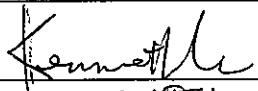
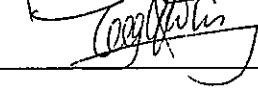


Contract No. SS M333

Reprovisioning of Diamond Hill Crematorium

**Contaminated Materials Investigation Report
(CMIR) for Phase II Works**

October 2007

	Name	Signature
Reviewed & Checked:	Kenneth Lau	
Approved:	Y.T. Tang (ET Leader)	

Version:	6	Date:	24 October 2007
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The information contained in this report is, to the best of our knowledge, correct at the time of printing. The interpretation and recommendations in the report are based on our experience, using reasonable professional skill and judgment, and based upon the information that was available to us. These interpretations and recommendations are not necessarily relevant to any aspect outside the restricted requirements of our brief. This report has been prepared for the sole and specific use of our client and ENSR Asia (HK) Ltd. accepts no responsibility for its use by others.

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ENSR Asia (HK) Ltd.

11/F, Grand Central Plaza, Tower 2, 138 Shatin Rural Committee Road, Shatin, NT, Hong Kong
 Tel: (852) 2893 1551 Fax: (852) 2891 0305 www.ensr.aecom.com www.maunsell.aecom.com



安域工程顧問有限公司
香港灣仔
皇后大道東183號
合和中心47樓

Hyder Consulting Limited
47/F Hopewell Centre,
183 Queen's Road East,
Wan Chai, Hong Kong

電話: (852) 2911 2233
傳真: (852) 2805 5028
電子郵件: hyder.hk@hyderconsulting.com
網址: www.hyderconsulting.com

Tel : (8621) 2911 2233
Fax : (8621) 2805 5028
Email : hyder.hk@hyderconsulting.com
Website : www.hyderconsulting.com

Hyder Consulting Limited is incorporated in Hong Kong with limited liability.
COI Number 126012

25 October 2007

BY POST & FAX (2524 8194)

Architectural Services Department
Queensway Government Offices
66 Queensway
Hong Kong

Your
Ref:

Our 1148-05/E07-39940
Ref:

For attention of: Ms. Renata Cheng

Dear Renata,

**Reprovisioning of Diamond Hill Crematorium
Contaminated Materials Investigation Report (CMIR) for Phase II Works (Version 6.0)**

We refer to the email of 24 October 2007 with the enclosure of the Contaminated Materials Investigation Report (CMIR) for Phase II Works (Version 6.0) from ENSR Asia Ltd.

We have no further comment and hereby verify the captioned report.

Should you have any queries, please do not hesitate to contact the undersigned on 2911 2729 or Winnie Ma on 2911 2912.

Yours sincerely

**Adi Lee
Independent Environmental Checker
HYDER CONSULTING LIMITED**

cc ENSR Asia Ltd – Mr. Y. T. Tang/Mr. Kenneth Lau
CRCCCL – Mr. Whyment Leung

(Fax: 2891 0305)
(Fax: 2827 2921)

ALWMMt



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1 INTRODUCTION

Background

- 1.1 The existing Diamond Hill Crematorium was commissioned in 1979. It is located along Po Kong Village Road in Diamond Hill, between Hammer Hill Road and Po Leung Lane. As the existing cremators approaching the end of their serviceable life, the Food and Environmental Hygiene Department (FEHD) proposes to demolish the existing crematorium building and construct a new crematorium.
- 1.2 Reprovisioning of Diamond Hill Crematorium (Environmental Impact Assessment (EIA) Report Register No. AEIAR-076/2004) (This Project) is divided into two phases: Phase I and Phase II. Phase I Works include construction of new crematorium building and major ancillary facilities and demolition of the sitting out areas at the southern part of the Project site. Phase II Works include demolition of existing crematorium building and construction of the remaining ancillary facilities at the northern part of the Project site as shown in **Drawing No. 1**.
- 1.3 During the Phase I Works (construction of new crematorium building), a supplementary contamination assessment had been carried out for the demolished CLP secondary substation. The Supplementary Contamination Assessment Report approved by Environmental protection Department (EPD) on 25 January 2004 presented that potential land contamination due to the transformer was not expected.
- 1.4 According to the Environmental Permit (EP) (No. EP-179/2004/B) of this Project, a contaminated materials investigation shall be required for the Phase II Works at the existing Diamond Hill Crematorium (The Site), in particular chimney, flue, cremators and air extractors before the demolition of the existing crematorium building.
- 1.5 ENSR Asia (HK) Ltd. (Formerly Maunsell Environmental Management Consultants Limited) (ENSR) was commissioned by the China Resources Construction Company Limited (The Contractor) to undertake the contaminated materials investigation for the Site.
- 1.6 A site inspection was conducted on 13 November 2006. It was observed that depositions (mainly in the form of ash waste) were found at the bottom of cremators and suspected to be accumulated in the flue and chimney. Ash-like substance was also found on the surface of air extractors in the air extractor room opposite to the cremators. Therefore, 4 sampling locations were proposed in the cremator, flue, chimney and air extractor room respectively to investigate any potential contaminated materials present in these areas. The structural layout of the Site is shown in **Drawing No. 2**.

- 1.7 A Sampling and Analysis Plan (The Plan) incorporating the site inspection and testing schedule for the assessment of dioxins, polyaromatic hydrocarbons (PAHs) and heavy metals in the depositions/building structures was prepared following the EP Clauses 5.3 – 5.5 [Submission of Contaminated Materials Investigation Report (CMIR) for Phase II Work] as well as the Particular Specification PS.G.11 (PS.G.11) Clause 4.5.5 [Contaminated Materials Investigation Report (CMIR) for Phase II Work] and Clause 4.6.4.4 [Contaminated Material] of the Project. The Plan was approved by the EPD on 10 January 2007.
- 1.8 The site investigation was subsequently carried out on 22 March and 16 April 2007 in accordance with the sampling and testing schedule stated in the Plan. The ash sampling and analytical testing were carried out by ALS Technichem (HK) Pty Ltd. (ALS) which is accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS). The ash sampling works were supervised by ENSR.

Objectives

- 1.9 This Contaminated Materials Investigation (This Investigation) is subject to assess the level of dioxin, polyaromatic hydrocarbon and heavy metals contamination in the depositions (mainly ash waste) in the existing crematorium building, in particular chimney, flue and cremators.
- 1.10 This Contaminated Materials Investigation Report (CMIR) is prepared following the EP Clauses 5.3 – 5.5 [Submission of Contaminated Materials Investigation Report (CMIR) for Phase II Work] as well as the PS.G.11 Clause 4.5.5 [Contaminated Materials Investigation Report (CMIR) for Phase II Work] and Clause 4.6.4.4 [Contaminated Material] of the Project in order to present the findings of the investigation works and produce a demolition plan that includes building surface decontamination protocols, demolition method, and method for handling, remediation and disposal of the contaminated materials.

2 ASSESSMENT METHODOLOGY

- 2.1 Ash sampling was conducted in the cremation room on 22 March and 16 April 2007. A total of three ash samples, namely CA-1, A-1 and F-1, were collected by hand tools for laboratory analysis. Each set of sampling equipment was used to collect sample at one location only to avoid cross-contamination among samples.
- 2.2 Among the six cremators situated in the crematorium, four cremators were still in operation and one was just cleaned during the sampling. As such, ash sample (CA-1) was collected at the bottom of one cremator only. Another ash sample (A-1) was collected as a composite sample from the surfaces of

all six air-extractors. As the flue connecting to the chimney was located immediately at the bottom of the chimney, it was noted that ashes accumulated on the wall of the chimney were loosely attached on the wall and would fall off and deposit on the internal surface of the flue. One ash sample (F-1) collected inside the flue near the bottom of chimney is therefore considered adequate to represent the contamination condition of both the flue and the chimney. The as-built sampling locations with ash samples collected for analysis are shown in **Drawing No. 2**.

- 2.3 Sufficient ash samples were taken to fill up the wide mouth amber glass jars with Teflon lid linear provided by the laboratory. Each ash sample was uniquely labeled and stored at temperature between 0 – 4°C until delivered to the laboratory.
- 2.4 Laboratory analysis for the ash samples was conducted by ALS for the parameters including polyaromatic hydrocarbons (PAH), heavy metals and dioxin. Such tests are accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS).
- 2.5 Chain of Custody (COC) protocol is a procedure to ensure the sample integrity throughout the sampling, transport and analysis process. COC protocol has been adopted in this Study to ensure the sample quality. The COC documentation for this Study is given in **Appendix A**.

3 ASSESSMENT CRITERIA

- 3.1 The “ProPECC PN 3/94 Contaminated Land Assessment and Remediation” and “Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repairing/Dismantling Workshops” issued by the EPD were used in setting the contamination criteria. The ProPECC PN 3/94 makes reference to criteria developed in the Netherlands (Dutch ‘ABC’ Levels), which are most comprehensive and widely used for contaminated site assessment. The preliminary screening approach adopted in this Study was based on the Dutch criteria which consist of 3 levels of guidelines, namely A, B, and C. The simplified explanation of the ABC levels is as follows:
- ‘A’ level implies unpolluted;
 - ‘B’ level implies potential pollution present that requires further investigation or remediation; and
 - ‘C’ level implies pollution which requires remediation.
- 3.2 The Dutch B levels would be referred to for assessing heavy metals and PAHs contamination in this Study. Relevant Dutch B levels for this Study are presented in **Table 3.1**. Dutch C levels are also included for easy reference.

Table 3.1 Dutch B and C Levels for Relevant Ash Testing Parameters

Parameter	Dutch B (mg/kg)	Dutch C (mg/kg)
<Polyaromatic Hydrocarbons, PAHs>		
Naphthalene	5	50
Phenanthrene	10	100
Anthracene	10	100
Fluoranthene	10	100
Benzo(a)pyrene	1	10
Pyrene	10	100
<Heavy Metals>		
Arsenic (As)	30	50
Barium (Ba)	400	2000
Cadmium (Cd)	5	20
Chromium (Cr)	250	800
Cobalt (Co)	50	300
Copper (Cu)	100	500
Molybdenum (Mo)	40	200
Nickel (Ni)	100	500
Lead (Pb)	150	600
Tin (Sn)	50	300
Zinc (Zn)	500	3000
Mercury (Hg)	2	10

3.3 As no dioxin criteria were available in the Dutch List, the US Environmental Protection Agency (USEPA) criteria of land contamination remediation target for residential sites would be used. The USEPA criterion for dioxin is 1 ppb TEQ, i.e. 1 ng/g, Toxicity Equivalent Unit.

