



香港建造商會
Hong Kong Construction Association



Best Practice Guide

for Environmental Protection
on Construction Sites

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Best Practice Guide for Environmental Protection on Construction Sites

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Disclaimer

The materials contained in this Best Practice Guide for Environmental Protection on Construction Sites (hereunder 'Best Practice Guide') have been developed to provide guidance to interested parties, including contractors and subcontractors, in managing environmental protection issues on sites. Every due care has been exercised taking into account the circumstances of local working environment and requirements of the laws of Hong Kong. Any advice or comment in this Best Practice Guide is given in this general context and should not be relied upon as a substitute for legal or other professional advice.

This document is produced to provide practical guidance on managing environmental protection issues on construction sites and to meet legal obligations. There is no intention whatsoever to offer exhaustive guidance and interpretation of the environmental legislations and regulations of Hong Kong. Anyone wishing to affirm the legal position of individual facts or situation should refer to the relevant regulations and other related statutory documents or consult a lawyer.

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Ir Ringo Yu (convener)
Mr Eddie Tse
Mr Chris Telford
Mr Tony Yam
Mr Patrick Tang

Preface

HKCA is in support of green construction initiatives and is committed to take lead in introducing those initiatives to our membership and the industry as a whole. We are pleased to publish the Best Practice Guide for Environmental Protection on Construction Sites 2013 (the Guide) to improving the environment.

The Guide was first published in 2002 and updated last in 2009. Given the current trend of society and the significant new legislation, regulations and non-statutory guidelines/ codes of practice that have been issued lately, we commissioned AECOM Asia Co., Ltd. to review and update the Guide and the key aspects of the update are as follows:



1. Update of statutory and regulatory requirements and new contractual requirements for government projects and public housing projects.
2. Update section of the “BEAM from HK-BEAM Society” to be in line with the latest version, i.e. BEAM Plus.
3. Add a new section for BEAM Plus and LEED credits related to contractor’s work and good practices, and provide practical measures and minimum supporting submittal required for achieving each concerned credits.
4. Provide hyperlinks to corresponding websites and relevant sections in the Guide

The purpose of the Guide is to provide a handy reference to frontline management teams in managing certain critical and environmental-prone site issues. By drawing on past cases, good and bad trade practices, the 2013 Guide aims to provide a framework for those who have direct influence over environmental performance, with some useful pointers for continuous improvement.

Last, but not least, special thanks are due to the Task Group members of our Environmental Committee to steer the project and have regular working sessions with AECOM to provide practical advice, insightful directions and thorough review to various drafts of the book. I hope that this Guide may serve as useful reference for industry practitioners and thus bring about significant beneficial change on the environmental performance of the whole industry.

Ir Ringo S M Yu
Chairman of Environmental Committee, HKCA
May 2013

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1 Introduction

ENSR Asia (HK) Limited (ENSR) was commissioned by the Hong Kong Construction Association (HKCA) to carry out the review and revision works for the Best Practice Guide for Environment Protection on Construction Sites (the Guide) which was launched in 2002 and amended in October 2004.

A desk top study was carried out to review and update statutory and non-statutory information, contained in the existing Guide which has changed as a result of revised or new requirements. The scope of this version of the Guide has been expanded to cover wider aspects with respect to environmental protection and management on construction sites and to incorporate the latest best practice.

To improve the readability of the Guide and keep it up-to-date, hyperlinks to the existing statutory and non-statutory requirements is provided in the softcopy version of this revision.

The Guide focuses on the environmental issues which are often encountered within the construction industry and the practical mitigation measures to reduce environmental impacts.

The purpose of the Guide is to provide the reader with a general understanding of the environmental pollution control ordinances and other requirements relevant to construction activities. It gives practical suggestions to the construction industry to implement environmental protection measures on sites to comply with current relevant environmental requirements in Hong Kong and to promote best available practice.

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2 Statutory and Non-Statutory Environmental Requirements

2.1 Sources and Nature

The legislation listed in this Section is that in effect as of March 2008. For the current version, please refer to the web-based database of Hong Kong legislation.



Readers may also refer to the EPD's webpage for the updated information on the environmental laws currently in force.



2.1.1 The Legal Source of Law

The legal source of law refers to law presently available to a judge when deciding a case. There are 4 main sources:

- The Basic Law
- Legislation: Ordinances in Hong Kong and those Acts of Parliament in the United Kingdom which are still in force after 30th June 1997
- Case Law: Both the United Kingdom and Hong Kong rules of common law and equity embodied in decided cases
- Chinese Law and Custom

In addition, after 1997, common law and rules of equity are still applied in Hong Kong because of Article 8 of the Basic Law (and also section 7 of the Hong Kong Reunification Ordinance which is a similar provision) which adopts the common law and rules of equity except for any contravening the Basic Law. In other words, cases, where applicable, judged by court in the past would be used as a reference to make judgement for similar cases.

Any person who breaches the environmental legislation requirement(s) is subject to criminal liabilities.

2.1.2 Strict Liability Offences

Criminal prosecution is normally subject to two simultaneous elements: *Mens Rea* (i.e. guilty mind) and *Actus Reus* (i.e. guilty act). However, in some circumstances, the party who make the prosecution, e.g. HKSAR, Secretary of Justice, etc., is not required to prove that the acts or omissions in question were accompanied by an intention, knowledge or negligence. Table 2.1 summarises the situation as described in the ordinance.

Table 2.1 Strict Liability under Environmental Legislation

Ordinance	Description	Summary
Air Pollution Control Ordinance, Cap 311 Section 48	In any proceedings for an offence under this Ordinance relating to the emission of an air pollutant it shall be a defence to prove the contravention complained of was: a) Solely due to the lighting up of a relevant plant which was cold and that the best practicable means had been taken to prevent or minimise the emission of the air pollutant; or b) Solely due to some failure of a chimney or relevant plant or of an apparatus used in connection with a chimney or relevant plant and that- i) The failure could not have reasonably been foreseen, or if foreseen, could not reasonably have been provided against; ii) The contravention could not reasonably have been prevented by action taken after the failure occurred; and iii) As soon as was reasonably practicable after the occurrence of the failure the EPD was informed thereof in writing.	Statutory defence: Due diligence
Waste Disposal Ordinance, Cap 354 Section 31	In any proceedings for an offence under section 11, 15, 15A, 15AA, 16, 16A, 17, 18A, 20E or 23 it shall not be necessary for the prosecution to prove that the acts or omissions in question were accompanied by an intention, knowledge or negligence on the part of the defendant as to any element of the offence.	No need of <i>mens rea</i> , <i>actus reus</i> suffice

Table 2.1 Strict Liability under Environmental Legislation (Continued)

Ordinance	Description	Summary
Water Pollution Control Ordinance, Cap 358 Section 10	In any proceedings for an offence under section 8(1), 8(1A), 8(2), 9(1) or 9(2) in which it is alleged that the defendant caused matter to enter the waters of Hong Kong or inland waters or a communal sewer or communal drain or caused matter to be deposited as provided in section 2(3) it shall not be necessary for the prosecution to prove that the acts or omissions in question were accompanied by any intention, knowledge or negligence on the part of the defendant as to any element of the offence.	No need of <i>mens rea</i> , <i>actus reus</i> suffice

2.2 Environmental Legislation and Regulations

There are eight major environmental ordinances in Hong Kong, these are:

- Air Pollution Control Ordinance (Cap 311);
- Noise Control Ordinance (Cap. 400);
- Waste Disposal Ordinance (Cap. 354);
- Water Pollution Control Ordinance (Cap. 358);
- Ozone Layer Protection Ordinance (Cap. 403);
- Dumping at Sea Ordinance (Cap. 466);
- Environmental Impact Assessment Ordinance (Cap. 499); and
- Hazardous Chemicals Control Ordinance (Cap. 595).

construction work. Regarding construction activities, the ordinance mainly concerns construction dust or black smoke emissions as well as specified processes such as operating a concrete batching plant.

Abatement notices are usually issued to anyone causing air pollution from a process or machinery and they will be asked to reduce or stop their emissions. Polluters failing to comply with the notice will face prosecution.

The ordinance is the principle law for managing air quality. Table 2.2 shows the relevant control legislation related to construction site air pollution.

2.2.1 Air Pollution Control Ordinance (APCO)

This ordinance empowers the EPD to control air pollution from industry, commercial operations and

Table 2.2 Legislation on Construction Site Air Pollution Control















Legislation	Description of Control
Air Pollution Control Ordinance (Cap. 311) 1983 	Provides for the control of air pollution from stationary sources and motor vehicles. Also enables promulgation of regulations (as below).
Air Pollution Control Ordinance (Cap. 311), Part VIII, S.51-S.68 	Provides for the control of environmental asbestos.
Air Pollution Control Ordinance (Cap. 311), Part IX, S.69-S.80 	Provides for the control of Asbestos Work.
Air Pollution Control (Air Control Zones) (Declaration) (Consolidation) Order 1993 	Provides for consolidated declaration of Air Control Zones.

Table 2.2 Legislation on Construction Site Air Pollution Control (Continued)

Legislation	Description of Control
Air Pollution Control (Appeal Board) Regulations 1983 	Stipulates the procedures and run down of an appeal.
Air Pollution Control (Construction Dust) Regulation 1997 	Requires contractors to take dust reduction measures when construction work is being carried out. Notification to EPD about the commencement of notifiable construction work.
Air Pollution Control (Open Burning) Regulation 1996 	Prohibits open burning of construction waste, tyres and cables for metal salvage, and controls other open burning activities by permit system.
Air Pollution Control (Smoke) Regulation 1983 	Restricts emission of dark smoke from stationary combustion sources.
Air Pollution Control (Specified Processes) Regulations 1987 	Provides the administrative framework for the licensing of Specified Processes.
Air Pollution Control (Asbestos) (Administration) Regulation 1996 	Provides for the qualifications and fees for registration of asbestos consultants, contractors, supervisors and laboratories.
Air Pollution Control (Volatile Organic Compounds) Regulation 2007 	Provides for the control of VOC emissions from paints, consumer products, printing inks, adhesives and sealants. Products are required to display their VOC content. Maximum VOC limits of regulated products have been fully implemented in stages, together with other requirements such as annual reporting of their sales data.
Air Pollution Control (Fuel Restriction) Regulation 	Regulates the use of Ultra Low Sulphur Diesel.
Building (Demolition Works) Regulations (Cap. 123) 1962 	Regulates building demolition, including prevention of nuisance.
Shipping and Port Control Ordinance (Cap. 313) 1978 	Regulates and controls ports, vessels and navigation, including control of smoke emissions.

2.2.2 Noise Control Ordinance

This ordinance controls construction noise, noise from commercial and industrial premises, neighbourhood noise and noise from newly registered motor vehicles as well as intruder alarms.

Generally, a place in Hong Kong is categorized as either a designated area or non-designated area, based on the degree of potential impact to the surroundings. More stringent control is applied to the designated areas.













The uses of Powered Mechanical Equipment (PME) in construction site are not allowed between 7pm and 7am or at any time on a general holiday, unless prior approval has been granted by the EPD through the Construction Noise Permit (CNP) system. The use of certain PME is also subject to restrictions. These PME are hand-held percussive breakers and air compressors, the noise levels of which must comply with the noise emissions standards and a noise emission label shall be obtained from the EPD.

Percussive pile driving is allowed on weekdays only with prior approval, in the form of a CNP from the EPD.

Certain noisy works (i.e. prescribed construction works) within designated areas are not allowed

between 7pm and 7am or at any time on a general holiday, unless prior approval by the EPD via CNP. Table 2.3 shows the relevant legislation for controlling noise from construction site activities.

Table 2.3 Legislation on Construction Site Noise Control

Noise Control	Legislation	Description of Control
General	Noise Control (Amendment) Ordinance (cap. 400) 2004 	The management of body corporate personally liable for repeated offences.
General Construction Work	Noise Control Ordinance (cap. 400) 1988 	Control construction noise from: a) The use of PME; and b) The carrying out of certain noisy works (i.e. prescribed construction works) in designated areas, between 7pm and 7am and any time on general holidays, by CNP.
	Noise Control (General) Regulations 1989 	
	Noise Control (Construction Work) Regulation 1996 	Director of Environmental Protection (DEP) issues permit in accordance with two relevant statutory Technical Memoranda.
	Noise Control (Construction Work Designated Areas) Notice 2008 	The Designated Areas are amended under the notice. This comes into operation on 1 January 2009.
Percussive Piling	Noise Control Ordinance (Cap. 400) 1998 	Prohibits percussive piling between 7pm and 7am and any time on general holidays and restricts the working hours of percussive piling at other times by CNP. DEP issues permit in accordance with a relevant statutory Technical Memorandum.
	Noise Control (General) Regulations 1989 	
	Noise Control (Appeal Board) Regulations 1989 	
	Noise Control (Amendment) Ordinance 1997 	
Noisy Products	Noise Control Ordinance (Cap. 400) 1998 	Controls the import, manufacture, supply and use of hand held percussive breakers (with mass of above 10kg) and portable air compressors (supply air at 500 kPa or above). The noise level of such PME-shall comply with a stringent noise emission standard and a noise emission label shall be obtained from the DEP before use.
	Noise Control (Hand Held Percussive Breakers) Regulations 1991 	
	Noise Control (Air Compressors) Regulation 1991 	The PME concerned shall be fitted with a noise emission label.

2.2.3 Waste Disposal Ordinance

This ordinance provides a comprehensive framework for managing waste from the point of production to the point of final disposal. The

intention of the legislation is that waste should be disposed of in an environmentally acceptable manner. Table 2.4 summarises the relevant legislation relating to waste and its disposal.

Table 2.4 Legislation on Construction Site Waste Management














Legislation	Description of Control
Waste Disposal Ordinance (Cap. 354) 1980 	Provides for the licensing of collection services and disposal facilities for all types of waste, the control scheme on handling and disposal of chemical waste, the control on illegal dumping of waste, the control on import and export of waste, the Construction Waste Charge Scheme and etc..
Waste Disposal (Amendment) Ordinance 1991 	Provides for control of chemical waste with respect to packaging, labelling, storage, collection, disposal, import and export activities.
Waste Disposal (Amendment) Ordinance 1997 	Expands the regulation making powers for implementation of the various waste disposal charging schemes and repeals section 28 which inconsistent with the Hong Kong Bill of Rights Ordinance (Cap. 383).
Waste Disposal (Chemical Waste) (General) Regulation 1992 	Provides for control of all aspects of chemical waste disposal, including packaging, labelling, storage, collection, transport, treatment and final disposal.
Waste Disposal (Permits, Authorisations and Licences) (Fees) Regulation 1992 	Prescribes the fees for application of licences for waste collection and disposal, and the permits for import and export of waste.
Waste Disposal (Appeal Board) Regulation 1992 	Provides for the setting up of an appeal mechanism against decisions made under the WDO.
Waste Disposal (Charges for Disposal of Chemical Waste) Regulation 1995 	Requires payment of charges for disposal of chemical waste at the Chemical Waste Treatment Centre thus creating an economic incentive towards waste minimisation.
Waste Disposal (Designated Waste Disposal Facility) Regulation 1997 	Provides for maintenance of orderly conduct within sites used for waste disposal activities; measures to counteract the evasion of charges payable in connection with the provision of waste disposal services at such sites; and proof of matters in proceedings before court in relation to the provision of waste disposal activities at such sites.
Waste Disposal (Charges for Disposal of Construction Waste) Regulation 2004 	Provides for charging for disposal of construction waste at designated waste disposal facilities and for enhancing control on fly-tipping of waste.
Foreshores and Sea Bed (Reclamations) Ordinance (Cap.127) 1985 	Provides for the control of reclamation and use of the foreshore and seabed.
Public Health and Municipal Services Ordinance (Cap.132) 1960 	Provides for prevention and control of waste. It also provides for removal of litter or waste from any places.

Table 2.4 Legislation on Construction Site Waste Management (continued)

Legislation	Description of Control
Land (Miscellaneous Provisions) Ordinance (Cap. 28) 1972 	Provides for control on dumping of public fill.
Dumping at Sea Ordinance (Cap. 466) 1997 	Provides for control on disposal of and dumping of substance and articles in the sea and under the sea-bed, and for connected purposes.

2.2.4 Water Pollution Control Ordinance

This ordinance and its subsidiary legislation allow the government to declare Hong Kong waters into ten water control zones (WCZs). Control of discharges in these zones to achieve and maintain water quality objectives are exercised mainly through a licensing system.





All discharges, other than discharge of domestic sewage to a foul sewer or unpolluted water to a storm drain, are subject to the licensing control under the Water Pollution Control Ordinance. Discharge licence must be obtained from EPD before any discharge is made. The discharge must

also comply with the terms and conditions stipulated in the said licence.

The licence specifies the permitted physical, chemical and microbial quality of the effluent and the general guidelines are that the effluent does not damage sewers or pollute inland or inshore marine waters. Details of the effluent standards can be found in the Technical Memorandum 'Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters'.

Table 2.5 summarises the relevant legislation in Water Pollution Control Ordinance.

Table 2.5 Legislation on Construction Site Water Quality Management

Legislation	Description of Control
Water Pollution Control Ordinance (Cap. 358) 1980 	Provides for the designation of control zones within which discharges of effluent, other than discharge of domestic sewage to a foul sewer or unpolluted water to a storm drain, are subject to the licensing control.
Water Pollution Control (General) Regulations 1986 	Give practical effect to the ordinance.
Water Pollution Control (Appeal Board) Regulations 1985 	Set out procedures to be followed in appeals against orders made or directions given under the ordinance.
Water Pollution Control (Amendment) Ordinance 1993 	Requires property owners to connect wastewater to the public foul sewerage system, ensures that private communal sewage treatment plants are operated properly and allows the government to carry out the necessary work on a cost recovery basis when the government requirements are not upheld.

2.2.5 Public Health and Municipal Services Ordinance

This ordinance provides for prevention and control of waste. It also provides for removal of litter or waste from any location.

2.2.6 Ozone Layer Protection Ordinance

This ordinance controls the production, import and export of products containing ozone-depleting substances, and the recycling of ozone-depleting substances, thereby giving effect to Hong Kong's international obligations under the 1985 Vienna Convention and the 1987 Montreal Protocol.

2.2.7 Dumping at Sea Ordinance

This Ordinance controls the disposal of substances at sea, and for connected purposes. Marine dumping should only be considered as the last resort for the disposal of substances provided no land-based disposal options are available and the substances cannot be further reused or recycled. Materials to be controlled by permit under the Dumping at Sea Ordinance are mostly large quantities of sediment arising from dredging works. More details can be found at EPD's webpage.



2.2.8 Environmental Impact Assessment Ordinance

The main objectives of the ordinance are to avoid, minimise and control the adverse impact on the environment of Designated Projects through the application of the environmental impact assessment (EIA) process and the environmental permit (EP) system.

Designated projects specified under Schedule 2 of the Ordinance, unless exempted, must follow the statutory EIA process and require an EP for their construction, operation or decommission. The EP will specify the environmental monitoring and audit requirements if necessary. Please refer to Chapter 13 of this Guide for more details.

2.2.9 Hazardous Chemicals Control Ordinance

This ordinance regulates, through an activity-based permit system, the import, export, manufacture and use of non-pesticide hazardous chemicals that have potentially harmful or adverse effects on human health or the environment. Any person importing, exporting, transshipping, transiting, manufacturing or using a scheduled chemical under the ordinance must hold a valid activity-based permit issued by the EPD. In addition, unless exempted otherwise, each consignment of scheduled chemical(s) entering/leaving Hong Kong must also be covered by a consignment-based import/export licence issued under the Import and Export Ordinance (IEO). Such licences are issued by the EPD under the delegated authorities from the Director-General of Trade and Industry.

2.3 Liable Person and Maximum Penalties for an Offence

The potential environmental pollutants generated from a construction site mainly include construction dust; noise from general construction activities and powered mechanical equipment; wastewater such as surface runoff, sewage, cleaning/rinsing water; construction and demolition material and chemical waste. Appendix 2.1 summarises the activity or source, liable person and Penalties with respect to the relevant legislation.

2.4 Non-Statutory Requirements

Non-statutory requirements with respect to environmental management on construction sites are published from various sources:

- Practice Note for Registered Contractors (PNRC), issued by Buildings Department (BD)
- Practice Note for Professional Persons (ProPECC), issued by Environmental Protection Department (EPD)
- Technical Circulars (TC), issued by Development Bureau, ex-Environment, Transport and Works Bureau (ETWB) and ex-Works Bureau (WB)
- Building Environmental Assessment Method (BEAM) from HK-BEAM Society
- Recommended Pollution Control Clauses for Construction Contracts" promulgated by EPD

2.4.1 Practice Note for Registered Contractors from Buildings Department

The PNRCs related to environmental management on construction sites are shown in Table 2.6.

2.4.2 Practice Note for Professional Persons from Environmental Protection Department

The ProPECC practice notes related to environmental aspects on construction sites are shown in Table 2.7.

2.4.3 Technical Circulars from Development Bureau (formally Environment, Transport and Works Bureau (ETWB) and Works Bureau (WB))

The technical circulars related to environmental aspects on construction sites are shown in Table 2.8.

Table 2.6 Practice Note for Registered Contractors Related to Construction Site






Practice Note	Description of Practice Note
PNRC 15 – Asbestos (1996) 	Provides guidelines in the design and construction of buildings that the use of asbestos containing material (ACM) in new buildings should be avoided and the removal of ACM from existing buildings should be handled with caution.
PNRC 17 –Control of Environmental Nuisance from Construction Sites (1997) 	Provides checklist for identifying possible environmental nuisance and practical advice for the Control of such nuisance from construction sites.
PNRC 21 – Tropical Hardwood Timber (1992) 	Provides guideline to reduce the amount of tropical hardwood timber used in building projects.
PNRC 24 –Metal Refuse Chutes at Construction Sites (1994) 	Requires using chutes made of other materials of to reduce the noise level.
PNRC 61 – Protection of natural streams/rivers from adverse impacts arising from construction works (2005) 	Requires contractor to carry out construction works in an environmentally responsible manner and with appropriate mitigation measures to minimize any adverse impact to natural streams/rivers.

Table 2.7 Practice Note for Professional Persons Related to Construction Site






Practice Note	Description of Practice Note
PN 1/93 – Noise from Construction Activities – Statutory 	Describes the legislation in force to control noise from construction activities.
PN 2/93 – Noise from Construction Activities - Non-statutory Controls 	Provides to set out the assessment criteria as well as requirements relating to construction noise not currently controlled under the Noise Control Ordinance.
PN 1/94 – Construction Site Drainage 	Provides some basic environmental guidelines for the handling and disposal of construction site discharges.
PN 1/96 – Use of Quiet Construction Equipment for Road Opening Works during Non-Sociable Hours 	Provides guidelines on the application of some commonly used quiet equipment and techniques for road pavement works.
PN 2/97 – Handling of Asbestos Containing Materials in Buildings 	Provides guidance on the basic precautionary measures applicable to asbestos abatement work.

Table 2.8 Technical Circulars from Development Bureau

























Technical Circular	Description of Technical Circular
WBTC No. 10/1992 – Provision of Refuse Containment Booms in Reclamation Contracts Involving Public Dumping 	Requires provision of refuse containment booms in reclamation contracts involving public dumping.
WBTC 02/1993 - Public Dumps 	Requires suitable construction waste is placed in public dumps on reclamation and land formation projects, and not disposed of in landfills.
WBTC 02/1993B - Public Filling Facilities 	Renames “public dumping” as “public filling”.
WBTC 16/1996 - Wet Soil in Public Dumps 	Avoids the delivery of wet soil to landfills for disposal.
WBTC 04/1997 - Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures 	Requires that where such a ecological mitigation measure is required, it would be provided to the extent that it is practicable, on a ‘like for like’ basis and within the boundaries of Hong Kong.
WBTC 04/1998 - Use of Public Fill in Reclamation and Earth Filling Projects 	Requires reclamation or earth filling projects with imported fill requirements of 300,000 m ³ or more to consider using public fill for the Works.
WBTC No. 18/1999 – Particular Specification Clause for Vehicles Carrying Dusty Materials 	Requires vehicles carrying dusty materials to provide proper coverage of dusty materials before leaving the Site.
WBTC 12/2000 - Fill Management 	Provides management framework on fill resources, construction and demolition material (C&DM), and dredged/excavated sediment disposal.
WBTC No.19/2001 – Metallic Site Hoardings and Signboards 	Requires the use of metallic site hoardings and signboards in order to reduce the amount of timber used on the construction sites.
WBTC No. 6/2002, (superseded by WBTC No.8/2010) – Enhanced Specification for Site Cleanliness and Tidiness 	Enhances cleanliness and tidiness of public works project sites through modifications on specifications.
WBTC No. 11/2002 – Control of Site Crushers 	Describes approval procedures for site crushers that may be installed in the project.
WBTC No. 12/2002 – Specifications Facilitating the Use of Recycled Aggregates 	Specifies the use of recycled aggregates in concrete production, and construction of road sub-base in projects.
ETWB TC(Works) No. 33/2002 – Management of Construction and Demolition Material Including Rock 	Introduce specification to enhance the management of construction and demolition (C&D) material including rock and to minimize its generation at source in public works projects.
ETWB TC(W) 34/2002 - Management of Dredged/Excavated Sediment 	Sets out the procedure for seeking approval to dredge/excavate sediment and the management framework for marine disposal of such sediment.

