6b. WASTE MANAGEMENT IMPLICATIONS (ARTIFICIAL ISLAND NEAR SKC)

6b.1 Introduction

6b.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.

6b.2 Environmental Legislation, Policies, Plans, Standards and Criteria

6b.2.1 General

6b.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.

6b.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;
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation; and
- Dumping at Sea Ordinance (Cap. 466).

6b.2.2 Waste Disposal Ordinance (Cap. 354)

6b.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).

6b.2.3 Public Health and Municipal Services Ordinance (Cap. 132)

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

6b.2.4 Land (Miscellaneous Provisions) Ordinance (Cap 28)

6b.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.

6b.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.

6b.2.5 Dumping at Sea Ordinance (Cap 466)

6b.2.5.1 The *Dumping at Sea Ordinance* (Cap. 466) (DASO) came into operation in April 1995 and empowers the Director of Environmental Protection (DEP) to control the disposal and incineration of substances and particles at sea for the protection of the marine environment. Under the Ordinance, a dumping permit from the DEP is required for the disposal of regulated substances within and outside the waters of Hong Kong.

6b.2.5.2 Marine disposal of any dredged/excavated sediment is subject to control under the DASO. Dredged/excavated sediment destined for marine disposal is classified based on its contaminant levels with reference to the *ETWB Technical Circular (Works) No. 34/2002 Management of Dredged/Excavated Sediment (ETWB TCW 34/2002).*

6b.2.5.3 The ETWB TCW 34/2002 sets out the procedure for seeking approval to and the management framework for marine disposal of dredged/excavated sediment. This Technical Circular outlines the requirements, in 3 tiers, to be followed in assessing and classifying the sediment and in determining the marine disposal arrangement for the classified material. The three-tiers are described below:

6b.2.5.4 Tier I – Desktop review on available information to determine whether the sediment belongs to Category L material (i.e. sediments with little or no contamination) that is suitable for open sea disposal. If there were insufficient data or if there were data indicating potential sediment contamination, Tier II screening will be conducted;

6b.2.5.5 Tier II – Chemical screening to categorise the sediments based on its chemical contaminants levels and to determine the marine disposal arrangements. The sediment quality criteria for the classification of sediment as presented in Appendix A of ETWB TCW 34/2002 were referred to as the *Lower Chemical Exceedance Level* (LCEL) and *Upper Chemical Exceedance Level* (UCEL). The sediments will be classified into three categories as based on the chemical screening results:

- Category L: Sediment with all contaminant levels not exceeding the LCEL. The materials must be dredged, transported and disposed of in a manner which minimizes the loss of contaminants either into solution or by resuspension.
- Category M: Sediment with any one or more contaminant levels exceeding the LCEL and none exceeding the UCEL. The material must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.
- Category H: Sediment with any one or more contaminant levels exceeding the UCEL. The material must be dredged and transported with great care, and must be effectively isolated from the environment upon final disposal.

6b.2.5.6 Tier III – Biological screening to identify the most appropriate disposal option for all Category M and certain Category H sediments with one or more contaminant levels exceeding 10 times the LCEL as revealed from Tier II screening. The biological screening involves the carrying out of toxicity tests on the sediments and the results are interpreted with reference to test endpoints and decision criteria as specified in Appendix B of ETWB TCW 34/2002.

6b.2.5.7 The disposal options for the dredged / excavated sediments will be determined based on the 3 tiers as outlined above. As stipulated in the ETWB TCW 34/2002, there are three types of disposal options for dredged/excavated sediments:

- Type 1 – Open Sea Disposal (for Category L sediment) or Open Sea Disposal in Dedicated Sites (for Category M sediments passing the Tier III screening);
- Type 2 – Confined Marine Disposal (for Category M sediments failing the Tier III screening or Category H sediments not requiring or passing the Tier III screening);
- Type 3 – Special Treatment / Disposal (for Category H with one or more contaminant levels exceeding 10 times the LCEL and failing the Tier III screening). The project proponent will be responsible, in consultation with the DEP, the most appropriate treatment and/or disposal arrangement for this type of sediments.

6b.2.6 Environmental Guidelines

6b.2.6.1 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. 34/2002, Management of Dredged/Excavated Sediment;
- 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.

6b.3 Assessment Approach and Methodology

6b.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.

6b.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.

6b.4 Identification and Evaluation of Environmental Impacts

<u>Construction Phase</u>

6b.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:

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

6b.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.

Dredged Marine Sediment

6b.4.1.3 According to the current engineering design and construction method, large-scale sediment dredging is not anticipated for the proposed reclamation and breakwater construction works at artificial island near SKC. Only small-scale dredging may be required along the proposed cofferdam during construction to remove the top 1 m of clayey marine deposit. The proposed dredging extent is shown in **Figure 6b.1**.

Sediment Sampling

6b.4.1.4 Historical records, including EPD's sediment monitoring data, aerial photographs from Lands Department and previous sediment quality investigation studies, had been reviewed and discussed in the Sediment / PFA Sampling and Testing Plan (the Plan) as attached in **Appendix 6.1**. Based on the findings of the review and given that little human activities were identified near the artificial island near SKC, the general sediment contamination levels within the area is expected to be low.

6b.4.1.5 Nevertheless, as there was no available sediment quality data within the artificial island near SKC, marine site investigation (SI) were conducted under this EIA Study to classify and determine the most appropriate disposal options for the proposed dredged sediments. The Plan was prepared, with reference to ETWB TCW 34/2002 and Clause 3.7.4.2 (iii)(a) of the EIA Study Brief, to present the sampling and testing requirements of the marine SI and was agreed with DEP on 23 June 2009. The Plan and acceptance letter are attached in **Appendix 6.1**.