3.4 According to the EP Clause 5.6 [Measures to Control Demolition of the Existing Crematorium Building] and PS.G.11 Clause 4.6.4.4.3 [Dioxin Containing Materials (DCM)/ Heavy Metal Containing Materials (HMCM) / Polyaromatic Hydrocarbon Containing Materials (PAHCM) from Demolition of the Existing Crematorium], the ash waste shall be classified in accordance with the contamination scheme presented in **Table 3.2** below which in turn determine the respective handling and disposal methods.

Table 3.2 Contamination Classification for Ash Waste

Classification of Contamination for Ash Waste	Dioxin Level in Ash Waste	Heavy Metal and PAH Level in Ash Waste
Low/Non Contaminated by DCM/HMCM/PAHCM	<1 ppb TEQ	< Dutch B level
Moderately/Severely Contaminated HMCM/PAHCM	<1 ppb TEQ	≥ Dutch B level
Moderately Contaminated DCM	≥1 and <10 ppb TEQ	Any level

Classification of Contamination for Ash Waste	Dioxin Level in Ash Waste	Heavy Metal and PAH Level in Ash Waste
Severely Contaminated DCM	≥10 ppb TEQ	Any level

Note:
 DCM = Dioxin-containing materials;
 HMCM = Heavy metal-containing materials;
 PAHCM = Polyaromatic hydrocarbon-containing materials
 1 ppb TEQ = 1 ng I-TEQ/g

4 ANALYTICAL RESULTS AND INTERPRETATION

4.1 A total of 3 ash samples were collected for laboratory analysis. There are heavy metals and/or PAHs exceeding Dutch B levels in all ash samples collected. Dioxin was found exceeding the USEPA criterion (1 ng/g) in the sample collected in the flue only. The detailed laboratory results are presented in **Appendix B**. The exceedances are summarized in **Table 4.1** below.

4.2 With reference to the analytical results and the contamination classification listed in the EP and PS.G.11 (or Table 3.2 of this Report), the ash waste in air extractor room and cremators is regarded as "Moderately/Severely Contaminated HMCM/PAHCM" while that in flue and chimney is regarded as "Moderately Contaminated DCM".

Table 4.1 Summary of Ash Samples Exceeding the Dutch B Values

Sample No.	Sampling Location	Contaminant	Dutch Level (mg/kg)		Concentration (mg/kg)	Ash waste Classification
			B	C		
A-1	Air Extractor Room	Cadmium	5	20	5.1	Moderately/ Severely Contaminated HMCM/PAHCM
		Chromium	250	800	1190	
		Copper	100	500	504	
		Lead	150	600	868	
		Tin	50	300	15700	
		Zinc	500	3000	3100	
CA-1	Cremator	Barium	400	2000	789	Moderately/ Severely Contaminated HMCM/PAHCM
		Chromium	250	800	2740	
		Copper	100	500	661	
		Lead	150	600	1420	
		Nickel	100	500	2470	
		Tin	50	300	17000	
		Zinc	500	3000	4220	
F-1	Flue	Pyrene	10	100	12.1	Moderately Contaminated DCM
		Arsenic	30	50	46	
		Cadmium	5	20	53.1	
		Chromium	250	800	1830	
		Cobalt	50	300	67	
		Copper	100	500	718	
		Lead	150	600	17600	

Sample No.	Sampling Location	Contaminant	Dutch Level (mg/kg)		Concentration (mg/kg)	Ash waste Classification
			B	C		
		Molybdenum	40	200	98	
		Nickel	100	500	2740	
		Tin	50	300	32500	
		Zinc	500	3000	8760	
		Dioxin	1 ng I-TEQ/g*		1.17 ng I-TEQ/g	

*: US Environmental Protection Agency criteria of land contamination remediation target for residential sites was used for assessing dioxin. It should be noted that 1 ng I-TEQ/g = 1 ppb TEQ.

5 DEMOLITION PLAN

- 5.1 As stated in the EP Clause 5.6 [Measures to Control Demolition of the Existing Crematorium Building] and PS.G.11 Clause 4.5.6 [Measures to Control Demolition of the Existing Crematorium Building] as well as Clause 4.6.4.4.5 [Demolition, Handling, Treatment and Disposal of Moderately Contaminated DCM and Moderately/Severely Contaminated HMCM/PAHCM from the Demolition of the Existing Crematorium], all contaminated materials shall be removed prior to the demolition of the existing crematorium unless contaminant could only be removed when access is granted to particular areas as the demolition progresses.
- 5.2 Special measures/methods for demolition, handling, treatment and disposal shall be followed and fully implemented for both moderately contaminated DCM and moderately/severely contaminated HMCM/PAHCM to minimize the exposure to the contaminants during the demolition of cremation room.
- 5.3 In this Investigation, contaminated ash wastes (with dioxin, heavy metals and/or PAHs exceeding relevant contamination levels) were found on the surfaces inside the flue and the cremators. In accordance with the Asbestos Abatement Plan (AAP), asbestos containing materials (ACM) were identified at insulation boards as part of the flue lining (at exterior surface from cremators No. 1 to No. 4) and asbestos gaskets at exterior surface of cremator No.5. In view of such close distance between the ACM and contaminated ash wastes, there is concern on contaminated ash wastes being embedded in asbestos boards and gaskets. Therefore, contaminated ash waste would be recommended to be removed prior to any asbestos abatement measures on these building structures described in Asbestos Abatement Plan (AAP).

Site Preparation

- 5.4 Except the cremators/flue/chimney/air extractors, all removable items inside the crematorium building shall be removed as far as practicable to avoid obstructing the decontamination activities. Preliminary

site decontamination of all debris shall be carried out using High Efficiency Particulate Air (HEPA) vacuum cleaner.

- 5.5 The cremation room where moderately contaminated DCM or moderately/severely contaminated HMCM/PAHCM is found shall be covered up to avoid fugitive emission. The following procedures shall be implemented at least 24 hours before the commencement of demolition. Details of the set up of containment, decontamination unit and negative air filtration system can refer to Sections 5.27 – 5.44:
- i. Enclosing the top portion of the chimney above the roof by a chamber lined with three layers polyethene sheets;
 - ii. Negative air filtration system shall be provided and equipped to minimize escape of contaminated ash wastes to the surroundings.
 - iii. Constructing a 3-chamber decontamination unit at the entrance to the cremators/flue/chimney/air extractors. The 3-chamber decontamination unit shall comprise a dirty room, a shower room and a clean room, each room of a minimum size of 1m (W) X 1m (L) and be lined with 3 layers of fire retardant polyethene sheet. The shower room shall be fitted with an adequate size tray to collect wash water.
 - iv. Warning signs in both Chinese and English should be put up at the entrance of the decontamination unit (at the clean end).
- 5.6 Full protection gear including disposable coverall (such as Tyvek) (with hood and shoe covers), nitrile gloves, rubber boots (or boot covers), and full-face positive pressure respirators equipped with a combination cartridge that filters particulate and removes organic vapour shall be provided and worn by all workers. Workers shall carry out decontamination procedures at the 3-chamber decontamination unit before leaving the work area.

Demolition and Decontamination Method

- 5.7 The cremators/flue/chimney/air extractors shall be removed from top down starting from the chimney. Any ash or residues attached to the cremators/flue/chimney/air extractors shall be removed by scrubbing and HEPA vacuuming before and after the removal.
- 5.8 After the scrubbing and HEPA vacuuming, the cremators/flue/chimney/air extractors are considered to be cleaned. Such building structures can be handled and disposed of as construction and demolition (C&D) materials.

- 5.9 Site personnel, tools, instrument and sealed wastes should be thoroughly decontaminated in the decontamination unit before leaving the work area. Detailed demolition and decontamination method statements shall be prepared by the Contractor for the Architects' Representative's approval.

Handling Method

- 5.10 The ash waste containing dioxin/heavy metals and in its untreated state would be classified as a chemical waste under the *Waste Disposal (Chemical Waste) (General) Regulation*.
- 5.11 The ash waste scrubbed and vacuumed from the cremation room where moderately contaminated DCM or moderately/severely contaminated HMCM/PAHCM is identified shall be handled and stored in accordance with the *Waste Disposal Ordinance, Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*.
- 5.12 DCM, which is chemically related to Polychlorinated Biphenyl (PCB) wastes, shall be handled and disposed of in accordance with the *Code of Practice on the Handling, Transportation and Disposal of PCB Wastes*.
- 5.13 In particular, DCM shall be stored in new and good condition steel drums of No. 16 gauge or heavier and fitted with removable lids as well as leak-proof polythene sacks in accordance with the *Code of Practice on the Handling, Transportation and Disposal of PCB Wastes*.
- 5.14 Besides the above requirements, Containers used for storage of chemical waste shall:
- i. Be suitable for the substance they are holding, resistant to corrosion, maintained in good condition and securely closed;
 - ii. Be bottom-lined to prevent generation of contaminated runoff;
 - iii. Be equipped with leachate sump to collect any leachate;
 - iv. Have a capacity of 200 litres unless specifications have been approved by the EPD; and
 - v. Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.
- 5.15 The storage area for chemical waste shall:
- i. Be clearly labeled and used solely for the storage of chemical waste;
 - ii. Be enclosed on at least 3 sides;
 - iii. Have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest.

- iv. Have adequate ventilation and air emissions control system that will provide a continuous negative pressure on the building, and will fully treat all air discharged from the building to prevent discharge of soil particles;
- v. Be covered to prevent rainfall entering (water collected within the bund must be tested and disposal as chemical waste if necessary);
- vi. Have a leachate collection system that completely prevents any liquids that may have contacted the contaminated ash waste from being released to the environment without suitable treatment; and
- vii. Be arranged so that incompatible materials are adequately separately.