Table 2.8 Technical Circulars from Development Bureau (Continued)

Technical Circular	Description of Technical Circular
ETWB TC(W) 2/2003 (superseded by ETWB TC(W) No. 3/2009 - Regulating Action where a Serious Incident has or Site Safety or Environmental Offences have occurred on a Construction Site 	Sets out the particular policies and procedures to be followed when considering taking regulating action against a contractor where a Serious Incident has or Site Safety or Environmental Offences have occurred on a Construction Site.
ETWB TC(W) 22/2003, 22/2003A - Additional Measures to Improve Site Cleanliness and Control Mosquito Breeding on Construction Sites 	Provides additional measures to improve site cleanliness and control mosquito breeding on construction sites.
ETWB TC(Works) No.24/2004 – Specification Facilitating the Use of Concrete Paving Units Made of Recycled Aggregates 	Specifies the use of concrete paving units made of recycled aggregates for road works and construction of pavements.
ETWB TC(W) 31/2004 (superseded by DEVB TC(W) 6/2010) - Trip Ticket System for Disposal of Construction & Demolition Materials 	Sets out the trip ticket system for public works contracts.
ETWB TC(W) 05/2005 - Protection of natural streams/rivers from adverse impacts arising from construction works 	Provides an administrative framework to better protect all natural streams/rivers from the impacts of construction works.
ETWB TC(Works) No.16/2005 – Adoption of Energy Efficient Features and Renewable Energy Technologies in Government Projects and Installation 	Sets out guidelines and procedures on the adoption of energy efficient features and renewable energy technologies in government projects and installations.
ETWB TC(W) 19/2005 - Environmental Management on Construction Sites 	Sets out policy and procedures requiring contractor to prepare and implement an environmental management plan in all public works contracts.
DEVB TC(W) 2/2011 - Encouraging the Use of Recycled and other Green Materials in Public Works Projects 	Sets out a comprehensive framework for the procurement of recycled and other green materials with a view to promoting their use in public works projects. It also streamlines the process for recyclers which manufacture recycled materials to collect construction and demolition (C&D) materials and introduces a recycler's list for C&D materials.
DEVB TC(W) 9/2011 - Enhanced Control Measures for Management of Public Fill 	To promulgate the control measures to enhance the management of public fill, as recommended by Public Fill Committee.

2.4.4 BEAM Plus from BEAM Society

BEAM is a green building assessment tool to assess performance of a building. This scheme covers the planning, design, demolition and construction, commissioning, management, operation and maintenance of buildings that enables buildings to be assessed under a series of categories in order to gain credits that will determine the level of attainment achieved. These levels are Platinum (Excellent), Gold (Very Good), Silver (Good), and Bronze (Above Average). For full details of the criteria used in the assessment, please refer to the BEAM Plus Guideline for New Buildings which can be downloaded from the website of BEAM Society. 

The various performance aspects covered in BEAM are grouped within the following 6 categories:

- Site Aspects (SA)

This aspect relates to the location and design of the building, of which the emissions from the site is of significance to the contractor during construction stage.

- Materials Aspects (MA)

This aspect concerns about the selection, efficient use, recycling and disposal of construction materials during construction stage.

- Energy Use (EU)

This aspect concerns about the energy use and energy management of a building. Some sections are related to the contractor during construction stage

- Water Use (WU)

This aspect concerns about the water conservation and effluent discharges of a building and is not related to the contractor during construction stage.

- Indoor Environmental Quality (IEQ)

This aspect focuses on the safety, hygiene, ventilation, thermal comfort, lighting, acoustic, and building amenities of a building and is not related to the contractor during construction stage.

- Innovations and Additions (IA)

This aspect considers the innovative techniques or performance enhancements that provide environmental benefit additional to the other aspects. The innovative construction technique

undertaken by the contractor to improve environmental performance of a building will also be considered.

Critical Design Stage Consideration

The critical BEAM requirements related to the design consideration are outlined below.

- BEAM Plus Prerequisites

For each section, BEAM Plus prescribes prerequisites which **MUST** be satisfied in order for the credits within the same category to be counted towards the awards. Failure of compliance would result in project disqualification.

- Energy Use Analysis

BEAM Plus requires a computational approach to determining the overall building energy performance.

The computer software to be used and methodology of the energy simulation should make reference to BEAM Plus Guidebook for New Building section EU 1.

- Water Efficient Features

Water efficient applicants should be selected to achieve a quantifiable reduction of water consumption compared with a baseline performance, following the assumptions given in BEAM Plus.

- Landscape Design

For residential development having an area of greater than 1,000m², greenery features should be provided equivalent to at least 20% of the site area in accordance with PNAP-152 calculation method.

- Computational Modeling

Computational modeling should be undertaken to evaluate various building performance including microclimate, natural lighting, light pollution, natural ventilation and indoor thermal comfort etc.

Consideration at Construction Stage

The BEAM Plus requirements related to the foundation and superstructure contractors during construction stage are outlined in **Table 2.9** Most credits apply to both foundation and superstructure contractors, while some apply to superstructure contractor only.

Table 2.9 BEAM Plus Credits Related to Foundation and/or Superstructure Contractors during Construction Stage

BEAM Plus Credits	Foundation (F)	Superstructure (S)
Site Aspects (SA)		
SA 10 – Environmental Management Plan	✓	✓
SA 11 – Air Pollution During Construction	✓	✓
SA 12 – Noise Pollution During Construction	✓	✓
SA 13 – Water Pollution During Construction	✓	✓

BEAM Plus Credits	Foundation (F)	Superstructure (S)
Material Aspects (MA)		
MA P1 – Timber Used for Temporary Works	✓	✓
MA P2 – Use of Non-CFC Based Refrigerants		✓
MA P3 – Construction and Demolition Waste Management Plan	✓	✓
MA 3 – Prefabrication	✓	✓
MA 6 – Sustainable Forest Product		✓
MA 7 – Recycled Materials	✓	✓
MA 8 – Ozone Depleting Substances		✓
MA 9 – Regionally Manufactured Materials	✓	✓
MA 11 – Construction Waste Reduction	✓	✓
Water Use (WU)		
WU P1 – Water Quality Survey		✓
WU 1 – Annual Water Use		✓
Energy Use (EU)		
EU 3 – Embodied Energy in Building Structural Elements	✓	✓
EU 10 – Testing and Commissioning		✓
EU 11 – Operation and Maintenance		✓
Indoor Environmental Quality (IEQ)		
IEQ 6 – Outdoor Sources of Air Pollution		✓
IEQ 7 – Indoor Sources of Air Pollution		✓
IEQ 8 – IAQ in Car Parks		✓

SA 10 – Environmental Management Plan

F	S
✓	✓

Baseline and impact monitoring should be carried out in accordance with the EM&A Manual.

Contractor should implement an Environmental Management Plan (EMP) including provisions for Environmental Monitoring and Auditing (EM&A). The EMP should cover activities from demolition to foundation and superstructure stages.

Failure of EMP implementation from any of demolition / foundation / superstructure contractors would result in the loss of credit.

The content of EMP should be referred to **Section 3.2.3**.

Equipment should be calibrated prior to any measurement (e.g. HOKLAS accredited laboratories).

Failure of monitoring implementation and/or compliance with Air Pollution Control Ordinances (i.e. conviction and/or complaint) from any of demolition / foundation / superstructure contractors would result in the loss of credit.

For sample of site inspection checklist (dust) please refer to **Appendix 4.1**

SA 11 – Air Pollution During Construction

F	S
✓	✓

Contractor should apply adequate mitigation measures for dust and air emissions during the construction as recommended by the EPD and demonstrate compliance with the air quality management guidelines as detailed in the Environmental Monitoring and Audit Manual (EM&A).



SA 12 – Noise Pollution During Construction

F	S
✓	✓

Contractor should monitor and implement a control of noise on site has met the requirements with reference to the latest best practice guidelines or practices, in respect of all Noise Sensitive Receivers as defined in Annex 13 of the Technical Memorandum under the Environmental Impact Assessment Ordinance.



Baseline and impact monitoring should be carried out in accordance with the EM&A Manual. Equipment should be calibrated prior to any measurement (e.g. HOKLAS accredited laboratories).

Failure of monitoring implementation and/or compliance with Noise Control Ordinances (i.e. conviction and/or complaint) from any of demolition / foundation / superstructure contractors would result in the loss of credit.

SA 13 – Water Pollution During Construction

F	S

Contractor should undertake measures to reduce water pollution during construction as made reference to the latest best practice guidelines or practices. Wastewater testing should be undertaken by HOKLAS accredited laboratories which comply with the Wastewater Discharge License.

Failure of monitoring implementation and/or compliance with Water Pollution Control Ordinances (i.e. conviction and/or complaint) from any of demolition / foundation / superstructure contractors would result in the loss of credit.

For sample of site inspection checklist (wastewater) please refer to **Appendix 7.1**.

Material Aspects (MA)

MA P1 – Timber Used for Temporary Works

F	S

This is a prerequisite credit which **MUST** be complied. Failure of compliance from any of demolition / foundation / superstructure contractors would result in project disqualification.

Contractor should ensure that no virgin forest products will be used for temporary works, unless exceptional circumstances require such use. Metal formwork is a recommended alternative for timber.

Wood products from well-managed or sustainable sources are acceptable for credit compliance, such as certified by Forest Stewardship Council (FSC), the American Forest and Paper Association (AFPA), or other known licensed sources.

For sample of BEAM Plus submission checklist please refer to **Appendix 2.2.1**.

FSC



AFPA



MA P2 – Use of Non-CFC Based Refrigerants

F	S

This is a prerequisite credit which **MUST** be complied. Failure of compliance from any of demolition / foundation / superstructure contractors would result in project disqualification. Contractor should ensure that no chlorofluorocarbon (CFC)-based refrigerants are being used in the HVAC&R systems.

Contractor should submit contract documents and specifications specifying the use of non-CFC based refrigerants, equipment schedule and equipment catalogue.

MA P3 – Construction and Demolition Waste Management Plan

F	S

This is a prerequisite credit. Failure of compliance from any of demolition / foundation / superstructure contractors would result in project disqualification. Contractor should implement a waste management system that provides for the sorting, recycling and proper disposal of waste materials.

Contractor should implement a waste sorting and recycling, and demonstrate through appropriate record keeping.

Section 8.6 provides guidance in waste management and implementation with examples.

MA 3 – Prefabrication

F	S

At least **20%** (1 BEAM credit) or **40%** (2 BEAM credits) of BEAM Plus-listed prefabricated building elements (concrete items only) should be manufactured off-site.

The manufacturing factory should be located within 800km from the site.

The calculation should accumulate the total weight or volume of prefabricated building elements used from both foundation and superstructure contractors, which should be consistent in overall.

Equation for prefabrication elements calculation is illustrated in below:-

% of prefabrication quantity = (Total unit of qualified prefabricated elements / Total unit of all listed elements) x 100%

MA 6 – Sustainable Forest Products

F	S

At least **50%** of all timber and composite timber products used in the project are from sustainable source / recycled timber (FSC, AFPA or other known licensed sources, reference please refer to MA P1).

The unit of calculation should be mass/volume/dollar value, which should be consistent in overall.

Equation for sustainable forest product calculation is illustrated in below:-

% of sustainable timber = (Total unit of permanently timber originated from sustainable sources/ Total unit of all permanently install timber) x 100%

For sample of BEAM Plus submission please refer to **Appendix 2.2.1**

MA 7 – Recycled Materials

F	S
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

At least **10%** of materials used in site exterior surfacing work, structures and features are recycled materials. (1 BEAM credit).

At least **10%** of materials used for façade and structural component are recycled materials. (1 BEAM credit).

At least **10%** of materials used for interior non-structural components are recycled materials. (1 BEAM credit).

The unit of calculation should be mass/volume/dollar value, which should be consistent in overall.

Equation for recycled materials calculation is illustrated below:-

% of recycled materials = (Total unit of recycled materials/ Total unit of all materials) x 100%

Materials which normally consist of recycled content will not be considered as achievement, for instance steel and glass.

MA 8 – Ozone Depleting Substances

F	S
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Contractor should submit the equipment schedule and catalogue of HVAC&R equipment showing the refrigerants employed.

Contractor should demonstrate by calculation that the global warming potential and ozone depletion potential of the refrigerants used in equipment meets the specified requirement of ASHRAE and CIBSE. (1 BEAM credit).

Contractor should submit catalogues of insulation materials or statement from manufacturer demonstrating that the products are free from CFC and HCFC (1 BEAM credit).

For sample of Ozone Depletion & Global Warming Potential calculation please refer to **Appendix 2.2.2**

MA 9 – Regionally Manufactured Materials

F	S
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

At least **10%** (1 BEAM credit) or **20%** (2 BEAM credits) of all building materials used in the project are manufactured locally within 800km from the site. Mechanical and electrical systems components should not be included in the calculation.

The unit of calculation should be mass/volume/dollar value, which should be consistent in overall.

Equation for regionally manufactured materials calculation is illustrated below:-

% of regional materials = (Total unit of regional manufactured material/ Total unit of all building materials) x 100%

For sample of BEAM Plus submission please refer to **Appendix 2.2.3**

MA 11 – Construction Waste Reduction

F	S
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

At least **30%** (1 BEAM credit) or **60%** (2 BEAM credits) of construction waste is recycled.

The excavated waste will not be considered as part of the construction waste. The disposal of inert waste to public fill will not be considered as an acceptable strategy for fulfilling this requirement. The unit of calculation should be weight /volume, which should be consistent in overall.

ETWB TWC 19/2005 should be used as a guide to the nature of reporting and recording keeping.

Water Use (WU)

WU P1 – Water Quality Survey

F	S
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Contractor should conduct portable water sampling and testing after completion of construction.

Water samples shall be taken at all the farthest point(s) of use in the distribution system from the storage tank, and shall include sampling for each water supply tank used in the building.

Water quality at all sample points should meet with the Water Supplies Department (WSD) Guidelines under the Quality Water Recognition Scheme for Buildings.

WU 1 – Annual Water Use

F	S
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Contractor should submit water fittings specification and catalogues.

Contractor should submit calculation to demonstrate the estimated aggregate annual water use saving to achieve at least **20%** (1 BEAM credit), or **25%** (2 BEAM credits), or **30%** (3 BEAM credits). For sample of Annual Water Use saving calculation please refer to **Appendix 2.4.4**.

Energy Use (EU)

EU 3 – Embodied Energy in Building Structural Elements

F	S
	✓

Contractor should provide sufficient information of major building elements (e.g. building quantities) for design team to undertake a Life Cycle Assessment. Only building elements and materials used in the foundation and superstructure are required for assessment. Building services materials are excluded for the calculation.

For the sample of building materials input fact sheet please refer to **Appendix 2.2.5**.

EU 10 – Testing and Commissioning

F	S
	✓

Contractor should provide commissioning specification indicating that details testing and commissioning requirements and cost provisions for all building services system, equipment and components.

Contractor should appoint a commissioning authority and provide a commissioning plan that embraces all specified commissioning work.

Contractor should provide a detailed T&C report for all systems, equipment and components that impact on energy use and indoor environmental quality.

All the testing and commissioning documents shall meet the requirements detailed in **Section 8.5.1-8.5.4** in BEAM Plus Guidelines as a minimum

EU 11 – Operation and Maintenance

F	S
	✓

Contractor should provide a fully documented operations and maintenance manual (1 BEAM credit).

Contractor should provide fully documented instructions in an energy management manual that enable systems to operate at a high level of energy efficiency (1 BEAM credit).

Contractor should provide training record for operations and maintenance staff and demonstrate that adequate maintenance facilities are provided for operations and maintenance work. The training program shall cover as a minimum the items listed in Section 8.5.8 in BEAM Plus Guidelines.

Indoor Environmental Quality (IEQ)

IEQ 6 – Outdoor Sources of Air Pollution

F	S
	✓

Contractor should demonstrate compliance with IAQ certification scheme “Good Class” criteria for Carbon monoxide (CO), Nitrogen dioxide (NO₂) and Ozone (O₃) (1 BEAM credit).

Contractor should demonstrate compliance with IAQ certification scheme “Good Class” criteria for Respirable suspended particulate (RSP) (1 BEAM credit).

Credit compliance can be achieved by on-site measurement after completion of construction

For detailed criteria please refer to IAQ Certification Scheme



IEQ 7 – Indoor Sources of Air Pollution

F	S
	✓

Contractor should demonstrate compliance with IAQ certification scheme “Good Class” criteria for Volatile organic compounds (VOCs), Formaldehyde (HCHO) and Radon (Rn) respectively (1 BEAM credit for each contaminant).

Credit compliance can be achieved by on-site measurement after completion of construction

For detailed criteria please refer to IAQ Certification Scheme



IEQ 8 – IAQ in Car Parks

F	S
	✓

Contractor should demonstrate that the design of the ventilation system meets or exceeds the guidelines given in *ProPECC PN 2/96*, including provisions for the monitoring and automatic control of air pollution.

Credit compliance can be achieved by on-site measurement after completion of construction

2.4.5 LEED from USGBC

BEAM Plus is the leading and well-recognized standard in Hong Kong to assess, improve, certify and label the environmental performance of buildings. In addition to BEAM Plus, project may also apply for US LEED certification, which will have additional consideration at both design and construction stages on top of BEAM Plus.

Critical Design Stage Consideration

The critical LEED requirements related to the design consideration are outlined below.

- Prerequisites

The applicant project **MUST** satisfy all the prerequisites and qualify for a minimum number of points to attain the established project ratings. Failure of compliance would result in project disqualification.

- Energy Use Analysis

LEED requires a comprehensive energy analysis to determining the overall building energy performance. Computational simulation is one of the common approaches.

The computer software to be used and methodology of the energy simulation should make reference to LEED Reference Guide section EAp2 and EA 1.

- Water Efficient Features

Water efficient applicants should be selected to achieve a quantifiable reduction of water consumption compared with a baseline performance, following the assumptions given in LEED.

- Commissioning of Building Energy System


An independent commissioning authority (CxA) should be employed to verify that the project's energy-related systems are well-installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents.

Critical Construction Stage Consideration


The LEED requirements related to the foundation and superstructure contractors during construction stage are outlined in **Table 2.10**.

Table 2.10 Compliance Path to meet both LEED and BEAM Plus requirement

BEAM Plus Credits	LEED Credits ^a	Compliance Path to meet both LEED and BEAM Plus requirement
Site Aspects (SA)		
SA 10 – Environmental Management Plan		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
	SS P1 – Construction Activity Pollution Prevention	This is a prerequisite credit in LEED which MUST be complied for any rating. There is no BEAM Plus related criteria. Create and implement an erosion and sedimentation control plan for all construction activities associated with the project.
SA 11 – Air Pollution During Construction		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
SA 12 – Noise Pollution During Construction		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
SA 13 – Water Pollution During Construction		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
Material Aspects (MA)		
MA P1 – Timber Used for Temporary Works		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
MA P2 – Use of Non-CFC Based Refrigerants	EA P3 – Fundamental Refrigerant Management	Use non-CFC based refrigerants in HVAC&R systems
MA P3 – Construction and Demolition Waste Management Plan	MR 2 – Construction Waste Management	Develop and implement a construction waste management plan. LEED requires recycling or salvaging construction waste by at least 50% (1 LEED point) or 75% (2 LEED points) . The required percentage of recycle quantities is different from BEAM Plus MA 11 (section 2.4.3).
MA 11 – Construction Waste Reduction		
MA 3 – Prefabrication		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
MA 6 – Sustainable Forest Product	MR 7 – Certified Wood	Use at least 50% of wood-based materials and products that are certified in accordance with the FSC's principles and criteria, for wood building components. Stringent LEED criteria beyond BEAM Plus - Calculation is based on cost only. - Selection of materials origin is limited to FSC only.

BEAM Plus Credits	LEED Credits ^a	Compliance Path to meet both LEED and BEAM Plus requirement
MA 7 – Recycled Materials	MR 4 – Recycled Content	<p>Use materials with recycled content such that the sum of postconsumer recycled content plus 1/2 of the pre-consumer content constitutes at least 10% (1 LEED point) or 20% (2 LEED points). Calculation is based on cost only.</p> <p>Stringent LEED criteria beyond BEAM Plus</p> <ul style="list-style-type: none"> - For LEED assessment, there is no separated calculation for outside surface works and structure (MA 7a), building structure (MA7b) and interior components (MA7c) - Calculation is based on cost only, and the calculation equation should be modified from BEAM Plus.
MA 8 – Ozone Depleting Substances	EA 4 – Enhanced Refrigerant Management	<p>Stringent LEED criteria beyond BEAM Plus</p> <p>The air-conditioning and refrigeration equipments shall fulfill the following equation which determines a maximum threshold for the combined contributions to ozone depletion and global warming potentials:</p> $LCGWP + LCODP \times 10^5 \leq 100$ <p>(Please refer to BEAM Plus Guideline section MA 8 for detailed calculation definitions)</p>
MA 9 – Regionally Manufactured Materials	MR 5 – Regional Materials	<p>At least 10% (1 LEED point) or 20% (2 LEED points) of all building materials and products that are extracted, harvested or recovered, as well as manufactured within 500miles (800km) of the project site, based on cost only.</p> <p>Stringent LEED criteria beyond BEAM Plus</p> <ul style="list-style-type: none"> - Regional materials are identified from point of extraction and harvest instead of manufacture location. - Calculation is based on cost only.
Water Use (WU)		
WU P1		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
WU 1	WE – 3 Water Use Reduction	<p>At least 30% (2 LEED credit), or 35% (3 LEED credits), or 40% (4 LEED credits) of estimated annual saving from the baseline</p> <p>Stringent LEED criteria beyond BEAM Plus</p> <p>LEED requires an estimated annual saving of at least 20% as a prerequisite. Flushing water use reduction from water closets and urinals cannot be included in the calculation.</p>

BEAM Plus Credits	LEED Credits ^a	Compliance Path to meet both LEED and BEAM Plus requirement
Energy Use (EU)		
EU 3 – Embodied Energy in Building Structural Elements		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.
EU 10 – Testing and Commissioning	EA P1 – Fundamental commissioning of Building Energy Systems	Stringent LEED criteria beyond BEAM Plus This is a prerequisite credit in LEED which MUST be complied for any rating. The Client MUST designate an independent commissioning authority (CxA) to lead, review and oversee the completion of the testing and commissioning process activities.
EU 11 – Operation and Maintenance	EA 3 – Enhanced Commissioning	Stringent LEED criteria beyond BEAM Plus The Client MUST designate an independent commissioning authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
Indoor Environmental Quality (IEQ)		
IEQ 6 – Outdoor Sources of Air Pollution	IEQ 3.2 -- Construction Indoor Air Quality Management Plan—Before Occupancy	<p>Conduct on-site measurement after completion of construction to demonstrate compliance of maximum concentration levels for:</p> <ul style="list-style-type: none"> • Carbon monoxide (BEAM & LEED) • Nitrogen dioxide (BEAM only) • Respirable Suspended Particles, PM10 (BEAM & LEED) • Total volatile organic compounds (BEAM & LEED) • Formaldehyde (BEAM & LEED) • Radon (BEAM only) • 4-Phenylcyclohexene (LEED only) <p>Stringent LEED criteria beyond BEAM Plus</p> <ul style="list-style-type: none"> • Carbon monoxide (<9 ppbv) • PM10 (<50 µg/m³) • Total volatile organic compounds (500 µg/m³) • Formaldehyde (27 ppbv)
IEQ 7 – Indoor Sources of Air Pollution		
IEQ 8 – IAQ in Car Parks		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.

BEAM Plus Credits	LEED Credits ^a	Compliance Path to meet both LEED and BEAM Plus requirement
MA 7 – Recycled Materials	MR 4 – Recycled Content	<p>Use materials with recycled content such that the sum of postconsumer recycled content plus 1/2 of the pre-consumer content constitutes at least 10% (1 LEED point) or 20% (2 LEED points). Calculation is based on cost only.</p> <p>Stringent LEED criteria beyond BEAM Plus</p> <ul style="list-style-type: none"> - For LEED assessment, there is no separated calculation for outside surface works and structure (MA 7a), building structure (MA7b) and interior components (MA7c) - Calculation is based on cost only, and the calculation equation should be modified from BEAM Plus.
MA 8 – Ozone Depleting Substances	EA 4 – Enhanced Refrigerant Management	<p>Stringent LEED criteria beyond BEAM Plus</p> <p>The air-conditioning and refrigeration equipments shall fulfill the following equation which determines a maximum threshold for the combined contributions to ozone depletion and global warming potentials:</p> $LCGWP + LCODP \times 10^5 \leq 100$ <p>(Please refer to BEAM Plus Guideline section MA 8 for detailed calculation definitions)</p>
MA 9 – Regionally Manufactured Materials	MR 5 – Regional Materials	<p>At least 10% (1 LEED point) or 20% (2 LEED points) of all building materials and products that are extracted, harvested or recovered, as well as manufactured within 500miles (800km) of the project site, based on cost only.</p> <p>Stringent LEED criteria beyond BEAM Plus</p> <ul style="list-style-type: none"> - Regional materials are identified from point of extraction and harvest instead of manufacture location. - Calculation is based on cost only.
Energy Use (EU)		
EU 3 – Embodied Energy in Building Structural Elements		There is no LEED related criteria. Please refer to section 2.4.4 for compliance.

Remark:

^a LEED addresses the different project development and delivery processes through the different rating systems, such as LEED for New Construction (NC), LEED for Core & Shell (CS) and LEED for School etc. Credits described in Table 2.4.2 is according to LEED NC criteria in general.

2.4.7 Specification

Overview of Housing Authority (HA) BEAM Plus-related specification for Contractor

This section is applicable to building, piling and demolition contracts specific to Housing Authority projects undergoing BEAM Plus certification. With reference to PRE.B8.2810, the responsibility of contractor includes the followings:

- Assist Chief Manager to conduct BEAM Plus assessment for the Works according to the BEAM Plus for New Buildings;
- Meet all the target BEAM Plus prerequisites and credits listed in PRE.B8.2820 and provide supporting documents outlined in the specification;
- Assign a BEAM Plus Construction Coordinator (BC) who is familiar with BEAM Plus assessment full time on site to coordinate all relevant works of BEAM Plus assessment.

Such person can be the Environmental Supervisor (ES) specified in PRE.B6.130;

- A BEAM Plus consultant will be appointed by HA to monitor the implementation of BEAM Plus credits and prerequisites. Contractor shall coordinate with and provide necessary information to the BEAM Plus consultant to facilitate the BEAM Plus assessment;
- Attend site inspection with the BEAM Assessor and provide necessary facilities, access and assistance to the BEAM Assessor to facilitate the BEAM Plus assessment.

A summary of all relevant BEAM Plus prerequisites and credits for contractor is given in Table 2.11. The listed prerequisites and credits cover both demolition and construction stages.

