

7 WASTE MANAGEMENT

7.1 INTRODUCTION

7.1.1 This section identifies the waste arising from the construction and operation of the Peng Chau STW Upgrade and assesses the potential environmental impacts associated with the handling and disposal of the waste. The options for reuse, minimisation, recycling, treatment, storage, collection, transport and disposal of wastes arising from the Project have been examined. Where appropriate, procedures for waste reduction and management are considered and environmental control measures for avoiding and minimising the potential impacts are recommended.

7.2 RELEVANT LEGISLATION, POLICIES, PLANS, STANDARD AND CRITERIA

Legislation

7.2.1 The legislation on handling, treatment and disposal of wastes, which are of relevant to this Project, are:

- ❑ Waste Disposal Ordinance (Cap. 354) & relevant regulations:
- ❑ Environmental Impact Assessment Ordinance (Cap. 499);
- ❑ Public Health and Municipal Services Ordinance (Cap. 132); and
- ❑ Dumping at Sea Ordinance (1995).

7.2.2 The Waste Disposal Ordinance (WDO) (Cap 354) enacted in 1980 provides the statutory framework for the management of all wastes from where they arise to the point of final disposal i.e. control on the collection, treatment and disposal of waste. The WDO prohibits any person from using any land or premises for the disposal of wastes unless the person has been authorised by or has obtained a license from the waste disposal authority. The ordinance was amended in early 1995 to enable a permit control on import and export of wastes in line with the requirements under the Basel Convention, and was in place in September 1996. The ordinance was further amended in early 1997 to enable more effective implementation of waste disposal charging.

7.2.3 There are a number of provisions under the WDO for dealing with certain types of waste. This include the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354) (CWR). This Cradle-to-grave control of chemical wastes was implemented in May 1993 to control all aspects of chemical waste disposal, including packaging, labelling, storage, collection, transport, treatment and final disposal. Under the CWR, any person who produces or causes to produce chemical waste must register with the Environmental Protection Department (EPD). Each registered producer has the obligation to inform the EPD as soon as practicable of any change in the particulars of the registration. The CWR requires wastes producers to arrange for proper disposal of their wastes at licensed facilities and to

engage a licensed collector to remove and transport the waste. It also requires that all chemical waste must be properly stored, packaged and labelled.

- 7.2.4 The Environmental Impact Assessment Ordinance (EIAO) came into operation in April 1998. Designated Projects specified under Schedule 2 of the EIAO must follow the statutory EIA process and apply for environmental permits for their construction and operation. Annex 7 of the Technical Memorandum on Environmental Impact Assessment Process (TM-EIAP) under the EIAO specifies the assessment criteria for evaluating waste management implications. The guidelines for assessment are provided in Annex 15.
- 7.2.5 Public Health and Municipal Services Ordinance provides for the control of the discharge of hazardous materials to sewers, and for the control of littering. It also places restrictions on the storage of wastes in buildings. This may be applicable to construction site offices.
- 7.2.6 The Dumping at Sea Ordinance empowers the Director of Environmental Protection to control the disposal and incineration of substances and articles at sea for the protection of the marine environment. Under the Ordinance, a permit from the DEP is required for the disposal of regulated substances within and outside the waters of the HK SAR. The permit contains terms and conditions that includes the following specifications:
- ❑ Type and quantity of substances to be dumped;
 - ❑ Location of the disposal grounds;
 - ❑ Requirement of equipment for monitoring the disposal operations; and
 - ❑ The need for environmental monitoring.

Other Waste Handling & Disposal Guidelines

- 7.2.7 A Waste Reduction Framework Plan (WTFP) was launched in November 1998. The WRFP sets out programme to avoid and minimise waste; promote recovery, recycling and reuse of materials; prolong to life of existing landfills and reduce the increasing costs of waste transportation, treatment and disposal. The WRFP also contains suggestions on how different sectors can incorporate various waste reduction measures into their business practices.
- 7.2.8 The Works Branch Technical Circular No. 2/93 – Public Dumps and the Works Bureau Technical Circular No. 2/93B – Public Filling Facilities outlines the policy relating to dumping of inert construction and demolition (C&D) material. The circulars state the C&D material suitable for use as fill material should not be disposed of to landfills, but should be reused in public filling area or reclamation and land formation projects. The Public Fill Committee together with Project Departments are responsible for considering the suitability of a site as a public filling area. In order to dispose of the inert portion of C&D material in a public filling area, a license issued by the Civil Engineering Department is required.

