements for the environmental monitoring and audit (EM&A) work which will be undertaken during the construction and operation of the CIF are set out, together with a description of how these will relate to the implementation of the environmental mitigation measures which have been described elsewhere in this report.

It is recommended that these EM&A requirements should form the basis of an EM&A Manual, taking account of the findings of this EIA, any further studies undertaken at the detailed design stage and the measures which will need to be incorporated into the environmental protection clauses of the CIF Contract.

10.1.1 *Objectives of the Monitoring and Audit Programme*

The overall objectives of the EM&A programme which will be undertaken during the construction and operation of the CIF are as follows:

- to provide a database against which the short or long term environmental effects associated with the CIF may be determined;
- to verify the environmental impacts predicted in the CIF EIA;
- to monitor the performance of the project and to provide an early indication if any of the environmental mitigation measures, identified in this report and/or implemented by the contractors, fail to achieve acceptable standards (*ie* the regulatory requirements, standards and Government policies identified in the EIA);
- to take remedial action if unexpected problems or unacceptable impacts arise; and
- to provide data to enable an environmental audit to be undertaken.

10.1.2 *General Arrangements*

As was noted above, one of the objectives of the EM&A requirements is to ensure that acceptable levels of environmental protection are achieved during the construction and operation of the CIF and that the recommended measures for the mitigation of environmental impacts are indeed being effective. This will be achieved by the Contractor taking responsibility for the EM&A work, and through the application of Event Contingency Plans (ECPs) to deal with the incidence of unacceptable pollution events, either in the course of normal construction working or through unforseen circumstances.

Figure 10.1a shows in graphic form the inter-relationships between the implementation of the recommended mitigation measures, the EM&A programme and the ECPs. The roles of each of these respective elements is further discussed in the following paragraphs.

10.1.3 *Measures for Mitigation*

The measures for mitigation which have been recommended for each of the various types of environmental impact likely to occur during the construction and operation are detailed in the previous sections of this report.

The Contractual Requirements will set out measures for mitigation which will be contractual obligations and with which the contractor must comply. These measures will be included in the contract, and the contractor will be obliged to comply with them.

10.1.4 *Environmental Monitoring and Audit*

The monitoring of the environmental impacts for which the Contractor is responsible shall be carried out by independent environmental consultants, to be appointed by the Contractor with the approval of EPD. The work will include:

Construction

In the construction phase, the EIA has identified no sensitive receivers near the CIF site where noise and dust monitoring will be required. However, because of the already poor air quality in the area, it is recommended that dust monitoring is undertaken to ensure that work on the site does not exceed the AQO.

Whilst not part of the EM&A, landfill gas monitoring is recommended for construction worker health and safety, the results should be reviewed before the facility becomes operational and a decision made as to whether it should be continued further in the light of the monitoring results.

Operation

In the operational phase, air quality and water quality impacts will be monitored as part of the conditions of the discharge licences. Odour monitoring should be undertaken to ensure that there are no offensive odours beyond the site boundary. Monitoring of ambient air quality should be undertaken at sensitive receivers nearest the locations of predicted maximum concentrations.

In order that the environmental monitoring may be audited, the Contractor will need to devise strict procedures and protocols for carrying out, recording and reporting this work. The procedures will form part of the environmental consultant's contract and they will be obliged to comply with these. These procedures, protocols and reporting formats will need to be set out in an EM&A Manual which will be produced as the first task of the independent consultants after they have been appointed.

The monitoring protocols and reporting formats should be agreed with EPD prior to work beginning on site.

10.1.5 *Event Contingency Plans*

The purpose of the ECPs is to provide, in association with the monitoring and audit activities undertaken by the Contractor's consultants, procedures for ensuring that if any significant pollution (either accidental or through inadequate implementation of mitigation measures on the part of the contractor) does occur, that the cause of this is quickly identified and remedied, and that the risk of a similar event re-occurring is reduced.

The principle upon which the ECPs are based is the prescription of procedures and actions associated with the recording of certain defined levels of pollution recorded by the environmental monitoring during construction and operation of the CIF. These levels are defined below.

- *Trigger Levels:* beyond which there is an indication of a deteriorating ambient environment for which a typical response could be more frequent monitoring.
- *Action Limits:* beyond which appropriate remedial actions may be necessary to prevent environmental quality from going beyond the *Target Limits*, which would be unacceptable.
- *Target Limits:* Statutory limits stipulated in the relevant pollution control ordinances, HKPSG guidelines, Environmental Quality Objectives established by EPD, or generally accepted voluntary limits. If these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

Recommendations for the format of the ECPs to be used during construction and operation of the CIF are set out in the following *Sections*.

10.2 NOISE

The findings of the EIA (see *Section 5.3*) show that the nearest NSRs are located at sufficient distance, and with such intervening topography that it is considerer unfeasible that either the construction or operation of the CIF will lead to noise impacts at any NSR. No monitoring of either construction or operational noise is, therefore, considered necessary.

10.3 WATER QUALITY

10.3.1 *Construction*

Provided that the measures recommended in *Section 6.7.1* are included in the contract requirements and effectively enforced, the monitoring of site run-off is not considered necessary during construction.

10.3.2 *Operation*

Operational discharges will be controlled as part of the discharge licence conditions and need not, therefore, be addressed here.

10.4 AIR QUALITY

10.4.1 *Introduction*

In this Section, requirements for the monitoring and audit of air quality impacts during the construction and operation of the CIF are recommended to be incorporated into the Contract Specifications.

Whilst dust impacts during construction are not considered to be of concern, the air quality in the area is already poor and monitoring is, therefore, recommended to ensure that cumulative impacts are minimised.

During the operation of the CIF, the effects of stack gas emissions on ambient air quality should be monitored. It is recommended that monitoring is undertaken for TSP, Respirable Suspended Particulates (RSP), SO_2, NO_2, specified metals and organic compounds. Monitoring should also be undertaken for fugitive odours from the plant.

10.4.2 *Monitoring and Audit Protocols*

The contract clauses should require that:

- **the Contractor retain a suitably qualified Consultant to carry out monitoring of air quality for the recommended air quality parameters throughout the construction and operational periods at the specified monitoring locations;**

- **monitoring should be undertaken using the standard methodologies established by the United States Environmental Protection Agency or to an alternative methodology approved by EPD;**

- **all samples collected as part of the monitoring programme should be analysed by a laboratory approved by the Employer and the results forwarded to the Employer;**

- **the samplers, equipment and shelters shall be constructed so as to be transferable between monitoring stations; and**

- **at each monitoring station, the Consultant shall, unless otherwise agreed with the Employer, construct a hardstanding surrounded by a galvanised wire fence with a lockable access gate and suitable access.**

In addition, the EM&A manual should advise that:

- **all equipment, calibration kit, etc., should be individually numbered and clearly labelled to assist in quality assurance.**

10.4.3 *Baseline Monitoring*

Construction Phase

The Contract should specify that:

(a) The Consultant shall carry out baseline monitoring for air quality and agree with the Employer ambient TSP levels at each specified monitoring location. The baseline monitoring shall be carried out for a continuous period of at least two weeks with daily ambient measurements to be taken every day at each monitoring location and at least three times per day for hourly sampling when the highest dust impacts are expected. Baseline monitoring resulting in a 24 hour and a 1 hour baseline value shall be completed within 4 weeks of the date of the letter of acceptance.

(b) The Consultant shall record the wind speed and direction during dust sampling to the satisfaction of the Employer.

Checking of baseline air quality levels shall be carried out at each location at 13 week intervals. At least one such baseline air quality level check shall be carried out each month. The checking shall be carried out when construction activities are not taking place.

The Consultant shall provide the following equipment within two weeks of the date of the letter of acceptance:

- **a suitable direct reading dust meter capable of reading 1 hr TSP in the range of 0.1–100 mg m^{-3};**

- **high volume air samplers, associated equipment and shelters complying with the requirements of Part 50 of Chapter 1 of 40 CFR; and**

- **the high volume samplers shall be equipped with electronic mass flow controls.**

Operational Phase

Prior to the commissioning of the CIF, baseline ambient air quality should be established by monitoring for the following compounds:

- **Total Suspended Particulates (TSP);**
- **Respirable (less than or equal to 10 μm diameter) Suspended Particulates (RSP);**
- **Sulphur Dioxide;**
- **Nitrogen Dioxide;**
- **Metals (Sb, As, Cd, Cr, Cu, Pb, Mn, Hg & Ni);**
- **Polychlorinated dibenzodioxins and Polychlorinated dibenzofurans (PCDD/PCDF).**

The organic compounds should be monitored in both suspended solid and vapour phases.

The Contract should specify that:

(a) **The Consultant shall carry out baseline monitoring for ambient air quality and agree with the Employer ambient levels at each specified monitoring location. The baseline monitoring shall be carried out for a continuous period of at least four weeks, prior to the commissioning of the plant, with daily ambient measurements to be taken every day at each monitoring location. Baseline monitoring resulting in a 24 hour baseline value shall be completed within six weeks of the date of the letter of acceptance.**

(b) **The Consultant shall record the wind speed and direction during sampling to the satisfaction of the Employer.**

Baseline monitoring should be undertaken under a range of wind speeds and directions to provide a representative assessment of the local air quality. Baseline checking should be carried out quarterly, if a suitable occasion arises when the CIF is not operating.

The Consultant shall provide the following equipment within two weeks of the date of the letter of acceptance:

- **all appropriate equipment and shelters of suitable type and in sufficient quantities to comply with the requirements of the stipulated monitoring methodologies.**

10.4.4 *Impact Monitoring*

The Contract should require that:

A quarterly schedule of monitoring activities shall be submitted to the Employer for approval 4 weeks prior to the commencement of the scheduled period.

Construction Impacts

At least once every six days one 24-hour dust measurement and three 1-hour dust measurements shall be undertaken, at each of the

specified monitoring locations, during the expected highest dust impacts.

Operational Impacts

Ambient air quality shall be monitored, for each of the identified compounds, over a 24-hour period, at least once per calendar month, at each of the three monitoring locations, during normal plant operations.

10.4.5 *Reporting and Audit*

The ECP contains a full monitoring and report procedure. However, the following Clause should also be included in the Contract:

The Contractor shall submit 3 copies of the monthly air quality monitoring report to the Employer within 10 days of the beginning of the following month, in both printed and magnetic form, to an agreed format. This should include a brief account of activities during the month, an interpretation of the significance of the monitoring results by verifying compliance and highlighting any failure to comply with the target levels, and an account of the remedial measures recommended and taken by the Contractor as a result.

Exceedance of the target levels shall be reported immediately to the Employer as well as the progress of the findings and remedial action taken. The event should also be included in the monthly report subsequently.

All the collected samples shall be kept for 6 months before disposal, all the data/records shall be retained permanently by the Contractor after completion of the whole project. The Consultant shall be responsible for organizing all monitoring data/records to establish the record of air quality change associated with the construction and operation of the CIF.

10.4.6 *Event Contingency Plan*

As noted above, the principle upon which the ECP is based is the prescription of procedures and actions associated with the measurement of certain defined levels of air pollution, recorded by the environmental monitoring process, during the construction and operational phases of the CIF. The Trigger, Action and Target (T/A/T) levels for air quality during construction of the CIF are recommended as:

- *Trigger*: 30% increase above the baseline monitoring data. The level beyond which there is an indication of deteriorating ambient environmental quality.
- *Action*: Average value of the Trigger and Target levels. The level beyond which appropriate remedial actions is necessary to prevent the environmental quality from going beyond the target limits.

- *Target*: The appropriate AQO standard, LAQS, or otherwise established levels beyond which the health of the public will be at risk. The proposed target levels are listed in *Table 10.4a* below.

Table 10.4a *Recommended Target Levels*

Pollutant	**Target Level** ($\mu g\ m^{-3}$)
Total Suspended Particulates (TSP)	260 (24-hour av) (HK AQO)
Respirable Suspended Particulates (RSP)	180 (24-hour av) (HK AQO)
Sulphur Dioxide (SO_2)	800 (1-hour av) 350 (24 hour av) (HK AQO)
Nitrogen Oxides (NO_x)	300 (1-hour av) 150 (24-hr av) (HK AQO)
Antimony (Sb)	5.0 (Annual Av) (LAQS)
Arsenic (As)	0.2 (Annual Av) (LAQS)
Cadmium (Cd)	0.1 (Annual Av) (LAQS)
Chromium III (Cr) Chromium VI	5.0 (Annual Av) (LAQS) 0.02 (Annual Av) (LAQS)
Copper (Cu)	2.0 (Annual Av) (LAQS)
Lead (Pb)	0.3 (Annual Av) (LAQS)
Manganese (Mn)	10.0 (Annual Av) (LAQS)
Mercury (Hg)	0.5 (Annual Av) (LAQS)
Nickel (Ni)	1.0 (Annual Av) (LAQS)
Dioxins and Furans (PCDD & PCDF).	9.15×10^{-8} (Annual average based on lifetime risk)

The ECP for exceedance of various levels shown in *Table 10.4b* should be strictly observed.

10.4.7 *Monitoring Locations*

Construction dust monitoring should be undertaken on the northern and eastern site boundaries during the construction phase to check compliance with the 1-hour and 24-hour TSP standards.

Operational air quality monitoring should be undertaken at three sites: as near as possible to the maximum predicted long-term level concentration (Castle Peak Firing Range Boundary); at the nearest residential receptor (Lung Tsai Village); and at an intermediate point between the two locations listed above.

10.4.8 *Odour Monitoring*

To ensure that no odour nuisance is caused at or beyond the site boundary, or at any sensitive receptor, odour monitoring should be carried out.

Routine odour monitoring can be accomplished by an odour patrol carried out as part of the duties of the Contractor's nominated site staff. The effectiveness of odour mitigation measures in place can be assessed by periodically repeating the odour patrol and comparing results to a baseline evaluation.

- **The duties of the nominated site staff shall include the carrying out of an odour patrol, at a frequency to be agreed with the Employer, along the Site boundary. Patrolling shall be scheduled for times corresponding to normal operational activities and should include all appropriate time periods such as morning, afternoon, evening and night–time.**

- **Wind directions shall be recorded prior to and during each patrol for use in analysing results.**

- **The patrolling should be carried out over the entire Site boundary, the location and strength of identifiable odours from the CIF at each observation stop (a total of 4 stops is recommended) should be recorded. Desensitisation due to olfactory fatigue should be avoided. Odour intensities detected may be categorized into the following classes:**

0	**Not detected**	**No odour perceived or an odour so weak that it cannot be readily characterized or described.**
1	**Slight**	**Identifiable odour, slight.**
2	**Moderate**	**Identifiable odour, moderate.**
3	**Strong**	**Identifiable odour, strong.**
4	**Extreme**	**Severe odour.**

- **All odours, whether related to the operation of the CIF or not, shall be recorded using this odour intensity scale. The results together with general wind conditions shall be included in the Monthly Report.**

- **Prior to operational activities commencing, the Contractor shall carry a baseline odour survey for a period of one week.**

- **The Contractor should establish an odour panel to establish the intensities of identified odours in relation to the T/A/T levels.**

Table 10.4b Air Quality Monitoring Event Contingency Plan

Event	Action: Environmental Monitor (Consultant)	Contractor	Employer (EPD)
TRIGGER LIMIT			
Exceedance	Identify source. Repeat measurement to confirm findings. Inform Contractor. Increase monitoring frequency. Discuss with Contractor for remedial actions required. If remedies required, contact Employer to make arrangements. If problem is short term, continue monitoring. If exceedance stops, additional monitoring can be ceased.	Rectify any unacceptable practice. Consider changes to working methods.	Check monitoring data and Contractor's working methods. Discuss with Contractor for remedial works, if necessary.
ACTION LIMIT			
Exceedance	Identify source. Repeat measurement to confirm findings. Inform Contractor. Increase monitoring frequency. Discuss with Employer remedial actions required. If exceedance continues, arrange meeting with Employer to identify further appropriate mitigation measures. If exceedance stops, additional monitoring can be ceased.	Submit proposals for remedial actions to Employer within 3 working days upon notification. Amend proposals if appropriate. Implement the agreed proposals.	Confirm receipt of notification of failure in writing Check monitoring data and Contractor's working methods. Discuss with Environmental Monitor and Contractor on remedial actions to be provided. Ensure remedial actions properly implemented.
TARGET LIMIT			
Exceedance	Identify source. Repeat measurement to confirm findings. Inform Contractor. Increase monitoring frequency. Investigate the cause of exceedance. Arrange meeting with Employer to discuss the remedial actions to be taken. Assess effectiveness of Contractor's remedial actions. If exceedance stops, additional monitoring can be ceased.	Take immediate action to avoid further exceedance. Submit proposals for remedial actions to Employer within 3 working days upon notification. Implement the agreed proposals. Resubmit proposals if problem still not under control.	Confirm receipt of notification of failure in writing. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. Discuss with Environmental Monitor and the Contractor remedial actions to be provided. Review Contractor's remedial actions whenever necessary to assure their effectiveness.

An ECP for unacceptable odour events, based on the findings of odour patrol and frequency of public complaints, is set out in *Table 10.4c*. The definitions of odour T/A/T limits are as follows:

- *Trigger* : one independently documented complaint about odour, or recording of a slight odour on 2 consecutive patrols;
- *Action* : more than one independently documented complaint within 2 weeks, or recording of a moderate odour on 2 consecutive patrols; and
- *Target* : more than 3 independently documented complaints within 2 weeks, or recording of a moderate odour on 3 consecutive odour patrols.

10.4.9 *Soil Quality*

Soil quality should also be monitored on an annual basis at the ambient air quality impact monitoring locations for the same suite of compounds. Sampling, to a methodology agreed with EPD, should be undertaken once prior to the commissioning of the plant and once per year during the operation of the plant.

Table 10.4c Event Contingency Plan for Odour Events

Event	Action: Environmental Monitor (Site Staff)	Contractor	Employer (EPD)
TRIGGER LIMIT			
Exceedance	Confirm odour intensity and identify source. Repeat odour patrolling to confirm findings. Inform Contractor. Increase patrolling frequency. Discuss with Contractor for remedial actions required. If remedies required, contact Employer to make arrangements. If problem is short term (*ie* less than 24 hours), continue patrolling. If exceedance stops, additional odour patrolling can be ceased.	Rectify any unacceptable practice. Consider changes to working methods.	Check patrolling data and Contractor's working methods. Discuss with Contractor for remedial works, if necessary.
ACTION LIMIT			
Exceedance	Confirm odour intensity and identify source. Repeat odour patrolling to confirm findings. Inform Contractor. Increase patrolling frequency. Discuss with Employer remedial actions required. If exceedance continues, arrange meeting with Employer to identify further appropriate mitigation measures. If exceedance stops, additional patrolling can be ceased.	Submit proposals for remedial actions to Employer within 3 working days upon notification. Amend proposals if appropriate. Implement the agreed proposals.	Confirm receipt of notification of failure in writing Check patrolling data and Contractor's working methods. Discuss with Environmental Monitor and Contractor on remedial actions to be provided. Ensure remedial actions properly implemented.
TARGET LIMIT			
Exceedance	Confirm odour intensity and identify source. Repeat patrolling to confirm findings. Inform Contractor. Increase patrolling frequency. Investigate the cause of exceedance. Arrange meeting with Employer to discuss the remedial actions to be taken. Assess effectiveness of Contractor's remedial actions. If exceedance stops, additional patrolling can be ceased.	Take immediate action to avoid further exceedance. Submit proposals for remedial actions to Employer within 3 working days upon notification. Implement the agreed proposals. Resubmit proposals if problem still not under control.	Confirm receipt of notification of failure in writing. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. Discuss with Environmental Monitor and the Contractor remedial actions to be provided. Review Contractor's remedial actions whenever necessary to assure their effectiveness.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 INTRODUCTION

The development of the CIF as a focus for the treatment of clinical waste in Hong Kong will lead to a significant improvement over current disposal practices. The use of a modern incineration plant, equipped with highly efficient emission control systems will ensure that potentially hazardous wastes will be reduced in volume and sterilised prior to landfilling, thus minimising the risks to the general public from their disposal.

This EIA has addressed the issues identified in the *Phase I Key Issue Report - Environmental Review* as requiring further investigation and other areas of concern identified by EPD. This *Section* discusses the results of the previous *Sections* and highlights the main findings of the Report.

Areas which could not be fully resolved, largely due to a lack of information on the detailed design of the CIF, have been identified and are listed in *Section 11.3*. These will be included in the Tender Specifications for the CIF which will require the successful Tenderer to undertake a Detailed Design Stage EIA which will assess all the outstanding issues.

11.2 OVERALL CONCLUSIONS

11.2.1 *Air Quality*

Construction dust impacts are not predicted to be significant, however, due to the already poor air quality in the area it would be advisable to minimise the potential for TSP emissions from the site.

Odour impacts from the transport and handling of wastes can be effectively controlled by the use of closed containers at all times. Large animal carcases are the exception but their transportation will be beyond the control of the CIF operator. Once on site, all wastes can be held under refrigeration in controlled storage areas where negative pressure can be used to direct potentially odorous air through the incinerator and cremator combustion chambers.

The operation of the CIF will lead to a significant improvement in the standard of emissions from clinical waste incineration throughout the territory. Stack gas emissions will be required to meet the proposed emission limits at which levels there will be no impacts on any of the air quality parameters in exeedance of the AQOs. Ambient air quality monitoring to measure emissions from the CIF will need to take the impacts of other sources in the area into account.

The limited potential for fugitive dust emissions during the operation of the CIF can be easily controlled through good housekeeping and the recommended mitigation measures.

11.2.2 *Long Term Human Health Impacts*

The closure of the existing hospital incinerators and their replacement with a single purpose–built incinerator will have a significant impact on the release of potentially harmful products into the atmosphere. Not only will the emission levels of harmful substances be reduced, but the emissions will be generated away from major urban areas. Both of these factors will ensure that the potential for adverse health impacts upon the population of Hong Kong are significantly reduced.

The findings of the health risk assessment show that at the proposed maximum emission concentrations, all pollutant concentrations arising from the operation of the CIF will be within the minimum acceptable safety threshold values identified for this assessment.

11.2.3 *Noise Impacts*

The CIF site is almost 2 km from the nearest sensitive receiver and this, coupled with the local topography, should be sufficient to ensure that no noise impacts are caused by the construction or operation of the CIF.

The CIF site is currently used for container storage and has a higher vehicle capacity than will be the case when it is handed over to the CIF contractor. This indicates that the development of the site for the CIF will lead to an overall decrease in traffic numbers. Traffic noise calculations have shown that neither the CIF construction traffic nor waste transport vehicles will lead to an increase in traffic noise.

11.2.4 *Water Quality*

The reclamation of the CIF will be completed as part of the Area 38 development before the site is handed over to the CIF contractor. Consequently, the potential for construction impacts on the marine environment are minimal and these can be controlled by the implementation of the recommended mitigation measures.

Operational discharges, either to the local sewerage system when complete, or as an interim measure directly to inshore waters, will be controlled by the requirements of the discharge licence, this is likely to include some degree of on–site water treatment.

If a wet gas scrubbing unit is chosen, a scrubbing water treatment unit will be required. The complexity of the wet scrubbing system is likely to increase the treatment costs when compared to alternative gas cleaning systems. Therefore, wet scrubbing will probably not be the preferred option selected by the Contractor.

The application of appropriate drainage control measures will ensure that aqueous waste and other contaminated water is not accidentally discharged to surface watercourses or inshore waters.

11.2.5 *Traffic*

Both the air quality and noise assessments addressed the potential impacts from CIF traffic. As has been discussed above, the CIF is predicted to generate less traffic than current activities on the CIF site. In addition, mathematical modelling has clearly shown that the CIF traffic will represent a very small proportion of the total traffic on local roads and will not, therefore, constitute a source of significant, or indeed noticeable, impacts when compared to the overall traffic loadings.

11.2.6 *Landuse and Visual Impacts*

The CIF site lies within the Area 38 special industries zone, it is a planned component of the area and will not, therefore, be incompatible with the other industrial landuses. It is sited adjacent to a steel mill, cement works and power station and will be designed to meet the overall architectural colouring and styling of other developments in the area.

Under the proposed emission limit requirements the plant will not be permitted to generate either visible smoke or any other type of plume from the stack.

11.2.7 *Waste Disposal*

Currently, some 70% of clinical waste is disposed of directly to landfill with associated health and aesthetic concerns. The incineration of clinical waste will reduce the bulk by approximately 80% as well as rendering it sterile and visually inoffensive.

The disposal of the solid wastes generated by the CIF will not lead to unacceptable impacts. Effective disposal routes are available for all wastes which will be generated by the CIF. Post-combustion wastes are considered suitable for disposal to landfill and the quantities generated will not significantly affect landfill capacity in the territory.

The Contractor will be required to develop effective procedures for the safe handling of wastes and for the containment and clean-up of accidental spillages either within the site or on the public highway.