Remediation and Disposal Method

- 5.16 As the quantity of DCM/HMCM/PAHCM is not significant, immobilization followed by disposal at landfill (if landfill disposal criteria can be met) would be considered as the most preferable option.
- 5.17 To obtain prior agreement to disposal from the landfill operator, the ash waste with moderately contaminated DCM or moderately/severely contaminated HMCM/PAHCM shall be stabilized by cement and complied with the landfill disposal criteria of the Waste Facilities Group (WFG) of EPD. Disposal permits shall be obtained from the EPD prior to the delivery of the ash waste to landfill.
- 5.18 It is envisaged that the process would involve collection and mixing of ash waste with cement. Pilot mixing and Toxicity Characteristics Leaching Procedure (TCLP) tests shall be carried out to establish the appropriate ratio of cement to ash waste to the satisfaction of EPD. In order to assess the required ratios of cement to ash and required curing time to produce a homogenous solidified/stabilized mass, pilot mixing of different ratios of cement to ash (e.g. 5%, 10% and 15% of cement) would be conducted to determine the appropriate amount of cement required for compliance with the TCLP limits. The mixing time shall also be recorded to determine the required time for homogenizing the mass.
- 5.19 TCLP tests shall then be conducted in accordance with USEPA Method 1311 for heavy metals by a HOKLAS accredited laboratory to demonstrate the compatibility of ash waste for the landfill disposal. The allowable limits for soluble metals in a TCLP extract are presented in **Table 5.1**. A method statement detailing the remediation procedure, pilot test and TCLP test shall be prepared by the Contractor and submitted for EPD's approval before the commencement of demolition works.

Table 5.1 Landfill Disposal Criteria for Contaminated Soil

Parameter	TCLP Limit (ppm)
Cadmium	10
Chromium	50
Copper	250
Nickel	250
Lead	50
Zinc	250
Mercury	1
Tin	250
Silver	50
Antimony	150
Arsenic	50
Beryllium	10
Thallium	50
Vanadium	250
Selenium	1
Barium	1000

- 5.20 If pilot mixing and TCLP tests demonstrate that the immobilization by cement is feasible, a full-scale immobilization of ash waste could proceed. The immobilization shall be conducted in an enclosed area to prevent the discharge of contaminated ash waste and cement. The mixing equipment shall be skip or similar plant having equivalent function or performance to achieve a homogenous ash-cement-water mixture. The mixing plant shall be set up within an area lined with heavy duty HDPE impermeable liner or equivalent and surrounded by berm at its four sides to prevent any surface runoff from leaching and overspill. The ash waste shall be mixed with standard earth moving equipment such as backhoe or bulldozer.
- 5.21 After immobilization of the ash waste by mixing with cement in the correct ratio as determined by the pilot mixing and TCLP test, the waste materials shall be transported to and sealed by placing inside polyethene lined steel drums for disposal at landfill. No equipment used for transport and handling of contaminated materials shall be used for transport and handling of treated ash wastes without being fully decontaminated prior to handling treated ash wastes. Transparent plastic sheeting of 0.15mm thickness low-density polyethene or PVC shall be employed. The drum shall be 16 gauge steel or thicker and fitted with double bung fixed ends adequately sealed and well labeled in new or good condition. The drums shall be clearly marked "DANGEROUS CHEMICAL WASTE" in English and Chinese. Prior agreement of the disposal criteria from the WFG of EPD and agreement to disposal from the landfill operator must be obtained.

Location	Ash Classification	Estimated Quantities
Exterior Surface of Air Extractors	Moderately Contaminated HMCM/PAHCM	136m^2 (total surface area of air extractor room) X 0.002m (thickness of ash depositions) + 6 (no. of air extractors) X 1.26m^2 (total surface area of one air extractor) X 0.002m (thickness of ash depositions) = 0.29m^3
Interior Surface of Flue	Moderately Contaminated DCM	37m^2 (total surface area of flue) X 0.002m (thickness of ash depositions) = 0.07m^3
Interior Surface of Chimney	Moderately Contaminated DCM	16.5m^2 (total surface area of chimney) X 0.002m (thickness of ash depositions) = 0.03m^3
Small pile of ash inside the flue	Moderately Contaminated DCM	5m^2 (base area of the pile) X 0.3m (height of the pile) X 0.33 (pyramid volume calculation coefficient) = 0.5m^3
Total Estimated Quantities (m³) =		1.55

- 5.25 Based on the conservative assumption that same volume of cement would be added to stabilize the ash wastes, i.e. 1:1 ratio, the estimated quantity of stabilized contaminated ash wastes would be $1.55\text{m}^3 \times 2 = 3.1\text{m}^3$. The quantity is estimated for indicative purpose and shall be subject to adjust according to the site condition and the percentage of cement used for the treatment.
- 5.26 The sealed wastes generated from the containment or decontamination unit including the protection clothing of the workers such as coverall, nitrile glove, rubber boots and materials used for wet wiping shall be disposed of at landfill sites to be designated by EPD.

Decontamination and Disposal Methods for Insulation Boards and Exhaust Pipe Gaskets

- 5.27 As mentioned in Section 5.3, there is concern on contaminated ash wastes being embedded in asbestos boards and gaskets. To handle such waste, the removal of dioxin contaminated insulation board and gasket should be conducted inside containment. The containment shall be constructed of 37mm x 63mm minimum wood stud framing to support plastic barrier sheeting. The top and bottom of the strut work shall have rubber strips added to confirm integrity of enclosure.
- 5.28 Viewing panels (300mm x 450mm with the lower edge no more than 1.2 above floor level) shall be provided for the containment. The panel should comprise one 2mm thick clear acrylic sheet, have at least 50mm overlap with the polythene sheet at the edge, and be securely fixed with 50 mm wide duct tape.
- 5.29 All non-asbestos and dioxin containing surfaces (e.g. floor, light fixtures and other apparatus) inside the containment shall be masked and sealed with polythene sheeting to give a smooth and impervious exterior. Each layer of plastic sheeting shall be applied separately and the minimum

number required is as below:

- 2 individual layers to solid wall and floor
- 3 individual layers to temporary partition wall
- 4 individual layers to temporary platform

5.30 The sheeting shall be sealed with tape at least 300 mm up the wall skirt to collect falling debris during the removal process.

Decontamination Unit

5.31 A central 3-chamber airlock decontamination hygiene unit comprising dirty, shower and clean rooms shall be constructed in the entrance of the containment for workers' decontamination.

5.32 Each compartment shall have a minimum size of 2m (height) x 1m (width) x 1m (length) and shall be constructed of 1½" strutwork at 4' centres, fixed to 3" x 3" main posts, and ¼" plywood fixed to strutwork forming top, floor and sides. Three layers of 0.15mm thick and opaque polythene sheeting shall be fixed to internal surfaces. All joints shall be sealed with tape or spray adhesive.

5.33 Each compartment is separated by a curtained doorway consisting of a polythene sheet with an I-shaped slit opening covered by a plastic flap that hangs and lifts in the direction of access. The plastic flap shall have an overlap of at least 100mm on each side of the slit opening and weighted at the bottom to maintain a good seal when negative air pressure ventilation is not in use.

5.34 The shower room shall be no water leakage and fitted with a tray of adequate size to collect wastewater. Hot and cold water adjustable at the showerhead shall be provided at a minimum of one showerhead per 6 workers calculated on the basis of the largest shift. All wastewater shall be sump pumped to an aquarium type filter unit to remove suspended particles down to 5µm before being discharged and drained.

5.35 The shower room shall be wet cleaned and HEPA vacuumed after each shift change and meal break.

5.36 The dirty room shall be equipped with a HEPA vacuum cleaner for the worker to vacuum-clean the coverall and the respirator prior to being taken off.

5.37 A 2-chamber debris port that consists of a washing room fitted with cold water supply and wastewater filtration facility and a clean room should be provided to control the transportation of bagged wastes and equipment.

Negative Air Filtration System

- 5.38 Each of the containment shall be equipped with a negative air filtration system to minimize escape of airborne fibres to the surroundings. Each containment shall be equipped with a duty and a standby HEPA air movers with certified capacity more than 500 CFM (for containment volume no more than 5000 cu.ft) to maintain inside the containment a negative pressure of 0.05" to 0.15" H₂O and to provide a minimum of six (6) air changes per-hour. Additional air movers would be required for highly branched containment to eliminate stagnant air pockets. Pressure monitoring equipment with continuous recorder and printout feature differential is less than 0.05" water gauge.
- 5.39 A waterproof box would be constructed to enclose and protect the negative pressure monitor from any weather condition. Monitoring record shall be kept dry inside the box continuously for inspection.
- 5.40 The unit shall be provided with pre-filters to protect the HEPA filters. The final HEPA filter shall be certified to capture particles to 0.3µm with 99.99% efficiency.
- 5.41 The exhaust of the air movers should be ducted out through window whenever possible, or it should not be situated in vicinity of, thus disturbing any other ACM and contaminated ash wastes in the same working area.
- 5.42 All negative air filtration system and HEPA vacuum cleaner shall hold a valid certificate maintenance records, and utilization log giving details of the equipment capacities and usage. They shall be kept available at site upon inspections by the Registered Asbestos Consultant and the EPD. If the negative pressure cannot be maintained within the prescribed range during the removal work, the following procedures shall be adopted:
- The Registered Asbestos Contractor shall stop all the processes that would produce more asbestos debris.
 - All loose debris shall immediately be place into suitable labelled containers and transported to the secure storage area.
 - All remaining ACM surfaces shall be thoroughly sprayed and soaked with amended water.
 - All other contaminated surfaces shall be thoroughly HEPA vacuum cleaned and wet-wiped.
 - All personnel and waste containers shall be decontaminated before leaving the containment.
 - The Registered Asbestos Contractor shall then thoroughly check the containment and rectify any leakage. The air mover shall be checked and replaced if necessary.
 - The Registered Asbestos Contractor shall confirm that the negative pressure inside the containment is satisfactory before re-commencing the removal work.

Testing of Containment

- 5.43 A portable smoke generator, such as Consept Smoke Generator, shall be used to test for air-tightness of the containment before the removal work starts.
- 5.44 The entire volume of the containment, including various chambers of the decontamination unit, shall be filled with sufficient amount of smoke. The registered asbestos consultant shall inspect for smoke leakage from outside the containment and any air pockets. When integrity of the containment is satisfactorily concluded, the vacuum cleaner should be switched on and timed to find out how long it would take to clear 90% of the smoke for 3 air changes per hour. The acceptable time limit should be within 30 minutes. Any leaks spotted shall be immediately amended.

