

## **6a. WASTE MANAGEMENT IMPLICATIONS (TTAL SITE)**

### **6a.1 Introduction**

6a.1.1.1 This section identifies the types of waste that are likely to be generated during construction and operation phases of the Project, and evaluates the potential environmental impacts that may result from these wastes. Mitigation measures and good site practices, including waste handling, storage and disposal, are recommended with reference to the applicable waste legislation and guidelines.

### **6a.2 Environmental Legislation, Policies, Plans, Standards and Criteria**

#### **6a.2.1 General**

6a.2.1.1 The criteria and guidelines for assessing waste management implications are outlined in Annex 7 and Annex 15 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), respectively.

6a.2.1.2 The following legislations also cover the handling, treatment and disposal of waste in Hong Kong:

- Waste Disposal Ordinance (Cap. 354) and subsidiary Regulations;
- Public Health and Municipal Services Ordinance (Cap. 132);
- Land (Miscellaneous Provisions) Ordinance (Cap. 28);
- Waste Disposal (Chemical Waste) (General) Regulation; and
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation.

#### **6a.2.2 Waste Disposal Ordinance (Cap. 354)**

6a.2.2.1 The Waste Disposal Ordinance (WDO) prohibits any unauthorized disposal of waste. Construction waste, defined under Cap. 354N of the WDO refers to a substance, matter or thing which is generated from construction works. It includes all abandoned materials, whether processed or stockpiled or not, before being abandoned, but does not include sludge, screenings or matter removed or generated from desludging, desilting or dredging works. Under WDO, waste can be disposed of only at designated waste disposal facilities licensed by the Environmental Protection Department (EPD).

#### **6a.2.3 Public Health and Municipal Services Ordinance (Cap. 132)**

6a.2.3.1 The Public Cleansing and Prevention of Nuisances Regulation provides control on illegal tipping of waste on unauthorized (unlicensed) sites.

#### **6a.2.4 Land (Miscellaneous Provisions) Ordinance (Cap 28)**

6a.2.4.1 The inert portion of Construction and Demolition (C&D) materials (including rocks, soil, broken concrete, building debris, etc.) may be taken to public fill reception facilities. Public fill reception facilities (PFRFs) usually form part of land reclamation schemes and are operated by the Civil Engineering and Development Department (CEDD) and others. The Land (Miscellaneous Provisions) Ordinance requires that individuals or companies who deliver public fill to the public fill reception facilities to obtain Dumping Licences. The licences are issued by CEDD under delegated authority from the Director of Lands.

6a.2.4.2 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions, public fill reception facilities will only accept soil, sand, rubble, brick, tile, rock, boulder, concrete, asphalt, masonry or used bentonite. In addition, in accordance with paragraph 11 of the Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) (TC(W)) No. 31/2004, Public Fill Committee will advise on the acceptance criteria. The material will, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public fill reception facility supervisor.

### **6a.2.5 Environmental Guidelines**

6a.2.5.1 Other guidelines which detail how the Contractor should comply with are as follow:

- A Guide to the Registration of Chemical Waste Producers, Environmental Protection Department, Hong Kong;
- A Guide to the Chemical Waste Control Scheme, Environmental Protection Department, Hong Kong;
- Code of Practice on Package, Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department, Hong Kong;
- Works Branch Technical Circular (WBTC) No. 2/93, Public Dumps;
- WBTC No. 2/93B, Public Filling Facilities;
- WBTC No.16/96, Wet Soil in Public Dumps;
- WBTC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Projects;
- WBTC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers;
- WBTC No. 12/2000, Fill Management;
- WBTC No. 11/2002, Control of Site Crusher;
- WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates;
- ETWB TC(W) No. 33/2002, Management of Construction/Demolition Materials including Rocks;
- ETWB TC(W) No. 31/2004, Trip-ticket System for Disposal of Construction and Demolition Materials; and
- ETWB TC(W) No. 19/2005, Environmental Management on Construction Sites.

## **6a.3 Assessment Approach and Methodology**

6a.3.1.1 Criteria for assessing waste management implications are outlined in Annex 7 of EIAO-TM. Whereas methods for assessing potential waste management impacts during construction and operation phases of the Project would be examined in accordance with Annex 15 of EIAO-TM, which includes the following:

- Estimation of types and quantities of the wastes generated;
- Assessment of potential impacts from the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharge and public transport; and
- Impacts on the capacity of waste collection, transfer and disposal facilities.

