Issue No 2
Issue Date October 2009
Project No. 912

PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Report Prepared by
Allied Environmental Consultants Ltd.

COMMERCIAL-IN-CONFIDENCE

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FAXED
13 OCT 2009

Architectural Services Department
Architectural Branch
41/F, Queensway Government Offices
66 Queensway
Hong Kong

Your reference:
Our reference: HKASD101/50/100182
Date: 13 October 2009

Attn.: Mr Andrew NAM / Ms Salina LEE

BY FAX ONLY
(Fax no.: 2524 7981)

Dear Sirs

Quotation Contract No. 9/2009/AB1
Provision of Cremators at Wo Hop Shek Crematorium - Independent Environmental Checker Service
Revised Supplementary Contamination Assessment Plan

We refer to the e-mail from your Environmental Team attached with a copy of the Revised Supplementary Contamination Assessment Plan and their subsequent revision, we have no further comment and hereby, verify the report in accordance with Condition 5.3 of the Environmental Permit EP-329/2009.

Should you have any queries, please do not hesitate to contact the undersigned or our Mr James Choi on 2869 6018.

Yours faithfully
EDMS CONSULTING LTD

Andy W L Chung
Independent Environmental Checker

AC/jc

cc AECOM - Ms Edith Ng (Fax: 2891 0305)

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Certified by

Adi Y.M. Lee
Environmental Team Leader

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To provide details of sampling and analysis of Supplementary Contamination Assessment for underground fuel tank, transformer room, dangerous goods stores, daily tank room, fuel pump room, sunken fuel pipe and cremator prior to the demolition of the Wo Hop Shek Crematorium.

SUMMARY

Pursuant to Condition 3.1 under Environmental Permit (EP EP-329/2009) for Provision of Cremators at Wo Hop Shek Crematorium, a Supplementary Contamination Assessment (SCA) is required to investigate the nature and extent of potential contamination in coffin crematorium building and skeletal cremator building upon decommissioning prior to demolition; as some of the areas were unavailable for site investigation during Environmental Impact Assessment Study. These areas include underground fuel tank, transformer room, dangerous goods stores, daily tank room, fuel pump room, sunken fuel pipe and cremators.

A site visit was undertaken on 19 August 2009 to identify sampling locations for SCA. The coffin crematorium building was decommissioned and handed over to the demolition contractor. The interior access of skeletal cremator building was unavailable as the skeletal cremator building is still in operation.

Ash and soil sampling and analysis are required to be undertaken in coffin crematorium building and skeletal cremator building. Ash sampling will be undertaken inside the cremator, flue, chimney and air extractor room, while soil sampling will be undertaken beneath the underground fuel tank, and at dangerous goods stores, daily tank room, fuel pump room, sunken fuel pipe and transformer room.

A further site visit will be required for skeletal cremator building upon decommissioning of the skeletal building to confirm the locations of ash and soil samplings as proposed in this Supplementary Contamination Assessment Plan (SCAP).

1.0 INTRODUCTION

1.1 Background

Allied Environmental Consultants Limited (AEC) has been commissioned by the Wan Chung Construction Co. Ltd. ("the Contractor") to conduct a Supplementary Land Contamination Assessment (SCA) for the Provision of Cremator at Wo Hop Shek Crematorium (hereafter referred to as the "Project").

Wo Hop Shek Crematorium was commissioned in 1960s and 1991. It is located at Kiu Tau Road, North District as shown in ***Figure 1***. As the existing cremators are approaching the end of their serviceable life, the Food and Environmental Hygiene Department (FEHD) proposes to demolish the existing crematorium building (the Site) and construct a new crematorium.

Since areas described in ***Table 1*** was unable to carry out site investigation during the course of the Environmental Impact Assessment (EIA) study stage, pursuant to Condition 3.1 under the Environmental Permit (EP) (No. EP-329/2009) of the Project EIA (Register No. AEIAR-119/2008), SCA shall be carried out for the areas as listed in ***Table 1*** at the Site after decommissioning and before demolition of the existing coffin crematorium and skeletal cremator buildings.

Table 1 List of Locations for Supplementary Contamination Assessment

Existing Coffin Crematorium	Underground Fuel Tank
	Dangerous Goods Stores
	Daily Tank Room, Fuel Pump Room and Sunken Fuel Pipe
	Cremators
	Transformer Room
Skeletal Cremator Building	Underground Fuel Tank
	Dangerous Goods Store
	Cremator

This Supplementary Contamination Assessment Plan (SCAP) is prepared in accordance with following documents

- *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair/Dismantling Workshops*
- *Guidance Note for Contaminated Land Assessment and Remediation*
- *Guidance Manual for Use of Risk-Based Remediation Goals for Contaminated Land Management*

1.2 Objectives

This SCAP is prepared following the Condition 3.2 of the EP-329/2009 to provide the details of sampling and analysis requirements for the assessment of the level of dioxins, metals, poly aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and polychlorinated biphenyls (PCB) in the building structures/depositions at the Site.

2.0 SITE INSPECTION AND OBSERVATION

A site inspection was conducted on 19 August 2009 to identify sampling locations of this SCA.

The coffin crematorium building was decommissioned and handed over to the Contractor; while the skeletal cremator building is still in operation.

There are a total of 4 cremators, 1 chimney and 1 flue observed inside the coffin crematorium building. On the opposite side of the cremators is the machine room with 4 air extractors. Each cremator fueled by diesel has its own duct and eventually joins into the flue. Inside each cremator, there is an air extractor room located opposite to the cremator. ***Figure 2*** shows the internal layout of the cremation room.

Some ash-waste was observed deposited at the bottom of the cremators and suspected to be accumulated in the flue and chimney. Some ash-like substance was also found on the surface of air extractors.

Sunken fuel pipe with length of around 13m was found in cremator room which is connected to daily tank room and fuel pump room. The potential soil contamination was unlikely along the sunken fuel pipe as the fuel pipe is protected by the surface duct and well covered by metal tiles.

