

1. INTRODUCTION

1.1 Purpose of the Manual

- 1.1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set up of an EM&A programme to ensure compliance with the recommendations of the Environmental Impact Assessment (EIA) Study and to assess the effectiveness of the recommended mitigation measures as well as to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme for the construction and operation phases of the Integrated Waste Management Facilities (IWMF). It aims to provide systematic procedures for monitoring, auditing and minimizing environmental impacts associated with the construction works and operational activities of the IWMF.
- 1.1.1.2 Hong Kong environmental regulations and the Hong Kong Planning Standards and Guidelines have served as environmental standards and guidelines in the preparation of this Manual. In addition, the EM&A Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on the EIA Process (EIAO-TM).
- 1.1.1.3 This Manual contains the following information:
- responsibilities of the Contractor, the Employer's Representative (ER)¹, the Independent Consultants (IC)¹, Environmental Team (ET), the Independent Environmental Checker (IEC), EIAO Authority of Environmental Protection Department (EPD) with respect to the environmental monitoring and audit requirements during the course of the Project;
 - project organization for the Project;
 - the basis for, and description of the broad approach underlying the EM&A programme;
 - requirements with respect to the construction programme schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;
 - details of the methodologies to be adopted, including all field laboratories and analytical procedures, and details on quality assurance and quality control programme;
 - definition of action and limit levels;
 - establishment of event and action plans;
 - requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints;
 - requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures; and
 - requirements for review of EIA predictions and the effectiveness of the mitigation measures / environmental management systems and the EM&A programme.
- 1.1.1.4 For the purpose of this manual, the ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the EM&A requirements.

¹ The IWMF will be procured using a design-build-operate (DBO) contract form. Under such type of contract, the contract administration and site supervision works are to be undertaken by the Employer's Representative (ER), an organisation to be appointed by the Employer and assisted by the Independent Consultants (IC) to be jointly appointed by the Employer and the Contractor as an independent checker for the Contractor's works.

1.2 Project Description

1.2.1 Introduction

1.2.1.1 The Project is to construct and operate a modern IWMF for managing municipal solid waste (MSW) under a design-build-operate (DBO) contract arrangement. The IWMF comprises: (a) an advanced thermal incineration plant with design capacity of 3,000 tonnes per day (tpd) and (b) a mechanical sorting and recycling plant with design capacity of 200 tpd. The non-recyclables sorted from the mechanical plant will be sent to the thermal incineration plant for further treatment. Under any conditions, the total MSW feeding to the thermal incineration plant and the mechanical plant will not exceed 3,000 tpd.

1.2.2 Project Location

1.2.2.1 Two potential sites have been identified for the development of the IWMF, including Tsang Tsui Ash Lagoons site in Tuen Mun (TTAL site) and an artificial island near Shek Kwu Chau (SKC) and their locations are shown in **Figures 1.1** and **1.2** respectively.

1.2.3 Scope of Project

Project Facilities

1.2.3.1 The infrastructure for this Project would comprise an incineration plant, a mechanical sorting and recycling plant, and ancillary & supporting facilities. The details of these components as listed below:-

Incineration Plant

- MSW receiving, storage and feeding system
- Moving grate incineration furnaces
- Waste heat recovery and power generation system
- Boiler feedwater treatment system
- Flue gas treatment system
- Flue gas discharge system with stack
- Ash storage and handling system
- Reagent reception and storage system
- Odour control system
- Process control and monitoring system

Mechanical Treatment (MT) Plant

- MSW receiving, storage and feeding system
- Mechanical treatment system including shredding and sorting facilities
- Products and by-products storage and handling system
- Odour control system
- Process control and monitoring system

Ancillary & Supporting Facilities

- Weighbridge
- Site security
- Administration building / environmental education centre
- Vehicle washing facilities
- Maintenance workshop
- Fuel storage tanks
- Water treatment plant
- Wastewater treatment plant
- Electricity supply and export system
- Utilities
- Berthing area for marine vessels and storage of refuse containers (for the artificial island near SKC only)

1.2.3.2 Design-Build-Operate (DBO) contract arrangement would be adopted for the Project and the operation period would be 15 years. Under this contract arrangement, a DBO contractor would be engaged to conduct the detailed design, construction and operation of the IWMF.

1.2.3.3 For the purpose of the EIA Study, a reference design for the IWMF was prepared. The preliminary layouts showing the IWMF facilities at the TTAL site and the artificial island near SKC are presented in **Figures 1.3 and 1.4** respectively.