11.2.8 *Ecological Impacts*

The CIF will be sited in the SIA, on newly reclaimed land. The suitability of the SIA for industrial uses was confirmed in the Expanded Development Study in 1990 and subsequently in the Area 38 EIA. The CIF EIA includes mitigation requirements based on the findings of the previous studies to ensure the acceptability of the SIA for the area. In view of the above, no adverse ecological impacts are predicted from the construction or operation of the CIF.

11.2.9 *Landfill Gas*

Landfill gas migration from the Sui Lang Shiu landfill is not considered likely to pose a risk to the CIF. The precautionary measures to be carried out as part of the development of the Area 38 SIA will be sufficient to deal with any gas generated by the landfill.

11.2.10 *Environmental Monitoring and Audit*

The monitoring of stack gas emissions and wastewater discharges at source will be required as part of the conditions of the operating licence of the CIF and do not, therefore, fall within the scope of the EM&A programme.

An EM&A programme will, however, be required for air quality. This will cover stack gas dispersion (ambient air quality), dust emissions during construction and operation and odour during operation. Noise and water quality are not predicted to be of concern and these are not, therefore, recommended for inclusion in the EM&A programme.

11.3 *RECOMMENDATIONS FOR THE DETAILED EIA*

A number of aspects of this assessment remain unresolved, largely due to the fact that until the CIF contract has been awarded the detailed design of the facility cannot be completed. Therefore, there are certain components of this assessment that must await the detailed design stage before they can be resolved. These matters are detailed below and represent the outline scope of the Detailed Design Stage EIA.

11.3.1 *Air Quality*

The Contractor should show that:

- **concentrations of emissions from the CIF stack will not present an unacceptable health risk to the local population;**
- **the construction programme and procedures will be effective in controlling dust generation;**
- **the design of the CIF and its operational procedures will effectively control fugitive dust and odour releases.**

Stack gas emissions will be controlled under the operational licensing of the CIF.

11.3.2 *Noise*

The Contractor will need to show that:

- **the highest sound power levels during the construction and operation of the CIF do not exceed acceptable levels and that no nuisance is caused to noise sensitive receivers by either the construction or operation of the CIF.**

11.3.3 *Water Quality*

The Contractor should be required to demonstrate that:

- **the temporary measures for disposal, prior to the completion of the Area 38 sewerage infrastructure, will ensure that effluent from the plant is treated to the required standards for discharge laid out in the TM; and**

- **the wastewater treatment plant proposed for the CIF which will discharge to the foul sewer is also capable of meeting the appropriate TM standards.**

The disposal of aqueous effluent will be controlled under the discharge licence which will include requirements for water quality monitoring.

11.3.4 *Landuse and Visual Impact*

The Contractor should:

- **ensure that the design and external appearance of the CIF will be appropriate for its location.**

11.3.5 *Waste*

The Contractor should:

- **develop waste handling procedures as part of the operational management of the CIF which will ensure that all wastes are stored and transported in a safe manner; and**

- **ensure that any spillages, either within the plant, or on the public highway, will be promptly and effectively dealt with thus minimising any risk to members of the public or CIF staff.**

11.3.6 *Landfill Gas*

The Contractor should be required to:

- **monitor landfill gas concentrations near the north-eastern site boundary during construction and to liaise with EPD to establish the need for permanent protection schemes.**

11.3.7 *Environmental Monitoring and Audit*

The Contractor should be required to:

- **develop a detailed EM&A programme based on the recommendations of this Report, monitoring locations should reflect the maximum impacts predicted in the detailed design stage EIA.**

11.4 RECOMMENDATIONS FOR THE TENDER SPECIFICATIONS

A number of requirements for mitigation measures have been identified in the preceding *Sections* and should be included with the EIA requirements above, in the contract clauses. These may be altered by the findings of the Detailed Design Stage EIA, but as general requirements it is recommended that the Contractor should:

- **undertake a detailed EIA to ensure that the construction and operation of the CIF, within the overall context of activities occurring in connection with the Special Industrial Area and the River Trade Terminal, will be managed in such a way that no significant environmental impacts will occur, or in the case of a significant impact, that measures are in place to deal with such events and prevent their recurrence;**

- **formulate detailed construction plans which contain satisfactory precautionary and mitigation measures to protect the environment;**

- **develop and implement comprehensive process procedures, including detailed operational manuals and effective operator training, that will ensure that the CIF is operated in a proper manner; and**

- **retain suitably qualified environmental specialists to carry out the EIA and to develop and undertake an EIA programme that will identify and control unacceptable impacts from the construction and operation of the CIF.**

Appendix A

Air Quality Modelling Results

Maximum Average Concentration in µg/m3				
	10mPD		35mPD	
	1-hr	Annual	1-hr	Annual
Pollutant with Emission rate of 1g/s				
92	11.86737	0.29741	12.58155	0.40748
93	14.8086	0.28814	16.64311	0.43273
Particulate				
92	4.4	0.1	4.7	0.2
93	5.5	0.1	6.2	0.2
Lead				
92	8.31E-03	2.08E-04	8.81E-03	2.85E-04
93	1.04E-02	2.02E-04	1.17E-02	3.03E-04
Cadmium & Thallium				
92	4.75E-03	1.19E-04	5.03E-03	1.63E-04
93	5.92E-03	1.15E-04	6.66E-03	1.73E-04
Mercury				
92	4.75E-03	1.19E-04	5.03E-03	1.63E-04
93	5.92E-03	1.15E-04	6.66E-03	1.73E-04
Individual metal				
92	8.31E-03	2.08E-04	8.81E-03	2.85E-04
93	1.04E-02	2.02E-04	1.17E-02	3.03E-04
Total metal				
92	4.39E-02	1.10E-03	4.66E-02	1.51E-03
93	5.48E-02	1.07E-03	6.16E-02	1.60E-03
Hydrogen sulphide				
92	0.44	0.01	0.47	0.02
93	0.55	0.01	0.62	0.02
Chlorine (HCl)				
92	4.4	0.1	4.7	0.2
93	5.5	0.1	6.2	0.2
Hydrogen fluoride				
92	0.44	0.01	0.47	0.02
93	0.55	0.01	0.62	0.02
Fluorine (HF)				
92	0.89	0.02	0.94	0.03
93	1.11	0.02	1.24	0.03
Hydorgen bromide				
92	0.44	0.01	0.47	0.02
93	0.55	0.01	0.62	0.02
SO2				
92	22.2	0.6	23.5	0.8
93	27.7	0.5	31.1	0.8
NO2				
92	35.5	0.9	37.6	1.2
93	44.3	0.9	49.7	1.3
CO				
92	8.9	0.2	9.4	0.3
93	11.1	0.2	12.4	0.3
Organic compounds (C)				
92	2.2	0.1	2.4	0.1
93	2.8	0.1	3.1	0.1
Phosphours				
92	0.44	0.01	0.47	0.02
93	0.55	0.01	0.62	0.02
Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)				
92	8.86E-09	2.22E-10	9.40E-09	3.04E-10
93	1.11E-08	2.15E-10	1.24E-08	3.23E-10

Appendix B

Responses to Comments on the Draft Final Report

	Annual Pollutant Concentration (ug/m3)			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration		Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.:	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	5	0.0119	0.0044	4.76E-06	4.76E-06	8.34E-06	4.41E-06	0.0004	0.0044	0.0004	0.0009	0.0004	0.0222	0.0356	0.0089	0.0022	0.0004	8.89677E-12
		15	0.0119	0.0044	4.76E-06	4.76E-06	8.33E-06	4.40E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0222	0.0356	0.0089	0.0022	0.0004	8.8893E-12
		25	0.0119	0.0044	4.76E-06	4.76E-06	8.33E-06	4.40E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0222	0.0356	0.0089	0.0022	0.0004	8.8893E-12
		35	0.0119	0.0044	4.75E-06	4.75E-06	8.32E-06	4.40E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0222	0.0355	0.0089	0.0022	0.0004	8.87436E-12
		45	0.0119	0.0044	4.74E-06	4.74E-06	8.30E-06	4.39E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0222	0.0354	0.0089	0.0022	0.0004	8.85942E-12
		55	0.0118	0.0044	4.74E-06	4.74E-06	8.29E-06	4.38E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0221	0.0354	0.0088	0.0022	0.0004	8.84448E-12
		65	0.0118	0.0044	4.72E-06	4.72E-06	8.27E-06	4.37E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0221	0.0353	0.0088	0.0022	0.0004	8.82207E-12
		75	0.0118	0.0044	4.71E-06	4.71E-06	8.24E-06	4.35E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0220	0.0352	0.0088	0.0022	0.0004	8.79219E-12
		85	0.0117	0.0043	4.69E-06	4.69E-06	8.21E-06	4.34E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0219	0.0351	0.0088	0.0022	0.0004	8.76231E-12
11	Richland Garden	8	0.0092	0.0034	3.68E-06	3.68E-06	6.43E-06	3.40E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0172	0.0275	0.0069	0.0017	0.0003	6.86493E-12
		15	0.0092	0.0034	3.67E-06	3.67E-06	6.43E-06	3.40E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0171	0.0274	0.0069	0.0017	0.0003	6.85746E-12
		25	0.0092	0.0034	3.67E-06	3.67E-06	6.43E-06	3.40E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0171	0.0274	0.0069	0.0017	0.0003	6.85746E-12
		35	0.0092	0.0034	3.67E-06	3.67E-06	6.42E-06	3.39E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0171	0.0274	0.0069	0.0017	0.0003	6.84999E-12
		45	0.0092	0.0034	3.66E-06	3.66E-06	6.41E-06	3.39E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0171	0.0273	0.0068	0.0017	0.0003	6.83505E-12
		55	0.0091	0.0034	3.66E-06	3.66E-06	6.40E-06	3.38E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0171	0.0273	0.0068	0.0017	0.0003	6.82758E-12
		65	0.0091	0.0034	3.64E-06	3.64E-06	6.38E-06	3.37E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0170	0.0272	0.0068	0.0017	0.0003	6.80517E-12
		75	0.0091	0.0034	3.64E-06	3.64E-06	6.36E-06	3.36E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0170	0.0272	0.0068	0.0017	0.0003	6.79023E-12
		85	0.0091	0.0034	3.62E-06	3.62E-06	6.34E-06	3.35E-05	0.0003	0.0034	0.0003	0.0007	0.0003	0.0169	0.0271	0.0068	0.0017	0.0003	6.76782E-12
12	Butterfly Beach	4.6	0.0131	0.0049	6.26E-06	6.26E-06	9.19E-06	4.86E-05	0.0005	0.0049	0.0005	0.0010	0.0005	0.0245	0.0392	0.0098	0.0025	0.0005	9.80811E-12
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.0150	0.0052	5.67E-06	5.67E-06	9.93E-06	5.25E-05	0.0005	0.0053	0.0005	0.0011	0.0005	0.0265	0.0424	0.0106	0.0026	0.0005	1.05925E-11
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.0142	0.0052	5.67E-06	5.67E-06	9.93E-06	5.25E-05	0.0005	0.0053	0.0005	0.0011	0.0005	0.0265	0.0424	0.0106	0.0026	0.0005	1.05925E-11
15	Siu Lang Shui Landfill Site for development into a recreational area	41	0.1668	0.0617	6.67E-05	6.67E-05	1.17E-04	6.17E-04	0.0062	0.0623	0.0062	0.0125	0.0062	0.3116	0.4986	0.1246	0.0312	0.0062	1.246E-10
16	As above	42	0.1111	0.0411	4.44E-05	4.44E-05	7.77E-05	4.11E-04	0.0042	0.0416	0.0042	0.0083	0.0042	0.2076	0.3320	0.0830	0.0207	0.0042	8.29693E-11
17	GIC at Siu Lang Shui	84.2	0.1395	0.0516	5.58E-05	5.58E-05	9.77E-05	5.16E-04	0.0052	0.0521	0.0052	0.0104	0.0052	0.2606	0.4170	0.1043	0.0261	0.0052	1.04214E-10
18	Proposed Steel Work	5	0.1191	0.0441	4.76E-05	4.76E-05	8.34E-05	4.41E-04	0.0045	0.0445	0.0045	0.0089	0.0045	0.2225	0.3560	0.0890	0.0222	0.0045	8.89677E-11
		15	0.1522	0.0563	6.09E-05	6.09E-05	1.07E-04	5.63E-04	0.0057	0.0569	0.0057	0.0114	0.0057	0.2844	0.4550	0.1138	0.0284	0.0057	1.13708E-10
		25	0.2243	0.0830	8.97E-05	8.97E-05	1.57E-04	8.30E-04	0.0084	0.0838	0.0084	0.0168	0.0084	0.4190	0.6704	0.1676	0.0419	0.0084	1.67537E-10
		35	0.3436	0.1271	1.37E-04	1.37E-04	2.41E-04	1.27E-03	0.0129	0.1284	0.0129	0.0257	0.0129	0.6419	1.0271	0.2568	0.0642	0.0129	2.56692E-10

	Annual Pollutant Concentration (ug/m3)			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration		Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.:	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	0.1511	0.0559	6.04E-05	6.04E-05	1.06E-04	5.59E-04	0.0057	0.0565	0.0057	0.0113	0.0057	0.2823	0.4516	0.1129	0.0282	0.0057	1.12872E-10
		15	0.1543	0.0571	6.17E-05	6.17E-05	1.08E-04	5.71E-04	0.0058	0.0577	0.0058	0.0115	0.0058	0.2883	0.4612	0.1153	0.0288	0.0058	1.1527E-10
		25	0.1617	0.0598	6.47E-05	6.47E-05	1.13E-04	5.98E-04	0.0060	0.0604	0.0060	0.0121	0.0060	0.3021	0.4833	0.1208	0.0302	0.0060	1.20782E-10
		35	0.1736	0.0642	6.94E-05	6.94E-05	1.22E-04	6.42E-04	0.0065	0.0648	0.0065	0.0130	0.0065	0.3243	0.5188	0.1297	0.0324	0.0065	1.29664E-10
2	Castle Peak Power Station	7.3	0.0747	0.0276	2.99E-05	2.99E-05	5.23E-05	2.76E-04	0.0028	0.0279	0.0028	0.0056	0.0028	0.1395	0.2233	0.0558	0.0140	0.0028	5.58009E-11
		15	0.0753	0.0279	3.01E-05	3.01E-05	5.27E-05	2.79E-04	0.0028	0.0281	0.0028	0.0056	0.0028	0.1407	0.2252	0.0563	0.0141	0.0028	5.62715E-11
		25	0.0767	0.0284	3.07E-05	3.07E-05	5.37E-05	2.84E-04	0.0029	0.0287	0.0029	0.0057	0.0029	0.1434	0.2294	0.0573	0.0143	0.0029	5.73248E-11
		35	0.0787	0.0291	3.15E-05	3.15E-05	5.51E-05	2.91E-04	0.0029	0.0294	0.0029	0.0059	0.0029	0.1470	0.2353	0.0588	0.0147	0.0029	5.87964E-11
3	Block Making Factory	58.3	0.0615	0.0228	2.46E-05	2.46E-05	4.31E-05	2.28E-04	0.0023	0.0230	0.0023	0.0046	0.0023	0.1149	0.1839	0.0460	0.0115	0.0023	4.59554E-11
4	Fresh Water Reservoir	64	0.0491	0.0182	1.96E-05	1.96E-05	3.44E-05	1.82E-04	0.0018	0.0184	0.0018	0.0037	0.0018	0.0918	0.1468	0.0367	0.0092	0.0018	3.66926E-11
5	Pillar Point Sewage Treatment Works	5	0.0209	0.0077	8.37E-06	8.37E-06	1.46E-05	7.74E-05	0.0008	0.0078	0.0008	0.0016	0.0008	0.0391	0.0625	0.0156	0.0039	0.0008	1.56272E-11
		15	0.0209	0.0077	8.37E-06	8.37E-06	1.47E-05	7.74E-05	0.0008	0.0078	0.0008	0.0016	0.0008	0.0391	0.0626	0.0156	0.0039	0.0008	1.56347E-11
		25	0.0210	0.0078	8.38E-06	8.38E-06	1.47E-05	7.75E-05	0.0008	0.0078	0.0008	0.0016	0.0008	0.0391	0.0626	0.0157	0.0039	0.0008	1.56497E-11
		35	0.0210	0.0078	8.39E-06	8.39E-06	1.47E-05	7.76E-05	0.0008	0.0078	0.0008	0.0016	0.0008	0.0392	0.0627	0.0157	0.0039	0.0008	1.56646E-11
6	WAHMO Building	12	0.0229	0.0085	9.16E-06	9.16E-06	1.60E-05	8.48E-05	0.0009	0.0086	0.0009	0.0017	0.0009	0.0428	0.0685	0.0171	0.0043	0.0009	1.71138E-11
7	Waterfront Industry	5	0.0157	0.0058	6.28E-06	6.28E-06	1.10E-05	5.81E-05	0.0006	0.0059	0.0006	0.0012	0.0006	0.0293	0.0469	0.0117	0.0029	0.0006	1.17204E-11
		15	0.0157	0.0058	6.28E-06	6.28E-06	1.10E-05	5.81E-05	0.0006	0.0059	0.0006	0.0012	0.0006	0.0293	0.0469	0.0117	0.0029	0.0006	1.17204E-11
		25	0.0157	0.0058	6.28E-06	6.28E-06	1.10E-05	5.81E-05	0.0006	0.0059	0.0006	0.0012	0.0006	0.0293	0.0469	0.0117	0.0029	0.0006	1.17279E-11
		35	0.0157	0.0058	6.28E-06	6.28E-06	1.10E-05	5.81E-05	0.0006	0.0059	0.0006	0.0012	0.0006	0.0293	0.0469	0.0117	0.0029	0.0006	1.17279E-11
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.0215	0.0079	8.59E-06	8.59E-06	1.50E-05	7.94E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0401	0.0642	0.0160	0.0040	0.0008	1.60381E-11
9	Melody Garden	5	0.0116	0.0043	4.64E-06	4.64E-06	8.12E-06	4.29E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0217	0.0347	0.0087	0.0022	0.0004	8.6652E-12
		15	0.0116	0.0043	4.64E-06	4.64E-06	8.12E-06	4.29E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0217	0.0347	0.0087	0.0022	0.0004	8.6652E-12
		25	0.0116	0.0043	4.64E-06	4.64E-06	8.11E-06	4.29E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0217	0.0346	0.0087	0.0022	0.0004	8.65773E-12
		35	0.0116	0.0043	4.63E-06	4.63E-06	8.10E-06	4.28E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0216	0.0346	0.0086	0.0022	0.0004	8.64279E-12
		45	0.0116	0.0043	4.62E-06	4.62E-06	8.09E-06	4.28E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0216	0.0346	0.0086	0.0022	0.0004	8.63532E-12
		55	0.0115	0.0043	4.61E-06	4.61E-06	8.07E-06	4.27E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0215	0.0345	0.0086	0.0022	0.0004	8.61291E-12
		65	0.0115	0.0043	4.60E-06	4.60E-06	8.05E-06	4.26E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0215	0.0344	0.0086	0.0021	0.0004	8.5905E-12
		75	0.0115	0.0042	4.59E-06	4.59E-06	8.03E-06	4.24E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0214	0.0343	0.0086	0.0021	0.0004	8.56809E-12
		85	0.0114	0.0042	4.57E-06	4.57E-06	7.99E-06	4.23E-05	0.0004	0.0043	0.0004	0.0009	0.0004	0.0213	0.0341	0.0085	0.0021	0.0004	8.53074E-12

Comment	Response
Planning Department Hong Kong, Tuen Mun and Yuen Long District Planning Office	
Although the RTT and SIA have been referred to in the Expanded Development Study of Tuen Mun Area 38 as areas 38 A & B, there is no dear boundary of Areas 38 A & B on our layout plan. For simplification, I suggest the location of CIF should refer as in Area 38 instead of Area 38B. Otherwise I have no further comment on the EIA report.	Noted, references to Area 38B have been altered to Area 38.
Additional Comments via WFPG (Source Unknown)	
(1) Page 93, line 20 - "Chemical Waste Regulations" should read "Waste Disposal (Chemical Waste) (General) Regulation".	Noted, the text has been amended as advised.
(2) Page 101, line 20-21 - "Chemical Waste Regulations" should read "Waste Disposal (Chemical Waste) (General) Regulation". The paragraph should preferably be re-written as "chemical waste as defined under Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation should be packed, labelled, stored and disposed of at the Tsing Yi Chemical Waste Treatment Centre through the engagement of licensed waste collector".	Noted, the text has been amended as advised and the paragraph no reads "chemical waste as defined under *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be packed, labelled, stored and disposed of in full compliance with the requirements as stipulated under the Regulation and, where appropriate, disposed of at the Chemical Waste Treatment Facility located at Tsing Yi through the engagement of licensed waste collectors;"

Comment	Response
Water Supplies Department I would be grateful if you would amend the height of AR No A4 in Table 3.6d to 64 m PD as previously agreed.	Noted, the Table has been amended as advised.
Further to our earlier memo, I would like to draw to your attention that the consultant's response to our comments should be incorporated in the draft EIA report either in the form of an appendix or a statement in the text stating that the CIF has no significant impact on our proposed Siu Lang Shui S/R.	The EIA has assessed the impacts on human health based on a lifetime exposure to aerial discharges. The potential impacts upon a covered reservoir would be several orders of magnitude less and are not considered to be of concern.
Project Manager/NTW I have no comment on the 2nd draft of the EIA report.	Noted.
Civil Engineering Department, Civil Engineering Office I have no comment on the captioned draft EIA report.	Noted.
Electrical and Mechanical Services Department I have no comment to make on the 2nd draft EIA report.	Noted.
District Lands Office, Tuen Mun Lands Department I have no comment on the 2nd draft EIA report of the CIF.	Noted.
Director of Agriculture and Fisheries 1) As the CIF will be located on a piece of newly reclaimed land, there should be no ecological issue and therefore an individual ecological survey is not necessary.	Noted. The following paragraph has been added to Section 11 as requested. "The CIF will be sited in the SIA, on newly reclaimed land. The suitability of the SIA for industrial uses was confirmed in the Expanded Development Study in 1990 and subsequently in the Area 38 EIA. The CIF EIA includes mitigation requirements based on the findings of the previous studies to ensure the acceptability of the SIA for the area. In view of the above, no adverse ecological impacts are predicted from the construction or operation of the CIF."
2) It is noted that wet scrubber discharges will contain trace organics including dioxins and furans. The specific mitigation measures should include proposals to reduce the input of these trace organics into marine waters.	The operator of the CIF will be required to demonstrate that wastewater discharges will meet the licence requirements which will be based on the TM. It is not, therefore, considered appropriate to pursue this matter further until the detailed design stage when the specifications for gas cleaning plant can be confirmed.

Comment	Response
Waste Policy Group	
I have no coment from the waste policy point of view except that we would like the consultants to clarify that his proposed capacity for the (backup) storage area viz "at least the waste inputs for a period of48 hours" will require that the CIF will be designed, constructed and operated in such a manner (eg via a good quality assurance programme) that it is highly unlikely that the CIF would fail to operate for a period exceeding 48 hours, or equivalent, in order that the proposed capacity would address my aforesaid comment. In other words, it is highly unlikely that waste received at the CIF will need to be diverted to landfills. Presumeably, this is the consultant's intention and we would like to see this point incorporated into the documents accordingly.	The Hong Kong Government's policy to incinerate, rather than landfill, clinical (and other special wastes) is clearly stated. The expectation that the CIF will be operated to a high standard is also noted in the EIA. The recommended tender requirements in *Section 11.4* also identify the importance of good management in all its forms. The tender requirements will include the need for the tenderer to prove his capability to operate the CIF efficiently and will be taken into consideration in the selection process.
Local Control Office	
1) Section 6.5.3, p 80, 2nd para, under "Storm Water Run-off" - the "first flush" collected should also be treated to TM standards before discharge.	Noted, the text has been amended to clarify this point.
2) Section 6.7.2, p 85, 1st para, under "Operation" - the storm water run-off should be treated to TM standards before discharge to the stormwater drain.	Noted, the text has been amended to clarify this point.
3) Section 6.7.2, p 86, last 4th para - should "water treatment unit" read as "wastewater treatment unit".	Noted, the text has been amended accordingly.
4) Section 6.7.2, p 86, last 3rd para, last sentence - as regards the alternative of tankering the sewage off-site for treatment and disposal, the discharger must ensure that the wastewater arisings are acceptable to the receiving sewage treatment works as it will contain industrial effluents as well as domestic sewage.	Noted, the text has been amended to emphasise this point.
5) Section 6.7.2, p 86, last 2nd para, last sentence - should "water treatment facility" read as "wastewater treatment facility".	Noted, the text has been amended accordingly.
6) Section 11.3.3, second para - should "water treatment plant" read as "wastewater treatment plant".	Noted, the text has been amended accordingly.
7) Finally, TM will be used as a guide for setting licence terms and conditions for both the discharges during the construction and operation phases.	Noted.