6b.4.1.6 The marine SI works was conducted in the period from October to November 2009 in accordance with the agreed Plan. The sampling works were conducted by Fugro Geotechnical Services Ltd. (Fugro) and the laboratory testing was carried out by ALS Technichem (HK) Pty. Ltd. (ALS), an HOKLAS accredited laboratory.

6b.4.1.7 Based on the agreed Plan, a total of twenty-five (25) offshore sampling locations (i.e MI1 to MI25) were proposed at a grid spacing of approximately 200m within the artificial island near SKC. The sediment samples were taken via gravity grab. In order to indicate the general vertical sediment contamination profile, vibrocoring were also carried out at 2 of the 25 sampling locations (i.e. MI11 and MI13) to collect and test the deeper sediments. The as-built sampling locations within Shek Kwu Chau are shown in **Figure 6b.1**.

6b.4.1.8 A gravity grab sample was also collected from EPD's routine marine sediment monitoring station PS6 at Port Shelter (850434E, 820057N) on 24 November 2009 as the reference sediment sample for possible Tier III biological screening.

Chemical and Biological Screening

6b.4.1.9 The chemical screening was carried out in accordance with the Plan and ETWB TCW 34/2002. Twenty nine samples within the artificial island near SKC and proposed dredging levels as well as one reference sample were tested and the results are summarised in **Table 6b.1**.

6b.4.1.10 As shown in **Table 6b.1**, the chemical contaminant levels in the sediment samples were below the LCEL, with no PAHs and PCBs detected. The sediment samples were thus classified as Category L sediments and no Tier III biological screening were considered necessary.

6b.4.1.11 It should be noted that there were insufficient amount of interstitial water available from most of the vibrocore sub-samples for TBT analysis. As such, TBT analyses were only conducted on the grab samples and vibrocore sub-sample MI13 (0.1-0.9m). Based on the analytical results, all the TBT levels were at least an order below the LCEL.

Table 6b.1 Chemical Screening Results

Sampling ID	Depth (m)		Type[1]	PAH (μg/kg)		Total PCB (μg/kg)	Metals (mg/kg)									TBT (μg/L)[4]	Overall Category	Disposal Type[5]
	From	To		LW[2]	HW[3]		Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag			
LCEL				550	1700	23	1.5	80	65	40	75	200	0.5	12	1	0.15		
UCEL				3160	9600	180	4	160	110	40	110	270	1	42	2	0.15		
Reporting Limit				550	1700	3	0.2	1	1	1	1	1	0.05	1	0.1	0.15		
MI1	-	-	G	<550	<1700	<3	<0.2	21	14	14	25	54	0.10	6	0.1	<0.011	L	Type 1
MI2	-	-	G	<550	<1700	<3	<0.2	38	23	21	33	93	0.08	8	0.2	0.007	L	Type 1
MI3	-	-	G	<550	<1700	<3	<0.2	27	18	17	24	70	0.05	6	0.2	<0.007	L	Type 1
MI4	-	-	G	<550	<1700	<3	<0.2	33	20	17	29	80	0.07	8	0.2	0.010	L	Type 1
MI5	-	-	G	<550	<1700	<3	<0.2	32	20	20	28	79	0.10	7	0.2	<0.007	L	Type 1
MI6	-	-	G	<550	<1700	<3	<0.2	37	22	21	33	91	0.06	8	0.2	0.015	L	Type 1
MI7	-	-	G	<550	<1700	<3	<0.2	49	31	32	39	128	0.10	11	0.3	<0.007	L	Type 1
MI8	-	-	G	<550	<1700	<3	<0.2	47	26	25	35	112	0.08	10	0.3	<0.011	L	Type 1
MI9	-	-	G	<550	<1700	<3	<0.2	48	26	25	35	114	0.10	10	0.2	0.015	L	Type 1
MI10	-	-	G	<550	<1700	<3	<0.2	49	26	25	35	116	0.08	10	0.2	<0.012	L	Type 1
MI11	-	-	G	<550	<1700	<3	<0.2	45	27	29	35	110	0.09	11	0.2	<0.008	L	Type 1
MI11	0	0.9	V	<550	<1700	<3	<0.2	38	13	25	25	82	<0.05	10	<0.1	-	L	Type 1
MI11	0.9	1.9[6]	V	<550	<1700	<3	<0.2	41	14	28	24	86	<0.05	9	<0.1	-	L	Type 1
MI12	-	-	G	<550	<1700	<3	<0.2	30	17	16	27	71	0.06	7	0.2	<0.007	L	Type 1
MI13	-	-	G	<550	<1700	<3	<0.2	36	19	18	34	80	0.08	6	0.2	<0.009	L	Type 1
MI13	0.1	0.9	V	<550	<1700	<3	<0.2	12	5	3	11	21	<0.05	3	<0.1	0.013	L	Type 1
MI13	0.9	1.9[6]	V	<550	<1700	<3	<0.2	9	3	<1	8	17	<0.05	5	<0.1	-	L	Type 1
MI14	-	-	G	<550	<1700	<3	<0.20	44	25	27	35	107	0.08	9	0.2	<0.008	L	Type 1
MI15	-	-	G	<550	<1700	<3	<0.20	53	31	32	41	128	0.10	11	0.3	0.016	L	Type 1
MI16	-	-	G	<550	<1700	<3	<0.20	43	27	27	35	109	0.10	10	0.2	<0.007	L	Type 1
MI17	-	-	G	<550	<1700	<3	<0.20	42	23	21	32	99	0.06	10	0.2	<0.012	L	Type 1
MI18	-	-	G	<550	<1700	<3	<0.20	45	28	29	37	113	0.10	10	0.2	<0.008	L	Type 1
MI19	-	-	G	<550	<1700	<3	<0.20	48	29	30	38	119	0.12	11	0.2	<0.009	L	Type 1
MI20	-	-	G	<550	<1700	<3	<0.20	52	32	33	41	128	0.10	11	0.3	<0.008	L	Type 1
MI21	-	-	G	<550	<1700	<3	<0.20	55	32	35	42	135	0.10	12	0.3	<0.008	L	Type 1
MI22	-	-	G	<550	<1700	<3	<0.20	46	25	24	34	109	0.10	10	0.2	<0.009	L	Type 1
MI23	-	-	G	<550	<1700	<3	<0.20	51	27	26	36	120	0.12	10	0.3	0.010	L	Type 1