No observable crack and oil stain was found on the concrete paved ground in the transformer room.

3.0 SAMPLING LOCATION

3.1 Ash sampling inside coffin crematorium building

Four ash sampling points are proposed to be undertaken inside the cremator, flue, chimney and air extractor room respectively to investigate any potential contaminated ash waste present in these areas. The rationales for selection locations are stated in the ***Table 2*** and ***Figure 2*** shows the sampling locations.

Table 2 Locations and Parameters for Ash Sampling inside Coffin Crematorium Building

Sampling ID	Sampling Locations	Rationale	Parameters to be Analysed
A-1	Ash at the bottom of cremator	To investigate the contamination status of the ash accumulated at the bottom of the cremator	PAHs Dioxins Metals (Cr, Co, Ni, Cu, Zn, As, Mo, Cd, Sn, Ba, Hg, Pb)
A-2	Ash at the bottom of flue	To investigate the contamination status of the ash at the bottom of the flue which is connected to the 4 cremators and chimney	
A-3	Ash at the wall of chimney	To investigate the contamination status of the ash on the chimney wall	
A-4	Ash on the exterior surface of the air extractors	To investigate the contamination status of the layer of ash-like substance covering the air extractors' surface	

Notes
1. Sampling locations will be determined on site subject to the availability and quantity of ash.
2. Ash sample will be collected in one of the cremators and extractors as all cremators operate in the same way.

3.2 Soil sampling at coffin crematorium building

A total of 6 soil sampling locations as listed in the ***Table 3*** are proposed to be sampled. ***Figure 3*** and ***Figure 4*** show the locations of soil sampling at the coffin crematorium.

Table 3 Locations and Parameters for Soil Sampling inside Coffin Crematorium Building

Sampling ID	Sampling Locations	Sampling Depth below Ground Level	Parameters to be Analysed
S-1	Underneath of underground fuel tank	Immediately below base of the fuel tank	TPH PAHs
S-2	Dangerous goods stores	0.5m, 1.5m and 3m	TPH PAHs
S-3	Daily Tank Room	0.5m, 1.5m and 3m	TPH PAHs
S-4	Fuel Pump room	0.5m, 1.5m and 3m	TPH PAHs
S-5A	Sunken Fuel Pipe	0.5m, 1.5m and 3m	TPH PAHs
S-5B		0.5m, 1.5m and 3m	TPH PAHs
S-6	Transformer room	0.5m, 1.5m and 3m	PCB

Note
1. Soil sampling at underneath of underground fuel tank should be carried out upon removal of fuel tank.

The approved Contamination Assessment Plan (CAP) and Contamination and Assessment Report (CAR) during the EIA stage reveal that land contamination was not identified surrounding the underground fuel tank. A confirmatory soil sample was proposed to be collected underneath of the underground fuel tank after the removal of tank to ensure any oil leakage from the base of the underground fuel tank according to S5.7.6 of the EPD's approved EIA Report. As such, only one sample is proposed to be collected immediately below the base of the tank to ensure that no contamination beneath the underground fuel tank due to fuel leakage. If contamination beneath the underground fuel tank is identified, a further confirmatory sampling shall be carried out to determine the vertical extent of soil contamination under the underground fuel tank until no further contamination is encountered.

The approved CAP during the EIA stage indicates that land contamination within dangerous goods stores, daily tank room and fuel pump room is unlikely. Moreover, as mentioned in ***Section 2.0***, no visible evidence of oil leakage was found in sunken fuel pipe and transformer room. Thus, deep soil contamination is not anticipated and sampling depth to 3m is proposed for initial determination of vertical extent of contamination as the potential contamination. If contamination is identified at 3m based on the laboratory results, sampling at further depths, if necessary, down to the end of excavation levels, should be conducted to confirm the vertical extent of contamination.

3.3 ASH AND SOIL SAMPLINGS INSIDE SKELETAL CREMATOR BUILDING

Sampling locations for ash waste are proposed in ***Table 4***. As the skeletal cremator building was still in operation during site visit, a further site inspection is required to confirm the proposed locations for ash sampling following decommissioning of the skeletal cremator prior to sampling and analysis works. The finalized sampling locations for ash sampling shall be updated and submitted to EPD for approval.

Table 4 Locations and Parameters for Ash Sampling inside Skeletal Cremator Building

Sampling ID	Sampling Locations	Rationale	Parameters to be Analyzed
AA-1	Ash at the bottom of cremator	To investigate the contamination status of the ash accumulated at the bottom of the cremator	PAHs Dioxins Metals (Cr, Co, Ni, Cu, Zn, As, Mo, Cd, Sn, Ba, Hg, Pb)
AA-2	Ash at the bottom of flue	To investigate the contamination status of the ash at the bottom of the flue which is connected to the 4 cremators and chimney	
AA-3	Ash at the wall of chimney	To investigate the contamination status of the ash on the chimney wall	
AA-4	Ash on the exterior surface of the air extractors	To investigate the contamination status of the layer of ash-like substance covering the air extractors' surface	

Notes
1. Sampling locations will be determined on site subject to the availability and quantity of ash.
2. Ash sample will be collected in one of the cremators and extractors as all cremators operate in the same way.

Sampling locations for soil substance are proposed in ***Table 5*** and ***Figure 5*** shows the locations for soil sampling. As the skeletal cremator building was still in operation during site visit, a further site inspection is required to confirm the proposed locations for soil sampling following decommissioning of the skeletal cremator prior to sampling and analysis works. The finalized sampling locations for soil sampling shall be updated and submitted to EPD for approval.

Table 5 Locations and Parameters for Soil Sampling inside Skeletal Cremator Building

Sampling Locations	Sampling ID	Sampling Depth below Ground Level	Parameters to be Analysed
Underneath of underground fuel tank	SS-1	Immediately below the base of the fuel tank	TPH PAHs
Dangerous goods stores	SS-2	0.5m, 1.5m and 3m	TPH PAHs

Notes
1. Soil sampling at underneath of underground fuel tank should be carried out upon the removal of fuel tank.