Removal Process

- 5.45 The following working sequence should be followed for removal of dioxin contaminated insulation board and gasket. **Drawing No. 3** summarizes the steps in the removal process.

Before setup of containment

- a. The chimney exhaust with insulation board & gasket to be removed should be confirmed not in operation and safe to access by the worker before commencement of the removal process.
- b. A working platform should be provided to prevent the collapse of the chimney exhaust during removal process and for the workers to reach the insulation board.
- c. Remove concrete wall to expose the connection of the chimney exhaust and vertical chimney stack.

Setup of containment

- d. Containment shall be setup with view panels and access path to inspect the removal work. The containment should only include the chimney exhaust to be removed.

Commencement of asbestos abatement work

- e. DCM inside chimney shall be removed by scrubbing and HEPA vacuuming before commencement of the removal of the insulation board and gasket. Vacuum cleaner for DCM removal shall be labelled and disposed as dioxin contaminated waste after completion of the removal work.
- f. Junction of chimney exhaust and the vertical chimney stack should be pre-cut and sealed by double layer polythene sheet, such that the whole horizontal exhaust is disconnected & isolated inside the containment.

- g. Connection of the chimney exhaust with the cremator No. 1-6 should be pre-cut and sealed by double layer polythene sheet inside the containment.
- h. Insulation board shall be thoroughly sprayed, using airless spray equipment, in a fine mist with amended water with sufficient time and quantity for enhanced penetration.

Option A- Removal by loosening of anchor bolts

- i. The anchor bolts attaching the insulation board with the metal casing shall be firstly removed and the whole piece of insulation board shall be taken down. Extreme care shall be exercised to avoid breakage of the insulation board during abatement. Any debris due to breakage or abrasion shall be immediately bagged as asbestos waste.
- j. Metal casing of the whole chimney exhaust inside the containment should cut into manageable size and disposed as asbestos waste.

Option B- Removal by hydraulic cutter

- k. In case the insulation board are unable to be taken down by loosening of anchor bolts, hydraulic cutter shall be use to cut the insulation board together with the chimney exhaust into manageable size and disposed as asbestos waste.
- l. Removed insulation board with exhaust sections shall be wrapped with double layer polythene sheet and labelled as asbestos waste according to "Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste".
- m. Bolts attaching the gasket should be loosened and remove the gasket in whole piece. All removed gasket should also be disposed as dioxin contaminated waste.
- n. After the asbestos removal is completed, all personnel, tools, bagged wastes shall be decontaminated prior to leaving the work area.

5.46 The wrapped insulation boards and gaskets shall be put into steel drums for landfill disposal. The estimated volume of insulation boards and exhaust pipe gaskets for landfill disposal is 80m³. The disposal site for these structures should be designated by EPD.

Site Clean-up and Acceptance of Work

- 5.47 The work zones shall be cleaned up simultaneously and the clean-up procedures below shall be followed after the insulation boards and gaskets are removed and bagged.
- 5.48 All personnel, tools, instruments including bagged wastes shall be decontaminated prior to leaving the work area.

- 5.49 HEPA vacuum cleaner for DCM removal work should be packed and labelled as dioxin contaminated waste for disposal. A backup vacuum cleaner should be prepared for site clean-up work.
- 5.50 All surfaces shall be wet-wiped and vacuum-cleaned from top to bottom and in a direction from the decontamination unit towards the air movers.
- 5.51 The innermost plastic sheet shall be sprayed with dyed PVA solution and allowed to dry. The plastic sheet shall be peeled off and placed in approved bags.
- 5.52 The surfaces of the second plastic layer shall be HEPA vacuumed and wet-wiped to remove any visible debris. The containment should then be cleaned and ready for a penultimate air test. All used wiping rags shall be disposed of as dioxin contaminated waste.
- 5.53 If the result of the penultimate air test is below 0.01 fibre/ml, a thorough visual inspection should be made by a registered asbestos consultant to verify that all visible ACM has been removed. A black cloth would be used to wet-wipe exposed surfaces to detect the presence of any dust deposit.
- 5.54 Upon the RAC's satisfactory visual inspection, all surfaces stripped of ACM and of the second plastic layer shall be sprayed with PVA and removed for disposal as asbestos waste. The area shall be then vacated 12 hours to allow fibrous materials to settle. All objects and surfaces in the work area should be HEPA vacuumed and wet-cleaned from the top to the bottom and in a direction from the decontamination units towards the air-movers.
- 5.55 A final clearance air test should be performed to confirm that an air quality of no more than 0.01 fibre/ml is attained. Otherwise, the work area shall be re-cleaned and a further clearance test shall be conducted. Aggressive sampling techniques shall be used to agitate any dust deposit that may be present inside the work area. Upon a satisfactory test result, all polythene sheeting, decontamination facility and air movers can be dismantled under the direct supervision of the Registered Asbestos Consultant. All materials to be disposed of should be treated as dioxin contaminated waste.
- 5.56 HEPA vacuum cleaner and air mover should be bagged as dioxin contaminated waste for disposal.
- 5.57 All tools and equipment would be bagged and removed off-site. They are to be decontaminated, where necessary, while immersing into water or inside containment.
- 5.58 The registered asbestos consultant shall make a reassurance inspection and certify in writing upon satisfaction of the inspection to declare completion of the asbestos abatement work.

- 5.59 The environmental permit holder (ArchSD) or his representative will submit letter to EPD to report the completion of contaminated materials removal works on site prior to Asbestos Abatement Works.
- 5.60 After the removal of all ACM identified structures, the HEPA vacuum cleaner for DCM removal, the used wiping rags, all polythene sheeting, decontamination facility and air movers should be bagged, labeled as dioxin contaminated waste and disposed of at landfill sites to be designated by EPD. **Table 5.4** summarizes the treatment and disposal methods for the wastes.

Table 5.4 Treatment and Disposal Methods for Different Wastes

Waste Type	Treatment and Disposal Method
<ul style="list-style-type: none"> ● Contaminated ash wastes from the following structures: <ul style="list-style-type: none"> - Cremators; - Chimney; - Flue; - Air extractors; and - Insulation boards and gaskets. 	<ul style="list-style-type: none"> ● Immobilized by cement mixing and disposed of at designated landfill; or ● Disposal at the CWTC at Tsing Yi if pilot and TCLP tests fail.
<ul style="list-style-type: none"> ● Insulation boards and gaskets 	<ul style="list-style-type: none"> ● Wrapped with double layer polythene sheet and put into steel drums for landfill disposal
<ul style="list-style-type: none"> ● Protection clothing of the workers and materials used for wet wiping; ● HEPA vacuum cleaner for DCM removal work; ● All polythene sheeting, decontamination facility and air movers 	<ul style="list-style-type: none"> ● Bagged and labeled as dioxin contaminated waste for landfill disposal

Air Monitoring

- 5.61 A Registered Asbestos Laboratory shall perform air monitoring that the results of the analysis shall be available within 24 hours of sampling.
- 5.62 Five (5) background air samples shall be taken after preliminary decontamination and prior to commencement of abatement activities. Sampling points should be taken at perimeter of the working area.
- 5.63 Personal air sample at a rate of 1 per 4 workers per workday shall be taken to monitor the fibre exposure to the asbestos workers throughout the removal process.

- 5.64 Leakage air tests at daily intervals shall be conducted during the abatement work. Four (4) leakage air samples per workday shall be collected outside the containment and in uncontaminated areas. The sampling point shall include the followings:
- One air sample shall be taken from the clean room of the decontamination unit.
 - Two samples shall be taken outside the containment but remote from the decontamination unit.
 - One area sample should be taken within 1.5m of the unobstructed exhaust of an air mover.
- 5.65 If air samples collected during abatement process contain fibres greater than 0.01 fibres/ml, the abatement works shall be stopped immediately for inspection. The containment and the decontamination unit shall be thoroughly visual checked for leaks by the Registered Asbestos Supervisor or with the aid of smoke tubes. The surfaces outside but within metres from the containment shall be cleaned by HEPA vacuuming and wet-wiping methods. It is important that the work shall not resume until all leaks have been amended.
- 5.66 Three (3) penultimate air samples should be carried out after the removal of asbestos as the surfaces of the work areas are thoroughly cleaned, with the innermost plastic sheet stripped for disposal.
- 5.67 Following satisfactory visual inspection by the Registered Asbestos Consultant, further wet cleaning and HEPA vacuuming of all surfaces are needed before a final clearance air test shall be conducted. Three (3) samples should be collected and analyzed to confirm the cleanliness of the area where the fibre level is less than 0.01 fibre.

Reporting

- 5.68 After completion of the demolition and decontamination, remediation report (RR) shall be prepared to demonstrate that the cleanup is adequate. Information such as remediation procedures, types and volume of contaminated materials treated, standards and levels of treatment, and locations of off-site disposal sites shall be included in the report. The RR shall then be certified by the Environmental Team leader and verified by Independent Environmental Consultant prior to submission to the EPD.

Health and Safety Measures

- 5.69 The relevant requirements under the Occupational Safety and Health Ordinance (OSHO) (Chapter 509) and their subsidiary Regulations shall be strictly followed throughout the Project. During the course of demolition, the following basic health and safety measures shall be implemented:
- i. Set up a list of safety measures for site workers;
 - ii. Provide written information and training on safety for site workers;

- iii. Keep a log-book and plan showing the contaminated zones and clean zones;
- iv. Fence off the contaminated zones to restrict unauthorized entrance;
- v. Maintain a hygienic working environment;
- vi. Provide adequate and appropriate personal protective equipment and clothing such as air purifying respirator and Latex gloves to all workers engaged in the demolition of contaminated building structures;
- vii. Prohibit smoking, eating and cooking inside the contaminated zones;
- viii. Avoid dust generation;
- ix. Provide first aid training and materials to site workers.

5.70 Health and Safety Plan (HASP) shall be prepared by the Contractor for Architects' Representative's approval to establish guidelines for the safety of personnel prior to the commencement of works.

