

3 WASTE MANAGEMENT

Introduction

- 3.1 Waste likely to be generated during the construction phase of the Project include excavated material, construction and demolition materials, contaminated materials including ash waste and building structure, chemical waste and general refuse.
- 3.2 During the operation phase of the new crematorium, the major types of waste to be generated are ash and non-combustible residues generated from combustion process, chemical waste generated from air pollution control system and machinery maintenance and servicing, and general refuse generated by visitors and staffs during daily operation.
- 3.3 Since the existing crematorium is still in operation, further contamination investigation in the site areas currently inaccessible is recommended. This investigation should occur after decommissioning but prior to demolition of the existing crematorium to confirm the quality and quantity of ash waste and building structures requiring treatment and disposal.
- 3.4 If good site practices are strictly followed, it is expected that adverse environmental impacts due to waste generation will not arise. Good management and control can prevent the generation of significant amounts of waste. In addition, specific mitigation measures are recommended to minimise environmental impacts during handling, transportation and disposal of wastes generated from the Project. The environmental mitigation measures for waste management during the construction phase as well as during the operation phase are summarised in the following sections.
- 3.5 Site audit has been recommended during the construction phase. The EIA Study has determined that with effective implementation of the appropriate mitigation measures, there will be no significant impact from these wastes. Implementation schedule for recommended waste management mitigation measures is presented in Appendix A.

Mitigation Measures for Construction Phase

General – Good Site Practice and Waste Reduction Measures

- 3.6 Adverse environmental impacts due to waste generation are not expected. The following recommendations should be implemented during the construction activities:
- Obtain relevant waste disposal permits from the appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap. 354), Waste Disposal (Chemical Waste)(General) Regulation (Cap. 354), Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap 345) and the Land (Miscellaneous Provision) Ordinance (Cap.28)
 - Prepare a Waste Management Plan approved by the Engineer / Supervising Officer of the Project based on current best practice on Construction Sites
 - Waste licensed collector to collect waste
 - Implementation of trip ticket system with reference to ETWB(W) No.31/2004 Trip Ticket System for Disposal of Construction & Demolition Materials.
 - Provide staff training for proper waste management and chemical waste handling procedures
 - Separation of chemical waste for special handling and dispose to licensed facility for treatment
 - Sufficient waste disposal points and regular collection programme setup
 - Recording system for waste generation, recycle and disposal
- 3.7 The ETWB TCW No.19/2005 “Environmental Management on Construction” includes procedures on waste management requiring contractors to reduce the C&D material to be disposed of during the course of construction. Under this ETWB TCW No.19/2005, the

Contractor is required to prepare and implement an Environmental Management Plan (EMP) and the Waste Management Plan (WMP) becomes part of the EMP.

3.8 Waste reduction should be considered in planning and design stage, the following practice should be implemented.

- Prior to disposal of C&D waste, wood, steel and other materials should be separated for reuse, recycling to minimize the quality of waste to be disposed of at landfill.
- Minimize use of wood and reuse non-timber formwork to reduce C&D waste
- As far as practicable, segregate and store different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
- Encourage collection of aluminum cans, plastic bottles and packaging material and office paper

Excavated Materials

3.9 Rock and soil generated from excavation should be reused during site formation and landscaping as far as practicable to reduce total amount to be disposed of off-site.

3.10 Trip-ticket system should be implemented for surplus excavated materials disposal in accordance with ETWB TC(W) No.31/2004 and the Construction Waste Disposal Charging Scheme. Waste should be delivered to a public fill reception facility. Copies or counterfoils of trip tickets will be kept for record purpose.

Construction and Demolition Materials

3.11 Well-planned design and good site management can minimize over-loading and generation of waste materials such as concrete and cement grouts. Wooden frame should be replaced by metals. Plastic fencing and reusable site office structure can reduce C&D waste generation.

3.12 The Contractor should recycle as much C&D materials as possible. Proper segregation of waste types on site to enhance reuse and recycling of materials. Designated areas for different materials storage should be assigned for segregation.

