EXECUTIVE SUMMARY
行政摘要

Green Island Cement Company Limited
青洲英坭有限公司

Decommissioning of the Co-Combustion Pilot Plant at Tap Shek Kok
清拆位於踏石角的環保廢物熔化系統試驗設施

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March 2009
二零零九年三月

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March 2009
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For and on behalf of
ERM-Hong Kong, Limited
香港環境資源管理顧問有限公司

Approval by 批核: Frank Wan 溫志雄

Signed by 簽署:

Position 職位: Partner 合夥人

Date 日期: 16 Mar 09 二零零九年三月十六日

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

In response to the Hong Kong SAR Government's initiative to develop bulk waste reduction facilities to tackle Hong Kong's waste disposal crisis, Green Island Cement Company Limited (the Project Proponent) established a pilot demonstration waste-to-energy facility (consisting of a Materials Recovery/Recycling Facility (MRRF) and a Co-Combustion Plant) (hereafter this facility is referred to as the Co-Combustion Pilot Plant (CCPP)) within the Green Island Cement Plant (GICP) site at Tap Shek Kok, Tuen Mun (see *Figure 1.1a*).

The aims of the CCPP were to determine the technical and economic issues associated with the operation of a MRRF as part of an integrated waste management system; to demonstrate that the CCPP will meet the requirements of the Guidance Note on the Best Practical Means for Incinerators (Municipal Waste Incineration) (BPM 12/1 (08)) issued by the Environmental Protection Department (EPD); and to obtain engineering data to refine the design of the Co-Combustion Plant.

The construction and installation of the CCPP was completed in February 2005 and commissioning tests were carried out in April and July/August 2005 in order to demonstrate its performance. Continuous operation of the CCPP was started in early October 2005. During the operation period, the cumulative operating time of the facility was 11 weeks and no more than 24 tonnes per day of Municipal Solid Waste (MSW) were treated. After achieving the research objectives, the operation of pilot plant was stopped on 17 December 2005.

1.2 OBJECTIVES

The decommissioning of such municipal waste incinerator is classified as a Designated Project under Item 3 of Part II Schedule 2 of the *Environmental Impact Assessment Ordinance* (EIAO) and hence the decommissioning of the CCPP (hereafter referred to the Project) is classified as a DP and requires an Environmental Permit (EP) prior to the decommissioning works.

A Project Profile (PP-315/2007) for the decommissioning of the CCPP was submitted to EPD for application of an EIA Study Brief under the *EIAO* and Study Brief (ESB-164/2007) was issued on 7 June 2007 which sets out the scope of the work for this EIA Study.

An Environmental Impact Assessment (EIA) Study has been conducted to evaluate the potential environmental impacts due to the Project in accordance with the EIA Study Brief and the guideline on assessment methodology provided in the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM). The overall objectives of the EIA Study are to provide information on the nature and extent of potential environmental impacts

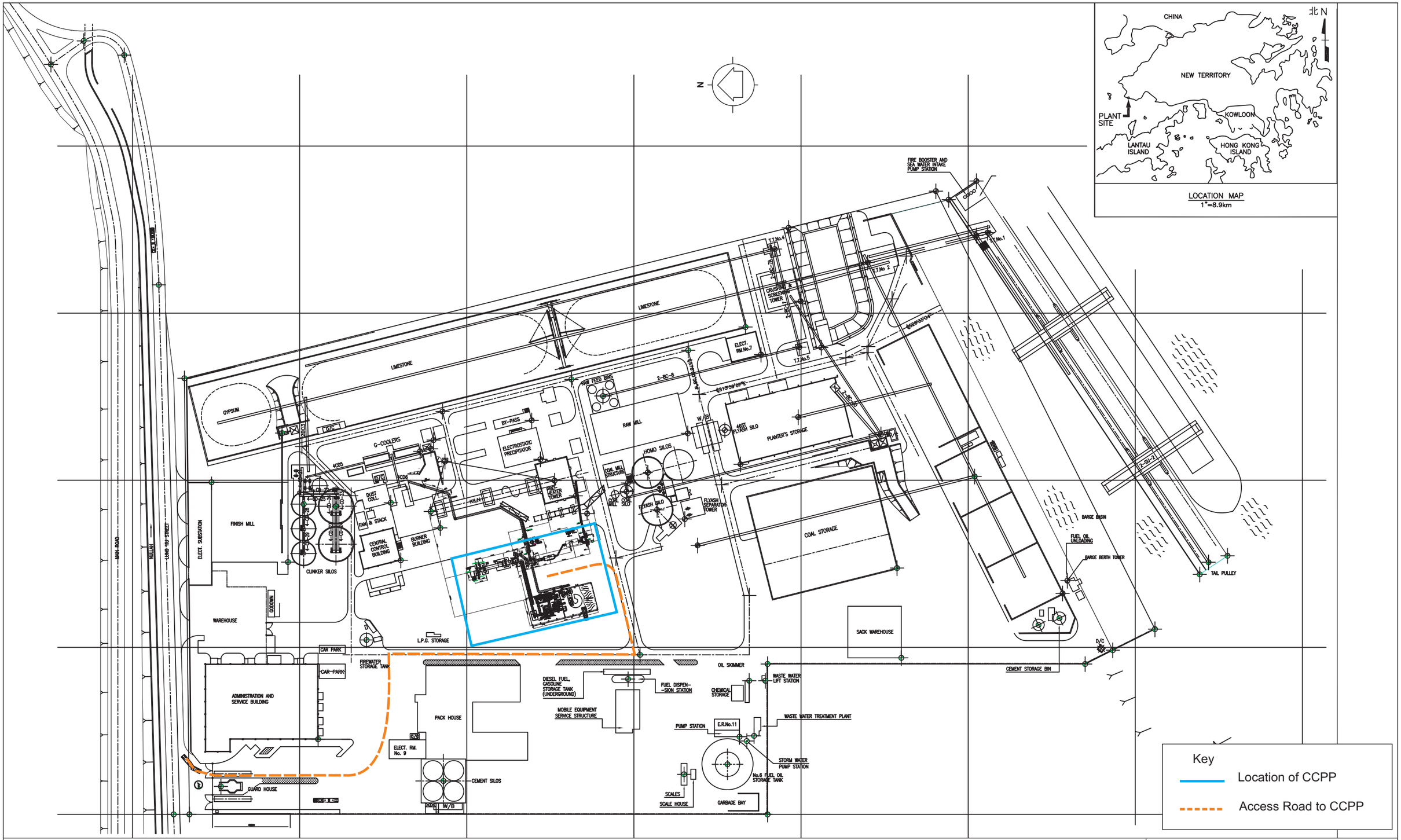

Figure 1.1a

Layout Plan of GICP and Location of CCPP

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arising from the Project; to recommend appropriate mitigation measures to control the potential environmental impacts so that it complies with the requirements of the EIAO-TM, and to confirm the environmental acceptability of the Project. Key environmental issues identified in the EIA Study Brief include air quality, land contamination, water quality and waste management implications.

The general approach for the assessment includes a description of the baseline environmental conditions, identification and evaluation of potential impacts and recommendations for mitigation measures and establishment of the environmental monitoring and audit requirements. The assessments in this EIA Study are conducted using well-proven and internationally accepted methods based on reasonable worst-case conditions.

2 PROJECT DESCRIPTION

2.1 THE CCPP

The pilot plant to co-combust MSW with cement production was developed by the Green Island Cement Company Limited (GIC) in collaboration with the Chemical Engineering Department of the Hong Kong University of Science and Technology (HKUST). The pilot demonstration was funded by the Innovation and Technology Fund under the University-Industry Collaboration Programme.

Continuous operation of the plant was started in early October 2005 and completed in December 2005. No more than 24 tonnes of MSW were treated per day during the pilot demonstration of the CCPP. During the operation of pilot plant, the GIC and HKUST obtained satisfactory results and sufficient design and operational data on the Co-Combustion technology. All MSW delivered to the site was treated and no MSW is currently stored on-site. All the Co-Combustion residues (including bottom ash and fly ash) were securely packed in labelled sealed bags and stored in the covered waste reception hall of the MRRF building.

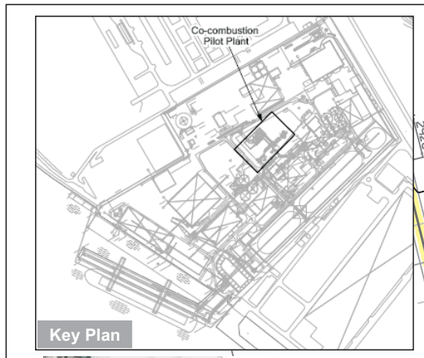
The pilot demonstration has fulfilled its objectives and the CCPP was closed down on 17 December 2005. It is necessary to demolish the whole pilot plant so that the Project Site could be released for the operation and future development of the GICP.

2.2 DEMOLITION METHODOLOGY

The CCPP has been decommissioned after the completion of the pilot demonstration. All structures and the associated foundation, and plant and equipment will be dismantled, cleaned (where necessary) and removed from the Project Site for reuse, recycled or disposal. The concrete slab of the Project Site will be demolished and the site will be backfilled with a layer of imported clean soil. The Project Site area will be levelled and landscaped. *Figure 2.2a* shows the general layout plan of the CCPP. *Figures 2.2b* to *2.2d* show the details of the plant and equipment and structure to be demolished.

The selection of preferred demolition/dismantling methods has made reference to the common demolition methods in Hong Kong and the characteristics of the Project such as size of the CCPP, building materials, degree of potential contamination, demolition/dismantling duration, etc to avoid adverse environmental impacts.