Sampling ID	Depth (m)		Type[1]	PAH (µg/kg)		Total PCB (µg/kg)	Metals (mg/kg)									TBT (µg/L)[4]	Overall Category	Disposal Type[5]
	From	To		LW[2]	HW[3]		Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag			
LCEL				550	1700	23	1.5	80	65	40	75	200	0.5	12	1	0.15		
UCEL				3160	9600	180	4	160	110	40	110	270	1	42	2	0.15		
Reporting Limit				550	1700	3	0.2	1	1	1	1	1	0.05	1	0.1	0.15		
MI24	-	-	G	<550	<1700	<3	<0.20	50	27	26	36	118	0.11	10	0.2	<0.007	L	Type 1
MI25	-	-	G	<550	<1700	<3	<0.20	51	28	27	36	121	0.10	11	0.2	0.008	L	Type 1
Reference Sample	-	-	G	<550	<1700	<3	<0.20	29	13	20	30	77	0.05	7	0.1	<0.008	L	-

Notes:
1. V: vibrocore sample and G: grab sample.
2. LW - Low molecular weight PAHs (ie acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene).
3. HW - High molecular weight PAHs, (ie benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and benzo[g,h,i]perylene).
4. TBT was not analysed in some vibrocore samples due to the difficulty in extracting sufficient interstitial water for TBT analysis.
5. Type 1 – Open Sea Disposal
6. The maximum dredging depth is anticipated to be about 1 m bsl.

Sediment Disposal Options and Quantities

6b.4.1.12 Based on the chemical screening results as shown in **Table 6b.1**, the sediment samples collected within the artificial island near SKC and to depth of dredging (i.e. 1 m bsl) were identified to be Category L. The results supported the findings of the historical records review in which the general sediment contamination levels within the area is expected to be low. According to the ETWB TCW 34/2002, the disposal option for the dredged sediment is Type 1 – Open Sea Disposal. Subject to agreement with Marine Fill Committee (MFC), Type 1 sediment is typically disposed to South Cheung Chau and/or East of Ninepin as open sea disposal.

6b.4.1.13 The quantities of sediments was estimated with consideration of the horizontal and vertical extent of dredging as shown in **Figure 6b.1** and the determined disposal option at each sampling locations / depths as based on the chemical screening results under this EIA Study. The estimated quantities are presented in **Table 6b.2**. Based on the current engineering design, dredging of the top 1 m of marine deposit along the proposed cofferdam would generate approximately 27,300 m^3 of sediment.

Table 6b.2 Disposal Quantity of Marine Sediment

Disposal Option	Corresponding Category	Disposal Quantity (m^3)
Type 1 – Open Sea Disposal	Category L Sediment	27,300
	Total	27,300

6b.4.1.14 The dredging, transportation and disposal of sediments could potentially cause the release and dispersion of suspended solids into nearby water bodies. In order to minimise the potential adverse impacts, sediment should be dredged, transported and disposed of in a manner that would minimise these potential adverse impacts. The implementation of appropriate mitigation measures, as discussed in **Section 6b.5.1.5** to **6b.5.1.9** as well as **Section 5**, is recommended.

6b.4.1.15 If the recommended mitigation measures were properly implemented and given that only little contamination were identified for the sediment within artificial island near SKC under this EIA Study, adverse environmental impacts associated with dredging, transportation and disposal of sediment would not be expected.

Construction and Demolition Materials

6b.4.1.16 To accommodate the necessary infrastructures of the IWMF Phase I development, a total of approximately 11.8 ha of land will be required and the land will be formed through reclamation. No construction and excavation works will be required for the existing land of Shek Kwu Chau.

6b.4.1.17 The C&D materials would be generated from the foundation works and piling works on reclaimed land. The excavated C&D materials would comprise mostly alluvium / estuarine deposit and rock, with an estimated total volume of approximately 26,200 m^3. In addition, approximately 4,345 m^3 of non-inert C&D materials would also be generated from the construction activities. A breakdown of the estimated volumes of C&D materials from the construction of the Project is tabulated in **Table 6b.3**.

6b.4.1.18 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. All the excavated materials from the reclaimed land will be reused on site. The volume of the C&D materials that cannot be reused and require disposal off-site is estimated to be approximately 3,476 m^3.

Table 6b.3 Summary of C&D Materials Volumes

Type of C&D Material		Material generated (m^3)	Inert C&D material to be reused on site (m^3)	Non-inert C&D material to be collected for recycling (m^3)	Non-inert C&D material to be disposed of off-site (m^3)
Inert Material	Excavated alluvium/ estuarine deposit	24,087	24,087	0	0
	Excavated rock	2,113	2,113	0	0
Non-inert Material	Others	4,345	0	869	3,476
Total		30,545	26,200	869	3,476

6b.4.1.19 The amount of C&D materials expected to be generated shall be quantified in the site Waste Management Plan to be prepared by the Contractor. 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 and water quality impacts.

Chemical Waste

6b.4.1.20 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.

6b.4.1.21 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.

6b.4.1.22 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 6b.5.1.13**. 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

6b.4.1.23 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.

6b.4.1.24 Potential environmental impacts will be insignificant provided that the mitigation measures and appropriate site practices suggested in **Section 6b.5.1.14** and **Table 6b.9** are implemented.