- 7.2.9 The Environment, Transport and Works Bureau Technical Circular (Works) No. 15/2003 – Waste Management on Construction Sites outlines the requirement of demolitions works for on-site sorting of all C&D material prior to disposal. This circular states a particular specification clause to be included in the tender documents for mandatory on-site sorting, processing and disposal of the same.
- 7.2.10 The Works Bureau Technical Circular No. 21/2002 – Trip-ticket System for Disposal of Construction and Demolition Material promulgates the policy to implement a trip-ticket system in Public Works Programme (PWP) contracts for the proper disposal of C&D material at public filling facilities or landfills.
- 7.2.11 The Environment, Transport and Works Bureau Technical Circular (Works) No. 15/2003 – Waste Management on Construction Sites introduces the requirement for contractors to prepare and implement a waste management plant (WMP). The requirement shall be included in all PWP contracts (including design and build contracts but excluding term contracts administered by Electrical and Mechanical Services Department).
- 7.2.12 The following guidelines should also be observed:
- ❑ Works Bureau Technical Circular No. 4/98 and No. 4/98A – Use of Public Fill in Reclamation & Earth Filling Projects
 - ❑ Works Bureau Technical Circular No. 19/2001 – Metallic Site Hoardings and Signboards
 - ❑ Works Bureau Technical Circular No. 12/2000 – Fill Management

7.3 WASTE GENERATED DURING CONSTRUCTION PHASE

General Site Wastes

- 7.3.1 Materials and equipment used on site would produce packaging and container wastes. Mitigation measures should include provision of a collection area where waste can be stored and loaded prior to removal from the site. The volume of general site wastes generated will be dependent on the Contractor's operating procedure and practices and cannot be quantified. With the implementation of the recommended mitigation measures in Section 7.6 (including site practices), the potential environmental impacts resulting from the storage, handling and transportation of general site wastes would be minimal.

Workforce Wastes

- 7.3.2 Throughout construction, the workforce would generate general refuse, comprising food scraps, paper, empty containers etc. Rapid and effective collection of site wastes will be required to prevent waste materials being blown around by wind, flushed or leached into the environment, and odour nuisance. The amount of general refuse which is likely to arise cannot be quantified at this time as it will be largely dependent on the size of the workforce employed by the contractor. Though with the implementation of waste management practices at the site (as recommended in Section 7.6), it is not expected that there would be any adverse

environmental impacts arise from the storage, handling and transportation of workforce wastes.

Maintenance and Chemical Wastes

- 7.3.3 Construction plant and equipment will require regular maintenance and servicing, which would generate waste. Substances generated are likely to include some chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. Equipment maintenance activities would also involve the use of a variety of chemicals, oil and lubricants, including heavy-duty cleaners, organic solvents, degreasers, brake fluids, battery acid and soldering fluids.
- 7.3.4 Chemical wastes arising during the construction phase may pose serious environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Chemical Waste Regulations (CWR). These hazards include:
- (a) Toxic effects to workers;
 - (b) Adverse impacts from spills on water gathering ground and other ecological sensitive areas; and
 - (c) Fire hazards.
- 7.3.5 It is required to register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes.
- 7.3.6 Materials classified as chemical wastes will need special handling and storage arrangements before removal for appropriate treatment at the chemical waste treatment facility (CWTF) at Tsing Yi. Wherever possible opportunities should be taken to reuse and recycle materials. Mitigation and control requirements for chemical waste are provided in Section 7.5. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts should not result.

Construction and Demolition (C&D) Material

- 7.3.7 The construction activities including site formation and foundation works at the proposed Peng Chau STW Upgrade, would generate construction and demolition material. An initial estimate of the total volume of excavated material likely to be generated from the construction works is given in **Table 7-1**.