6a.3.1.2 Opportunities for waste reduction have been assessed based upon the following:

- Avoidance and minimization of waste generation throughout design, construction and operation stage;
- Segregation of waste materials would be promoted and considered as the best management practices;
- Reuse and recycling on site or on other projects; and
- Material diversion to public fills as far as possible.

## 6a.4 Identification and Evaluation of Environmental Impacts

### 6a.4.1 Construction Phase

6a.4.1.1 The construction activities to be carried out for the proposed Project would generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified waste types include:

- Construction and demolition (C&D) materials;
- General refuse; and
- Chemical waste.

6a.4.1.2 The nature of each type of waste arising is described below, together with an evaluation of the potential environmental impacts associated with the waste.

#### Construction and Demolition Materials

6a.4.1.3 Construction and demolition (C&D) materials would be generated from site formation, foundation works for buildings and facilities, foundation piling and construction of the civil structures and access road. The estimated volume of C&D materials to be generated is 29,903m<sup>3</sup>. A breakdown of the estimated volumes of C&D materials and PFA generated from the construction of the Project is given in **Table 6a.1**.

**Table 6a.1 Summary of C&D Materials Volumes**

Type of C&D Material		Material generated (m <sup>3</sup> )	Inert C&D material to be reused on site (m <sup>3</sup> )	Non-inert C&D material to be collected for recycling (m <sup>3</sup> )	Non-inert C&D material to be disposed of off-site (m <sup>3</sup> )
Inert Material	Pulverised Fuel Ash (PFA)	21,415	21,415	0	0
Non-inert material	Top soil & vegetation	4,387	0	0	4,387
	Other <sup>(1)</sup>	4,101	0	820	3,281
<b>Total</b>		29,903	21,415	820	7,668

Note: (1) Other waste includes paper/cardboard packaging, timber, metallic waste, etc.

6a.4.1.4 The C&D materials should be re-used on-site for filling works as far as possible to minimize the net amount of C&D materials generated from the Project. Filling works would include site formation, backfilling and access road construction. To avoid offsite

disposal, the excavated PFA would be totally reused as filling material within the IWMF site area at the middle part of the ash lagoon. The volume of the C&D materials that cannot be reused and require disposal off-site is estimated to be approximately 7,688 m<sup>3</sup>.

6a.4.1.5 The amount of C&D materials and PFA expected to be generated shall be quantified in the site Waste Management Plan to be prepared by the Contractor. Since the construction activities would be located near the coast, improper management of C&D materials may introduce debris and pollutants to the water bodies, and mitigation measures, including adoption of good site practices, would be required for control of impacts. With proper implementation of good construction site practice and the mitigation measures recommended in Sections 3, 4 and 5, the handling and transportation of C&D materials to the disposal sites will not cause adverse dust, noise or water quality impacts.

#### Chemical Waste

6a.4.1.6 The maintenance and servicing of construction plant and equipment may possibly generate some chemical wastes, for instance, cleaning fluids, solvents, lubrication oil and fuel. Maintenance of vehicles may also involve the use of a variety of chemicals, oil and lubricants. It is difficult to quantify the amount of chemical waste that will arise from the construction activities since it will be dependent on the Contractor's on-site maintenance requirements and the amount of plant utilised. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, would be small and in the order of a few cubic metres per month. The amount of chemical waste expected to be generated shall be quantified in the site Waste Management Plan to be prepared by the Contractor.

6a.4.1.7 Chemical wastes generated during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers;
- Adverse impacts on water quality from spills; and
- Fire hazards.

6a.4.1.8 Materials classified as chemical wastes will be required for special handling and storage arrangements before removal for appropriate treatment such as the Chemical Waste Treatment Facility at Tsing Yi. Wherever possible, opportunities should be taken to reuse and recycle materials. Mitigation and control requirements for chemical wastes are detailed in **Section 6a.5.1.8**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected to result.