The approved CAP and CAR during the EIA stage reveal that land contamination was not identified surrounding the unused underground fuel tank. A confirmatory soil sample was proposed to be collected underneath of the unused underground fuel tank after the removal of tank to ensure any oil leakage from the base of the unused underground fuel tank according to S5.7.6 of the EPD's approved EIA Report. As such, only one sample is proposed to be collected immediately below the base of the tank to ensure that no contamination beneath the unused underground fuel tank due to fuel leakage. If contamination beneath the unused underground fuel tank is identified, a further confirmatory sampling shall be carried out to determine the vertical extent of soil contamination under the unused underground fuel tank until no further contamination is encountered.

The approved CAP during the EIA stage indicates that potential land contamination due to the leakage of diesel oils stored in the dangerous goods stores is unlikely. Thus, the sampling depth to 3m is proposed for initial determination of vertical extent of contamination. If contamination is identified at 3m based on the laboratory results, sampling at further depths, if necessary, down to the end of excavation levels, should be conducted to confirm the vertical extent of contamination.

3.4 GROUNDWATER SAMPLING

It is proposed to collect groundwater samples if groundwater is encountered at the sampling locations during site investigation.

4.0 SAMPLING METHODOLOGY

Prior sampling, HOKLAS laboratory responsible for analysis should be consulted on the particular sample size and preservation procedures which are necessary for each chemical analysis.

The ash on the chimney wall should be collected by scratching and ash samples in flue, cremator and air extractor should be collected using hand tools. For soil sampling,

where possible, undisturbed samples should be collected by driving an open tube sampler into the side or base of the trial pits or the base of the boreholes. The base of the sampler should be covered with a plastic or aluminum file and sealed with a plastic lid immediately following sampling.

The collected samples should be transferred immediately to pre-cleaned sample containers provided by the laboratory. The sample containers should be laboratory cleaned, sealable, water-tight and made of glass or other suitable materials with aluminum or Teflon-lined lids so that the container surface will not react with the sample or adsorb contaminants.

All samples must be uniquely labeled with sampling ID, date and time and sampling depth. If the contents are hazardous, warning should be clearly marked and precautions should be taken during delivery.

Samples should be stored at between 0-4^{0}C and delivered to the laboratory within the sample retention time which should be advised by the laboratory.

Equipment in contact with ash or soil substance shall be thoroughly decontaminated between each sampling event to minimize the potential cross contamination. The sampling tools shall be decontaminated by steam cleaning or high pressure hot water jet and then washed by phosphate-free detergent and rinsed with distilled or deionized water.

For each proposed borehole sampling location, a groundwater sampling well should be installed into the boreholes if groundwater is encountered. A typical design of the groundwater sampling well is shown in ***Figure 6***.

After installation of the monitoring wells, the depth to water table at all monitoring wells should be measured at the same time with an interface probe. Well developments (approximately five well volumes) should be carried out to remove slit and drilling fluid reside from the wells. The wells should be allowed to stand for a day to permit groundwater conditions to equilibrate. Groundwater level and thickness of free product layer, if present, should be measured at each well before groundwater samples are taken.

Prior to groundwater sampling, the monitoring wells should be purged (at least three well volumes) to remove fine-grained materials and to collect freshly refilled representative groundwater samples. Time for each groundwater purging/recharge should be recorded as well as the estimated groundwater flow.

After the purging, one groundwater sample should then be collected at each well using Teflon bailer and decanted into appropriate sample vials or bottles in a manner which minimizes agitation and volatilization of VOCs from the samples. All samples should be uniquely labeled.

If trial pit(s) is/are considered as an alternative for sampling due to site constraints for the proposed sampling locations, groundwater sample(s) should be collected at all trial pit(s) if groundwater was encountered during excavation. The trial pit(s) should be

pumped to near dry and allowed to stand for 24 hours. Groundwater sample(s) should be collected using the decontaminated bucket.

Groundwater samples should be transferred to new, clean glass jar supplied by the laboratory for storage/transport immediately after collection. The sampling glass jars should be "darken" type. Groundwater samples should be placed in the glass jars with zero headspace and promptly sealed with a septum-lined cap. Samples should be stored at between 0-40C and delivered to the laboratory within the sample retention time which should be advised by the laboratory.

4.1 QA/QC PROCEDURES

QA/AC samples should be collected with reference to the following frequency criteria where appropriate during the SI Chain of Custody protocol should be adopted.

- 1 duplicate per 20 samples for full suite analysis
- 1 equipment blank per 20 samples for full suite analysis
- 1 field blank per 20 samples for full suite analysis; and
- 1 trip blank per trip for the analysis of light fraction (C6-C8) of TPHs and PAHs

5.0 HEALTH AND SAFETY MEASURES

The specific safety measures to be taken depend on the nature and content of contamination, site conditions and the regulations related to site safety requirements. Workmen Compensation Insurance and third party insurance must be provided for the SI.

Extreme care should be exercised when toxic gases or other hazardous materials are encountered. Any abnormal conditions found shall be reported immediately to the safety officer and the land contamination specialist.

The SI contractor shall establish and maintain a Health and Safety Plan before commencement of the SI including

- Instruction of works on work procedures, safe practices, emergency duties and applicable regulations;
- Regularly scheduled and impromptu meetings of the workers in which the possible hazards, problems of the job and related safe practices are emphasized and discussed;
- Good housekeeping practices; and
- Availability of and instruction in the location, use and maintenance of personal protective equipment.

The SI Contractor shall maintain equipments and supplies reasonably as required in an emergency including lifesaving, evacuation, rescue and medical equipment in good order and conditions. The SI Contractor shall use all reasonable means to control and prevent fires and explosions, injury to personnel, damage to equipment or property. The SI Contractor shall

- maintain proper safety devices and barriers to minimize hazards during performance of the work;
- prohibit smoking and open burning;
- develop and maintain a written emergency plan;
- maintain equipment in good condition and have first aid equipments ready for use;
- conduct equipment tests to ensure that equipment is properly placed and in good working condition; and
- require all workers employed or retained by the Contractor or a subcontractor to at all time wearing suitable clothing for work, weather and environmental conditions.