Table 7-1 Types and Quantities of Construction Waste

Categories	Estimated Spoil Quantities - Mainlaying (m ³)	Estimated Spoil Quantities - Existing Structures Demolition and Site Formation Activities (m ³)
Generation	Insignificant	7,000
Reused Onsite	Insignificant	500
Reused in Public Filling Area	Insignificant	6,500
Disposal of at Landfill	Insignificant	Insignificant

- 7.3.8 The mainlaying construction activity is scheduled from early 2005 while major structure demolition and site formation activities are scheduled in 2005/2006. Given the relatively small scale of construction, the quantities of C&D waste generated is not large. Inert C&D materials should be disposed of at public filling area, such as Penny Bay Reclamation, Central Reclamation or other CED designated public filling facilities. Nevertheless, on-site sorting of all C&D materials should be provided prior to disposal. Non-inert portion of C&D materials (i.e. C&D wastes) that cannot be reused or recycled should be disposed of to designated landfill sites.
- 7.3.9 The Contractor should be responsible for ensuring that waste is collected by approved licensed waste collectors and that appropriate measures are taken to minimise adverse impacts, such as dust generation. The Contractor must also ensure that all necessary waste disposal permits are obtained. The requirements stipulated in WBTC 21/2002 should be followed closely.
- 7.3.10 No potential hazard is associated with handling and disposal of excavated spoil. The excavated spoil will be tipped to spoil banks within the construction site temporary before removal to disposal sites.
- 7.3.11 On completion of the construction works, site buildings and facilities will be demolished and removed from site. Demobilisation of infrastructure and site clearance will generate C&D material and scrap material residues which will require disposal. Certain elements may need to be disposed to landfill or public filling areas. However, recyclable materials should be salvaged for reuse (such as wood and metal) and inert waste utilised as public fill.

Marine Dredging for Submarine Outfall

- 7.3.12 Dredged marine mud will be produced from the construction of submarine outfall components. As reviewed in Chapter 6 that the marine sediment quality in the surrounding Peng Chau and Tai Lei Island is classified as Category L. Based on the current design, the estimated volume of dredged material for marine disposal is about 22,000m³. As the proposed dredged volume is less than 50,000m³, a dumping permit would be required from the Territory Control Group (TCG) of EPD under the Dumping at Sea Ordinance.

7.4 WASTE GENERATED DURING OPERATION PHASE

Sludge

- 7.4.1 Sludge will be produced from the primary and secondary biological treatment of the sewage. Two arrangements of sludge dewatering and disposal, namely sludge export scheme and onsite drying bed dewatering scheme would be adopted (see **Appendix 2C**). Sludge export scheme would involve transporting of wet digested sludge at about 3-5% solids to other designated sewage treatment works for centralised dewatering and disposal. The wet sludge would be stored on site temporary and would be barged for further treatment at regular intervals to prevent any excessive odour emission. The estimated production of wet sludge is approximately 9.5m³/day. The storage container would be covered to minimise the potential odour nuisance. Sludge drying bed would be used as standby sludge dewatering device in the case when sludge export is not feasible in the initial stage of STW Upgrade operation.
- 7.4.2 Sludge export scheme would become less cost effective when higher volume of sludge would need to be barged away. In addition, this scheme would also be constrained by the treatment capacity of the designated centralised dewatering facility. In view of the above, DSD may consider switching the sludge export scheme to on-site sludge drying bed scheme as the duty dewatering facility. Sludge drying bed is capable for sludge dewatering to a 30% dry solid content. The estimated volume of dewatered sludge, based on the design flow, would be approximately 1.0m³/day. The dewatered sludge would be collected and stored on site before sea-transport to the designated landfill site (via the nearby refuse transfer station) for disposal. Same as sludge export scheme, the storage container would be covered to minimise the potential odour nuisance.

Chemical Waste

- 7.4.3 If wet scrubber system is used for odour control, it will generate chemical wastes. Spent scrubber fluids may contain undesirable chemicals or extreme pH, which may be classified as chemical under Schedule 1 of the CWR, depending on the concentrations of the fluid. Unless the spent fluids are treated to meet discharge standards as stipulated in the Technical Memorandum under Water Pollution Control Ordinance, they should not be discharged. These materials will need special handling and storage arrangements before removal for appropriate disposal or treatment, which should follow the requirements under the CWR. Due to relatively small scale of the proposed Project, the Chemical wastes to be produced are anticipated to be insignificant.