#### General Refuse

6a.4.1.9 Throughout construction, the workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. Release of general refuse into coastal waters should not be permitted, as introduction of these wastes is likely to have detrimental effects on water quality in the area. Rapid and effective collection of site wastes would be required to prevent waste materials being blown around by wind or flushed into the coastal waters or stream. The work sites may also attract pests and vermin and create odour nuisance if the waste storage area is not well maintained and cleaned regularly. Disposal of refuse at sites other than approved waste transfer or disposal facilities can also result in similar impacts. With the implementation of good waste management practices at the site, adverse environmental impacts would not be expected to arise from the storage, handling and transportation of workforce wastes. The maximum number of construction workers to be employed is estimated to be about 400 workers. Based on a generation rate of 0.65 kg

per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 260 kg.

- 6a.4.1.10 Potential environmental impacts will be insignificant provided that the mitigation measures and appropriate site practices suggested in **Section 6a.5.1.9** and **Table 6a.4** are implemented.

### 6a.4.2 Operation Phase

- 6a.4.2.1 As discussed in **Section 2**, the IWMF would comprise (a) an advanced thermal incineration plant of about 2,800 tpd capacity and (b) a demonstration-scale mechanical treatment (MT) plant of about 200tpd or less for mixed MSW. The wastes to be generated from the thermal incineration plant are discussed below:

#### Incineration By-products

- 6a.4.2.2 The main waste type to be generated during the operation of the thermal incineration plant would be bottom ash, fly ash and air pollution control (APC) residues. For treating 3,000 tpd of mixed MSW, it is estimated that approximately 660 tpd of bottom ash and 120 tpd of fly ash and APC residues would be generated from the thermal incineration plant.
- 6a.4.2.3 The bottom ash is considered to be inert provided that the combustion systems in the incinerator are designed and operated correctly, and would be disposed of at landfill. Fly ash and APC residues from the flue gas stream can also be disposed of at landfill after proper treatment. The pollution load in fly ash and APC residues would likely be higher and more readily leachable than that in bottom ash. Cement solidification or chemical stabilization would be adopted to pre-treat the fly ash and APC residue to ensure that they would conform to the proposed Incineration Residue Pollution Control Limits shown in **Table 6a.2** and leachability criteria before disposal.

**Table 6a.2 Incineration Residue Pollution Control Limits**

Pollutant Parameter	Pollution Control Limit
Each Skip Load Prior to Transportation to Disposal Site	
Residue Itself:	
Bottom Ash and Fly Ash:	
• Total organic carbons <sup>(a)</sup>	3% by wt (d)
• Dioxins/Furans <sup>(b)</sup>	1 ppb (or 1 µg kg <sup>-1</sup> )
Leachate Derived from the Residue:	
pH	>8
Heavy Metals <sup>(c)</sup>	
• Cd	10 ppm (or mg kg <sup>-1</sup> )
• Cr	50 ppm (or mg kg <sup>-1</sup> )
• Cu	250 ppm (or mg kg <sup>-1</sup> )
• Ni	250 ppm (or mg kg <sup>-1</sup> )
• Pb	50 ppm (or mg kg <sup>-1</sup> )
• Zn	250 ppm (or mg kg <sup>-1</sup> )
• Hg	1 ppm (or mg kg <sup>-1</sup> )
• Sn	250 ppm (or mg kg <sup>-1</sup> )
• Ag	50 ppm (or mg kg <sup>-1</sup> )
• Sb	150 ppm (or mg kg <sup>-1</sup> )
• As	50 ppm (or mg kg <sup>-1</sup> )
• Be	10 ppm (or mg kg <sup>-1</sup> )
• Tl	50 ppm (or mg kg <sup>-1</sup> )
• V	250 ppm (or mg kg <sup>-1</sup> )
• Se	1 ppm (or mg kg <sup>-1</sup> )
• Ba	1,000ppm (or mg kg <sup>-1</sup> )

Notes:

- (a) Checking of carbon burnout of the ash is necessary to ensure adequate sterility
- (b) I-TEQ (International Toxic Equivalents)
- (c) Toxicity Characteristic Leaching Procedure (TCLP) limits for landfill disposal
- (d) The EU Directive on Incineration of Waste requires a TOC of 3% by wt.

6a.4.2.4 The incineration ash generated should not be considered as chemical wastes under the Waste Disposal (Chemical Waste) (General) Regulation if the Toxicity Characteristic Leaching Procedure (TCLP) results of the ash comply with the Incineration Residue Pollution Control Limits. In case that the Incineration Residue Pollution Control Limits are not conformed, pre-treatment to the ashes and residues, such as cement solidification or chemical stabilization, will be required to ensure compliance of the proposed Incineration Residue Pollution Control Limits.