The main system and MRRF building of the CCPP are mainly made of steel while the fire service water tank and pump house are made of concrete. In a view of small size of the CCPP, the best option for dismantling the steel structures (eg the MRRF Building) and process equipment (eg the




Cyclones


Elevated Pipe


Elevated Pipe


Secondary Combustion Chambers


Dust Collector

Urea Tank

Pre-calciner

Fuel Oil Overhead Pipe


Heat Exchanger


Rotary Kiln

Working Platform


Leachate UST


Belt Conveyor


F.S. Pump House & Sprinkler Water Tank


Workshop & Reception Hall

Legends

Equipment / Structures to be demolished

Figure 2.2a

General Layout of CCPP

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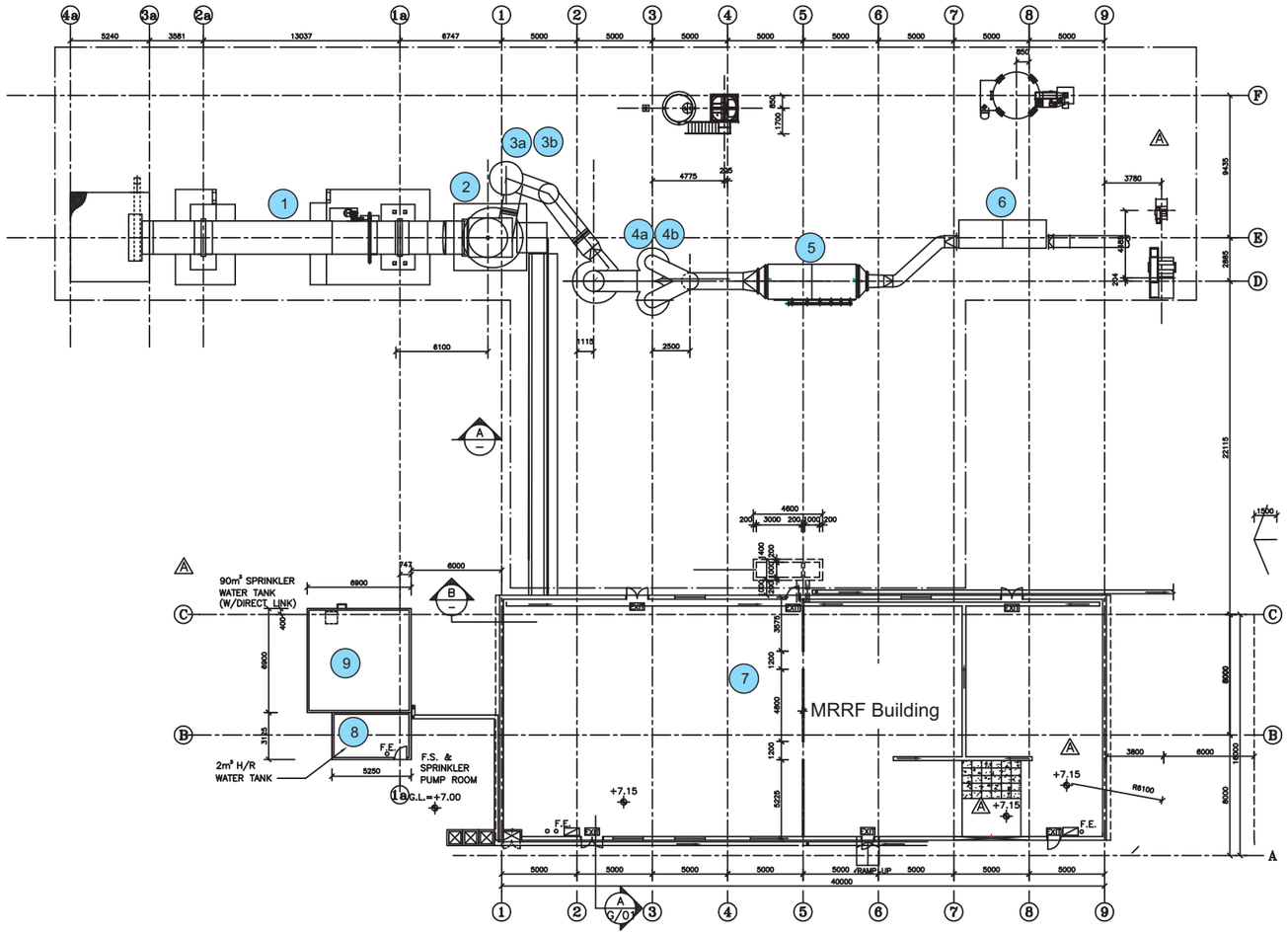
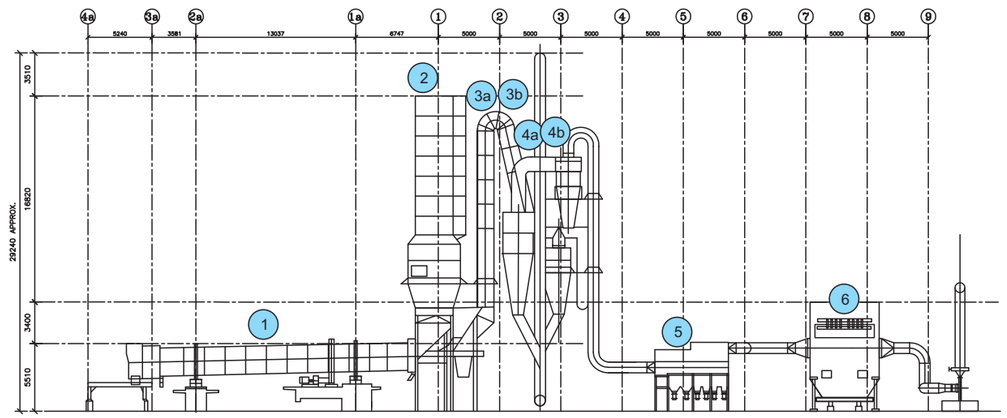
Plan View of CCPP



Elevation Plan of CCPP



Major equipment and building details	
Equipment	Dimension
1 Rotary Kiln	Dia 2.2 x21.6m long
2 Secondary Combustion Chamber	Dia 2.6 x16.8m long
3a Precalciner 1	Dia 2.2x11m long
3b Precalciner 2	Dia1.3x10m long
4a Cyclone 1	cyclone body Dia 2.4x 7.9m height
4b Cyclone 2	cyclone body Dia 1.7x 5.6m height
5 Heat exchanger	2m x7.6m x4.8m height
6 Dust collector	3.4m x 7.6m x10m height
7 MRRF building	40m x16m x 6.8m
8 FS water tank	7m x7m x 3.7m height
9 FS water pump house	5.3m x3.2m x2.6m height

Figure 2.2b

Structure to be Demolished (1)

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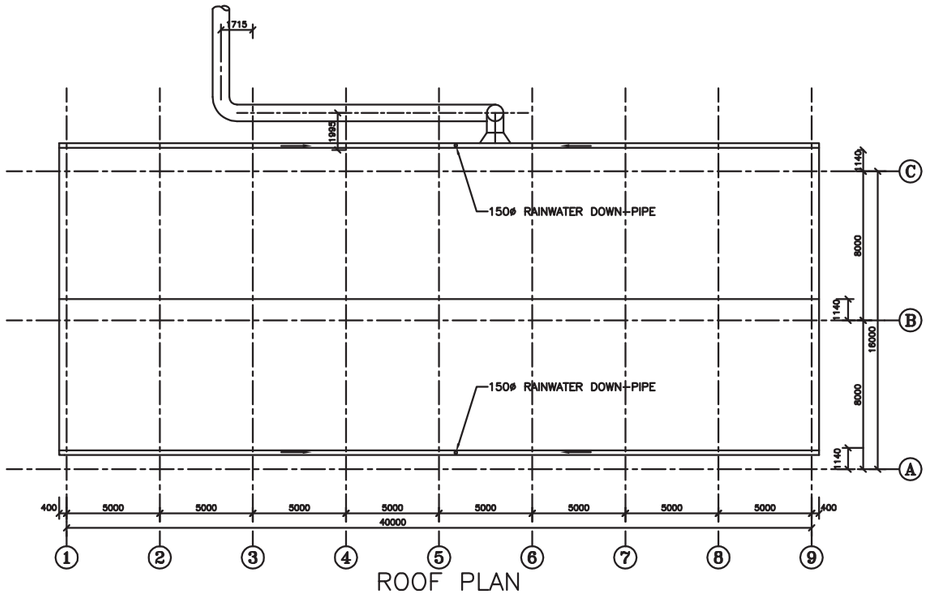
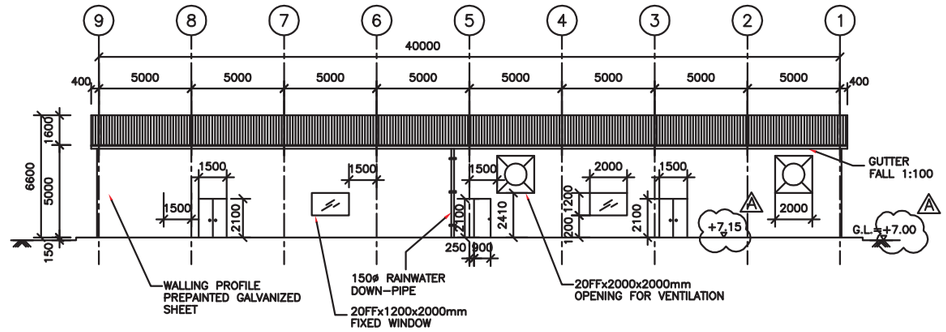
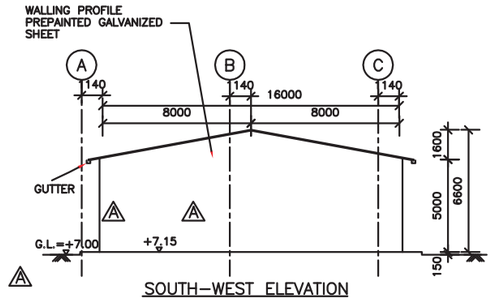