Table 2.11 Summary of BEAM Plus Prerequisites and Credits for Contractor

BEAM Plus Credits	Clause Reference	Remark
Site Aspects (SA)		
SA 10 – Environmental Management Plan	PRE.B8.2510 – PRE.B8.2560	Prepare and implement the Environmental Management Plan
SA 11 – Air Pollution During Construction	PRE.B8.APPEND9	Provide substantiation showing the mitigation measures have been properly implemented. The substantiation shall cover the relevant items in under “Air Pollution Control During Construction”.
	PRE.B8.510 – PRE.B8.570	Conduct and report on construction dust monitoring
SA 12 – Noise Pollution During Construction	PRE.B8.APPEND9	Provide substantiation showing the mitigation measures have been properly implemented. The substantiation shall cover the relevant items under “Noise Control During Construction”.
	PRE.B8.890 – PRE.B8.899	Conduct and report on construction noise monitoring
SA 13 – Water Pollution During Construction	PRE.B8.APPEND9	Provide substantiation showing the measures have been properly implemented. The substantiation shall cover the relevant items under Water Pollution Control During Construction”.
	PRE.B8.2410	Conduct and report on discharged water monitoring
Material Aspects (MA)		
MA P1 – Timber Used for Temporary Works	PRE.B8.2450 CON2.M080	Use sustainable timber for temporary works during construction

BEAM Plus Credits	Clause Reference	Remark
MA P2 – Use of Non-CFC Based Refrigerants	PRE.B8.2820	Use no chlorofluorocarbon-based refrigerants in HVAC&R
MA P3 – Construction and Demolition Waste Management Plan	PRE.B8.2520	Prepare and implement the Waste Management Plan
	PRE.B8.APPEND9	Provide substantiation showing the measures for waste management have been properly implemented. The substantiation shall cover the relevant items under “Waste Management”.
MA 3 – Prefabrication	PRE.B8.2820	Use and demonstrate not less than 40% of the precast concrete components is fabricated off-site and the manufacturing factory shall be located within 800 km from the Site
MA 6 – Sustainable Forest Product	PRE.B8.2820	Use timber products including timber doorsets such that not less than 50% of the timber is originated from sustainable source
MA 8 – Ozone Depleting Substances	PRE.B8.2820	Use zero ozone depleting potential products for thermal insulation and fire retardant materials in building fabrics and building services
MA 9 – Regionally Manufactured Materials	PRE.B8.2820	Use and demonstrate not less than 20% of all the building materials is manufactured locally within 800 km from the Site
MA 10 – Demolition Waste Reduction	PRE.B8.2820	Demonstrate not less than 30% of demolition waste is recycled. The amount of inert waste disposed to public fill shall be discounted from the calculation.
MA 11 – Construction Waste Reduction	PRE.B8.2820	Demonstrate not less than 30% of construction waste is recycled. The excavated waste is not considered as part of the construction waste. The amount of inert waste disposed to public fill shall be discounted from the calculation.
Water Use (WU)		
WU P1 – Water Quality Survey	PRE.B8.2820 PLU2.T070	Conduct water quality test specified in PLU2.T070 to demonstrate the quality of potable water meets the specified drinking water quality standards at all points of use
WU 1 – Annual Water Use	PRE.B8.2820 PLU2.M510	Use water efficient devices specified in PLU2.M510 that lead to an annual saving of consumption of potable water of not less than 20% when calculated in accordance with the method described in BEAM Plus
Energy Use (EU)		
EU 10 – Testing and Commissioning	PRE.B8.2820	Commissioning of electrical and mechanical systems
EU 11 – Operation and Maintenance	PRE.B8.2820	Provide operation and maintenance manual and energy management manual for specified electrical and mechanical system covering details in Appendix 8.5 of BEAM Plus for New Buildings
Indoor Environmental Quality (IEQ)		
IEQ 6 – Outdoor Sources of Air Pollution	PRE.B8.2820	Measurement of indoor air quality including carbon monoxide, nitrogen dioxide, ozone and respirable suspended particulate

BEAM Plus Credits	Clause Reference	Remark
IEQ 7 – Indoor Sources of Air Pollution	PRE.B8.2820	Measurement of indoor air quality including volatile organic compounds, formaldehyde and radon
IEQ 8 – IAQ in Car Parks	PRE.B8.2820	Measurement of indoor air quality including carbon monoxide and nitrogen dioxide

Appendix 2.1: Penalties of Relevant Environmental Legislations

Legislation Related to Air Pollution Control

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First Offence	Second or Subsequent Offence
Air Pollution Control Ordinance (Cap. 311) 1983	10	Fails to comply with an air pollution abatement notice given.	A person who commits the offence	Failing to cease the operation of a polluting process as specified in the air abatement notice: Fine of \$500,000 12 months imprisonment Further fine of \$100,000 for each day if offence continues In any other case: Fine of \$100,000	Failing to cease the operation of a polluting process as specified in the air abatement notice: Not applicable In any other case: Fine of \$200,000 6 months imprisonment Further Fine of \$20,000 for each day if offence continues
	30	Fails to comply with any of the requirements of a notice.	Any owner who commits the offence	Fine of \$100,000	Fine of \$200,000 6 months imprisonment Fine of \$20,000 for each day if offence continues
	13	Conducts a Specified Process without a licence.	Any owner who commits the offence	Fine of \$200,000 6 months imprisonment Fine of \$20,000 for each day if offence continues	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First Offence	Second or Subsequent Offence
Air Pollution Control Ordinance (Cap. 311) 1983	29	Any person who: 1 Wilfully resists, obstructs or delays any officer in the exercise of any power conferred on such officer by or under section 28; 2 Fails without reasonable excuse to comply with any requirement duly made by an officer under section 28; 3 In compliance or purported compliance with any such requirement produces any drawing, record or document which he knows to be incorrect or inaccurate in a material respect or does not believe to be correct or accurate; or 4 Wilfully or recklessly gives information which is incorrect in a material respect or withholds information as to any of the matters in respect of which information is required to be given under section 28.	Any person who commits the offence	Fine of \$50,000	
Air Pollution Control (Construction Dust) Regulation (Cap. 311R) 1997	3	Carry out notifiable work without prior notice to the Authority.	Any person who commits the offence	Fine at Level 4	Fine at Level 5
	4	Carry out notifiable work not in accordance with the Schedule.	Any person who commits the offence	Fine at Level 5	Fine at Level 6 3 months imprisonment Fine of \$10,000 each day if offence continues during the whole or any part of the works

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First Offence	Second or Subsequent Offence
Air Pollution Control (Construction Dust) Regulation (Cap. 311R) 1997 (cont')	5, 6	Carry out regulatory / excluded work not in accordance with the Schedule.	Any person who commits the offence	Fine at Level 4	Fine at Level 5 Fine of \$5,000 each day if offence continues during the whole or any part of the works
Air Pollution Control (Open Burning) Regulation (Cap. 311O) 1996	4	Carry out prohibited open burning activities such as the disposal of construction waste, clearance of site for construction work, disposing tyres and salvage of metal.	Any person who commits the offence	Fine at Level 5 Fine of \$500 for every 15 minutes if offence continues	Fine at Level 5 3 months imprisonment Fine of \$500 for every 15 minutes if offence continues
	7	Carry out open burning without permit or in contravention of permit condition.	Any person who commits the offence	Fine at Level 5 Fine of \$500 for every 15 minutes if offence continues	Fine at Level 5 3 months imprisonment Fine of \$500 for every 15 minutes if offence continues
Air Pollution Control (Smoke) Regulation (Cap. 311C) 1983	3	Emit dark smoke for more than 6 minutes in any period of 4 hours or for more than 3 minutes continuously at one time.	An owner of premises who operates any chimney or relevant plant	Fine of \$20,000 Fine of \$100 for every one quarter of an hour during the whole or any part of which such offence is knowingly and wilfully continues	Fine of \$20,000 3 months imprisonment Fine of \$100 for one quarter of an hour during the whole or any part of which such offence knowingly and wilfully continues
Air Pollution Control (Volatile Organic Compounds) Regulation (Cap. 311W) 2007	3, 17	Import or manufacture regulated paint that is listed in Part 2, 3 or 4 of Schedule 1 and has a volatile organic compound content in excess of the prescribed limit.	A person who imports or manufactures the regulated paints	Fine of \$200,000 6 months imprisonment	
	17	Knowingly or recklessly displays, gives, reports or records any information that is misleading, false or incomplete in a material particular.	A person who commits the offence	Fine at level 5 3 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First Offence	Second or Subsequent Offence
Air Pollution Control (Fuel Restriction) (Amendment) Regulation (Cap. 311I) 2008	5	Contravenes the fuel restriction requirements of the Regulation 4(1), 4A, 4C (1) or 4D.	Any person who commits the offence	Fine of not exceeding \$20,000 6 months imprisonment	Additional daily fine not exceeding \$5,000 if the offence continues
Air Pollution Control (Fuel Restriction) (Amendment) Regulation (Cap. 311I) 2008	5	Fails to keep the certificates of compliance issued for 3 years and produce for inspection upon request by the Authority.	The owner of the relevant plant commits the offence	Fine at Level 5	Fine at Level 5 3 months imprisonment
	5	Issues a certificate of compliance in respect of a fuel-using equipment not according to the stipulated requirements.	A Competent examiner who commits the offence	Fine at Level 5	Fine at Level 5 3 months imprisonment
Building (Demolition Works) Regulations (Cap. 123C) 1962	3, 13	The authorized person and registered specialist appointed in respect of the demolition work do not carry out required activities before commencing of demolition.	An authorized person, and/or registered specialist contractor who is guilty of the offence	Fine of \$25,000	
Shipping and Port Control Ordinance (Cap. 313) 1978	50	Any vessel in the waters of Hong Kong that emits smoke in such quantity as to be a nuisance, except in circumstances affecting the safety of life or of the vessel.	The owner and master of the vessel who commits the offence	Fine of \$10,000	Fine of \$20,000
Shipping and Port Control Ordinance (Cap. 313) 1978	74	Obstructs the Director of Marine, or any other person, performing or exercising any function, duty or power under this Ordinance.	Any person who commits the offence	Fine of \$10,000 6 months imprisonment	
			An owner, agent or master of a vessel who commits the offence	Fine of \$50,000 2 years imprisonment	

Legislation Related to Noise Control

Legislation	Section	Activity / Source	Liability*	Maximum Penalties	
				First offence	Second or Subsequent Offence
Noise Control Ordinance (Cap. 400) 1988	6 (1)	Causes or permits to use of powered mechanical equipment at any place between 1900-0700 or anytime on a general holiday without construction noise permit (CNP) or non-compliance with CNP condition.	Any person who commits the offence	Fine of \$100,000	Fine of \$200,000 Fine of \$20,000 each day if offence continues
	6 (2)	Carries out, causes or permits to be carried out prescribed construction work at any place within designated area between 1900-0700 or anytime on a general holiday without construction noise permit (CNP) or non-compliance with CNP condition.			
	26	Any person who: 1 Wilfully resists, obstructs or delays any public officer in the exercise of any power conferred by section 25 which he is authorized to exercise under section 24; 2 Fails without reasonable excuse to comply with any requirement duly made by any public officer in the exercise of any such power; 3 In compliance or purported compliance with any such requirement produces any drawing, record or document which he knows to be incorrect or inaccurate in a material respect or does not believe to be correct or accurate; or 4 Wilfully or recklessly gives information which is incorrect in a material respect or withholds information as to any of the matters in respect of which information is required to be given under section 25.	Any person who commits the offence	Fine of \$50,000	

Legislation	Section	Activity / Source	Liability*	Maximum Penalties	
				First offence	Second or Subsequent Offence
Noise Control Ordinance (Cap. 400) 1988 (cont')	6 (3)	Carries out, causes or permits to be carried out percussive piling at any place in 0700-1900 on any day, not being a general holiday, without construction noise permit (CNP) or non-compliance with CNP condition.	Any person who commits the offence	Fine of \$100,000	Fine of \$200,000 Fine of \$20,000 each day if offence continues
	6 (4)	Carries out, causes or permits to be carried out percussive piling at any place between 1900-0700 or anytime on a general holiday.			
	14 (1a)	Trades or business imports, manufactures, supplies, offers or exposes of supply of prescribed products intended for use in Hong Kong without fitted with noise label.	Any Person who commits the offence	Fine of \$100,000	Fine of \$200,000 Fine of \$20,000 each day if offence continues
	14 (1b)	Noise from prescribed product does not comply with standard.			
Noise Control Ordinance (Cap. 400) 2002	28A	Commits an offence under NCO by a body corporate.	A director or an officer of the body incorporate	--	--

*Remark: Liability for prosecution under the ordinance for an offence may include the management and supervisory staff of the Contractor, e.g. site agent, foreman.

Legislation Related to Waste Management Control

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal Ordinance (Cap.354) 1990	13	Fails to comply with the requirements on removal of wastes from any premises as stated in the notice issued by the collection authority.	Any person who commits the offence	Fine of \$50,000	Fine of \$10,000 each day if offence continues
	16	Disposal of waste to any land or premises without license from the DEP.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Fine of \$500,000 6 months imprisonment Fine of \$10,000 each day if offence continues
	16A	Any person who, without lawful authority or excuse, or permission of any owner or lawful occupier of the place, deposits or causes or permits to be deposited any waste in any place.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Fine of \$500,000 6 months imprisonment Fine of \$10,000 each day if offence continues
	17	Fails to give notice to the DEP as required, or fails to comply with any direction given under this section.	Any person who commits the offence	Fine of \$100,000	Fine of \$200,000 6 months imprisonment Fine of \$10,000 each day if offence continues
	23	Contravenes any term or condition subject to which the license was granted.	Any person has been granted a waste disposal license	Fine of \$200,000 6 months imprisonment	Fine of \$500,000 6 months imprisonment Additional fine of \$10,000 each day if offence continues
			Any person has been granted a waste collection license	Fine of \$100,000	Fine of \$200,000 Additional fine of \$5,000 per day if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal Ordinance (Cap.354) 1990	23B	Fails without reasonable excuse to comply with the requirements of the notice or in purported compliance with such notice, makes any statement to the authority which he knows to be incorrect in a material respect or recklessly makes any statement to the authority which is incorrect in a material respect or knowingly omits any material particular.	A person who commits the offence	Fine of \$100,000	
	23F	Any person who: 1 Wilfully obstructs a collection authority or a waste disposal authority or any authorized officers in the exercise of authority's or the officer's power under this ordinance; 2 Fails without reasonable excuse to comply with the requirement duly made by a collection authority or a waste disposal authority or any authorized officers under this ordinance; 3 In purported compliance with any requirement produces any drawing, document or record which he knows to be incorrect or inaccurate in a material particular or does not believe to be correct and accurate.	Any person who commits the offence	Fine of \$100,000	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992 (For the details of the requirements under s.9, 10, 12, 13, 15 and 18, please refer to the booklet “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes”)	6, 38	Fails to register before producing any chemical waste.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	7, 38	Fails to inform the DEP of any change in the particulars contained in the application as soon as practicable after such change occurs.	A registered waste producer	Fine of \$10,000	Additional daily fine of \$10,000 if offence continues
	8(1), 38	Waste producer fails to arrange for his chemical waste to be delivered to a reception point or an appropriate waste disposal facility.	A registered waste producer	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	8(4), 38	Waste producer fails to provide record i.e. trip ticket to the DEP to show that the proper disposal arrangement for waste disposal had been made.		Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	9, 38	Fails to ensure that chemical waste should be packed and stored in a suitable container, the container should be maintained in good condition and repair and be free from corrosion, contamination or any other defect	A waste producer who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	10, 38	Fails to ensure that there is proper packing of chemical waste in a safe place, and No mixing of incompatible chemical waste in a container is allowed.	A Waste producer who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	11, 38	Fails to comply that capacity of a chemical waste container should not exceed 450 litres, unless approved by the DEP.	A waste producer and the person responsible for such packing and storing who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992	12, 38	Fails to comply requirement for labelling of the chemical waste container.	A waste producer who commits the offence	Fine of \$50,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	13, 38	Fails to ensure that any area for the storage of chemical waste containers: 1 Is for storage of chemical waste only; 2 Be enclosed on at least 3 sides by a wall; 3 Is well ventilated; 4 Is not connected to any sewer or drains; 5 Has adequate space for the handling of the container; 6 If located inside a multi-storey building, be so located as not to obstruct the use of any means of escape or exit from the building; 7 If the storing area is not within a building, be provided with a roof or a similar covering; 8 Should be kept clean and dry; and 9 Is secured with a lock except during necessary normal operations.	A waste producer who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992	14, 38	Fails to ensure that waste container contains liquid chemical waste should: 1 Have an impermeable floor or surface; 2 Have a retention structure with the capacity to accommodate I) the contents of the largest container or II) 20% by volume of the chemical waste stored in that area, whichever is the greater; and 3 Be enclosed by walls or partitions constructed out of an impermeable material, where such containers are stacked.	A waste producer who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	15, 38	Fails to ensure that containers of incompatible chemical waste are not stored together where potentially dangerous consequence may result in the event of contact between the different wastes and any stacks of containers of chemical waste are made secure so as to prevent their falling down.		Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	18, 38	Fails to ensure that the chemical waste store should display a proper warning panel, notice or marking at or near the entrance or the opening.		Fine of \$50,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	21, 38	Fails to engage the services of a waste collector to remove or transport the chemical waste from the site or premises.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992	22, 38	Waste producer fails to ensure: 1 Required information is recorded on trip tickets; 2 Chemical waste to be delivered is correctly classified, described, quantified and labelled, and certify as such on the trip tickets; and 3 Comply with requirements which the trip ticket specifies.	A person who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	28, 38	Fails to retain the copy of the trip ticket for at least one year from the date it is handed over, and shall make it available to the EPD if required.	Any person who commits the offence	Fine of \$50,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	29, 38	The DEP may require a waste producer, a person who is in possession of or has the custody of chemical waste, a waste collector or a reception point manager fails to furnish to him in such form and within such time as determined by him, any information in respect of any chemical waste produced by such waste producer or consigned by or on his behalf to a waste collector, collected by such waste collector or received by or on behalf of such reception point manager, as the case may be.	A person who commits the offence	Fine of \$100,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992	30, 38	Waste producer fails to: 1 Prepare and make available written procedures to be observed in the event of emergencies due to spillage, leakage or accidents arising in the course of or from the handling and the storage of chemical wastes; and 2 Ensure that his employees or agents have received adequate instructions and training for implementing such procedures.	A waste producer who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	31, 38	Fails to comply the requirement that: If the Director of Environmental Protection is of the opinion that any stored chemical waste is likely to threaten public health or safety or cause pollution, he may require the owner or occupier of the premises in which the waste is stored to remove or cause to be removed the chemical waste to a particular facility by notice in writing.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
	32, 38	Any person contravenes: 1 In the storage, collection, transportation, reception, transfer, disposal, import or export or in otherwise handling chemical waste, take all necessary precautions for preventing any hazard or danger to public health or safety or pollution or risk of pollution to the environment; and 2 Not deal with or dispose of chemical waste in any manner contrary to this Regulation or so as to cause any hazard or danger to public health or safety.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C) 1992	37, 38	Any person who: 1 In furnishing any information or particulars under this Regulation in a trip ticket or any form specified for the purposes of this Regulation, in relation to arrangements for disposal of chemical waste or otherwise, makes a statement or gives an estimate which he knows to be incorrect in a material particular or recklessly makes a statement or gives an estimate which is incorrect in a material particular or knowingly or recklessly omits a material particular; 2 For the purposes of this Regulation, certifies as correct anything which he knows to be incorrect or recklessly certifies as correct anything which is incorrect.	Any person who commits the offence	Fine of \$200,000 6 months imprisonment	Additional daily fine of \$10,000 if offence continues
Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N) 2004	8	If the account holder does not inform the DEP in writing of the change in the information provided to the DEP in relation to an exemption account.	The account holder who commits the offence	Fine at Level 6	
	9 (1)	Fails to apply for a billing account within 21 days after being awarded the contract for construction work with a value of \$1,000,000 or above under a contract.	A main contractor who commits the offence	Fine at Level 5	Fine of \$1,000 daily if offence continues
	9 (2)	Fails to ensure that 1 Billing account is used for paying any prescribed charge payable in respect of construction waste generated from construction work undertaken under that contract; and 2 Billing account is not used for paying any prescribed charge payable in respect of any other construction waste.	A main contractor who commits the offence	Fine at level 5	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N) 2004	22	A person who: 1 Makes any statement or gives any information that he knows to be incorrect in a material particular; 2 Recklessly makes any statement or gives any information that is incorrect in a material particular; or 3 Knowingly or recklessly omits any material particular from any statement or information.	A person who commits the offence	Fine at Level 6	

Legislation Related to Chemical Control

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Hazardous Chemical Control Ordinance (Cap. 595) 2008	6	Manufacture any scheduled chemical, except under and in accordance with a permit.	A person who commits the offence	Fine at Level 5 1 year imprisonment	
	8	Import any scheduled chemical, except under and in accordance with a permit.	A person who commits the offence	Fine at Level 5 1 year imprisonment	
	9	Use any scheduled chemical, except under and in accordance with a permit.	A person who commits the offence	Fine at Level 5 1 year imprisonment	
	16	Without reasonable excuse, return the permit to the Director of Environmental Protection later than 10 working days after the variation of conditions of a permit takes effect.	A Permit Holder who commits the offence	Fine at Level 1 6 months imprisonment	
	18	Contravenes a condition of his permit that falls within the description of section 11(1)(a), (b), (c) or (d).	A Permit Holder who commits the offence	Fine at Level 4 6 months imprisonment	
	21	Without reasonable excuse, return the permit to the Director of Environmental Protection later than 10 working days after a cancellation of a permit takes effect.	A Permit Holder who commits the offence	Fine at Level 1 6 months imprisonment	
	26	Fails to comply with any of the directions given under section 22 or, where the directions are varied under section 23, any of such directions as varied.	A person who commits the offence	Fine at Level 3 6 months imprisonment	
	29	Without reasonable excuse, return the permit to the Director of Environmental Protection later than 10 working days after a suspension of a permit takes effect.	A person who commits the offence	Fine at Level 1 6 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Hazardous Chemical Control Ordinance (Cap. 595) 2008	32	A person who: 1 Without reasonable excuse, fails to comply with a requirement made under subsection (2)(a) or (b); or 2 Wilfully obstructs an authorized officer in the exercise of any power conferred under subsection (1) or (2).	A person who commits the offence	Fine at Level 3 6 months imprisonment	
	33	A person who: 1 Without reasonable excuse, fails to comply with a requirement made under subsection (1)(b) or (c); or 2 Wilfully obstructs an authorized officer in the exercise of any power conferred under subsection (1).	A person who commits the offence	Fine at Level 3 6 months imprisonment	
	40	A person who: 1 Produces any document or provides any information that he knows to be misleading, false or inaccurate in a material particular; 2 Recklessly produces any document or provides any information that is misleading, false or inaccurate in a material particular; or 3 Produces any document or provides any information that he has no reasonable ground to believe to be true or accurate; or 4 When required to produce any document or provide any information in respect of any matter to an authorized officer in the exercise of his powers under this Ordinance, withholds the document or information.	A person who commits the offence	Fine at level 3 6 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Ozone Layer Protection Ordinance (Cap. 403) 1997	3	Manufactures a scheduled substance (does not apply where the scheduled substance is manufactured solely for the purpose of research or academic instruction and the person manufactures no more than 1 kg of the substance in any 12 month period).	A person who commits the offence	Fine of \$1,000,000 2 years imprisonment	Fine of \$100,000 for each day on which the offence continues
	4	Imports or exports a scheduled substance without a licence.	A person who commits the offence	Fine of \$1,000,000 2 years imprisonment	
Ozone Layer Protection Ordinance (Cap. 403) 1997	6	Contravenes a condition of a licence.	A person who commits the offence	Fine of \$1,000,000 2 years imprisonment	
	13	A person who: 1 Wilfully resists, obstructs or delays any authorized officer in the exercise of any powers conferred on him by or under this Ordinance; 2 Fails without reasonable excuse to comply with any requirement made by an authorized officer under section 10, 11 or 12; 3 In compliance or purported compliance with any such requirement produces a record or document which is incorrect or inaccurate in a material respect and which he knows to be incorrect or inaccurate or does not believe to be correct or accurate; or 4 Wilfully or recklessly gives information which is incorrect or inaccurate in a material respect or withholds information as to any of the matters in respect of which information is required to be given under this Ordinance.	A person who commits the offence	Fine of \$100,000 6 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Ozone Layer Protection (Controlled Refrigerants) Regulation (Cap. 403B) 1993	5	Allows or causes any controlled refrigerant used or intended for use in a refrigeration equipment or motor vehicle air-conditioner to escape into the atmosphere.	A person who commits the offence	Fine of \$100,000	
Ozone Layer Protection (Controlled Refrigerants) Regulation (Cap. 403B) 1993	6	<p>Recover, recycle or otherwise treat or cause or allow to be recovered, recycled or otherwise treated a controlled refrigerant unless:</p> <ol style="list-style-type: none"> 1 Refrigerant recycling equipment approved by the Director of Environmental Protection under section 4 is used for recovering or recycling the controlled refrigerant; and 2 Equipment is used- <ol style="list-style-type: none"> (i) in accordance with any instruction issued by the manufacturer of the equipment; and (ii) in a manner as may be specified by notice in the Gazette by the DEP. 	A person who commits the offence	Fine of \$100,000	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Ozone Layer Protection (Products Containing Scheduled Substance) (Import Banning) Regulation (Cap. 403C) 1993	3	<p>A person who:</p> <ol style="list-style-type: none"> 1 Import a controlled product from any country or place which is not bound by the terms of the Protocol unless the Director of Environmental Protection is satisfied that the country or place is in full compliance with the relevant requirements of the Protocol. 2 Import a portable fire extinguisher from any country or place, whether or not bound by the terms of the Protocol, unless the Director of Environmental Protection after consulting the Director of Fire Services certifies that the portable fire extinguisher is required for essential applications relating to emergency situations or where lives are at risk. <p>{Does not apply to a controlled product or portable fire extinguisher imported into Hong Kong by a vessel, aircraft or vehicle if the controlled product or portable fire extinguisher is</p> <ol style="list-style-type: none"> (a) the necessary equipment or part of the necessary stores of the vessel, aircraft or vehicle; (b) an item of personal property reasonably required for the personal use of the crew or passengers of the vessel, aircraft or vehicle; (c) an used item imported for the personal use of an owner who is taking up residence in Hong Kong; or (d) imported by a passenger of the vessel, aircraft or vehicle in his personal baggage or carried by him.} 	A person who commits the offence	Fine of \$200,000 6 months imprisonment	