5.71 All personnel shall follow the site safety regulations:

- i. Contact with contaminated or suspected contaminated surfaces should be avoided;
- ii. Alcoholic beverages and controlled substances shall not be allowed on-site;
- iii. All personnel shall be familiar with standard operating safety procedures and any additional instructions and information contained in the site HASP.
- iv. All personnel shall adhere to the site HASP. Personnel entering the site will be required to read and sign the HASP, demonstrating their concurrence with the requirements and their understanding of the safety procedures of the plan.
- v. All personnel going on-site shall be adequately trained and thoroughly briefed on anticipated hazards, safety equipment to be employed, safety practices to be followed, emergency procedures and communications, and responsible safety personnel on-site.
- vi. Entrance and exit locations shall be designated and posted, and emergency escape routes shall be delineated. Warning signals for site evacuation must be established and communicated to all personnel.

Environmental Mitigation Measures

5.72 During transportation, the treated ash waste shall be properly contained and covered by impermeable sheet to avoid spillage. Dump truck shall never be overloaded. Speed control of vehicles should be imposed to minimize dust emission.

5.73 Vehicle wheel and body washing facilities at the Site's existing points shall be established and used.

- 5.74 Separate equipment shall be employed for transport of treated materials to prevent any potential for recontamination. A "contaminated" loader shall load only the contaminated materials into the decontamination system, and a "clean" loader shall be assigned to remove the treated materials at the outlets of the decontamination system.
- 5.75 The following environmental mitigation measures should be taken during immobilization:
- i. The loading, unloading, handling, transfer or storage of ash wastes should be carried out in enclosed system;
 - ii. Handling and mixing of cement shall follow Air Pollution Control (Construction Dust) Regulation to limit cement emission;
 - iii. The impacts of dust containing dioxin and/or heavy metals on air quality and workers' health shall be mitigated during the handling and transportation of the contaminated materials;
 - iv. The mixing process and other material handling activities should be properly planned and scheduled to avoid cross contamination;
 - v. Excessive addition of water shall be avoided during the process; and
 - vi. The mixing area should be sited as far as practicable to the nearby noise sensitive receivers.
- 5.76 If the ash waste would be disposed of at CWTC, the following measures shall be taken:
- i. The ash waste shall be enclosed in sealed containers securely attached to the transportation vehicle and transported in roll-off truck with sealable top and watertight gaskets on all doors;
 - ii. The truck delivering the ash waste shall be escorted by two other vehicles, one in the front and the other at the back;
 - iii. The truck shall be painted with clear identification label on all side; and
 - iv. The truck shall be labeled, handled and transported in accordance with the *Waste Disposal Ordinance*, the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Handling, Transportation and Disposal of PCB Wastes*.
- 5.77 The wash water collected from the decontamination unit and equipment decontamination as well as leachate from the leachate sump shall be stored properly in a sealed drum and collected by licensed chemical waste collector for disposal. Direct discharge of such wastewaters shall not be allowed without proper treatment.

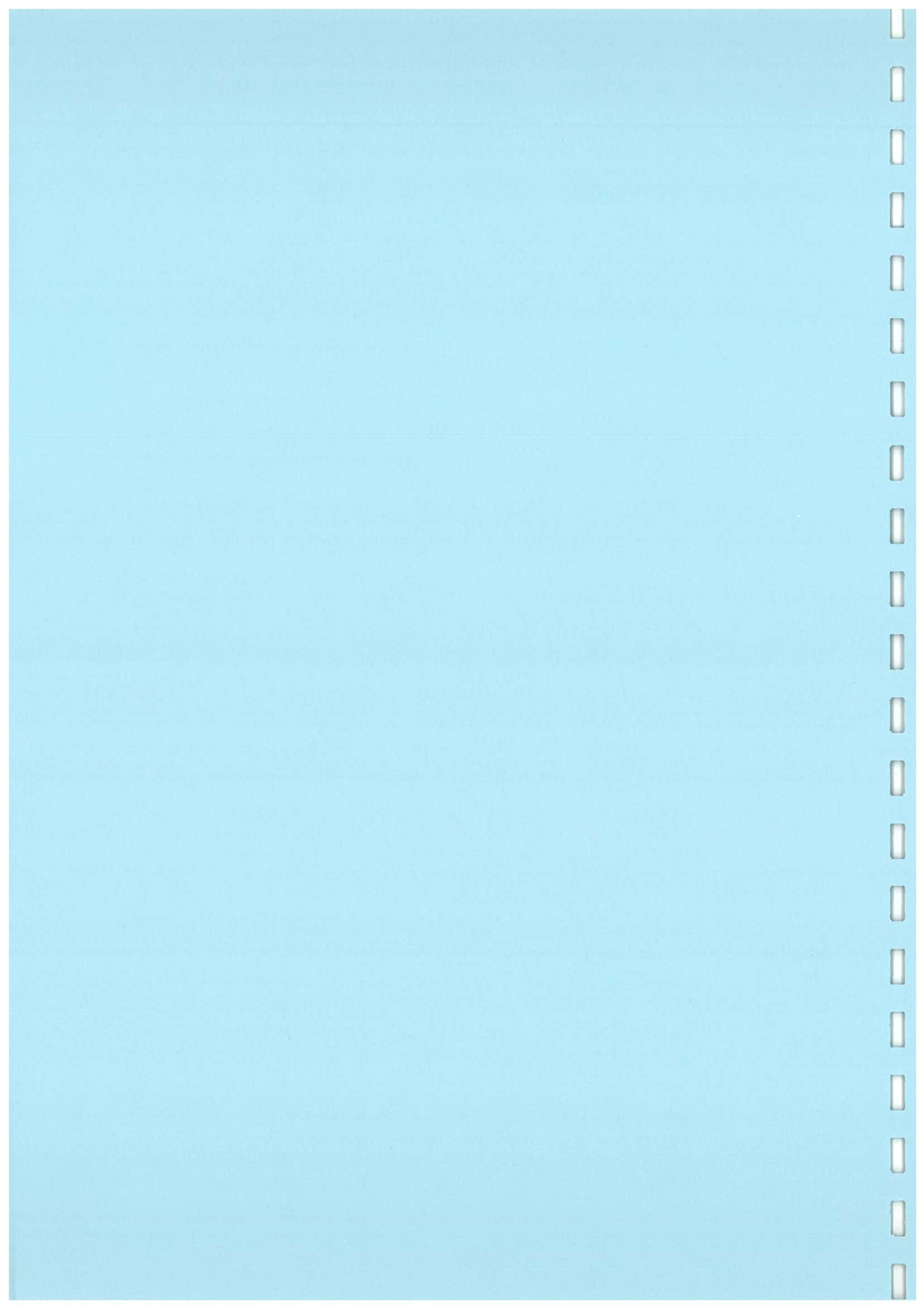
6 CONCLUSIONS

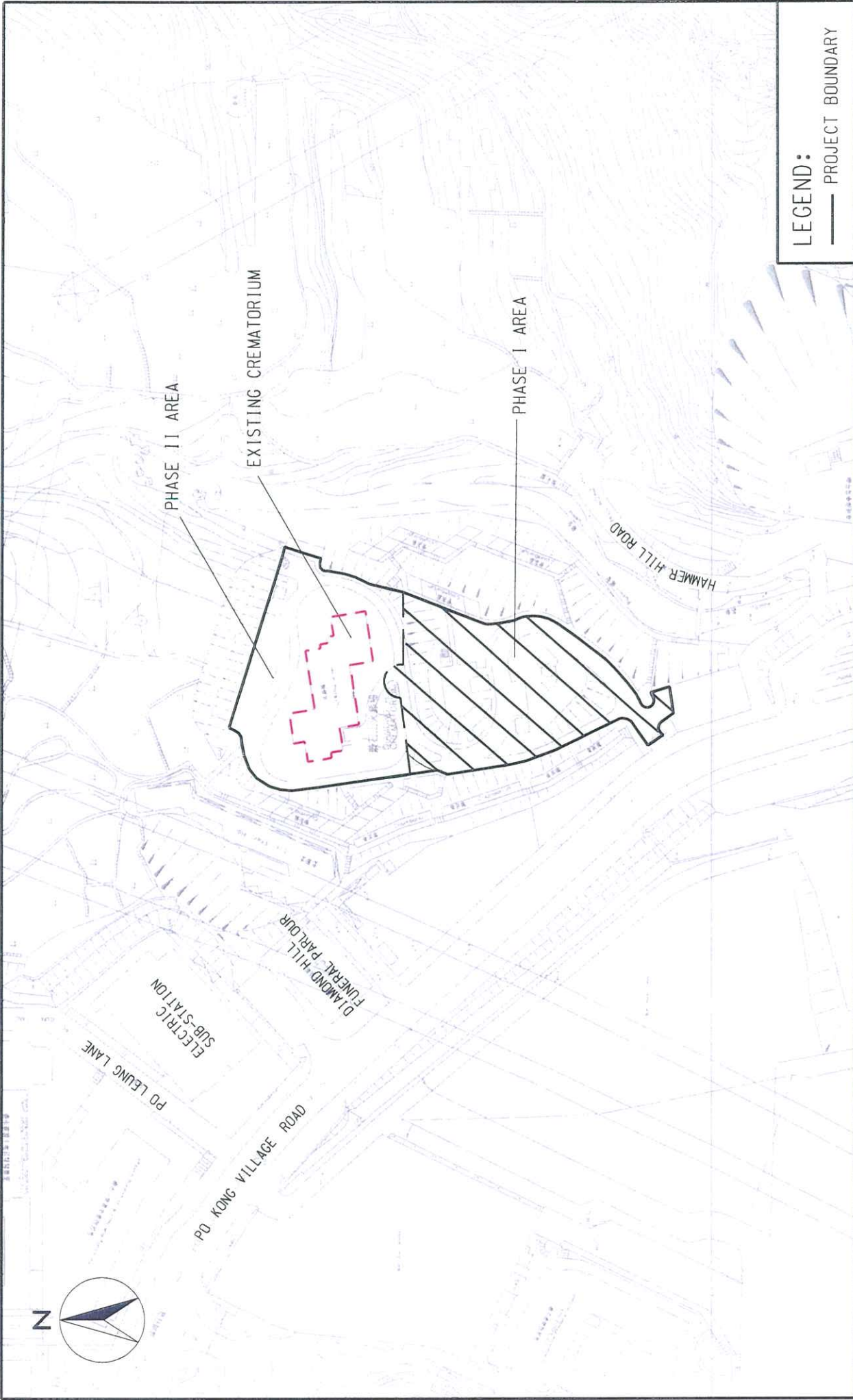
- 6.1 A contaminated materials investigation has been conducted for the existing Diamond Hill Crematorium, in particular for the chimney, flue, cremators and air extractors, following the Environmental Permit (EP) Clauses 5.3 – 5.5 [Submission of Contaminated Materials Investigation Report (CMIR) for Phase II Work] as well as the Particular Specification PS.G.11 Clause 4.5.5 [Contaminated Materials Investigation Report (CMIR) for Phase II Work] and Clause 4.6.4.4 [Contaminated Material] of the Project.
- 6.2 A total of 3 ash samples were collected from cremator, flue and air extractors in accordance with the approved Sampling and Analysis Plan for laboratory analysis where all samples were found with elevated levels of heavy metals. The sample collected at the cremator was also found with pyrene exceeding Dutch B level while the sample collected at the flue was found with dioxin exceeding the USEPA criterion. The estimated quantity of contaminated ash waste is about 1.5m³.
- 6.3 In accordance with the EP and PS.G.11, the ash wastes in the cremators, chimney, flue and air extractors were classified as Moderately Contaminated DCM or Moderately/Severely Contaminated HMCM/PAHCM. Special demolition, handling, treatment and disposal measures/methods detailed in the demolition plan shall be followed and implemented.
- 6.4 The ash attached to the contaminated parts shall be removed by scrubbing and utilizing of High Efficiency Particulate Air (HEPA) vacuum. The ash waste should then be stabilized by mixing with cement followed by disposal at landfill.
- 6.5 Pilot mixing and TCLP tests by a HOKLAS accredited laboratory shall be carried out to establish the appropriate ratio of cement to ash waste to the satisfaction of EPD prior to the actual stabilization treatment.
- 6.6 If the landfill disposal criteria cannot be met after immobilization of the ash waste, disposal at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi would be considered.
- 6.7 After scrubbing and HEPA vacuuming, the cremators/flue/chimney/air extractors where contaminated materials were found are considered to be cleaned. Such building structures can be handled and disposed as construction and demolition (C&D) materials.