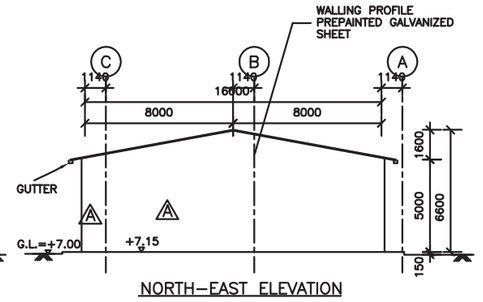
ROOF PLAN



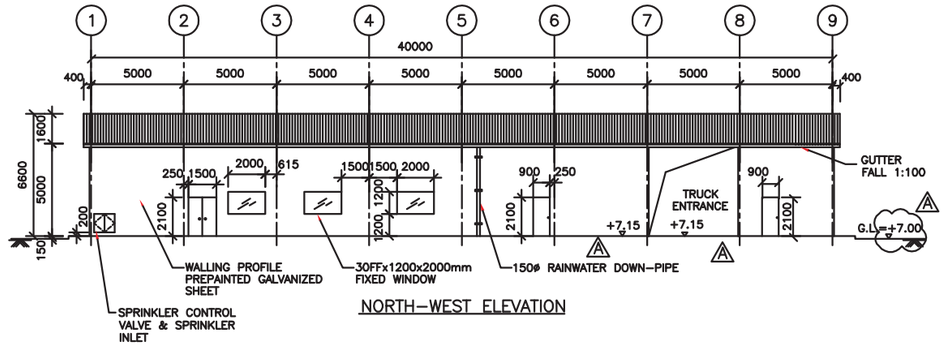
SOUTH-EAST ELEVATION



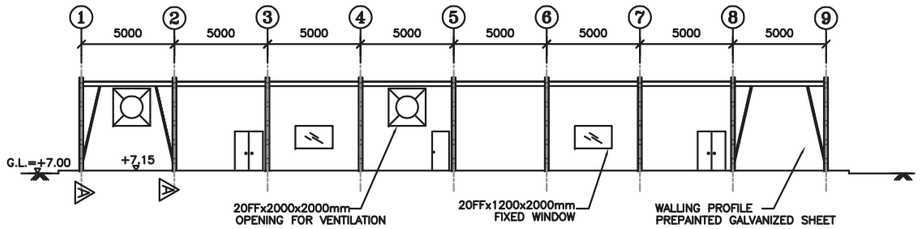
SOUTH-WEST ELEVATION



NORTH-EAST ELEVATION



NORTH-WEST ELEVATION



SECTION B

Figure 2.2c

Structure to be Demolished (2)
(Workshop and Reception Hall)

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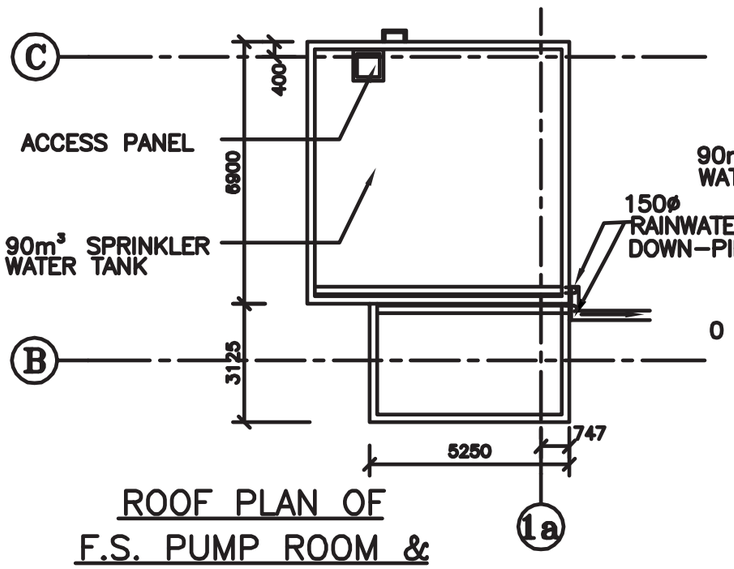
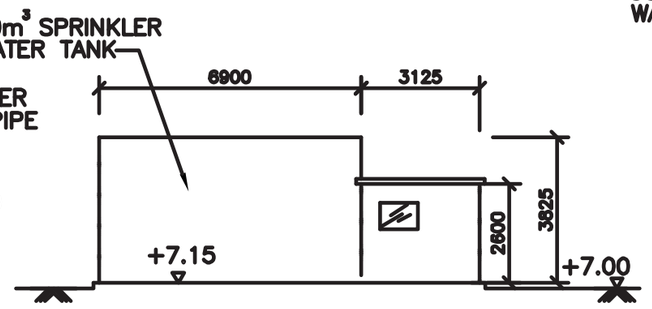
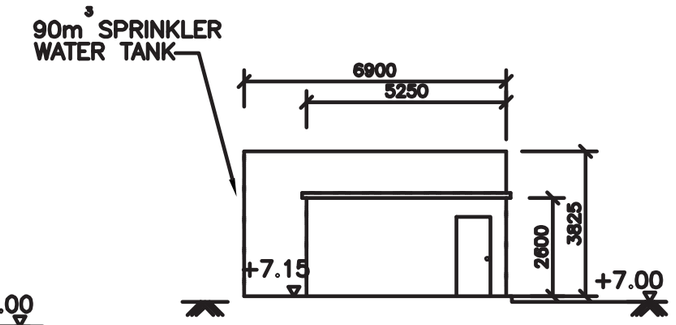


ROOF PLAN OF
F.S. PUMP ROOM &
WATER TANK



NORTH-EAST ELEVATION
OF F.S. PUMP ROOM &
WATER TANK



NORTH-WEST ELEVATION
OF F.S. PUMP ROOM &
WATER TANK

Figure 2.2d

Structure to be Demolished (3)
(Fire Services Water Tank and Pump Room)

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Co-Combustion unit) will be by loosing the flanges /cutting and lifting of the segments to the ground level. Mechanical cutting and thermal cutting are most common and will not cause significant environmental impacts. The sequence of the demolition works will be from the top to the bottom of the structures.

For the small concrete structures of the fire service water tank and pump house, the structure will be demolished by jack hammer, pneumatic or hydraulic breaker.

The overall sequence of demolition works is as follow:

- Cordon off the site and erection of hoarding;
- Disconnect the utilities (except for the power and water supplies to the fire services pump room and water tank);
- Dismantling and removal of all plant and equipment inside the MRRF building;
- Dismantling and removal of the Co-Combustion unit;
- Cleaning of the Co-Combustion unit within the enclosed cleaning workshop inside the MRRF building;
- Demolition of the steel structure of the MRRF building;
- Demolition of the fires services pump room and water tank;
- Demolition of the concrete slab and shallow footing foundation;
- Backfilling the site with clean soil;
- Provision of surface water drains at the site;
- Landscaping the Project site area.

The whole demolition process will be conducted in a safe manner for the protection of the workers and to minimise occupational health and safety hazards.

The duct works of the Co-Combustion unit and the gas cooler will be dismantled by removal of the bolts or cutting at the joints. The openings (both ends of ducts) will be immediately sealed with 2 layers of fire retardant polyethylene sheets to prevent escape of any dust within the duct. The sheets will be secured with duct tapes. The capped equipment sections/pieces will be lowered to ground level by crane and transported to the cleaning workshop for cleaning.

The refractory bricks of the rotary kiln will be removed before lifting the whole equipment down to the ground. The refractory bricks will be placed in sealed bags and disposed of at a designated landfill. The internal wall will be

properly cleaned with wet cloths or other suitable absorbents to remove the loose dust deposits. The steel frame of the equipment will then be cut into manageable sections and sold to scrap metal recyclers.

The pumps and control panels of the fire services system will be dismantled and sold. All water in the water tank will be drained out. The concrete wall of the water tank and the pump house will be demolished and removed by a pneumatic drill mounted backhoe. The concrete structures will be damped down before and during the demolition works to control dust. The steel reinforcement will be recovered as far as practicable for recycling. The broken concrete will be disposed of at the public fill reception facilities. The load will be properly covered with tarpaulin to minimise dust during transportation.

The materials recovery/recycling equipment (including shredder, conveyor belts, picking station, magnetic separator, eddy current separator, etc) in the MRRF building will be disassembled using powered mechanical hand tools and removed. Most of the plant and equipment are still in good serviceable conditions and will be sold to other MRRF operators or second hand equipment vendors. After the completion of the cleaning works (see *Section 2.3*) the MRRF building will be demolished progressively from top to bottom. The external non-loading bearing cladding or any non-structural elements will be removed first. Crane and lifting gear will be used where possible to support the structural beams and columns whist they are being cut and lowered to the ground. Air-powered wrenches, cutting torches, cranes and similar industrial equipment will be used. The steel beams and column will be cut to manageable size to facilitate transportation. This together with the metal claddings and scrap metals from the MRRF equipment will be sold to the scrap metal recyclers.

2.3 CLEANING METHODOLOGY

After all the machinery and equipment were removed, half of the MRRF building will be converted into a cleaning workshop for cleaning works. The cleaning workshop will be provided with forced ventilation and a slight negative pressure would be maintained within the cleaning workshop during the cleaning works. The exhaust air from the cleaning workshop will be cleaned using a High Efficiency Particulate Air (HEPA) filter prior to discharge to the atmosphere.

It is expected that a small quantity of residues (e.g. fly ash, bottom ash) will remain inside the Co-Combustion unit since the operation of the CCPP was completed. All residues remaining in the CCPP system will be removed by a vacuum cleaner with a HEPA filter. Any residues attached within the equipments will be removed by a combined method of scraping and cleaning. The internal surfaces of the equipments will be cleaned by wet wiping. To minimise the exposure of residues, the workers will wear appropriate personal protection equipment (including face mask, protective gloves, overcoat, and safety boots).

The scraped lining material will be placed in sealed bags and disposed of at a designated landfill. The filtered materials, and cloths used for wet wiping will be packed in sealed bags and disposal of at a designated landfill. With proper precautionary measures and handling procedures in place, contamination of steel structure of the MRRF is not anticipated.

After completion of the cleaning process of the Co-Combustion equipment and removal of the equipment, the cleaning workshop will be vacuum cleaned and wet wiping. The cleaning materials will be disposed of at designated landfill.

2.4 PROJECT PLANNING AND IMPLEMENTATION

The tentative programme for the demolition, cleaning and disposal works is shown in *Table 2.4a*.