Legislation Related to Water Pollution Control

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Water Pollution Control Ordinance (Cap. 358) 1980	8(1), 8(2), 9(1), 9(2)	<ol style="list-style-type: none"> 1 Discharge any waste or polluting matter into the waters of Hong Kong in a water control zone. 2 Discharge any matter into any inland waters in a water control zone which tends (either directly or in combination with other matter which has entered those waters) to impede the proper flow of the water in a manner leading or likely to lead to a substantial aggravation of pollution. 3 Discharge any matter into a communal drain in a Water Control Zone (WCZ) or communal drain in a WCZ other than the discharge of domestic sewage into a communal sewer and the discharge of unpolluted water into a communal sewer/drain for carriage of surface drainage water. 	<ol style="list-style-type: none"> 1. The Occupier of premises or vessel; or 2. The person having command or charge of the vessel; or 3. A Person causing the discharge 	<p>\$200,000 6 months imprisonment</p>	<p>\$400,000 6 months imprisonment</p> <p>Fine of \$10,000 each day if offence continues</p>
	8(1A), 8(2), 9(1), 9(2)	<ol style="list-style-type: none"> 1 Discharge any poisonous or noxious matter into the waters of Hong Kong. 2 Discharge any poisonous or noxious matter into any inland waters in a WZC. 3 Discharge any poisonous or noxious matter into a communal drain in WCZ. 	<ol style="list-style-type: none"> 1. The Occupier of premises or vessel; or 2. The person having command or charge of the vessel; or 3. A person causing the discharge 	<p>Fine of \$400,000 and imprisonment for 1 year</p>	<p>Fine of \$1,000,000 and imprisonment for 2 years</p> <p>Fine of \$40,000 each day if offence continues</p>

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Water Pollution Control Ordinance (Cap. 358) 1980	35	<p>A person who:</p> <ol style="list-style-type: none"> 1 Fails without reasonable excuse to comply with the requirement of notice from Authority (DEP); or 2 In compliance or purported compliance with a notice from Authority makes any statement which he knows to be false in a material particular or recklessly makes any statement which is false in a material particular or knowingly omits any material particular; or 3 In an application makes a statement or gives an estimate which he knows to be false in a material particular or who recklessly makes a statement or gives an estimate which is false in a material particular or knowingly omits a material particular from the application. 	A person who commits the offence	Fine of \$10,000	
	40	<p>A person who:</p> <ol style="list-style-type: none"> 1 Wilfully obstructs an authorized officer in exercise of any power conferred on such officer; or 2 Fails without reasonable excuse to comply with the requirement duly made by officer under WPCO; or 3 In compliance or purported compliance with any requirement produces any drawing, document or record which he knows to be incorrect or inaccurate in a material particular or does not believe to be correct and accurate. 	A person who commits the offence	Fine of \$10,000	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Water Pollution Control Ordinance (Cap. 358) 1980	40A	A person who: 1 Tampers or interferes with a device that is used for sampling any matter; 2 Tampers or interferes with a sample obtained; 3 Diverts an effluent stream away from installed device that is used for sampling discharges; 4 Does anything in relation to an effluent stream for the purpose of causing a misleading sample to be taken from an installed device that is used for sampling discharges.	A person who commits the offence	Fine of \$10,000	
Water Pollution Control Ordinance (Cap. 358) 1980	46	A contravention of any specified provision of regulation or of a license or a notice under WPCO.	Depends on different provision	Fine of \$200,000 6 months imprisonment	Fine of \$10,000 each day if offence continues
Water Pollution Control (General) Regulation (Cap. 358D) 1986	17(2)	Complete the form prescribed in Second Schedule, makes a statement or gives an estimate which he knows to be incorrect in a material particular or recklessly makes a statement or gives an estimate which is incorrect in a material particular or knowingly omits a material particular.	A person who commits the offence	Fine of \$10,000	
	17B	A person who contravenes any provisions of a licence.	A person who commits the offence	Fine of \$200,000 6 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Dumping at Sea Ordinance (Cap. 466) 1997 #	25 (1)	A person who: 1 Does anything without required permit; or 2 Causes or allows another person to do anything for without required permit.	A person who commits the offence	Fine of \$200,000 6 months imprisonment	Fine of \$500,000 and to imprisonment for 2 years, Further fine of \$10,000 for each day that the court is satisfied that the operation has continued.
	25 (2) & (3)	A person who: 1 Makes a statement which he knows to be false in a material particular; 2 Recklessly makes a statement which is false in a material particular; or 3 Intentionally fails to disclose a material particular. In order to procure the issue of a permit or in purporting to comply with a condition imposed on him under a permit.	A person who commits the offence	Fine of \$200,000 6 months imprisonment	
	25 (6)(a)	Fails to cease the operation as specified in the marine pollution abatement notice.	A person who commits the offence	Fine of \$200,000 6 months imprisonment Further fine of \$10,000 for each day that the court is satisfied that the failure to cease the operation has continued.	
	25 (6)(b)	Fails to comply with a marine pollution abatement notice served on him in any other case.	A person who commits the offence	Fine of \$200,000 6 months imprisonment	

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Dumping at Sea Ordinance (Cap. 466) 1997 #	25 (7)	<p>A person who:</p> <ol style="list-style-type: none"> 1 Intentionally obstructs the Authority or an authorized officer in the performance of his functions under this Ordinance; 2 Fails without reasonable excuse to comply with a requirement made or direction given by the Authority or an authorized officer in the performance of his functions under this Ordinance; or 3 In purporting to give information required by the Authority or an authorized officer for the performance of his functions under this Ordinance- <ol style="list-style-type: none"> (a) Makes a statement which the person knows to be false in a material particular; (b) Recklessly makes a statement which is false in a material particular; or (c) Intentionally fails to disclose a material particular. 	A person who commits the offence	Fine of \$200,000 6 months imprisonment	

#Remark: Liability for prosecution under the ordinance for an offence may include body corporate, management of the firm, the partner or the firm.

Legislation Related to Environmental Impact Assessment

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Environmental Impact Assessment Ordinance (Cap. 499) 1997	9, 26	Construct or operate a designated project or decommission a designated project: 1 Without an environmental permit for the project; or 2 Contrary to the conditions set out in the permit.	A person who commits the offence	Fine of \$2,000,000 6 months imprisonment Fine of \$10,000 each day if offence continues (For summary conviction) Fine at Level 6 6 months imprisonment Fine of \$10,000 each day if offence continues	Fine of \$5,000,000 2 years imprisonment Fine of \$10,000 each day if offence continues (For summary conviction) Fine of \$1,000,000 1 year imprisonment Fine of \$10,000 each day if offence continues

Legislation	Section	Activity / Source	Liability	Maximum Penalties	
				First offence	Second or Subsequent Offence
Environmental Impact Assessment Ordinance (Cap. 499) 1997	23, 27	<p>A person who:</p> <ol style="list-style-type: none"> 1 Wilfully resists, obstructs, or delays any public officer in the exercise of a power conferred by section 23 which he is authorized to exercise; 2 Fails without reasonable excuse to comply with a requirement duly made by a public officer in the exercise of a power under section 23 which he is authorized to exercise; 3 In compliance or purported compliance with a requirement of a public officer under Part VII produces a drawing, record or document which he knows to be incorrect or inaccurate in a material respect or does not believe to be correct; 4 Wilfully or recklessly gives information which is incorrect in a material respect or withholds information as to any of the matter for which information is required to be given under Part VII. 	A person who commits the offence	Fine at Level 5	

Appendix 2.2.1

MA 6 – Sustainable Timber Calculation Sample

No.	Component	Quantity	Total Timber Cost	Sustainable Timber?	Total Sustainable Timber Cost
1	e.g. Door frame 1	e.g. 8	e.g. 6,400	e.g. No	e.g. 0
2	e.g. Door 1	e.g. 8	e.g. 8,000	e.g. Yes (FSC)	e.g. 8,000
3	e.g. Timber floor	e.g. 2	e.g. 2,000	e.g. Yes (FSC)	e.g. 2,000
4	...				
		Total:	16,400		10,000
		Sustainable Timber %	61.0%		

* The exact full list of regional material items should be project specific, which should be suggested by the project BEAM / LEED consultant.

Appendix 2.2.2

MA 8 – Ozone Depletion & Global Warming Potential calculation

HVAC&R equipment	No. of Units	Q unit (kW)	Refrigerant	GWPr	ODPr	Rc (kg/kW)	Life (yrs)	Lr (%)	Mr (%)	Total Q unit (kW)	Tr (Lr x Life x Mr)	LCGWP	LCODP	RAI	TRAIR	
A	1	11.2	R410a	1,890	0	0.76	10	2.0%	10%	11.2	30.0%	43.03	0	43.03	481.95	
B	4	22.4	R410a	1,890	0	0.38	10	2.0%	10%	89.6	30.0%	21.52	0	21.52	1927.80	
C	6	15.5	R410a	1,890	0	0.55	10	2.0%	10%	93	30.0%	31.09	0	31.09	2891.70	
D	3	22.4	R410a	1,890	0	0.38	10	2.0%	10%	67.2	30.0%	21.52	0	21.52	1445.85	
E	2	15.5	R410a	1,890	0	0.55	10	2.0%	10%	31	30.0%	31.09	0	31.09	963.90	
...																
Total Q										292	Total RAI					7711.20
											Average RAI					26.41

* The exact full list of regional material items should be project specific, which should be suggested by the project BEAM / LEED consultant.

Appendix 2.2.3

MA 9 – Regional Materials Sample Checklist

No.	Items	Location of Manufacturing	Distance between project site and manufacture	Product Cost	Within 800km
			(km)	(HK\$)	
1	Concrete	e.g.PRC - Guangdong	e.g. 100	e.g. 4,000,000	Yes
2	Steel Bar	e.g.PRC - Guangdong	e.g. 100	e.g. 8,990,000	Yes
3	Structural steel	e.g.PRC - Guangdong	e.g. 100	e.g. 10,000,000	Yes
4	Gypsum	e.g.PRC - Guangdong	e.g. 100	e.g. 200,000	Yes
5	Masonry	e.g.PRC - Guangdong	e.g. 100	e.g. 300,000	Yes
6	Aluminum Profile	e.g. PRC - Shanghai	e.g. 950	e.g. 1,800,000	No
7	Timber Product	e.g. PRC - Shanghai	e.g. 950	e.g. 400,000	No
8	Glass	e.g. PRC - Shanghai	e.g. 950	e.g. 3,500,000	No
	...				
Total Cost of all materials				HK\$ 29,190,000	
Total Cost of regional material				HK\$ 16,300,000	
Percentage of regional material				55.8%	

* The exact full list of regional material items should be project specific, which should be suggested by the project BEAM / LEED consultant.

* According to BEAM Plus Guidelines, building material taken into account in MA 9 credit is defined as the final product at the point of manufacturing, not raw material at the point of extraction, harvest or recovery

Appendix 2.2.4

WU 1 – Annual Water Use saving calculation sample

Flow Devices ^a	Model	Watering Duration (sec)		Number of Occupancy	Freq. of use per occupant per day	Flow Rate of fitting (l/min)		Annual Operation Day	Annual Water Use (l)	
		Design	Baseline			Design ^b	Baseline		Design	Baseline
Pantry										
Faucet	example	15	15	100	1	5	8.3	365	45,625	75,738
					Sub-total =				45,625	75,738
Showers										
Showerhead	example	300	300	100	0.1	6	9.5	365	109,500	173,375
					Sub-total =				109,500	173,375
Restroom Faucet										
Faucet	example	10	10	100	5	5.8	8.3	365	176,417	252,458
					Sub-total =				176,417	252,458
						Total Annul Water Consumption=			331,542	501,571
						Annual Water Saving =			33.9%	

Remarks:

^a Flow devices include water taps for bath, basin, pantry, kitchen, and also shower heads and exclude water closet, urinal, water features, appliance and irrigation. There should be separate entries for water use in male and female facilities.

^b Design flow rate is base on the equipment catalogues provided.

Appendix 2.2.5

EU 3 – Embodied Energy Sample Checklist

No.	Items	Product Model	Quantity	Unit
1	Concrete			m ³
2	Reinforcement Steel			kg
3	Structural steel			kg
4	Fenestration of curtain wall			m ²
5	Spandrel of curtain wall			m ²
6	Louvre			m ²
7	Aluminum cladding			m ²
	...			

** The exact full list of regional material items should be project specific, which should be suggested by the project BEAM / LEED consultant.*

**Data input from the checklist will be used to calculate the total embodied energy of the building structural elements*

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3 Project Planning

In order to complete a project in an environmentally friendly manner, environmental protection measures should be considered during each stage of the project. The key stages covered by this section include:

- Tendering
- Contract Award
- Construction

3.1 Stage 1 – Tendering

During the project tender stage, environmental measures should be considered for the following tasks/areas:

- Tender Document Review and Pay for Environment
- Budgeting
- Programming
- Method Statement Preparation – adopting a Proactive Approach
- Preparation and Review of Sub-Contractor Tender Documents
- Selection of the Sub-Contractor

3.1.1 Tender Document Review and Pay for Environment

The Contractor should carefully check the Specification and Bill of Quantities (BQ) to understand the precise environmental requirements. Those may include:

- Implementing an Environmental Policy and Environmental Management System
- Maintaining environmental performance records
- Maintaining registers of environmental legislation and in-house rules to be followed
- Implementing specific requirements laid down in the EIA Report and Environmental Permit (for Designated Projects only)
- Preparing an outline Environmental Management Plan
- Appointing designated staff to be responsible for environmental management
- Restricting certain processes, activities and materials to be used
- Deploying “green” working practices and equipment

3.1.2 Project Budgeting

The budget for the implementation of environmental management requirements on site should be allocated. Budgeting includes two key areas:

- Human resources to be employed who are responsible for environmental management or protection; and
- Specific working practices, equipment and facilities necessary to carry out practical mitigation measures for environmental impacts.

Costing of human resources should include:

- Environmental management staff such as an Environmental Officer to oversee environmental issues on site;
- Supervisory staff such as Environmental Supervisors and Foremen to supervise the implementation of environmental control measures;
- Personnel such as skilled labour for carrying out the environmental control measures including operation of environmental facilities such as a wastewater treatment plant; and
- Provision of internal and external training for workforce and staff on environmental protection issues.

The budgeting for working practices, equipment and facilities (where applicable) is particularly important during the tendering stage. It may involve procurement and installation of an automatic wheel washing machine or special configuration of a noise barrier to suit the construction methodology.

Table 3.1 shows the items which may require budget allocation for equipment and material with respect to different environmental issues. The Contractor may take into account that there is deduction for specified capital expenditure incurred in relation to environmental protection facilities, which include Quality Powered Mechanical Equipment (QPME) system, air pollution control machinery or plant, waste treatment plant and wastewater treatment plant with the requirement under respective ordinance. Details can be referred to the Revenue Ordinance 2008.



Appendix 3.1 shows a pricing schedule for recommended items to be included in the project budget.

Table 3.1 Items Requiring Budget Allocation for Equipment / Material with Respect to Different Environmental Issues

Environmental Issue	Items Requiring Budget Allocation
C&D Material Management	<ul style="list-style-type: none"> • Storage facilities for waste and segregated materials • On-site sorting of C&D waste • Delivery of C&D Materials • Deposit for Billing Account for construction waste disposal • Disposal charges to government's facilities
Chemical Waste Management	<ul style="list-style-type: none"> • Storage (including containers and enclosures) • Drip trays • Labelling • Packaging • Chemical waste producer registration • Collection cost of chemical waste • Disposal costs for chemical wastes • Spill clean-up and emergency response equipment
Dust and Air Pollution Control	<ul style="list-style-type: none"> • Vehicle washing facilities (e.g. automatic, use of recycled water) • Spray devices e.g. sprinkler system • Dust suppression chemicals • Hoardings • Paving of haul roads and site exits • Impervious sheeting for covering materials/hoists • Enclosures and storage facilities • Air quality monitoring equipment (if required) • Hard paving • Use of ULSD fuel • Position of ventilation outlet (away from sensitive environmental receivers nearby) • Maintenance of plant and equipment
Noise Control	<ul style="list-style-type: none"> • Quality Powered Mechanical Equipment • Maintenance of plant and equipment • Noise barriers • Noise enclosures • Absorption materials • CNP applications • Noise monitoring equipment (meter and calibrator) (if required)

Table 3.1 Items Requiring Budget Allocation for Equipment / Material with Respect to Different Environmental Issues (Continued)

Environmental Issue	Items Requiring Budget Allocation
Wastewater Control	<ul style="list-style-type: none">• Wastewater treatment plant/sedimentation tanks• Coagulant and neutralization agents• Perimeter cut off drains• Temporary site drainage• Chemicals for treatment processes• Licence applications• oil interceptors• Sand bags• Water quality monitoring and analysis• Submersible pumps and water pipe• Sludge disposal• Provision of chemical toilets and maintenance• Sewage treatment facility (if required)

3.1.3 Programming

Good project planning involves developing a programme that takes account of the sequencing of construction activities to minimise environmental impacts and allows the time necessary for establishing environmental mitigation measures. For example:

- No construction activities can proceed during restricted hours without a Construction Noise Permit (note that a Construction Noise Permit may not be issued if the predicted noise levels exceed the standards set in the Technical Memorandum, so avoid programming work in restricted hours, whenever possible);
- Avoid noisy activities during sensitive hours (e.g. during school examination periods);
- Select working practices and equipment that is environmentally friendly, e.g. using quieter plant such as Quality Powered Mechanical Equipment;
- Sequence construction activities to minimise land disturbance to reduce dust impact;
- Schedule compaction and hydroseeding such as soil stabilization to prevent environmental impacts caused by heavy rain;
- Schedule the procurement and installation of pollution control equipment;
- Schedule licence and permit applications; and
- Schedule environmental monitoring, inspection, training and meetings.

Appendix 3.2 shows the items to be considered in project programming.

3.1.4 Method Statement Preparation – Adopting a Proactive Approach

It is important to demonstrate a commitment to environmental protection and to provide proposals to minimise environmental impacts that may be caused by the Contractor's construction methods. Comprehensive proposals showing commitment to environmental protection can provide a competitive advantage in the tendering process. The following initiatives are examples of how the Contractor's environmental capability can be demonstrated:

- Establish a policy on environmental protection endorsed by top management
- Prepare environmental management plan
- Establish an environmental team
- Adopt environmentally friendly construction methods, e.g. using modern well maintained plant

- Use environmentally friendly construction materials and products, e.g. reusable metal scaffold instead of bamboo scaffold
- Consider options for “green” purchasing
- Implement HKCA “Clean Air” Charter

3.1.5 Sub-contract Tender Document

In preparing the tender documents for sub-contractors, the main contractor should make sure that sub-contractors are made aware of their environmental duties and responsibilities for the project. The sub-contract tender document may include:

- Reference to the environmental management plan developed for the project
- Designating a person to act as the sub-contractor's environmental representative
- Statements requiring the sub-contractor to perform construction works strictly in accordance with the environmental legislation in Hong Kong
- Environmental requirements and specifications for the project that the sub-contractors should meet
- Particular significant environmental aspects and sensitive areas of the project
- Incentive/promotion schemes for environmental good practice

3.1.6 Selection of the Sub-contractor

The main contractor undertakes the environmental duties and responsibilities specified in the main contract document. In selecting sub-contractors, the main contractor should also evaluate the sub-contract tenders on environmental grounds. The following evaluation criteria are suggested when selecting a sub-contractor:

- Does the sub-contractor have their own environmental policy and environmental management system?
- Does their method statement demonstrate commitment to environmental protection?
- What is their previous performance records and experience?
- Can they provide competent and experienced environmental staff?

3.2 Stage 2 – Contract Award

Upon award of the contract, the following should be carried out:

- Site planning for environmental protection
- Set up performance targets on resources management for specific construction site
- Green purchasing policy

- Document Environmental Management Plan
- Immediate training needs
- Notifications and permit and licence applications to EPD

3.2.1 Site Planning

The following should be considered during site planning:

- Identify significant environmental aspects and associated impacts;
- Identify environmentally sensitive areas and receivers;
- Carry out baseline survey and monitoring if necessary; and
- Develop environmental mitigation and control measures to address significant environmental impacts.

Appendix 3.3 provides a checklist of items to be considered during site planning.

3.2.2 Green Purchasing Policy

Green purchasing is becoming more important and should be adopted in the project planning stage to make sure the requirements for using environmental friendly products agreed in the tender document are obtained. The following approaches may be considered:

- Adopting alternative environmentally friendly construction methods, e.g. off-site fabrication in controlled conditions and on-site assembly can minimise waste generation and local nuisance
- Adopting more environmentally friendly construction material, e.g. using metal scaffold and formwork of timber from sustainable managed forests
- Using more environmentally friendly machinery and equipment like QPMEs, in which QPME system is administered by EPD. The Contractor may be beneficial from the deduction for specified capital expenditure as mentioned in Section 3.1.2.
- Returning surplus material to the supplier for reuse rather than disposal
- Agreeing “take-back” service with supplier for material packaging and pallets

3.2.3 Environmental Management Plan

An Environmental Management Plan (EMP) should be prepared to address the potential significant environmental aspects and impacts and to propose appropriate mitigation measures. Preparation of an EMP is a requirement of ETWB TC 19/2005 for capital works contracts (including Design & Build

contracts and E&M contracts, with a contract sum greater than \$20 million and contract period longer than 6 months).

The content of the EMP should include:

- Environmental policy
- Organizational structure for environmental management
- Environmental duties and responsibilities of different levels of staff
- Environmental training
- In-house rules and regulations
- Environmental committees
- Performance monitoring
- Promotion
- Review of legal and other requirements
- Nuisance abatement measures
- Emergency preparedness procedures
- Waste reduction targets
- Waste management measures
- Environmental records and their control

3.2.4 Training

To ensure a consistent high-level of environmental performance on both the construction project, training should be provided to the project team and workforce to raise their environmental awareness, knowledge and skills. The training provided should target the significant environmental aspects relating to the project. Refer to Chapter 15 of this Guide for more details on training resources.

3.2.5 Promotion

The Contractor may consider organizing competitions which serve as another mean to increase their environmental awareness. Besides, incentive schemes could be considered to be provided to front line site staffs on different environmental initiatives, such as resources saving and good site practices to enhance their commitments and environmental performance.

3.2.6 Notifications and Licence and Permit Application

As soon as practicable following award of the contract and prior to the commencement of construction work, the following should be undertaken, as necessary:

- Notify EPD of the commencement dates of construction work relating to construction dust (Notifiable Work)
- Open a billing account for disposal of construction waste (within 21 days of contract award)
- Register as a chemical waste producer

- Application to EPD for licence for conducting Specified Processes, if necessary
- Application to EPD for permit for dumping at sea, if necessary
- Apply for an effluent discharge licence
- Apply for a Further Environmental Permit, if necessary
- Apply for a Construction Noise Permit, if necessary

3.2.7 Planning for Emergencies related to Environmental Issues

Emergency situations identified on construction sites may include:

- Accidental spillage of fuels, oil or other chemicals to land or to water bodies causing pollution
- Surface water run-off due to rainstorms causing flooding and pollution

When planning how to response to an environmental emergency situation, the following should be addressed:

- Identify all environmental hazards that could cause an emergency situation. A risk assessment can assist in this process;
- Develop suitable emergency preparedness and response plans and procedures;
- Carry out regular emergency drills; and
- establish an emergency team and communicate to all personnel.

The emergency team should be provided with appropriate training to handle the predicted emergency situations. The emergency team should be lead by a senior staff member.

The responsibilities of the Emergency Team include:

- Implementing the emergency plans and procedures including preventing pollution impacts when it is safe to do so
- Notifying emergency services and authorities as appropriate
- Providing first-aid when needed before emergency services arrive
- Conducting a debriefing after the emergency to review procedures for their continued effectiveness

An emergency contact list should be prepared including the emergency hotline numbers of the relevant utilities (e.g. electricity, gas and water supply), appropriate government agencies (ambulance, police, fire service and EPD) and

members of the emergency team. That information should be posted permanently on-site.

3.2.8 Carrying out Baseline Monitoring

Environmental monitoring is usually required to be carried out at designated locations under an EM&A programme and/or the specification. It is also considered best practice to conduct voluntary monitoring in other cases when the project is situated close to sensitive receivers.

Baseline monitoring should be carried out before main construction works starts so it is important to establish monitoring stations as soon as possible. Environmental monitoring is carried out to ascertain the baseline and to establish compliance levels with respect to parameters such as dust and noise.

3.3 Stage 3 – Construction

During construction the following should be undertaken:

- Implement EMP
- Carry out impact monitoring
- Maintain public relations
- Implement emergency response procedures

3.3.1 Implement EMP

During the construction stage it is essential to effectively implement the plan. All personnel should be made aware of their responsibilities under the EMP. The EMP should be regularly reviewed to make sure it reflects current site activities. The implementation of the EMP should include:

Recognizing legal and other requirements

- Site management should be fully aware of the legal, contractual and other requirements relevant to the construction project
- Significant environmental aspects should be identified and appropriate mitigation measures and operational controls determined

Enforcing mitigation measures

- Make sure all mitigation measures are in place and in good condition and are capable of reducing environmental impacts to comply with relevant standards
- Allocate personnel and resources to maintain facilities and equipment

Monitoring and reporting

- Conduct monitoring and inspection of the site and perimeter on a regular basis, check compliance and take action when necessary
- Meet with relevant parties and sub-contractors to resolve any sub-standard performance both on an ad-hoc and regular basis
- Regularly report performance to top management.

Continual improvement

- Identify opportunities to improve performance through regular analysis and review of performance data, including reviewing on performance targets on resources management
- Establish corrective action plan to improve the environmental performance if necessary.

3.3.2 Impact Monitoring

During the course of construction, impact monitoring should be carried out in accordance with the EM&A Manual (if any) and/or the specification or on a voluntary basis.

Should there be any exceedance of the compliance levels, the situation should be investigated and corrective action taken when necessary.

3.3.3 Maintaining Public Relations

It is important to maintain good relations with neighbours close to the site and the general public.