Comment	Response
Air Group (09/02/95)	
(a) Target Level for PCDD/F - The target level of 1 in a million is referring to the lifetime risk and the calculations do not involve annual risks. The taget level concentration should be 9.15×10^{-8} $\mu g\ m^{-3}$ ($1 \times 10^{-6} \times 3.23 \times 10^{-10}$ / 3.53×10^{-9}). Please amend *Table 10.4a* accordingly.	Noted, the Table has been amended as advised.
(b) Table 4.3b - It is noted that the OEL of Chromium VI has been amended by you to 0.01. In which case, the LAQS should be 0.02. Please amend the corresponding figures in Tables 4.3c and 4.5a and the associated Conc/LAQS.	Noted, the Tables have been amended as advised.
(c) The sentence at the bottom line of page 48 is not complete.	The sentence continues on page 49.
(d) S.10.4.3, page 116 - Baseline monitoring is to determine the background before the project is in place. Therefore, the last sentence on this page which implies baseline monitoring would be carried out during the operation of the CIF is not correct.	Noted, the sentence has been amended as advised.
(e) S.10.4.3, page 116 - Only high volume samplers are specified as the monitoring equipment to be provided for the operational phase baseline monitoring. Please note high volume samplers can only serve for the sampling of particulates and the metals in the particulates but not other parameters. Additional equipments shall be specified. Alternatively, the DFR should state that the Consultants shall provide the appropriate equipment for the monitoring of the stated pollutants conforming to the chosen USEPA methods.	Noted, the requirements have been amended to "the appropriate equipment" as advised.
(f) Table 10.4a - We have reservations concerning the proposed sampling methods in this Table. Since it is stated in the second bullet point of S.10.4.2 that "monitoring should be undertaken using the standard methodologies established by the USEPA or to an alternative methodology approved by EPD", I therefore suggestyou delete this column and the Note from the Table and retain the previous title (Recommended Target Levels).	Noted, the Table has been amended as advised.
(g) S.10.4.8, last bullet point, page 121 - As discussed, the establishment of an odour panel is to quantify thestrength of detected odour and not to train the odour patrol. Please amend accordingly.	Noted, the text has been amended as advised.

Comment	Response
S.4.3.4, page 42, last para - We need to point out that from the references provided by the consultants (extract of Bridges' document), that there was no incorporation of factor for converting the 10-min STEL to the hourly SAQS to take account of the difference in averaging time. Therefore, the consultants should take this into consideration when reviewing and comparing the predicted concentrations with the proposed SAQS. Notwithstanding this, we note that the assessment results indicate that the maximum predicted concentrations in Table 4.5d are more than 10 fold below the SAQS proposed by the consultants. Therefore, we have no objection to the consultant's conclusion that no adverse short-term effects should arise.	The STEL/10 is based on two factors: STEL/2 is included to allow for the difference in the averaging period; and STEL/5 is an allowance for human variability. The actual factoring to allow for differences in the time averaging period is considerably less than might appear to be appropriate, however, this is comparable with the established relationship of OEL/3 = STEL.
Table 4.5c - As informed by the consultants in their responses to our comments dated 13/1/95 that the maximum predicted concentration for PCDD/PCDF used in the calculation of dose value is 3.23 x 10^{-10}, however, the unit for dose value has not been given. Assuming the unit to be $\mu g\ m^{-3}$, we calculated a dose value of 2.26 x 10^{-14} instead of 8.68 x 10^{-13} for PCDD/PCDF as stated in Table 4.5c. Would the consultants please clarify.	The maximum predicted concentration is 3.23 x 10^{-10}, giving an inhalation exposure of 2.26 x 10^{-14}. This translates into a lifetime risk of 3.53 x 10^{-9} and a worst case total lifetime risk from all substances of 4.5 x 10^{-6}.
S.10.4 - The requirements on air quality monitoring is considered not adequate. For ambient monitoring requirements, the consultants had proposed to include a monitoring protocol as enclosed ion their responses to our comments dated 13/1/95 (see attachment 2). However, this is not included in this revised version of the report. The draft protocol should also be updated with the following amendments: (i) Respirable Suspended Particulates (RSP) should also be included in Table 1. Regarding the monitoring techniques for SO_2, NO_x, TSP and RSP, the consultants should not quote CLP or EPD. Instead they should recommend the standard methods and criteria developed by USEPA. (ii) The sampling frequency for the pollutants - SO_2, NO_x, TSP and RSP, should be monthly.	The proposed EM&A programme has been further developed and supplied to APG for comment on 6/2/95.

Comment	Response
Air Group (26/01/95) S. 2.1 – It is suggested to replace "more stringent" in the last line by "current".	Noted, the text has been amended as advised.
S.3.8.1 – In accordance with EPD DTC No 18-5-94 which suggests avoidance of the terms such as "acceptable" or "insignificant", it is recommended to replace the first paragraph by "Dust impacts from the construction of the CIF are expected to be within the HK AQOs as the ARs are at least 1.8 km from the site". Similarly, please also amend the last sentence of the second paragraph to read "The modelling results show that, for the substances covered by the AQOs, the CIF with 60 m stack and operating at full load and at the proposed emission limits will not pose air quality impacts exceeding the established standards on the surrounding environment nor on the identified ARs".	Noted, the text has been amended as follows: "Dust impacts from the construction of the CIF are predicted to be within the AQOs, the nearest ARs are at least 1.8 km from the site." and "The modelling results show that, for the substances covered by the AQOs, the CIF with 60 m stack and operating at full load and at the proposed emission limits will not lead to air quality impacts to the surrounding environment or to the identified ARs which exceed the established standards." The rest of EIA text has also been reviewed and amended where appropriate.
S.3.8.2 – The consultants have been previously requested to include monitoring of ambient pollutants such as SO_2, NO_x, RSP, dioxins and hydrocarbons. Hence such requirements should also be stated in the recommended EM&A programme at the end of this section.	Noted, the text has been amended as follows: • An EM&A programme should be developed which can be applied to: construction dust, ambient air quality (for stack gas emissions) and operational odours
Table 4.3b – The odour threshold for hydrogen sulphide should be 0.66 $\mu g\ m^{-3}$ instead of 7.0 $\mu g\ m^{-3}$ given in the table (see reference attachment 1).	Noted, the table has been amended accordingly. However, the reference attachment was not received.
Table 4.3c and Table 4.5a – The values of LAQOS for Carbon Monoxide given in these two tables are different (550 & 500 respectively). Please clarify and amend accordingly.	The OEL for CO is 55 $mg\ m^{-3}$, therefore, the LAQS is 550 $\mu g\ m^{-3}$. The subsequent tables have been amended accordingly.

	Annual Pollutant Concentration (ug/m3)			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration		Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.:	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
19	Proposed Chemical Waste Bulk Treatment Facility	5	0.1728	0.0639	6.91E-05	6.91E-05	1.21E-04	6.39E-04	0.0065	0.0646	0.0065	0.0129	0.0065	0.3228	0.5165	0.1291	0.0323	0.0065	1.29082E-10
		15	0.2009	0.0743	8.04E-05	8.04E-05	1.41E-04	7.43E-04	0.0075	0.0751	0.0075	0.0150	0.0075	0.3754	0.6006	0.1502	0.0375	0.0075	1.50095E-10
		25	0.2584	0.0956	1.03E-04	1.03E-04	1.81E-04	9.56E-04	0.0097	0.0965	0.0097	0.0193	0.0097	0.4826	0.7722	0.1931	0.0483	0.0097	1.92987E-10
		35	0.3459	0.1280	1.38E-04	1.38E-04	2.42E-04	1.28E-03	0.0129	0.1292	0.0129	0.0258	0.0129	0.6462	1.0339	0.2585	0.0646	0.0129	2.5838E-10
20	Proposed Special Industrial Area	5	0.1514	0.0560	6.06E-05	6.06E-05	1.06E-04	5.60E-04	0.0057	0.0566	0.0057	0.0113	0.0057	0.2829	0.4527	0.1132	0.0283	0.0057	1.13126E-10
		15	0.1597	0.0591	6.39E-05	6.39E-05	1.12E-04	5.91E-04	0.0060	0.0597	0.0060	0.0119	0.0060	0.2984	0.4774	0.1194	0.0298	0.0060	1.19303E-10
		25	0.1758	0.0650	7.03E-05	7.03E-05	1.23E-04	6.50E-04	0.0066	0.0657	0.0066	0.0131	0.0066	0.3284	0.5254	0.1314	0.0328	0.0066	1.313E-10
		35	0.1987	0.0735	7.96E-05	7.96E-05	1.39E-04	7.35E-04	0.0074	0.0742	0.0074	0.0148	0.0074	0.3712	0.5939	0.1485	0.0371	0.0074	1.48429E-10
21	River Trade Terminal	5	0.1820	0.0673	7.28E-05	7.28E-05	1.27E-04	6.73E-04	0.0068	0.0680	0.0068	0.0136	0.0068	0.3400	0.5440	0.1360	0.0340	0.0068	1.35961E-10
		15	0.1841	0.0681	7.36E-05	7.36E-05	1.29E-04	6.81E-04	0.0069	0.0688	0.0069	0.0138	0.0069	0.3439	0.5503	0.1376	0.0344	0.0069	1.3753E-10
		25	0.1886	0.0697	7.54E-05	7.54E-05	1.32E-04	6.97E-04	0.0070	0.0704	0.0070	0.0141	0.0070	0.3521	0.5633	0.1408	0.0352	0.0070	1.4078E-10
		35	0.1953	0.0722	7.81E-05	7.81E-05	1.37E-04	7.22E-04	0.0073	0.0730	0.0073	0.0146	0.0073	0.3648	0.5837	0.1469	0.0366	0.0073	1.45867E-10
22	Existing Castle Peak Firing Range (Boundary)	70	0.0567	0.0210	2.27E-05	2.27E-05	3.97E-05	2.10E-04	0.0021	0.0212	0.0021	0.0042	0.0021	0.1060	0.1696	0.0424	0.0106	0.0021	4.23848E-11

	Maximum 1-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration	Maximum 1 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	9.6809	3.5819	3.87E-03	3.87E-03	6.78E-03	3.58E-02	0.3621	3.6168	0.3621	0.7232	0.3621	18.0849	28.9363	7.2346	1.8084	0.3621	7.23165E-09
		15	9.7337	3.6015	3.89E-03	3.89E-03	6.81E-03	3.60E-02	0.3640	3.6365	0.3640	0.7271	0.3640	18.1835	29.0939	7.2740	1.8182	0.3640	7.27104E-09
		25	9.8492	3.6442	3.94E-03	3.94E-03	6.89E-03	3.64E-02	0.3684	3.6797	0.3684	0.7357	0.3684	18.3993	29.4393	7.3603	1.8398	0.3684	7.35737E-09
		35	10.0187	3.7069	4.01E-03	4.01E-03	7.01E-03	3.71E-02	0.3747	3.7430	0.3747	0.7484	0.3747	18.7158	29.9458	7.4869	1.8715	0.3747	7.48394E-09
2	Castle Peak Power Station	7.3	8.4331	3.1202	3.37E-03	3.37E-03	5.90E-03	3.12E-02	0.3154	3.1506	0.3154	0.6300	0.3154	15.7539	25.2065	6.3020	1.5753	0.3154	6.29952E-09
		15	8.4723	3.1347	3.39E-03	3.39E-03	5.93E-03	3.13E-02	0.3169	3.1652	0.3169	0.6329	0.3169	15.8271	25.3237	6.3313	1.5826	0.3169	6.3288E-09
		25	8.5624	3.1681	3.42E-03	3.42E-03	5.99E-03	3.17E-02	0.3202	3.1989	0.3202	0.6396	0.3202	15.9954	25.5930	6.3987	1.5995	0.3202	6.39611E-09
		35	8.6944	3.2169	3.48E-03	3.48E-03	6.09E-03	3.22E-02	0.3252	3.2482	0.3252	0.6495	0.3252	16.2420	25.9876	6.4973	1.6241	0.3252	6.49472E-09
3	Block Making Factory	58.3	16.2969	6.0299	6.52E-03	6.52E-03	1.14E-02	6.03E-02	0.6095	6.0886	0.6095	1.2174	0.6095	30.4443	48.7115	12.1787	3.0443	0.6095	1.21738E-08
4	Fresh Water Reservoir	64	12.6446	4.6785	5.06E-03	5.06E-03	8.85E-03	4.68E-02	0.4729	4.7240	0.4729	0.9446	0.4729	23.6214	37.7947	9.4493	2.3620	0.4729	9.44552E-09
5	Pillar Point Sewage Treatment Works	5	4.6847	1.7333	1.87E-03	1.87E-03	3.28E-03	1.73E-02	0.1752	1.7502	0.1752	0.3499	0.1752	8.7515	14.0025	3.5009	0.8751	0.1752	3.49946E-09
		15	4.7698	1.7648	1.91E-03	1.91E-03	3.34E-03	1.76E-02	0.1784	1.7820	0.1784	0.3563	0.1784	8.9105	14.2570	3.5645	0.8910	0.1784	3.56306E-09
		25	4.9328	1.8251	1.97E-03	1.97E-03	3.45E-03	1.83E-02	0.1845	1.8429	0.1845	0.3685	0.1845	9.2149	14.7440	3.6863	0.9214	0.1845	3.68477E-09
		35	5.1594	1.9090	2.06E-03	2.06E-03	3.61E-03	1.91E-02	0.1930	1.9276	0.1930	0.3854	0.1930	9.6383	15.4215	3.8556	0.9638	0.1930	3.85409E-09
6	WAHMO Building	12	6.5583	2.4266	2.62E-03	2.62E-03	4.59E-03	2.43E-02	0.2453	2.4502	0.2453	0.4899	0.2453	12.2516	19.6026	4.9010	1.2251	0.2453	4.89902E-09
7	Waterfront Industry	5	4.2435	1.5701	1.70E-03	1.70E-03	2.97E-03	1.57E-02	0.1587	1.5854	0.1587	0.3170	0.1587	7.9273	12.6838	3.1712	0.7927	0.1587	3.16989E-09
		15	4.2751	1.5818	1.71E-03	1.71E-03	2.99E-03	1.58E-02	0.1599	1.5972	0.1599	0.3194	0.1599	7.9864	12.7784	3.1948	0.7986	0.1599	3.19352E-09
		25	4.3378	1.6050	1.74E-03	1.74E-03	3.04E-03	1.60E-02	0.1622	1.6206	0.1622	0.3240	0.1622	8.1034	12.9656	3.2416	0.8103	0.1622	3.24032E-09
		35	4.4243	1.6370	1.77E-03	1.77E-03	3.10E-03	1.64E-02	0.1656	1.6529	0.1655	0.3305	0.1655	8.2650	13.2241	3.3062	0.8265	0.1655	3.30492E-09
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	6.2288	2.3047	2.49E-03	2.49E-03	4.36E-03	2.30E-02	0.2330	2.3271	0.2330	0.4653	0.2330	11.6361	18.6180	4.6548	1.1635	0.2330	4.65294E-09
9	Melody Garden	5	3.9592	1.4649	1.58E-03	1.58E-03	2.77E-03	1.46E-02	0.1481	1.4791	0.1481	0.2957	0.1481	7.3961	11.8339	2.9587	0.7396	0.1481	2.95749E-09
		15	3.9570	1.4641	1.58E-03	1.58E-03	2.77E-03	1.46E-02	0.1480	1.4783	0.1480	0.2956	0.1480	7.3921	11.8275	2.9571	0.7392	0.1480	2.95589E-09
		25	3.9523	1.4623	1.58E-03	1.58E-03	2.77E-03	1.46E-02	0.1478	1.4766	0.1478	0.2952	0.1478	7.3832	11.8133	2.9535	0.7383	0.1478	2.95233E-09
		35	3.9440	1.4593	1.58E-03	1.58E-03	2.76E-03	1.46E-02	0.1475	1.4735	0.1475	0.2946	0.1475	7.3678	11.7887	2.9474	0.7367	0.1475	2.94619E-09
		45	3.9311	1.4545	1.57E-03	1.57E-03	2.75E-03	1.45E-02	0.1470	1.4687	0.1470	0.2937	0.1470	7.3437	11.7501	2.9377	0.7343	0.1470	2.93654E-09
		55	3.9120	1.4474	1.56E-03	1.56E-03	2.74E-03	1.45E-02	0.1463	1.4615	0.1463	0.2922	0.1463	7.3080	11.6929	2.9234	0.7308	0.1463	2.92226E-09
		65	3.8850	1.4375	1.55E-03	1.55E-03	2.72E-03	1.44E-02	0.1453	1.4514	0.1453	0.2902	0.1453	7.2576	11.6123	2.9033	0.7257	0.1453	2.9021E-09
		75	3.8484	1.4239	1.54E-03	1.54E-03	2.69E-03	1.42E-02	0.1439	1.4378	0.1439	0.2875	0.1439	7.1893	11.5030	2.8759	0.7189	0.1439	2.87478E-09

	Maximum 1-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration	Maximum 1 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
9	Melody Garden	85	3.8006	1.4062	1.52E-03	1.52E-03	2.66E-03	1.41E-02	0.1421	1.4199	0.1421	0.2839	0.1421	7.0999	11.3600	2.8402	0.7100	0.1421	2.83904E-09
10	Butterfly Estates	5	3.7886	1.4018	1.52E-03	1.52E-03	2.66E-03	1.40E-02	0.1417	1.4164	0.1417	0.2830	0.1417	7.0776	11.3242	2.8312	0.7077	0.1417	2.8301E-09
		15	3.7855	1.4006	1.51E-03	1.51E-03	2.65E-03	1.40E-02	0.1416	1.4142	0.1416	0.2828	0.1416	7.0716	11.3147	2.8289	0.7071	0.1416	2.82774E-09
		25	3.7788	1.3981	1.51E-03	1.51E-03	2.65E-03	1.40E-02	0.1413	1.4118	0.1413	0.2823	0.1413	7.0591	11.2948	2.8239	0.7059	0.1413	2.82275E-09
		35	3.7679	1.3941	1.51E-03	1.51E-03	2.64E-03	1.39E-02	0.1409	1.4077	0.1409	0.2815	0.1409	7.0388	11.2623	2.8158	0.7038	0.1409	2.81462E-09
		45	3.7519	1.3882	1.50E-03	1.50E-03	2.63E-03	1.39E-02	0.1403	1.4017	0.1403	0.2803	0.1403	7.0088	11.2143	2.8038	0.7008	0.1403	2.80263E-09
		55	3.7294	1.3799	1.49E-03	1.49E-03	2.61E-03	1.38E-02	0.1395	1.3933	0.1395	0.2786	0.1395	6.9670	11.1473	2.7870	0.6967	0.1395	2.78589E-09
		65	3.6994	1.3688	1.48E-03	1.48E-03	2.59E-03	1.37E-02	0.1384	1.3821	0.1384	0.2763	0.1384	6.9108	11.0574	2.7645	0.6910	0.1384	2.76341E-09
		75	3.6602	1.3543	1.46E-03	1.46E-03	2.56E-03	1.35E-02	0.1369	1.3675	0.1369	0.2734	0.1369	6.8377	10.9404	2.7353	0.6837	0.1369	2.73419E-09
		85	3.6108	1.3360	1.44E-03	1.44E-03	2.53E-03	1.34E-02	0.1350	1.3490	0.1350	0.2697	0.1350	6.7453	10.7926	2.6983	0.6745	0.1350	2.69724E-09
11	Richland Garden	5	2.2461	0.8310	8.98E-04	8.98E-04	1.57E-03	8.31E-03	0.0840	0.8391	0.0840	0.1678	0.0840	4.1969	6.7136	1.6785	0.4196	0.0840	1.67782E-09
		15	2.2433	0.8300	8.97E-04	8.97E-04	1.57E-03	8.30E-03	0.0839	0.8381	0.0839	0.1676	0.0839	4.1907	6.7052	1.6764	0.4190	0.0839	1.67574E-09
		25	2.2376	0.8279	8.95E-04	8.95E-04	1.57E-03	8.28E-03	0.0837	0.8359	0.0837	0.1671	0.0837	4.1800	6.6880	1.6721	0.4180	0.0837	1.67145E-09
		35	2.2286	0.8246	8.91E-04	8.91E-04	1.56E-03	8.25E-03	0.0833	0.8326	0.0833	0.1665	0.0833	4.1632	6.6612	1.6654	0.4163	0.0833	1.66475E-09
		45	2.2160	0.8199	8.86E-04	8.86E-04	1.55E-03	8.20E-03	0.0829	0.8279	0.0829	0.1655	0.0829	4.1397	6.6236	1.6560	0.4139	0.0829	1.65534E-09
		55	2.1993	0.8137	8.80E-04	8.80E-04	1.54E-03	8.14E-03	0.0823	0.8216	0.0823	0.1643	0.0823	4.1084	6.5736	1.6435	0.4108	0.0823	1.64284E-09
		65	2.1778	0.8058	8.71E-04	8.71E-04	1.52E-03	8.06E-03	0.0815	0.8136	0.0815	0.1627	0.0815	4.0684	6.5096	1.6275	0.4068	0.0815	1.62685E-09
		75	2.1512	0.7959	8.60E-04	8.60E-04	1.51E-03	7.96E-03	0.0805	0.8037	0.0805	0.1607	0.0805	4.0187	6.4299	1.6076	0.4018	0.0805	1.60695E-09
		85	2.1188	0.7839	8.48E-04	8.48E-04	1.48E-03	7.84E-03	0.0792	0.7916	0.0792	0.1583	0.0792	3.9581	6.3330	1.5834	0.3958	0.0792	1.58273E-09
12	Butterfly Beach	4.6	2.8047	1.0377	1.12E-03	1.12E-03	1.96E-03	1.04E-02	0.1049	1.0478	0.1049	0.2095	0.1049	5.2395	8.3833	2.0960	0.5239	0.1049	2.09513E-09
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	5.1476	1.2461	1.35E-03	1.35E-03	2.36E-03	1.25E-02	0.1260	1.2582	0.1260	0.2516	0.1260	6.2913	10.0662	2.5167	0.6291	0.1260	2.5157E-09
	Future ASRs																		
14	Low density residential developments in Area 45C	10	3.3677	1.2461	1.35E-03	1.35E-03	2.36E-03	1.25E-02	0.1260	1.2582	0.1260	0.2516	0.1260	6.2913	10.0662	2.5167	0.6291	0.1260	2.5157E-09
15	Siu Lang Shui Landfill Site for development into a recreational area	41	19.1896	7.1002	7.68E-03	7.68E-03	1.34E-02	7.10E-02	0.7177	7.1692	0.7177	1.4336	0.7177	35.8481	57.3578	14.3404	3.5846	0.7177	1.43346E-08
16	As above	42	16.2708	6.0202	6.51E-03	6.51E-03	1.14E-02	6.02E-02	0.6085	6.0789	0.6085	1.2154	0.6085	30.3955	48.6334	12.1592	3.0394	0.6085	1.21543E-08
17	GIC at Siu Lang Shui	64.2	27.3558	10.1216	1.09E-02	1.09E-02	1.91E-02	1.01E-01	1.0231	10.2201	1.0231	2.0435	1.0231	51.1033	81.7664	20.4430	5.1101	1.0231	2.04348E-08

	Maximum 1-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted Hourly Concentration	Maximum 1 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
18	Proposed Steel Works	5	5.7892	2.1420	2.32E-03	2.32E-03	4.05E-03	2.14E-02	0.2165	2.1629	0.2165	0.4325	0.2165	10.8148	17.3040	4.3263	1.0814	0.2165	4.32455E-09
		15	6.2780	2.3229	2.51E-03	2.51E-03	4.39E-03	2.32E-02	0.2348	2.3455	0.2348	0.4690	0.2348	11.7279	18.7649	4.6915	1.1727	0.2348	4.68967E-09
		25	7.3292	2.7118	2.93E-03	2.93E-03	5.13E-03	2.71E-02	0.2741	2.7382	0.2741	0.5475	0.2741	13.6916	21.9069	5.4771	1.3691	0.2741	5.4749E-09
		35	9.1361	3.3804	3.68E-03	3.68E-03	6.40E-03	3.38E-02	0.3417	3.4133	0.3417	0.6825	0.3417	17.0672	27.3079	6.8274	1.7066	0.3417	6.8247E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	6.8551	2.5364	2.74E-03	2.74E-03	4.80E-03	2.54E-02	0.2564	2.5611	0.2564	0.5121	0.2564	12.8060	20.4899	5.1228	1.2805	0.2564	5.12075E-09
		15	7.1641	2.6507	2.87E-03	2.87E-03	5.01E-03	2.65E-02	0.2679	2.6765	0.2679	0.5352	0.2679	13.3832	21.4133	5.3537	1.3382	0.2679	5.35155E-09
		25	7.7585	2.8706	3.10E-03	3.10E-03	5.43E-03	2.87E-02	0.2902	2.8986	0.2902	0.5796	0.2902	14.4937	23.1902	5.7979	1.4493	0.2902	5.79561E-09
		35	8.8321	3.2679	3.83E-03	3.83E-03	6.18E-03	3.27E-02	0.3303	3.2997	0.3303	0.6598	0.3303	16.4992	26.3991	6.6002	1.6498	0.3303	6.59756E-09
20	Proposed Special Industrial Area	5	7.7661	2.8735	3.11E-03	3.11E-03	5.44E-03	2.87E-02	0.2905	2.9014	0.2905	0.5801	0.2905	14.5078	23.2128	5.8036	1.4507	0.2905	5.80127E-09
		15	7.8857	2.9177	3.15E-03	3.15E-03	5.52E-03	2.92E-02	0.2949	2.9461	0.2949	0.5891	0.2949	14.7313	23.5704	5.8930	1.4730	0.2949	5.89062E-09
		25	8.1711	3.0233	3.27E-03	3.27E-03	5.72E-03	3.02E-02	0.3056	3.0527	0.3056	0.6104	0.3056	15.2645	24.4235	6.1063	1.5264	0.3056	6.10383E-09
		35	9.2670	3.4288	3.71E-03	3.71E-03	6.49E-03	3.43E-02	0.3466	3.4622	0.3466	0.6922	0.3466	17.3117	27.6991	6.9252	1.7311	0.3466	6.92246E-09
21	River Trade Terminal	5	7.2669	2.6887	2.91E-03	2.91E-03	5.09E-03	2.69E-02	0.2718	2.7149	0.2718	0.5428	0.2718	13.5752	21.7206	5.4305	1.3574	0.2718	5.42834E-09
		15	7.2786	2.6931	2.91E-03	2.91E-03	5.10E-03	2.69E-02	0.2722	2.7193	0.2722	0.5437	0.2722	13.5972	21.7558	5.4393	1.3596	0.2722	5.43713E-09
		25	7.3342	2.7137	2.93E-03	2.93E-03	5.13E-03	2.71E-02	0.2743	2.7401	0.2743	0.5479	0.2743	13.7010	21.9220	5.4809	1.3700	0.2743	5.47865E-09
		35	8.0656	2.9842	3.23E-03	3.23E-03	5.65E-03	2.98E-02	0.3016	3.0133	0.3016	0.6025	0.3016	15.0671	24.1076	6.0273	1.5066	0.3016	6.02489E-09
22	Existing Castle Peak Firing Range (Boundary)	70	30.3113	11.2152	1.21E-02	1.21E-02	2.12E-02	1.12E-01	1.1336	11.3243	1.1336	2.2643	1.1336	56.6246	90.6004	22.6516	5.6621	1.1336	2.26425E-08