Table 2.4a Tentative Programme for the Demolition, Cleaning and Disposal Works of CCPP

Tasks	Tentative Date
Issue of Environmental Permit by EPD	June 2009
Issue of Buildings Department Permit	July 2009
Demolition Works Tendering	June 2009
Site Preparation for Demolition Works	July 2009
Demolition and Cleaning	August to December 2009
Disposal of Scrap Materials	September to December 2009
Backfilling & Re-surfacing	December 2009
Completion of Demolition and Decommissioning	December 2009

3 ENVIRONMENTAL IMPACTS

3.1 INTRODUCTION

The environmental outcomes associated with the demolition and cleaning of the CCPP have been assessed in the EIA Study. The key findings and recommendations are summarised below.

3.2 AIR QUALITY

The number of construction plant and equipment (1 to 2 mobile cranes, and 1 to 2 backhoe (with pneumatic drill mounted on the backhoe)) used for the demolition works will be limited. Only a few dump trucks/lorries will be working on site at any one time to remove the demolished concrete and scrap metals. The air emissions from the operation of these plant and equipment will be minimal and it is therefore not anticipated that it will cause adverse air quality impact to the identified Air Sensitive Receivers (ASRs).

The additional road traffic generated during the decommissioning of the CCPP will be small (i.e. a maximum of 10 truck trips per day associated with the disposal of C&D materials). The potential air quality impacts due to vehicular emissions are therefore, expected to be minimal.

The Co-Combustion unit will be dismantled by removal of the bolts or cutting at the joints. The openings (both ends of ducts) will be immediately sealed with two layers of fire retardant polyethylene sheets to prevent escape of any dust from the duct. The sheets will be secured with duct tapes. The capped equipment sections/pieces will be lowered to ground level. The segments of the equipment will be transported to the cleaning workshop within the MRRF building. No significant dust and air emissions will be generated from this activity.

After removal of the materials recovery equipment from the MRRF building, the MRRF will be used as the cleaning workshop for the Co-Combustion unit. The cleaning workshop will be provided with forced ventilation and maintained with a slight negative pressure during the cleaning works. The exhaust air will be cleaned with a HEPA filter prior to discharge to the atmosphere. The internal wall of the ducts and equipment will be damped with water spray and properly cleaned with wet cloths. The potential dust/residues release to the atmosphere due to the cleaning process will be minimal.

The chemical analysis of the Co-Combustion residues contains very low concentration of heavy metals and extremely low concentration (in part per trillion levels) of dioxins and furans. The proposed demolition method has been carefully designed to minimise potential release of residues during the dismantling and cleaning of the plant and equipment. With the implementation of control measures recommended in *EIA Report*, the

emissions of the residues will be effectively controlled. The emissions of dioxins and heavy metals associated with the residues will therefore be minimal and will not cause adverse air quality impact to the identified ASRs.

After the completion of the cleaning of the co-combustion unit, the cleaning workshop will be cleaned. The MRRF building will be disassembled. Crane and lifting gear will be used where possible to support the structural beams and columns whist they are being cut and lowered to the ground. Air-powered wrenches, cutting torches, cranes and similar industrial equipment will be used. The air emissions from the operation of these plant and equipment will be minimal and no adverse air quality impact is anticipated.

The concrete structures (fire services water tank and pump house, concrete slab and foundation) will be sprayed with water immediate prior to and regularly during the demolition works to control potential of dust emissions. The broken concrete and scrap metals will be placed in separate skips and removed off-site as soon as practicable. With the implementation of the proposed dust and air control measures, it is not anticipated that the demolition of the concrete structures will cause adverse dust impacts to the identified ASRs.

The CCPP Site will be backfilled with imported clean soil and restored into an open area. Due to the relative small area of the CCPP site and small volume of soil to be handled on site at any one time, it is not anticipated that the minor earthworks will cause adverse dust impact to the identified ASRs with the implementation of the dust control measures described in the *Air Pollution Control (Construction Dust) Regulation*.

GIC will implement good site practices and dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* and the recommended mitigation measures presented in the *EIA Report* throughout the demolition and cleaning works. With respect to the nature of the works and the small scale of the concrete structures, the demolition and cleaning works will not cause adverse air quality impact to the identified ASRs.

3.3 LAND CONTAMINATION

The assessment of land contamination sources and the potential impacts to sensitive receptors were investigated in accordance with the EPD's *Guidance Manual for Use of Risk-based Remediation Goals (RBRGs) for Contaminated Land Management* (the RBRG Guidance Manual), the associated *Guidance Note for Contaminated Land Assessment and Remediation,* and the EPD's *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshop*.

Site appraisal comprising a site visit, and a review of background information and land history in relation to possible land contamination was conducted. Potential sources of contamination and associated impacts, risks or hazards are identified in the *Contamination Assessment Plan*. Land contamination assessment was carried out and results presented in the *Contamination Assessment Report*. The results of the site investigation works determined that:

- Total petroleum hydrocarbon (TPH)/ benzene, toluene, ethyl benzene, and xylene (BTEX) were below the reported detection limits in any of the soil samples collected;

- Concentrations of priority pollutant metals detected were well below the RBRG standards; and

- Levels of PCBs, dioxins and furans analysed in all samples were well below the RBRG values.

Excavation works proposed for the demolition works will be limited to the concrete sub-structures and underground storage tank. No soil excavation or groundwater extraction will be required for the Project and hence no off-site disposal of soil and groundwater will be required.

The substructure areas of the Project Site will be filled using clean imported fill materials and rehabilitated as green lawn and open area. The potential for human contact with any underlying contamination in the future is considered low. As the result of the above, no potential impact from the contaminated soil is anticipated.

The Project Site's future use remains industrial (manufacture of cement and cement related products) and is surrounded by remaining areas of the GICP. It is considered that the only potential receptors at risk might be site workers involved in decommissioning and demolition works. As the contaminants analysed were either not detected or with concentrations well below the RBRG guideline values, the potential risk to the workers due to demolition activities will be minimal.

3.4 WASTE MANAGEMENT IMPLICATIONS

The decommissioning of the CCPP will generate a variety of wastes (including public fill (about 1,806 m^3), scrap metals (about 369 tonnes), Co-Combustion residues (about 200 tonnes), refractory bricks and lining (about 345 tonnes), general refuse (about 9.1 kg d^{-1}) and sewage (about 2.1 m^3 d^{-1})) and recyclables (MRRF Equipment , unused reagents, etc). The waste management implications and environmental impacts associated with the handling, storage and disposal of these wastes have been assessed.

The public fill will be disposed of at the Tuen Mun Area 38 Fill Bank.

The physical properties and chemical analysis results show that the characteristics of the Co-Combustion residues are similar to those of the typical clinker raw materials. The residues contain very low levels of heavy metals and extremely low levels of (in the order of part per trillion) dioxins and furans, which will not have adverse impacts on the gaseous emissions and the cement plant. The residues will be used as an alternative feedstock for the cement clinker production.

With the proposed loading rate of 0.5% w/w of the Co-Combustion residue to other raw materials for cement clinker production, it will not adversely affect

the environmental performance of the cement plant. It will take about 7 days for the cement plant to consume all the residues. There is no concern of long-term environmental impacts associated with the proposed residue reuse option. This will avoid the disposal of residues at landfill.

As a last resort, the residues will be disposed of at a landfill designated by the EPD. The Toxicity Characteristic Leaching Procedure (TCLP) tests indicate that the concentrations of heavy metals in the leachate arising from the residues are well below the respective limits for landfill disposal. The residues can therefore be disposed of at the designated landfill without further treatment. An advance agreement should be obtained from the Landfill Authority (EPD) for the disposal of the residues at landfill.

The refractory bricks and lining of the Co-Combustion unit and waste generated from cleaning of the Co-Combustion unit will be placed in sealed polyethylene bags and disposed of at a landfill designated by the EPD.

The MRRF equipment is still in good serviceable condition and will be sold to other MRRF operators or second hand equipment vendors. Scrap metals and unused reagents will be recycled.

Due the small scale of the CCPP, the quantities of public fill, chemical waste, general refuse, sewage to be generated will be small. With the implementation of the recommended mitigation measures in this *EIA Report*, the handling and disposal of these wastes will not cause adverse environmental and traffic impacts.

3.5 WATER QUALITY

Clean surface runoff from the Project Site will be diverted to the existing drainage system of the GICP which will lead to the on-site stormwater detention pond. Suspended solids will be settled out in the pond before discharging into the stormwater drainage. No unacceptable impact to water sensitive receivers is anticipated.

The cleaning works will be carried out inside the cleaning workshop of the MRRF building. During the cleaning process, wet wiping and vacuum cleaning will be used to clean the internal lining of the ducting/equipment and remove the loose dust particles deposited on the surface of the ducts and equipment. Water flushing will not be used to clean the plant and equipment of the Co-Combustion unit and hence the wastewater generated from the cleaning works will be minimal. All wastewater will be treated in the existing on-site wastewater treatment plant (WWTP) of the GICP.

A small quantity of sewage (about 2.1 m^3 per day) will arise from the demolition workforce. The existing toilet facility of the GICP will be available to the construction workforce. The sewage will be discharged to the on-site WWTP. No adverse impact water quality is anticipated due to the treatment and disposal of sewage generated from the workforce.

With the implementation of general good site practices, the demolition of CCPP will not cause adverse water quality impact.

3.6 ENVIRONMENTAL MONITORING AND AUDIT

No environmental monitoring for air quality and water quality will be required.

Monthly site audits will be undertaken jointly by the site representative of GIC and the contractor during the Project to ensure that dust control, construction waste and site runoff and are managed in accordance with the good site practices recommended in *EIA Report*.

An *Implementation Schedule*, containing the recommended mitigation measures, monitoring and audit requirements, and the implementation agent are presented in *Annex C* of the *EIA Report*.

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4 OVERALL CONCLUSIONS

In accordance with the *EIA Study Brief* and the guidance in the *EIAO-TM*, the EIA Study has identified and assessed potential environmental impacts (including air quality, land contamination, waste management and water quality) associated with the Project.

The study concludes that with the implementation of the recommended environmental control measures during the Project, no unacceptable environmental impacts are envisaged.

Regular site audits are recommended to ensure proper implementation of the recommended mitigation measures.