A suggested public relations strategy can be developed and implemented using the following approaches:

Set up clear communication channels

- Display environmental hotline at prominent locations along the site boundary
- Provide contact details to key sensitive receivers such as schools and residential buildings nearby
- Deploy designated personnel to be responsible for receiving, investigating and responding to enquiries and complaints in a timely manner.

Meet with relevant stakeholders

- Explain details of the construction project
- Organize activities and environmental promotion to engage with the public and neighbours
- Show the mitigation measures such as noise barriers, dust suppression, treatment facilities being implemented on site

- Consider posting results of environmental inspections and monitoring to demonstrate performance.

3.3.4 Emergency Response Procedure

Emergency response procedures established for each potential emergency situation should be implemented. Practice drills should be conducted on a regular basis and also before high-risk periods (e.g. conduct rainstorm drills before summer wet season).

Typical procedures for typhoon events and heavy rainstorms

Precautions to be taken prior to wet season:

- Check and maintain all silt removal facilities, channels and manholes and remove any deposited silt and grit or other blockage regularly;
- Provide intercepting channels along the crest/edge of excavation to prevent storm runoff from washing across exposed soil surfaces; and
- Excavate and backfill trenches in short sections. Measures should be taken to minimize the ingress of rainwater into trenches.

Actions to be taken when a typhoon or rainstorm is imminent or forecast:

- Check silt removal facilities, channels and manholes to ensure that they can function properly;
- Minimize open stockpiles of construction materials such as aggregates, sand and fill materials on site; and
- Secure all temporary covers to stockpiles.

Actions to be taken during or after typhoons or rainstorms

- Avoid an unnecessary risk during typhoons and rainstorms; personnel should take care not to put themselves at risk; and
- Check and maintain silt removal facilities, channels and manholes after typhoons or rainstorms to ensure they are clear of silt and debris.

Typical procedures for chemical spill

- Alert all personnel in the work area and inform the Emergency Team. Consult the MSDS to determine safe handling and disposal procedures.

- Assess the severity of the spillage, the Emergency Team Leader should determine whether emergency services such as the Fire Services Department should be informed to handle the incident.
- If it is safe to do so, the Emergency Team should take the following immediate actions:
 - Stop the spill;
 - Confine the spill with earth barriers or similar;
 - Contain the spill inside the work area and prevent it from entering waterways or drainage systems; and
 - Remove all heat and ignitable sources.
- The Emergency Team should take the following action if safe to do so:
 - Use the chemical spill kit;
 - Absorb the spill with soil, sawdust or absorbent;
 - Pack the used absorbent into plastic bag and label it; and
 - Dispose the labelled plastic bag in chemical waste store for subsequent collection by licensed waste collector.

If the chemical properties of the spilt material are not known and/or the spill is large, extra care must be taken. Personnel should be evacuated from the area and await the emergency services.

Appendix 3.1: Recommended Items to be included in the Project Budget

Tender No. :

Project Name :

Budget Schedule

Item	Description	Quantity	Unit	Rate	Amount (HK\$)
1	GENERAL				
1.1	Preparation of an Environmental Management Plan for the project		Item		
1.2	Update Environmental Management Plan		Month		
1.3	Arrange and attend weekly environmental walk with reporting		Week		
1.4	Provide Environmental Officer on site		Month		
1.5	Provide Environmental Supervisor on site		Month		
1.6	Arrange and attend Site Safety and Environmental Committee Meeting		Month		
1.7	Arrange and attend Site Safety and Environmental Management Committee Meeting		Month		
1.8	Provide environmental induction training to all staff and workers		Item		
1.9	Provide environmental toolbox talk to all workers		Item		
1.10	Incentive schemes for construction site staffs to enhance their involvement in various environmental initiatives		Item		
1.11	Various environmental award schemes		Item		

Item	Description	Quantity	Unit	Rate	Amount (HK\$)
2	DUST CONTROL				
2.1	Provision and maintenance of vehicle washing / water recycling facilities at site exit		Item		
2.2	Paving of main haul road		m ²		
2.3	Application of water/dust suppression chemicals for dust control		Job		
2.4	Establishment of dust monitoring equipment		Item		
2.5	Monitoring and reporting of dust level		Month		
2.6	Dismantling of dust monitoring equipment		Item		
2.7	Provision and maintenance of hoarding		m		
2.8	Provision of covering of dusty materials		Item		
3	AIR POLLUTION CONTROL				
3.1	Application of licence for conducting Specified Processes		Item		
3.2	Handling of asbestos containing materials		Job		
3.3	Use of non/low VOC products		Item		
3.4	Use of ULSD fuel		Litre		
4	CHEMICAL WASTE				
4.1	Provision of chemical waste storage facilities		Item		

Item	Description	Quantity	Unit	Rate	Amount (HK\$)
4.2	Designated staff to manage chemical wastes		Job		
4.3	Disposal costs for chemical waste		Job		
4.4	Emergency Spillage Kit		Item		
4.5	Fee for register as chemical waste producer		Item		
4.6	Conducting chemical spillage drills		Item		
5	WASTEWATER CONTROL				
5.1	Provision and maintenance of perimeter ditch and site drainage		m		
5.2	Provision of wastewater treatment system to treat the construction wastewater to the required discharge standards		Unit		
5.3	Operation/maintenance of wastewater treatment system		Month		
5.4	Monitoring and analysis of effluent discharge quality		Month		
5.5	Provision of chemical toilets with inclusion of maintenance and desludging contracts throughout the project period		Item		
5.6	Fee for application for discharge licence		Item		
6	NOISE CONTROL				
6.1	Establishment of noise monitoring equipment		Item		
6.2	Monitoring and reporting of noise level		Month		

Item	Description	Quantity	Unit	Rate	Amount (HK\$)
6.3	Dismantling of noise monitoring equipment		Item		
6.4	Provision of suitable noise barriers or enclosures		Item		
6.5	Provision of Quality Powered Mechanical Equipment (QPME)		Item		
7	WASTE MANAGEMENT				
7.1	Application for permit for sea dumping		Item		
7.2	Provision of waste sorting containers		Item		
7.3	Delivery of C&D waste, recyclable materials		Ton		
7.4	Deposit for Billing Account of construction waste disposal		Job		
7.5	Charge of disposal of C&D waste to landfill		Tonne		
7.6	Charge of disposal of public fill to public filling facility		Tonne		
8	TREE PROTECTION				
8.1	Carry out tree survey		Item		
8.2	Tree transplanting		Item		
8.3	Tree felling		Item		
8.4	Provision and maintenance of protective fence for individual tree		Item		
8.5	Routine preservation of protected tree within site		Month		

Item	Description	Quantity	Unit	Rate	Amount (HK\$)
9	COMMUNITY RELATIONS				
9.1	Provide environmental bulletin board		Item		
9.2	Prepare and publish environmental performance report		Item		
9.3	Organise environmental campaign		Item		
9.4	Handle public complaints against pollution nuisances arising from the construction sites				
				Sub-total	HK\$

Appendix 3.2: Checklist for Project Programming

Item	Considered in programme		Remarks
	Yes	No	
GENERAL			
Schedule for baseline environmental monitoring	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule for environmental training	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule for inspections	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule for environmental meeting	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule for meeting requirements stipulated in the Environmental Permit for Designated Project	<input type="checkbox"/>	<input type="checkbox"/>	
AIR			
Submission of Form NA - Notification of Commencement of Construction Works included	<input type="checkbox"/>	<input type="checkbox"/>	
Application to conduct a Specified Process (e.g. concrete batching plant)	<input type="checkbox"/>	<input type="checkbox"/>	
Erection of hoarding prior to carry out construction works	<input type="checkbox"/>	<input type="checkbox"/>	
Scheduling of earthworks during dry season	<input type="checkbox"/>	<input type="checkbox"/>	
Purchase or hire and delivery of air pollution control equipment (e.g. wheel wash, sprinkler systems)	<input type="checkbox"/>	<input type="checkbox"/>	
Installation of air pollution control equipment and associated facilities	<input type="checkbox"/>	<input type="checkbox"/>	
Maintenance of air pollution control equipment	<input type="checkbox"/>	<input type="checkbox"/>	
NOISE			
Purchasing or hire of necessary plant (e.g. QPME)	<input type="checkbox"/>	<input type="checkbox"/>	
Maintenance of plant and mechanical equipment	<input type="checkbox"/>	<input type="checkbox"/>	
Purchase and installation of noise barriers or enclosures	<input type="checkbox"/>	<input type="checkbox"/>	
Limit working hours between 0700 and 1900 on weekdays	<input type="checkbox"/>	<input type="checkbox"/>	
Carry out no works in restricted hours without Construction Noise Permit issued by EPD	<input type="checkbox"/>	<input type="checkbox"/>	
Application periods for Construction Noise Permits considered?	<input type="checkbox"/>	<input type="checkbox"/>	
Percussive piling requiring CNP considered?	<input type="checkbox"/>	<input type="checkbox"/>	
Application for Effluent Discharge Licence	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Considered in programme		Remarks
	Yes	No	
WATER QUALITY			
Installation of site temporary drainage facilities	<input type="checkbox"/>	<input type="checkbox"/>	
Purchase or hire of wastewater control facilities	<input type="checkbox"/>	<input type="checkbox"/>	
Installation and commissioning of wastewater control facilities	<input type="checkbox"/>	<input type="checkbox"/>	
Maintenance of wastewater control and site temporary drainage facilities	<input type="checkbox"/>	<input type="checkbox"/>	
WASTE MANAGEMENT			
Registration as a Chemical Waste Producer	<input type="checkbox"/>	<input type="checkbox"/>	
Application for a billing account for construction waste and obtain chits	<input type="checkbox"/>	<input type="checkbox"/>	
Application for permit for dumping at sea	<input type="checkbox"/>	<input type="checkbox"/>	
Frequency of the disposal of chemical wastes	<input type="checkbox"/>	<input type="checkbox"/>	
Selection and engaging licensed waste collectors at the early stage of the project	<input type="checkbox"/>	<input type="checkbox"/>	
Select and establish suitable chemical waste storage area on site to avoid relocation at the later stages of the project	<input type="checkbox"/>	<input type="checkbox"/>	
Select and establish suitable areas on site for waste segregation and sorting	<input type="checkbox"/>	<input type="checkbox"/>	
Frequency for the collection of C&D waste and the recyclables	<input type="checkbox"/>	<input type="checkbox"/>	
Handling of contaminated land issues	<input type="checkbox"/>	<input type="checkbox"/>	
TREE PROTECTION			
Time allowed for tree survey (if required)	<input type="checkbox"/>	<input type="checkbox"/>	
Time allowed to obtain approval for tree transplantation or tree felling	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule tree transplantation/ tree felling /on-site protection	<input type="checkbox"/>	<input type="checkbox"/>	

Appendix 3.3: Checklist for Site Planning

	Planned		Remarks
	Yes	No	
GENERAL			
Consider site and surrounding environment, location of nearby sensitive receivers	<input type="checkbox"/>	<input type="checkbox"/>	
Use site offices and containers as barriers to shield sensitive receivers	<input type="checkbox"/>	<input type="checkbox"/>	
Establish environmental emergency team and procedures	<input type="checkbox"/>	<input type="checkbox"/>	
Erect signboards (e.g. for publicity and environmental hotline numbers)	<input type="checkbox"/>	<input type="checkbox"/>	
AIR			
Select suitable haul road routing and site entrance/exit	<input type="checkbox"/>	<input type="checkbox"/>	
Erection of hoarding	<input type="checkbox"/>	<input type="checkbox"/>	
Provide dust screen on scaffold and impervious sheeting on material hoist	<input type="checkbox"/>	<input type="checkbox"/>	
Provide water supply for dust suppression	<input type="checkbox"/>	<input type="checkbox"/>	
Control vehicle speed (speed bumps and speed limit signs)	<input type="checkbox"/>	<input type="checkbox"/>	
Provide dust control for demolition works, debris handling, drilling, blasting or other dusty operations	<input type="checkbox"/>	<input type="checkbox"/>	
Provide areas available to store stockpile of dusty materials	<input type="checkbox"/>	<input type="checkbox"/>	
Locate and provide sufficient space to install wheel washing facility at each site exit	<input type="checkbox"/>	<input type="checkbox"/>	
Provide space and location to accommodate air pollution control facilities	<input type="checkbox"/>	<input type="checkbox"/>	
Determine work schedule to minimise dust emission	<input type="checkbox"/>	<input type="checkbox"/>	
NOISE			
Select suitable plant and equipment to reduce sound power level (e.g. use of QPME)	<input type="checkbox"/>	<input type="checkbox"/>	
Use silencers and mufflers	<input type="checkbox"/>	<input type="checkbox"/>	
Minimise the number of concurrent noisy activities	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	
Site or orientate noisy equipment and activities away from receivers	<input type="checkbox"/>	<input type="checkbox"/>	
Locate where noise barriers or enclosures are required	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule activities to prevent work being carried out in restricted hours	<input type="checkbox"/>	<input type="checkbox"/>	

	Planned		Remarks
	Yes	No	
WATER QUALITY			
Design site temporary drainage system	<input type="checkbox"/>	<input type="checkbox"/>	
Locate and provide sufficient space for wastewater treatment facility	<input type="checkbox"/>	<input type="checkbox"/>	
Identify location of wastewater discharge point	<input type="checkbox"/>	<input type="checkbox"/>	
Provide adequate supply of chemicals for water treatment	<input type="checkbox"/>	<input type="checkbox"/>	
Establish monitoring schedule for checking quality of water discharge	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule work activities to minimise water pollution (e.g. minimize exposed ground surface)	<input type="checkbox"/>	<input type="checkbox"/>	
Seal hoarding to prevent surface water entering site	<input type="checkbox"/>	<input type="checkbox"/>	
Provide cut off drainage to prevent surface water leaving the site	<input type="checkbox"/>	<input type="checkbox"/>	
WASTE MANAGEMENT			
Locate waste collection points (including, inert C&D Material, recyclables and C&D Waste) and provide access route	<input type="checkbox"/>	<input type="checkbox"/>	
Locate waste segregation and sorting areas	<input type="checkbox"/>	<input type="checkbox"/>	
Locate chemical waste storage area and provide access route	<input type="checkbox"/>	<input type="checkbox"/>	
Determine routing for transport of wastes	<input type="checkbox"/>	<input type="checkbox"/>	
Locate segregation bins for general waste (e.g. paper, cans)	<input type="checkbox"/>	<input type="checkbox"/>	
Establish trip-ticketing system for waste disposal	<input type="checkbox"/>	<input type="checkbox"/>	
Establish Waste Flow Table (i.e. to identify and record expected quantities of waste to be managed)	<input type="checkbox"/>	<input type="checkbox"/>	
Provide chemical spill kits	<input type="checkbox"/>	<input type="checkbox"/>	
Arrange and conduct spill drills	<input type="checkbox"/>	<input type="checkbox"/>	
TREE PROTECTION			
Establish tree management plan	<input type="checkbox"/>	<input type="checkbox"/>	

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4 Construction Dust Management

4.1 Terminology

Construction Dust

Dusty materials produced as a result of construction work being carried out. This may include cement, earth, pulverized fuel ash, aggregates, silt, stone fines, sand, debris, sawdust and wooden chips.

Notifiable Work

Notifiable Work under the Construction Dust Regulations includes:

- Site formation
- Reclamation
- Building demolition
- Work to be carried out inside a tunnel where it is within 100m from the portal
- Construction of building foundation
- Construction of building superstructure
- Road construction

Regulatory Work

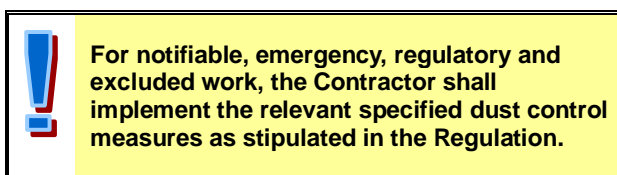
Regulatory Work under the Construction Dust Regulations includes, but is not limited to, road opening or resurfacing, external renovation and slope stabilization works.

Emergency Work

Emergency Work under the Construction Dust Regulations is works required in an emergency situation where human life or building safety is being threatened. It also includes repair work that is required as a result of a failure of utility services, road collapse or road blockage.

Excluded Work

Excluded Work includes, but is not limited to, internal renovation, a specified process, cleansing and inspection of underground utilities, and works to be carried out entirely under water.



Air Sensitive Receivers

Air sensitive receivers are locations that are susceptible to air pollution, such as:

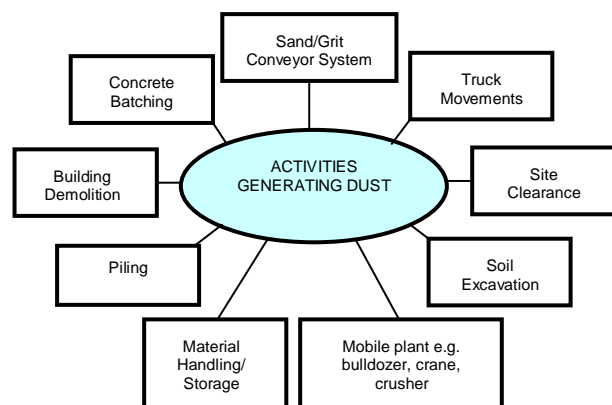
- Human environment (e.g. residential dwellings)
- Natural environment (e.g. parks, playgrounds and ecologically sensitive areas).

Total Suspended Particulates (TSP)

Small airborne particulates such as dust, fumes and smoke with a diameter of less than 100 micrometres. The observed human health effects of TSP include breathing and respiratory symptoms, aggravation of existing respiratory disease and damage to lung tissues.

4.2 Major Source of Construction Dust

Construction dust arises from a variety of activities as shown in the graphic below. Preventing dust at source is the most effective method of mitigation. The following sections provide further details of those methods.



4.3 Licence and Notification Requirements

4.3.1 Licence Requirements for Conducting a Specified Process

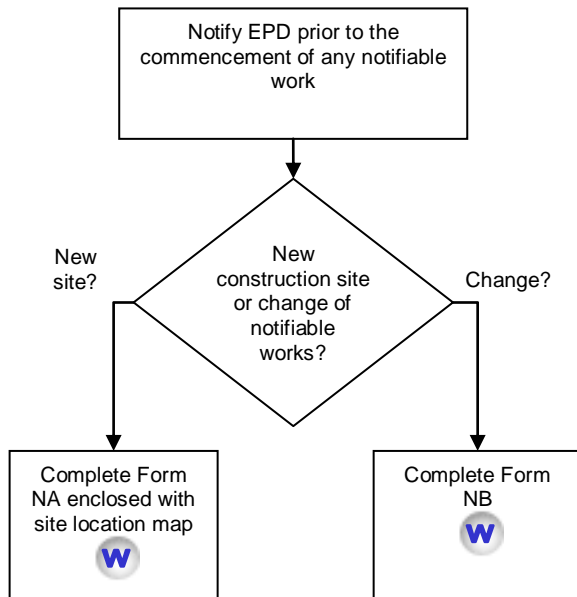
A licence is required to carry out any Specified Process such as cement works. Details of Specified Processes and their licence requirement can be found in Chapter 5, Section 5.2 of this Guide.

4.3.2 Control Requirements for Notifiable Work

Under the Air Pollution Control (Construction Dust) Regulation (Refer to Chapter 2 for details), the main contractor responsible for a construction site where notifiable work is proposed to be carried out has to give notice to EPD before the commencement of the work.

The main contractor also needs to give notice to EPD of any proposed change relating to the particulars given in the previous notice(s) before the proposed change takes effect. Giving notice to Environmental Protection Department enables them

to carry out checks of the construction site to verify that the control measures as stipulated in the regulation have been properly implemented. The notification procedure is shown below:

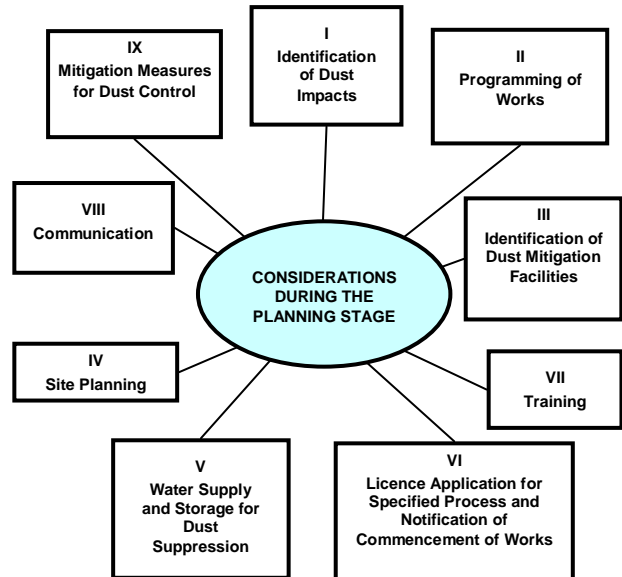


Notification to EPD under the regulation is free of charge. Notification is not required for Emergency Work, Excluded Work and Regulatory Work.

4.4 Construction Dust Control

4.4.1 Planning Dust Controls

During the planning stage of the project, the elements to consider when determining effective dust controls are shown in the graphic below and described in this section:



I Identification of Dust Impacts

In order to determine the likely dust impacts arising from the construction works, the construction activities that may produce dust should be identified together with the location of the nearest air sensitive receivers in relation to the construction site. Construction activities that involve generating and handling of dusty materials, include:

- Grinding
- Breaking concrete
- Excavation
- Vehicle movements

Other considerations include the direction of the prevailing winds in relation to the site and the weather conditions.

II Programming of Works

Dust impacts can also be reduced by careful programming of works:

- Schedule the work with consideration of the potential major dust generating activities to minimise the exposure period and exposed area of dusty stockpiles/materials;
- Backfill and reinstate the excavated area as soon as possible; and

- If possible, arrange trucks to transport the dusty materials during off-peak hours

III Identification of Dust Mitigation Facilities

- Identify dust mitigation facilities required, e.g. water lorry, wheel-washing facilities and water sprinkler system.
- Work out the cost effectiveness of those facilities. For instance:
 - timer control for the sprinkler system along the haul road (water could be mixed with dust suppression chemicals to enhance performance); and
 - sprinkling areas manually that cannot be reached by the sprinkler system.
- The haul road surface should be kept wet at all times. As a rule of thumb, water spraying should be conducted at least every 2 hours during hot and dry conditions when evaporation of water is greatest. More frequent water spraying should be conducted as and when necessary.

IV Site Planning

To reduce dust impacts:

- Avoid conducting construction activities such as handling dusty material near to sensitive receivers;
- Consider the prevailing wind direction; avoid handling dusty materials upwind of sensitive receivers;
- Locate activities or processes that may generate dust as far away from sensitive receivers as possible (e.g. haul roads and stockpiles.)
- Locate temporary structures such as site offices and containers to act as dust barriers;
- Pave site areas as far as possible; and
- Regularly review construction activities to make sure mitigation is effective.

V Water Supply for Dust Suppression

A consistent supply of water for dust suppression purposes should be made available, make sure:

- Adequate quantities of water are available;
- Water is available at each area requiring dust suppression;
- Reuse and recycling of water is promoted;
- Supply of reused water is segregated from potable water supply;
- Water is stored to avoid risk of mosquito breeding;
- Label water tanks to identify contents; and
- Distribution system is provided.

Encourage reuse of the treated water from the wastewater treatment facility and construct a rainwater harvesting system on site to provide water for dust suppression.

VI Licence Application for Specified Process and Notification of Commencement of Works

- For application of specified process licence, refer to Section 4.4.7 and Section 5.2 for details; and
- For notifiable work, refer to Section 4.3 for details.

VII Training

All personnel should receive training relevant to their needs. It is particularly important for supervisors and workers to be made aware of:

- dust impacts resulting from their activities; and
- how to control dust on site in terms of using the dust control facilities and good housekeeping practices.

Training material such as The Environmental Toolbox Training Kit developed by the Hong Kong Construction Association (HKCA) is referenced in this Guide. Refer to Chapter 15 for details.

VIII Communications

Pro-actively obtain feedback about the effectiveness of the implementation of dust mitigation measures from sensitive receivers.

IX Mitigation Measures for Dust Control

- Dust control requirements under the Air Pollution Control (Construction Dust) Regulation should be followed throughout the construction period.



- Modifications to the mitigation measures may be required to suit actual site conditions.

An instruction video showing construction site dust management can be viewed at EPD's website.





Exemption

Some construction works are exempted from certain dust control measures because of the physical constraint in the construction site in adopting the required control measures:

Road construction work

- Exempt from hoarding requirement.

Road opening or resurfacing work

- Exempt from vehicle washing facilities and hoarding requirements.

Slope stabilization

- Exempt from vehicle washing facilities requirement; and
- Exempt from hoarding requirement if the site boundary adjoins road for vehicular traffic.



Cleaning trucks before leaving the site

- Provide 2.4 m high hoarding along the site boundary that is accessible to the public except for a site entrance or exit, it is recommended to seal the base of the hoarding and provide cut-off drainage to prevent water run-off

4.4.2 Dust Control Measures

Good Housekeeping

A good housekeeping checklist for construction dust is attached in Appendix 4.1.

Site Boundary, Entrance and Hoarding

Except for road opening or resurfacing work or construction work carried out in a construction site that is completely paved or completely covered with hardcore:

- Vehicle washing facilities with high pressure water jet are to be provided



Using high-pressure water for vehicle cleaning

- Water for vehicle washing should be recycled
- Wastewater should be treated prior to discharge
- The road between the vehicle washing facilities and the site exit should be paved with concrete, bituminous materials or hard core

Road Opening/Resurfacing Work

- Spray water or dust suppression chemical on the working surface where piling, drilling, cutting, polishing or other mechanical breaking operations causing dust emissions are carried out
- In addition, isolate the work site appropriately using impervious sheets so as to minimise uncontrolled dust dispersion to surrounding public areas



Dust barrier using impervious sheeting



The main contractor is responsible for making sure trucks leaving the site comply with regulations such as cleaning vehicles and covering loads of dusty material.

As a good practice, the Contractor should erect a drop bar or deploy a security guard at every site exit to allow checking. Only those vehicles that are clean and have their dusty loads covered should be allowed to leave the site. Photos or video could be taken to provide record of compliance.