6a.4.2.5 To confirm that the bottom ash, and the treated fly ash and APC residues of the IWMF would not contain elevated levels of heavy metals and as a precautionary measure, it is proposed that TCLP tests be carried out for each batch of bottom ash and treated fly ash and APC residues to be disposed of at WENT Landfill at the initial stage of the IWMF operation (i.e. for a period of 6 months). If the test results confirm that heavy metals or pH are not of concern, the TCLP test can be deleted or reduced to half-yearly intervals.

MT By-products

6a.4.2.6 For MT plant, the materials that are sorted out by the mechanical treatment but considered inappropriate to be recycled (e.g. badly-contaminated paper and plastics) would be treated as refuse.

6a.4.2.7 The estimated amount of refuse would be about 185 tpd. Most of the refuse will be diverted to the incinerators of the IWMF for combustion. Only a small amount of undersize, non-combustible inert refuse (about 23 tpd), which contains glass, sand, etc., will be disposed of at the WENT Landfill.

6a.4.2.8 The estimated quantities of waste products generated from the operation of the IWMF are indicated in **Table 6a.3** below.

**Table 6a.3 Summary of Waste Generation from Operation of the IWMF**

Waste Product	Quantity	Disposal Route
<b>Incineration by-products</b>		
<b>Bottom Ash</b>	660 tpd	To be complied with proposed Incineration Residue Pollution Control Limits prior to disposal to WENT landfill
<b>Fly ash and APC Residue</b>	120 tpd (240 tpd after cementation)	Pre-treatment would be applied (e.g. cement solidification) for compliance with proposed Incineration Residue Pollution Control Limits prior to disposal to WENT landfill.
<b>MT by-products</b>		
<b>Refuse from MT</b>	162 tpd	Refuse (e.g. badly contaminated textiles, wood and residual paper, plastics etc.) to be diverted to the incinerators of the IWMF for combustion.
	23 tpd	Undersized, non-combustible inert refuse (e.g. glass, sand, residual metals etc.) to be disposed at WENT landfill.

## **6a.5 Mitigation of Adverse Environmental Impacts**

### **6a.5.1 Construction Phase**

6a.5.1.1 This section recommends the mitigation measures needed to avoid or minimize potential adverse environmental impacts associated with the handling, collection and disposal of waste arising from the construction and operation of the IWMF.

#### Good Site Practices

6a.5.1.2 Adverse environmental impacts in relation to waste management are not expected, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities would include:

- Obtain relevant waste disposal permits from appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap. 354) and subsidiary Regulations and the Land (Miscellaneous Provisions) Ordinance (Cap. 28);
- Provide staff training for proper waste management and chemical handling procedures;
- Provide sufficient waste disposal points and regular waste collection;
- Provide appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers; and
- Carry out regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors;
- Separate chemical wastes for special handling and disposed of to licensed facility for treatment; and
- Employ licensed waste collector to collect waste.

#### Waste Reduction Measures

6a.5.1.3 Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Design foundation works that could minimise the amount of excavated material to be generated.
- Provide training to workers on the importance of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling;
- Sort out demolition debris and excavated materials from demolition works to recover reuseable/recyclable portions (i.e. soil, broken concrete, metal etc.);
- 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 the collection of aluminium cans by providing separate labelled bins to enable this waste to be segregated from other general refuse generated by the work force;
- Proper storage and site practices to minimise the potential for damage or contamination of construction materials; and
- Plan and stock construction materials carefully to minimise amount of waste to be

generated and to avoid unnecessary generation of waste.

- 6a.5.1.4 In addition to the above measures, specific mitigation measures are recommended below for the identified waste so as to minimise environmental impacts during handling, transportation and disposal of the waste.

#### Construction and Demolition Materials

- 6a.5.1.5 In order to minimise the impact resulting from collection and transportation of C&D materials for off-site disposal, the excavated material arising from site formation and foundation works should be reused on-site as backfilling material and for landscaping works as far as practicable. Other mitigation requirements are listed below:

- A Waste Management Plan (WMP), which becomes part of the Environmental Management Plan (EMP), should be prepared in accordance with *ETWB TCW No. 19/2005*;
- A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be adopted for easy tracking; and
- In order to monitor the disposal of C&D materials at public filling facilities and landfills and to control fly-tipping, a trip-ticket system should be adopted (refer to *ETWB TCW No. 31/2004*).