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目錄

1 簡介

1.1 背景

爲回應香港特區政府爲應付香港廢物棄置危機而興建縮減廢物體積設施的倡議，青洲英坭有限公司（工程倡議人）在屯門踏石角的青洲水坭廠建立一座示範性規模的廢物轉化能源設施（包括物料回收/循環再造設施及一個用作高溫處理廢物的環保熔爐）（以下稱爲環保廢物熔化系統環熔試驗設施）（簡稱「環熔設施」）(見*圖 1. 1a*)。

環熔設施的目的在於確定作爲綜合廢物管理系統一部分的物料回收/循環再造設施在運作上的技術及經濟問題；展示環保廢物熔化系統能符合環境保護署（以下簡稱「環保署」）頒佈的《焚化爐（都市固體廢物）最好的切實可行方法指南》（BPM 12/1(08)的要求；及取得工程資料以改進環保廢物熔化系統的設計。

環熔設施的興建工程於2005年2月完成，而設施的測試已於2005年4月及7至8月進行以展示其性能。環熔設施的運作於2005年10月初開始及於2005年12月完成；每天處理不多於24公噸都市固體廢物，運作時間累積合共11星期。在試驗目標達到後，環熔設施於2005年12月17日停止運作。

1.2 目標

根據《環境影響評估條例》附表2第II部份第三項的規定，此都市固體廢物焚化爐被介定爲「指定工程項目」。因此，清拆環熔設施（以下稱爲「本工程項目」）會被介定爲「指定工程項目」，並需要在清拆前取得環境許可證。

清拆環熔設施的工程項目簡介（PP－315/2007）已提交予環保署以申請《環境影響評估條例》下的環評研究概要，而該研究概要（ESB－164/2007）已於2007年6月7日發出，以界定該環評研究的工作範圍。

環境影響評估（環評）研究乃根據環評研究概要及《環境影響評估程序的技術備忘錄》（以下簡稱《環評技術備忘錄》）規定的評估方法指引進行，以評估本工程項目可能導致的環境影響。環評研究的整體目的是就本工程項目的性質及引起的潛在環境影響提供相關

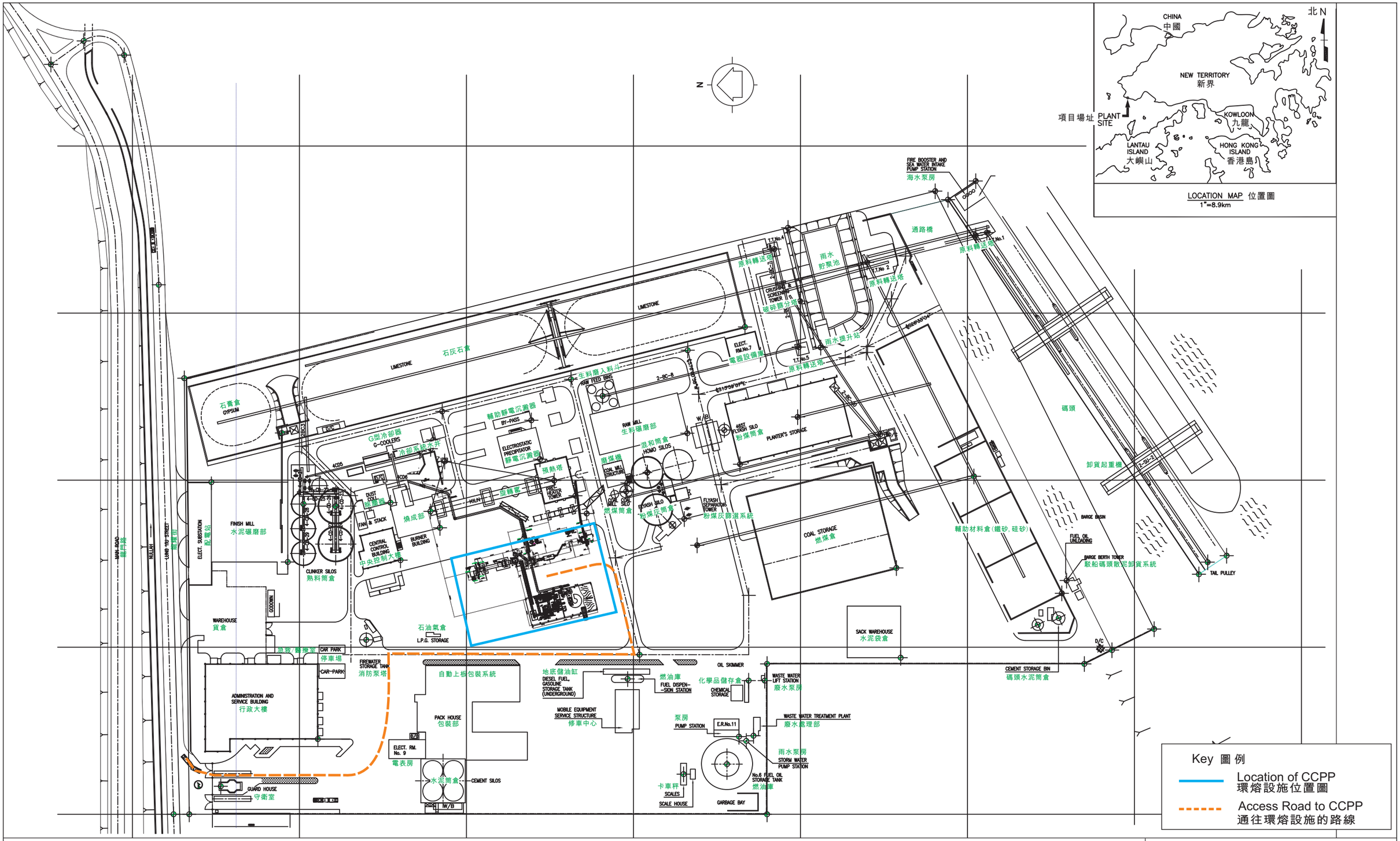

Figure 1.1a
圖1.1a

Layout Plan of GICP and Location of CCPP
青洲英坭水泥廠整體佈置及環熔設施位置圖

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資訊，提出適當的緩解措施以控制潛在的環境影響，使本項目符合《環評技術備忘錄》的要求，並確認本工程項目在環境影響方面的可接受性。環評研究概要中已確定的主要環境事項包括空氣質素、土地污染、水質及廢物管理影響。

評估的一般方法包括描述基本環境狀況、辨別及評估潛在影響、提出緩解措施及確立環境監察及審核要求。本環評研究是根據在合理的最壞情況下，以經驗證可靠及受國際認受的方法進行。

2 *項目描述*

2.1 環熔設施

環熔設施（把廢物處理融合於水泥工藝當中）是由青洲英坭有限公司及香港科技大學化學工程學系共同合作開發。這試驗示範是由創新及科技基金轄下的大學及產業合作計劃提供資金支援。

環熔設施的運作於自2005年10月初開始及於2005年12月完成。在運作期間，每天處理不多於24公噸的都市固體廢物。在試驗計劃中，青洲英坭有限公司及香港科技大學在環保廢物熔化技術上取得滿意的成果及充足的設計及運作數據。所有運送到環熔設施的都市固體廢物都已經被處理，現場目前並無存放任何都市固體廢物。所有熔化殘餘物（包括爐底灰及飛灰）均安全地裝入已標籤的密封袋內並存放於物料回收/循環再造設施大樓內的廢物接收廳內。

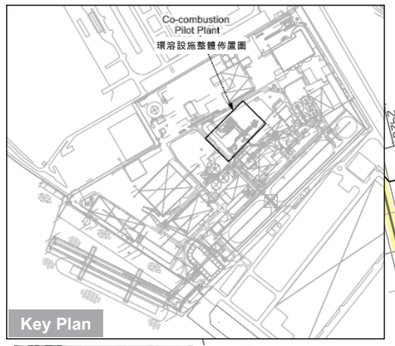
該試驗計劃已達到了其目的，而環熔設施已於2005年12月17日起停止運作。整個設施須進行拆卸，令本工程項目場地可用作青洲英坭水泥廠的運作及未來發展。

2.2 拆卸方法

環熔設施已於本試驗示範結束後停止運作。所有建築物及其地基、系統及設備將會被拆除、清理（如需要）及移走作重用、回收或處理。本工程項目場地的混凝土地台會被拆除移走，並以一層清潔的泥土覆蓋。本工程項目場地範圍亦會被平整及綠化。*圖2.2a* 顯示環熔設施的整體佈置圖。*圖2.2b*至*2.2d* 則顯示將被拆除的設備及建築物的詳細資料。

挑選最合適的拆除/拆卸方法時已參考了普遍用於香港的拆除方法及本工程項目的特性，如環熔設施的大小、建築材料、潛在污染程度、所需的拆除/拆卸時間等等，以避免對環境帶來不良影響。

環熔設施的主要系統及物料回收/循環再造設施大樓主要以鋼鐵建造，而消防水箱及泵房則以混凝土建造。鑒於環熔設施的規模小，拆除鋼鐵建築（如物料回收/循環再造設施大樓）及工藝設備（如環保廢物熔化系統）的最好方法是透過鬆卸凸緣/將拆卸部分切割及吊運至地面。機械切割及熱能切割爲最常用方法且不會對環境造成重大影響，拆卸工作的次序會由建築物的頂部開始至其底部。