1.2.3.4 The heat produced during the incineration process will be recovered and used for electricity generation. The electricity generated from the incineration process will be used to support the normal operation of the facilities within the IWMF. Surplus energy will be exported to other users via the existing electricity grids maintained by power companies. For the TTAL site, underground cables will be laid to export surplus energy to the nearby Black Point Power Station; no submarine cables will be required. For the artificial island near SKC, installation of submarine cables will be required in order to export the surplus energy from the artificial island near SKC to an electricity substation at Cheung Sha. The preliminary alignment of the submarine cable route is shown in **Figure 1.5**.

Construction of the IWMF

1.2.3.5 The scope of works in construction and operation phases of the Project for the two potential sites are described below.

Tsang Tsui Ash Lagoons Site

1.2.3.6 The Project would require decommissioning of the Middle Lagoon, formation of about 1.2 hectares of pond habitat for Litter Grebe and about 9.8 hectares of land and associated roads and drains, followed by foundation works, construction of superstructures and installation of plants and equipment for the various systems of the IWMF. As there is no existing structure in the Middle Lagoon, the works related to the decommissioning of the lagoon would be minimal.

1.2.3.7 The construction of the IWMF at the TTAL site will include the following stages:-

- Site drainage;

- Site formation;
- Foundation piling;
- Civil works;
- Mechanical & electrical plant installation;
- Roads, utilities, services and landscaping; and
- Ancillary instrumentation and control works.

Artificial Island near Shek Kwu Chau

- 1.2.3.8 Reclamation will be needed to form about 11.8 hectares of land for the IWMF. Due to occasionally rough sea condition in the vicinity of the artificial island near SKC, breakwater will be provided to ensure safe loading and unloading operation at the berth area.
- 1.2.3.9 The reclamation will be formed with filling materials supported on the insitu marine deposits with suitable geotechnical ground treatment (such as surcharge loading, installation of vertical band drains, etc.) at a finished ground level of about +5mPD high. Seawalls will be constructed to confine the reclamation area and breakwaters will be provided to protect the water basin. To minimize dredging and filling activities and the associated environmental impacts, vertical cellular structure consisting of circular cells instead of sloping gravity structure is proposed to be adopted for the construction of the seawalls and breakwaters. The cellular breakwater protecting the reclamation area and the water basin would be about +9mPD high for resisting waves with significant heights.
- 1.2.3.10 The berth area, which will be extended from the seawall at the northwest side of the reclaimed area, will be formed by a piled deck structure with precast slab. Tubular piles are proposed to form the foundation of the berth. Non-percussive bore piling method would be adopted for the installation of tubular piles.
- 1.2.3.11 The construction of the IWMF will include the following stages:-
- Construction of cofferdam surrounding the reclamation area;
 - Site filling for reclamation;
 - Surcharge loading for reclamation area;
 - Construction of breakwater;
 - Pilling for berth area;
 - Site drainage;
 - Foundation (spread footing);
 - Civil and building works;
 - Mechanical & electrical plant installation;
 - Roads, utilities, services and landscaping; and
 - Ancillary instrumentation and control works.
- 1.2.3.12 The submarine cables would be installed by burying method using water jets. A cable burying machine would include an injector lowered to the seabed. The injector fluidizes a trench using high pressure water jets and a cable is immediately laid within the trench. The sides of the trench slip around the cable, burying it and leaving a small depression in the seabed.

Operation of the IWMF

- 1.2.3.13 The IWMF will be operated on a 24-hour basis daily, while the reception of MSW would be limited from 8 am to 8 pm.
- 1.2.3.14 For the artificial island near SKC, about 3,000 tpd MSW would be delivered by marine vessels from the existing refuse transfer stations, including Island East Transfer Station, Island West Transfer Station and West Kowloon Transfer Station. For the TTAL site, about 3,000 tpd MSW currently delivered to the berth of WENT Landfill by marine vessels or delivered directly to the WENT Landfill or its extension by land transport will be diverted from the WENT Landfill to the adjoining the TTAL site by land transport.

1.3 Construction Programme

- 1.3.1.1 The tentative construction programmes for the TTAL site and the artificial island near SKC are shown in **Table 1.1** and **Table 1.2**.