- 6a.5.1.6 The Contactor should prepare and implement an EMP in accordance with *ETWB TCW No.19/2005*, which describes the arrangements for avoidance, reuse, recovery, recycling, storage, collection, treatment and disposal of different categories of waste to be generated from construction activities. Such a management plan should incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. The EMP should be submitted to the Engineer for approval. The Contractor should implement waste management practices in the EMP throughout the construction stage of the Project. The EMP should be reviewed regularly and updated by the Contractor, preferably on a monthly basis.

- 6a.5.1.7 All surplus C&D materials arising from or in connection with construction works should become the property of the Contractor when it is removed unless otherwise stated. The Contractor would be responsible for devising a system to work for on-site sorting of C&D materials and promptly removing all sorted and process materials arising from the construction activities to minimize temporary stockpiling on-site. The system should be included in the EMP identifying the source of generation, estimated quantity, arrangement for on-site sorting, collection, temporary storage areas and frequency of collection by recycling Contractors or frequency of removal off-site.

#### Chemical Wastes

- 6a.5.1.8 Should chemical wastes be produced at the construction site, the Contractor would be required to register with EPD as a Chemical Waste Producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste (such as explosive, flammable, oxidizing, irritant, toxic, harmful, or corrosive). The Contractor should employ a licensed collector to transport and dispose of the chemical wastes, to either the Chemical Waste Treatment Centre at Tsing Yi, or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.



General Refuse

6a.5.1.9 General refuse should be stored in enclosed bins or compaction units separate from C&D materials. A licensed waste collector should be employed by the Contractor to remove general refuse from the site, separately from C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.

6a.5.1.10 **Table 6a.4** provides a summary of the various waste types likely to be generated during the construction activities for the IWMF, together with the recommended handling and disposal methods.

**Table 6a.4 Summary of Waste Handling Procedures and Disposal Outlets during Construction Phase**

Waste Type	Generated from works item	Total Amount Generated	Amount to be disposed of	Handling Process	Recommended Disposal Outlets
C&D Materials & PFA	Site formation; Foundation Works; Construction of civil structures & access road	29,903 m <sup>3</sup>	7,668 m <sup>3</sup>	Segregate inert C&D materials i.e. public fill to avoid contamination from other waste arisings	Inert material (i.e. excavated PFA) to be reused on-site for filling works including site formation, backfilling and road widening (21,415 m <sup>3</sup> )  Recyclable non-inert material such as metallic waste and paper/cardboard packaging to be collected for recycling (820 m <sup>3</sup> )  C&D materials cannot be reused or recycled to be disposed to public fill reception facilities (PFRFs) upon approval from CEDD.
Chemical Waste	Cleansing fluids, solvent, lubrication oil and fuel from construction plants and equipment	Few cubic meters/month (preliminary estimate)	Few cubic meters/month	Collected for disposal by licensed collector; Stored on-site within suitably designed containers	Chemical Waste Treatment Centre
General Refuse	Waste paper, empty container generated from workforce	260 kg/ day	260 kg/ day	Provide on-site refuse collection points	Refuse station for compaction and containerisation and then to landfill

## **6a.5.2 Operation Phase**

### Good Site Practices

6a.5.2.1 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) and Waste Disposal (Chemical Waste) (General) Regulation;
- 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 solid wastes at 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; and
- Implementation of a recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites).

### Waste Reduction Measures

6a.5.2.2 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; and
- Any unused chemicals or those with remaining functional capacity should be reused as far as practicable.

### Storage, Handling, Treatment, Collection and Disposal of Incineration By-Products

6a.5.2.3 The following measures are recommended for the storage, handling and collection of the incineration by-products:

- Ash should be stored in storage silos;
- Ash should be handled and conveyed in closed systems fully segregated from the ambient environment;
- Ash should be wetted with water to control fugitive dust, where necessary;
- All fly ash and APC residues should be treated, e.g. by cement solidification or chemical stabilization, for compliance with the proposed Incineration Residue Pollution Control Limits and leachability criteria prior to disposal;
- The ash should be transported in covered trucks or containers to the designated landfill site.