	Maximum 8-hour average concentration			Using 1992 Lau Fau Shan Met. Data																
			Predicted 8-hour Concentration		Maximum 8 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																	
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																			
1	Cement Works	6.7	3.2764	1.2123	1.31E-03	1.31E-03	2.29E-03	1.21E-02	0.1225	1.2241	0.1225	0.2447	0.1225	6.1207	9.7932	2.4485	0.6120	0.1225	2.44748E-09
		15	3.2769	1.2124	1.31E-03	1.31E-03	2.29E-03	1.21E-02	0.1226	1.2242	0.1226	0.2448	0.1226	6.1216	9.7946	2.4488	0.6121	0.1226	2.44784E-09
		25	3.2771	1.2125	1.31E-03	1.31E-03	2.29E-03	1.21E-02	0.1226	1.2243	0.1226	0.2448	0.1226	6.1220	9.7953	2.4490	0.6122	0.1226	2.44799E-09
		35	3.2763	1.2119	1.31E-03	1.31E-03	2.29E-03	1.21E-02	0.1225	1.2237	0.1225	0.2447	0.1225	6.1187	9.7900	2.4477	0.6118	0.1225	2.44668E-09
2	Castle Peak Power Station	7.3	1.8053	0.6680	7.22E-04	7.22E-04	1.26E-03	6.68E-03	0.0675	0.6745	0.0675	0.1349	0.0675	3.3726	5.3962	1.3491	0.3372	0.0675	1.34859E-09
		15	1.8113	0.6702	7.25E-04	7.25E-04	1.27E-03	6.70E-03	0.0677	0.6767	0.0677	0.1353	0.0677	3.3837	5.4140	1.3536	0.3384	0.0677	1.35305E-09
		25	1.8250	0.6753	7.30E-04	7.30E-04	1.28E-03	6.75E-03	0.0683	0.6818	0.0683	0.1363	0.0683	3.4093	5.4550	1.3638	0.3409	0.0683	1.36329E-09
		35	1.8451	0.6827	7.38E-04	7.38E-04	1.29E-03	6.83E-03	0.0690	0.6893	0.0690	0.1378	0.0690	3.4468	5.5149	1.3788	0.3447	0.0690	1.37827E-09
3	Block Making Factory	56.3	2.0391	0.7545	8.16E-04	8.16E-04	1.43E-03	7.54E-03	0.0763	0.7618	0.0763	0.1523	0.0763	3.8093	6.0949	1.5238	0.3809	0.0763	1.52322E-09
4	Fresh Water Reservoir	64	1.7178	0.6356	6.87E-04	6.87E-04	1.20E-03	6.36E-03	0.0642	0.6418	0.0642	0.1283	0.0642	3.2090	5.1344	1.2837	0.3209	0.0642	1.28318E-09
5	Pillar Point Sewage Treatment Works	5	0.9888	0.3658	3.96E-04	3.96E-04	6.92E-04	3.66E-03	0.0370	0.3694	0.0370	0.0739	0.0370	1.8471	2.9555	0.7389	0.1847	0.0370	7.38619E-10
		15	0.9888	0.3658	3.96E-04	3.96E-04	6.92E-04	3.66E-03	0.0370	0.3694	0.0370	0.0739	0.0370	1.8471	2.9555	0.7389	0.1847	0.0370	7.38619E-10
		25	0.9888	0.3658	3.96E-04	3.96E-04	6.92E-04	3.66E-03	0.0370	0.3694	0.0370	0.0739	0.0370	1.8471	2.9555	0.7389	0.1847	0.0370	7.38619E-10
		35	0.9888	0.3658	3.96E-04	3.96E-04	6.92E-04	3.66E-03	0.0370	0.3694	0.0370	0.0739	0.0370	1.8471	2.9555	0.7389	0.1847	0.0370	7.38619E-10
6	WAHMO Building	12	1.1633	0.4304	4.65E-04	4.65E-04	8.14E-04	4.30E-03	0.0435	0.4346	0.0435	0.0869	0.0435	2.1731	3.4770	0.8693	0.2173	0.0435	8.68963E-10
7	Waterfront Industry	5	0.9128	0.3377	3.65E-04	3.65E-04	6.39E-04	3.38E-03	0.0341	0.3410	0.0341	0.0682	0.0341	1.7051	2.7283	0.6821	0.1705	0.0341	6.81839E-10
		15	0.9128	0.3377	3.65E-04	3.65E-04	6.39E-04	3.38E-03	0.0341	0.3410	0.0341	0.0682	0.0341	1.7051	2.7283	0.6821	0.1705	0.0341	6.81839E-10
		25	0.9128	0.3377	3.65E-04	3.65E-04	6.39E-04	3.38E-03	0.0341	0.3410	0.0341	0.0682	0.0341	1.7051	2.7283	0.6821	0.1705	0.0341	6.81839E-10
		35	0.9128	0.3377	3.65E-04	3.65E-04	6.39E-04	3.38E-03	0.0341	0.3410	0.0341	0.0682	0.0341	1.7051	2.7283	0.6821	0.1705	0.0341	6.81839E-10
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.7829	0.2897	3.13E-04	3.13E-04	5.48E-04	2.90E-03	0.0293	0.2925	0.0293	0.0585	0.0293	1.4626	2.3402	0.5851	0.1463	0.0293	5.84849E-10
9	Melody Garden	5	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		15	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		25	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		35	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		45	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		55	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		65	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		75	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
		85	0.6463	0.2391	2.59E-04	2.59E-04	4.52E-04	2.39E-03	0.0242	0.2415	0.0242	0.0483	0.0242	1.2073	1.9317	0.4830	0.1207	0.0242	4.82771E-10
10	Butterfly Estates	5	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		15	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		25	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		35	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		45	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10

	Maximum 8-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted 8-hour Concentration		Maximum 8 hour average Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	55	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		65	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		75	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
		85	0.6906	0.2555	2.76E-04	2.76E-04	4.83E-04	2.56E-03	0.0258	0.2580	0.0258	0.0516	0.0258	1.2901	2.0642	0.5161	0.1290	0.0258	5.15871E-10
11	Richland Garden	5	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		15	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		25	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		35	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		45	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		55	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		65	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.818E-10
		75	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
		85	0.5111	0.1891	2.04E-04	2.04E-04	3.58E-04	1.89E-03	0.0191	0.1910	0.0191	0.0382	0.0191	0.9548	1.5277	0.3820	0.0955	0.0191	3.81799E-10
12	Butterfly Beach	4.6	0.6892	0.2550	2.76E-04	2.76E-04	4.82E-04	2.55E-03	0.0258	0.2576	0.0258	0.0516	0.0258	1.2874	2.0599	0.5150	0.1287	0.0258	5.1481E-10
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.8049	0.2705	2.92E-04	2.92E-04	5.12E-04	2.71E-03	0.0273	0.2732	0.0273	0.0546	0.0273	1.3659	2.1854	0.5464	0.1366	0.0273	5.46169E-10
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.7312	0.2705	2.92E-04	2.92E-04	5.12E-04	2.71E-03	0.0273	0.2732	0.0273	0.0546	0.0273	1.3659	2.1854	0.5464	0.1366	0.0273	5.46169E-10
15	Siu Lang Shui Landfill Site for development into a recreational area	41	7.0995	2.6231	2.84E-03	2.84E-03	4.96E-03	2.62E-02	0.2651	2.6486	0.2651	0.5296	0.2651	13.2439	21.1906	5.2980	1.3243	0.2651	5.29585E-09
16	As above	42	4.2743	1.5815	1.71E-03	1.71E-03	2.99E-03	1.58E-02	0.1599	1.5969	0.1599	0.3193	0.1599	7.9847	12.7767	3.1941	0.7984	0.1599	3.19286E-09
17	GIC at Siu Lang Shui	54.2	4.7006	1.7392	1.88E-03	1.88E-03	3.29E-03	1.74E-02	0.1758	1.7561	0.1758	0.3511	0.1758	8.7812	14.0500	3.5127	0.8781	0.1758	3.51133E-09
18	Proposed Steel Work	5	4.3982	1.6273	1.76E-03	1.76E-03	3.08E-03	1.63E-02	0.1645	1.6431	0.1645	0.3285	0.1645	8.2162	13.1461	3.2867	0.8216	0.1645	3.28542E-09
		15	4.8588	1.7978	1.94E-03	1.94E-03	3.40E-03	1.80E-02	0.1817	1.8152	0.1817	0.3630	0.1817	9.0767	14.5229	3.6310	0.9076	0.1817	3.62952E-09
		25	5.7328	2.1212	2.29E-03	2.29E-03	4.01E-03	2.12E-02	0.2144	2.1418	0.2144	0.4282	0.2144	10.7095	17.1355	4.2842	1.0709	0.2144	4.28243E-09
		35	6.9257	2.5626	2.77E-03	2.77E-03	4.85E-03	2.56E-02	0.2590	2.5874	0.2590	0.5173	0.2590	12.9379	20.7009	5.1756	1.2937	0.2590	5.1735E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	4.5101	1.6687	1.80E-03	1.80E-03	3.16E-03	1.67E-02	0.1687	1.6850	0.1687	0.3369	0.1687	8.4253	13.4807	3.3704	0.8425	0.1687	3.36905E-09
		15	4.6545	1.7222	1.86E-03	1.86E-03	3.26E-03	1.72E-02	0.1741	1.7389	0.1741	0.3477	0.1741	8.6951	13.9124	3.4783	0.8695	0.1741	3.47693E-09
		25	4.9295	1.8239	1.97E-03	1.97E-03	3.45E-03	1.82E-02	0.1844	1.8417	0.1844	0.3682	0.1844	9.2089	14.7344	3.6838	0.9208	0.1844	3.68237E-09
		35	5.3966	1.9968	2.16E-03	2.16E-03	3.78E-03	2.00E-02	0.2018	2.0162	0.2018	0.4031	0.2018	10.0814	16.1306	4.0329	1.0081	0.2018	4.03128E-09

	Maximum 8-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted 8-hour Concentration		Maximum 8 hour average Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
20	Proposed Special Industrial Area	5	3.5861	1.3269	1.43E-03	1.43E-03	2.51E-03	1.33E-02	0.1341	1.3398	0.1341	0.2679	0.1341	6.6992	10.7189	2.6799	0.6699	0.1341	2.67883E-09
		15	3.6630	1.3553	1.47E-03	1.47E-03	2.56E-03	1.36E-02	0.1370	1.3685	0.1370	0.2736	0.1370	6.8428	10.9487	2.7374	0.6842	0.1370	2.73625E-09
		25	3.8069	1.4085	1.52E-03	1.52E-03	2.66E-03	1.41E-02	0.1424	1.4222	0.1424	0.2844	0.1424	7.1116	11.3787	2.8449	0.7111	0.1424	2.84372E-09
		35	3.9991	1.4797	1.60E-03	1.60E-03	2.80E-03	1.48E-02	0.1496	1.4941	0.1496	0.2987	0.1496	7.4707	11.9533	2.9886	0.7470	0.1496	2.98734E-09
21	River Trade Terminal	5	2.4979	0.9242	9.99E-04	9.99E-04	1.75E-03	9.24E-03	0.0934	0.9332	0.0934	0.1866	0.0934	4.6664	7.4663	1.8667	0.4666	0.0934	1.86595E-09
		15	2.5213	0.9329	1.01E-03	1.01E-03	1.76E-03	9.33E-03	0.0943	0.9420	0.0943	0.1883	0.0943	4.7101	7.5363	1.8842	0.4710	0.0943	1.88344E-09
		25	2.5648	0.9490	1.03E-03	1.03E-03	1.80E-03	9.49E-03	0.0959	0.9582	0.0959	0.1916	0.0959	4.7914	7.6663	1.9167	0.4791	0.0959	1.91594E-09
		35	2.6221	0.9702	1.05E-03	1.05E-03	1.84E-03	9.70E-03	0.0981	0.9796	0.0981	0.1959	0.0981	4.8983	7.8373	1.9596	0.4898	0.0981	1.95868E-09
22	Existing Castle Peak Firing Range (Boundary)	70	3.8054	1.4080	1.52E-03	1.52E-03	2.66E-03	1.41E-02	0.1423	1.4217	0.1423	0.2843	0.1423	7.1089	11.3743	2.8438	0.7108	0.1423	2.84263E-09

	Maximum 24-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted 24 hour Concentration	Maximum 24 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	1.3548	0.5013	5.42E-04	5.42E-04	9.48E-04	5.01E-03	0.0507	0.5061	0.0507	0.1012	0.0507	2.5309	4.0494	1.0124	0.2531	0.0507	1.01202E-09
		15	1.3738	0.5083	5.50E-04	5.50E-04	9.62E-04	5.08E-03	0.0514	0.5132	0.0514	0.1026	0.0514	2.5663	4.1062	1.0266	0.2566	0.0514	1.0262E-09
		25	1.4149	0.5235	5.66E-04	5.66E-04	9.90E-04	5.24E-03	0.0529	0.5286	0.0529	0.1057	0.0529	2.6432	4.2293	1.0574	0.2643	0.0529	1.05696E-09
		35	1.4742	0.5454	5.90E-04	5.90E-04	1.03E-03	5.45E-03	0.0551	0.5507	0.0551	0.1101	0.0551	2.7539	4.4062	1.1016	0.2754	0.0551	1.10119E-09
2	Castle Peak Power Station	7.3	1.1227	0.4154	4.49E-04	4.49E-04	7.86E-04	4.15E-03	0.0420	0.4195	0.0420	0.0839	0.0420	2.0974	3.3558	0.8390	0.2097	0.0420	8.38679E-10
		15	1.1262	0.4167	4.50E-04	4.50E-04	7.88E-04	4.17E-03	0.0421	0.4208	0.0421	0.0841	0.0421	2.1039	3.3663	0.8416	0.2104	0.0421	8.41301E-10
		25	1.1343	0.4197	4.54E-04	4.54E-04	7.94E-04	4.20E-03	0.0424	0.4238	0.0424	0.0847	0.0424	2.1190	3.3905	0.8477	0.2119	0.0424	8.4733E-10
		35	1.1461	0.4241	4.58E-04	4.58E-04	8.02E-04	4.24E-03	0.0429	0.4282	0.0429	0.0856	0.0429	2.1411	3.4258	0.8565	0.2141	0.0429	8.56152E-10
3	Block Making Factory	58.3	0.9053	0.3349	3.62E-04	3.62E-04	6.34E-04	3.35E-03	0.0339	0.3382	0.0339	0.0676	0.0339	1.6911	2.7058	0.6765	0.1691	0.0339	6.76229E-10
4	Fresh Water Reservoir	64	0.7280	0.2694	2.91E-04	2.91E-04	5.10E-04	2.69E-03	0.0272	0.2720	0.0272	0.0544	0.0272	1.3599	2.1759	0.5440	0.1360	0.0272	5.43801E-10
5	Pillar Point Sewage Treatment Works	5	0.5547	0.2052	2.22E-04	2.22E-04	3.88E-04	2.05E-03	0.0207	0.2072	0.0207	0.0414	0.0207	1.0361	1.6578	0.4145	0.1036	0.0207	4.14324E-10
		15	0.5547	0.2052	2.22E-04	2.22E-04	3.88E-04	2.05E-03	0.0207	0.2072	0.0207	0.0414	0.0207	1.0361	1.6578	0.4145	0.1036	0.0207	4.14324E-10
		25	0.5547	0.2052	2.22E-04	2.22E-04	3.88E-04	2.05E-03	0.0207	0.2072	0.0207	0.0414	0.0207	1.0361	1.6578	0.4145	0.1036	0.0207	4.14324E-10
		35	0.5547	0.2052	2.22E-04	2.22E-04	3.88E-04	2.05E-03	0.0207	0.2072	0.0207	0.0414	0.0207	1.0361	1.6578	0.4145	0.1036	0.0207	4.14324E-10
6	WAHMO Building	12	0.6407	0.2371	2.56E-04	2.56E-04	4.49E-04	2.37E-03	0.0240	0.2394	0.0240	0.0479	0.0240	1.1969	1.9151	0.4788	0.1197	0.0240	4.78618E-10
7	Waterfront Industry	5	0.4996	0.1848	2.00E-04	2.00E-04	3.50E-04	1.85E-03	0.0187	0.1866	0.0187	0.0373	0.0187	0.9333	1.4932	0.3733	0.0933	0.0187	3.73186E-10
		15	0.4996	0.1848	2.00E-04	2.00E-04	3.50E-04	1.85E-03	0.0187	0.1866	0.0187	0.0373	0.0187	0.9333	1.4932	0.3733	0.0933	0.0187	3.73186E-10
		25	0.4996	0.1848	2.00E-04	2.00E-04	3.50E-04	1.85E-03	0.0187	0.1866	0.0187	0.0373	0.0187	0.9333	1.4932	0.3733	0.0933	0.0187	3.73186E-10
		35	0.4996	0.1848	2.00E-04	2.00E-04	3.50E-04	1.85E-03	0.0187	0.1866	0.0187	0.0373	0.0187	0.9333	1.4932	0.3733	0.0933	0.0187	3.73186E-10
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.2611	0.0966	1.04E-04	1.04E-04	1.83E-04	9.66E-04	0.0098	0.0976	0.0098	0.0195	0.0098	0.4878	0.7804	0.1951	0.0488	0.0098	1.95042E-10
9	Melody Garden	5	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		15	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		25	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		35	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		45	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		55	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		65	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		75	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
		85	0.2870	0.1062	1.15E-04	1.15E-04	2.01E-04	1.06E-03	0.0107	0.1072	0.0107	0.0214	0.0107	0.5362	0.8580	0.2145	0.0536	0.0107	2.14419E-10
10	Butterfly Estates	6	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		15	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		25	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		35	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10

	Maximum 24-hour average concentration			Using 1992 Lau Fau Shan Met. Data															
			Predicted 24 hour Concentration	Maximum 24 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	45	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		55	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		65	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		75	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
		85	0.3231	0.1195	1.29E-04	1.29E-04	2.26E-04	1.20E-03	0.0121	0.1207	0.0121	0.0241	0.0121	0.6035	0.9656	0.2414	0.0603	0.0121	2.41326E-10
11	Richland Garden	5	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		15	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		25	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.6517E-10
		35	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		45	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		55	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		65	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		75	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
		85	0.2211	0.0818	8.84E-05	8.84E-05	1.55E-04	8.18E-04	0.0083	0.0826	0.0083	0.0165	0.0083	0.4131	0.6609	0.1652	0.0413	0.0083	1.65169E-10
12	Butterfly Beach	4.6	0.3022	0.1118	1.21E-04	1.21E-04	2.12E-04	1.12E-03	0.0113	0.1129	0.0113	0.0226	0.0113	0.5645	0.9033	0.2258	0.0565	0.0113	2.25743E-10
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.3721	0.1189	1.29E-04	1.29E-04	2.25E-04	1.19E-03	0.0120	0.1200	0.0120	0.0240	0.0120	0.6002	0.9604	0.2401	0.0600	0.0120	2.40019E-10
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.3213	0.1189	1.29E-04	1.29E-04	2.25E-04	1.19E-03	0.0120	0.1200	0.0120	0.0240	0.0120	0.6002	0.9604	0.2401	0.0600	0.0120	2.40019E-10
15	Siu Lang Shui Landfill Site for development into a recreational area	41	3.5712	1.3213	1.43E-03	1.43E-03	2.50E-03	1.32E-02	0.1336	1.3342	0.1336	0.2668	0.1336	6.6713	10.6742	2.6687	0.6671	0.1336	2.66766E-09
16	As above	42	1.4264	0.5278	5.71E-04	5.71E-04	9.99E-04	5.28E-03	0.0533	0.5329	0.0533	0.1066	0.0533	2.6647	4.2636	1.0660	0.2666	0.0533	1.06556E-09
17	GIC at Siu Lang Shui	54.2	1.9301	0.7141	7.72E-04	7.72E-04	1.35E-03	7.14E-03	0.0722	0.7211	0.0722	0.1442	0.0722	3.6066	5.7689	1.4423	0.3605	0.0722	1.44175E-09
18	Proposed Steel Work	5	1.3759	0.5091	5.50E-04	5.50E-04	9.63E-04	5.09E-03	0.0515	0.5140	0.0515	0.1028	0.0515	2.5703	4.1126	1.0282	0.2570	0.0515	1.0278E-09
		15	1.5591	0.5769	6.24E-04	6.24E-04	1.09E-03	5.77E-03	0.0583	0.5825	0.0583	0.1165	0.0583	2.9126	4.6601	1.1651	0.2912	0.0583	1.16465E-09
		25	1.9320	0.7148	7.73E-04	7.73E-04	1.35E-03	7.15E-03	0.0723	0.7218	0.0723	0.1443	0.0723	3.6091	5.7747	1.4438	0.3609	0.0723	1.44318E-09
		35	2.4993	0.9247	1.00E-03	1.00E-03	1.76E-03	9.26E-03	0.0935	0.9337	0.0935	0.1867	0.0935	4.6689	7.4703	1.8677	0.4669	0.0935	1.86696E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	1.3726	0.5079	5.49E-04	5.49E-04	9.61E-04	5.08E-03	0.0513	0.5128	0.0513	0.1025	0.0513	2.5642	4.1028	1.0258	0.2564	0.0513	1.02536E-09
		15	1.4166	0.5241	5.67E-04	5.67E-04	9.92E-04	5.24E-03	0.0530	0.5292	0.0530	0.1058	0.0530	2.6463	4.2342	1.0586	0.2646	0.0530	1.05819E-09
		25	1.7899	0.6623	7.16E-04	7.16E-04	1.25E-03	6.62E-03	0.0669	0.6687	0.0669	0.1337	0.0669	3.3437	5.3500	1.3376	0.3344	0.0669	1.33705E-09
		35	2.3963	0.8866	9.58E-04	9.58E-04	1.68E-03	8.87E-03	0.0896	0.8952	0.0896	0.1790	0.0896	4.4765	7.1624	1.7907	0.4476	0.0896	1.79001E-09