Cyclones 氣旋淨化器


Elevated Pipe 架空管道


Elevated Pipe 架空管道


Secondary Combustion Chambers
二次焚燒爐


Dust Collector 除塵器


Rotary Kiln 旋轉窯


Heat Exchanger 熱能轉換器


Leachate UST 地底污水儲存缸


Belt Conveyor 輸送帶


F.S. Pump House & Sprinkler Water Tank
消防水箱及泵房


Workshop & Reception Hall
物料回收 / 循環再造設施大樓

Legends圖 例

Equipment / Structures to be demolished
需折卸的設備/建築物

Figure 2.2a
圖2.2a

General Layout of CCPP
環溶設施整體佈置圖

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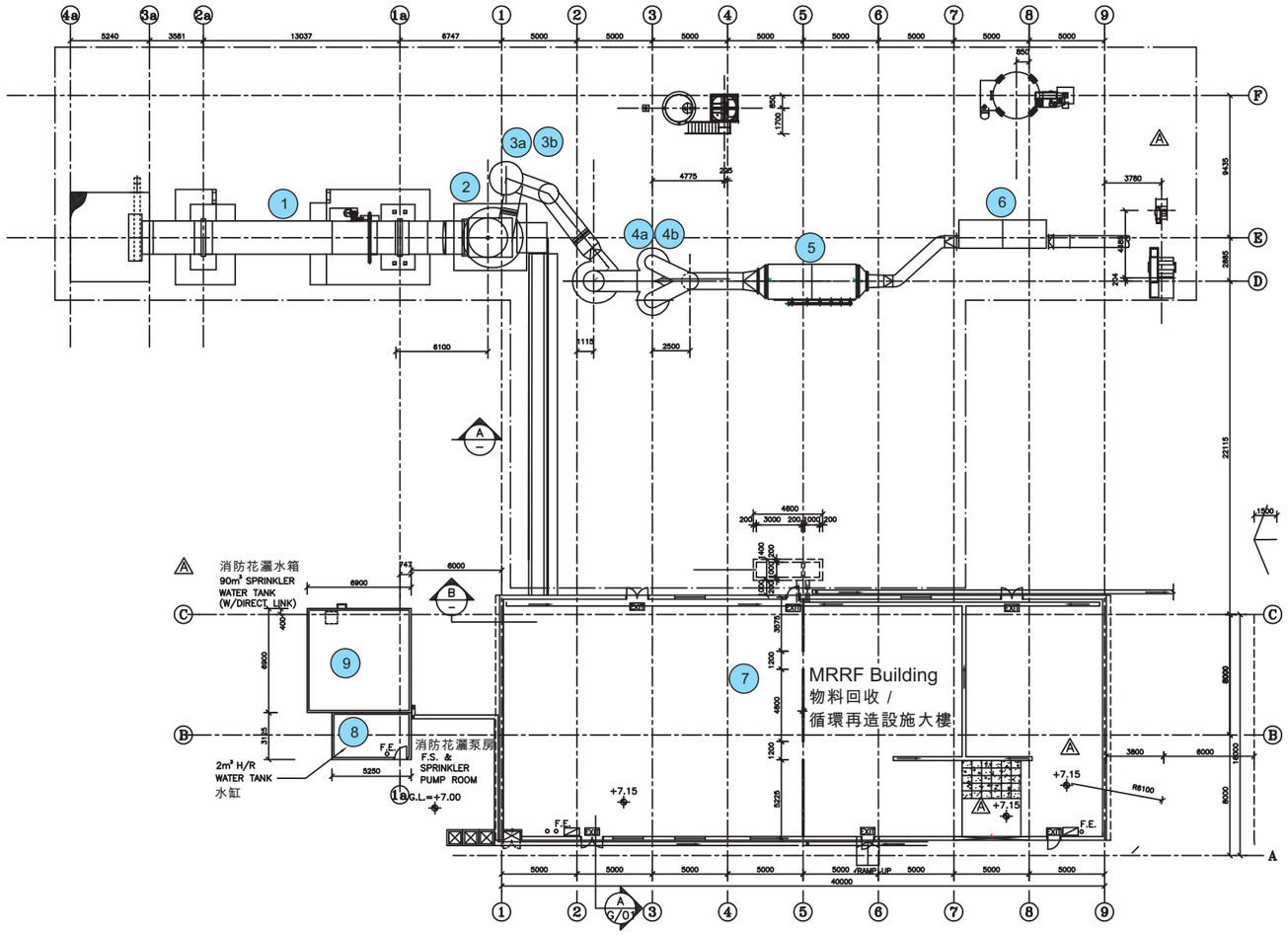
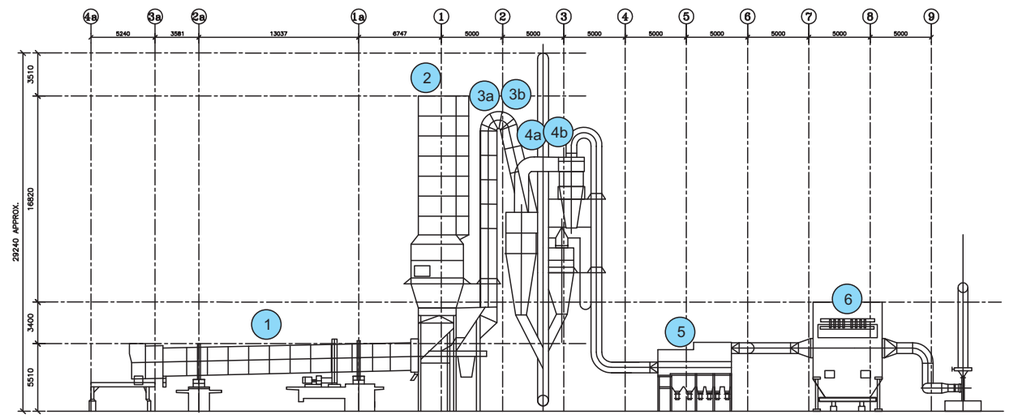
Plan View of CCPP
環溶設施平面圖



Elevation Plan of CCPP
環溶設施橫切面圖



Major equipment and building details 主要設備及建築物

Equipment 設備	Dimension 建築物尺碼
1 Rotary Kiln 旋轉窯	Dia 2.2 x21.6m long 直徑 2.2 x21.6米 長
2 Secondary Combustion Chamber 二次焚燒爐	Dia 2.6 x16.8m long 直徑 2.6 x16.8米 長
3a Precalciner 1 預段燒爐 1	Dia 2.2x11m long 直徑 2.2x11米 長
3b Precalciner 2 預段燒爐 2	Dia1.3x10m long 直徑 1.3x10米 長
4a Cyclone 1 氣旋淨化器 1	cyclone body Dia 2.4x 7.9m height 氣旋淨化器直徑 2.4x 7.9米 高
4b Cyclone 2 氣旋淨化器 2	cyclone body Dia 1.7x 5.6m height 氣旋淨化器直徑 1.7x 5.6米 高
5 Heat exchanger 熱能轉換器	2m x7.6m x4.8m height 2米 x7.6米 x4.8米 高
6 Dust collector 除塵器	3.4m x 7.6m x10m height 3.4米 x 7.6米 x10米 高
7 MRRF building 物料回收/循環再造設施大樓	40m x16m x 6.8m 40米 x16米 x 6.8米
8 FS water tank 消防水箱	7m x7m x 3.7m height 7米 x7米 x 3.7米 高
9 FS water pump house 消防泵房	5.3m x3.2m x2.6m height 5.3米 x3.2米 x2.6米 高

Figure 2.2b
圖 2.2b

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DATE: 06/03/2009

Structure to be Demolished (1)
需清拆的設備 (1)

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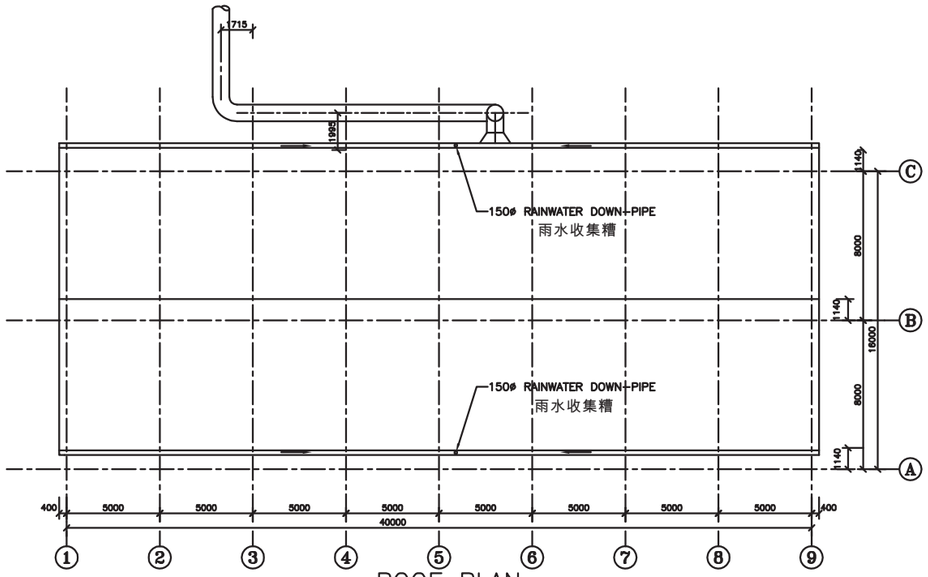
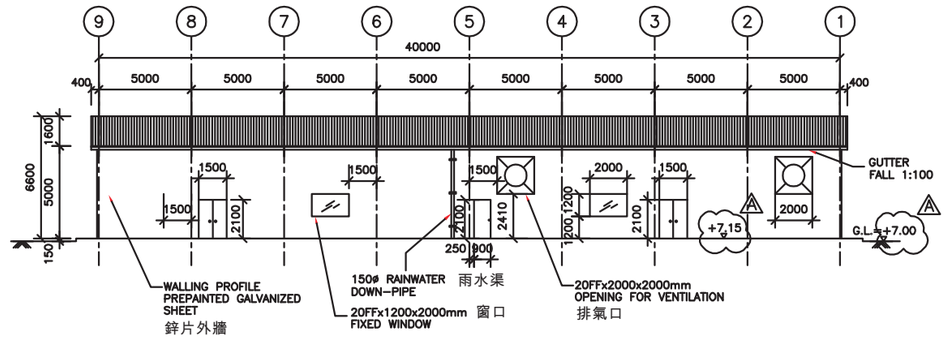
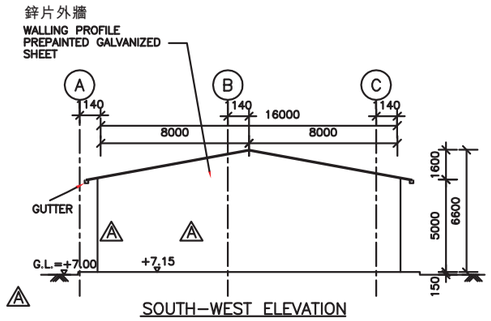