Other Operational Wastes

- 7.4.4 Small amounts of domestic waste may be generated from site management offices, and chemical waste from equipment maintenance. Improper storage of domestic waste onsite can give rise to adverse environmental impact such as odour nuisance, vermin and pests, water quality impacts, and adverse visual impacts. If proper handling and disposal measures, as mentioned in the Section 7.5, are undertaken, no adverse impact is envisaged.

7.5 MITIGATION MEASURES

Construction Phase

7.5.1 A proper Waste Management Plan (WMP) should be submitted to the Engineer for approval and implemented. The potential for recycling or reuse should be explored and opportunities taken if waste generation is unavoidable. The WMP should provide recommendations for appropriate disposal routes if waste can not be recycled. The WMP should include the method statement for stockpiling and transportation of the excavated materials and other construction wastes. The WMP should be approved before the commencement of construction. All mitigation measures arising from the approved WMP should be fully implemented.

Waste Reduction Measures

7.5.2 Good management and control can prevent the generation of 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 are as follows:

Planning and Design Stage

- ❑ Excavated material to be generated from construction works to be re-used on-site as far as practicable to reduce off-site disposal.

Construction Stage

- ❑ 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;
- ❑ To encourage collection of aluminium cans by individuals collectors, separate labelled bins should be provided to segregate this waste from other general refuse generated by the workforce;
- ❑ Any unused chemicals or those with remaining functional capacity should be recycled;
- ❑ Prior to disposal of C&D waste, it is recommended that wood, steel and other metals be separated for re-use and/or recycling and inert waste utilised as fill material to minimise the quantify of waste to be disposed of to landfill;
- ❑ 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 generated and avoid unnecessary generation of waste.

Good Site Practices

7.5.3 Minimisation of waste generation can also be achieved by good site practices, which include:

- (a) Nominating an approved personnel, such as a site manager, to be responsible for good site practices, and arrangements for collection and effective disposal to an appropriate facility of all wastes generated at the site;
- (b) Training of site personnel in proper waste management and chemical handling procedures;
- (c) Provision of sufficient trash bins and regular collection for disposal;
- (d) Implementing of appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;
- (e) Separating chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Facility;
- (f) Adopting regular cleaning and maintenance programme for the drainage systems, silt traps, sumps and oil interceptors;
- (g) Bookkeeping of the amount of wastes generated, recycled and disposed (including the disposal sites);
- (h) Re-using of excavated material and C&D materials on-site as far as practicable to reduce off-site disposal;
- (i) Using of non-timber formwork to reduce the amount of C&D materials;
- (j) Recycling of any unused chemicals or those with remaining functional capacity;
- (k) Storing and sorting of different types of waste in different containers, skips stockpiles to facilitate reuse or recycling of waste materials and their proper disposal; and
- (l) Minimising the potential for damage or contamination of construction materials by proper storage and site practice.

7.5.4 In addition to the above good site practices and waste reduction measures, specific mitigation measures are recommended below for the identified waste arising to minimise environmental impacts during the handling, transportation and disposal of these wastes.

General Site Wastes

7.5.5 A collection area should be provided where waste can be stored and loaded prior to removal from site. An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material. If an open area is unavoidable for the storage or loading/unloading of wastes, then the area should be bunded and all the polluted surface run-off collected within this area should be diverted into wastewater treatment system.

Maintenance and Chemical Wastes

7.5.6 After use, chemical wastes (e.g. cleaning fluids, solvents, lubrication oil and fuel) should be handled according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Spent chemicals should be stored and collected by an approved operator for disposal at the Chemical Waste Treatment Facility or other licensed facility in accordance with the Chemical Waste (General) Regulation. The Contractor should register as chemical waste producer if chemical waste is produced.

C&D Material

7.5.7 Stockpiles of C&D material should be covered to minimise run-off during heavy rainstorms and should be located to minimise visual impacts and nuisance related to noise and dust. Appropriate haul routes should be designated. Elevated levels of suspended solids in surface water should be prevented through appropriate bunding, interceptors, and direction of run-off into settling ponds.