3.13 Under the Construction Waste Disposal Charging Scheme, construction waste producers such as construction and renovation contractors and premises owners, prior using government waste disposal facilities, need to prepare a billing account with EPD and pay for construction waste disposal.

3.14 It is expected that trip-ticket system will be implemented for surplus C&D materials disposal in accordance with ETWB TC(W) No.31/2004 and the Construction Waste Disposal Charging Scheme. Waste should be delivered to a public fill reception facility. Copies or counterfoils of trip tickets will be kept for record purpose.

Contaminated Materials

3.15 Since all twelve cremators in the existing crematorium will remain in operation during Phase 1 and demolition works will be carried out during Phase 2, contaminated material would only be generated during the Phase 2 construction and demolition works.

Specific Plan for Contaminated Materials arising from Demolition Works

3.16 Building structure of cremators, flues and chimneys would likely to be contaminated by DCM ash due to long term servicing. As the cremators are still in operation, it is not possible to carry out site investigation in the areas of cremators, flues and chimneys at this stage. To maintain uninterrupted cremation services, further site investigation in cremation rooms and

- associated equipments are proposed to undertake after decommissioning and prior to demolition of the existing crematorium.
- 3.17 According to the asbestos investigation report, asbestos gasket (woven) and insulation sheet were identified with ACM. It is also not possible to inspect all potential asbestos containing material locations due to on-going operation of cremators, concealed pipeline inside wall and metal cover of flange connection. Further inspection of the inaccessible locations will be undertaken after decommissioning and prior to demolition of the existing crematorium.
- 3.18 Under this consideration, contaminated ash and ACM potential contamination locations will be further identified. In view of close distance between the contaminated ash and ACM, there is a concern on contaminated ash wastes being embedded in ACM. Therefore, it is advisable to remove contaminated ash waste prior to any asbestos containing material on building structures. This is considered as the worst case scenario in this assessment.
- 3.19 Should contaminated ash is identified on the ACM, the contaminated ash will be removed first prior to removal of ACM. If the procedures and precautionary measures described in Section 3.23 to 3.26 are followed properly, cross contamination could be minimized under normal circumstances. These procedures and measures are considered as reasonable approach to handle the cross contaminated wastes.
- 3.20 Asbestos waste will be handled in accordance with the Code of practice on the Handling, Transportation and Disposal of Asbestos Waste issued by the Environment Bureau.
- 3.21 Production, collection and disposal of asbestos waste will follow the "trip-ticket" system. The registered asbestos contractor will appoint a licensed asbestos waste collector to collect the packaged asbestos waste and deliver to the designated landfill for disposal. Notification has to be given to EPD for its disposal. EPD will normally require ten working days notice of the intention to dispose of any quantity of asbestos waste. After processing the notification, EPD will issue specific instructions and directions for disposal of the waste. The waste producer or his agent must strictly follow these directions.
- 3.22 Different contamination classifications based on dioxin level in ash waste are proposed in **Table 3.1** and corresponding mitigation measures are also described:

Table 3.1 Proposed Contamination Classifications for Ash Waste

Classification of Contamination	Dioxin Level in Ash Waste
Low Contaminated DCM	<1ppb TEQ
Moderately Contaminated DCM	>1 and <10 ppb TEQ
Severely Contaminated DCM	>10ppb TEQ

- 3.23 Where the ash waste contains low contamination levels of DCM, the Contractor should avoid ash waste becoming airborne during demolition. General dust suppression measures will be followed and ash waste will be directly disposed of at landfill.
- 3.24 Where the ash waste contains moderately contaminated DCM, the following steps should be followed:
- Site Preparation
 - Except the cremators / flue / chimney, all removable items should be removed as far as practicable to avoid obstructing the decontamination activities;
 - Preliminary site decontamination of all debris should be carried out using High Efficiency Particulate Air (HEPA) vacuum cleaner;