	Maximum 24-hour average concentration			Using 1992 Lau Fau Shan Met. Data																
			Predicted 24 hour Concentration	Maximum 24 hour average Pollutant Concentration (ug/m3)																
			1 g/s emission																	
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
20	Proposed Special Industrial Area	5	1.2033	0.4452	4.81E-04	4.81E-04	8.42E-04	4.45E-03	0.0450	0.4495	0.0450	0.0899	0.0450	2.2479	3.5966	0.8992	0.2248	0.0450	8.98858E-10
		15	1.2311	0.4555	4.92E-04	4.92E-04	8.62E-04	4.55E-03	0.0460	0.4599	0.0460	0.0920	0.0460	2.2997	3.6796	0.9200	0.2300	0.0460	9.19602E-10
		25	1.2832	0.4748	5.13E-04	5.13E-04	8.98E-04	4.75E-03	0.0480	0.4794	0.0480	0.0959	0.0480	2.3971	3.8353	0.9589	0.2397	0.0480	9.58513E-10
		35	1.4791	0.5472	5.92E-04	5.92E-04	1.04E-03	5.47E-03	0.0553	0.5526	0.0553	0.1105	0.0553	2.7630	4.4209	1.1063	0.2763	0.0553	1.10486E-09
21	River Trade Terminal	5	1.1394	0.4216	4.56E-04	4.56E-04	7.98E-04	4.22E-03	0.0426	0.4257	0.0426	0.0851	0.0426	2.1285	3.4056	0.8515	0.2128	0.0426	8.51109E-10
		15	1.1464	0.4242	4.59E-04	4.59E-04	8.02E-04	4.24E-03	0.0429	0.4283	0.0429	0.0856	0.0429	2.1416	3.4266	0.8567	0.2141	0.0429	8.56353E-10
		25	1.1592	0.4289	4.64E-04	4.64E-04	8.11E-04	4.29E-03	0.0434	0.4331	0.0434	0.0866	0.0434	2.1655	3.4648	0.8663	0.2165	0.0434	8.65922E-10
		35	1.1764	0.4349	4.70E-04	4.70E-04	8.23E-04	4.36E-03	0.0440	0.4391	0.0440	0.0878	0.0440	2.1958	3.5134	0.8784	0.2196	0.0440	8.78054E-10
22	Existing Castle Peak Firing Range (Boundary)	70	1.3236	0.4897	5.29E-04	5.29E-04	9.27E-04	4.90E-03	0.0495	0.4945	0.0495	0.0989	0.0495	2.4727	3.9564	0.9892	0.2473	0.0495	9.88759E-10

	Maximum 1 month average concentration			Using 1992 Lau Fau Shan Met. Data															
				Maximum 1 month average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	0.2684	0.0993	1.07E-04	1.07E-04	1.88E-04	9.93E-04	0.0100	0.1003	0.0100	0.0201	0.0100	0.5015	0.8024	0.2006	0.0501	0.0100	2.00525E-10
		15	0.2726	0.1009	1.09E-04	1.09E-04	1.91E-04	1.01E-03	0.0102	0.1018	0.0102	0.0204	0.0102	0.5092	0.8147	0.2037	0.0509	0.0102	2.03617E-10
		25	0.2823	0.1045	1.13E-04	1.13E-04	1.98E-04	1.04E-03	0.0106	0.1055	0.0106	0.0211	0.0106	0.5274	0.8438	0.2110	0.0527	0.0106	2.10878E-10
		35	0.2984	0.1104	1.19E-04	1.19E-04	2.09E-04	1.10E-03	0.0112	0.1115	0.0112	0.0223	0.0112	0.5575	0.8920	0.2230	0.0557	0.0112	2.2292E-10
2	Castle Peak Power Station	7.3	0.1702	0.0630	6.81E-05	6.81E-05	1.19E-04	6.30E-04	0.0064	0.0636	0.0064	0.0127	0.0064	0.3179	0.5086	0.1272	0.0318	0.0064	1.27102E-10
		15	0.1712	0.0633	6.85E-05	6.85E-05	1.20E-04	6.33E-04	0.0064	0.0640	0.0064	0.0128	0.0064	0.3198	0.5117	0.1279	0.0320	0.0064	1.27879E-10
		25	0.1736	0.0642	6.94E-05	6.94E-05	1.21E-04	6.42E-04	0.0065	0.0648	0.0065	0.0130	0.0065	0.3242	0.5188	0.1297	0.0324	0.0065	1.29657E-10
		35	0.1770	0.0655	7.08E-05	7.08E-05	1.24E-04	6.55E-04	0.0066	0.0661	0.0066	0.0132	0.0066	0.3306	0.5289	0.1322	0.0331	0.0066	1.32189E-10
3	Block Making Factory	58.3	0.1136	0.0420	4.54E-05	4.54E-05	7.95E-05	4.20E-04	0.0042	0.0424	0.0042	0.0085	0.0042	0.2121	0.3394	0.0849	0.0212	0.0042	8.48219E-11
4	Fresh Water Reservoir	64	0.0988	0.0366	3.95E-05	3.95E-05	6.92E-05	3.66E-04	0.0037	0.0369	0.0037	0.0074	0.0037	0.1846	0.2953	0.0738	0.0185	0.0037	7.38111E-11
5	Pillar Point Sewage Treatment Works	5	0.0345	0.0128	1.38E-05	1.38E-05	2.41E-05	1.28E-04	0.0013	0.0129	0.0013	0.0026	0.0013	0.0644	0.1030	0.0258	0.0064	0.0013	2.57416E-11
		15	0.0345	0.0128	1.38E-05	1.38E-05	2.42E-05	1.28E-04	0.0013	0.0129	0.0013	0.0026	0.0013	0.0644	0.1031	0.0258	0.0064	0.0013	2.57715E-11
		25	0.0346	0.0128	1.38E-05	1.38E-05	2.42E-05	1.28E-04	0.0013	0.0129	0.0013	0.0026	0.0013	0.0646	0.1033	0.0258	0.0065	0.0013	2.58163E-11
		35	0.0347	0.0128	1.39E-05	1.39E-05	2.43E-05	1.28E-04	0.0013	0.0129	0.0013	0.0026	0.0013	0.0647	0.1036	0.0259	0.0065	0.0013	2.58836E-11
6	WAHMO Building	12	0.0361	0.0134	1.44E-05	1.44E-05	2.53E-05	1.34E-04	0.0013	0.0135	0.0013	0.0027	0.0013	0.0674	0.1079	0.0270	0.0067	0.0013	2.69582E-11
7	Waterfront Industry	5	0.0258	0.0095	1.03E-05	1.03E-05	1.81E-05	9.55E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0482	0.0771	0.0193	0.0048	0.0010	1.92801E-11
		15	0.0258	0.0095	1.03E-05	1.03E-05	1.81E-05	9.55E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0482	0.0771	0.0193	0.0048	0.0010	1.92726E-11
		25	0.0258	0.0095	1.03E-05	1.03E-05	1.81E-05	9.54E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0482	0.0771	0.0193	0.0048	0.0010	1.92651E-11
		35	0.0258	0.0095	1.03E-05	1.03E-05	1.80E-05	9.54E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0482	0.0771	0.0193	0.0048	0.0010	1.92577E-11
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.0454	0.0168	1.82E-05	1.82E-05	3.18E-05	1.68E-04	0.0017	0.0170	0.0017	0.0034	0.0017	0.0849	0.1358	0.0339	0.0085	0.0017	3.39362E-11
9	Melody Garden	5	0.0213	0.0079	8.53E-06	8.53E-06	1.49E-05	7.89E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0398	0.0638	0.0159	0.0040	0.0008	1.59335E-11
		15	0.0213	0.0079	8.53E-06	8.53E-06	1.49E-05	7.89E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0398	0.0638	0.0159	0.0040	0.0008	1.59335E-11
		25	0.0213	0.0079	8.52E-06	8.52E-06	1.49E-05	7.88E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0398	0.0637	0.0159	0.0040	0.0008	1.59186E-11
		35	0.0213	0.0079	8.52E-06	8.52E-06	1.49E-05	7.88E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0398	0.0636	0.0159	0.0040	0.0008	1.59036E-11
		45	0.0213	0.0079	8.50E-06	8.50E-06	1.49E-05	7.87E-05	0.0008	0.0079	0.0008	0.0016	0.0008	0.0397	0.0635	0.0159	0.0040	0.0008	1.58812E-11
		55	0.0212	0.0079	8.49E-06	8.49E-06	1.49E-05	7.85E-05	0.0008	0.0079	0.0008	0.0016	0.0008	0.0396	0.0634	0.0159	0.0040	0.0008	1.58513E-11
		65	0.0212	0.0078	8.46E-06	8.46E-06	1.48E-05	7.83E-05	0.0008	0.0079	0.0008	0.0016	0.0008	0.0395	0.0632	0.0158	0.0040	0.0008	1.58065E-11
		75	0.0211	0.0078	8.44E-06	8.44E-06	1.48E-05	7.80E-05	0.0008	0.0079	0.0008	0.0016	0.0008	0.0394	0.0630	0.0158	0.0039	0.0008	1.57542E-11
		85	0.0210	0.0078	8.40E-06	8.40E-06	1.47E-05	7.77E-05	0.0008	0.0078	0.0008	0.0016	0.0008	0.0392	0.0627	0.0157	0.0039	0.0008	1.56795E-11
10	Butterfly Estates	5	0.0216	0.0080	8.65E-06	8.65E-06	1.51E-05	8.00E-05	0.0008	0.0081	0.0008	0.0016	0.0008	0.0404	0.0646	0.0162	0.0040	0.0008	1.61501E-11
		15	0.0216	0.0080	8.65E-06	8.65E-06	1.51E-05	8.00E-05	0.0008	0.0081	0.0008	0.0016	0.0008	0.0404	0.0646	0.0162	0.0040	0.0008	1.61501E-11
		25	0.0216	0.0080	8.64E-06	8.64E-06	1.51E-05	7.99E-05	0.0008	0.0081	0.0008	0.0016	0.0008	0.0404	0.0646	0.0161	0.0040	0.0008	1.61352E-11
		35	0.0216	0.0080	8.63E-06	8.63E-06	1.51E-05	7.98E-05	0.0008	0.0081	0.0008	0.0016	0.0008	0.0403	0.0645	0.0161	0.0040	0.0008	1.61203E-11
		45	0.0216	0.0080	8.62E-06	8.62E-06	1.51E-05	7.97E-05	0.0008	0.0081	0.0008	0.0016	0.0008	0.0403	0.0644	0.0161	0.0040	0.0008	1.60979E-11
		55	0.0215	0.0080	8.60E-06	8.60E-06	1.51E-05	7.96E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0402	0.0643	0.0161	0.0040	0.0008	1.6068E-11

	Maximum 1 month average concentration			Using 1992 Lau Fau Shan Met. Data																
				Maximum 1 month average Pollutant Concentration (ug/m3)																
			1 g/s emission																	
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	65	0.0215	0.0079	8.58E-06	8.58E-06	1.50E-05	7.94E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0401	0.0641	0.0160	0.0040	0.0008	1.60306E-11
		75	0.0214	0.0079	8.56E-06	8.56E-06	1.50E-05	7.91E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0400	0.0639	0.0160	0.0040	0.0008	1.59783E-11
		85	0.0213	0.0079	8.52E-06	8.52E-06	1.49E-05	7.88E-05	0.0008	0.0080	0.0008	0.0016	0.0008	0.0398	0.0637	0.0159	0.0040	0.0008	1.59111E-11
11	Richland Garden	8	0.0172	0.0064	6.90E-06	6.90E-06	1.21E-05	6.38E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0322	0.0516	0.0129	0.0032	0.0006	1.28783E-11
		15	0.0172	0.0064	6.89E-06	6.89E-06	1.21E-05	6.38E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0322	0.0515	0.0129	0.0032	0.0006	1.28708E-11
		25	0.0172	0.0064	6.88E-06	6.88E-06	1.20E-05	6.37E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0322	0.0514	0.0129	0.0032	0.0006	1.28559E-11
		35	0.0172	0.0064	6.87E-06	6.87E-06	1.20E-05	6.36E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0321	0.0514	0.0128	0.0032	0.0006	1.28335E-11
		45	0.0171	0.0063	6.86E-06	6.86E-06	1.20E-05	6.34E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0320	0.0512	0.0128	0.0032	0.0006	1.28036E-11
		55	0.0171	0.0063	6.84E-06	6.84E-06	1.20E-05	6.32E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0319	0.0511	0.0128	0.0032	0.0006	1.27662E-11
		65	0.0170	0.0063	6.81E-06	6.81E-06	1.19E-05	6.30E-05	0.0006	0.0064	0.0006	0.0013	0.0006	0.0318	0.0509	0.0127	0.0032	0.0006	1.27214E-11
		75	0.0170	0.0063	6.78E-06	6.78E-06	1.19E-05	6.28E-05	0.0006	0.0063	0.0006	0.0013	0.0006	0.0317	0.0507	0.0127	0.0032	0.0006	1.26691E-11
		85	0.0169	0.0062	6.75E-06	6.75E-06	1.18E-05	6.24E-05	0.0006	0.0063	0.0006	0.0013	0.0006	0.0315	0.0504	0.0126	0.0032	0.0006	1.26019E-11
12	Butterfly Beach	4.6	0.0251	0.0093	1.00E-05	1.00E-05	1.76E-05	9.28E-05	0.0009	0.0094	0.0009	0.0019	0.0009	0.0469	0.0750	0.0187	0.0047	0.0009	1.87422E-11
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.0273	0.0100	1.08E-05	1.08E-05	1.90E-05	1.00E-04	0.0010	0.0101	0.0010	0.0020	0.0010	0.0506	0.0810	0.0203	0.0051	0.0010	2.02437E-11
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.0271	0.0100	1.08E-05	1.08E-05	1.90E-05	1.00E-04	0.0010	0.0101	0.0010	0.0020	0.0010	0.0506	0.0810	0.0203	0.0051	0.0010	2.02437E-11
15	Siu Lang Shui Landfill Site for development into a recreational area	41	0.4891	0.1810	1.96E-04	1.96E-04	3.42E-04	1.81E-03	0.0183	0.1827	0.0183	0.0366	0.0183	0.9137	1.4619	0.3656	0.0914	0.0183	3.65359E-10
16	As above	42	0.2128	0.0787	8.51E-05	8.51E-05	1.49E-04	7.87E-04	0.0080	0.0796	0.0080	0.0159	0.0080	0.3976	0.6360	0.1590	0.0397	0.0080	1.58947E-10
17	GIC at Siu Lang Shui	64.2	0.2640	0.0977	1.06E-04	1.06E-04	1.86E-04	9.77E-04	0.0099	0.0986	0.0099	0.0197	0.0099	0.4931	0.7889	0.1972	0.0493	0.0099	1.97171E-10
18	Proposed Steel Work	5	0.2189	0.0810	8.75E-05	8.75E-05	1.53E-04	8.10E-04	0.0082	0.0818	0.0082	0.0163	0.0082	0.4088	0.6541	0.1635	0.0409	0.0082	1.63481E-10
		15	0.2591	0.0959	1.04E-04	1.04E-04	1.81E-04	9.59E-04	0.0097	0.0968	0.0097	0.0194	0.0097	0.4840	0.7744	0.1936	0.0484	0.0097	1.93525E-10
		25	0.3644	0.1348	1.46E-04	1.46E-04	2.55E-04	1.35E-03	0.0136	0.1361	0.0136	0.0272	0.0136	0.6807	1.0891	0.2723	0.0681	0.0136	2.72184E-10
		35	0.5855	0.2166	2.34E-04	2.34E-04	4.10E-04	2.17E-03	0.0219	0.2188	0.0219	0.0437	0.0219	1.0938	1.7501	0.4376	0.1094	0.0219	4.37391E-10
19	Proposed Chemical Waste Bulk Treatment Facility	5	0.4102	0.1518	1.64E-04	1.64E-04	2.87E-04	1.52E-03	0.0153	0.1532	0.0153	0.0306	0.0153	0.7662	1.2260	0.3065	0.0766	0.0153	3.0639E-10
		15	0.4687	0.1734	1.87E-04	1.87E-04	3.28E-04	1.73E-03	0.0175	0.1751	0.0175	0.0350	0.0175	0.8755	1.4009	0.3502	0.0875	0.0175	3.50096E-10
		25	0.5854	0.2166	2.34E-04	2.34E-04	4.10E-04	2.17E-03	0.0219	0.2187	0.0219	0.0437	0.0219	1.0936	1.7498	0.4375	0.1094	0.0219	4.37301E-10
		35	0.7568	0.2800	3.03E-04	3.03E-04	5.30E-04	2.80E-03	0.0283	0.2827	0.0283	0.0565	0.0283	1.4137	2.2619	0.5655	0.1414	0.0283	5.65292E-10
20	Proposed Special Industrial Area	5	0.3309	0.1224	1.32E-04	1.32E-04	2.32E-04	1.22E-03	0.0124	0.1236	0.0124	0.0247	0.0124	0.6182	0.9891	0.2473	0.0618	0.0124	2.47182E-10
		15	0.3491	0.1292	1.40E-04	1.40E-04	2.44E-04	1.29E-03	0.0131	0.1304	0.0131	0.0261	0.0131	0.6522	1.0435	0.2609	0.0652	0.0131	2.60778E-10

	Maximum 1 month average concentration			Using 1992 Lau Fau Shan Met. Data															
				Maximum 1 month average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
20	Proposed Special Industrial Area	25	0.3841	0.1421	1.54E-04	1.54E-04	2.69E-04	1.42E-03	0.0144	0.1435	0.0144	0.0287	0.0144	0.7176	1.1482	0.2871	0.0718	0.0144	2.86945E-10
		35	0.4333	0.1603	1.73E-04	1.73E-04	3.03E-04	1.60E-03	0.0162	0.1619	0.0162	0.0324	0.0162	0.8095	1.2953	0.3238	0.0809	0.0162	3.23705E-10
21	River Trade Terminal	5	0.3350	0.1240	1.34E-04	1.34E-04	2.35E-04	1.24E-03	0.0125	0.1252	0.0125	0.0250	0.0125	0.6259	1.0014	0.2504	0.0626	0.0125	2.50275E-10
		15	0.3372	0.1248	1.35E-04	1.35E-04	2.36E-04	1.25E-03	0.0126	0.1260	0.0126	0.0252	0.0126	0.6299	1.0078	0.2520	0.0630	0.0126	2.51866E-10
		25	0.3417	0.1264	1.37E-04	1.37E-04	2.39E-04	1.26E-03	0.0128	0.1277	0.0128	0.0255	0.0128	0.6384	1.0214	0.2554	0.0638	0.0128	2.55265E-10
		35	0.3490	0.1291	1.40E-04	1.40E-04	2.44E-04	1.29E-03	0.0131	0.1304	0.0131	0.0261	0.0131	0.6520	1.0433	0.2608	0.0652	0.0131	2.60733E-10
22	Existing Castle Peak Firing Range (Boundary)	70	0.1182	0.0437	4.73E-05	4.73E-05	8.27E-05	4.37E-04	0.0044	0.0441	0.0044	0.0088	0.0044	0.2208	0.3532	0.0883	0.0221	0.0044	8.8273E-11

	Annual Pollutant Concentration (ug/m3)			Using 1993 Lau Fau Shan Met. Data															
					Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	0.13219	0.0489	5.29E-05	5.29E-05	9.25E-05	4.89E-04	0.0049	0.0494	0.0049	0.0099	0.0049	0.2469	0.3951	0.0988	0.0247	0.0049	9.87459E-11
		15	0.13545	0.0501	5.42E-05	5.42E-05	9.48E-05	5.01E-04	0.0051	0.0506	0.0051	0.0101	0.0051	0.2530	0.4049	0.1012	0.0253	0.0051	1.01181E-10
		25	0.14308	0.0529	5.72E-05	5.72E-05	1.00E-04	5.29E-04	0.0054	0.0535	0.0054	0.0107	0.0054	0.2673	0.4277	0.1069	0.0267	0.0054	1.06881E-10
		35	0.15569	0.0576	6.23E-05	6.23E-05	1.09E-04	5.76E-04	0.0058	0.0582	0.0058	0.0116	0.0058	0.2908	0.4654	0.1163	0.0291	0.0058	1.163E-10
2	Castle Peak Power Station	7.3	0.08544	0.0316	3.42E-05	3.42E-05	5.98E-05	3.16E-04	0.0032	0.0319	0.0032	0.0064	0.0032	0.1596	0.2554	0.0638	0.0160	0.0032	6.38237E-11
		15	0.08666	0.0321	3.47E-05	3.47E-05	6.07E-05	3.21E-04	0.0032	0.0324	0.0032	0.0065	0.0032	0.1619	0.2590	0.0648	0.0162	0.0032	6.4735E-11
		25	0.08943	0.0331	3.58E-05	3.58E-05	6.26E-05	3.31E-04	0.0033	0.0334	0.0033	0.0067	0.0033	0.1671	0.2673	0.0668	0.0167	0.0033	6.68042E-11
		35	0.0934	0.0346	3.74E-05	3.74E-05	6.54E-05	3.46E-04	0.0035	0.0349	0.0035	0.0070	0.0035	0.1745	0.2792	0.0698	0.0174	0.0035	6.97698E-11
[illegible]	Block Making [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Annual Pollutant Concentration (ug/m3)			Using 1993 Lau Fau Shan Met. Data															
					Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	15	0.01037	0.0038	4.15E-06	4.15E-06	7.26E-06	3.84E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0194	0.0310	0.0077	0.0019	0.0004	7.74639E-12
		25	0.01037	0.0038	4.15E-06	4.15E-06	7.26E-06	3.84E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0194	0.0310	0.0077	0.0019	0.0004	7.74639E-12
		35	0.01036	0.0038	4.14E-06	4.14E-06	7.25E-06	3.83E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0194	0.0310	0.0077	0.0019	0.0004	7.73892E-12
		45	0.01035	0.0038	4.14E-06	4.14E-06	7.25E-06	3.83E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0193	0.0309	0.0077	0.0019	0.0004	7.73145E-12
		55	0.01033	0.0038	4.13E-06	4.13E-06	7.23E-06	3.82E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0193	0.0309	0.0077	0.0019	0.0004	7.71651E-12
		65	0.01031	0.0038	4.12E-06	4.12E-06	7.22E-06	3.81E-05	0.0004	0.0039	0.0004	0.0008	0.0004	0.0193	0.0308	0.0077	0.0019	0.0004	7.70157E-12
		75	0.01028	0.0038	4.11E-06	4.11E-06	7.20E-06	3.80E-05	0.0004	0.0038	0.0004	0.0008	0.0004	0.0192	0.0307	0.0077	0.0019	0.0004	7.67916E-12
		85	0.01025	0.0038	4.10E-06	4.10E-06	7.18E-06	3.79E-05	0.0004	0.0038	0.0004	0.0008	0.0004	0.0191	0.0306	0.0077	0.0019	0.0004	7.65675E-12
11	Richland Garden	5	0.00824	0.0030	3.30E-06	3.30E-06	5.77E-06	3.05E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0154	0.0246	0.0062	0.0015	0.0003	6.15528E-12
		15	0.00824	0.0030	3.30E-06	3.30E-06	5.77E-06	3.05E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0154	0.0246	0.0062	0.0015	0.0003	6.15528E-12
		25	0.00823	0.0030	3.29E-06	3.29E-06	5.76E-06	3.05E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0154	0.0246	0.0062	0.0015	0.0003	6.14781E-12
		35	0.00823	0.0030	3.29E-06	3.29E-06	5.76E-06	3.05E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0154	0.0246	0.0062	0.0015	0.0003	6.14781E-12
		45	0.00822	0.0030	3.29E-06	3.29E-06	5.75E-06	3.04E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0154	0.0246	0.0061	0.0015	0.0003	6.14034E-12
		55	0.0082	0.0030	3.28E-06	3.28E-06	5.74E-06	3.03E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0153	0.0245	0.0061	0.0015	0.0003	6.1254E-12
		65	0.00818	0.0030	3.27E-06	3.27E-06	5.73E-06	3.03E-05	0.0003	0.0031	0.0003	0.0006	0.0003	0.0153	0.0245	0.0061	0.0015	0.0003	6.11046E-12
		75	0.00816	0.0030	3.26E-06	3.26E-06	5.71E-06	3.02E-05	0.0003	0.0030	0.0003	0.0006	0.0003	0.0152	0.0244	0.0061	0.0015	0.0003	6.09552E-12
		85	0.00814	0.0030	3.26E-06	3.26E-06	5.70E-06	3.01E-05	0.0003	0.0030	0.0003	0.0006	0.0003	0.0152	0.0243	0.0061	0.0015	0.0003	6.08058E-12
12	Butterfly Beach	4.6	0.01171	0.0043	4.68E-06	4.68E-06	8.20E-06	4.33E-05	0.0004	0.0044	0.0004	0.0009	0.0004	0.0219	0.0350	0.0088	0.0022	0.0004	8.74737E-12
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.01321	0.0047	5.06E-06	5.06E-06	8.86E-06	4.68E-05	0.0005	0.0047	0.0005	0.0009	0.0005	0.0237	0.0378	0.0095	0.0024	0.0005	9.45702E-12
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.01266	0.0047	5.06E-06	5.06E-06	8.86E-06	4.68E-05	0.0005	0.0047	0.0005	0.0009	0.0005	0.0237	0.0378	0.0095	0.0024	0.0005	9.45702E-12
15	Siu Lang Shui Landfill Site for development into a recreational area	41	0.23575	0.0872	9.43E-05	9.43E-05	1.65E-04	8.72E-04	0.0088	0.0881	0.0088	0.0176	0.0088	0.4404	0.7047	0.1762	0.0440	0.0088	1.76106E-10
16	As above	42	0.1326	0.0491	5.30E-05	5.30E-05	9.28E-05	4.91E-04	0.0050	0.0496	0.0050	0.0099	0.0050	0.2477	0.3963	0.0991	0.0248	0.0050	9.90522E-11
17	GIC at Siu Lang Shui	64.2	0.13267	0.0491	5.31E-05	5.31E-05	9.29E-05	4.91E-04	0.0050	0.0496	0.0050	0.0099	0.0050	0.2478	0.3966	0.0991	0.0248	0.0050	9.91045E-11
18	Proposed Steel Works	5	0.09461	0.0350	3.78E-05	3.78E-05	6.62E-05	3.50E-04	0.0035	0.0353	0.0035	0.0071	0.0035	0.1767	0.2828	0.0707	0.0177	0.0035	7.06737E-11
		15	0.12054	0.0446	4.82E-05	4.82E-05	8.44E-05	4.46E-04	0.0045	0.0450	0.0045	0.0090	0.0045	0.2252	0.3603	0.0901	0.0225	0.0045	9.00434E-11
		25	0.17673	0.0654	7.07E-05	7.07E-05	1.24E-04	6.54E-04	0.0066	0.0660	0.0066	0.0132	0.0066	0.3301	0.5282	0.1321	0.0330	0.0066	1.32017E-10
		35	0.26931	0.0996	1.08E-04	1.08E-04	1.89E-04	9.96E-04	0.0101	0.1006	0.0101	0.0201	0.0101	0.5031	0.8050	0.2013	0.0503	0.0101	2.01175E-10

ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Annual Pollutant Concentration (ug/m3)			Using 1993 Lau Fau Shan Met. Data															
					Annual Pollutant Concentration (ug/m3)														
			1 g/s emission																
19	Proposed Chemical Waste Bulk Treatment Facility	5	0.16589	0.0614	6.64E-05	6.64E-05	1.16E-04	6.14E-04	0.0062	0.0620	0.0062	0.0124	0.0062	0.3099	0.4958	0.1240	0.0310	0.0062	1.2392E-10
		15	0.19306	0.0714	7.72E-05	7.72E-05	1.35E-04	7.14E-04	0.0072	0.0721	0.0072	0.0144	0.0072	0.3607	0.5771	0.1443	0.0361	0.0072	1.44216E-10
		25	0.24825	0.0919	9.93E-05	9.93E-05	1.74E-04	9.19E-04	0.0093	0.0927	0.0093	0.0185	0.0093	0.4638	0.7420	0.1855	0.0464	0.0093	1.85443E-10
		35	0.33175	0.1227	1.33E-04	1.33E-04	2.32E-04	1.23E-03	0.0124	0.1239	0.0124	0.0248	0.0124	0.6197	0.9916	0.2479	0.0620	0.0124	2.47817E-10
20	Proposed Special Industrial Area	5	0.12237	0.0453	4.89E-05	4.89E-05	8.57E-05	4.53E-04	0.0046	0.0457	0.0046	0.0091	0.0046	0.2286	0.3658	0.0914	0.0229	0.0046	9.14104E-11
		15	0.12792	0.0473	5.12E-05	5.12E-05	8.95E-05	4.73E-04	0.0048	0.0478	0.0048	0.0096	0.0048	0.2390	0.3824	0.0956	0.0239	0.0048	9.55562E-11
		25	0.13865	0.0513	5.55E-05	5.55E-05	9.71E-05	5.13E-04	0.0052	0.0518	0.0052	0.0104	0.0052	0.2590	0.4144	0.1036	0.0259	0.0052	1.03572E-10
		35	0.15384	0.0569	6.16E-05	6.16E-05	1.08E-04	5.69E-04	0.0058	0.0575	0.0058	0.0115	0.0058	0.2874	0.4598	0.1150	0.0287	0.0058	1.14918E-10
21	River Trade Terminal	5	0.16144	0.0597	6.46E-05	6.46E-05	1.13E-04	5.97E-04	0.0060	0.0603	0.0060	0.0121	0.0060	0.3016	0.4825	0.1206	0.0302	0.0060	1.20596E-10
		15	0.16359	0.0605	6.54E-05	6.54E-05	1.15E-04	6.05E-04	0.0061	0.0611	0.0061	0.0122	0.0061	0.3056	0.4890	0.1223	0.0306	0.0061	1.22202E-10
		25	0.16816	0.0622	6.73E-05	6.73E-05	1.18E-04	6.22E-04	0.0063	0.0628	0.0063	0.0126	0.0063	0.3141	0.5026	0.1257	0.0314	0.0063	1.25616E-10
		35	0.17562	0.0650	7.02E-05	7.02E-05	1.23E-04	6.50E-04	0.0066	0.0656	0.0066	0.0131	0.0066	0.3281	0.5249	0.1312	0.0328	0.0066	1.31189E-10
22	Existing Castle Peak Firing Range (Boundary)	70	0.06125	0.0227	2.45E-05	2.45E-05	4.29E-05	2.27E-04	0.0023	0.0229	0.0023	0.0046	0.0023	0.1144	0.1831	0.0458	0.0114	0.0023	4.57538E-11

	Maximum 1-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 1 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	11.27252	4.1708	4.51E-03	4.51E-03	7.89E-03	4.17E-02	0.4216	4.2114	0.4216	0.8421	0.4216	21.0582	33.6936	8.4240	2.1057	0.4216	8.42057E-09
		15	11.37161	4.2075	4.55E-03	4.55E-03	7.96E-03	4.21E-02	0.4253	4.2484	0.4253	0.8495	0.4253	21.2433	33.9897	8.4980	2.1242	0.4253	8.49459E-09
		25	12.65897	4.6838	5.06E-03	5.06E-03	8.86E-03	4.68E-02	0.4734	4.7294	0.4734	0.9456	0.4734	23.6482	37.8377	9.4600	2.3647	0.4734	9.45625E-09
		35	15.0367	5.5636	6.01E-03	6.01E-03	1.05E-02	5.56E-02	0.5624	5.6177	0.5624	1.1232	0.5624	28.0901	44.9447	11.2369	2.8089	0.5624	1.12324E-08
2	Castle Peak Power Station	7.3	11.42592	4.2276	4.57E-03	4.57E-03	8.00E-03	4.23E-02	0.4273	4.2687	0.4273	0.8535	0.4273	21.3448	34.1521	8.5386	2.1344	0.4273	8.53516E-09
		15	11.43299	4.2302	4.57E-03	4.57E-03	8.00E-03	4.23E-02	0.4276	4.2714	0.4276	0.8540	0.4276	21.3580	34.1732	8.5439	2.1357	0.4276	8.54044E-09
		25	11.44885	4.2361	4.58E-03	4.58E-03	8.01E-03	4.24E-02	0.4282	4.2773	0.4282	0.8552	0.4282	21.3876	34.2206	8.5557	2.1386	0.4282	8.55229E-09
		35	11.47107	4.2443	4.59E-03	4.59E-03	8.03E-03	4.24E-02	0.4290	4.2856	0.4290	0.8569	0.4290	21.4291	34.2870	8.5723	2.1428	0.4290	8.56889E-09
3	Block Making Factory	58.3	24.98717	9.2453	9.99E-03	9.99E-03	1.75E-02	9.25E-02	0.9345	9.3352	0.9345	1.8665	0.9345	46.6785	74.6867	18.6729	4.6676	0.9345	1.86654E-08
4	Fresh Water Reservoir	64	18.28993	6.7673	7.32E-03	7.32E-03	1.28E-02	6.77E-02	0.6840	6.8331	0.6840	1.3663	0.6840	34.1674	54.6686	13.6681	3.4166	0.6840	1.36626E-08
5	Pillar Point Sewage Treatment Works	5	4.60099	1.7024	1.84E-03	1.84E-03	3.22E-03	1.70E-02	0.1721	1.7189	0.1721	0.3437	0.1721	8.5951	13.7524	3.4383	0.8595	0.1721	3.43694E-09
		15	4.59748	1.7011	1.84E-03	1.84E-03	3.22E-03	1.70E-02	0.1719	1.7176	0.1719	0.3434	0.1719	8.5886	13.7419	3.4357	0.8588	0.1719	3.43432E-09
		25	4.59044	1.6985	1.84E-03	1.84E-03	3.21E-03	1.70E-02	0.1717	1.7150	0.1717	0.3429	0.1717	8.5754	13.7208	3.4304	0.8575	0.1717	3.42906E-09
		35	4.57985	1.6945	1.83E-03	1.83E-03	3.21E-03	1.69E-02	0.1713	1.7110	0.1713	0.3421	0.1713	8.5556	13.6892	3.4225	0.8555	0.1713	3.42115E-09
6	WAHMO Building	12	5.33258	1.9731	2.13E-03	2.13E-03	3.73E-03	1.97E-02	0.1994	1.9923	0.1994	0.3983	0.1994	9.9618	15.9391	3.9850	0.9961	0.1994	3.98344E-09
7	Waterfront Industry	5	3.5798	1.3245	1.43E-03	1.43E-03	2.51E-03	1.32E-02	0.1339	1.3374	0.1339	0.2674	0.1339	6.6874	10.7000	2.6752	0.6687	0.1339	0.0000
		15	3.57674	1.3234	1.43E-03	1.43E-03	2.50E-03	1.32E-02	0.1338	1.3363	0.1338	0.2672	0.1338	6.6817	10.6909	2.6729	0.6681	0.1338	0.0000
		25	3.57039	1.3210	1.43E-03	1.43E-03	2.50E-03	1.32E-02	0.1335	1.3339	0.1335	0.2667	0.1335	6.6698	10.6719	2.6682	0.6669	0.1335	0.0000
		35	3.56088	1.3175	1.42E-03	1.42E-03	2.49E-03	1.32E-02	0.1332	1.3303	0.1332	0.2660	0.1332	6.6521	10.6435	2.6610	0.6652	0.1332	0.0000
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	9.39856	3.4775	3.76E-03	3.76E-03	6.58E-03	3.48E-02	0.3515	3.5113	0.3515	0.7021	0.3515	17.5574	28.0923	7.0235	1.7557	0.3515	7.02072E-09
9	Melody Garden	5	6.4687	2.3934	2.59E-03	2.59E-03	4.53E-03	2.39E-02	0.2419	2.4167	0.2419	0.4832	0.2419	12.0842	19.3349	4.8341	1.2084	0.2419	4.83212E-09
		15	6.47228	2.3947	2.59E-03	2.59E-03	4.53E-03	2.39E-02	0.2421	2.4180	0.2421	0.4835	0.2421	12.0909	19.3456	4.8367	1.2090	0.2421	4.83479E-09
		25	6.4785	2.3970	2.59E-03	2.59E-03	4.53E-03	2.40E-02	0.2423	2.4204	0.2423	0.4839	0.2423	12.1025	19.3642	4.8414	1.2102	0.2423	4.83944E-09
		35	6.4855	2.3996	2.59E-03	2.59E-03	4.54E-03	2.40E-02	0.2426	2.4230	0.2426	0.4845	0.2426	12.1156	19.3852	4.8466	1.2115	0.2426	4.84467E-09
		45	6.49063	2.4015	2.60E-03	2.60E-03	4.54E-03	2.40E-02	0.2427	2.4249	0.2427	0.4849	0.2427	12.1251	19.4005	4.8504	1.2124	0.2427	4.8485E-09
		55	6.49063	2.4015	2.60E-03	2.60E-03	4.54E-03	2.40E-02	0.2427	2.4249	0.2427	0.4849	0.2427	12.1251	19.4005	4.8504	1.2124	0.2427	4.8485E-09
		65	6.48182	2.3983	2.59E-03	2.59E-03	4.54E-03	2.40E-02	0.2424	2.4216	0.2424	0.4842	0.2424	12.1087	19.3742	4.8439	1.2108	0.2424	4.84192E-09
		75	6.46029	2.3903	2.58E-03	2.58E-03	4.52E-03	2.39E-02	0.2416	2.4136	0.2416	0.4826	0.2416	12.0685	19.3098	4.8278	1.2068	0.2416	4.82584E-09
		85	6.42217	2.3762	2.57E-03	2.57E-03	4.50E-03	2.38E-02	0.2402	2.3993	0.2402	0.4797	0.2402	11.9973	19.1959	4.7993	1.1997	0.2402	4.79736E-09

	Maximum 1-hour average concentration			Using 1993 Lau Fau Shan Met. Data																
				Maximum 1 hour average Pollutant Concentration (ug/m3)																
			1 g/s emission																	
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	5	6.20851	2.2971	2.48E-03	2.48E-03	4.35E-03	2.30E-02	0.2322	2.3196	0.2322	0.4638	0.2322	11.5981	18.5672	4.6396	1.1597	0.2322	4.63776E-09
		15	6.20958	2.2975	2.48E-03	2.48E-03	4.35E-03	2.30E-02	0.2322	2.3199	0.2322	0.4639	0.2322	11.6001	18.5604	4.6404	1.1599	0.2322	4.63856E-09
		25	6.21097	2.2981	2.48E-03	2.48E-03	4.35E-03	2.30E-02	0.2323	2.3204	0.2323	0.4640	0.2323	11.6027	18.5646	4.6415	1.1602	0.2323	4.63959E-09
		35	6.21116	2.2981	2.48E-03	2.48E-03	4.35E-03	2.30E-02	0.2323	2.3205	0.2323	0.4640	0.2323	11.6031	18.5652	4.6416	1.1602	0.2323	4.63974E-09
		45	6.20801	2.2970	2.48E-03	2.48E-03	4.35E-03	2.30E-02	0.2322	2.3193	0.2322	0.4637	0.2322	11.5972	18.5557	4.6392	1.1597	0.2322	4.63738E-09
		55	6.19889	2.2936	2.48E-03	2.48E-03	4.34E-03	2.29E-02	0.2318	2.3159	0.2318	0.4631	0.2318	11.5801	18.5285	4.6324	1.1580	0.2318	4.63057E-09
		65	6.18081	2.2869	2.47E-03	2.47E-03	4.33E-03	2.29E-02	0.2312	2.3092	0.2312	0.4617	0.2312	11.5464	18.4744	4.6189	1.1546	0.2312	4.61707E-09
		75	6.15059	2.2757	2.46E-03	2.46E-03	4.31E-03	2.28E-02	0.2300	2.2979	0.2300	0.4594	0.2300	11.4899	18.3841	4.5963	1.1489	0.2300	4.59449E-09
		85	6.1051	2.2589	2.44E-03	2.44E-03	4.27E-03	2.26E-02	0.2283	2.2809	0.2283	0.4561	0.2283	11.4049	18.2481	4.5623	1.1404	0.2283	4.56051E-09
11	Richland Garden	5	3.69992	1.3690	1.48E-03	1.48E-03	2.59E-03	1.37E-02	0.1384	1.3823	0.1384	0.2764	0.1384	6.9118	11.0591	2.7650	0.6911	0.1384	2.76384E-09
		15	3.69853	1.3685	1.48E-03	1.48E-03	2.59E-03	1.37E-02	0.1383	1.3818	0.1383	0.2763	0.1383	6.9092	11.0549	2.7639	0.6909	0.1383	2.7628E-09
		25	3.69543	1.3673	1.48E-03	1.48E-03	2.59E-03	1.37E-02	0.1382	1.3806	0.1382	0.2760	0.1382	6.9034	11.0456	2.7616	0.6903	0.1382	2.76049E-09
		35	3.68994	1.3653	1.48E-03	1.48E-03	2.58E-03	1.37E-02	0.1380	1.3786	0.1380	0.2756	0.1380	6.8932	11.0292	2.7575	0.6893	0.1380	2.75639E-09
		45	3.68113	1.3620	1.47E-03	1.47E-03	2.58E-03	1.36E-02	0.1377	1.3753	0.1377	0.2750	0.1377	6.8767	11.0029	2.7509	0.6876	0.1377	2.7498E-09
		55	3.66785	1.3571	1.47E-03	1.47E-03	2.57E-03	1.36E-02	0.1372	1.3703	0.1372	0.2740	0.1372	6.8519	10.9632	2.7410	0.6852	0.1372	2.73988E-09
		65	3.64877	1.3500	1.46E-03	1.46E-03	2.55E-03	1.35E-02	0.1365	1.3632	0.1365	0.2726	0.1365	6.8163	10.9062	2.7267	0.6816	0.1365	2.72563E-09
		75	3.6225	1.3403	1.45E-03	1.45E-03	2.54E-03	1.34E-02	0.1355	1.3534	0.1355	0.2706	0.1355	6.7672	10.8277	2.7071	0.6767	0.1355	2.70601E-09
		85	3.58768	1.3274	1.44E-03	1.44E-03	2.51E-03	1.33E-02	0.1342	1.3404	0.1342	0.2680	0.1342	6.7021	10.7236	2.6811	0.6702	0.1342	2.68E-09
12	Butterfly Beach	4.6	4.51845	1.6718	1.81E-03	1.81E-03	3.16E-03	1.67E-02	0.1690	1.6881	0.1690	0.3375	0.1690	8.4409	13.5056	3.3766	0.8440	0.1690	3.37528E-09
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	8.35412	2.0071	2.17E-03	2.17E-03	3.80E-03	2.01E-02	0.2029	2.0266	0.2029	0.4052	0.2029	10.1336	16.2138	4.0537	1.0133	0.2029	4.05209E-09
	Future ASRs																		
14	Low density residential developments in Area 45C	10	5.42448	2.0071	2.17E-03	2.17E-03	3.80E-03	2.01E-02	0.2029	2.0266	0.2029	0.4052	0.2029	10.1336	16.2138	4.0537	1.0133	0.2029	4.05209E-09
15	Siu Lang Shui Landfill Site for development into a recreational area	41	18.5543	6.8651	7.42E-03	7.42E-03	1.30E-02	6.87E-02	0.6939	6.9319	0.6939	1.3860	0.6939	34.6613	55.4588	13.8656	3.4659	0.6939	1.38601E-08
16	As above	42	12.82983	4.7470	5.13E-03	5.13E-03	8.98E-03	4.75E-02	0.4798	4.7932	0.4798	0.9584	0.4798	23.9674	38.3484	9.5877	2.3966	0.4798	9.58388E-09
17	GIC at Siu Lang Shui	54.2	35.81075	13.2500	1.43E-02	1.43E-02	2.51E-02	1.32E-01	1.3393	13.3780	1.3393	2.6761	1.3393	66.8981	107.0383	26.7614	6.6894	1.3393	2.67506E-08
18	Proposed Steel Works	5	5.82229	2.1542	2.33E-03	2.33E-03	4.08E-03	2.15E-02	0.2178	2.1752	0.2178	0.4349	0.2178	10.8766	17.4028	4.3510	1.0876	0.2178	4.34925E-09
		15	6.28189	2.3243	2.51E-03	2.51E-03	4.40E-03	2.32E-02	0.2349	2.3469	0.2349	0.4693	0.2349	11.7352	18.7766	4.6945	1.1735	0.2349	4.69257E-09

	Maximum 1-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 1 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
18	Proposed Steel Works	25	7.15394	2.6470	2.86E-03	2.86E-03	5.01E-03	2.65E-02	0.2676	2.6727	0.2676	0.5344	0.2676	13.3643	21.3831	5.3461	1.3364	0.2676	5.34399E-09
		35	9.16471	3.3909	3.67E-03	3.67E-03	6.42E-03	3.39E-02	0.3428	3.4239	0.3428	0.6846	0.3428	17.1206	27.3933	6.8488	1.7120	0.3428	6.84604E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	6.96862	2.5784	2.79E-03	2.79E-03	4.88E-03	2.58E-02	0.2606	2.6035	0.2606	0.5206	0.2606	13.0181	20.8292	5.2076	1.3017	0.2606	5.20556E-09
		15	7.29558	2.6994	2.92E-03	2.92E-03	5.11E-03	2.70E-02	0.2729	2.7256	0.2729	0.5450	0.2729	13.6289	21.8065	5.4520	1.3628	0.2729	5.4498E-09
		25	7.92573	2.9325	3.17E-03	3.17E-03	5.55E-03	2.93E-02	0.2964	2.9611	0.2964	0.5921	0.2964	14.8061	23.6900	5.9229	1.4805	0.2964	5.92052E-09
		35	9.12773	3.3773	3.65E-03	3.65E-03	6.39E-03	3.38E-02	0.3414	3.4101	0.3414	0.6818	0.3414	17.0516	27.2828	6.8212	1.7061	0.3414	6.81841E-09
20	Proposed Special Industrial Area	5	8.03437	2.9727	3.21E-03	3.21E-03	5.62E-03	2.97E-02	0.3005	3.0016	0.3005	0.6002	0.3005	15.0090	24.0147	6.0041	1.5008	0.3005	6.00167E-09
		15	8.17941	3.0264	3.27E-03	3.27E-03	5.73E-03	3.03E-02	0.3059	3.0558	0.3059	0.6110	0.3059	15.2800	24.4483	6.1125	1.5279	0.3059	6.11002E-09
		25	8.49669	3.1438	3.40E-03	3.40E-03	5.95E-03	3.14E-02	0.3178	3.1744	0.3178	0.6347	0.3178	15.8727	25.3966	6.3496	1.5872	0.3178	6.34703E-09
		35	9.70718	3.5917	3.88E-03	3.88E-03	6.80E-03	3.59E-02	0.3630	3.6266	0.3630	0.7251	0.3630	18.1340	29.0148	7.2542	1.8133	0.3630	7.25126E-09
21	River Trade Terminal	5	6.53439	2.4177	2.61E-03	2.61E-03	4.57E-03	2.42E-02	0.2444	2.4412	0.2444	0.4881	0.2444	12.2069	19.5313	4.8831	1.2206	0.2444	4.88119E-09
		15	6.67865	2.4711	2.67E-03	2.67E-03	4.68E-03	2.47E-02	0.2498	2.4951	0.2498	0.4989	0.2498	12.4764	19.9625	4.9910	1.2476	0.2498	4.98895E-09
		25	7.12823	2.6374	2.85E-03	2.85E-03	4.99E-03	2.64E-02	0.2666	2.6631	0.2666	0.5325	0.2666	13.3162	21.3063	5.3269	1.3316	0.2666	5.32479E-09
		35	7.79745	2.8851	3.12E-03	3.12E-03	5.46E-03	2.89E-02	0.2916	2.9131	0.2916	0.5826	0.2916	14.5664	23.3066	5.8270	1.4566	0.2916	5.8247E-09
22	Existing Castle Peak Firing Range (Boundary)	70	38.52026	14.2525	1.54E-02	1.54E-02	2.70E-02	1.43E-01	1.4407	14.3912	1.4407	2.8775	1.4407	71.9597	115.1371	28.7862	7.1956	1.4407	2.87746E-08