6a.5.2.4 The Contractor should provide EPD with chemical analysis results of the bottom ash, and treated fly ash and APC residues to confirm that the ash/residue can comply with the proposed Incineration Residue Pollution Control Limits before disposal.

## 6a.6 Contamination Prevention Measures

### 6a.6.1 General

6a.6.1.1 The IWMF is proposed to be located at the TTAL site. Based on the available information, the lagoons were constructed in year 1987 and the lagoons have been used solely for ash disposal purpose since its formation. No other contaminating activities including storage and use of chemicals or fuels were practised on site. This is verified by review of historic aerial photos and no observable contamination was noticed in recent site walkover. Potential land contamination impact associated with the previous uses of the lagoon site is therefore not anticipated.

6a.6.1.2 With reference to Clause 3.4.4.3 of the EIA Study Brief, the following tasks have been conducted in accordance with the *Guidance Manual for Use of Risk based Remediation Goals for Contaminated Land Management* and the *Guidance Note for Contaminated Land and Remediation* to prevent contamination problem due to operation of the IWMF from arising in the future:

- Identify the possible sources of contamination associated with the operation of the Project; and
- Formulate appropriate operational practices, waste management strategies and precautionary measures for the prevention of contamination problems.

### 6a.6.2 Potential Sources of Contamination

6a.6.2.1 A variety of chemicals is expected to be used during the IWMF operation. Moreover, the IWMF operation would produce chemical wastes and incineration residues. Without proper management of the chemicals, chemical wastes and incineration residues, there is potential for land contamination due to uncontrolled spillages, or improper handling and disposal of these materials.

6a.6.2.2 The expected types and quantities of the materials involved in the IWMF operation with contamination potential are presented in **Table 6a.5**.

6a.6.2.3 A minimum amount of chemical wastes are expected to be generated. Chemical wastes will only arise if chemicals are over-ordered and cannot be consumed before the expiry of the chemicals.

**Table 6a.5 Materials used in the IWMF Operation with Land Contamination Potential**

Material	Expected Annual Consumption / Production	Estimated Quantity to be Stored On-site
<b>Chemicals Consumption</b>		
Slaked lime	12,065 tonnes	496 tonnes
Ammonia water	4,015 tonnes	165 tonnes
Activated carbon	383 tonnes	31 tonnes
Kerosene	283 m <sup>3</sup>	12 m <sup>3</sup>
Caustic soda	206 tonnes	8,466 kg
Hydrochloric acid	83 tonnes	3,411 kg
Sulfurous acid	3,906 kg	161 kg
<b>Production of Incineration By-products</b>		
Bottom Ash	240,900 tonnes	1,980 m <sup>3</sup>
Fly ash & APC residues	43,800 tonnes	360 m <sup>3</sup>

### 6a.6.3 Approach to Prevent Land Contamination

#### Fuel Oil Spillage Prevention

6a.6.3.1 Precautionary measures to prevent fuel oil spillage are presented below.

- (i) Fuel Oil Tank Construction and Test
  - The fuel tank to be installed should be of specified durability.
  - Double skin tanks are preferred.
  - Underground fuel storage tank should be placed within a concrete pit.
  - The concrete pit shall be accessible to allow regular tank integrity tests to be carried out at regular intervals.
  - Tank integrity tests should be conducted by an independent qualified surveyor or structural engineer.
  - Any potential problems identified in the test should be rectified as soon as possible.
- (ii) Fuel Oil Pipeline Construction and Test
  - Installation of aboveground fuel oil pipelines is preferable; if underground pipelines are unavoidable, concrete lined trenches should be constructed to contain the pipelines.
  - Double skin pipelines are preferred.
  - Distance between the fuel oil refuelling points and the fuel oil storage tank shall be minimized.
  - Integrity tests for the pipelines should be conducted by an independent qualified surveyor or structural engineer at regular intervals.
  - Any potential problems identified in the test should be rectified as soon as possible.
- (iii) Fuel Oil Leakage Detection
  - Installation of leak detection device at storage tank and pipelines.
  - Installation and use of pressure gauges (e.g. at the two ends of a filling line) in fuel filling, which allows unexpected pressure drop or difference and sign of leakage to be detected.