- Top portion of the chimney should be enclosed by a 3-layer chamber of polyethylene sheets;
- At the entrance to the cremators / flues / chimney, a 3-chamber decontamination unit should be constructed for entry and exit from the work area. The 3-chamber decontamination unit should comprise a dirty room, a shower room and a clean room of at least 1m x 1m base with 3-layer of fire retardant polyethylene sheet;
- Workers should carry out decontamination procedure before leaving the work area;
- Workers should wear full protective equipment, nitrile gloves, rubber boots and full-face positive pressure respirator; and
- Warning signs in both Chinese and English should be displayed in conspicuous areas.
- Demolition and Handling
 - The cremators / flue / chimney should be removed from top down. Any ash or residues attached to the cremators / flue / chimney or any other building structure should be removed by scrubbing and HEPA vacuuming;
 - Waste generated from the containment or decontamination unit including the protection clothing of the workers should be disposed to landfill;
 - After removal, all surfaces should be decontaminated by HEPA vacuum cleaner; and
 - The storage area for ash waste should be properly enclosed throughout the demolition works. The location of storage area for ash waste will be identified in the Waste Management Plan to be prepared by the Contractor.
- Treatment and Disposal
 - Immobilise ash waste by proper mixing with cement as determined by the pilot mixing and Toxicity Characteristic Leaching Procedure (TCLP);
 - Waste material should be placed in polyethylene lined steel drums for disposal at landfill, the drums should be 16 gauge steel or thicker and fitted with double bung fixed ends adequately sealed and well labeled in new or good condition.
 - Drums should be clearly marked "DANGEROUS CHEMICAL WASTE" in English and Chinese. Prior agreement of the disposal criteria must be obtained from EPD and the landfill operator.
 - As a fall back option, if landfill disposal criteria cannot be met after immobilization of the ash waste, disposal at the Chemical Waste Treatment Center (CWTC) should be considered.

3.25 The areas with severely contaminated DCM should be removed under containment as a prudent approach to avoid the release of ash waste to the environment during the demolition works of the existing building and the following should be addressed.

- Site Preparation
 - Except the cremators / flue / chimney, all identified removable items with

- severely contaminated DCM should be removed as far as practicable to avoid obstructing the decontamination activities;
- Preliminary site decontamination of all debris should be carried out using High Efficiency Particulate Air (HEPA) vacuum cleaner;
- The walls, floor and ceiling of the cremator room where severely contaminated DCM should be lined with 3-layer chamber of fire retardant polyethene sheets. Top portion of the chimney above the roof should be enclosed by a 3-layer chamber of polyethene sheets;
- At the entrance to the cremators / flues / chimney, a 3-chamber decontamination unit should be constructed for entry and exit from the work area. The 3-chamber decontamination unit should comprise a dirty room, a shower room and a clean room of at least 1m x 1m base with 3-layer of fire retardant polyethylene sheet where all workers would carry out decontamination procedures before leaving the work area;
- Air movers should be installed at the cremator room, and at the bottom of the chimney to exhaust air from work area. A stand-by air mover should be installed with each of air movers. Sufficient air movement should be maintained to give a minimum of 6 air changes per hour to the work area;
- New pre-filters and HEPA filters should be used on the air movers.
- Before commencement of the decommissioning work, a smoke test with non-toxic smoke should be carried out to confirm the air tightness of the containment;
- Workers should wear full protective equipment, disposable protective coverall (such as Tyvek with shoe covers and hood), nitrile gloves, rubber boots and full-face positive pressure respirator equipped with a combination cartridge that filters particulate and removes organic vapour; and
- Warning signs in both Chinese and English should be displayed in conspicuous areas.
- Decontamination, Demolition and Handling
 - The cremators / flue / chimney should be removed from top down. Any ash or residues attached to the cremators / flue / chimney or any other building structure should be removed by scrubbing and HEPA vacuuming;
 - The contaminated detached sections of the building structure with severely contaminated DCM should be wrapped with 2 layers of fire retardant polyethene sheets. The third layer should be wrapped and secured with duct tape. Decontaminate the outer layer of the wrapped flue sections by wet wiping;
 - After completion of removal and decontamination, spray the innermost layer of the fire retardant polyethene sheet with PVA. Upon drying, peel off and dispose of at landfill site; and
 - The storage area for ash waste should be properly enclosed throughout the demolition works. The location of storage area for ash waste will be identified in the Waste Management Plan to be prepared by the Contractor.
- Treatment and Disposal