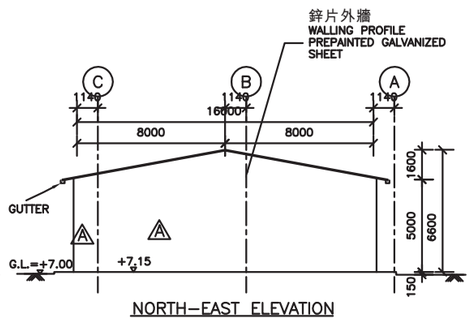
ROOF PLAN
天花平面圖



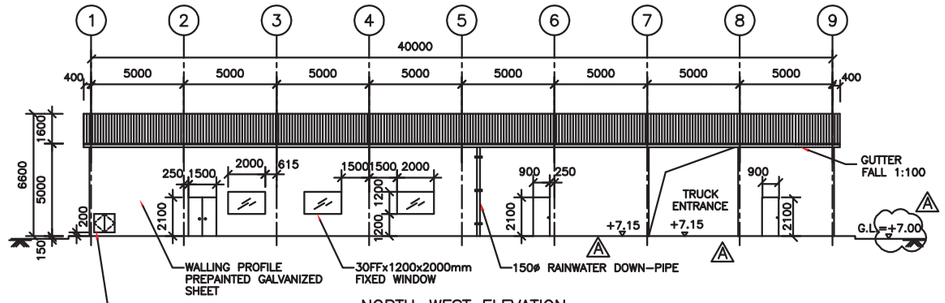
SOUTH-EAST ELEVATION
橫切面 - 東南面



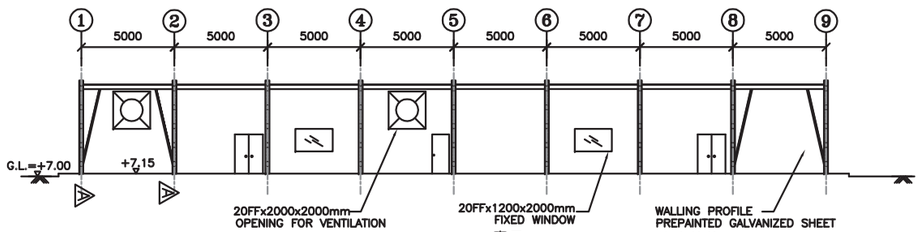
SOUTH-WEST ELEVATION
橫切面 - 西南面



NORTH-EAST ELEVATION
橫切面 - 東北面



NORTH-WEST ELEVATION
橫切面 -西北面



SECTION B
橫切面 - 切面圖

Figure 2.2c
圖2.2c

FILE: 0071019I3
DATE: 04/03/2009

Structure to be Demolished (2)
(Workshop and Reception Hall)
需清拆的設備 (2) - 物料回收 / 循環再造設施大樓

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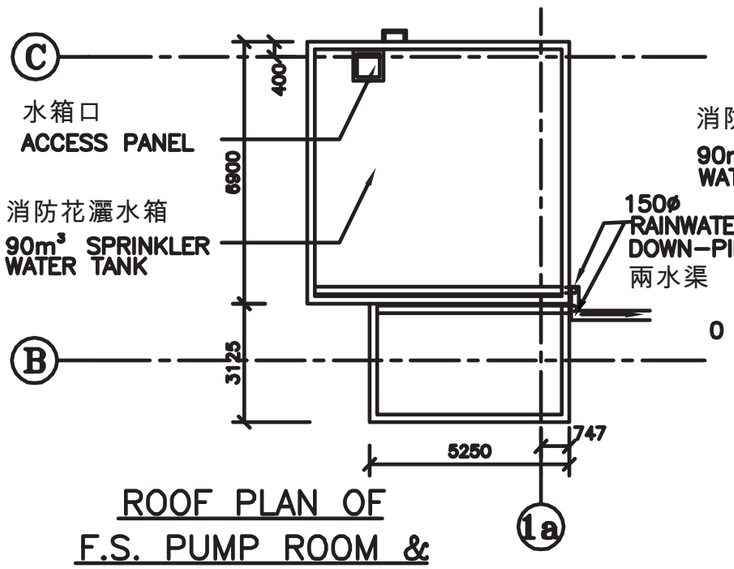
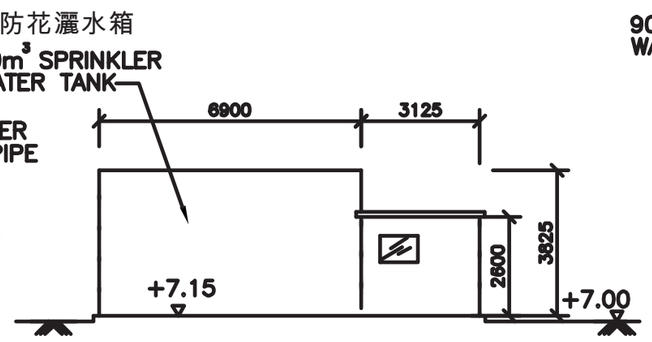
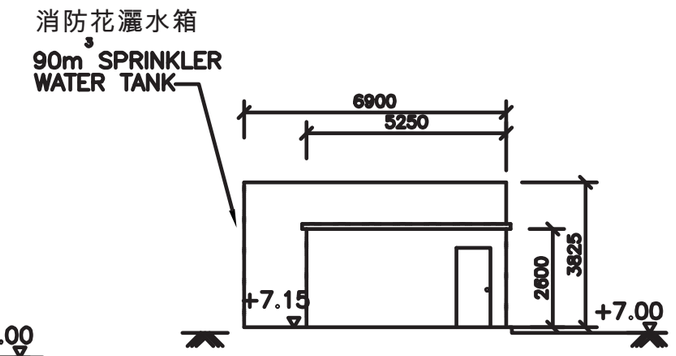


ROOF PLAN OF
F.S. PUMP ROOM &
WATER TANK
消防水箱及泵房
天井面



NORTH-EAST ELEVATION
OF F.S. PUMP ROOM &
WATER TANK
消防水箱及泵房
橫切面 - 東北面



NORTH-WEST ELEVATION
OF F.S. PUMP ROOM &
WATER TANK
消防水箱及泵房
橫切面 - 西北面

Figure 2.2d
圖 2.2d

FILE: 0071019I2
DATE: 04/03/2009

Structure to be Demolished (3)
(Fire Services Water Tank and Pump Room)
需清拆的設備 (3)-(消防水箱及泵房)

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消防水箱及泵房的小型混凝土結構，將會用風砲、氣動或油壓破碎機拆除。

拆卸工作的整體次序如下：

- 封鎖工地並豎立地盤圍板；
- 切斷水電供應（爲消防泵房及水箱提供電力及水源的設施除外）；
- 拆除並移走物料回收/循環再造設施大樓內的所有機械設備；
- 拆除並移走環保廢物熔化系統的裝置；
- 在物料回收/循環再造設施大樓內的密閉清理工場清理被拆卸的環保廢物熔化系統的組件；
- 拆除物料回收/循環再造設施大樓的鋼鐵結構；
- 拆除消防泵房及水箱；
- 拆除混凝土地台及淺地基；
- 以泥土回填工地；
- 在工地舖設地面水排水渠；
- 綠化工地。

整個拆除過程會以安全方式實施，以保障工人，並將職業健康及安全的危險因素減至最低。

環保廢物熔化系統及氣體冷卻機的喉管將透過移除螺絲或切割接合處予以拆除。開口（即喉管兩端）將立即以兩層防火膠布密封以防止喉管內的灰塵溢出。防火膠布亦會以水管膠布牢固封好。拆卸的部件/零件會用起重機吊到地面，並運至清理工場進行清理。

把整個旋轉窯吊至地面前，窯內的耐火磚將先被移除，放置在密封袋內，並運往指定的堆填區棄置。窯的內壁會以濕布或其他合適的物料作適當清理，以清除鬆散的灰塵。設備的鋼鐵結構會被切割成易於處理的大小。

消防水泵和控制板予以拆除後會售予回收商。水箱內的水會被全部排出。水箱和泵房的混凝土結構會以風鑽挖土機拆除及移走。在拆

除工作前或進行期間會於混凝土結構上灑水以防止塵土飛揚。鋼筋盡量回收，並循環再造。混凝土碎塊會棄置於公眾填料接收設施，泥頭車斗會以帆布妥善覆蓋以減少運送時所產生的灰塵。

物料回收/循環再造設施大樓內的設備（包括輾碎機、輸送帶、檢選站、磁力分離機、渦流分離機等）會以機動手提工具拆除並移走。大部分器材及設備仍然運作良好，將會售予其他物料回收/循環再造承辦商或二手設備供應商。在清理工作結束後（見*第2.3節*），物料回收/循環再造設施大樓將由頂部起至底部逐步拆除。首先會移走非承重外牆面板或任何非結構組件。當切割和吊運結構樑柱時，於有需要時會使用起重機及起重裝置支撐；同時亦會使用氣動扳手、火焰切割器、起重機及類似的工業設備。鋼樑柱將會切割至易於處理的大小以便於運輸。鋼樑柱及金屬面板會連同物料回收/循環再造設施的金屬廢料售予金屬廢料回收商。

2.3 清理方法

在移走所有機械及設備後，物料回收/循環再造設施大樓的其中一半會用作清理工場以清理拆卸後的環保廢物溶化系統的組件。清理工場將設置抽風設備，並於清理工作進行期間維持輕微負壓。清理工場內的廢氣排出室外前，會先以高效能的空氣粒子隔濾系統進行過濾。

在環熔設施停止運作後，仍有少量的殘餘物（如飛灰、爐底灰）殘留在環保廢物熔化系統內。系統內的殘餘物會以附有高效能空氣粒子隔濾系統的吸塵機清除。附於設備內的殘留物而又不能用吸塵機清除會使用擦除的方法予以清除。設備的內壁會以濕抹方式清潔。爲減少與殘餘物的接觸，工人須著上適當的個人防護裝備（包括面罩、防護手套、外衣和安全靴）。

設備內壁的隔熱層被拆除後會放置於密封袋內，並運往指定的堆填區棄置。用過的過濾物料及清理用的抹布亦會放置於密封袋內，並運往指定的堆填區棄置。透過適當的預防措施和處理程序，預期清理工序將不會污染物料回收/循環再造設施的鋼鐵架構。