- (iv) Fuel Oil Storage Tank Refuelling
  - Storage tank refuelling (from road tanker) should only be conducted by authorized staff of the oil company using the company's standard procedures.
- (v) Fuel Oil Spillage Response
  - An Oil Spill Response Plan should be prepared by the operator to document the appropriate response procedures for oil spillage incidents in detail. General procedures to be taken in case of fuel oil spillage are presented below.
    - Training

Training on oil spill response actions should be given to relevant staff. The training shall cover the followings:

      - Tools & resources to combat oil spillage and fire, e.g. locations of oil spill handling equipment and fire fighting equipment;
      - General methods to deal with oil spillage and fire incidents;
      - Procedures for emergency drills in the event of oil spills and fire; and
      - Regular drills shall be carried out.
    - Communication

Establish communication channel with the Fire Services Department (FSD) and EPD to report any oil spillage incident so that necessary assistance from relevant department can be quickly sought.
    - Response Procedures

Any fuel oil spillage within the IWMF site should be immediately reported to the Plant Manager with necessary details including location, source, possible cause and extent of the spillage.

Plant Manager should immediately attend to the spillage and initiate any appropriate action to confine and clean up the spillage. The response procedures shall include the following:

      - Identify and isolate the source of spillage as soon as possible.
      - Contain the oil spillage and avoid infiltration into soil/ groundwater and discharge to storm water channels.
      - Remove the oil spillage.
      - Clean up the contaminated area.
      - If the oil spillage occurs during storage tank refuelling, the refueling operation should immediately be stopped.
      - Recovered contaminated fuel oil and the associated material to remove the spilled oil should be considered as chemical waste. The handling and disposal procedures for chemical wastes are discussed in the following paragraphs.

#### Chemicals and Chemical Wastes Handling & Spillage Prevention

6a.6.3.2 The precautionary measures to prevent improper handling/ use of chemicals and chemical waste spillage are presented below.

- (i) Chemicals and Chemical Wastes Handling & Storage
  - Chemicals and chemical wastes should only be stored in suitable containers in purpose-built areas.

- The storage of chemical wastes should comply with the requirements of the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.
  - The storage areas for chemicals and chemical wastes shall have an impermeable floor or surface. The impermeable floor/ surface shall possess the following properties:
    - Not liable to chemically react with the materials and their containers to be stored.
    - Able to withstand normal loading and physical damage caused by container handling
    - The integrity and condition of the impermeable floor or surface should be inspected at regular intervals to ensure that it is satisfactorily maintained
  - For liquid chemicals and chemical wastes storage, the storage area should be banded to contain at least 110% of the storage capacity of the largest containers or 20% of the total quantity of the chemicals/chemical wastes stored, whichever is the greater.
  - Storage containers shall be checked at regular intervals for their structural integrity and to ensure that the caps or fill points are tightly closed.
  - Chemical handling shall be conducted by trained workers under supervision.
- (ii) Chemicals and Chemical Wastes Spillage Response
- A Chemicals and/ or Chemical Wastes Spillage Response Plan shall be prepared by the operator to document in detail the appropriate response procedures for chemicals or chemical wastes spillage incidents. General procedures to be undertaken in case of chemicals/ chemical waste spillages are presented below.
    - Training

Training on spill response actions should be given to relevant staff. The training shall cover the followings:

      - Tools & resources to handle spillage, e.g. locations of spill handling equipment;
      - General methods to deal with spillage; and
      - Procedures for emergency drills in the event of spills.
    - Communication

Establish communication channel with FSD and EPD to report the spillage incident so that necessary assistance from relevant department can be quickly sought.
    - Response Procedures

Any spillage within the IWMF site should be reported to the Plant Manager.

Plant Manager shall attend to the spillage and initiate any appropriate actions needed to confine and clean up the spillage. The response procedures shall include the followings:

      - Identify and isolate the source of spillage as soon as possible;
      - Contain the spillage and avoid infiltration into soil/ groundwater and discharge to storm water channels (in case the spillage occurs at locations out of the designated storage areas);
      - Remove the spillage; the removal method/ procedures documented

in the Material Safety Data Sheet (MSDS) of the chemicals spilled should be observed;

- Clean up the contaminated area (in case the spillage occurs at locations out of the designated storage areas); and
- The waste arising from the cleanup operation should be considered as chemical wastes.