Biogas Generation

Introduction

6b.4.1.25 When marine sediments rich in organic matter are covered over by reclamation fill, anaerobic degradation of the organic matter in the sediments would generate biogas (methane) which could pose a potential risk to the development on the reclamation area. The issue of methane risk is required to be assessed in accordance with the EIA Study Brief. As per the current design, dredging would not be required for the reclamation, and thus the IWMF site (Shek Kwu Chau option) would be susceptible to potential biogas risk. The potential gas emission from the proposed reclamation at artificial island near SKC is therefore assessed in the following section.

Assessment Methodology and Criteria

6b.4.1.26 Sediment samples were collected at three vibrocore locations (MI5(3), MI11 and MI13) as indicated in **Figure 6b.1** and according to the Plan. The collected samples were packed in ice and transported to ALS for analysis of moisture content, density, Total Organic Carbon (TOC) content and Sediment Oxygen Demand (SOD).

6b.4.1.27 TOC and SOD levels in the sediment samples collected from the two vibrocore locations (MI5(3), MI13) within the boundary of the reclamation area are used for the assessment of methane hazard. Relevant sample locations and the results are presented in **Table 6b.4**. Sediment samples in the top 3m of sediment at each vibrocore location were selected because of their comparatively higher levels of TOC and SOD. The highest TOC levels were measured within the top 2m of sediment at vibrocore locations.

Table 6b.4 Sampling Locations and Relevant Results

Sampling Location	Sample Depth (m below seabed)	Moisture (% w/w)	TOC (% dry w)	SOD (mg/kg)
MI5(3)	0.1 – 0.9	24.2	0.86	211
	0.9 – 1.9	23.8	1.38	247
	1.9 – 2.9	23.4	0.17	128
MI13	0.1 – 0.9	29.9	1.50	68
	0.9 – 1.9	23.2	3.29	105
	1.9 – 2.9	27.8	0.69	226
	Average (3m)	25.4	1.32	164

6b.4.1.28 Typically, landfill gas hazard assessment has been undertaken using guidance or standards based on the concentrations of gases (methane and carbon dioxide), rather than mass flow rates. Such guidance usually recommends restrictions on development in areas where the gas concentration exceeds a stated proportion of the lower explosive limit (LEL) of methane, which is 5% (v/v). Typical margins of safety are in the range of 1-20% of LEL (0.05 – 1% (v/v)).

6b.4.1.29 Most of the guidance on this subject has been developed for application to sanitary landfill sites and much less has been written on the subject of standards or guidance for levels of methane arising from other sources, such as natural peat formations, marshland, rice paddies, coal measures and other organic deposits of anthropogenic origin, such as marine sediments. In fact, methane arises naturally in many areas which have apparently been safely developed or redeveloped without any regard for gas protection measures. Nonetheless, the evaluation of potential biogas risk and, if required, the carrying out of monitoring would confirm whether gas protection measures are required.

6b.4.1.30 With reference to approved EIA studies, relevant landfill criterion from UK and the Landfill Gas Hazard Guidance Note from HK EPD, the following criteria (**Table 6b.5**) would be used in the assessment.

Table 6b.5 Methane Hazard Assessment Criteria

EPD's Guidance Note (% v/v)	UK Guidance Value (L/m^2d)
1[a]	18[b] – 432[c] 10[d]

Notes:
a. Guidance value from Landfill Gas Hazard Guidance Note, EPD HK
b. UK Landfill Completion Criterion from Department of Environment (1993), Landfill Completion, Waste Management Paper No. 26A, London: HMSO
c. Carpenter's guidance levels
d. Maximum "safe" rate of gas emission derived from Department of Environment (1993), Landfill Completion, Waste Management Paper No. 26A, London: HMSO

6b.4.1.31 From **Table 6b.4**, the calculated mean TOC level is 1.32% on a dry weight basis and the calculated mean SOD level is 164mg/kg. Based on the average moisture content of 25.4%, dry matter made up 74.6% of the sediment on average.

6b.4.1.32 The reclamation area is approximately 11.8ha, and with the top 3m of sediment with higher TOC content, the quantity of mud that would likely generate biogas was estimated to be 354,000m^3.

6b.4.1.33 The capping of the reclamation would likely create underlying anaerobic conditions which favour degradation of organic matter by microbial activity in the contaminated sediment. The end product of this degradation is biogas, which mainly consists of methane (CH_4) and carbon dioxide (CO_2).

6b.4.1.34 The rate of biogas generation is dependent on the amount of organic matter, degradability of organic matter, extent of anaerobic conditions, temperature, and transport medium for bacteria (water). Although the available information is limited, a theoretical calculation can be made for an estimate of biogas generation within the reclamation area.

6b.4.1.35 From experience in several anaerobic degradation projects (with waste as well as sludge), it is known that the biogas formation can be described as a first order degradation process. This process is characterized by high gas generation rates at the start, followed by an exponential decrease over the course of time. Biogas generation can be calculated based on the available data on organic matter content.

6b.4.1.36 Not all organic carbon present in the sediment would be biodegradable. The SOD represents the biodegradable fraction of the organic carbon present in the sediment and thus is convertible to methane. Under anaerobic conditions, all of the oxygen demand of degradable organic material is preserved in the methane formed. The following equation shows that 4 g of oxygen demand would have a total yield of 1 g of methane (the molar mass of methane is half the molar mass of oxygen and two moles of oxygen are required to oxidize one mole of methane).

$$CH_4 + 2\ O_2 \rightarrow CO_2 + H_2O$$

No. of moles: 1 2

6b.4.1.37 As an example, sediment with a SOD of 200mg/m^3 will ultimately generate 50mg of methane, equivalent to 0.07 litre of methane per m^3 of sediment at standard temperature and pressure (STP).