環保廢物熔化系統設備的清理工作完成後，清理工場會進行除塵及濕抹。清潔物料會運往指定的堆填區棄置。

2.4 項目規劃及實施

*表2. 4a*列出拆除、清理及棄置環熔設施的時間表。

表2. 4a 環熔設施的拆除、清理及棄置工作時間表

工作	暫定日期
獲環保署發出環境許可證	2009年6月
獲屋宇署發出許可証	2009年7月
拆除工程招標	2009年6月
拆除工程的現場準備	2009年7月
拆除及清理	2009年8月至12月
廢料處理	2009年9月至12月
回填工地及重鋪地面	2009年12月
完成拆除及清理工作	2009年12月

3 環境影響

3.1 簡介

環評研究就拆除及清理環熔設施對環境的影響作出評估。主要結果及建議概述如下。

3.2 空氣質素

拆卸工程使用有限的機械設備（一至兩台流動起重機及一至兩台附有風鑽的挖土機）。在工作期間工地在同一期段只有數架泥頭車/貨車，用以運走已拆除的混凝土和金屬廢料。操作這些機械設備只會排放少量的廢氣，因此預期不會對易受空氣污染影響的敏感受體造成不良影響。

在拆卸環熔設施期間，本工程項目只會產生少量交通（運送拆建廢料的泥頭車每天最多來回10趟）。因此，由車輛排放的廢氣對空氣質素的影響預期會極輕微。

環保廢物熔化系統組件會用移除螺絲或切割接合處的方式拆除。開口（即喉管兩端）會立即以兩層防火膠布密封以防止灰塵溢出。防火膠布會以水管膠布牢固封好。已密封的設備部件/零件會被吊運至地面。設備的各個部分會被運往物料回收/循環再造設施大樓的清理工場。這些工程不會釋出大量灰塵和廢氣。

當物料回收設備從物料回收/循環再造設施大樓移走後，物料回收/循環再造設施大樓會用作清理環保廢物熔化系統組件的工場。清理工場將設置抽風系統，並於清理過程中維持輕微負壓。廢氣排放到室外前會先以高效能空氣粒子隔濾系統進行過濾。喉管及設備內壁會以水噴濕並以濕布妥善清理。因此，清理過程只會排放極微量的灰塵/殘餘物到大氣中。

經化學分析，環保廢物熔化系統所產生的殘餘物僅含有少量的重金屬及極微量（以萬億分比計）的二噁英及呋喃。建議中的拆卸方法經過周密設計，以將拆卸及清理環熔設施過程中可能排放的殘餘物減至最少。透過實施環評報告建議的控制措施，將有效地控制殘餘物的排放。因此，附於殘餘物的二噁英及重金屬的排放，亦將會是極微量，並不會對易受空氣污染影響的敏感受體造成不良的影響。

在清理環保廢物熔化系統組件的工作完成後，清理工場將進行清理。物料回收/循環再造設施大樓亦會拆卸。當切割和吊運結構樑柱時，於有需要時會使用起重機及起重裝置支撐；同時亦會使用氣動扳手、火焰切割器、起重機及類似的工業設備。操作有關器材及設備時只會排放極少量廢氣，預期不會引致不良空氣質素影響。

拆卸工作進行前及進行期間會以水噴灑混凝土結構（消防水箱及泵房、混凝土地台及地基），以避免塵土飛揚。混凝土碎塊和金屬廢料會分別存放於廢物車斗，並於可行的情況下盡快運離現場。透過實施建議的灰塵及空氣控制措施，預期混凝土結構的拆卸工作不會對易受空氣污染影響的敏感受體造成不良的塵埃影響。

環熔設施的工地會以清潔的填料覆蓋及平整。由於環熔設施工地的面積相對較小，在任何情況下工地只能處理少量泥土，透過實施《空氣污染管制（建造工程塵埃）規例》中的灰塵控制措施後，預期小規模的土木工程不會對易受空氣污染影響的敏感受體造成不良的塵埃影響。

在拆卸及清理工作的過程中，青洲英坭會實施《空氣污染管制（建造工程塵埃）規例》規定的良好工地守則及環評報告建議的緩解措施。鑒於本工程項目的工作性質及所需拆卸的混凝土結構規模很小，拆卸及清理工作不會對易受空氣污染影響的敏感受體造成不良影響。

3.3 土地污染

土地污染源頭及對敏感受體的潛在影響已根據環保署的《按風險釐定的土地污染整治標準的使用指引》（《RBRG使用指引》）、有關的《受污染土地的評估及整治指引》及環保署的《受污染土地勘察及整治指引》進行評估。

工地勘測評估包括工地考察、背景資料及有關可能存在土地污染的土地歷史的評估。《污染評估計劃》辨識了潛在的污染源頭及相關的影響、風險或危害。土地污染評估經已完成，結果詳列於《污染評估報告》。工地勘測結果已確定：

- 收集的泥土樣本中的總石油類（TPH）/ 苯、甲苯、乙苯及二甲苯（BTEX）的濃度遠低於檢測上限;
- 檢驗出的首要金屬濃度遠低於RBRG所定出的土地污染整治標準；及

- 所有樣本所檢驗出的多氯聯苯、二噁英及呋喃含量遠低於RBRG所定出的土地污染整治標準。

拆卸工程中建議的挖掘工程僅限於混凝土地台的地基底部結構以及地下貯糟。由於本工程項目不涉及挖掘泥土或抽取地下水，因此毋需場外棄置土壤及地下水。

本工程項目工地會以清潔的填料覆蓋，並修復成草坪。日後工人接觸潛在污染物的可能性亦較低。因此，預期本工程項目不會引致土地污染或相關的影響。

項目工地將會繼續用作工業用地（製造水泥及水泥有關產品）及會被青洲英坭廠其他設施包圍。在清拆工程期間只有清拆工人可能受到污染物的影響。由於在收集的泥土樣本檢驗出的污染物濃度低於檢測上限或遠低於RBRG所定出的土地污染整治標準，清拆工人因清拆活動而引致的潛在風險將會是非常低。

3.4 廢物管理影響

清拆環熔設施會產生各種廢物（包括公眾填料（約1,806立方米）、金屬廢料（約369噸）、環保廢物熔化系統殘餘物（約200噸）、環保廢物溶化系統的耐火磚及襯層物料（約345噸）、一般垃圾（約每日9.1公斤）、污水（約每日2.1立方米））以及可循環再造物料（包括物料回收/循環再造設施、未經使用的化學品等）。有關該等廢物的運輸、儲存及棄置所產生的環境影響已作評估。

公眾填料將會棄置於屯門第38區填料庫。

物理性質及化學分析結果顯示環保廢物溶化系統的殘餘物的性質與一般用作水泥生產的原料類似。殘餘物含有少量重金屬，以及極少量的二噁英及呋喃（以萬億分比計），不會對水泥廠的氣體排放及水泥品質量造成不良影響。殘餘物將用作生產水泥原料的替代原料。

建議殘餘物以0.5%（w/w）（重量百分比）加入一般水泥原料，這不會對水泥廠的環境表現造成不良影響。水泥廠只需要大約7天便可以消耗所有殘餘物。建議把殘餘物用以製造水泥不但不會造成任何長期環境影響，亦能避免於堆填區棄置殘餘物。

如果沒有其他可行的方法，殘餘物可棄置於環保署指定的堆填區。毒性滲慮測試顯示，殘餘物滲漏液中的重金屬濃度遠低於堆填棄置的相關標準。殘餘物因此可棄置於指定堆填區，而無需作進一步處

理。於堆填區棄置殘餘物前，應先取得堆填區監督（環保署）的協議。

環保廢物溶化系統的耐火磚及襯層物料，以及清理設備產生的廢料會放置於密封膠袋內，運往於環保署指定的堆填區棄置。

物料回收/循環再造設施仍可使用，將會售予其他物料回收/循環再造承辦商或二手設備供應商。金屬廢料及未經使用的化學品會循環再造。

由於環熔設施規模較小，清拆過情所產生的公眾塡料、化學廢料、一般垃圾、污水的數量亦相對較少。在實施環評報告建議的緩解措施後，有關廢料的處理及棄置將不會對環境及交通造成不良影響。

3.5 水質

項目工地所產生的潔淨表面徑流會引導流向青洲英坭廠現有的雨水排水系統，最後流到現有的雨水集蓄池。懸浮粒子在流入雨水渠前會於集蓄池沉澱。因此預期不會對水質敏感受體造成不良影響。

清理工作會於物料回收/循環再造設施大樓的清理工場內進行。在清理過程中，採用濕抹法和真空吸塵法清除喉管/設備內部鬆散的塵粒。由於清理器材及設備時沒有以水沖洗，因此清理工作只會產生少量廢水。所有由本工程項目所產的廢水會排放到現有青洲英坭廠的污水處理廠進行處理。

負責拆卸的工作人員會產生少量生活污水（每天約2.1立方米）。青洲英坭會爲拆卸工作人員提供現有的洗手間設施。污水會排放至現有的污水處理廠處理。預期處理及棄置工作人員所產生的生活污水不會爲水質帶來不良影響。

透過實施良好的工地守則，清拆環熔設施不會對水質造成不良影響。

3.6 環境監察及審核

毋需爲空氣質素及水質進行環境監察。

在清拆工程期間，青洲英坭的代表會聯同承辦商進行每月場地審核，以確保灰塵控制、廢物處理及工地徑流的管理均按照環評報告建議的良好工地守則進行。

環評報告亦制訂了實施緩解措施的綱要，包含建議的緩解措施、監察及審核要求，以及實施單位詳情載於環評報告《附錄C》。

本頁特意留空

4 結論

根據環評研究概要及*《環評技術備忘錄》*指引，環評研究已就工程項目的潛在環境影響（包括空氣質素、土地污染、廢物處理及水質）作出辨識及評估。

本研究總結在項目期間執行建議的環境控制措施後，將不會對環境造成不良影響。

同時亦建議定期進行現場審核以確保建議的緩解措施獲得妥善實施。

本頁特意留空