	Maximum 8-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
					Maximum 8 hour average Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	3.86203	1.4290	1.54E-03	1.54E-03	2.70E-03	1.43E-02	0.1444	1.4429	0.1444	0.2885	0.1444	7.2147	11.5436	2.8861	0.7214	0.1444	2.88494E-09
		15	4.05364	1.4998	1.62E-03	1.62E-03	2.84E-03	1.50E-02	0.1516	1.5144	0.1516	0.3028	0.1516	7.5726	12.1163	3.0293	0.7572	0.1516	3.02807E-09
		25	4.46664	1.6527	1.79E-03	1.79E-03	3.13E-03	1.65E-02	0.1671	1.6687	0.1671	0.3337	0.1671	8.3441	13.3508	3.3379	0.8344	0.1671	3.33658E-09
		35	5.05361	1.8698	2.02E-03	2.02E-03	3.54E-03	1.87E-02	0.1890	1.8880	0.1890	0.3775	0.1890	9.4406	15.1052	3.7766	0.9440	0.1890	3.77505E-09
2	Castle Peak Power Station	7.3	2.88381	1.0670	1.15E-03	1.15E-03	2.02E-03	1.07E-02	0.1079	1.0774	0.1079	0.2154	0.1079	5.3872	8.6197	2.1551	0.5387	0.1079	2.15421E-09
		15	2.88519	1.0675	1.15E-03	1.15E-03	2.02E-03	1.07E-02	0.1079	1.0779	0.1079	0.2155	0.1079	5.3898	8.6238	2.1561	0.5390	0.1079	2.15524E-09
		25	2.88829	1.0687	1.16E-03	1.16E-03	2.02E-03	1.07E-02	0.1080	1.0791	0.1080	0.2158	0.1080	5.3956	8.6331	2.1584	0.5395	0.1080	2.15755E-09
		35	2.89263	1.0703	1.16E-03	1.16E-03	2.02E-03	1.07E-02	0.1082	1.0807	0.1082	0.2161	0.1082	5.4037	8.6461	2.1617	0.5403	0.1082	2.16079E-09
3	Block Making Factory	58.3	3.28793	1.2166	1.32E-03	1.32E-03	2.30E-03	1.22E-02	0.1230	1.2284	0.1230	0.2456	0.1230	6.1422	9.8276	2.4571	0.6142	0.1230	2.45608E-09
4	Fresh Water Reservoir	64	2.30993	0.8547	9.24E-04	9.24E-04	1.62E-03	8.55E-03	0.0864	0.8630	0.0864	0.1726	0.0864	4.3152	6.9044	1.7262	0.4315	0.0864	1.72552E-09
5	Pillar Point Sewage Treatment Works	5	0.57513	0.2128	2.30E-04	2.30E-04	4.03E-04	2.13E-03	0.0215	0.2149	0.0215	0.0430	0.0215	1.0744	1.7191	0.4298	0.1074	0.0215	4.29622E-10
		15	0.57469	0.2126	2.30E-04	2.30E-04	4.02E-04	2.13E-03	0.0215	0.2147	0.0215	0.0429	0.0215	1.0736	1.7177	0.4295	0.1074	0.0215	4.29293E-10
		25	0.57381	0.2123	2.30E-04	2.30E-04	4.02E-04	2.12E-03	0.0215	0.2144	0.0215	0.0429	0.0215	1.0719	1.7151	0.4288	0.1072	0.0215	4.28636E-10
		35	0.57249	0.2118	2.29E-04	2.29E-04	4.01E-04	2.12E-03	0.0214	0.2139	0.0214	0.0428	0.0214	1.0695	1.7112	0.4278	0.1069	0.0214	4.2765E-10
6	WAHMO Building	12	0.66814	0.2472	2.67E-04	2.67E-04	4.68E-04	2.47E-03	0.0250	0.2496	0.0250	0.0499	0.0250	1.2482	1.9971	0.4993	0.1248	0.0250	4.99101E-10
7	Waterfront Industry	5	0.44871	0.1660	1.79E-04	1.79E-04	3.14E-04	1.66E-03	0.0168	0.1676	0.0168	0.0335	0.0168	0.8382	1.3412	0.3353	0.0838	0.0168	3.35186E-10
		15	0.44834	0.1659	1.79E-04	1.79E-04	3.14E-04	1.66E-03	0.0168	0.1675	0.0168	0.0335	0.0168	0.8375	1.3401	0.3350	0.0837	0.0168	3.3491E-10
		25	0.44758	0.1656	1.79E-04	1.79E-04	3.13E-04	1.66E-03	0.0167	0.1672	0.0167	0.0334	0.0167	0.8361	1.3378	0.3345	0.0836	0.0167	3.34342E-10
		35	0.44643	0.1652	1.79E-04	1.79E-04	3.13E-04	1.65E-03	0.0167	0.1668	0.0167	0.0333	0.0167	0.8340	1.3344	0.3336	0.0834	0.0167	3.33483E-10
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	1.34265	0.4968	5.37E-04	5.37E-04	9.40E-04	4.97E-03	0.0502	0.5016	0.0502	0.1003	0.0502	2.5082	4.0132	1.0034	0.2508	0.0502	1.00296E-09
9	Melody Garden	5	0.81072	0.3000	3.24E-04	3.24E-04	5.68E-04	3.00E-03	0.0303	0.3029	0.0303	0.0606	0.0303	1.5145	2.4232	0.6059	0.1514	0.0303	6.05608E-10
		15	0.81117	0.3001	3.24E-04	3.24E-04	5.68E-04	3.00E-03	0.0303	0.3031	0.0303	0.0606	0.0303	1.5153	2.4246	0.6062	0.1515	0.0303	6.05944E-10
		25	0.81194	0.3004	3.25E-04	3.25E-04	5.68E-04	3.00E-03	0.0304	0.3033	0.0304	0.0607	0.0304	1.5168	2.4269	0.6068	0.1517	0.0304	6.06519E-10
		35	0.81281	0.3007	3.25E-04	3.25E-04	5.69E-04	3.01E-03	0.0304	0.3037	0.0304	0.0607	0.0304	1.5184	2.4295	0.6074	0.1518	0.0304	6.07169E-10
		45	0.81345	0.3010	3.25E-04	3.25E-04	5.69E-04	3.01E-03	0.0304	0.3039	0.0304	0.0608	0.0304	1.5196	2.4314	0.6079	0.1520	0.0304	6.07647E-10
		55	0.81344	0.3010	3.25E-04	3.25E-04	5.69E-04	3.01E-03	0.0304	0.3039	0.0304	0.0608	0.0304	1.5196	2.4314	0.6079	0.1520	0.0304	6.0764E-10
		65	0.81233	0.3006	3.25E-04	3.25E-04	5.69E-04	3.01E-03	0.0304	0.3035	0.0304	0.0607	0.0304	1.5175	2.4281	0.6071	0.1517	0.0304	6.06811E-10
		75	0.81019	0.2998	3.24E-04	3.24E-04	5.67E-04	3.00E-03	0.0303	0.3027	0.0303	0.0605	0.0303	1.5135	2.4217	0.6055	0.1513	0.0303	6.05212E-10
		85	0.80607	0.2982	3.22E-04	3.22E-04	5.64E-04	2.98E-03	0.0301	0.3011	0.0301	0.0602	0.0301	1.5058	2.4093	0.6024	0.1506	0.0301	6.02134E-10
10	Butterfly Estates	5	0.78544	0.2906	3.14E-04	3.14E-04	5.50E-04	2.91E-03	0.0294	0.2934	0.0294	0.0587	0.0294	1.4673	2.3477	0.5870	0.1467	0.0294	5.86724E-10
		15	0.78566	0.2907	3.14E-04	3.14E-04	5.50E-04	2.91E-03	0.0294	0.2935	0.0294	0.0587	0.0294	1.4677	2.3483	0.5871	0.1468	0.0294	5.86888E-10
		25	0.786	0.2908	3.14E-04	3.14E-04	5.50E-04	2.91E-03	0.0294	0.2936	0.0294	0.0587	0.0294	1.4683	2.3494	0.5874	0.1468	0.0294	5.87142E-10
		35	0.78627	0.2909	3.15E-04	3.15E-04	5.50E-04	2.91E-03	0.0294	0.2938	0.0294	0.0587	0.0294	1.4688	2.3502	0.5876	0.1469	0.0294	5.87344E-10

	Maximum 8-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
					Maximum 8 hour average Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	45	0.7862	0.2909	3.14E-04	3.14E-04	5.50E-04	2.91E-03	0.0294	0.2937	0.0294	0.0587	0.0294	1.4687	2.3500	0.5875	0.1469	0.0294	5.87291E-10
		55	0.78545	0.2906	3.14E-04	3.14E-04	5.50E-04	2.91E-03	0.0294	0.2934	0.0294	0.0587	0.0294	1.4673	2.3477	0.5870	0.1467	0.0294	5.86731E-10
		65	0.78363	0.2899	3.13E-04	3.13E-04	5.49E-04	2.90E-03	0.0293	0.2928	0.0293	0.0585	0.0293	1.4639	2.3423	0.5856	0.1464	0.0293	5.85372E-10
		75	0.78034	0.2887	3.12E-04	3.12E-04	5.46E-04	2.89E-03	0.0292	0.2915	0.0292	0.0583	0.0292	1.4578	2.3324	0.5831	0.1458	0.0292	5.82914E-10
		85	0.77517	0.2868	3.10E-04	3.10E-04	5.43E-04	2.87E-03	0.0290	0.2896	0.0290	0.0579	0.0290	1.4481	2.3170	0.5793	0.1448	0.0290	5.79052E-10
11	Richland Garden	8	0.4683	0.1733	1.87E-04	1.87E-04	3.28E-04	1.73E-03	0.0175	0.1750	0.0175	0.0350	0.0175	0.8748	1.3997	0.3500	0.0875	0.0175	3.4982E-10
		15	0.46813	0.1732	1.87E-04	1.87E-04	3.28E-04	1.73E-03	0.0175	0.1749	0.0175	0.0350	0.0175	0.8745	1.3992	0.3498	0.0874	0.0175	3.49693E-10
		25	0.46773	0.1731	1.87E-04	1.87E-04	3.27E-04	1.73E-03	0.0175	0.1747	0.0175	0.0349	0.0175	0.8738	1.3980	0.3495	0.0874	0.0175	3.49394E-10
		35	0.46703	0.1728	1.87E-04	1.87E-04	3.27E-04	1.73E-03	0.0175	0.1745	0.0175	0.0349	0.0175	0.8725	1.3960	0.3490	0.0872	0.0175	3.48871E-10
		45	0.46592	0.1724	1.86E-04	1.86E-04	3.26E-04	1.72E-03	0.0174	0.1741	0.0174	0.0348	0.0174	0.8704	1.3926	0.3482	0.0870	0.0174	3.48042E-10
		55	0.46424	0.1718	1.86E-04	1.86E-04	3.25E-04	1.72E-03	0.0174	0.1734	0.0174	0.0347	0.0174	0.8672	1.3876	0.3469	0.0867	0.0174	3.46787E-10
		65	0.46183	0.1709	1.85E-04	1.85E-04	3.23E-04	1.71E-03	0.0173	0.1725	0.0173	0.0345	0.0173	0.8627	1.3804	0.3451	0.0863	0.0173	3.44987E-10
		75	0.45853	0.1697	1.83E-04	1.83E-04	3.21E-04	1.70E-03	0.0171	0.1713	0.0171	0.0343	0.0171	0.8566	1.3705	0.3427	0.0857	0.0171	3.42522E-10
		85	0.45414	0.1680	1.82E-04	1.82E-04	3.18E-04	1.68E-03	0.0170	0.1697	0.0170	0.0339	0.0170	0.8484	1.3574	0.3394	0.0848	0.0170	3.39243E-10
12	Butterfly Beach	4.6	0.58497	0.2164	2.34E-04	2.34E-04	4.09E-04	2.16E-03	0.0219	0.2186	0.0219	0.0437	0.0219	1.0928	1.7486	0.4371	0.1093	0.0219	4.36973E-10
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	1.05294	0.2583	2.79E-04	2.79E-04	4.89E-04	2.58E-03	0.0261	0.2608	0.0261	0.0522	0.0261	1.3043	2.0869	0.5218	0.1304	0.0261	5.21556E-10
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.6982	0.2583	2.79E-04	2.79E-04	4.89E-04	2.58E-03	0.0261	0.2608	0.0261	0.0522	0.0261	1.3043	2.0869	0.5219	0.1304	0.0261	5.21556E-10
15	Siu Lang Shui Landfill Site for development into a recreational area	41	8.56697	3.1698	3.43E-03	3.43E-03	6.00E-03	3.17E-02	0.3204	3.2006	0.3204	0.6400	0.3204	16.0040	25.6067	6.4021	1.6003	0.3204	6.39953E-09
16	As above	42	3.61885	1.3390	1.45E-03	1.45E-03	2.53E-03	1.34E-02	0.1353	1.3520	0.1353	0.2703	0.1353	6.7604	10.8167	2.7044	0.6760	0.1353	2.70328E-09
17	GIC at Siu Lang Shui	64.2	4.5339	1.6775	1.81E-03	1.81E-03	3.17E-03	1.58E-02	0.1696	1.6939	0.1696	0.3387	0.1696	8.4698	13.5518	3.3882	0.8469	0.1696	3.38682E-09
18	Proposed Steel Works	5	3.59682	1.3308	1.44E-03	1.44E-03	2.52E-03	1.33E-02	0.1345	1.3438	0.1345	0.2687	0.1345	6.7192	10.7509	2.6879	0.6719	0.1345	2.68682E-09
		15	4.02346	1.4887	1.61E-03	1.61E-03	2.82E-03	1.49E-02	0.1505	1.5032	0.1505	0.3006	0.1505	7.5162	12.0261	3.0067	0.7516	0.1505	3.00552E-09
		25	4.83436	1.7887	1.93E-03	1.93E-03	3.38E-03	1.79E-02	0.1808	1.8061	0.1808	0.3611	0.1808	9.0311	14.4499	3.6127	0.9031	0.1808	3.61127E-09
		35	5.94148	2.1983	2.38E-03	2.38E-03	4.16E-03	2.20E-02	0.2222	2.2197	0.2222	0.4438	0.2222	11.0993	17.7591	4.4401	1.1099	0.2222	4.43829E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	3.69981	1.3689	1.48E-03	1.48E-03	2.59E-03	1.37E-02	0.1384	1.3822	0.1384	0.2764	0.1384	6.9116	11.0587	2.7649	0.6911	0.1384	2.76376E-09
		15	4.02702	1.4900	1.61E-03	1.61E-03	2.82E-03	1.49E-02	0.1506	1.5045	0.1506	0.3008	0.1506	7.5229	12.0368	3.0094	0.7522	0.1506	3.00818E-09
		25	4.67298	1.7290	1.87E-03	1.87E-03	3.27E-03	1.73E-02	0.1748	1.7458	0.1748	0.3491	0.1748	8.7296	13.9675	3.4921	0.8729	0.1748	3.49072E-09
		35	5.61018	2.0758	2.24E-03	2.24E-03	3.93E-03	2.08E-02	0.2098	2.0960	0.2098	0.4191	0.2098	10.4804	16.7688	4.1925	1.0480	0.2098	4.1908E-09

	Maximum 8-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
					Maximum 8 hour average Pollutant Concentration (ug/m3)														
			1 g/s emission																
ASR No.	Description	Height (mPD	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
20	Proposed Special Industrial Area	5	2.79652	1.0347	1.12E-03	1.12E-03	1.96E-03	1.03E-02	0.1046	1.0448	0.1046	0.2089	0.1046	5.2242	8.3588	2.0898	0.5224	0.1046	2.089E-09
		15	2.88118	1.0660	1.15E-03	1.15E-03	2.02E-03	1.07E-02	0.1078	1.0764	0.1078	0.2152	0.1078	5.3823	8.6118	2.1531	0.5382	0.1078	2.15224E-09
		25	3.13951	1.1616	1.26E-03	1.26E-03	2.20E-03	1.16E-02	0.1174	1.1729	0.1174	0.2345	0.1174	5.8649	9.3840	2.3462	0.5865	0.1174	2.34521E-09
		35	3.84234	1.4217	1.54E-03	1.54E-03	2.69E-03	1.42E-02	0.1437	1.4355	0.1437	0.2870	0.1437	7.1779	11.4848	2.8714	0.7177	0.1437	2.87023E-09
21	River Trade Terminal	5	3.17564	1.1750	1.27E-03	1.27E-03	2.22E-03	1.17E-02	0.1188	1.1864	0.1188	0.2372	0.1188	5.9324	9.4920	2.3732	0.5932	0.1188	2.3722E-09
		15	3.25925	1.2059	1.30E-03	1.30E-03	2.28E-03	1.21E-02	0.1219	1.2177	0.1219	0.2435	0.1219	6.0886	9.7419	2.4356	0.6088	0.1219	2.43466E-09
		25	3.42019	1.2655	1.37E-03	1.37E-03	2.39E-03	1.27E-02	0.1279	1.2778	0.1279	0.2555	0.1279	6.3893	10.2229	2.5559	0.6389	0.1279	2.55488E-09
		35	3.64629	1.3491	1.46E-03	1.46E-03	2.55E-03	1.35E-02	0.1364	1.3623	0.1364	0.2724	0.1364	6.8116	10.8988	2.7249	0.6811	0.1364	2.72378E-09
22	Existing Castle Peak Firing Range (Boundary)	70	4.81507	1.7816	1.93E-03	1.93E-03	3.37E-03	1.78E-02	0.1801	1.7989	0.1801	0.3597	0.1801	8.9960	14.3922	3.5983	0.8995	0.1801	3.59686E-09

	Maximum 24-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 24 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	1.43857	0.5323	5.75E-04	5.75E-04	1.01E-03	5.32E-03	0.0538	0.5374	0.0538	0.1075	0.0538	2.6874	4.2999	1.0750	0.2687	0.0538	1.07461E-09
		15	1.46845	0.5433	5.87E-04	5.87E-04	1.03E-03	5.43E-03	0.0549	0.5486	0.0549	0.1097	0.0549	2.7432	4.3892	1.0974	0.2743	0.0549	1.09693E-09
		25	1.54553	0.5718	6.18E-04	6.18E-04	1.08E-03	5.72E-03	0.0578	0.5774	0.0578	0.1155	0.0578	2.8872	4.6196	1.1550	0.2887	0.0578	1.15451E-09
		35	1.75162	0.6481	7.01E-04	7.01E-04	1.23E-03	6.48E-03	0.0655	0.6544	0.0655	0.1308	0.0655	3.2722	5.2356	1.3090	0.3272	0.0655	1.30846E-09
2	Castle Peak Power Station	7.3	1.19974	0.4439	4.80E-04	4.80E-04	8.40E-04	4.44E-03	0.0449	0.4482	0.0449	0.0896	0.0449	2.2412	3.5860	0.8966	0.2241	0.0449	8.96206E-10
		15	1.20032	0.4441	4.80E-04	4.80E-04	8.40E-04	4.44E-03	0.0449	0.4484	0.0449	0.0897	0.0449	2.2423	3.5878	0.8970	0.2242	0.0449	8.96639E-10
		25	1.20161	0.4446	4.81E-04	4.81E-04	8.41E-04	4.45E-03	0.0449	0.4489	0.0449	0.0898	0.0449	2.2447	3.5916	0.8980	0.2245	0.0449	8.97603E-10
		35	1.20343	0.4453	4.81E-04	4.81E-04	8.42E-04	4.45E-03	0.0450	0.4496	0.0450	0.0899	0.0450	2.2481	3.5971	0.8993	0.2248	0.0450	8.98962E-10
3	Block Making Factory	58.3	1.28419	0.4752	5.14E-04	5.14E-04	8.99E-04	4.75E-03	0.0480	0.4798	0.0480	0.0959	0.0480	2.3990	3.8384	0.9597	0.2399	0.0480	9.5929E-10
4	Fresh Water Reservoir	64	0.81888	0.3030	3.28E-04	3.28E-04	5.73E-04	3.03E-03	0.0306	0.3059	0.0306	0.0612	0.0306	1.5297	2.4476	0.6119	0.1530	0.0306	6.11703E-10
5	Pillar Point Sewage Treatment Works	5	0.24242	0.0897	9.70E-05	9.70E-05	1.70E-04	8.97E-04	0.0091	0.0906	0.0091	0.0181	0.0091	0.4529	0.7246	0.1812	0.0453	0.0091	1.81088E-10
		15	0.24229	0.0896	9.69E-05	9.69E-05	1.70E-04	8.96E-04	0.0091	0.0905	0.0091	0.0181	0.0091	0.4526	0.7242	0.1811	0.0453	0.0091	1.80991E-10
		25	0.24202	0.0895	9.68E-05	9.68E-05	1.69E-04	8.95E-04	0.0091	0.0904	0.0091	0.0181	0.0091	0.4521	0.7234	0.1809	0.0452	0.0091	1.80789E-10
		35	0.2416	0.0894	9.66E-05	9.66E-05	1.69E-04	8.94E-04	0.0090	0.0903	0.0090	0.0180	0.0090	0.4513	0.7221	0.1805	0.0451	0.0090	1.80475E-10
6	WAHMO Building	12	0.25942	0.0960	1.04E-04	1.04E-04	1.82E-04	9.60E-04	0.0097	0.0969	0.0097	0.0194	0.0097	0.4846	0.7754	0.1939	0.0485	0.0097	1.93787E-10
7	Waterfront Industry	5	0.1759	0.0651	7.04E-05	7.04E-05	1.23E-04	6.51E-04	0.0066	0.0657	0.0066	0.0131	0.0066	0.3286	0.5258	0.1315	0.0329	0.0066	1.31397E-10
		15	0.17577	0.0650	7.03E-05	7.03E-05	1.23E-04	6.50E-04	0.0066	0.0657	0.0066	0.0131	0.0066	0.3284	0.5254	0.1314	0.0328	0.0066	1.313E-10
		25	0.17552	0.0649	7.02E-05	7.02E-05	1.23E-04	6.49E-04	0.0066	0.0656	0.0066	0.0131	0.0066	0.3279	0.5246	0.1312	0.0328	0.0066	1.31113E-10
		35	0.17513	0.0648	7.01E-05	7.01E-05	1.23E-04	6.48E-04	0.0065	0.0654	0.0065	0.0131	0.0065	0.3272	0.5235	0.1309	0.0327	0.0065	1.30822E-10
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.44956	0.1663	1.80E-04	1.80E-04	3.15E-04	1.66E-03	0.0168	0.1680	0.0168	0.0336	0.0168	0.8398	1.3437	0.3360	0.0840	0.0168	3.35821E-10
9	Melody Garden	5	0.30574	0.1131	1.22E-04	1.22E-04	2.14E-04	1.13E-03	0.0114	0.1142	0.0114	0.0228	0.0114	0.5712	0.9139	0.2285	0.0571	0.0114	2.28388E-10
		15	0.30589	0.1132	1.22E-04	1.22E-04	2.14E-04	1.13E-03	0.0114	0.1143	0.0114	0.0228	0.0114	0.5714	0.9143	0.2286	0.0571	0.0114	2.285E-10
		25	0.30615	0.1133	1.22E-04	1.22E-04	2.14E-04	1.13E-03	0.0115	0.1144	0.0115	0.0229	0.0115	0.5719	0.9151	0.2288	0.0572	0.0115	2.28694E-10
		35	0.30643	0.1134	1.23E-04	1.23E-04	2.15E-04	1.13E-03	0.0115	0.1145	0.0115	0.0229	0.0115	0.5724	0.9159	0.2290	0.0572	0.0115	2.28903E-10
		45	0.30664	0.1135	1.23E-04	1.23E-04	2.15E-04	1.13E-03	0.0115	0.1146	0.0115	0.0229	0.0115	0.5728	0.9165	0.2292	0.0573	0.0115	2.2906E-10
		55	0.30663	0.1135	1.23E-04	1.23E-04	2.15E-04	1.13E-03	0.0115	0.1146	0.0115	0.0229	0.0115	0.5728	0.9165	0.2291	0.0573	0.0115	2.29053E-10
		65	0.30626	0.1133	1.23E-04	1.23E-04	2.14E-04	1.13E-03	0.0115	0.1144	0.0115	0.0229	0.0115	0.5721	0.9154	0.2289	0.0572	0.0115	2.28776E-10
		75	0.30535	0.1130	1.22E-04	1.22E-04	2.14E-04	1.13E-03	0.0114	0.1141	0.0114	0.0228	0.0114	0.5704	0.9127	0.2282	0.0570	0.0114	2.28096E-10
		85	0.30375	0.1124	1.22E-04	1.22E-04	2.13E-04	1.12E-03	0.0114	0.1135	0.0114	0.0227	0.0114	0.5674	0.9079	0.2270	0.0567	0.0114	2.26901E-10
10	Butterfly Estates	6	0.29661	0.1097	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1108	0.0111	0.0222	0.0111	0.5541	0.8866	0.2217	0.0554	0.0111	2.21568E-10
		15	0.29666	0.1098	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1108	0.0111	0.0222	0.0111	0.5542	0.8867	0.2217	0.0554	0.0111	2.21605E-10
		25	0.29671	0.1098	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1109	0.0111	0.0222	0.0111	0.5543	0.8869	0.2217	0.0554	0.0111	2.21642E-10
		35	0.29672	0.1098	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1109	0.0111	0.0222	0.0111	0.5543	0.8869	0.2217	0.0554	0.0111	2.2165E-10