- 6.8 In accordance with the Asbestos Abatement Plan (AAP), asbestos containing materials (ACM) were identified at insulation boards as part of the flue lining (at exterior surface from cremators No. 1 to No. 4) and asbestos gaskets at exterior surface of cremator No. 5. Contaminated ash wastes were also found on the surfaces inside the flue and the cremators. In view of such close distance between the ACM and contaminated ash wastes, there is concern on contaminated ash wastes being embedded in asbestos boards and gaskets.
- 6.9 Therefore, contaminated ash wastes would be firstly removed by scrubbing and HEPA vacuuming. After the removal of ash wastes, the insulation boards (at exterior surface of flue) and exhaust pipe gasket (at exterior surface of cremator No.5) with ACM identified would be removed inside full containment under negative pressure and wrapped with double layer polythene sheet and put into steel drums with proper labels for landfill disposal. Special removal, handling and disposal measures/methods detailed in the demolition plan shall be followed and implemented.
- 6.10 Environmental mitigation measures have been proposed to minimize the potential environmental impacts of the remediation activities. Health and safety measures should be followed to minimize safety hazard posed to site workers.
- 6.11 After the completion of demolition and decontamination, remediation report (RR) shall be prepared to demonstrate that the cleanup is adequate. Information such as remediation procedures, types and volume of contaminated materials treated, standards and levels of treatment, and locations of off-site disposal sites shall be included in the report. The RR shall then be certified by the Environmental Team leader and verified by Independent Environmental Consultant prior to submission to the EPD for approval.



DRAWINGS



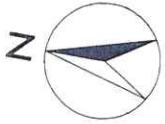


LEGEND:
 ——— PROJECT BOUNDARY

SCALE	A4 1:2000	DATE	MAY 07
CHECK	IWSL	DRAWN	ILPY
JOB No.	60016796 (2.1)	DRAWING No.	1
		REV	—

CONTRACT NO. SS M333
 REPROVISIONING OF DIAMOND HILL CREMATORIUM
EXISTING CREMATORIUM AND PROJECT SITE BOUNDARY



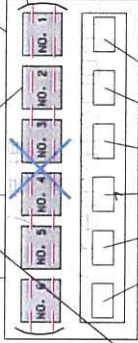


CREMATION ROOM

CA-1

F-1

EXISTING CREMATORIUM BUILDING



A-1

AIR EXTRACTOR ROOM

LEGEND:

— PROJECT BOUNDARY

□ CREMATOR

≡ FLUE

× CHIMNEY

□ AIR EXTRACTOR

⊙ SAMPLING LOCATION

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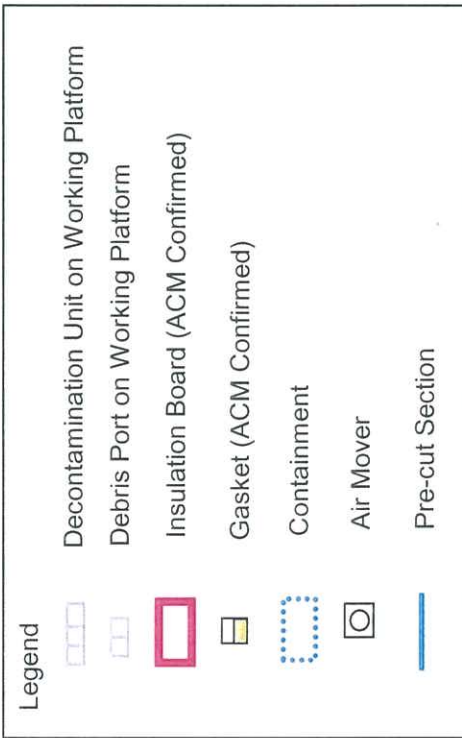
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DRAWING NO.

MAY 07
ILPY
2
REV —

CONTRACT NO. SS M333
REPROVISIONING OF DIAMOND HILL CREMATORIUM
**AS-BUILT ASH SAMPLING LOCATIONS FOR CONTAMINATED
MATERIALS INVESTIGATION FOR PHASE II WORKS**





Chimney Stack at Roof

Step 5
Pre-cut at junction of chimney exhaust and vertical chimney stack (Section 5.45f)

Step 4
Vacuum clean ash waste (Section 5.45e)

Step 3
Setup of containment (Section 5.45d)

Step 6
Pre-cut connection of chimney exhaust and cremator No. 1-6 (Section 5.45g)

30cm

30cm

Step 2
Remove concrete wall to expose the connection (Section 5.45c)

Step 7
Remove ACM insulation board (Section 5.45h-l)

Step 1
Setup of working platform (Section 5.45b)



CREMATOR

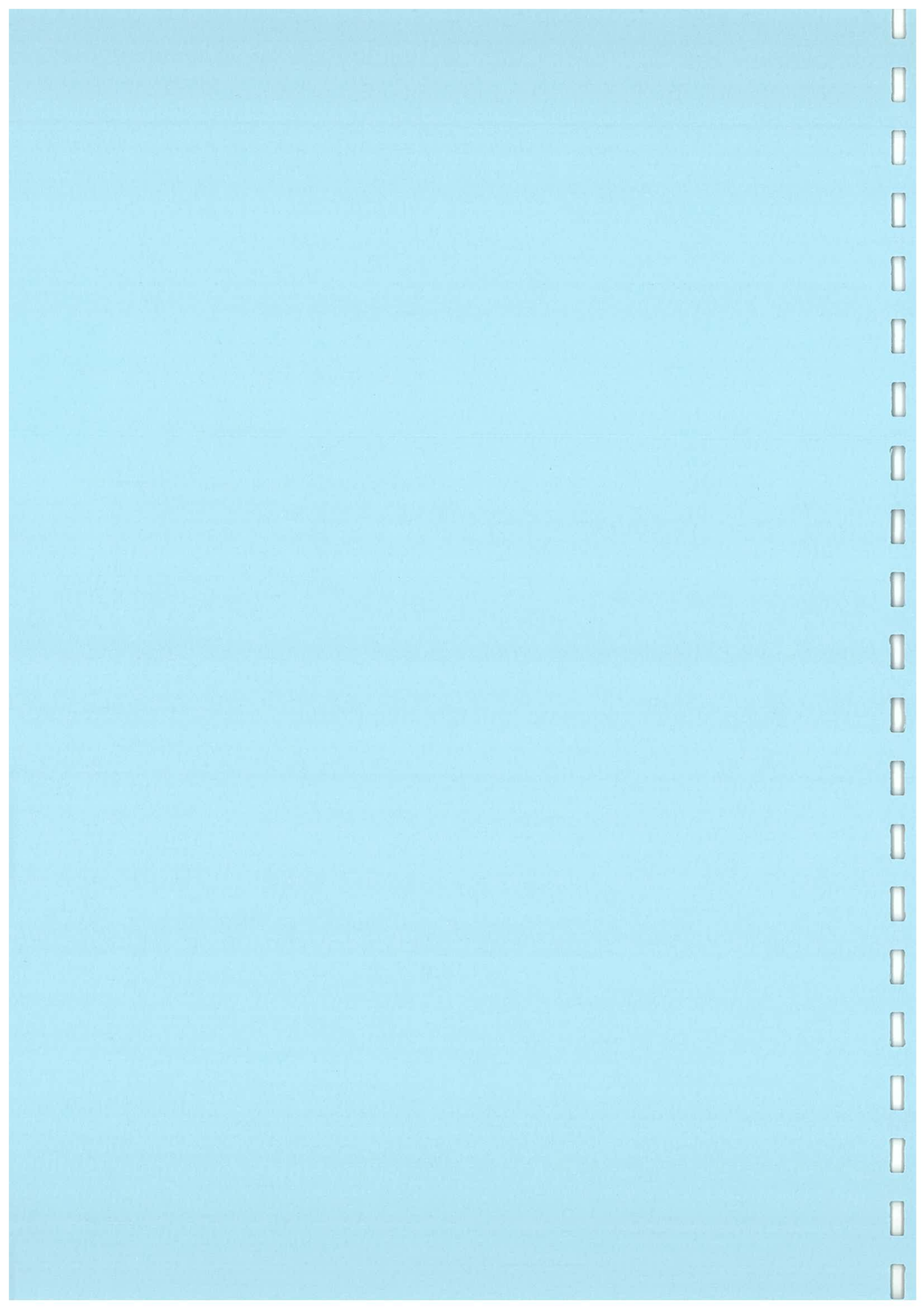
Crementation Room

E

F

<p>ENSR AECOM</p>		<p>CONTRACT NO. SS M333</p>		<p>SCALE</p>	<p>N.T.S.</p>	<p>DATE</p> <p>Oct-07</p>	
		<p>REPROVISIONING OF DIAMOND HILL CREMATORIUM</p> <p>SCHEMATIC DIAGRAM FOR REMOVAL OF INSULATION BOARDS AND EXHAUST PIPE GASKETS</p>		<p>CHECK</p>	<p>DRAWN</p>	<p>MCYT</p>	
		<p>JOB NO.</p>	<p>60016796 (2.1)</p>	<p>DRAWING NO.</p>	<p>3</p>	<p>Rev</p>	<p>-</p>