- All contaminated ash waste with severely contaminated DCM removed and the used HEPA filters should be sent to Chemical Waste Treatment Center (CWTC) at Tsing Yi accordingly to Chapters 2 & 3 *Code of Practice on the Packaging, Labelling & Storage of Chemical Wastes* published under the Waste Disposal Ordinance (Cap 354), Section 35; and
 - Other waste including the building structures and its associated panels as well as waste generated from this decommissioning works are also considered as contaminated waste and should be disposed of at designated landfill. Waste generated from this decommissioning works refer to the polyethene wrapping sheets should be placed into appropriate containers for disposal. Waste Disposal Permit has to be obtained from EPD. Disposal trip ticket is required to be made available as record after disposal.
- 3.26 Further investigation and confirmatory test for ash waste in cremator, chimney and flues should be carried out on DCM prior to the demolition works of the existing building. The sampling and analysis plan should be prepared and submitted to EPD for approval.
- 3.27 The principles as stated in Section 3.23 to 3.26 aim to address the detailed measures of avoiding cross contamination of DCM and ACM and should form part of the DCM Assessment Report which will be submitted to EPD for approval before the commencement of the demolition of the existing crematorium.
- 3.28 Contaminated Soil:
- According to the Contamination Assessment Report (CAR) and Remediation Action Plan (RAP) provide in **Appendix 5.2**, among five 0.1m samples analyzed, no surface soil samples were found to have testing parameters exceeding the relevant Risk-Based Remediation Goals (RBRGs).
 - In additional, further investigations and confirmatory test should be carried out to determine if additional remediation (in addition to the current RAP) is required.

Chemical Waste

- 3.29 All the chemical waste should be handled according to the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. The chemical waste should be stored and collected by a licensed contractor for disposal at licensed facility in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*. Containers used for the storage of chemical waste should be:
- Suitable for substance holding, resistant to corrosion, maintained in good condition and securely closed;
 - Capacity of less than 450 liters unless the specifications have been approved by the EPD; and
 - Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the *Waste Disposal (Chemical Waste)(General) Regulation*.
- 3.30 The storage area for chemical waste should:
- Be clearly labeled and used solely for the storage of chemical waste;
 - Be enclosed on at least 3 sides;
 - 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;

- Have adequate ventilation;
- Be covered to prevent rainfall from entering (water collection within the bund must be tested and disposal as chemical waste if necessary); and
- Be properly arranged so that incompatible materials are adequately separated.

3.31 The chemical waste should be disposed of by:

- A licensed waste collector;
- A facility licensed to receive chemical waste, such as CWTC at Tsing Yi, which offers chemical waste collection service and can supply the necessary storage containers; and
- A waste recycling plant as approved by EPD.

General Refuse

3.32 General refuse should be stored in enclosed bins or compaction units separated from C&D and chemical wastes. Waste collector should be employed by the Contractor to minimize odour, pest and litter impacts. Open burning of refuse on construction site is prohibited by law.

3.33 The Contractor should carry out an education programme for workers in avoiding, reducing, reusing and recycling. This should include provision of three-colour recycling bins and on site and posters and leaflets advising on the use of recycling bins.