	Maximum 24-hour average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 24 hour average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	45	0.29658	0.1097	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1108	0.0111	0.0222	0.0111	0.5540	0.8865	0.2216	0.0554	0.0111	2.21545E-10
		55	0.29619	0.1096	1.18E-04	1.18E-04	2.07E-04	1.10E-03	0.0111	0.1107	0.0111	0.0221	0.0111	0.5533	0.8853	0.2213	0.0553	0.0111	2.21254E-10
		65	0.29543	0.1093	1.18E-04	1.18E-04	2.07E-04	1.09E-03	0.0110	0.1104	0.0110	0.0221	0.0110	0.5519	0.8830	0.2208	0.0552	0.0110	2.20686E-10
		75	0.29417	0.1088	1.18E-04	1.18E-04	2.06E-04	1.09E-03	0.0110	0.1099	0.0110	0.0220	0.0110	0.5495	0.8793	0.2198	0.0550	0.0110	2.19745E-10
		85	0.29226	0.1081	1.17E-04	1.17E-04	2.05E-04	1.08E-03	0.0109	0.1092	0.0109	0.0218	0.0109	0.5460	0.8736	0.2184	0.0546	0.0109	2.18318E-10
11	Richland Garden	6	0.18438	0.0682	7.38E-05	7.38E-05	1.29E-04	6.82E-04	0.0069	0.0689	0.0069	0.0138	0.0069	0.3444	0.5511	0.1378	0.0344	0.0069	1.37732E-10
		15	0.18433	0.0682	7.37E-05	7.37E-05	1.29E-04	6.82E-04	0.0069	0.0689	0.0069	0.0138	0.0069	0.3443	0.5510	0.1377	0.0344	0.0069	1.37695E-10
		25	0.18419	0.0682	7.37E-05	7.37E-05	1.29E-04	6.82E-04	0.0069	0.0688	0.0069	0.0138	0.0069	0.3441	0.5505	0.1376	0.0344	0.0069	1.3759E-10
		35	0.18396	0.0681	7.36E-05	7.36E-05	1.29E-04	6.81E-04	0.0069	0.0687	0.0069	0.0137	0.0069	0.3437	0.5499	0.1375	0.0344	0.0069	1.37418E-10
		45	0.18359	0.0679	7.34E-05	7.34E-05	1.29E-04	6.79E-04	0.0069	0.0686	0.0069	0.0137	0.0069	0.3430	0.5488	0.1372	0.0343	0.0069	1.37142E-10
		55	0.18303	0.0677	7.32E-05	7.32E-05	1.28E-04	6.77E-04	0.0068	0.0684	0.0068	0.0137	0.0068	0.3419	0.5471	0.1368	0.0342	0.0068	1.36723E-10
		65	0.18222	0.0674	7.29E-05	7.29E-05	1.28E-04	6.74E-04	0.0068	0.0681	0.0068	0.0136	0.0068	0.3404	0.5447	0.1362	0.0340	0.0068	1.36118E-10
		75	0.18112	0.0670	7.24E-05	7.24E-05	1.27E-04	6.70E-04	0.0068	0.0677	0.0068	0.0135	0.0068	0.3384	0.5414	0.1354	0.0338	0.0068	1.35297E-10
		85	0.17965	0.0665	7.19E-05	7.19E-05	1.26E-04	6.65E-04	0.0067	0.0671	0.0067	0.0134	0.0067	0.3356	0.5370	0.1343	0.0336	0.0067	1.34199E-10
12	Butterfly Beach	4.6	0.23373	0.0865	9.35E-06	9.35E-06	1.64E-04	8.65E-04	0.0087	0.0873	0.0087	0.0175	0.0087	0.4366	0.6986	0.1747	0.0437	0.0087	1.74596E-10
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.39425	0.1016	1.10E-04	1.10E-04	1.92E-04	1.01E-03	0.0103	0.1026	0.0103	0.0205	0.0103	0.5123	0.8198	0.2050	0.0512	0.0103	2.04872E-10
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.27426	0.1016	1.10E-04	1.10E-04	1.92E-04	1.01E-03	0.0103	0.1026	0.0103	0.0205	0.0103	0.5123	0.8198	0.2050	0.0512	0.0103	2.04872E-10
15	Siu Lang Shui Landfill Site for development into a recreational area	41	4.8059	1.7782	1.92E-03	1.92E-03	3.36E-03	1.78E-02	0.1797	1.7965	0.1797	0.3590	0.1797	8.9779	14.3648	3.5914	0.8977	0.1797	3.59001E-09
16	As above	42	1.95407	0.7230	7.82E-04	7.82E-04	1.37E-03	7.23E-03	0.0731	0.7300	0.0731	0.1460	0.0731	3.6504	5.8407	1.4603	0.3650	0.0731	1.45969E-09
17	GIC at Siu Lang Shui	84.2	1.9034	0.7043	7.61E-04	7.61E-04	1.33E-03	7.04E-03	0.0712	0.7111	0.0712	0.1422	0.0712	3.5557	5.6893	1.4224	0.3556	0.0712	1.42184E-09
18	Proposed Steel Works	5	1.37459	0.5086	5.50E-04	5.50E-04	9.62E-04	5.09E-03	0.0514	0.5135	0.0514	0.1027	0.0514	2.5679	4.1086	1.0272	0.2568	0.0514	1.02682E-09
		15	1.56822	0.5802	6.27E-04	6.27E-04	1.10E-03	5.80E-03	0.0587	0.5859	0.0587	0.1171	0.0587	2.9296	4.6874	1.1719	0.2929	0.0587	1.17146E-09
		25	1.94612	0.7201	7.78E-04	7.78E-04	1.36E-03	7.20E-03	0.0728	0.7271	0.0728	0.1454	0.0728	3.6355	5.8170	1.4543	0.3635	0.0728	1.45375E-09
		35	2.48458	0.9193	9.94E-04	9.94E-04	1.74E-03	9.19E-03	0.0929	0.9282	0.0929	0.1856	0.0929	4.6414	7.4264	1.8567	0.4641	0.0929	1.85898E-09
19	Proposed Chemical Waste Bulk Treatment Facility	5	1.23401	0.4566	4.94E-04	4.94E-04	8.64E-04	4.57E-03	0.0462	0.4610	0.0462	0.0922	0.0462	2.3053	3.6885	0.9222	0.2305	0.0462	9.21805E-10
		15	1.34399	0.4973	5.38E-04	5.38E-04	9.41E-04	4.97E-03	0.0503	0.5021	0.0503	0.1004	0.0503	2.5107	4.0172	1.0044	0.2511	0.0503	1.00396E-09
		25	1.65158	0.6111	6.61E-04	6.61E-04	1.16E-03	6.11E-03	0.0618	0.6170	0.0618	0.1234	0.0618	3.0853	4.9366	1.2342	0.3085	0.0618	1.23373E-09

	Maximum 24-hour average concentration			Using 1993 Lau Fau Shan Met. Data																
				Maximum 24 hour average Pollutant Concentration (ug/m3)																
			1 g/s emission																	
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
19	Proposed Chemical Waste Bulk Treatment Facility	35	2.29728	0.8500	9.19E-04	9.19E-04	1.61E-03	8.50E-03	0.0859	0.8583	0.0859	0.1716	0.0859	4.2916	6.8666	1.7168	0.4291	0.0859	1.71607E-09
20	Proposed Special Industrial Area	5	0.94194	0.3485	3.77E-04	3.77E-04	6.59E-04	3.49E-03	0.0352	0.3519	0.0352	0.0704	0.0352	1.7596	2.8155	0.7039	0.1760	0.0352	7.03629E-10
		15	1.0677	0.3950	4.27E-04	4.27E-04	7.47E-04	3.95E-03	0.0399	0.3989	0.0399	0.0798	0.0399	1.9946	3.1914	0.7979	0.1994	0.0399	7.97572E-10
		25	1.3052	0.4829	5.22E-04	5.22E-04	9.14E-04	4.83E-03	0.0488	0.4876	0.0488	0.0975	0.0488	2.4382	3.9012	0.9754	0.2438	0.0488	9.74984E-10
		35	1.62941	0.6029	6.52E-04	6.52E-04	1.14E-03	6.03E-03	0.0609	0.6087	0.0609	0.1217	0.0609	3.0439	4.8703	1.2177	0.3044	0.0609	1.21717E-09
21	River Trade Terminal	5	1.54807	0.5728	6.19E-04	6.19E-04	1.08E-03	5.73E-03	0.0579	0.5784	0.0579	0.1156	0.0579	2.8919	4.6272	1.1569	0.2892	0.0579	1.15641E-09
		15	1.55688	0.5760	6.23E-04	6.23E-04	1.09E-03	5.76E-03	0.0582	0.5817	0.0582	0.1163	0.0582	2.9084	4.6535	1.1635	0.2908	0.0582	1.16299E-09
		25	1.57305	0.5820	6.29E-04	6.29E-04	1.10E-03	5.82E-03	0.0588	0.5877	0.0588	0.1175	0.0588	2.9386	4.7018	1.1755	0.2938	0.0588	1.17507E-09
		35	1.59382	0.5897	6.38E-04	6.38E-04	1.12E-03	5.90E-03	0.0596	0.5955	0.0596	0.1191	0.0596	2.9774	4.7639	1.1911	0.2977	0.0596	1.19058E-09
22	Existing Castle Peak Firing Range (Boundary)	70	1.62666	0.6019	6.51E-04	6.51E-04	1.14E-03	6.02E-03	0.0608	0.6077	0.0608	0.1215	0.0608	3.0388	4.8621	1.2156	0.3039	0.0608	1.21512E-09

	Maximum 1 month average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 1 month average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
	Existing ASRs																		
1	Cement Works	6.7	0.28998	0.1073	1.16E-04	1.16E-04	2.03E-04	1.07E-03	0.0108	0.1083	0.0108	0.0217	0.0108	0.5417	0.8668	0.2167	0.0542	0.0108	2.16615E-10
		15	0.29716	0.1099	1.19E-04	1.19E-04	2.08E-04	1.10E-03	0.0111	0.1110	0.0111	0.0222	0.0111	0.5551	0.8882	0.2221	0.0555	0.0111	2.21979E-10
		25	0.3137	0.1161	1.25E-04	1.25E-04	2.20E-04	1.16E-03	0.0117	0.1172	0.0117	0.0234	0.0117	0.5860	0.9376	0.2344	0.0586	0.0117	2.34334E-10
		35	0.34041	0.1260	1.36E-04	1.36E-04	2.38E-04	1.26E-03	0.0127	0.1272	0.0127	0.0254	0.0127	0.6359	1.0175	0.2544	0.0636	0.0127	2.54286E-10
2	Castle Peak Power Station	7.3	0.20811	0.0770	8.32E-05	8.32E-05	1.46E-04	7.70E-04	0.0078	0.0777	0.0078	0.0155	0.0078	0.3888	0.6220	0.1555	0.0389	0.0078	1.55458E-10
		15	0.20908	0.0774	8.36E-05	8.36E-05	1.46E-04	7.74E-04	0.0078	0.0781	0.0078	0.0156	0.0078	0.3906	0.6249	0.1562	0.0391	0.0078	1.56183E-10
		25	0.21125	0.0782	8.45E-05	8.45E-05	1.48E-04	7.82E-04	0.0079	0.0789	0.0079	0.0158	0.0079	0.3946	0.6314	0.1579	0.0395	0.0079	1.57804E-10
		35	0.21425	0.0793	8.57E-05	8.57E-05	1.50E-04	7.93E-04	0.0080	0.0800	0.0080	0.0160	0.0080	0.4002	0.6404	0.1601	0.0400	0.0080	1.60045E-10
3	Block Making Factory	58.3	0.12762	0.0472	5.10E-05	5.10E-05	8.93E-05	4.72E-04	0.0048	0.0477	0.0048	0.0095	0.0048	0.2384	0.3815	0.0954	0.0238	0.0048	9.53321E-11
4	Fresh Water Reservoir	64	0.10361	0.0383	4.14E-05	4.14E-05	7.25E-05	3.83E-04	0.0039	0.0387	0.0039	0.0077	0.0039	0.1936	0.3097	0.0774	0.0194	0.0039	7.73967E-11
5	Pillar Point Sewage Treatment Works	5	0.03086	0.0114	1.23E-05	1.23E-05	2.16E-05	1.14E-04	0.0012	0.0115	0.0012	0.0023	0.0012	0.0576	0.0922	0.0231	0.0058	0.0012	2.30524E-11
		15	0.03084	0.0114	1.23E-05	1.23E-05	2.16E-05	1.14E-04	0.0012	0.0115	0.0012	0.0023	0.0012	0.0576	0.0922	0.0230	0.0058	0.0012	2.30375E-11
		25	0.03082	0.0114	1.23E-05	1.23E-05	2.16E-05	1.14E-04	0.0012	0.0115	0.0012	0.0023	0.0012	0.0576	0.0921	0.0230	0.0058	0.0012	2.30225E-11
		35	0.03079	0.0114	1.23E-05	1.23E-05	2.16E-05	1.14E-04	0.0012	0.0115	0.0012	0.0023	0.0012	0.0575	0.0920	0.0230	0.0058	0.0012	2.30001E-11
6	WAHMO Building	12	0.02943	0.0109	1.18E-05	1.18E-05	2.06E-05	1.09E-04	0.0011	0.0110	0.0011	0.0022	0.0011	0.0550	0.0880	0.0220	0.0055	0.0011	2.19842E-11
7	Waterfront Industry	5	0.02052	0.0076	8.21E-06	8.21E-06	1.44E-05	7.59E-05	0.0008	0.0077	0.0008	0.0015	0.0008	0.0383	0.0613	0.0153	0.0038	0.0008	1.53284E-11
		15	0.02052	0.0076	8.21E-06	8.21E-06	1.44E-05	7.59E-05	0.0008	0.0077	0.0008	0.0015	0.0008	0.0383	0.0613	0.0153	0.0038	0.0008	1.53284E-11
		25	0.02051	0.0076	8.20E-06	8.20E-06	1.44E-05	7.59E-05	0.0008	0.0077	0.0008	0.0015	0.0008	0.0383	0.0613	0.0153	0.0038	0.0008	1.5321E-11
		35	0.02052	0.0076	8.21E-06	8.21E-06	1.44E-05	7.59E-05	0.0008	0.0077	0.0008	0.0015	0.0008	0.0383	0.0613	0.0153	0.0038	0.0008	1.53284E-11
8	Villages in Lung Kwu Sheung Tan Area : the nearest village is Lung Tsai	4	0.05081	0.0188	2.03E-05	2.03E-05	3.56E-05	1.88E-04	0.0019	0.0190	0.0019	0.0038	0.0019	0.0949	0.1519	0.0380	0.0095	0.0019	3.79551E-11
9	Melody Garden	5	0.02561	0.0095	1.02E-05	1.02E-05	1.79E-05	9.48E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0478	0.0765	0.0191	0.0048	0.0010	1.91307E-11
		15	0.02561	0.0095	1.02E-05	1.02E-05	1.79E-05	9.48E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0478	0.0765	0.0191	0.0048	0.0010	1.91307E-11
		25	0.0256	0.0095	1.02E-05	1.02E-05	1.79E-05	9.47E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0478	0.0765	0.0191	0.0048	0.0010	1.91232E-11
		35	0.02559	0.0095	1.02E-05	1.02E-05	1.79E-05	9.47E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0478	0.0765	0.0191	0.0048	0.0010	1.91157E-11
		45	0.02557	0.0095	1.02E-05	1.02E-05	1.79E-05	9.46E-05	0.0010	0.0096	0.0010	0.0019	0.0010	0.0478	0.0764	0.0191	0.0048	0.0010	1.91008E-11
		55	0.02552	0.0094	1.02E-05	1.02E-05	1.79E-05	9.44E-05	0.0010	0.0095	0.0010	0.0019	0.0010	0.0477	0.0763	0.0191	0.0048	0.0010	1.90634E-11
		65	0.02545	0.0094	1.02E-05	1.02E-05	1.78E-05	9.42E-05	0.0010	0.0095	0.0010	0.0019	0.0010	0.0475	0.0761	0.0190	0.0048	0.0010	1.90112E-11
		75	0.02534	0.0094	1.01E-05	1.01E-05	1.77E-05	9.38E-05	0.0009	0.0095	0.0009	0.0019	0.0009	0.0473	0.0757	0.0189	0.0047	0.0009	1.8929E-11
		85	0.02519	0.0093	1.01E-05	1.01E-05	1.76E-05	9.32E-05	0.0009	0.0094	0.0009	0.0019	0.0009	0.0471	0.0753	0.0188	0.0047	0.0009	1.88169E-11
10	Butterfly Estates	5	0.02466	0.0091	9.86E-06	9.86E-06	1.73E-05	9.12E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0461	0.0737	0.0184	0.0046	0.0009	1.8421E-11
		15	0.02465	0.0091	9.86E-06	9.86E-06	1.73E-05	9.12E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0460	0.0737	0.0184	0.0046	0.0009	1.84136E-11
		25	0.02464	0.0091	9.86E-06	9.86E-06	1.72E-05	9.12E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0460	0.0736	0.0184	0.0046	0.0009	1.84061E-11
		35	0.02461	0.0091	9.84E-06	9.84E-06	1.72E-05	9.11E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0460	0.0736	0.0184	0.0046	0.0009	1.83837E-11

	Maximum 1 month average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 1 month average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
10	Butterfly Estates	45	0.02457	0.0091	9.83E-06	9.83E-06	1.72E-05	9.09E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0459	0.0734	0.0184	0.0046	0.0009	1.83538E-11
		55	0.02452	0.0091	9.81E-06	9.81E-06	1.72E-05	9.07E-05	0.0009	0.0092	0.0009	0.0018	0.0009	0.0458	0.0733	0.0183	0.0046	0.0009	1.83164E-11
		65	0.02443	0.0090	9.77E-06	9.77E-06	1.71E-05	9.04E-05	0.0009	0.0091	0.0009	0.0018	0.0009	0.0456	0.0730	0.0183	0.0046	0.0009	1.82492E-11
		75	0.02431	0.0090	9.72E-06	9.72E-06	1.70E-05	8.99E-05	0.0009	0.0091	0.0009	0.0018	0.0009	0.0454	0.0727	0.0182	0.0045	0.0009	1.81596E-11
		85	0.02416	0.0089	9.66E-06	9.66E-06	1.69E-05	8.94E-05	0.0009	0.0090	0.0009	0.0018	0.0009	0.0451	0.0722	0.0181	0.0045	0.0009	1.80475E-11
11	Richland Garden	8	0.01933	0.0072	7.73E-06	7.73E-06	1.35E-05	7.16E-05	0.0007	0.0072	0.0007	0.0014	0.0007	0.0361	0.0578	0.0144	0.0036	0.0007	1.44395E-11
		15	0.01932	0.0071	7.73E-06	7.73E-06	1.35E-05	7.15E-05	0.0007	0.0072	0.0007	0.0014	0.0007	0.0361	0.0577	0.0144	0.0036	0.0007	1.4432E-11
		25	0.01929	0.0071	7.72E-06	7.72E-06	1.35E-05	7.14E-05	0.0007	0.0072	0.0007	0.0014	0.0007	0.0360	0.0577	0.0144	0.0036	0.0007	1.44096E-11
		35	0.01926	0.0071	7.70E-06	7.70E-06	1.35E-05	7.13E-05	0.0007	0.0072	0.0007	0.0014	0.0007	0.0360	0.0576	0.0144	0.0036	0.0007	1.43872E-11
		45	0.0192	0.0071	7.68E-06	7.68E-06	1.34E-05	7.10E-05	0.0007	0.0072	0.0007	0.0014	0.0007	0.0359	0.0574	0.0143	0.0036	0.0007	1.43424E-11
		55	0.01913	0.0071	7.65E-06	7.65E-06	1.34E-05	7.08E-05	0.0007	0.0071	0.0007	0.0014	0.0007	0.0357	0.0572	0.0143	0.0036	0.0007	1.42901E-11
		65	0.01904	0.0070	7.62E-06	7.62E-06	1.33E-05	7.04E-05	0.0007	0.0071	0.0007	0.0014	0.0007	0.0356	0.0569	0.0142	0.0036	0.0007	1.42229E-11
		75	0.01892	0.0070	7.57E-06	7.57E-06	1.32E-05	7.00E-05	0.0007	0.0071	0.0007	0.0014	0.0007	0.0353	0.0566	0.0141	0.0035	0.0007	1.41332E-11
		85	0.01878	0.0069	7.51E-06	7.51E-06	1.31E-05	6.95E-05	0.0007	0.0070	0.0007	0.0014	0.0007	0.0351	0.0561	0.0140	0.0035	0.0007	1.40287E-11
12	Butterfly Beach	4.6	0.02728	0.0101	1.09E-06	1.09E-06	1.91E-05	1.01E-04	0.0010	0.0102	0.0010	0.0020	0.0010	0.0510	0.0816	0.0204	0.0051	0.0010	2.03782E-11
13	Public Recreation & Sports Centre in Area 45 (Horse Riding School)	10	0.03233	0.0111	1.20E-06	1.20E-06	2.11E-06	1.11E-04	0.0011	0.0113	0.0011	0.0022	0.0011	0.0563	0.0900	0.0226	0.0056	0.0011	2.24996E-11
	Future ASRs																		
14	Low density residential developments in Area 45C	10	0.03012	0.0111	1.20E-06	1.20E-06	2.11E-06	1.11E-04	0.0011	0.0113	0.0011	0.0022	0.0011	0.0663	0.0900	0.0226	0.0056	0.0011	2.24996E-11
15	Siu Lang Shui Landfill Site for development into a recreational area	41	0.92266	0.3414	3.69E-04	3.69E-04	6.46E-04	3.41E-03	0.0345	0.3447	0.0345	0.0689	0.0345	1.7236	2.7578	0.6895	0.1724	0.0345	6.89227E-10
16	As above	42	0.39283	0.1453	1.57E-04	1.57E-04	2.75E-04	1.45E-03	0.0147	0.1468	0.0147	0.0293	0.0147	0.7338	1.1742	0.2936	0.0734	0.0147	2.93444E-10
17	GIC at Siu Lang Shui	64.2	0.28903	0.1069	1.16E-04	1.16E-04	2.02E-04	1.07E-03	0.0108	0.1080	0.0108	0.0216	0.0108	0.5399	0.8639	0.2160	0.0540	0.0108	2.15905E-10
18	Proposed Steel Works	5	0.21223	0.0785	8.49E-05	8.49E-05	1.49E-04	7.85E-04	0.0079	0.0793	0.0079	0.0159	0.0079	0.3965	0.6344	0.1586	0.0396	0.0079	1.58536E-10
		15	0.25139	0.0930	1.01E-04	1.01E-04	1.76E-04	9.30E-04	0.0094	0.0939	0.0094	0.0188	0.0094	0.4696	0.7514	0.1879	0.0470	0.0094	1.87788E-10
		25	0.33172	0.1227	1.33E-04	1.33E-04	2.32E-04	1.23E-03	0.0124	0.1239	0.0124	0.0248	0.0124	0.6197	0.9915	0.2479	0.0620	0.0124	2.47795E-10
		35	0.45573	0.1686	1.82E-04	1.82E-04	3.19E-04	1.69E-03	0.0170	0.1703	0.0170	0.0340	0.0170	0.8513	1.3622	0.3406	0.0851	0.0170	3.4043E-10
19	Proposed Chemical Waste Bulk Treatment Facility	5	0.34933	0.1293	1.40E-04	1.40E-04	2.45E-04	1.29E-03	0.0131	0.1305	0.0131	0.0261	0.0131	0.6526	1.0441	0.2611	0.0653	0.0131	2.6095E-10
		15	0.39839	0.1474	1.59E-04	1.59E-04	2.79E-04	1.47E-03	0.0149	0.1488	0.0149	0.0298	0.0149	0.7442	1.1908	0.2977	0.0744	0.0149	2.97597E-10
		25	0.49594	0.1835	1.98E-04	1.98E-04	3.47E-04	1.83E-03	0.0185	0.1853	0.0185	0.0370	0.0185	0.9265	1.4824	0.3706	0.0926	0.0185	3.70467E-10

	Maximum 1 month average concentration			Using 1993 Lau Fau Shan Met. Data															
				Maximum 1 month average Pollutant Concentration (ug/m3)															
			1 g/s emission																
ASR No.	Description	Height (mPD)	ug/m3	Particulates	Cadmium & Thallium	Mercury	Individual Metals	Total metals	Hydrogen sulphide	Chlorine	Hydrogen fluoride	Fluorine (HF)	Hydrogen bromide	Sulphur dioxide	Nitrogen oxides	Carbon monoxide	Organic compounds (C)	Phosphorus	Polychlorinated dibenzodioxins & polychlorinated dibenzofurans (TCDD)
19	Proposed Chemical Waste Bulk Treatment Facility	35	0.63842	0.2362	2.55E-04	2.55E-04	4.47E-04	2.36E-03	0.0239	0.2386	0.0239	0.0477	0.0239	1.1926	1.9082	0.4771	0.1193	0.0239	4.769E-10
20	Proposed Special Industrial Area	5	0.18367	0.0680	7.35E-05	7.35E-05	1.29E-04	6.80E-04	0.0069	0.0686	0.0069	0.0137	0.0069	0.3431	0.5490	0.1373	0.0343	0.0069	1.37201E-10
		15	0.19254	0.0712	7.70E-05	7.70E-05	1.35E-04	7.12E-04	0.0072	0.0719	0.0072	0.0144	0.0072	0.3597	0.5755	0.1439	0.0360	0.0072	1.43827E-10
		25	0.21018	0.0778	8.41E-05	8.41E-05	1.47E-04	7.78E-04	0.0079	0.0785	0.0079	0.0157	0.0079	0.3926	0.6282	0.1571	0.0393	0.0079	1.57004E-10
		35	0.23698	0.0877	9.48E-05	9.48E-05	1.66E-04	8.77E-04	0.0089	0.0886	0.0089	0.0177	0.0089	0.4427	0.7083	0.1771	0.0443	0.0089	1.77024E-10
21	River Trade Terminal	5	0.34447	0.1275	1.38E-04	1.38E-04	2.41E-04	1.27E-03	0.0129	0.1287	0.0129	0.0257	0.0129	0.6435	1.0296	0.2574	0.0643	0.0129	2.57319E-10
		15	0.34951	0.1293	1.40E-04	1.40E-04	2.45E-04	1.29E-03	0.0131	0.1306	0.0131	0.0261	0.0131	0.6529	1.0447	0.2612	0.0653	0.0131	2.61084E-10
		25	0.36056	0.1334	1.44E-04	1.44E-04	2.52E-04	1.33E-03	0.0135	0.1347	0.0135	0.0269	0.0135	0.6736	1.0777	0.2694	0.0674	0.0135	2.69338E-10
		35	0.37936	0.1404	1.52E-04	1.52E-04	2.66E-04	1.40E-03	0.0142	0.1417	0.0142	0.0283	0.0142	0.7087	1.1339	0.2836	0.0709	0.0142	2.83382E-10
22	Existing Castle Peak Firing Range (Boundary)	70	0.18023	0.0667	7.21E-05	7.21E-05	1.26E-04	6.67E-04	0.0067	0.0673	0.0067	0.0135	0.0067	0.3367	0.5387	0.1347	0.0337	0.0067	1.34632E-10