6.0 ANALYTICAL REQUIREMENTS

The suite of analysis will examine the potential contaminants that are of concern at the Site. ***Table 6*** summarizes the analytical requirements.

All laboratory test methods must be accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or one of its Mutual Recognition Arrangement partners.

Table 6 Analytical Requirement

Parameter	**Soil**		**Groundwater**	
	Analytical Method	**Detection Limit (mg/kg)**	**Analytical Method**	**Detection Limit (µg/kg)**
TPH				
C6-C8	USEPA 8015	5	USEPA 8015	20
C9-C16		200	USEPA 8260	500
C17-C35		500		500
PAHs				
Naphthalene	USEPA 8270	0.5	USEPA 8270	2
Acenaphthylene	USEPA 8100	0.5		2
Acenaphthene		0.5		2
Fluorene		0.5		2
Phenanthrene		0.5		2
Anthracene		0.5		2
Pyrene		0.5		2
Chrysene		0.5		2
Benz(a)anthracene		0.5		NA
Benzo(a)pyrene		0.5		NA
Indeno(1,2,3-cd)pyrene		0.5		NA
Dibenz(a,h)anthracene		0.5		NA
Benzo(g,h,I)preylene		0.5		NA
Benzo(b) & (k) fluoranthene		1		4
Metals				
As	USEPA 6010	0.5	USEPA 6020	NA
Ba	USEPA 6020	0.5	USEPA 7470A	NA
Cr		0.5		NA
Co		0.5		NA
Cu		0.5		NA
Pb		0.5		NA
Mo		0.5		NA
Ni		0.5		NA
Sn		0.5		NA
Zn		0.5		NA
Cd		0.2		NA
Hg		0.02		0.05
PCB	USEPA 8270	3µg/kg	USEPA 8070	0.1

Parameter	Soil		Groundwater	
	Analytical Method	**Detection Limit (mg/kg)**	**Analytical Method**	**Detection Limit (µg/kg)**
Dioxins (l-TEQ)				
2,3,7,8-Tetrachlorodibenzo-p-	USEPA 8290	0.005µg/kg	USEPA 8290	0.005
1,2,3,7,8-Pentachlorodibenzo-p-		0.01µg/kg		0.025
1,2,3,6,7,8-Hexachlorodibenzo-p-		0.05µg/kg		0.025
1,2,3,4,7,8-Hexachlorodibenzo-p-		0.05µg/kg		0.025
1,2,3,7,8,9-Hexachlorodibenzo-p-		0.05µg/kg		0.025
1,2,3,4,6,7,8-Heptachlorodibenzo-p-		0.05µg/kg		0.025
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-		0.2µg/kg		0.1
2,3,7,8-Tetrachlorodibenzofuran		0.01µg/kg		0.005
1,2,3,7,8-Pentachlorodibenzofuran		0.01µg/kg		0.025
2,3,4,7,8-Pentachlorodibenzofuran		0.01µg/kg		0.025
1,2,3,4,5,6,7,8-Octachlorodibenzofuran		0.2µg/kg		0.05
1,2,3,4,7,8-Hexachlorodibenzofuran		0.05µg/kg		0.025
1,2,3,6,7,8-Hexachlorodibenzofuran		0.05µg/kg		0.025
1,2,3,7,8,9-Hexachlorodibenzofuran		0.05µg/kg		0.025
2,3,4,6,7,8-Hexachlorodibenzofuran		0.05µg/kg		0.025
1,2,3,4,6,7,8-Heptachlorodibenzofuran		0.05µg/kg		0.025
1,2,3,4,7,8,9-Heptachlorodibenzofuran		0.05µg/kg		0.025

NA – Not Applicable

If any soil samples are found exceeding the assessment criteria and excavation and landfill disposal is selected as a remedial method as a last resort and will be subject to the acceptance requirements as set by the Landfill Authority for disposal, one sample per $500m^3$ [1] shall be conducted for the Toxicity Characteristics Leaching Procedure (TCLP) test in order to determine whether the samples comply with the criteria for landfill disposal in accordance with the *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filing Stations, Boatyards, and Car Repari/Dismantling Workshops* before landfill disposal. ***Table 7*** summarized the landfill disposal criteria for contaminated soil. The soil samples will thus be retained and stored at $0\text{-}4^0C$ for TCLP analysis following completion of the laboratory testing of the above parameters.

Table 7 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

7.0 INTERPRETATION OF RESULTS

7.1 Soil substances

All sampling results for soil substances shall be interpreted in accordance with the *Guidance Note for Contaminated land Assessment and Remediation and* R*isk-Based Remediation Goals (RBRGs)* for *Contaminated Land Management* published by EPD.

The RBRGs shall be referred to for assessing contamination status of soil substances. As the future land use for the Site will be taken as "Industrial" under the RBRGs land use scenarios, the findings of the laboratory analysis of soil samples will be used in accordance with the RBRGs "Industrial" scenario as summarized in ***Table 8***.

All analytical results for groundwater samples shall be interpreted in accordance with the *Guidance Note for* Contaminated *land Assessment and Remediation and* R*isk-Based Remediation Goals (RBRGs) for Contaminated Land Management* published by EPD.

[1] The soil density is assumed as $1.25g/cm^3$.

The RBRGs shall be referred to for assessing contamination status of groundwater. As the future land use for the Site will be taken as "Industrial" under the RBRGs land use scenarios, the findings of the laboratory analysis of groundwater samples will be used in accordance with the RBRGs "Industrial" scenario as summarized in ***Table 8***.