Mitigation Measures for Operation Phase

General - Good Site Practices and Waste Reduction Measures

3.34 It is recommended that the following good operational practices should be adopted to minimise waste management impacts:

- Obtain the necessary waste disposal permits from the appropriate authorities, in accordance with the *Waste Disposal Ordinance (Cap. 354)*, *Waste Disposal (Chemical Waste) (General) Regulation and the Land (Miscellaneous Provision) Ordinance (Cap. 28)*;
- Nomination of an approved person to be responsible for good site practice, arrangements for collection and effective disposal to an appropriate facility of all wastes generated at the site;
- Use of a waste haulier licensed to collect specific category of waste;
- A trip-ticket system should be included as one of the contractual requirements and implemented by the Environmental Team to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and to control fly tipping. Reference should be made to ETWB TCW No. 31/2004.
- Training of site personnel in proper waste management and chemical waste handling procedures;
- Separation of chemical wastes for special handling and appropriate treatment at a licensed facility;
- Routine cleaning and maintenance programme for drainage systems, sumps and oil interceptors;

- Provision of sufficient waste disposal points and regular collection for disposal;
 - Adoption of appropriate measures to minimize windblown litter and dust during transportation of waste, such as covering trucks or transporting wastes in enclosed containers;
 - Implementation of a recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites).
- 3.35 Good management and control can prevent the generation of significant amounts of waste. It is recommended that the following good operational practices should be adopted to ensure waste reduction:
- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal;
 - Encourage collection of aluminium cans, plastic bottles and packaging material (e.g. carton boxes) and office paper by individual collectors. Separate labelled bins should be provided to help segregate this waste from other general refuse generated by the work force;
 - Any unused chemicals or those with remaining functional capacity should be reused as far as practicable.

Ash and Non-Combustible Residues

- 3.36 The disposal of bone and non-combustible residues should be properly collected and handled to avoid dust emissions. In line with the current practices, the bone ash will be stored in covered containers for collection by the deceased's relatives within 2 months upon appointment while the non-combustible residues will be collected in sealed heavy-duty polyethene bags for disposal at landfill. Potential secondary environmental impacts will be kept to a minimum.
- 3.37 Combustion gas temperature, residence time, air supply and gas turbulence of the new cremators will be properly and adequately controlled to optimize the effectiveness of combustion during cremation process, therefore generation of bottom ash will be expected in low amount.

Chemical Waste

- 3.38 Chemical waste generated from the air pollution system as well as from machinery maintenance and servicing should be managed in accordance with the *Code of Practice on the Packaging, Labelling and storage of Chemical Wastes* under the provisions of the *Waste Disposal (Chemical Waste)(General) Regulation*. The chemical waste should be collected by drum-type containers and removed by licensed chemical waste contractor.
- 3.39 Plant / equipment maintenance schedules should be planned in order to minimize the generation of chemical waste.
- 3.40 Non-recyclable chemical wastes and lubricants should be disposed at an appropriate facility, such as EPD Chemical Waste Treatment Centre at Tsing Yi. Copies or counterfoils from collection receipts issued by the licensed waste collector should be kept for record purpose.
- 3.41 Recyclable chemical waste that is collected will be transported off-site for treatment by a licensed collector. The Contractor will need to register with EPD as a chemical waste producer. Where possible, chemical wastes (e.g. waste lubricants) would be recycled at an appropriate facility, e.g. at Dunwell's oil re-refinery.

Fly Ash

- 3.42 During the operation phase of the Project, combustion gas temperature, residence time, air

supply and gas turbulence of the new cremators will be properly and adequately controlled to optimize the effectiveness of combustion during cremation process, thereby minimizing the generation of fly ash.

- 3.43 Fly ash is collected by the APC equipment. This is designed to maximize the collection of fly ash.
- 3.44 Disposal method of fly ash from the cremators should be stored in sealed drums and placed in a designated area for collection by CWTC. Fully incinerated residues should be disposed to landfill.

General Refuse

- 3.45 Waste generated in offices should be reduced through segregation and collection of recyclable waste materials (such as paper). To promote recycling of waste paper, aluminum cans and plastic bottles, it is recommended to place clearly labeled recycling bins at designated locations. The recyclable waste materials should be collected by licensed collectors.
- 3.46 General refuse, other than segregated recyclable wastes, should be separated from any chemical waste and stored in covered skips. FEHD should remove general refuse from the site on daily basis to minimize odour, pest and litter impacts. Also, open burning of refuse must be strictly prohibited.