The Contractor would not be responsible under the Regulation for any vehicles running on the road with its load not entirely covered or whose bodies and wheels are not clean. Such cases will be controlled by FEHD and the Police under other relevant ordinances.

Excavation or Earth Moving

Activities where materials are excavated or transferred are subject to control:

- Spray excavation or earth with water or dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet



Water browser tanker can be used to spray water over a large construction site, especially for civil construction



Water should be sprayed regularly to avoid dust emission. Automatic sprinkler system should be considered to reduce manpower required

Site Clearance

- The work area for the uprooting of trees, shrubs, or vegetation or for the removal of boulders, poles, pillars or temporary or permanent structures should be sprayed with water or dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet
- All demolished items which are likely to dislodge dust particles when exposed should be covered entirely by impervious sheeting or placed in an area sheltered on the top and three sides

Exposed Surface in Open Areas

- Monitor the exposed surface condition and spray with water or dust suppression chemicals as necessary
- Carry out compaction, turfing, hydroseeding and vegetation planting as far as practicable to protect the exposed surface
- Do not place stockpiles of dusty materials outside the construction site/hoarding



Compacting and hydroseeding slopes and open areas prevents dust

Exposed Dust Generating Stockpile

- Exposed stockpile and debris should be dampened or covered entirely by impervious sheets or stored in a sheltered debris collection area, i.e. with covers on the top and three sides.
- Minimise the number of stockpiles
- Allocate suitable locations for placing stockpiles of dusty materials
- Store materials away from the site boundary and downwind of sensitive areas
- Compact stockpile surfaces
- Minimise storage time on site

Haul Roads and Access Roads

Except for road opening or resurfacing work:

- The main haul road (with 4 or more vehicles passing in any 30 minutes) shall be:

- (i) paved with concrete, bituminous materials, hardcore or metal plates, and kept clear of dusty materials; or
- (ii) compacted and sprayed with water or a dust suppression chemical to maintain the entire road surface wet.
- Impose a reasonable vehicle speed limit such as 8 kph within the site
- The portion of any road only leading to a construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials



Providing a paved road prevents dust impacts and keeps the site clean

Loading and Unloading of Dusty Materials

- Except for cement and pulverised fuel ash and special cases when dusty materials are to be maintained dry, all dusty materials shall be sprayed with water or dust suppression chemical immediately prior to loading and unloading operations
- Cover the dusty materials loaded in trucks with impervious sheeting before leaving the site. As a good practice, mechanical cover for dump truck should be considered for more effective mitigation
- To promote the use of mechanical covers, the Government has reserved budget in those public works contracts which have adopted the Pay for Safety Scheme (PFSS) or Pay for Safety and Environment Scheme (PFSES) to pay the installation costs of mechanical covers on the dump trucks serving these contracts. The Government requires the contractors to pay to the owners of the concerned dump trucks serving the respective public works contracts. Dump Truck owners must have their dump trucks installed with mechanical covers and registered in the Scheme at CEDD. For details, please refer to CEDD's webpage. [W](#)



Mechanical covers on dump trucks have environmental and safety benefits

Concrete Production

- For production of concrete or any other substances using bagged cement or dry pulverised fuel ash, the de-bagging, batching and mixing processes should be carried out in an area sheltered on the top and three sides
- Storage of 20 or more bags of cement should be either covered or enclosed in an area sheltered on the top and the 3 sides



Providing an enclosure and dust extraction equipment when conducting dusty activities

Disposal of Dusty Material

- Cement, pulverized fuel ash or any other dusty materials collected by fabric filters or other air pollution control system or equipment should be disposed of in totally enclosed containers

Debris handling

- Any debris shall be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the 3 sides

- Where a debris chute discharges into a skip or container, it should be enclosed with impervious sheeting or sprayed with water
- Before debris is dumped into a debris chute, it should be sprayed with water

Pneumatic or power-driven drilling, cutting and polishing

- Water or a dust suppression chemical shall be continuously sprayed on the surface where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation that causes dust emission is carried out, unless the process is accompanied by the operation of an effective dust extraction and filtering device

Blasting

- Wet the area within a radius of 30m prior to blasting
- No blasting should be carried out during the strong wind signal or tropical cyclone warning No.3 or higher is hoisted unless prior permission of the Commissioner of Mines is obtained
- Erect a dust screen or blast door

Control of Dark Smoke

Dark smoke from any plant (for example diesel generators) can be reduced by:

- Maintaining plant and equipment properly
- Using better quality diesel fuel that enhances combustion efficiency
- Adding a precipitator at the exhaust

Refer to Chapter 5 of this Guide for more details of these controls.

Implementing Dust Suppression Measures

- Select most suitable dust suppression method
- Allocate resources to apply suppression
- Monitor performance by recording frequency of application and review its effectiveness
- Amend frequency or method when necessary to improve effectiveness

Avoiding Bad Practice

- Make sure air pollution control systems are operating correctly, when such a system is required
- Do not place any stockpile of dusty materials beyond the pedestrian barriers, fencing or traffic cones when carrying out road opening or resurfacing works

- Compressed air jets shall not be used for cleaning or clearing dust from any vehicle or equipment

4.4.3 Construction Dust Mitigation Techniques

Physical Barriers

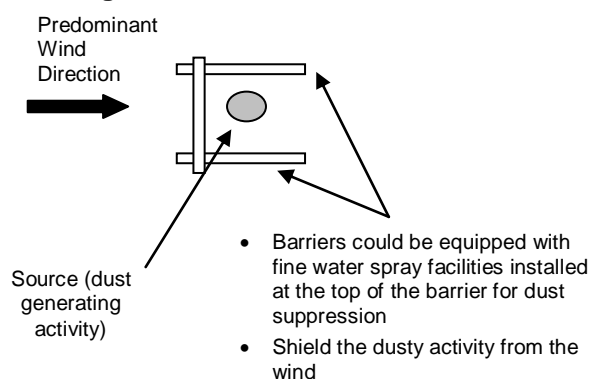
Use of physical barriers to reduce dust dispersion:

- Erect hoardings to contain the dust within the site
- The height of the hoarding should not be less than 2.4m
- Noise barriers can also serve as a barrier to reduce dust emission
- To increase the effectiveness of the barrier, it should be placed as close to dust generating activities as possible, and should shield against the wind



The site hoarding can act as a general barrier against construction dust dispersion

Positioning of Barrier to Reduce Dust Emission



If the wind direction varies during the dust emitting activity, barrier(s) should be placed to provide maximum shielding to the closest sensitive

receivers, or to shield activities from the more prevalent wind direction.

Use of Covers

- In some cases, dust mitigation may be more efficient if the dusty material is dampened before placing the cover
- An impervious sheet (e.g. tarpaulin) can enclose the dusty materials, and retain moisture within the material
- For production of concrete using bagged cement or dry pulverized fuel ash, the debagging, batching and mixing process shall be carried out in an area covered on top and 3 sides



Dust enclosure



Covers are used to minimise dust emission at construction sites, especially for locations near sensitive receivers

Use of Recycled Wastewater for Dust Suppression

- Recycled water is ideal for dust suppression. Wastewater that has been treated should be retained for reuse
- Water tanks or holding ponds are used to store the treated water temporarily but they should be regularly checked to avoid mosquitoes breeding



Some construction sites use recycled/treated water for cleaning

Use of Sprinkler System for Dust Suppression

The use of fixed sprinkler systems is effective to suppress dust in situations including:

- Large construction sites
- Haul roads where there is considerable distance to the public pavement
- Aggregate storage areas (be aware of any moisture content implications)

Systems may be automated by using timers or trip switches.

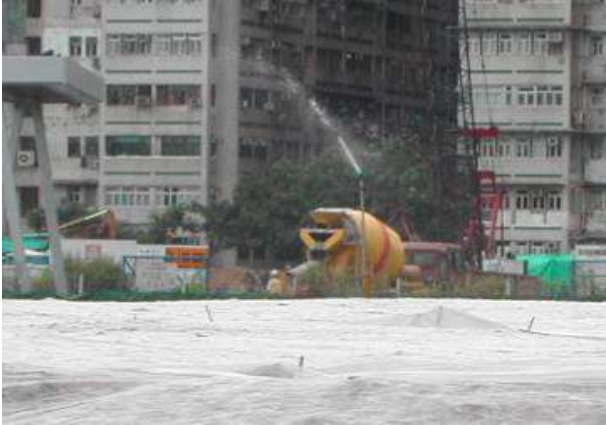
Sprinkler systems do have limitations including:

- Wind affects
- Limited area coverage, normally up to 5 m radius
- Obstruction of construction activities



Fine water spray used to suppress dust at waste discharge point (Photo is extracted from EPD's website)

The water spraying system installed laterally on the waste collection bins provides a water mist to suppress dust emission. Equipped with sensors at the access doors of the chutes, the water consumption of the water spraying system can be minimized while remaining effective.



Sprinkler System is an Effective Mitigation Measure for Dust Suppression at Large Construction Site

Use of Chemicals for Dust Suppression

An alternative solution for the mitigation of dust emissions. They have the following characteristics for effective results:

- Aqueous acrylic vinyl acetate polymer emulsion
- 5 – 50% (weight) acrylic and vinyl acetate polymer
- 50 – 90% (weight) water
- specific gravity 1.01 to 1.15
- non-hazardous
- non-combustible
- acrylic odour
- low toxicity

Suggested application frequency is shown below:

Traffic Situation	Frequency	Dosage
Heavy Traffic	Once every 2 – 4 weeks	0.5 – 0.7 litre/m ²
Moderate Traffic	Once every 2 – 6 weeks	0.4 – 0.5 litre/m ²
Light Traffic	Once every 2 – 8 weeks	0.3 – 0.4 litre/m ²

Use of Wheel-Washing Facilities

A wheel wash facility needs to be established at all exit points that are used by construction traffic. The facilities should include as a minimum:

- high pressure water jet, and
- cut off drainage to prevent water entering existing drainage.

The washing area should be laid to a fall so that wastewater can be collected for reuse or treatment.

Heavy duty metal grating may also be provided so that dust and sand can drop off from the vehicles when they move slowly over the grating.

A tank can be installed under the grating facility to retain washed sand and water.

The use of automatic wheel-washing facilities can be very efficient and cost effective but do require maintenance. They often need to be “built-in” so are less flexible when the site arrangement needs to change regularly.



Wheel Wash Bay at Site Exit



Install Grating to Further Remove Sand and Dust from the Vehicles

Belt Conveyor System

A belt conveyor system is an effective way to transfer large quantities of material on or off construction site (see photo below). They can be useful in transferring excavation material such as soil during earth work and site formation work. To mitigate dust:

- Enclose belt conveyors by covering its top and two sides
- Enclose all transfer point between belt conveyors
- Install belt scrapers and bottom plates
- Limit the vertical distance between the end of a belt conveyor and the material landing point

- Cover the unloading area (e.g. a storage bin, a truck or a barge should be covered on the top and the three sides)



Example of Conveyor Belt System

4.4.4 Site Examples

Good Practices

Bad Practices

Stockpile and Exposed Slope



Dusty stockpile is properly covered to avoid windblown dust emission



Dusty stockpile is not covered, leading to potential windblown dust emission

Haul Road



Water spraying is applied on haul road to suppress dust emission



Haul road is dry and dusty

Site Exit



Wheel-wash facility is provided at site exit to remove sand / dust from vehicles



Washing facility at site exit is not provided leading to deposition of soil and dust on the public road

Good Practices

Bad Practices

Handling of Dusty Material



Dusty loading on dump truck is properly covered to avoid dust emission during transportation



Loading is higher than the side and tail boards of the vehicles, resulting in dust emission during transportation

Dusty Operation



Water spraying and covering are applied during drilling work



No water spraying and covering during drilling work, resulting in dust emission



The breaking surface is wetted to suppress dust during breaking work



No water spraying is applied during breaking work, resulting in local dust emission

4.4.5 Building Works

Building Superstructure



Dust Screen along Site Boundary



Impervious Sheeting as Dust Screen for Building Work

Effective dust screens

Where scaffolding is erected around the perimeter of a building under construction or renovation of the outer surface, the following measures should be provided:

- Effective dust screens;
- Sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building. Impervious sheeting can provide better dust screening effect yet wind load should be considered to avoid collapsing of the scaffolding during windy day; and
- If a canopy is provided at the first floor level, sheeting or netting should be provided from the first floor level, up to the highest level of the scaffolding.

Skip Hoist

- Enclose the skip hoist by impervious sheeting

Debris Chute

- Any debris shall be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the 3 sides
- Where a debris chute discharges into a skip or container, it should be enclosed with impervious sheeting or sprayed with water
- Before debris is dumped into a debris chute, it should be sprayed with water

Building Demolition

The area demolition work takes place shall be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after the demolition activities. Wet the working area prior to, during and immediately after demolition.



Water Spraying for Demolition Work

For any wall of the building to be demolished that abuts or fronts upon a street, service lane or other open area accessible to the public, the following additional measures should be provided:

- Impervious dust screens or sheeting should be used to enclose the whole wall to a height at least 1m higher than the highest level of the structure being demolished



Impervious Sheeting as Dust Screen for Demolition Work

- Dusty materials remaining after a stockpile is removed shall be wetted with water and cleared

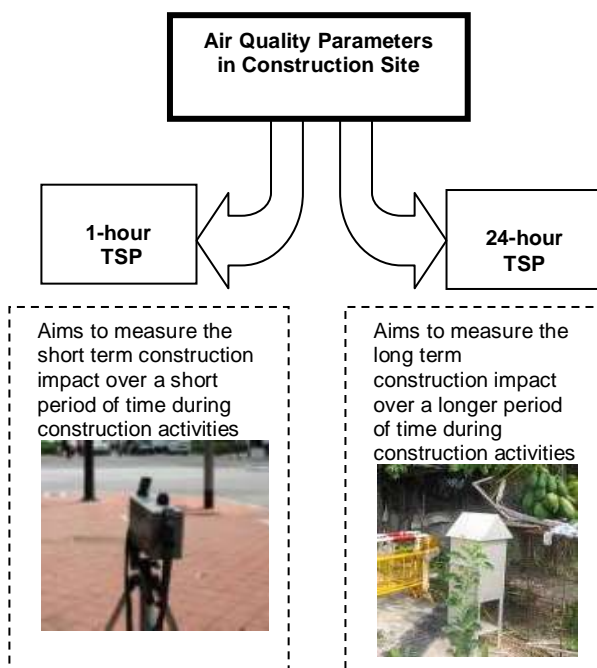
4.4.6 Tunnelling Works

In case where works to be carried out in any part of a tunnel that is within 100m of any exit to the open air, any relevant requirements mentioned in Section 4.4.2 should be met.

4.4.7 Air Quality Monitoring

Air quality monitoring can provide an early indication of deteriorating of air quality and confirm the effectiveness of established mitigation measures.

Air Quality Parameters in Construction Site



Typical requirements for monitoring air quality are provided in Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong.



If your project has an EM&A Manual, the monitoring locations, numbers, measurement frequency, etc are normally given in the manual.

Consult your Environmental Team (ET) Leader or Environmental Officer as prior to commencement of the works if you are not clear about the requirement.

Statutory Requirements

Monitoring as specified under an EP for Designated Projects is usually carried out in accordance with the approved EM&A Manual. Those guidelines are used in developing EM&A Programmes under the EIAO.

Contractual Requirements

Preparation of an Environmental Management Plan (EMP) for construction projects has become a common practice for the construction industry as requested by some clients. The EMP may include the requirements for construction dust mitigation and the associated dust monitoring.



Some projects will require baseline monitoring for consecutive days (normally 14 days) prior to starting the construction works.

It is advisable to check your Contract, Particular Specification or Environmental Monitoring & Audit (EM&A) Manual (if any) to confirm requirements.

For a Designated Project, baseline monitoring is normally required. It can be arranged by the Employer or through the Contractor under the Contract.

To avoid delaying the commencement of construction works, baseline monitoring should be arranged as soon as possible once the award of the construction contract is confirmed.



Can I dispose of waste or generate smoke for expelling mosquito on a construction site by means of open burning?

The disposal of construction waste or the clearance of a site in preparation for construction work or generation of smoke by open burning is prohibited under the Air Pollution Control (Open Burning) Regulation.



Can I apply for a permit for open burning of construction waste?

EPD will not entertain any application for permit for open burning of construction waste or for the purpose of site clearance, which are prohibited by the Air Pollution Control (Open Burning) Regulation.

Appendix 4.1: Site Inspection Checklist

Site Inspection Checklist – Dust				
		Implemented		Remark
		Yes	No	
Material Handling				
1	Watering is undertaken whenever necessary for the following:			
	Unpaved areas (e.g. unpaved main haul road)	<input type="checkbox"/>	<input type="checkbox"/>	
	Access roads	<input type="checkbox"/>	<input type="checkbox"/>	
	Construction areas	<input type="checkbox"/>	<input type="checkbox"/>	
	Any dusty materials before loading and unloading	<input type="checkbox"/>	<input type="checkbox"/>	
	Stockpile of dusty materials	<input type="checkbox"/>	<input type="checkbox"/>	
	Debris chute	<input type="checkbox"/>	<input type="checkbox"/>	
2	Water sprays are either fixed or mobile to allow individual areas to be wetted as and when required	<input type="checkbox"/>	<input type="checkbox"/>	
3	Application of suitable wetting agents (e.g. dust suppression chemicals) is used in addition to water if necessary	<input type="checkbox"/>	<input type="checkbox"/>	
4	Debris is covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the 3 sides	<input type="checkbox"/>	<input type="checkbox"/>	
5	Every debris chute shall be enclosed by impervious sheeting or similar materials	<input type="checkbox"/>	<input type="checkbox"/>	
6	Conveyor belts are fitted within windboards	<input type="checkbox"/>	<input type="checkbox"/>	
7	Conveyor transfer points and hopper discharges are enclosed	<input type="checkbox"/>	<input type="checkbox"/>	
8	Drop heights are minimised from all conveyors	<input type="checkbox"/>	<input type="checkbox"/>	
9	Materials that have the potential to create dust are totally enclosed	<input type="checkbox"/>	<input type="checkbox"/>	
10	Storage time of materials on site is minimised	<input type="checkbox"/>	<input type="checkbox"/>	
11	Bulk crushing and/or material storage takes place inside sheds	<input type="checkbox"/>	<input type="checkbox"/>	
12	Skip hoist is enclosed by impervious sheeting	<input type="checkbox"/>	<input type="checkbox"/>	
13	Debris chute is enclosed by impervious sheeting	<input type="checkbox"/>	<input type="checkbox"/>	
14	Debris collection area is sheltered on the top and the 3 sides	<input type="checkbox"/>	<input type="checkbox"/>	
Hoarding / Dust Screen				
15	Hoarding of not less than 2.4 m high from ground level is provided along the building site boundary	<input type="checkbox"/>	<input type="checkbox"/>	
16	Effective dust screens, sheeting or netting is provided to enclose any scaffolding built around the perimeter of the building under construction	<input type="checkbox"/>	<input type="checkbox"/>	
17	Screening of dust generating activities through the use of wind breaks	<input type="checkbox"/>	<input type="checkbox"/>	

Site Inspection Checklist – Dust				
		Implemented		Remark
		Yes	No	
Excavation				
18	Working area of any excavation or earth moving operation is sprayed with water immediately before, during and immediately after the operation	<input type="checkbox"/>	<input type="checkbox"/>	
19	Exposed earth is properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with suitable surface stabiliser within 6 months after the last construction activity on the site	<input type="checkbox"/>	<input type="checkbox"/>	
20	Any spoil, debris or material and silt are removed and the affected land and areas are restored to the natural state	<input type="checkbox"/>	<input type="checkbox"/>	
Vehicle Dust / Emission				
21	Heights from which excavated materials are dropped during loading/unloading are minimised	<input type="checkbox"/>	<input type="checkbox"/>	
22	Three-sided roofed enclosure with a flexible curtain across the entry is provided when dusty materials are discharged to vehicles from a conveying system at a fixed transfer point	<input type="checkbox"/>	<input type="checkbox"/>	
23	Surface of the areas within the site where there is regular movement of vehicles are paved and any loose surface material is removed	<input type="checkbox"/>	<input type="checkbox"/>	
24	Vehicles within the site are restricted to a maximum speed of 8 kph and speed limit signage is put up at appropriate locations	<input type="checkbox"/>	<input type="checkbox"/>	
25	Haulage and delivery vehicles are confined to designated roadways inside the site	<input type="checkbox"/>	<input type="checkbox"/>	
26	Materials transported off-site by vehicles are covered by tarpaulin, with the cover properly secured and extended over the edges of the side and tailboards	<input type="checkbox"/>	<input type="checkbox"/>	
27	Dusty materials are dampened before transportation	<input type="checkbox"/>	<input type="checkbox"/>	
28	Vehicle washing facility(ies) is/are provided at all site exist(s) to wash away any dusty materials from vehicle body and wheels before they leave the site	<input type="checkbox"/>	<input type="checkbox"/>	
29	A hard-surfaced road between any washing facility and the public road is provided	<input type="checkbox"/>	<input type="checkbox"/>	
30	Wheel washing facilities are inspected, maintained and cleaned on a regular basis	<input type="checkbox"/>	<input type="checkbox"/>	
31	Vehicles are inspected regularly and well maintained to ensure that they are operating efficiently and that exhaust emissions are not causing nuisance	<input type="checkbox"/>	<input type="checkbox"/>	
32	Vehicle engines are turned off when they are not in use	<input type="checkbox"/>	<input type="checkbox"/>	
33	Settling silt/sediment in wheel washing bays is removed regularly	<input type="checkbox"/>	<input type="checkbox"/>	
34	Any earth, mud and debris at the site exit is removed	<input type="checkbox"/>	<input type="checkbox"/>	

Site Inspection Checklist – Dust				
		Implemented		
		Yes	No	Remark
Demolition Works				
35	Any area in which demolition work takes place is sprayed with water immediately prior to, during and immediately after the demolition activities to maintain the entire surface wet	<input type="checkbox"/>	<input type="checkbox"/>	
36	Impervious dust screens or sheeting is used to enclose the whole wall to a height of a least 1m higher than the highest level of the structure being demolished	<input type="checkbox"/>	<input type="checkbox"/>	
37	Any dusty materials remaining after a stockpile is removed are wetted with water and cleared from road surfaces	<input type="checkbox"/>	<input type="checkbox"/>	
38	Use of enclosed chutes for dropping demolition materials to ground level and the chutes are dampened regularly	<input type="checkbox"/>	<input type="checkbox"/>	
39	If asbestos is found in the buildings or structure, special procedures as detailed in the Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste must be followed	<input type="checkbox"/>	<input type="checkbox"/>	
Drilling and Blasting				
40	Spray water during breaking of rock or concrete	<input type="checkbox"/>	<input type="checkbox"/>	
41	Areas within 30m from the blasting area shall be wetted with water prior to blasting	<input type="checkbox"/>	<input type="checkbox"/>	
42	Blasting operations are well arranged and appropriate precautions are taken (e.g. use of blast nets, canvas covers and watering)	<input type="checkbox"/>	<input type="checkbox"/>	

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5 Air Pollution Control

5.1 Plant and Equipment Emissions

5.1.1 Statutory Requirements

Under the Air Pollution Control (Smoke) Regulation, dark smoke shall not be emitted continuously for more than 3 minutes or more than 6 minutes in any period of 4 hours from any chimney or industrial plant. Dark smoke means smoke with intensity equal to or darker than shade 1 on a Ringelmann Chart.

Machinery commonly found on construction sites, such as excavator, air compressor and bulldozer fall under the control of this regulation.

An owner of any premises who operates any chimney or relevant plant in such a manner described above commits an offence and is liable:

- (a) on first conviction, to a fine of \$20,000 and in addition to a fine of \$100 for every 15 minutes during the whole or any part of which such offence is knowingly and wilfully continued; and
- (b) on any subsequent conviction, to a fine of \$20,000 and to imprisonment for 3 months and in addition, to a fine of \$100 for every 15 minutes during the whole or any part of which such offence is knowingly and wilfully continued.

Under the Air Pollution Control (Furnaces, Ovens and Chimneys) (Installation and Alteration) Regulations, diesel generators in a construction site that are used as a fixed installation including stand-by generators for tunnelling works and bio-piles for soil remediation have special control requirements if they also met the following criteria:

- The total diesel consumption of the generator exceeds 25 litres per hour;
- The total capacity of the generators is below 5 MW; and
- The generators are not part of a Specified Process.

Prior approval is required from EPD to install this type of equipment. Application is free of charge but must be made at least 28 days in advance of commencing the related works.

The application should be submitted with an elevation and plan view of the proposed installation prepared by an Authorized Person (i.e. an architect, engineer or surveyor on the authorized persons'

register kept under section 3 of the Building Ordinance) or a Qualified Engineer (i.e. a registered professional engineer in the building services, gas, chemical, marine or mechanical engineering disciplines under the Engineers Registration Ordinance).

Under the Air Pollution Control (Fuel Restriction) (Amendment) Regulation 2008, no person shall use diesel fuel that has a sulphur content of more than 0.005% by weight or a viscosity of more than 6 centistokes at 40°C in any relevant plant.

5.1.2 Contractual Requirement

In accordance with ETWB TCW 19/2005, for land-based constructional plant driven by internal combustion engines such as an air compressor and generator, the Contractor shall ensure that the smoke emission does not exceed Shade 1 on a Ringelmann Chart continuously for 30 seconds at any time.

Smoke includes:

- dust or fumes, and
- soot, ash, grit or gritty particles emitted in smoke or steam.

Monitoring parameter includes:

- Smoke density, and
- Visual assessment by Ringelmann chart.

Ultra-low-sulphur diesel (ULSD) (defined as diesel fuel containing not more than 0.005% by weight of sulphur) shall be used in all diesel-operated construction plant on most of Government projects. This can help reduce the emission of sulphur dioxide. Note that this contractual requirement became a legal requirement from October 2008.

Exhaust fumes should be directed away from sensitive areas such as where workers are present or where there is an interface with the public.

Where the public can be affected by exhaust fumes or smoke emission from any construction plant or activities, the related activities shall be shielded by an incombustible screen such as corrugated sheet. The screen should be of at least 2m in width and 1.8m in height such that the emission source can be effectively shielded.