6b.4.1.38 It is assumed that 50% of the gas produced from anaerobic degradation of organic matter of the sediment is methane (the remainder being carbon dioxide). This is true for substrates such as carbohydrates that are neither highly oxidized nor highly reduced:

$$2\ CH_2O \rightarrow CH_4 + CO_2$$

6b.4.1.39 On that basis, the mass of methane generated from unit mass of TOC is calculated as follows:

$$2\ CH_2O \rightarrow CH_4 + CO_2$$

Molar Mass: 2x12=24 16

i.e. methane potential = 16/24 = 0.67 times TOC

6b.4.1.40 Assuming a SOD in the material to be contained in the future reclaimed land of 164mg/kg, the total methane potential would be 41mg/kg, or assuming a dry matter content of 74.6%, 54.9mg/kg. However, SOD represents only a fraction of the organic carbon present in the sediment. Based on a sediment TOC of 1.32% of dry matter and assuming that half is converted to methane (the remainder being carbon dioxide), methane potential would be about 8,810mg/kg dry matter. This implies that only 0.62% of TOC represents readily biodegradable organic matter. Use of TOC to estimate methane potential therefore provides an over-estimate of that potential. Furthermore, some organic substrates which are degradable aerobically (and which therefore contribute to SOD) are not degradable at all in anaerobic conditions. Therefore, estimation based on SOD would probably provide a lower-end estimation.

6b.4.1.41 It is difficult to estimate the half life of substrates in systems such as contaminated marine sediment. However, at low substrate concentrations in engineered systems such as facultative ponds, half lives of substrates in the anaerobic could be of the order of half a year. In landfills, the average half life of organic substrates could be 5 years. Hence, for conservatism, the methane potential is calculated based on TOC, rather than SOD because the former represents the extreme worst case assuming all organic matter is biodegradable and convertible to methane. In fact, as indicated above, probably only 0.62% of the organic carbon is readily degradable. Thus, an analysis based on TOC alone will overestimate the impact.

6b.4.1.42 Based on the range of half-lives of 0.5-5 years, the peak annual methane potential would be between 13 and 75% of the total. The peak annual methane potential corresponding to a half life of decay of 0.5 years, is actually not significant in terms of development because after two years over 90% will have degraded and the flux will have fallen proportionately to a rate less than that of the lower figure after the same time. Therefore, the peak annual methane potential based on a half-life of 5 years is adopted for the calculations of potential methane gas emission for the comparison with the UK methane hazard assessment criteria. A half-life of 2 years is also adopted for the calculation of potential methane gas emission to represent a worst-case scenario (as a half-life of 2 years will result in a higher flux rate at 2 years after reclamation than that resulting from a half-life of 5 years). **Table 6b.6** shows calculations of the peak annual methane potential and the daily potential methane flux from the Shek Kwu Chau reclamation.

6b.4.1.43 The methane concentrations of the boundary layer at the surface of the artificial island near SKC is also estimated as shown in **Table 6b.6** for the comparison with the guideline value (1% v/v) as stipulated in EPD's Landfill Gas Hazard Guidance Note. The boundary layer is assumed to be 1m to represent a conservative scenario.

Table 6b.6 Calculation of Methane Flux from the Shek Kwu Chau Reclamation

	Half-Life Cycle of 2 yr	Half-Life cycle of 5 yr	Criteria
Volume (m^3)	354,000	354,000	
Density (kg/m^3)	1,494	1,494	
Dry Matter (% w/w)	74.6%	74.6%	
Dry Matter (kg/m^3)	1,114.8	1,114.8	
Average TOC (%)	1.32	1.32	
Avg TOC (kg/m^3)	14.7	14.7	
CH_4 Potential (kg/m^3)	9.8	9.8	
Total CH_4 Potential	3.48×10^6kg $4.87 \times 10^6 m^3$	3.48×10^6kg $4.87 \times 10^6 m^3$	
Peak Annual CH_4 Potential (m^3/yr)	1.69×10^6	6.74×10^5	
Total Area (m^2)	118,000	118,000	
Potential CH_4 Flux (L/m^2d) assuming 100% TOC biodegradable	40.5	16.2	18 – 432 10
Potential CH_4 Flux (L/m^2d) assuming 0.62% TOC biodegradable	0.25	0.10	
Potential CH_4 concentration (% v/v) at the surface boundary layer assuming 100% TOC biodegradable	4.1	1.6	1%
Potential CH_4 concentration (% v/v) at the surface boundary layer assuming 0.62% TOC biodegradable	0.03	0.01	

6b.4.1.44 The above analysis is based on a number of broad assumptions which might affect the precision of the estimates. Furthermore, it takes no account of biological methane oxidation that will probably occur in the upper layers of the sediment. In the case of a uniform emission through a permeable, aerobic reclamation layer, methane (or part of it) can be oxidised microbiologically. In the literature, oxidation efficiencies can be found of 2% up to 100% (Hoeks J., 1972). For landfills, covered by a very permeable top layer, oxidation efficiencies were found in the range of 0-50% (Federal Environment Agency, Berlin, 1990; UK Department of the Environment, 1993; US-EPA, 1993). High efficiencies will only occur when the fill material is well aerated (e.g. by diffusion of air) and the gas is able to emit uniformly over the surface area. Low efficiencies, however, will occur when the fill material is poorly permeable for gases and when the gas generation rate is rather high, so that concentrated emissions can take place via fissures, or other preferential pathways (e.g. gravel layers).

Evaluation of Significance of Potential Gas Emissions

6b.4.1.45 The predicted methane emission from the reclamation for the artificial island near SKC, assuming 0.62% TOC biodegradable, for a half-life of 2 year and 5 year is $0.25L/m^2d$ and $0.10L/m^2d$ respectively. These calculated values are within the UK Landfill completion criterion ($18L/m^2d$), Carpenter's guidance level ($432L/m^2d$) and the "safe" rate of gas emission ($10L/m^2d$). While the methane concentration at the surface boundary layer is estimated to be 0.03% and 0.01% respectively, which are also less than the guide value of 1% (v/v) as stipulated in EPD's Landfill Gas Hazard Guidance Note.