Table 1.1 Construction Programme of the IWMF at the TTAL Site

Description	Date
Award of Contract	March 2013
Site Clearance & Backfilling	March 2013 – August 2013
Foundation (Pilling)	June 2013 – February 2015
Civil and E&M Works	November 2013 – May 2016
Testing and Commissioning	June 2016 – August 2016

Table 1.2 Construction Programme of the IWMF at the Artificial Island near SKC

Description	Date
Award of Contract	March 2013
Construction of Cofferdam Surrounding Reclamation Area Phase 1	June 2013 – November 2013
Construction of Breakwater Phase 1	June 2013 – November 2013
Construction of Cofferdam Surrounding Reclamation Area Phase 2	June 2014 – July 2014
Site Filling for Reclamation	January 2014 – October 2014
Surcharge Loading for Reclamation Area	May 2014 – July 2015
Construction of Breakwater Phase 2	June 2014 – October 2014
Installation of Anti-scouring Layer	November 2014
Pilling for Berth Area	June 2014 – November 2014
Construction of Submarine Cables	June 2015
Foundation (Spread Footing)	May 2015 – October 2015
Civil and E&M Works	August 2015 – February 2018
Testing and Commissioning	March 2018 – May 2018

1.4 Project Organization

1.4.1 Introduction

- 1.4.1.1 The roles and responsibilities of the various parties involved in the construction phase and operation phase of the EM&A process and the implementation of the EM&A programme are outlined below. The proposed project organization and lines of communication during

construction and operation phases with respect to environmental protection works are shown in **Figure 1.6** and **Figure 1.7** respectively.

1.4.2 Construction Phase

Employer's Representative

1.4.2.1 The term "Employer's Representative (ER)" refers to the organization responsible for overseeing the construction works of the Project undertaken by the Contractor, and for ensuring that they are undertaken by the Contractor in accordance with the specification and contractual requirements. The responsibilities of the ER include the followings:-

- Monitor the Contractor's compliance with contract specifications, including the implementation and operation of the environmental mitigation measures and ensure their effectiveness, and other aspects of the EM&A programme;
- Monitor the Contractor's, the ET's and the IEC's compliance and ensure that the requirements in the Environmental Permit (EP) and EM&A Manual are fully complied with;
- Provide assistance to the ET as necessary in the implementation of the EM&A programme;
- Participate in joint site inspection undertaken by the ET and the IEC;
- Comply with the agreed Event / Action Plan in the event of any exceedance; and
- Adhere to the procedures for carrying out complaint investigation.

Contractor

1.4.2.2 The term "Contractor" should be taken to mean all construction contractors and sub-contractors, working on site at any one time. Besides reporting to the ER, the Contractor should also be responsible for the following tasks:

- Work within the scope of the relevant contract and other tender conditions;
- Provide assistance to the ET in carrying out monitoring;
- Participate in the site inspections undertaken by the ET as required, and undertake any corrective actions;
- Provide information / advice to the ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
- Submit proposals on mitigation measures in case of exceedances of action or limit levels in accordance with the event / action plans;
- Implement measures to reduce impact where action or limit levels are exceeded; and
- Adhere to the procedures for carrying out complaint investigation.

Independent Environmental Checker (IEC)

1.4.2.3 The Independent Environmental Checker (IEC) should not be in any way an associated body of the Contractor for the Project. The responsibilities of the IEC should include the followings:-

- Advise the ER on environmental issues related to the project, independent from the management of construction works, but empowered to audit the environmental performance of construction and operation of the IWMF;

- Provide proactive advice to the ER and the Employer of the Project on environmental matters;
- Review and audit all aspects of the EM&A programme, including the implementation of environmental mitigation measures, submission relating to the EP and EM&A, and any other submission required under the EP and EM&A Manual;
- Review and verify the monitoring data and all submissions relating to or under the EP and EM&A Manual submitted by the ET, including but not limited to the EM&A reports;
- Monitor the implementation of the EM&A programme and the overall level of environmental performance being achieved;
- Arrange and conduct regular, at least monthly site inspections of the works during construction phase, and ad hoc inspections if significant environmental problems are identified;
- Comply with the agreed event / action plan in the event of any exceedance;
- Check and ensure the procedures for carrying out complaint investigation being followed and check the effectiveness of corrective measures;
- Feedback audit results to ET by signing off relevant EM&A proforma;
- Ensure the impact monitoring is conducted at the correct locations at the frequency identified in the EM&A Manual;
- Check that the mitigation measures are effectively implemented; and
- Report the works conducted, the findings, recommendation and improvement of the site inspections, the findings, recommendation, and improvement after reviewing the ET's and the Contractor's works, and any advices to the ER and the Employer of the Project on a monthly basis.