Table 8 RBRGs Values for "Industrial" Scenario

Parameter	**Soil**		**Groundwater**	
	RBRGs " Industrial" Scenario Concentration (mg/kg, dry weight basis)	**Soil Saturation Limit (C_{sat}) (mg/kg, dry weight basis)**	**RBRGs " Industrial" Scenario Concentration (mg/L)**	**Solubility Limit (C_{sat}) (mg/L)**
TPH				
C6-C8	10,000	1,000	1,150	5.23
C9-C16	10,000	3,000	9,980	2.8
C17-C35	10,000	5,000	178	2.8
PAH				
Acenaphthene	10,000	60.2	10,000	4.24
Acenaphthylene	10,000	19.8	10,000	3.93
Anthracene	10,000	2.56	10,000	0.0434
Benz(a)anthracene	91.8	-	-	-
Benzo(a)pyrene	9.18	-	-	-
Phenanthrene	10,000	28	10,000	1
Benzo(g,h,i)preylene	10, 000	-	-	-
Chrysene	1,140	-	812	0.0016
Dibenz(a,h)anthracene	9.18	-	-	-
Fluorene	10,000	54.7	10,000	1.98
Indeno(1,2,3-cd)pyrene	91.8	-	-	-
Naphthalene	453	125	862	31
Pyrene	10,000	-	10,000	0.135
Benzo(b)fluoranthene	17.8	-	7.53	0.0015
Benzo(k)fluoranthene	918	-	-	-
PCB	0.748	-	5.11	0.0312

Parameter	Soil		Groundwater	
	RBRGs " Industrial" Scenario Concentration (mg/kg, dry weight basis)	**Soil Saturation Limit (C_{sat}) (mg/kg, dry weight basis)**	**RBRGs " Industrial" Scenario Concentration (mg/L)**	**Solubility Limit (C_{sat}) (mg/L)**
Metals				
Cr (III)	10,000	-	-	-
Cr (VI)	1,960	-	-	-
Co	10,000	-	-	-
Ni	10,000	-	-	-
Cu	10,000	-	-	-
Zn	10,000	-	-	-
As	196	-	-	-
Mo	3,260	-	-	-
Cd	653	-	-	-
Sn	10,000	-	-	-
Ba	10,000	-	-	-
Hg	38.4	-	6.79	-
Pb	2,290	-	-	-
Dioxins (l-TEQ)	0.005	-	-	-

7.2 Ash waste

Dioxins shall be assessed by comparing with United State Environmental Protection Agency (USEPA) criteria of land contamination remediation target, 1ppb TEQ.

As the future land use of the Project Site will be classified as "industrial", RBRGs for the "Industrial" scenario would be considered to assess metals and PAH in ash waste.

The findings of the laboratory analysis of the ash samples will be used to classify the ash waste in accordance with contamination classification scheme as listed in ***Table 9.***

Table 9 Contamination Classification for Ash Waste

Classification of Contamination for Ash Waste	**Dioxin Level in Ash Waste**	**Metals and PAH Level in Ash Waste**
Low/Non Contaminated by DCM/MCM/PAHCM	<1ppb TEQ	< RBRGs (Refer to *Table 8*)
Moderately/Severely Contaminated MCM/PAHCM	<1ppb TEQ	> RBRGs (Refer to *Table 8*)
Moderately Contaminated DCM	>1 and <10 ppb TEQ	Any level
Severely Contaminated DCM	>10ppb TEQ	Any level

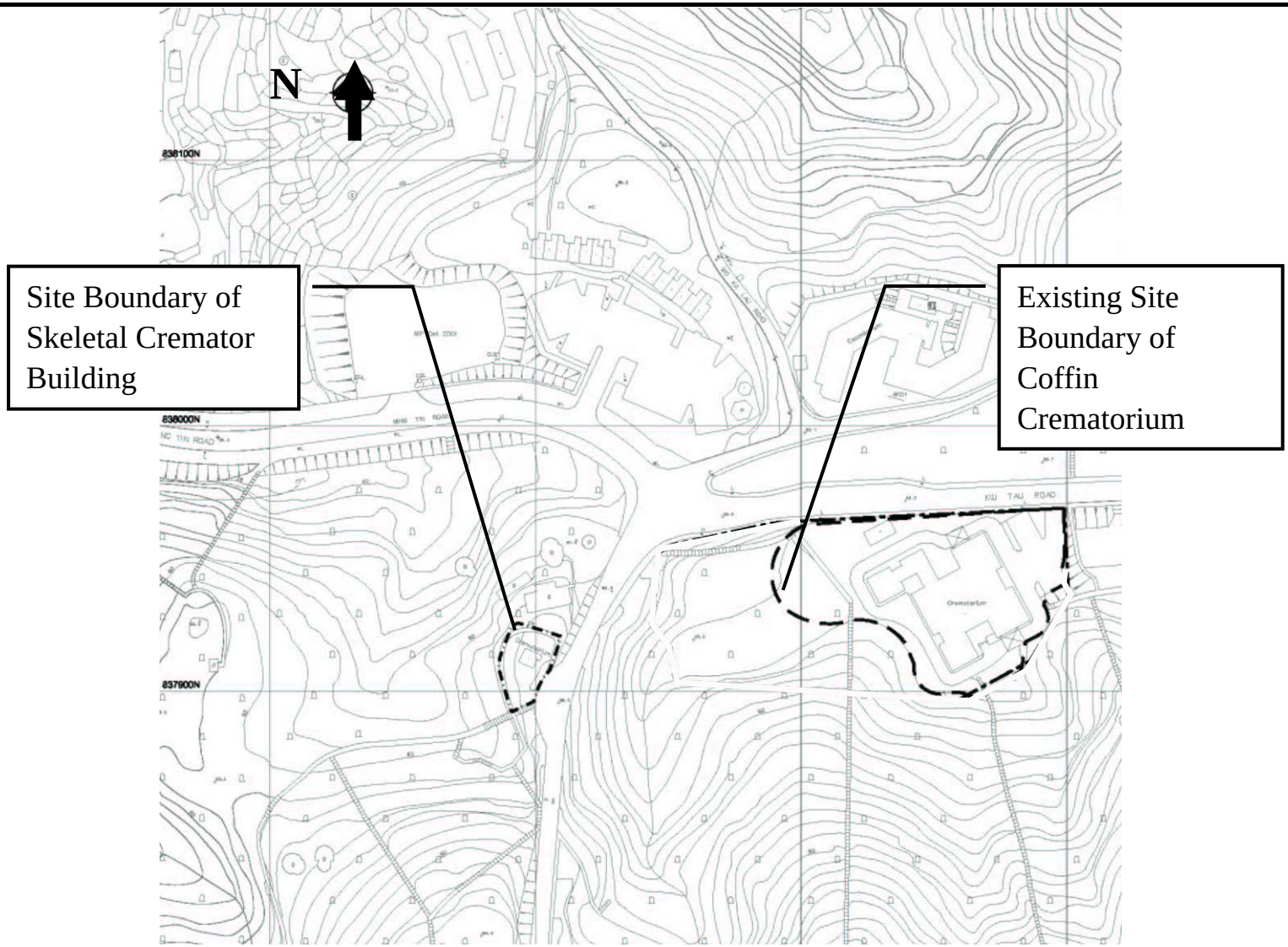
Notes
DCM Dioxin containing materials
MCM Metal containing materials
PAHCM Polyaromatic Hydrocarbon containing materials