#### Preventive Measures for Incineration By-products Handling

6a.6.3.3 The recommended measures listed below can minimize the potential contamination to the surrounding environment due to the incineration by-products:

- Ash should be stored in storage silos;
- Ash should be handled and conveyed in closed systems fully segregated from the ambient environment;
- Ash should be wetted with water to control fugitive dust, where necessary;
- All fly ash and APC residues should be treated, e.g. by cement solidification or chemical stabilization, for compliance with the proposed Incineration Residue Pollution Control Limits and leachability criteria prior to disposal;
- The ash should be transported in covered trucks or containers to the designated landfill site.

#### Incident Record

6a.6.3.4 After any spillage, an incident report should be prepared by the Plant Manager. The incident report should contain details of the incident including the cause of the incident, the material spilled and estimated spillage amount, and also the response actions undertaken. The incident record should be kept carefully and able to be retrieved when necessary.

6a.6.3.5 The incident report should provide sufficient details for the evaluation of any environmental impacts due to the spillage and assessment of the effectiveness of measures taken.

6a.6.3.6 In case any spillage or accidents results in significant land contamination, EPD should be informed immediately and the IWMF operator should be responsible for the cleanup of the affected area. The responses procedures described in **Section 6a.6.3.1** and **Section 6a.6.3.2** above should be followed accordingly together with the land contamination assessment and remediation guidelines stipulated in the *Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management* and the *Guidance Note for Contaminated Land and Remediation*.

### **6a.7 Evaluation of Residual Impacts**

6a.7.1.1 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste, no adverse residual impact is expected to arise during the construction of the proposed Project.

6a.7.1.2 For the operation phase of the Project, provided that the incineration by-products of the IWMF operation comply with the proposed Incineration Residue Pollution Control Limits as recommended in **Table 6a.2** and leachability criteria of material prior to disposal at landfill, the residual impact arising from the disposal of the incineration by-products is considered to be minimal and thus acceptable. Besides, with the implementation of the

contamination preventive measures, contamination problems during the operation phase of the Project are not expected.

## **6a.8 Environmental Monitoring and Audit**

- 6a.8.1.1 It would be the Contractor's responsibility to ensure that all wastes produced during the construction of the Project are handled, stored and disposed of in accordance with the recommended good waste management practices and EPD's regulations and requirements. A Waste Management Plan (WMP) which would become part of the Environmental Management Plan (EMP) should be prepared in accordance with ETWB TCW No.19/2005 by the Contractor. The mitigation measures recommended in this section should form the basis of the WMP.
- 6a.8.1.2 Waste materials generated from construction activities, such as construction and demolition (C&D) materials and general refuse, are recommended to be audited at regular intervals (at least once per week as part of the regular site inspections described in EM&A Manual) to ensure that proper storage, transportation and disposal practices are being implemented. The Contractor would be responsible for the implementation of the mitigation measures to minimize waste or redress problems arising from the waste materials.
- 6a.8.1.3 Besides, during operation phase of the Project, it is recommended that the incineration by-products should be tested in accordance with the requirements of the proposed Incineration Residue Pollution Control Limits as recommended in **Table 6a.2** above prior to disposal to landfill. A number of the land contamination preventive measures are also recommended for the operation of the Project.

## **6a.9 Conclusion**

- 6a.9.1.1 Waste types generated by the construction activities for the IWMF are likely to include C&D materials (from site formation, foundation works and construction of access road), general refuse from the workforce and chemical wastes from the maintenance of construction plant and equipment. Provided that the waste is handled, transported and disposed of using approved methods and that the recommended good site practices are strictly followed, adverse environmental impacts would not be expected during the construction phase.
- 6a.9.1.2 The end product from the incineration process would be bottom ash, fly ash and APC residues which would be disposed of at landfill after complied with the proposed incineration residue pollution control limits. Pre-treatment would be applied for fly ash and APC residues prior to disposal. A small amount of non-combustible inert refuse (e.g. glass, sand, residual metals etc.) sorted out in the MT process would be disposed of at landfill.
- 6a.9.1.3 The potential sources of contamination in the IWMF operation have been identified. Limited amount of chemicals or chemical wastes would be used/ produced in the IWMF operation. Good practices and response procedures for contamination prevention have been recommended. With proper implementation of the recommended practices and procedures, the potential for contamination due to the IWMF operation is expected to be minimal.