Environmental Team

1.4.2.4 The ET shall not be in any way an associated body of the Contractor, and shall be responsible to conduct the EM&A programme. The ET should be managed by the ET Leader. The ET Leader shall be a person who has at least 7 years' experience in EM&A and have relevant professional qualifications. Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfilment of the Project's EM&A requirements as specified in the EM&A Manual during construction of the Project. The ET shall report to the ER and the duties of ET shall include the followings:-

- Monitor and audit various environmental parameters as required in this EM&A Manual;
- Analyse the environmental monitoring and audit data and review the success of EM&A programme to cost-effectively confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions and to identify any adverse environmental impacts arising;
- Carry out regular site inspection to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and effect proactive action to pre-empt problems;
- Monitor compliance with conditions in the EP, environmental protection, pollution prevention and control regulations and contract specifications;
- Audit environmental monitoring data and site environmental conditions;
- Report on the environmental monitoring and audit results to EPD, the ER, the IEC and Contractor or their delegated representative;

- Recommend suitable mitigation measures to the Contractor in the case of exceedance of action or limit levels in accordance with the event and action plans;
- Liaise with the IEC on all environmental performance matters and timely submit all relevant EM&A proforma for approval by the IEC;
- Advise the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Adhere to the procedures for carrying out complaint investigation; and
- Timely submit the EM&A Reports to EPD.

1.4.2.5 Sufficient and suitably qualified professional and technical staff should be employed to ensure full compliance with their duties and responsibilities, as required under the EM&A programme during the construction phase of the Project.

1.4.3 Operation Phase

1.4.3.1 Under the DBO contract, the Contractor will be responsible for the operation of the IWMF. The Contractor will ensure compliance of the conditions of the Environmental Permit and continue to appoint the ET and IEC to carry out the monitoring works and audit works respectively during the operation phase in accordance to this EM&A Manual. The responsibilities of the IEC shall be the same as the construction phase.

1.4.3.2 The responsibilities of the ET during the operation phase shall include the follows:-

- Monitor various environmental parameters as required in this EM&A Manual;
- Report on the environmental monitoring results to the Contractor, the ER and the IEC;
- Analyze monitoring results collected from the monitoring works;
- Prepare monitoring reports to provide the impact evaluation results to the Contractor, the ER and the IEC; and
- Recommend suitable actions to the Contractor and ER in case of exceedance of any assessment criteria.

1.5 Structure of this Manual

1.5.1.1 Based on the two potential sites, the following 3 assessment scenarios have been examined in the EIA Study:

- (a) developing a 3,000 tpd IWMF at the TTAL site alone;
- (b) developing a 3,000 tpd IWMF at the artificial island near SKC alone; and
- (c) developing a 3,000 tpd IWMF at each of the two potential sites (co-exist scenario).

1.5.1.2 The EIA concluded that adverse additional environmental impacts specifically associated with the co-existence of the two IWMFs are not anticipated and the EM&A requirements recommended for each individual project site should be strictly followed under the respective scenario.

1.5.1.3 Following this introductory section, the structure of the EM&A Manual is set out below:-

- Sections 2a & 2b detail the requirement for impact monitoring for dust during the construction phase and for air emission from IWMF and odour during the operation phase at the TTAL site and the artificial island near SKC respectively.

- Sections 3a & 3b detail the requirement for impact monitoring for construction noise and operation noise at the TTAL site and the artificial island near SKC respectively.
- Sections 4a & 4b detail the requirements for baseline and impact monitoring for water quality during the construction phase at the TTAL site and the artificial island near SKC respectively.
- Sections 5a & 5b detail the audit requirements with regard to waste management issues as well as the waste control and mitigation measures recommended in the EIA at the TTAL site and the artificial island near SKC respectively.
- Sections 6a & 6b detail the requirements for monitoring and audit of the ecological impacts during the construction and operation phases at the TTAL site and the artificial island near SKC respectively.
- Sections 7a & 7b detail the requirements for monitoring and audit of the fisheries impacts during the construction and operation phases at the TTAL site and the artificial island near SKC respectively.
- Sections 8a & 8b detail the monitoring requirements with regard to human health risk as recommended in the EIA at the TTAL site and the artificial island near SKC respectively.
- Sections 9a & 9b detail the requirements with regard to landscape and visual issues at the TTAL site and the artificial island near SKC respectively.
- Sections 10a & 10b detail the requirements for monitoring and audit of the cultural heritage impact during the construction and operation phases at the TTAL site and the artificial island near SKC respectively.
- Section 11a details the landfill gas hazards that are likely to be generated from the WENT Landfill and its extensions, during the construction and operation phases of this Project at the TTAL site.
- Section 12 details the requirements on site environmental audit and the environmental complaints handling procedure.
- Section 13 details the EM&A reporting requirements.