C&D material should be separated on-site into three categories:

- ❑ Inert portion of the C&D material (e.g. concrete and rubble), which should be re-used as much as possible or disposed of at designated public filling area.
- ❑ Non-inert portion of the C&D material (e.g. steel and other metals wood, glass and plastic), which is to be recycled as much as possible.
- ❑ Waste that can not be re-used or recycled and should be disposed of at strategic landfills.

Dredged Marine Mud

7.5.8 Mitigation measures for handling, transporting and disposal of the dredged marine mud is provided in Chapter 6. The location of open sea disposal is to be recommended by the TCG on the dumping permits to be issued. A marine mud transportation route will be designed based on the dumping location. It is recommended that the Contractor should avoid passing through the Fish Culture Zone at Cheung Sha Wan of southern Lantau as far as practicable.

7.5.9 As a result of consultation with the Peng Chau Fisherman Association, transportation route of dredged mud via the direction of Sunshine Island (Chau Kung To) is recommended.

Operational Phase

7.5.10 Waste generated from the normal operation of the STW will include screening and digested sludge. Currently there is sufficient dewatering capacity in other outlying islands sewage treatment works where centralised treatment can be implemented, digested sludge would be collected and stored prior to export for dewatering and disposal of. The estimated production of digested sludge is about 9.5 m³/day, based

on the design flow. Storage containers are recommended to be covered to minimise the potential odour nuisance and would be barged away regularly.

7.5.11 In case sludge export becomes infeasible, digested sludge can be dewatered on site by using sludge drying bed. Such dewatering device is capable of producing sludge of 30% solid contents. Based on the design flow, the estimated dry solid volume is 1.0 m³/day, which is not significant. Dewatered sludge can be disposed of at designated landfill. It is also recommended to cover the storage container before disposal to minimise the potential odour nuisance.

7.5.12 As mentioned in Clause 4.7.3 of Appendix 2C, the operation will be reversed (i.e. drying bed as duty unit and export as standby unit) if the export option turns out to be expensive due to the build up of sludge amount in the future.

7.6 RESIDUAL IMPACTS

7.6.1 With the implementation of the appropriate mitigation measures as discussed above during the handling, collection, and disposal of waste material, the residual environmental impacts would not be significant. These mitigation measures can be enforced by specifying a waste management plan as part of the contract document. Environmental monitoring and audit would be necessary to ensure the implementation of correct disposal requirements for the various wastes generated from construction works.

7.7 ENVIRONMENTAL MONITORING AND AUDIT

7.7.1 It was recommended that auditing of each waste stream be carried out periodically to determine if waste is being managed in accordance with approved procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal. An appropriate audit programme would include a first audit at the commencement of the construction works and then to audit monthly thereafter.

7.8 CONCLUSIONS AND RECOMMENDATIONS

Construction Phase

- 7.8.1 Waste generated by construction works include workforce waste, maintenance and chemical waste and construction and demolition material. With the implementation of appropriate mitigation measures during the handling, collection and disposal of construction waste material, the residual environmental impacts would be acceptable. The mitigation measures can be enforced by incorporating them in to a waste management plan as part of the contract document. Environmental monitoring and audit would be necessary to ensure the implementation of correct disposal requirements for the various waste generated from construction works.
- 7.8.2 Dredging activities would be occurred at the proposed outfall. Approximately 22,000 m³ of marine mud would be dredged and disposed of. It is recommended to avoid the leakage of the dredged mud into the marine environment by implementing appropriate mitigation measures. The residual impact would not be significant given the small amount of dredged mud to be handled and disposed of.

Operational Phase

- 7.8.3 Waste generated during operational phase of Peng Chau STW Upgrade would mainly be sludge from secondary treatment units. The digested wet sludge would be barged away for centralised treatment and disposal. Sludge can also be dewatered on site by drying bed to 30% solid content and for disposal of at designated landfill site when sludge export is infeasible.
- 7.8.4 The operation will be reversed (i.e. drying bed as duty unit and export as standby unit) when the export option turns out to be expensive due to the build up of sludge amount in the future.