APPENDIX A





ALS Laboratory Group

125914

CHAIN OF CUSTODY DOCUMENTATION

CLIENT: MEMCL SAMPLER: _____
 ADDRESS / OFFICE: _____ MOBILE: _____
 PROJECT MANAGER (PM): Cary Wain PHONE: _____
 PROJECT ID: Diamond Hill EMAIL REPORT TO: _____
 SITE: _____ P.O. NO.: _____
 QUOTE NO.: HK190A/2007 EMAIL INVOICE TO: (if different to report) _____

RESULTS REQUIRED (Date): _____ ANALYSIS REQUIRED INCLUDING SUITES (note - suite codes must be listed to attract suite prices) _____

FOR LABORATORY USE ONLY
 COOLER SEAL (circle appropriate): Intact YES NO N/A
 SAMPLE TEMPERATURE: LAB STAFF
 CHILLED: YES YES NO N/A

ALS ID	SAMPLE ID	MATRIX	DATE	Time	CONTAINER INFORMATION	
					Type / Code	Total bottles
1	A1	Ash	22/3		S. Jar	
2	CA1	Ash	"		"	
3	S4	Soil	"		"	
4	S5	Soil	"		"	
5	F1	Ash	18/4		"	
6	S1	Soil	"		"	
7	S2	Soil	"		"	
8	S3	Soil	"		"	
9	S6	Soil	"		"	

Notes: e.g. Highly contaminated samples
 e.g. "High PAHs expected".
 Extra volume for QC or trace LORs etc.

ALS Technicheim (HK) Pty
 Ltd
 Work Order
HK0705103



Telephone : + 852 2610 1044

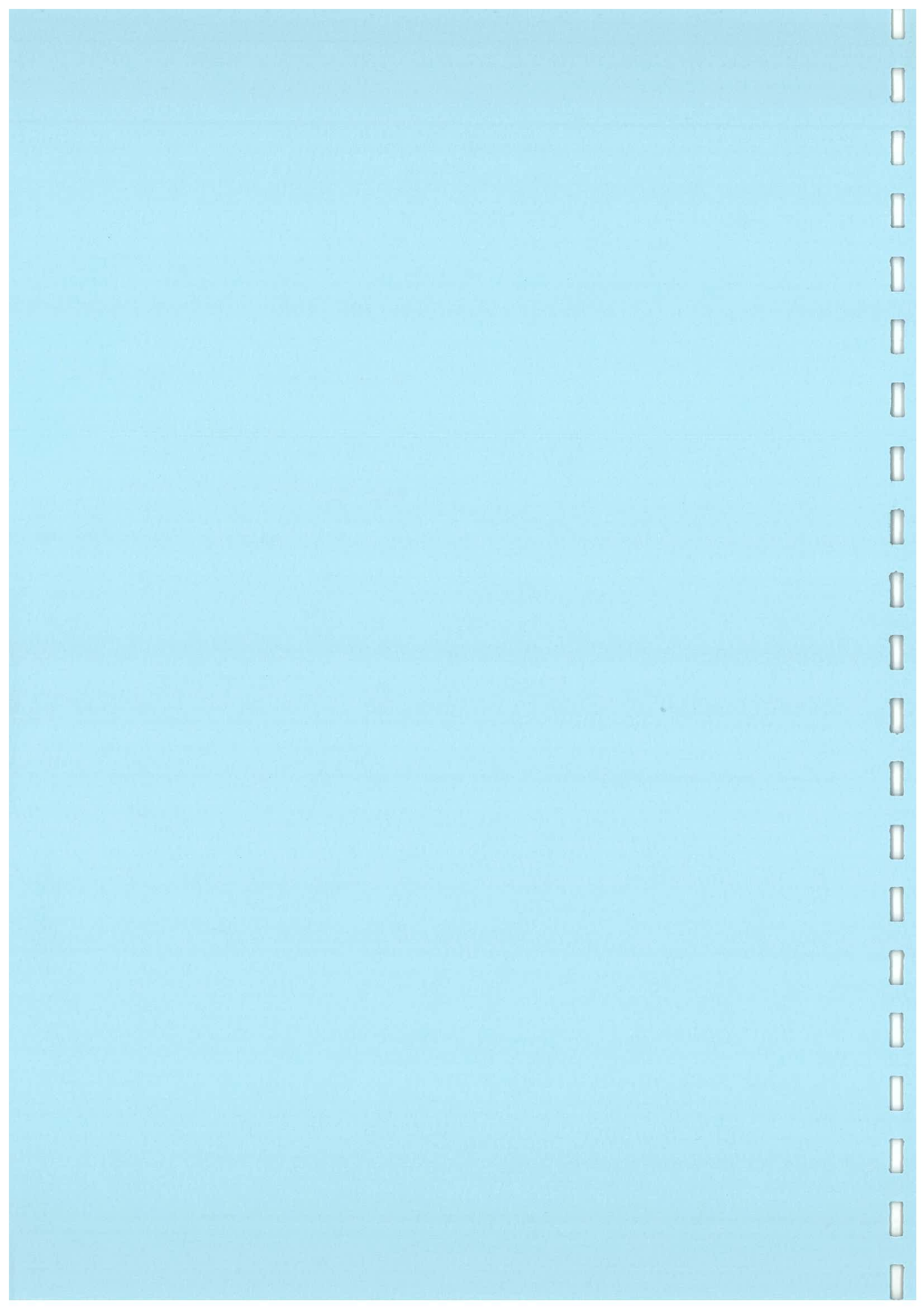
RELINQUISHED BY: RICHARD Fung Date: 27/4/2007
ALS Technicheim Time: 10:00 AM
Henry Wong Date: 18/4/2007
FAISR Time: _____

RECEIVED BY: Arnel Ho Name: _____ Date: 13/4/07
AIS Of: _____ Time: 10:00 AM
 Name: _____ Date: _____
 Of: _____ Time: _____

Water ContAINER Codes: P = Unpreserved Plastic; N = Nitro Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved;
 V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass;
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



APPENDIX B



Contract No. SS M333 Reprovisioning of Diamond Hill Crematorium - Contaminated Materials Investigation Report for Phase II Works

Criteria	Heavy metals, mg/kg										Polycyclic Aromatic Hydrocarbons (PAH), mg/kg						ng ITEQ/g				
	Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Molybdenum (Mo)	Nickel (Ni)	Lead (Pb)	Tin (Sn)	Zinc (Zn)	Mercury (Hg)	Naphthalene	Phenanthrene	Anthracene	Fluoranthene		Pyrene	Benzo(a)pyrene	Chlokin	
Dutch A	20	200	1	100	20	50	10	50	50	20	200	0.5	0.1	0.1	0.1	0.1	0.1	0.1	1*		
Dutch B	30	400	5	250	50	100	40	100	150	50	500	2	5	10	10	10	10	10	1*		
Dutch C	50	2000	20	800	300	500	200	500	600	300	3000	10	50	100	200	100	100	10	1*		
Ash Sample Identification																					
Location	Type	Sampling Date																			
A-1	Ash	22/02/2007	24	308	5.1	1150	24.3	50.5	13	92	358	15700	3100	0.08	1.1	8.8	0.8	7.5	4	0.355	
CA-1	Ash	22/02/2007	11	783	3.4	2740	18.4	68.1	25	2470	1420	17000	4220	0.11	5*	45*	5*	5.3	12.1	5*	0.661
F-1	Ash	16/04/2007	46	131	53.1	1830	67	718	93	2740	17600	9260	9260	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.17

Notes:

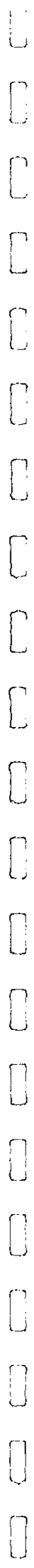
Squares in bolded line indicates exceedance of Dutch B Level