5.2 Best Practice to Reduce Emission

The following practices can help reduce and control emissions:

Construction Plant and Equipment


- Switch off the engine of construction plant when idling and place reminder notices near the switches.
- Implement preventive maintenance for plant and equipment and maintain stock of regularly required replacement parts.
- Hire plant and equipment of adequate size and power output. Do not overload the plant.
- Use cleaner fuel such as ULSD in diesel-operated construction plant to reduce sulphur dioxide emission.
- Use power supplied from power utilities when practicable (e.g. to replace generators).
- Install catalytic converters or particulate traps on plant exhausts to reduce soot emission.
- Extend the exhaust pipe to point away from sensitive receivers.
- Erect screen to shield the emission source from sensitive receivers.

Site Office and Workplace

To improve environmental performance in the workplace the following should be implemented:

- Set a comfortable room temperature for site offices.
- Use high efficiency fluorescent tubes, e.g. T5 tubes or LED, for lighting.
- Switch off air conditioning and lighting for conference room and other functional room when not in use and place reminder notices near the switches.
- Switch off unnecessary lighting and equipment after working hours.
- Arrange dedicated mass transport (e.g. shuttle bus) or car pooling to remote projects to minimize individuals need to drive to work.

5.3 Specified Processes

The major stationary air polluting processes such as power plant, incinerator, concrete batching plant, which are classified as Specified Processes in the Air Pollution Control Ordinance, are subject to a more stringent emission control. A licence is required for the operation of these processes under Part IV of the Ordinance. The list of these thirty processes and their definitions are contained in the Schedule 1 of the Ordinance. 

5.3.1 Examples Relevant to the Construction Industry

Cement Works

Works in which the total silo capacity exceeds 50 tonnes and in which cement is handled or in which argillaceous and calcareous materials (fine dusty materials) are used in the production of cement clinker, and works in which cement clinker is ground.



Concrete Batching Plant

Tar and Bitumen Works

Works of the following kinds in which the installed capacity exceeds 250 kg per hour and in which:-

- gas tar or coal tar or bitumen is distilled or is heated in any manufacturing process; or
- any product of the distillation of gas tar or coal tar or bitumen is distilled or heated in any process involving the evolution of any noxious or offensive gas; or
- heated materials produced from gas tar or coal tar or bitumen are applied in coating or wrapping of iron or steel pipes or fittings.



Bitumen Plant

Mineral Works

Works in which the processing capacity exceeds 5000 tonnes per annum and in which:-

- Metallurgical slag; or
- pulverised fuel ash; or
- Minerals, other than moulding sand in foundries or coal at electricity works.

are subjected to any size reduction, grading or heating by a process giving rise to dust, not being any works described in any other specified process.



The application process for a Specified Process Licence requires at least 3 months. Therefore, it is advised to submit the application as soon as practicable to avoid any delay to the subsequent construction programme.

Under Section 12 of the APC Ordinance, the owner of the premises conducting a specified process shall use best practicable means (BPM), to prevent noxious or offensive emissions.

The EPD will also use the published guidance notes when assessing a licence application. The List of Guidance Notes on Best Practicable Means can be found at EPD's webpage.



The application forms prescribed in the Second Schedule to the Air Pollution Control (Specified Processes) Regulations and guideline is provided on the EPD's website.

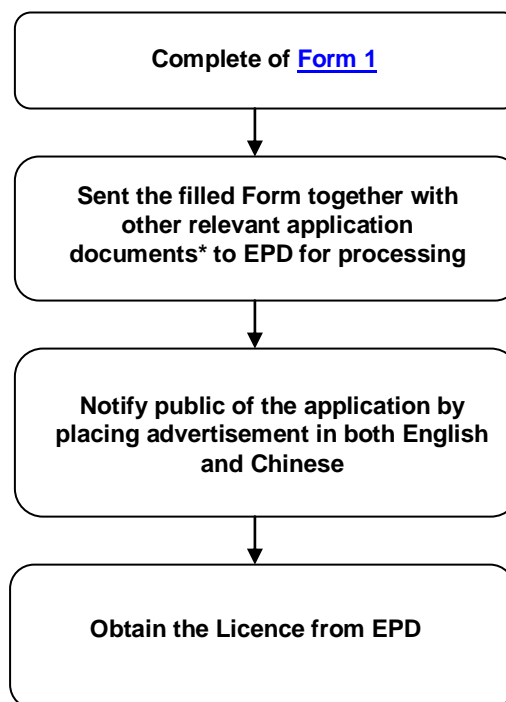


A separate application form is required for each process. If more than one process is being conducted in the same premises requiring a licence to be renewed, use a separate application form for each process.

5.3.2 Application Process

The application procedure for a Specified Process Licence is shown in Figure 5.1.

Figure 5.1 – Application Procedure for Specified Process Licence



*** Relevant application document include:**


- Application payment
- Air pollution control plan (2 copies)
- A block plan, drawn to a scale of 1:500 and prepared & endorsed by an authorized person (i.e. an architect, engineer or surveyor whose name for the time being on the authorized persons' register kept under section 3 of the Building Ordinance) (2 copies)
- Schematic diagrams of process flow prepared & endorsed by a qualified engineer (i.e. a registered professional engineer in the building services, gas, chemical, marine or mechanical engineering disciplines under the Engineers Registration Ordinance) (2 copies)
- 2 copies of Business Registration Certificate (BRC) and Certificate of Incorporation (COI) of the applicant

5.4 Volatile Organic Compounds

5.4.1 What are Volatile Organic Compounds?

Volatile Organic Compounds (VOCs) are organic chemical compounds that have high enough vapour pressures under normal conditions to significantly vaporize and enter the atmosphere. VOCs are present in paints and solvents and upon use, are released inadvertently to the ambient air contributing to photochemical smog pollution that reduces visibility.

There are 51 types of architectural paints/coatings, 7 types of printing inks, 6 broad categories of consumer products, 14 types of vehicle refinishing paints/coatings, 36 types of vessel paints/coatings and pleasure craft paints/coatings, and 47 types of adhesives and sealants being regulated under the Air Pollution Control (Volatile Organic Compounds) Regulation.

Architectural paint/coatings are widely used in construction site. The list of these regulated paints and their corresponding limit of VOC content can be found in Schedule 1 of the VOC Regulation. 

It is the importers and manufacturers' obligation to comply with the VOC limit of the regulated paint. The Contractor can help by switching to using zero- or low-VOC paint products.

5.4.2 Best Practices to Reduce VOC Emission

The following practices can help reduce VOCs emission at construction site:

Painting work

- Use water-based paint over solvent-based paint.
- Use low-VOC content retarder or high pressure water jet to remove old paint instead of using high-VOC content stripping chemicals.
- Adopt the "little and often" practice to prepare paint on site. Paint can evaporate as VOCs and be wasted.
- Avoid spraying; where possible use brushes or rollers for painting instead. When spraying is necessary, use HVLP (high-volume low-pressure) spray guns to reduce the amount of thinner and any overspray.
- Consider the use of pre-painted items instead of painting on site. Emission from the coating of pre-painted items in a factory environment can be more effectively controlled than spraying on site.

Storage of VOC chemicals

- Accurately estimate the amount of chemicals to be used, do not over order.
- Keep records of chemicals in stock to help identify wastage.
- Store chemicals in lidded, light-colour containers in a cool place away from strong sunlight.
- Keep the lid on containers as much as possible to prevent evaporation. Seal with adhesive tape if necessary to store long term to prevent vapour loss.
- Avoid spills.

5.5 Prohibition on Open Burning

5.5.1 Air Pollution Control (Open Burning) Regulation

Open burning means burning of any materials in the open air without any enclosure nor any chimney to direct the smoke away so generated.

The Air Pollution Control (Open Burning) Regulation is introduced to prohibit open burning of construction waste, the clearance of a site in preparation for construction work, tyres, and open burning for the salvage of metal.

5.5.2 Activities Exempted from the Regulation

The following activities are exempted from the regulation.

- burning of incense, candle sticks, joss paper for ritual purposes.
- fires for cooking of food such as barbecue for amenity purposes se water-based paint over solvent-based paint.
- fires set for fire testing, training and education by any Government fire fighting force or agency.
- agricultural burning of materials grown on site, solely for weeding, land disinfection, pest control, or burning to make firebreaks in the countryside.
- open burning required for emergency situations to ensure public safety.

5.5.3 Application for Open Burning Permit

If opening burning is required, application form should be submitted to EPD for their approval. A permit will be granted only if the Authority is fully satisfied that there is no viable alternative to achieve the purpose.



5.5.4 Practical Means to Prevent Illegal Open Burning at Construction Site

In this section, the following practical means is suggested to prevent illegal open burning at construction site:

- Refraining from carrying out prohibited open burning activities.
- Advise your staff and others to abide by the regulation by disseminating tool-box talks.
- Remind all staff and others not to repel mosquito by burning of papers. To be proactive, good housekeeping should be maintained to prevent mosquito breeding in construction site.
- Any waste should be properly disposed of at landfills or recycled at a recycling plant with emission control equipment.

- **Establishment and contributions to targets:**

To establish specific energy consumption and air emissions targets, contribute to achieving them, and to share good practices and air quality expertise with their counterparts.

- **Review and continual improvement:** To review and monitor energy efficiency/emissions reduction results in a consistent manner, to map out appropriate strategies for enhancement and to report appropriate information to all levels of management and employees.

5.6 HKCA Clean Air Charter

The Clean Air Charter program was launched by HKCA in August 2007. Participating organizations and companies are expected to abide by the following principles when they implement their energy/emissions management system on construction sites under their stewardship.

- **Corporate priority:** To recognize energy/emissions management as among the highest corporate priorities; to establish policies, programs and practices that make sustained improvement to air quality on every site.
- **Integrated management:** To fully integrate the policies, programs and practices into each business area as an important element in the corporate management agenda.
- **Process of improvement:** To improve the performance of reducing air pollution of participating projects, taking into consideration technological developments, legislative changes and community expectations.
- **Benchmarking:** To use benchmarking as an effective way of identifying areas that could be improved and hence prioritized in energy efficiency and emission reductions.
- **Training and promotion:** To raise the awareness and knowledge of all levels of management and employees of the project team on the Clean Air Policy by supporting training initiatives.

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6 Noise Impact Control

6.1 Terminology

Acceptable Noise Level (ANL)

Acceptable Noise Level (ANL) is the term used in Technical Memoranda for assessing a Construction Noise Permit (CNP) application. The ANL is a level determined by considering the location of a noise sensitive receiver (NSR), duration of the CNP and multiple permit situations.

Construction Noise

Noise associated with construction activities at:

- Domestic premises (e.g. domestic renovations);
- Public places (e.g. roadworks); and
- Construction sites and other places (e.g. renovation of offices).

Examples of construction activities include installation, construction, alteration, repair, maintenance and demolition. This type of noise also tends to be temporary and transient. Excessive noise will lead to hearing loss and mental stress and irritation. It can also interfere with daily activities such as doing homework, watching television and talking on the telephone.

Corrected Noise Level (CNL)

Corrected Noise Level (CNL) is the term used in Technical Memoranda for assessing a Construction Noise Permit (CNP) application. In general, it is determined by considering the summation of SWL of all PME, the distance and existence of substantial barriers between the PME and NSR, and acoustic reflection from the NSR. In normal situations, a CNP may be granted only when the CNL is found to be equal to or less than the ANL.

Designated Areas

Designated Areas are areas that have further controls imposed under the NCO. They are mostly the urban areas of Hong Kong SAR and are set out on plans held by EPD and available to view at Regional Offices of EPD and at EPD's website. The Designated Areas have been extended under laws which will come into effect on 1 January 2009.

Control of SPME and PCW will apply in a Designated Area.



Influencing Factor

Influencing Factor (IF) for classification of Area Sensitivity Rating (ASR) of an area.

As defined by the Technical Memoranda (TM) of Noise Control Ordinance (NCO), any industrial area, major road or area within the boundary of Hong Kong International Airport shall be considered to be an IF.

The term "major road" means a road which has a heavy and generally continuous flow of vehicular traffic and, in normal circumstances, means a road with an annual average daily traffic flow in excess of 30,000. Where a major road has an unusually low traffic flow rate (< 300 veh./hr.) at the time of day under consideration, it shall not be considered as an IF at that time.

Noise Sensitive Receiver (NSR)

Noise Sensitive Receiver (NSR) means any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing arts centre etc. Any other premises or place, not being in the nature of either industrial or commercial premises, which is considered by the Authority to have a similar sensitivity to noise as the premises and places above shall also be considered to be a Noise Sensitive Receiver. Any premises or place shall, however, be considered to be a Noise Sensitive Receiver only when it is in use for its intended purpose.

Powered Mechanical Equipment (PME)

Powered Mechanical Equipment (PME) is defined under the Noise Control Ordinance as any machine or device driven by electrical, chemical or thermal energy including energy transmitted by compressed air, steam, or hydraulic means; a principal function of which is to produce mechanical movement. Items of PME include generators, drills, breakers, excavators and cranes. The use of PME during restricted hours (between 1900 and 0700 hours and any time on a general holiday, including Sunday) within any Hong Kong territories shall be under the Construction Noise Permit control mechanism.

Prescribed Construction Work (PCW)

Prescribed Construction Work means the construction work prescribed for the purpose of section 6(2) of the Noise Control Ordinance. PCW is:

- Erection or dismantling of formwork or scaffolding;
- Loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material; and
- Hammering.

The conduction of PCW during restricted hours (between 1900 and 0700 hours and any time on a general holiday, including Sunday) within the Designated Areas shall be under the Construction Noise Permit control mechanism.

Restricted Hours

Restricted hours means the time between 1900 and 0700 hours on normal weekdays and any time on a general holiday, including Sunday.

Sound Power Level (SWL)

Sound power level is a logarithmic measure of the sound power in comparison to a specified reference level. The sound power level is, generally, given the symbol L_w or SWL and is measured in "dB(A)".

Specified Powered Mechanical Equipment (SPME)

Specified Powered Mechanical Equipment means those items of PME as specified in Table A.3 of Annex A in the Technical Memorandum on Noise from Construction Work in Designated Areas. SPME are hand-held breaker, bulldozer, concrete lorry mixer, dump truck and hand-held vibratory poker.

6.2 Statutory and Non-Statutory Requirements

Refer to Chapter 2 of this Guide with respect to the Noise Control Ordinance (NCO) for details of subsidiary regulations and non-statutory requirements.

6.3 Liability of Directors under the Noise Control Ordinance (NCO)

There is a provision in the NCO that a company's director may be liable for conviction under the NCO.

Under the NCO – Section 28A, where an offence under this Ordinance has been committed by a body corporate, any person who at the time of the offence was:

- a director concerned in the management of the body corporate;
 - a director who has delegated his authority for the management of the body corporate to an officer;
 - an officer mentioned in the second point above; or
 - an officer:
 - concerned in the management of the body corporate; and
 - acting under the immediate authority of a director of the body corporate,
- shall be guilty of the like offence.

Top management should implement good management practice to prevent violation of the NCO. A "*Code of Practice on Good Management Practice to Prevent Violation of the Noise Control Ordinance*" is issued by EPD providing general guidance to the construction industry.



6.4 Good Management Practices to Prevent Violation of NCO

Good management practices to prevent violation of NCO include:

- Prepare and issue a Noise Control Policy statement
- Establish Management System to address NCO issues
- Establish noise management responsibility for different levels of staff
- Keep top management up to date on noise control activities
- Include noise control matters on the agenda of top management meetings
- Establish regular meeting to review construction noise incidents
- Top management to check and review noise control activities to ensure compliance with NCO
- Prepare report to top management advising whether noise concerns are properly addressed
- Promptly notify top management of noise incidents
- Take actions to correct any noise incident and non-compliance with NCO
- Ensure top management is fully aware of the implementation of corrective action
- Liaise and communicate with affected neighbours on an ongoing basis



If the main contractor is the CNP holder but has handed over the site to a sub-contractor, which party would then be responsible for a noise offence spotted at the site?

Each suspected offence case under the NCO should be considered on its own merits. EPD would consider all available information to ascertain whether there is any real non-compliance under the NCO. Concerned parties should approach EPD to provide all necessary background case information where appropriate to facilitate the investigation of any alleged offence.

6.5 Construction Noise Source

6.5.1 Noise Generating Activities

Noise generating activities at a construction site can broadly be grouped into:

- i) General Construction Work, which includes the use of PME and operation of PCW; and
- ii) Percussive Piling.

6.6 Construction Noise Permit

6.6.1 When is a Construction Noise Permit Needed?

It is the statutory requirement under Section 6 of the NCO that a CNP is required for the following situations:

- PME is used during restricted hours
- PCW is carried out in a Designated Area during restricted hours
- Percussive piling is carried out

Flowcharts identifying when it is necessary to apply for a CNP are provided in Appendix 6.1.



Percussive piling is prohibited during restricted hours such that CNP will not be granted by EPD.



Can I carry out some minor preparatory works on Sundays, such as tiling works, painting or wall plastering?

If your works only involve manual works and do not involve any PME or PCW, the works could be carried out without a CNP.

If PME (e.g. generator for lights, electric grinder/drill/water pump) is required, a valid CNP must be obtained prior to commencement of the works.

If your construction site is located inside Designated Areas and the works involve PCW, a valid CNP shall be obtained prior to commencement of the works.

Use of PME or carrying out of PCW inside Designated Areas without valid CNP is an offence under NCO.

6.6.2 Construction Noise Permit in Force

The CNPs, which are in force, can be viewed from EPD's website.



Checking the existence of other CNPs in force in the vicinity of the site prior to application for CNP is important. Any new CNP issued by EPD shall in result increase the noise influence to nearby NSR(s) such that the chance on getting additional CNP from EPD would be reduced.

6.6.3 Application for a CNP

EPD provides guidance notes for CNP application. Those notes can be viewed at EPD's website.



Application forms can be downloaded from EPD's website:

- General Construction Work



- Percussive Piling




CNPs can also be applied for through an on-line application process.



Time for Application for a CNP

Under the NCO, EPD shall notify their decision of the CNP application within **28 days** after receiving the application.

However, since 2004, EPD aims to handle CNP applications within **14 days** provided that the given information is adequate and comprehensive.



What information do I need to submit to EPD apart from the completed application form for CNP?

1 copy of Business Registration Certificate;


2 copies of the site plan(s) (preferably 1:1000) showing the construction site and the noise sensitive receivers;

2 sets of photograph (3R size) for each item of powered mechanical equipment to be used (No photograph is required for the application of CNP for percussive piling); and

1 copy of the Noise Emission Label for any air compressor and/or hand held percussive breaker to be used.


What are the fees for the application or renewal of a CNP? Can the fee be refunded if my application is refused?

The fees required for the application of CNPs can be found at EPD's webpage.



The fees for renewal of CNPs are the same as fresh applications.

The fees are not refundable even if your application is refused.

EPD have established self-assessment tools to help applicants carry out a preliminary calculation. The Contractor is recommended to assess the construction noise level to determine the likelihood of getting CNP before application.

- Assessment tool for General Construction Noise



- Assessment tool for Percussive Piling



Case 1: General Construction Work - Site not within a Designated Area


- CNP is required for use of PME during restricted hours
- The acceptable noise level depends on the area sensitivity rating of the concerned area
- More details can be found from "*Technical Memorandum on Noise From Construction Work Other Than Percussive Piling*"



Case 2: General Construction Work – Site within a Designated Area

- Apart from the use of PME during restricted hours, the use of SPME and carrying out of PCW are regulated at Designated Areas during restricted hours
- **PCW** is generally not permitted inside a Designated Areas during restricted hours
- For use of **SPME**, the Acceptable Noise Levels are more stringent being 15 dB(A) less than those listed in the "*Technical Memorandum on Noise From Construction Work Other Than Percussive Piling*" before a CNP may be issued;
- More details can be found from "*Technical Memorandum on Noise from Construction Work in Designated Areas*"




The effect of reducing the number of the same plant items by half results in a 3 dB(A) reduction in SWL

Case 3: Percussive Piling

Under the NCO, Percussive Piling means piling:

- By sinking or driving a pile by direct/indirect hammering; or
- By other percussive means including use of a drop hammer, diesel hammer, double acting hammer, single acting hammer, internal drop hammer, pneumatic hammer, steam hammer or other percussive device other than a device that

is portable and designed for operation while held by hand without any form of support.

The permitted hours of operation for percussive piling are shown in Table 6.1.

**Table 6.1 – Permitted Hours of Operation for Percussive Piling
(Not involving the use of diesel, pneumatic and/or steam hammers)**

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a holiday *
10 dB(A) < CNL-ANL	0800 – 0900; and 1230 – 1330 and 1700 – 1800
0 < CNL-ANL ≤ 10 dB(A)	0800 – 0930; and 1200 – 1400; and 1630 – 1800
CNL-ANL ≤ 0 dB(A)	0700 – 1900

*The Authority may vary the timing (but not the total duration) of the permitted hours of operation if it considers that such variation would be justified by the nature or requirements of any NSR which may be affected or of the percussive piling under consideration.

Issuing of a CNP for percussive piling will be based on the results from the assessment described in “*Technical Memorandum on Noise from Percussive Piling*”.



If I use vibratory hammers for piling, do I need a Percussive Piling-CNP for work?

No.

If you use a vibratory hammer for piling, it does not involve the motion of driving a pile by direct/indirect hammering. So you do not need to have a Percussive Piling-CNP for the work.

If I use an excavator mounted breaker for driving sheet piles, do I need a Percussion Piling-CNP for work?

Yes.

The use of excavator mounted breaker for driving sheet piles will involve percussive hammering actions and you do need to have a PP-CNP for the work.

6.6.4 Factors Considered in a CNP Application

The following issues will be considered by EPD in assessing an application:

- Other CNPs concurrently in force;
- Whether the site is located within a Designated Area (not applicable to PP-CNP);
- The Area Sensitivity Rating (ASR) of the NSR (not applicable to PP-CNP);
- Whether the NSR is with/without windows, other openings, central air conditioning system (for PP-CNP only);
- Noise generated by either General Construction Work or Percussive Piling;
- Any complaint history associated with the construction noise; and
- Any prosecution records associated with the applicant.

6.6.5 Strategies for Successful Application of CNP






The following strategies can help increase the likelihood of obtaining a CNP from Environmental Protection Department:

- Surrender CNPs no longer in use. If you have other valid CNP on hand that will not be used concurrently with the new CNP being applied, state it clearly in the application. This information can help reduce the negative correction for multiple CNP situations on ANL.
- Check area sensitivity rating and correction for multiple CNP situations from EPD to obtain up-to-date ANL of the surrounding NSR.
- PME will not always be used concurrently throughout the entire construction sequence. Try to break down the PME list into small groups of equipment that must be used at the same time. State clearly in the application that different groups of PME will not be used concurrently.
- Minimize the working area so as to maximize the distance from the nearest NSR.
- The correct and exact boundary of the working area should be defined clearly to facilitate the Authority to assess the potential noise impact arising from the construction activities concerned. Any change in working area boundary should be justified.
- Take advantage of existing topographic feature of the construction site. If there are large solid objects in between the construction site and the NSR such that none of the PME will be visible as viewed from the NSR, take photos of the situation and state it clearly in the application.

- Construct an acoustic barrier or enclosure to screen the PME. Take photos of the barrier/ enclosure and state it clearly in the application. A negative correction on the noise level could be gained.
- Focus on mitigating the PME with the highest SWL first.
- Discuss your assumptions on noise correction with EPD prior to submitting the application.

The Contractor will need to demonstrate that systems are in place to implement the above.

EPD has prepared a series of on line reference materials and tools to facilitate the application of CNP. For details, please refer to the web links as below:

- Checklists 
- Guidelines 
- Examples 
- Tools to estimate the Acceptable Noise Level (ANL) 
- On line application of CNP 

6.6.6 Special Cases

EPD may consider special cases for acceptance of a CNP application. The provisions for special cases are tabulated in Table 6.2.

Table 6.2 – Provisions of Special Cases for CNP Application

Special Case	Descriptions
Quiet working method or other special factors for PME	Use of Quality Powered Mechanical Equipment (QPME) (see Section 6.8 for details); Provide sufficient details of particularly quiet PME or percussive piling methods, e.g. a sound power measurement report prepared by a qualified person; or Provide special noise mitigation measures, e.g. enclosure or barrier
Quiet working method or other special factors for PCW	CNP may be granted for disposal of rubble through plastic chutes as it is considered as a quiet working method; or EPD is satisfied that location of the work is effectively screened by barriers, acoustic screens, buildings

Special Case	Descriptions
	or other topographical features.
Unavoidable constraints on working hours (not applicable to PP-CNP)	Provide sufficient evidence to demonstrate to the satisfaction of EPD that carrying out the work during restricted hours would cause less public annoyance or inconvenience than during non-restricted hours. Examples: there may be serious interruption or disruption to road user, rail or other forms of transport, utilities (water supply, gas or electricity, etc) or work governed by tidal conditions. Demonstrated to EPD that the quietest practicable working methods (use of silenced PME, acoustic screens) have been exhausted. Note: EPD may lay down additional conditions in a CNP to restrict the use of noisy road-breaking equipment and other particularly noisy work during certain time periods.
Construction work having important social implications	Refusal to grant a CNP may not be in public interest or granting of a CNP may arouse considerable public concern, EPD may refer the matter to the Secretary for the Environment for advice.
Designated geological difficult areas (PP-CNP only)	EPD may consider a CNP application to use diesel hammers if the site is situated in Schedule Areas 2 and 4 in the Fifth Schedule of the Buildings Ordinance (Chapter 123) in which these areas are designated as Geologically Difficult Areas.

A CNP may not be issued for construction work which is to be carried out on or within a building which is either:

- A Noise Sensitive Receiver (NSR) either wholly or partially in use for its intended purpose at the time of the proposed construction work; or
- Directly adjoining a building which is an NSR.


The sound power levels of different types of PME taken from Technical Memoranda are shown in Appendix 6.2.