6b.4.1.46 In consideration of the highly unlikely event of assuming 100% TOC biodegradable, the methane emission is estimated to be $40.5L/m^2d$ and $16.2L/m^2d$ for a half-life of 2 year and 5 year respectively. These values exceed the "safe" gas emission rate, but less than the Carpenter's guidance level. The estimated emission rate for a half-life of 2 year would exceed the UK Landfill Completion criterion, while the rate for half-life of 5 year would be less than the criterion. The surface boundary concentration (4.1% for half-life of 2yr and 1.6% for half-life of 5yr) would exceed the guide value of EPD's Landfill Gas Hazard Guidance Note.

6b.4.1.47 The methane calculations provided above are based on numerous theoretical assumptions and there is virtually no precedent established on practical grounds against which they can test. The analysis results suggest that there is potential biogas risk, and therefore, as a conservative approach, monitoring and mitigation measures are recommended to minimize the biogas impact during the construction and operation of the Project. Given that the assessment was based on the testing results from two sampling locations, the Contractor may carry out additional site investigation during the design and construction phase of the Project to confirm the monitoring and mitigation measures requirements.

Operation Phase

6b.4.1.48 As discussed in **Section 2**, the IWMF would comprise (a) an advanced thermal incineration plant of about 3,000 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 and the MT plant are discussed below.

Incineration By-products

6b.4.1.49 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.

6b.4.1.50 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 and leachability criteria shown in **Table 6b.7** before disposal.

Table 6b.7 Incineration Residue Pollution Control Limits

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

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.

6b.4.1.51 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.

6b.4.1.52 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, 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

6b.4.1.53 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.

6b.4.1.54 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.

6b.4.1.55 The estimated quantities of waste products generated from the operation of the IWMF are indicated in **Table 6b.8** below.

Table 6b.8 Summary of Waste Generation from Operation of the IWMF

Waste Product	Quantity	Disposal Route
Incineration by-products		
Bottom Ash	660 tpd	Comply with proposed Incineration Residue Pollution Control Limits prior to disposal to WENT landfill
Fly ash and APC Residue	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.
MT by-products		
Refuse from MT	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.

6b.5 Mitigation of Adverse Environmental Impacts

6b.5.1 Construction Phase

6b.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.

<u>Good Site Practices</u>

6b.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

6b.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.

6b.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.

Dredged Sediments

6b.5.1.5 From the above, the estimated total volume of sediments generated is approximately 27,300 m^3 for the dredging works along the proposed cofferdam. All of the dredged sediments are expected to be suitable for Type 1 open sea disposal.

6b.5.1.6 The basic requirements and procedures for dredged sediment disposal specified under ETWB TCW 34/2002 shall be followed. According to the ETWB TCW 34/2002, the Marine Fill Committee (MFC) is responsible for managing the disposal facilities in Hong Kong for the dredged sediment, while EPD is the authority of issuing marine dumping permit under the DASO.

6b.5.1.7 The project proponent should agree in advance with MFC of CEDD on the site allocation. The project proponent or contractor for the dredging works shall then apply for the site allocations of marine sediment disposal based on the prior agreement with MFC/CEDD. The project proponent or contractor should also be responsible for the application of all necessary permits from relevant authorities, including the dumping permit as required under DASO from EPD, for the disposal of dredged sediment prior to the commencement of the dredging works.

6b.5.1.8 As part of **Section 6b.5.1.7** above, the project proponent or contractor will need to satisfy the appropriate authorities that the quality of the marine sediment to be dredged has been identified according to the requirements of ETWB TCW 34/2002. This should be completed well before the dredging works and would include at least the submission of a formal Sediment Quality Report under Tier I of ETWB TCW No. 34/2002 to DEP for approval. Subject to advice from DEP, it is possible that further marine SI in accordance with ETWB TCW 34/2002 might be necessary for the application of dumping permit under

DASO. In such case, a sediment sampling and testing proposal shall be submitted to and approved by DEP before the additional marine SI works.

6b.5.1.9 The dredged marine sediments would be loaded onto barges, transported to and disposed of at the designated disposal sites (subject to agreement with MFC and given Type 1 sediment were identified, the disposal sites are typically South Cheung Chau and/or East of Ninepin as open sea disposal). In addition to the mitigation measures as discussed in **Section 5b**, the barge transporting the sediments to the designated disposal sites should be equipped with tight fitting seals to prevent leakage and should not be filled to a level that would cause overflow of materials or laden water during loading or transportation. In addition, monitoring of the barge loading shall be conducted to ensure that loss of material does not take place during transportation. Transport barges or vessels shall be equipped with automatic self-monitoring devices as specified by the DEP.

<u>Construction and Demolition Materials</u>

6b.5.1.10 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*).

6b.5.1.11 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.

6b.5.1.12 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.

<u>Chemical Wastes</u>

6b.5.1.13 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

6b.5.1.14 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.

6b.5.1.15 **Table 6b.9** 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 6b.9 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
Dredged Marine Sediment	Dredging along the proposed cofferdam	27,300 m^3 (Category L Sediment)	27,300 m^3	- Type 1 – Open Sea Disposal - gazetted marine disposal ground allocated by MFC - Mitigation measures as per **Section 6b.5.1.5** to **6b.5.1.9**	Final disposal site shall be determined by MFC; typically South Cheung Chau / East of Ninepin.
C&D Materials	Site formation; foundation works and piling works ; Construction of new buildings, etc	30,545 m^3	3,476 m^3	Segregate inert C&D materials i.e. public fill to avoid contamination from other waste arisings	Inert material (i.e. alluvium / estuarine deposit & rock) to be reused on-site for filling works including site formation, backfilling (26,200 m^3) Recyclable non-inert material such as metallic waste and paper/cardboard packaging to be collected for recycling (869 m^3) 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

Biogas Generation

6b.5.1.16 According to the analysis result, biogas monitoring after the reclamation and design mitigation measures are recommended. Nevertheless, depending on the work programme, The Contractor may conduct further SI and evaluation to confirm whether monitoring and gas protection measures are required. Subject to further SI, if any, the following measures are recommended to be considered. In case the Contractor proposed any alternative monitoring or design mitigation measures, they should provide the relevant testing data, analysis, and details of the monitoring and design requirements to EPD for agreement.