Shaded square indicates exceedance of Dutch C Level

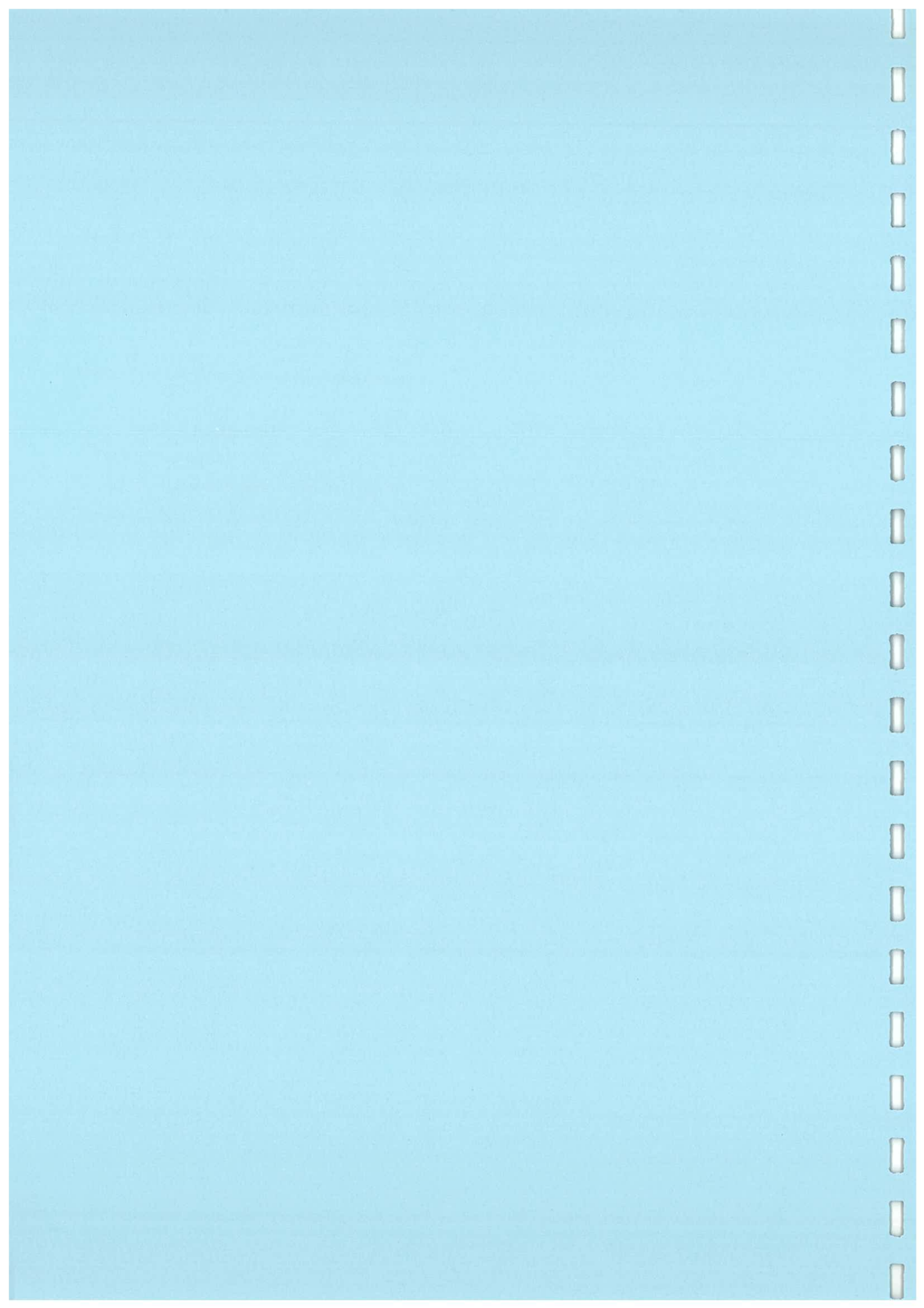
Full analytical results should be referred to laboratory report

*: Due to severe matrix interference encountered, the sample has been diluted 10-fold and detection limits have also been raised accordingly.

^: USEPA criteria of land contamination remediation target for residential sites: 1 ppb TEQ, i.e. 1 ng/g. Toxicity Equivalent Unit, has been used.



APPENDIX C



Contract No. SS M333
Reprovisioning of Diamond Hill Crematorium
Contaminated Materials Investigation Report (CMIR) for Phase II Works (V2)

Comments & Responses

Comment from: Environmental Protection Department		Date: 27 July 2007	Contact: MW Ho
Comments	Responses		
<p>(a) S.5.14 – (i) Please provide relevant specifications (e.g. type of materials, thickness, etc.) for the container including its internal lining to be used for storage of contaminated wastes including ash waste.</p> <p>(ii) It seems that the proposed size of container is rather too big for handling, please consider to use smaller size of container.</p>	<p>Noted and relevant specifications have been added in S.5.13.</p>		
<p>(b) S.5.17 – “Facilities Management Group” should read as “Waste Facilities Group”. Please amend.</p>	<p>Noted. 200L container would be used for handling the ash waste and S.5.14 has been amended.</p> <p>Noted and S.5.17 has been amended.</p>		
<p>(c) S.5.18 – It is noted that pilot test for stabilization/ immobilization of the contaminated wastes including ash waste is recommended. Relevant details should be provided in the text.</p>	<p>Noted and details have been added in S.5.18.</p>		
<p>(d) S.5.22 – Please provide a table to summarize the estimated quantities of dioxin and other contaminated materials to be disposed of to the CWTC, landfill or treated on-site before disposal to landfill.</p>	<p>Noted and the estimated quantity of contaminated ash waste has been added in S.5.24 and Table 5.3.</p>		
<p>(e) Table of Content (TOC) – The title of Table 3.1 in the TOC does not tally with the one in the main text. Please ensure the table of content is consistent with the main text.</p>	<p>Noted and TOC has been amended.</p>		
<p>(f) S.5.6 & S.5.10 – We understand asbestos investigation report and asbestos abatement plan have already been done. Therefore, it is necessary to state clearly in these sections whether asbestos containing materials are in fact identified based on the findings of the above reports.</p>	<p>Noted. S.5.6 & S.5.10 of CMIR (Version 1) have been deleted and relevant information has been added in S.5.3.</p>		
<p>(g) S.5 – For the sake of clarity, please indicated if there is any specific handling procedure/ measures for the demolished “building structures” where contamination is found.</p>	<p>Noted and details have been added in S.5.8.</p>		

Contract No. SS M333

Reprovisioning of Diamond Hill Crematorium

Contaminated Materials Investigation Report (CMIR) for Phase II Works (V3)

Comments & Responses

Comment from: Environmental Protection Department	Date: 6 September 2007 Contact: Mr. David Cox
<p><u>Comments</u></p> <p>(a) S.5.3 – According to your investigation, ACM were identified in the insulation board of the chimney exhaust and exhaust pipe gasket at crematory no. 5. To avoid ambiguity, please indicate clearly, based on your findings, whether there is any asbestos/ dioxin mixed wastes found at the site. If yes, the handling/ treatment/ disposal method and disposal outlet for such "mixed" contaminated wastes should be outlined clearly in the report.</p>	<p><u>Responses</u></p> <p>In this investigation, contaminated ash wastes (with dioxin, heavy metals and/or PAHs exceeding relevant contamination levels) were found on the surfaces inside the flue and the cremators. Some asbestos insulation boards were found as part of the flue lining (at exterior surface) while asbestos gaskets were found at exterior surface of cremator No.5. Due to such close distance between the ACM and contaminated ash wastes, there is concern on contaminated ash wastes being embedded in asbestos boards and gaskets.</p> <p>To handle such wastes, the contaminated ash wastes inside the flue and cremator would be firstly removed by scrubbing and HEPA vacuuming. After the removal of ash wastes, the insulation board (at exterior surface of the flue) and exhaust pipe gaskets (at exterior surface of cremator No.5) with ACM identified would be removed inside full containment under negative pressure and wrapped with double layer polythene sheet and put into steel drums with proper labels for landfill disposal. The decontamination and disposal method for insulation board and gasket has been added in Sections 5.27 – 5.47.</p> <p>According to the decontamination and disposal method stated in Sections 5.27 – 5.47, after the removal of ash wastes by scrubbing and HEPA vacuuming, the structures would be removed inside full containment under negative pressure and wrapped with double layer polythene sheet and put into steel drums with proper labels for landfill disposal.</p> <p>The estimated quantity of ash waste (prior to treatment) would be around 1.55m³. Based on the conservative assumptions that same volume of cement would be added to stabilize the ash wastes, the quantity of stabilized ash wastes would be about 3.1m³. However, the quantity of stabilized contaminated ash wastes would be subject to the site conditions and the percentage of cement used for the treatment. S.5.25 has been added to estimate the quantity of stabilized ash wastes.</p>
<p>(b) S.5.3 – It was mentioned that dioxin contaminated materials should be removed prior to the asbestos abatement measures. Subject to our clarification on item i) (item (a) in this Responses to Comments), please critically review if such a discrete approach (removing one after the other) is technically feasible in case the asbestos and dioxin mixed wastes do exist and amend the text if necessary.</p>	
<p>(c) S.5.24 – Please also provide an estimated on the amount of stabilized contaminated ash wastes, in particular the stabilized dioxin ash wastes, to be landfilled.</p>	

Comment from: Environmental Protection Department		Date: 6 September 2007	Contact: Mr. David Cox
Comments	Responses		
(d) S.5.8 – It was stated that the building structures once scrubbed and HEPA vacuum to remove the contaminated ash wastes would be cleaned and would be disposed of as C&DM. However, it appears from S.5.25 that the building structures where contamination is identified will be sealed for disposal to landfill. Please clarify.	No contamination was found in building structures other than cremators/ chimney/ flue/ air extractors in this investigation. The building structures with contaminants found would be scrubbed and HEPA vacuumed to remove the ash wastes. After scrubbing and HEPA vacuuming, the building structures are considered to be cleaned and would be disposed of as C&D materials. S.5.26 has been amended.		

Contract No. SS M333
Reprovisioning of Diamond Hill Crematorium
Contaminated Materials Investigation Report (CMIR) for Phase II Works (V5)

Comments & Responses

Comment from: Environmental Protection Department		Date: 18 October 2007	Contact: Mr. David Cox
<u>Comments</u>		<u>Responses</u>	
(a)	For clarity, please add drawings (as those contained in the approved Asbestos Abatement Plan) to demonstrate the various steps involved in the removal of the insulation boards and exhaust pipe gasket.	Noted and Drawing No. 3 has been added.	
(b)	S.5.45, bullet e), m), S.5.49, S5.52, S5.56 – It is confusing to just state certain materials would be disposed as dioxin contaminated wastes as the earlier section recommends contaminated (dioxin) ash wastes be stabilized with cement before disposal to landfill or CWT. To avoid confusion, please include a summary table to summarize the treatment (if any) and disposal outlet for the different type of wastes generated including the contaminated ash wastes, potential dioxin contaminated wastes from the insulation boards & gasket removal, other dioxin contaminated wastes (say from decontamination unit/ tool).	Noted and Table 5.4 has been added.	
(c)	I would presume the requirements under S.5.27 – S.5.67 are relevant to the removal of the insulation boards and exhaust pipe gasket. This should be made clear to avoid confusion.	Noted and the sub titles under section "Decontamination and Demolition Methods for Insulation Boards and Exhaust Pipe Gaskets" have been formatted to <i>italic</i> to avoid confusion.	
(d)	While it is noted that negative air filtration system is proposed for the removal of insulation boards and exhaust pipe gasket, such requirement is not mentioned in S5.4 – 5.9. Please clarify if such arrangement will be adopted in general during the demolition/ removal works.	Negative air filtration system will be adopted in general during the demolition/ removal works. The requirement has been added in S5.5.	