8.0 REPORTING

The testing results for ash and soil samplings shall be presented in a Supplementary Contaminated Assessment Report (SCAR) in accordance with EP (No. EP-329/2009). The SCAR shall also present the methodology used during ash and soil sampling, details of field observations and interpretation of laboratory testing results.

If land contamination is confirmed, a Remediation Action Plan (RAP) shall be drawn up to formulate necessary remedial measures. A Remediation Work Report (RWR) to demonstrate adequate clean-up should be prepared and submitted to EPD for endorsement. The subsequent SCAR, RAP and RWR shall be certified by the ET leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA Report.

Since the skeletal cremator building is still in operation, a further site inspection shall be carried out prior to the commencement of demolition work in order to confirm the locations and details of ash and soil sampling proposed in this SCAP.



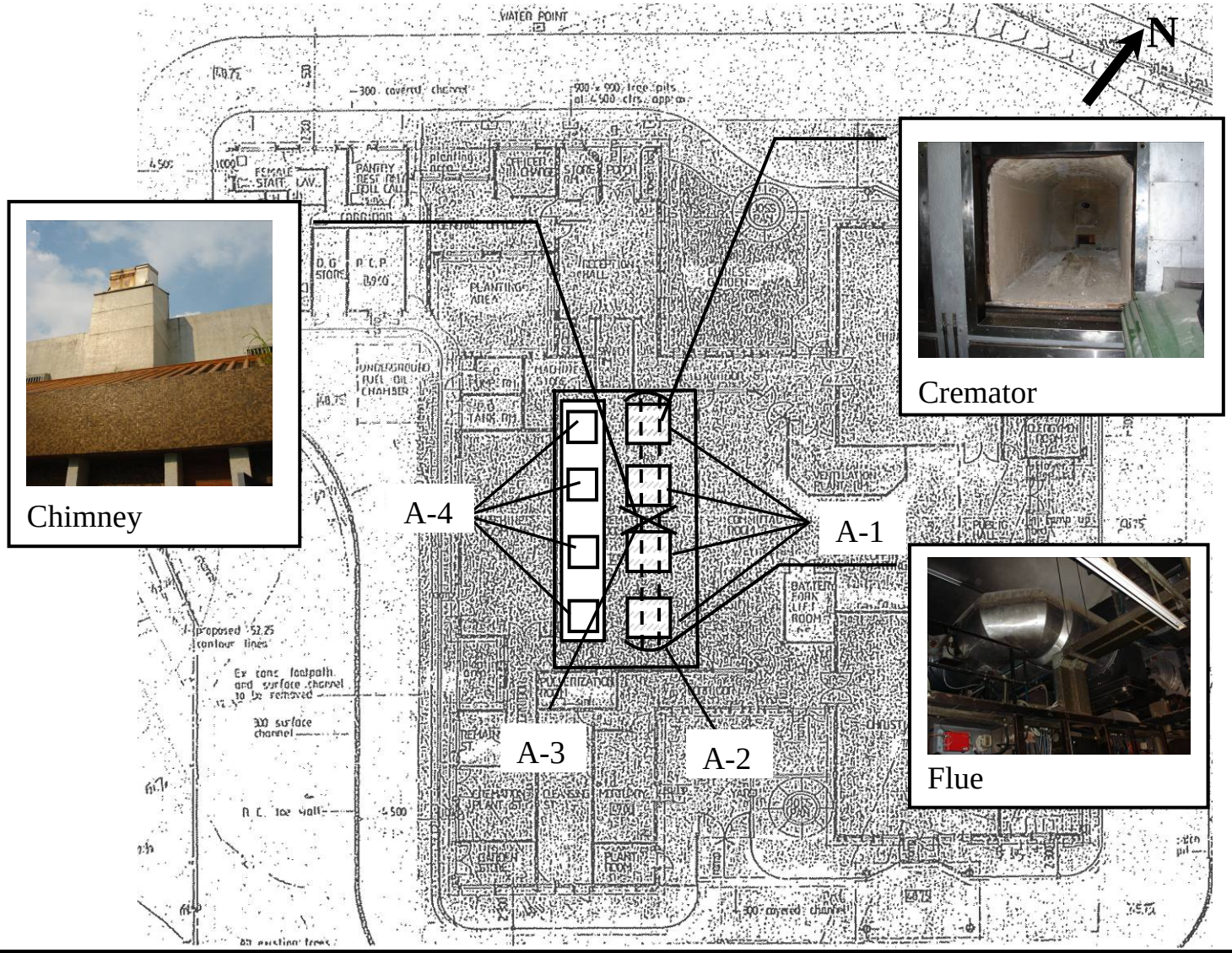
PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Location Plan