6b.5.1.17 If the biogas monitoring is required, it is recommended to establish gas monitoring borehole immediately after reclamation for the artificial island near SKC. With regular monitoring prior to the development, actual rates of methane gas emission generated from the marine sediment underlying the reclamation can be determined. The predicted methane emission based on the conservative assumption of 100% biodegradable TOC are well below the upper UK guide value (which is the level at which development would be restricted according to Carpenter's guidelines). The recommended monitoring requirements are detailed below.

6b.5.1.18 The potential biogas risk has been assessed based on the predicted peak methane generation potential and total daily methane flux (based on the TOC results and assuming all organic matter is biodegradable). Based on this conservative approach, the predicted daily methane flux is higher than the UK "safe" rate of methane gas emission (as derived from Waste Management Paper No. 26A for methane ingress into an 'at risk' room within a building constructed on a restored landfill site). The UK maximum "safe" rate of landfill gas emissions is based on a number of assumptions regarding the size and rate of ventilation of the 'at risk' room or void space. This criterion was developed to determine when monitoring of landfill gas emissions at a restored landfill can be discontinued and when the site can be used for unrestricted development.

6b.5.1.19 Since there would be sensitive 'at risk' rooms (plant rooms, service voids, etc) in the proposed development, it is recommended that a precautionary principle be applied where biogas risk is found to be of concern. Gas protection measures are therefore recommended to be incorporated in the building design if found necessary. Subject to the further SI and monitoring results, if any, it is proposed that the detailed design of the mitigation measures should be reviewed if possible.

Gas Monitoring

6b.5.1.20 If the biogas monitoring is required, monitoring should be undertaken via purposely installed monitoring wells within boreholes drilled into the fill material. The boreholes should be drilled down to the level of the groundwater (mean sea water level) and standard landfill gas-type monitoring wells installed. During the drilling of boreholes, the safety and working procedures described in the EPD Landfill Gas Hazard Assessment Guidance Note (1997) should be followed. It is recommended that the monitoring wells be installed in an approximately even distribution across the reclamation area.

6b.5.1.21 Concentrations of methane gas should be measured using intrinsically safe, portable gas monitoring instruments. Fluxes should also be measured if the emission velocities are not too low. With reference to the EPD's Landfill Gas Hazard Assessment Guidance Notes, it is recommended that monitoring be undertaken bi-weekly for a period of at least 3 months (preferably 6 months or more). The results of the gas monitoring should be reviewed to determine whether the length of the monitoring period should be extended.

6b.5.1.22 Depending on the monitoring results, it may be necessary to incorporate a number of gas protection measures into the design of the IWMF. A combination of different measures may be used for protecting both the ground level and underground structures at the development against possible risks due to biogas emissions. At this stage, the following generic gas protection measures should be considered; while at later stage, subject to further SI and evaluation, if any, and the monitoring results, details on protection measures should be provided if the measures are found necessary.

Protection of Above Ground Structures

6b.5.1.23 Passive sub-floor ventilation may be incorporated in the building design for those buildings with no underground basement or rooms. Passive control measures for buildings to prevent gas build-up involve the creation of a clear void beneath the structure allowing natural air movements such that any emissions of gas from the ground are mixed and diluted by air.

Measures to Prevent Ingress of Gas into "At Risk" Rooms

6b.5.1.24 To prevent the ingress of methane gas into a building, a low gas permeability membrane may be incorporated in the design of the floor and any below ground walls of identified 'at risk' rooms (e.g. rooms housing electrical equipment, pumps or switchgear). In addition, measures should be taken to avoid or seal any openings in the floor (e.g. at services entry points). Such techniques are commonly used where there is a risk of landfill gas entering a building and have been employed on a number of developments in Hong Kong.

6b.5.1.25 There are various proprietary products available in the market and the specific details of their application will depend on the detailed design of the 'at risk' rooms. Possible measures include gas-resistant polymeric membranes which can be incorporated into the floor or wall construction as a continuous sealed layer. Membranes should be able to demonstrate low gas permeability and resistance to possible chemical attack. Other building materials such as dense well-compacted concrete or steel shuttering also enhance resistance to gas permeation. In all cases, extreme care is needed during the installation of the membrane and subsequent construction works to avoid damage to the membrane.

Ventilation within "At Risk" Rooms

6b.5.1.26 As an additional measure for the protection of specific 'at risk' rooms, mechanical ventilation may be provided to ensure that if any gas enters the room it is dispersed and cannot accumulate to potentially dangerous concentrations. For particularly sensitive rooms, such as below ground confined spaces which contain sources of ignition, forced ventilation may be used in addition to the use of a low gas permeability membrane.

Protection of Utilities or Below Ground Services

6b.5.1.27 Below ground ducts or trenches for the installation of utilities or services (e.g. telecommunications, gas, water, electricity supply or drainage connections) would be particularly prone to the ingress and accumulation of any biogas emissions. It is therefore important to prevent such ducts and trenches acting as routes by which gas may enter buildings by avoiding, as far as possible, the penetration of floor slabs by such services. In addition, any unavoidable penetrations should be carefully sealed using puddle flanges, low permeability sealant and/or membrane.

Precautions During Construction Works

6b.5.1.28 Special care must be taken during the construction period. Sub-surface excavations into the mud layers might encounter gas occasionally, but not at levels likely to be dangerous provided that the gas vents freely to atmosphere. Emission rates are unlikely to be sufficient to sustain a flame. These gas bubbles will only occur for short periods, and therefore, as a precaution, smoking and naked flames in the vicinity of drilling activities and excavations of 1m depth or more should be prohibited.

6b.5.1.29 Precautions may be required to ensure that there is no risk due to the accumulation of gas within any temporary structures, such as site offices, during construction works on the reclamation area. It may be necessary, for example, to raise such structures slightly off the ground so that any gas emitted from the ground beneath the structure may disperse to atmosphere rather than entering the structure. A minimum clear separation distance of 500mm, as measured from the highest point on the ground surface to the underside of the lowest floor joist, is recommended in the Landfill Gas Hazard Assessment Guidance Note, EPD (1997).

Precautions Prior to Entry of Below Ground Services

6b.5.1.30 Following construction, accumulation of gas within any below ground services can pose a risk to the staff of the utility companies. As a good working practice, prior to entry into any confined space within the reclamation site (such as manholes, underground culverts and utility casings), the gas atmosphere within the confined space should be monitored for oxygen, methane and carbon dioxide. Personnel should be made aware of the potential dangers and advised to take appropriate precautions.

6b.5.1.31 The working practices should follow the Landfill Gas Hazard Assessment Guidance Note, EPD (1997) guidelines as follows:

- Any chamber, manhole or culvert which is large enough to permit access to personnel should be subject to entry safety procedures. Such work in confined spaces is controlled by the Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance. Following the Safety Guide to Working in Confined Spaces ensures compliance with the above regulations.
- The entry or access point should be clearly marked with a warning notice (in English and Chinese) which states that there is the possibility of flammable and asphyxiating gases accumulated within.
- The warning notice should also give the telephone number of an appropriate competent person who can advise on the safety precautions to be followed before entry and during occupation of the manhole.
- Personnel should be made aware of the dangers of entering confined spaces potentially containing hazardous gases and, where appropriate, should be trained in the use of gas detection equipment.
- Prior to entry, the atmosphere within the chamber should be checked for oxygen, methane and carbon dioxide concentrations. The chamber may then only be entered if oxygen is greater than 18% by volume, methane is less than 10% of the Lower Explosive Limit (LEL), which is equivalent to 0.5% by volume (approximately), and carbon dioxide is less than 0.5% by volume.
- If either carbon dioxide or methane are higher, or oxygen lower, than the values given above, then entry to the chamber should be prohibited and expert advice sought.

6b.5.1.32 Even if conditions are safe for entry, no worker should be permitted to enter the chamber without having another worker present at the surface. The worker who enters the chamber should wear an appropriate safety/recovery harness and, preferably, should carry a portable methane, carbon dioxide and oxygen meter.

6b.5.1.33 In general, when work is being undertaken in confined spaces sufficient approved resuscitation equipment, breathing apparatus and safety torches should be available. Persons involved in or supervising such work should be trained and practised in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and consistently employed.

6b.5.2 Operation Phase

Good Site Practices

6b.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

6b.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

6b.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.

6b.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.

6b.6 Contamination Prevention Measures

6b.6.1 General

6b.6.1.1 The IWMF Shek Kwu Chau option is proposed to be located at a newly reclaimed area. Therefore, potential land contamination impact associated with previous land uses is not anticipated.

6b.6.1.2 With reference to Clause 3.7.4.3 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.

6b.6.2 Potential Sources of Contamination

6b.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.

6b.6.2.2 The expected types and quantities of the materials involved in the IWMF operation with contamination potential are presented in **Table 6b.10**.

6b.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 6b.10 Materials used in the IWMF Operation with Land Contamination Potential

Material	Expected Annual Consumption / Production	Estimated Quantity to be Stored On-site
Chemicals Consumption		
Slaked lime	12,065 tonnes	496 tonnes
Ammonia water (25%)	4,015 tonnes	165 tonnes
Activated carbon	383 tonnes	31 tonnes
Kerosene	283 m^3	12 m^3
Caustic soda	206 tonnes	8,466 kg
Hydrochloric acid	83 tonnes	3,411 kg
Sulfurous acid	3,906 kg	161 kg
Production of Incineration By-products		
Bottom Ash	240,900 tonnes	3,300 m^3
Fly ash & APC residues	43,800 tonnes	600 m^3

6b.6.3 Approach to Prevent Land Contamination

Fuel Oil Spillage Prevention

6b.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.

    o <u>Training</u>

    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.

    o <u>Communication</u>

    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.

    o <u>Response Procedures</u>

    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.

<u>Chemicals and Chemical Wastes Handling & Spillage Prevention</u>

6b.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:
  - o Not liable to chemically react with the materials and their containers to be stored.
  - o Able to withstand normal loading and physical damage caused by container handling
  - o 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 bunded 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.
  - o <u>Training</u>

    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.

  - o <u>Communication</u>

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

  - o <u>Response Procedures</u>

    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

6b.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

6b.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.

6b.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.

6b.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 6b.6.3.1** and **Section 6b.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*.

6b.7 Evaluation of Residual Impacts

6b.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.

6b.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 6b.7** 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.

6b.8 Environmental Monitoring and Audit

6b.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.

6b.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.

6b.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 6b.7** above prior to disposal to landfill. A number of the land contamination preventive measures are also recommended for the operation of the Project.

6b.8.1.4 As recommended in **Section 6b.5.1.16** to **6b.5.1.21**, if the biogas monitoring is required, it is recommended to establish gas boreholes for the monitoring of methane gas emission immediately after reclamation. Details of the recommended monitoring requirements are given in the EM&A Manual.

6b.9 Conclusion

6b.9.1.1 Waste types generated by the construction activities for the IWMF are likely to include dredged marine sediment, C&D materials (from foundation works and piling works), 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.

6b.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.

6b.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.

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