Figure No.	Rev:
1	0
Scale	Date
NTS	09/2009

AEC



PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

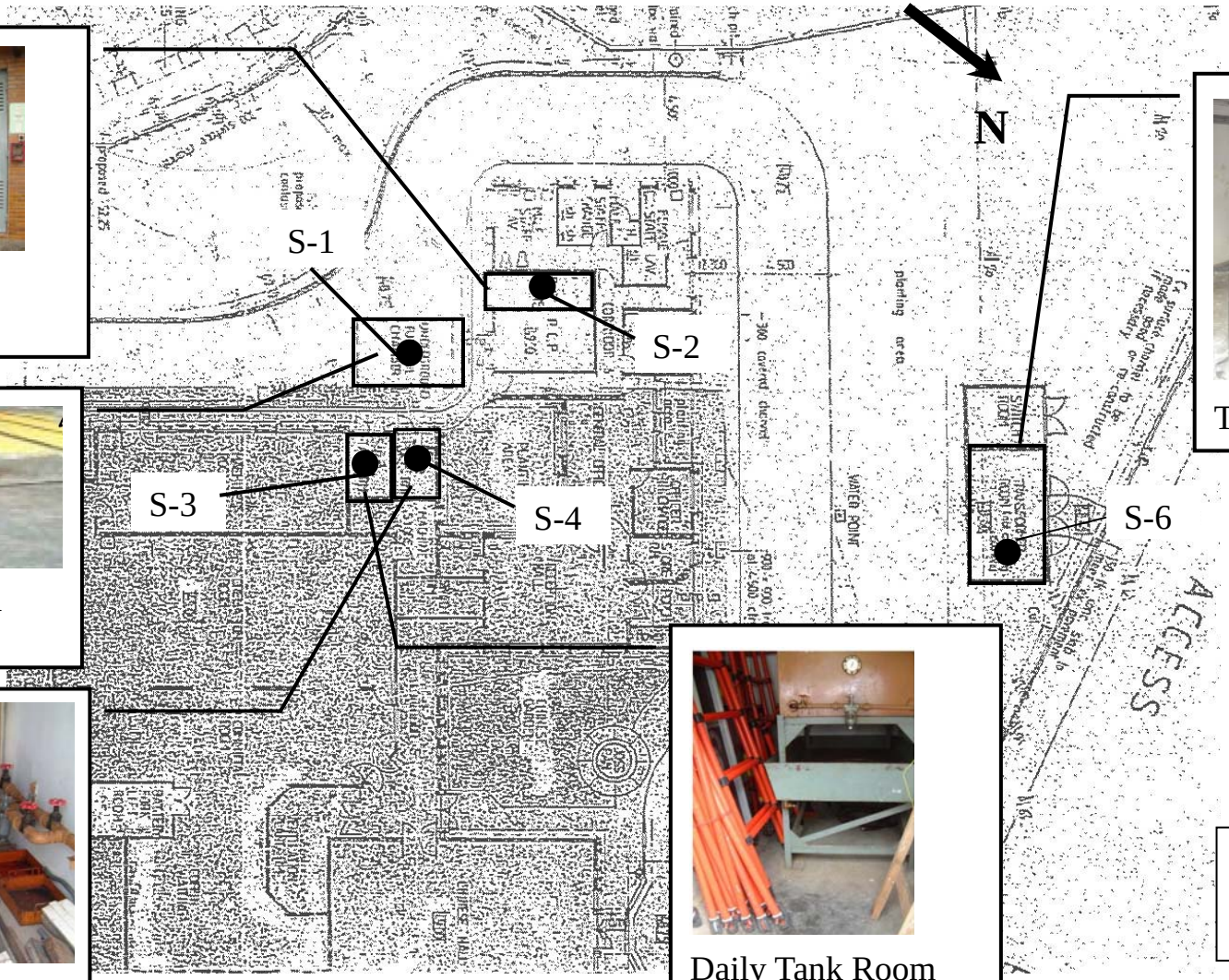
Ash sampling locations at Coffin Crematorium Building

Figure No.	Rev:
2	1
Scale: NTS	Date: 09/2009

Dangerous Goods Store

Underground Fuel Tank

Fuel Pump Room



Daily Tank Room

Transformer Room

Legend:

● Sampling point

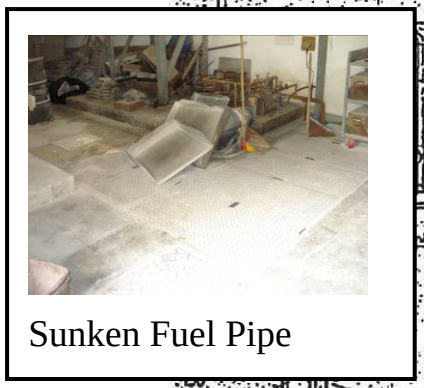
PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Soil sampling locations at Coffin Crematorium Building

Figure No.	Rev:
3	1
Scale	Date
NTS	09/2009

AEC



Sunken Fuel Pipe

Sunken Fuel Pipe

Legend:

● Sampling point

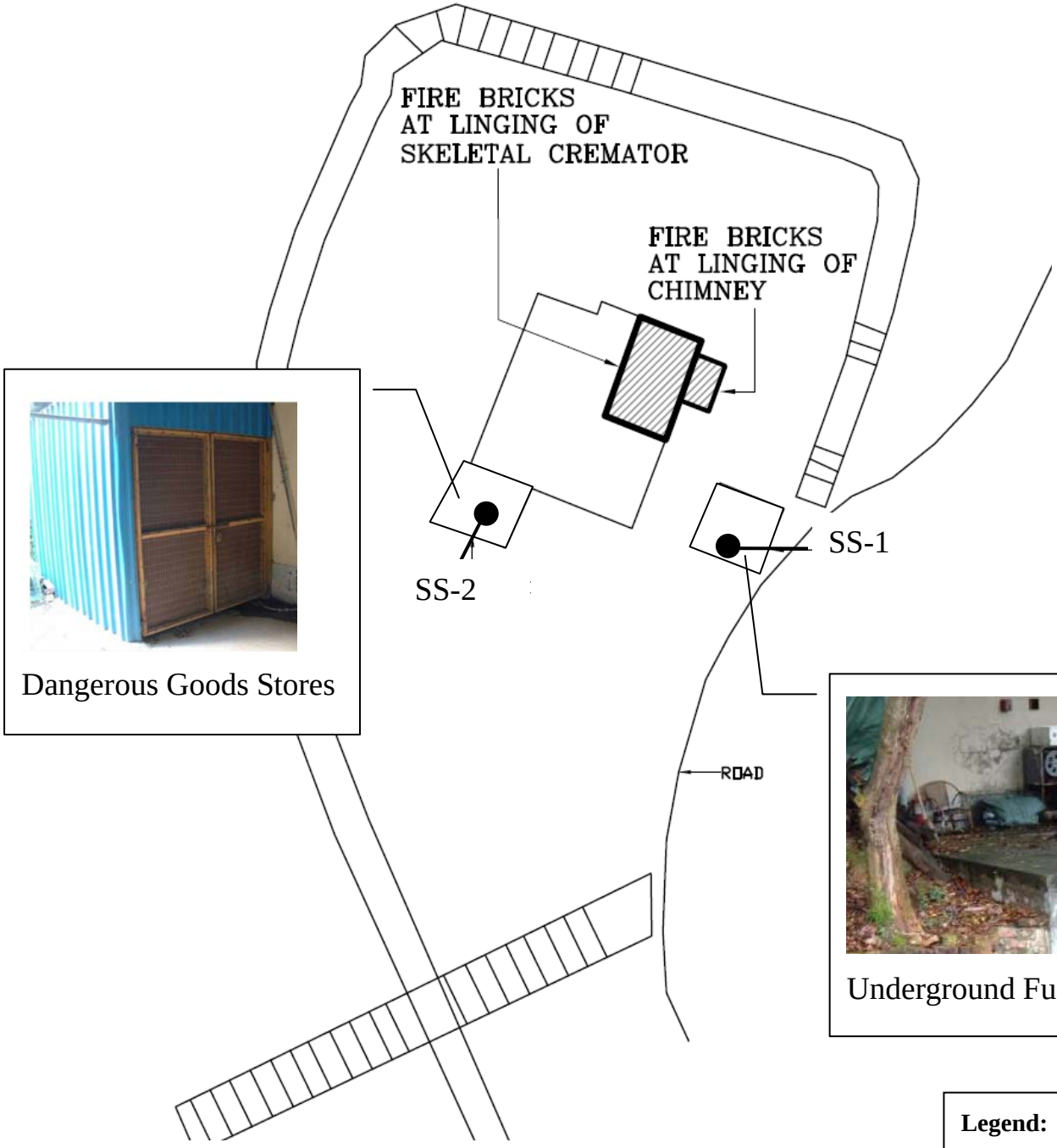
PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Soil sampling locations at Coffin Crematorium Building

Figure No.	Rev:
4	1
Scale	Date
NTS	09/2009

AEC



Dangerous Goods Stores

Underground Fuel Tank

Legend:

● Sampling point

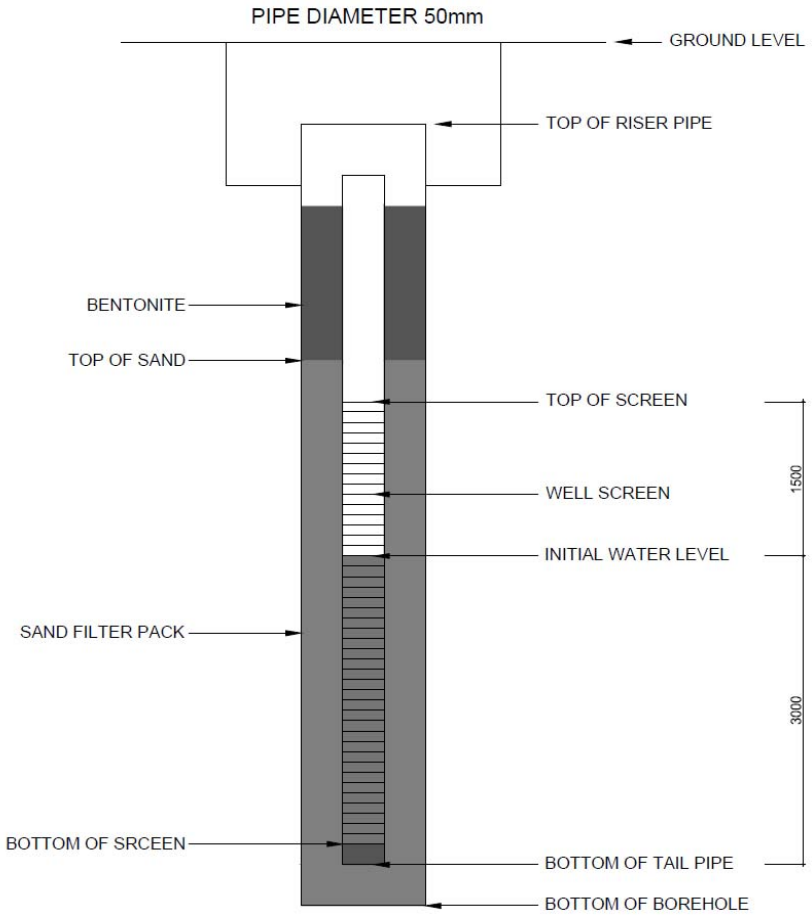
PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Soil sampling locations at Skeletal Crematorium Building

Figure No.	Rev:
5	1
Scale	Date
NTS	10/2009

AEC



PROVISION OF CREMATORS AT WO HOP SHEK CREMATORIUM

SUPPLEMENTARY CONTAMINATION ASSESSMENT PLAN

Typical Design of Groundwater Sampling Well

Figure No.	Rev:
6	1
Scale	Date
NTS	10/2009