6.6.7 Actions after Obtaining a CNP


After obtaining a CNP, the Contractor shall:

- Strictly follow CNP conditions, e.g. the number of equipment permitted to be used on the construction site;

- Strictly follow the time allowed to operate the equipment;
- Carry out the activities in accordance with the conditions stipulated in the CNP, e.g. use of noise barrier; and
- Renew the CNP if it is expired before continuation of the works; and
- Establish communication channel with affected neighbours (e.g. notify date and time of the construction works and provide manned complaint hotline to address concerns from affected neighbours).




Under the NCO, there is no statutory control on the noise from general works during the unrestricted hours (i.e. 7 am - 7 pm on weekdays). Contractor should fully utilize the unrestricted hours, which are less noise sensitive. People living near the site have the right of peace during night time and holidays.



If I have a CNP, but I have not fully utilized the plant list permitted in the CNP. Can I use a PME, with a lower sound power level, to substitute the permitted PME which I have not used?

It would be an offence if you use any PME that is not on the list of PME permitted/specified under the CNP. If there is any expected change in the list of PME to be used, you can apply for a new CNP from EPD. EPD would assess each application of CNP on its own merits, and in accordance with the provisions under the NCO.



EPD considers that the granting of a CNP is an exception rather than the norm.

6.7 Noise Emission Label (NEL)

6.7.1 When is a Noise Emission Label needed?

A Noise Emission Label (NEL) is required for the following items when used in a construction site at any time.

- Any Hand Held Percussive Breaker weighted above 10kg; and
- Any Air Compressor capable of supplying compressed air at 500 kPa pressure or above.

6.7.2 Application for a NEL

You should ensure that a valid NEL is available before any items listed in Section 6.7.1 is used in a construction site at any time. In fact, you do not normally need to apply for a NEL, especially for new equipment. The manufacturers or agents normally had already applied for one during the import of the equipment.

In case the original NEL is lost, a duplicate NEL can be applied by completing a prescribed form:

Form for Breaker



Form for Air Compressor




Form for Duplicate of NEL




6.7.3 Actions after Obtaining NEL

After obtaining a NEL, the NEL shall be fitted onto the equipment when it is being used in Hong Kong.




Do I need a second NEL if the noise of the equipment deteriorates?

No. The NEL is good for the life of the equipment. If the equipment is properly maintained and operated, the noise should not deteriorate much. Or else, the equipment is at fault and would need to be repaired.



Some workers do not like to attach the NEL to the breaker when it is being used. Can I provide the NEL to EPD staff for inspection afterwards?

The NEL should be put in a weather proof jacket and affix it on the air compressor or the hand-held percussive breaker.



If the NEL is adhere onto equipment. Do not detach it from the equipment even you find it loosening. You may put it in a weather proof jacket and reaffix it firmly onto the equipment.

6.8 Quality Powered Mechanical Equipment (QPME)

6.8.1 What is QPME?

QPME is equipment that is recognized by EPD as new, notably quieter, more environmentally friendly and efficient.

Typically, QPME is:

- certified to comply with the European Council (EC) Directive 2000/14/EC;
- issued with Low Noise or Super Low Noise Emission Label by the Ministry of Land, Infrastructure and Transport of Japan (MLIT);
- complies with other equivalent or better environmental standards; or
- for a piece of equipment with years of services (counting from the date of manufacture) less than 6 years, the validity period of the first label will be diminishingly apportioned in accordance with Table 6.3 shown below; or
- for those QPME with validity of labels to be expired, the applicants may re-apply, within 6 months before the date of expiry, for the label with the provision of the following documents to demonstrate that the QPME still maintains with quality noise emission complying with the prevailing requirement implemented by the relevant parties.

Table 6.3 Validity Period of QPME Label

Age of Equipment (i.e. years between date of application and the date of manufacture)	Validity Period of QPME Label (from the Date of Issuance)
Less than one year of age since manufacture	6 years
Over 1 year but not exceeding 2 years of age since manufacture	5 years
Over 2 years but not exceeding 3 years of age since manufacture	4 years
Over 3 years but not exceeding 4 years of age since manufacture	3 years
Over 4 years but not exceeding 5 years of age since manufacture	2 years
Over 5 years but not exceeding 6 years of age since manufacture	1 year

There are currently 12 types of equipment commonly used in building work, road work and general construction work that are included in the QPME system.



Individual items of equipment registered with EPD as QPME will be issued with a QPME label.

6.8.2 Application for a QPME Label

A QPME label for individual item of equipment can be applied by submitting a completed application form to EPD. The application is free of charge and will be processed within 28 days. The following documents should be submitted with the application form:-

- PME photos in hard or soft copy showing the serial number, the CE and SWL marking for EU equipment or the low noise/super low noise emission label for Japanese equipment;
- manufacturer's documents showing equipment model type/number, serial number, manufacturing location and the commissioning date; and
- either (a) EC Declaration of Conformity or (b) Japan MLIT letter together with the relevant noise test report/certificate attached.

6.8.3 Actions after Obtaining a QPME Label

If the application is successful, the equipment will be registered into the QPME database and the applicant will be assigned with a QPME User Account.

User can login on to EPD QPME's website with the assigned User Account. Print out the QPME label of the corresponding QPME on a piece of white paper then laminate with clear plastic. Then, affix the label to the corresponding QPME.

6.8.4 Merits of QPME System

The SWL for each of the QPME would be recognized by the EPD for purposes of a CNP application assessment. As the SWL of QPME is normally lower than its traditional PME counterpart, the relevant CNP application is more likely to be successful.

The QPME system supports the "Pay for Safety and Environment" concept of the Works Branch of the Development Bureau. As from April 2008, the capital expenditure on QPME can be deducted from Profits Tax.

From the communities' point of view, the wider use of QPME would help reduce the noise from construction works.

When replacing older plant, the Contractor should consider the manufacturing standards of the new plant as part of its procurement strategy.

6.9 Noise Control

A number of strategies can be adopted by the Contractor to control noise resulting from its activities. Those strategies incorporate administration, system and physical controls. Examples of those strategies are provided.

6.9.1 Noise Policy and Programme

The development and implementation of a noise policy and programme with the aim to:-

- Minimize noise levels and annoyance to the NSRs
- Ensure adequate protection to the staff working in excessive noise environments
- Ensure compliance with all legislation so as to promote a better image to the public and EPD

The noise policy may cover:

- Goals for daily noise exposure levels (for staff health) and peak noise levels in existing and new work areas
- Selection, hire or purchase of “quiet” plant
- Noise controls in temporary noisy areas and situations
- Agreements with all staff in terms of responsibilities for noise control and provision of information on noisy processes
- Periodic review of the noise control programme

A Noise Control Action Programme should:

- Assign a person responsible for implementing and monitoring the programme
- Conduct a preliminary noise assessment to determine whether the noise exposure level will exceed the noise standards
- Develop a programme for the selection of new plant or replacement of plant which can further minimise exposure to noise when necessary
- Decide whether or not engineering noise control measures are practicable and what priorities should be given to different noisy situations (refer to Section 6.9.2 and 6.9.3 of this Guide)
- Decide suitable administrative noise control measures (refer to Section 6.9.4 of this Guide)
- Identify, with the use of appropriate signs, hearing protection areas
- Provide on-going training to employees for noise control
- Develop monitoring procedures to check the effectiveness of the noise control measures and

that those measures are maintained in good order and in position during operations

- Maintain relevant records such as CNP, NEL and noise monitoring records
- Establish a patrol team to ensure legal compliance
- Implement best practice such as turning off plant that is either with long idling or waiting time

6.9.2 Source Control

Controlling or mitigating the actual noise source is the most effective way of managing noise on the construction site. Some examples of common controls are described in this section.

Hand-held Breakers

Hand-held breakers should be:

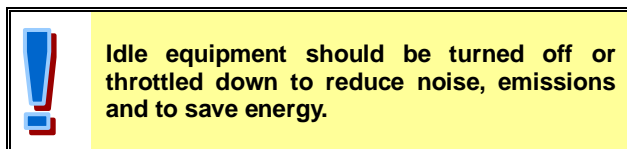
- Fitted with mufflers to minimise the exhaust noise (sudden release of exhaust air) through a longer exhaust passage and to reduce the body radiated noise that originates from the cylinder enclosure



Handheld percussive breaker attached with Noise Emission Label

Mufflers can reduce exhaust noise and body radiated noise by up to 15 dB(A) and 6 dB(A) respectively.

- Fitted with dampening layer with steel collars to minimise ringing noise caused by the steel bit vibration and to keep the damping material in place and protect it from abrasion. About 3 dB(A) reduction can be achieved by using this control.



Excavator-mounted breakers

Excavator-mounted breakers are amongst the noisiest items of general construction equipment. To reduce noise from excavator-mounted breakers, use of a hammer bracket (the bracket is made of special alloy and the inside of it is lined with sound insulation material). A noise reduction of up to 10 dB(A) can be provided.

Equipment with Internal Combustion Engines

Equipment with Internal Combustion Engines include stationary and mobile plant, examples include:

- Stationary Plant: compressors, generators, concrete pumps and welding sets
- Mobile Plant: excavators, bulldozers, loaders and dump trucks

The nature of the noise emissions relating to this kind of equipment includes exhaust noise, cooling system noise and engine noise. Control measures for these include:

- Exhaust Noise
 - Install suitably designed exhaust silencers
- Cooling System Noise (including noise from water pumps, belts, pulleys and cooling fans)
 - Replace poor fan blade design or damaged fan blades with an aerodynamic model
 - Install a contoured fan shroud or cowl with a close fan tip-to-shroud clearance
 - Remove all obstructions such as bars and pipes from the inlet airflow
- Engine Noise
 - Installing a vibration isolator for individual components to reduce transmission of engine noise
 - Installing specially designed partial or full acoustic enclosures for individual noise generating components. Partial or full enclosures can result in a reduction in the overall noise level of up to 5 and 10 dB(A) respectively
 - Apply damping material to vibrating panels

It is essential to regularly maintain and service all mechanical plant and equipment:

- Implement a preventive maintenance programme to ensure equipment is operating in good order and not emitting abnormal noise
- Make sure stocks of regularly required spare parts are available

Piling

Typical noise sources for percussive piling include:

- Ringing noise (radiated from the surface of the pile);
- Impact noise; and
- Exhaust noise (created by the release of pressurized gases from exhaust ports).

Control measures for piling include:

- Use non-percussive piling techniques such as pre-bore, vibratory hammers or hydraulic hammer for driving steel piles.
- Use resilient packing and dolly
 - For percussive piling, the head of the pile should be protected by a helmet fitted with resilient packing over the top of the pile and a dolly which cushions the blow of the hammer.
- Use of a shroud
 - Enclose the complete pile and the pile driver. The shroud should consist of a robust framework fitted with an acoustically designed cladding or acoustic panels.
 - Alternatively, a flexible acoustic curtain of appropriate thickness can be suspended to enclose the whole length of the exposed pile and pile driver.

Joint Cutter / Stone Saw

Noise mitigation measures that can be fitted to a joint cutter and stone saw include:

- A metal hood to screen the operator from the machine;
- Anti-vibration mounts between the engine/motor and the support frame; and
- A small pad supplied with water (for cooling the blade) to serve as a viscous damping layer between pad and blade.

Demolition and Concrete Breaking Works

Noise mitigation measures for demolition and concrete breaking works include using non-percussive equipment such as a hydraulic crusher and quiet plant. The sound pressure level of some commonly used quiet plant is shown in Table 6.3.

- Hydraulic concrete cutter and crushers can replace excavator-mounted percussive breakers in demolition work resulting in noise

reduction of around 8dB(A). More information with the construction industry on the use of Hydraulic concrete crusher can be found from the Housing Authority's website.



- Hydraulic rock drill with a SWL not exceeding 110dB(A) can replace conventional crawler mounted pneumatic rock drill resulting in noise reduction of up to 20 dB(A)¹.
- Quiet Construction Equipment for Road Opening Works during Non-Sociable Hours are given in ProPECC PN 1/96.



Table 6.4 – Sound Pressure Level of Some Commonly Used Quiet Plant²

Quiet Plant	Sound Pressure Level in dB(A) at 7 m from equipment
Modern Breakers (Mounted on demolition robot)	89 – 91
Modern Saw (power wire saw, or modern wall saw)	76 – 81
Kick Ripper, Saw - and – lift method	78 – 80
Bursting System	70 – 72
Hydraulic crusher (hand-held or mounted on demolition robot)	67 – 69
Pipe Jacking	60 – 65
Non-explosive chemical agent (for site formation)	60 – 65

¹ reference from BS5228:Part 1:1997

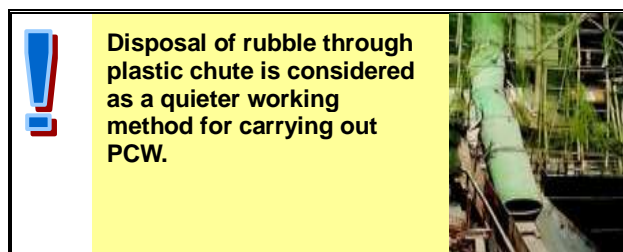
² Reference: Best Practice Guide for Environmental Protection on Construction Sites, HKCA

Table 6.5 – Sound Power Level of Some Quality Powered Mechanical Equipment (QPME)

QPME	Sound Power Level in dB(A)
Bulldozer, tracked	102 – 116
Bulldozer, wheeled	110 – 114
Excavator, tracked/wheeled	93 – 114
Loader tracked	106 – 112
Loader, wheeled	104
Asphalt paver	101 – 112

Road roller	95 – 109
Roller, vibratory	95 – 113
Power rammer (petrol)	108
Compactor, vibratory	102 – 109
Crane, mobile	94
Generator	87 – 102

* Reference: Quality Powered Mechanical Equipment (QPME) list from EPD, <http://www.epd.gov.hk/cgi-bin/npg/qpme/index.pl?lang=eng>



6.9.3 Sound Transmission Path Control

Two common options to control sound transmission path are:-

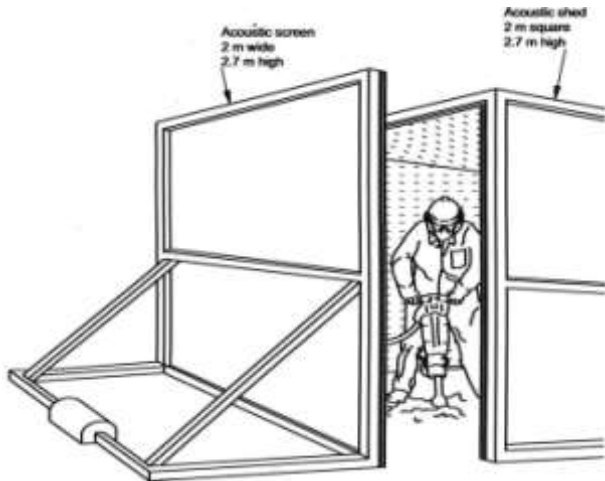
- Noise Enclosures** – fully enclose the equipment
- Noise Barriers** – prevent sound path reaching receivers

The noise reduction performance of those controls depends on the materials, design, configurations and distance between noise source and receivers and between the noise source and the noise barriers / enclosures.

Noise Enclosures

An enclosure can be constructed from a variety of materials and the maximum achievable noise reductions for some materials are shown in Table 6.4. To achieve desirable results, material with superficial density/surface mass of **at least 10kg/m²** should be used.

In addition to effective materials used, the enclosure should also be so constructed and maintained that there is no noise leakage due to defects (such as gaps, poorly sealed joints).



Carrying out of concrete breaking work inside noise enclosure
(Figure is extracted from BS5228: Part 1:2007)

Table 6.6 – Sound Insulation Materials for Machine Enclosures

Material	Thickness (mm)	Superficial density (Kg/m ²)	Max. achievable noise reduction dB(A)
Brickwork	113	220	35 – 40
Compressed strawboard	50	17	28
Chipboard	18	12	26
Plasterboard	13	12	26
Fibreboard	12	4	18
Plywood	6	4	21
Proprietary product - Barrier Composite	25	2.5	6-46*
Proprietary product - Barrier Composite	51	4.9	10-49*

* reduction depends on frequency of noise

Remark: Actual noise reduction subject to design of enclosure and agreement with EPD

Source: BS 5228:Part 1:1997 Table B-2.



Doors of an operating air compressor should always be kept properly closed to prevent excessive noise.

Noise Barriers

Noise barriers reduce sound transmission by breaking the direct path between the noise source

and the sensitive receiver. However, sound will still be transmitted at a reduced level by refraction and reflection. Noise barriers are most effective when they are placed close to the noise source.

Barriers can either be fabricated on site from readily available construction materials or can be constructed from proprietary acoustic panels to achieve the maximum screening effect.

Depending on the material used and the design of the noise barriers, an overall reduction of **between 5 to 10 dB(A)** can be achieved.



Noise Barrier for Breaking Work



To ensure the noise barrier, is effective:-

- It should be **gap-free**; even a small gap or opening will substantially decrease the noise reduction performance. Special design should be applied to mobile noise barriers to ensure that there is no noise leakage due to different positionings or settings (e.g. uneven ground levels or frequent movements of the equipment being shielded).
- It should be of sufficient size and placed close to the noise source such that the direct line of sight from the NSR can be completely screened.

A noise barrier is most effective when there is a single noise source and it can be totally shielded. However, there are likely to be several noise sources at different areas within a construction site and the noise barrier may not be able to shield the noise completely from all these sources. If this is the case, erection of a large barrier close to the NSR may be considered such that the direct line of sight from all the noise sources can be screened.

Alternatively, the barrier should be used to shield the dominant noise source to maximize reduction.

6.9.4 Administrative Site Control

Apart from reducing noise through good engineering, administrative noise control measures can further reduce the noise impact from construction sites. Those measures include:

- Scheduling construction work carefully to maximize any required noisy work during less sensitive hours (e.g. lunch time, outside school hours and avoiding exam periods), and for unavoidable night works with a Construction Noise Permit, carefully schedule noisy works at locations close to any sensitive receiver so as to minimize sleep disturbance
- Minimising the cumulative noise sources from various activities
- Keeping residents informed of what is being planned and do so that they are more likely to accept the inevitable impact noise, resulting in fewer complaints
- Establish a communication channel (e.g. manned hotline) to address concerns from the affected neighbours, so that immediate responsive actions could be taken to reduce adverse noise impact
- Limiting the time workers spend in noisy areas by moving them to quiet work before their daily noise exposure becomes excessive
- Switching off noisy equipment when not in use
- locating noisy equipment as far away as possible from any NSRs
- Selecting quieter equipment
- Using electricity supply from public utility for all machinery if possible, to avoid generator noise
- Using stockpiles of earth as an additional natural sound barrier whenever possible
- Providing regular and effective maintenance for all PME in order to prolong the life of equipment as well as to reduce noise emission
- Undertaking regular site supervision and training to promote good site practice – unnecessary noise disturbance created from shouting, colliding of materials or striking of steel bars can be avoided
- Taking care when loading and unloading vehicles, dismantling scaffolding or moving materials, to reduce unnecessary noise impact
- Using alternative methods, such as a totally enclosed conveyor belt system to avoid the use of noisier plant such as dump trucks

- Arranging delivery of noisy/bulky equipment/material to avoid disturbance to surrounding NSRs and within permitted hours
- Providing adequate planning with contingency to ensure that lengthy operations e.g. concrete pours, can be completed within the permitted hours
- Avoiding carrying out noisy operation in early morning. Schedule such operation after 9:00am as far as practicable
- Fabricating units off site to minimise impacts on site, when practicable
- Planning routes for construction vehicles carefully, to reduce noise to nearby NSRs
- Maintain equipment in good condition. Using lubricant to reduce noise impacts
- Monitoring noise on site regularly. If there is an exceedance, further mitigation measures may be necessary
- Maintaining a good security system especially at the site entrance to avoid unauthorised entry of workers in restricted hours
- Setting up a restricted hours patrol team to ensure compliance with the NCO.
- Requesting sub-contractors to obtain prior permission (e.g. through a permit-to-work system) before carrying out work during restricted hours
- Seek professional advice on noise control measures

6.9.5 Noise Calculation

Addition of sound pressure levels from noise sources can be calculated by the following equation:

$$SPL_T = 10 \log_{10} \left[\sum_{i=1}^n (10^{\frac{SPL_i}{10}}) \right]$$

where

SPL_T = Total Sound Pressure Level
n = number of SPL acting together,
i = number of PME

Example 1

Addition of sound pressure levels of 2 PMEs;
SPL₁ = 90dB and SPL₂ = 95dB.

Total Sound Pressure Level

Method 1: by Equation

$$\begin{aligned} SPL_T &= 10 \log_{10}(10^{90/10} + 10^{95/10}) \\ &= 96.0\text{dB(A)} \end{aligned}$$

Method 2: by referring Table

Refer to *Table A6.3.1 Summation of Noise Levels* attached in Appendix 6.3.

Difference in dB(A) between two noise levels to be summed = 5 dB(A)

Amount in dB(A) to be added to the higher noise level = 1 dBA

Total sound power level = 95dB(A) + 1dB(A) = 96 dB(A)

Example 2

Addition of sound pressure levels of N identical PMEs each with SPL_i dB(A)

Total Sound Pressure Level

$$\begin{aligned}SPL_T &= 10 \log_{10}(N \times 10^{SPL_i/10}) \\ &= SPL_i + 10 \log_{10}N\end{aligned}$$

Keep the noise sources away from sensitive receivers as far as possible. Distance attenuation of a noise source can be calculated by the following equation:

$$\text{Distance Attenuation} = (20\log D + 8)$$

where

D = Distance (m) between the noise source and the point 1m from the façade of the receiver

Example 3

Distance between the opening of the noise source and 1m from the façade of R = 6m,

Method 1: by Equation

$$\begin{aligned}\text{Distance Attenuation} &= (20\log D + 8), \\ &= 23.6\text{dB(A)} \\ &\sim 24\text{dB(A)}\end{aligned}$$

Method 2: by referring Table

Refer to *Table A6.3.2 Correction Factors to Obtain the PNL from Sound Power Level at Given Distances* attached in Appendix 6.3.

Correction is 24dB(A)

6.10 Noise Monitoring

Noise monitoring is often required to verify performance such as under an EM&A programmes or to validate the effectiveness of mitigation

measures such as noise barriers. An outline of the typical requirements relating to statutory monitoring is set out below.

Instrumentation

Sound level meters need to comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) (as referred to the GW-TM).

Other noise measuring and analysis instrumentation shall be of a comparable professional quality.

Calibration Requirements

Immediately prior to and following each noise measurement, the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration levels from before and after the noise measurement agree to within 1.0 dB.

Measurement Locations

When carrying out measurements at the assessment point, the following requirements should be observed:

- For a building, the assessment point should normally be at a position 1m from the exterior of the building facade but may be at any other point considered to be appropriate by EPD
- For a place other than a building, the assessment point shall be at a position 1.2m above the ground, at a particular point considered appropriate by Environmental Protection Department
- The construction noise levels shall be measured in terms of A-weighting equivalent continuous sound pressure level (L_{eq}) measured in decibels dB(A)

Measurement Parameters

The measurement parameters for different time periods are set out below:

- A-weighted equivalent sound pressure level over a 30-min, $L_{eq}(30\text{min})$, should be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays.
- For all other time periods, when applicable, A-weighted equivalent sound pressure level over any 5-min. period, $L_{eq}(5\text{min})$, should be employed for comparison with the NCO criteria.

Other Requirements

All noise measurements shall be rounded to the nearest whole dB(A), with values of 0.5 or more being rounded upwards.

Noise measurements should be made in accordance with standard acoustical principles and practices in relation to weather conditions.



Some projects require baseline monitoring on consecutive days (normally 14 days) prior to starting the construction works. It is advisable to check your Contract, Particular Specification or Environmental Monitoring & Audit (EM&A) Manual (if any) to confirm requirements.

For a Designed Project, baseline monitoring is normally required. It can be either arranged by the Employer or through the Contractor under the contract.

To avoid delaying the commencement of construction works, baseline monitoring should be arranged as soon as possible once the award of the construction contract is confirmed.



If your project has an EM&A Manual, the monitoring locations, numbers and measurement frequency are normally given in the manual.

Consult your Environmental Team (ET) Leader or Environmental Protection Officer prior to commencement of the works if you are not clear about the requirements.



Should operation of a concrete batching plant be classified as construction work?

The production of concrete in a concrete batching plant for sale or supply to clients of different construction sites is similar to other industrial processes and its noise emission is controlled under section 13 of the NCO. If a concrete batching plant is established for supplying concrete to a particular construction site or project, its operation is a kind of "construction work" and its noise emission is controlled under section 6 of the NCO.



Should operation of a barging point be classified as a construction work?

Operation of a barging point that is established for provision of public fill exclusively to a particular construction site or project is a kind of "construction work". Its noise emission is controlled under section 6 of the NCO.



Should electric arc welding device be classified as a PME?

Powered Mechanical Equipment (PME) is defined under the NCO as any machine or device driven by electrical, chemical or thermal energy including energy transmitted by compressed air, steam, or hydraulic means; a principal function of which is to produce mechanical movement.

As the principal function of an electric arc welding device does not involve mechanical movement, the device itself should not be classified as a PME. Nonetheless, if a diesel generator is used, the generator is a PME.

Please note that the arc welder with cooling fan is to be regarded as a PME since it is a composite device of welder + fan.



When I need to work during restricted hours, do I need to apply for a CNP if the works do not involve operation of a PME?

If your site is outside a Designated Area and no PME is used, then no CNP is required. If your site is within a Designated Area and your works involve Prescribed Construction Work (PCW), or use of SPME or PME, then a CNP is required.

6.11 Case Studies

Case 1: Sheet Piling Works

A "silent piler" has been used in a number of projects for sheet piling works. The "silent piler" is a hydraulic machine for vibration-free installation or extraction of sheet piles. It operates by gripping previously driven piles to provide reaction force for pressing in the next pile. As it involves no percussive motion emission of impact noise are reduced.

Innovations in material usage made this silent pile capable of pressing in U piles, H piles, tubular steel sheet piles and precast concrete piles. The press-in technology has also advanced into hard ground subsoil where sheet piles can be installed into rocks using an integrated auger.



Super silent piler for sheet piling works
The photo is extracted from EPD's website



Wire saw for concrete cutting works
The photo is extracted from EPD's website

Case 2: Demolition Works

Use of hydraulic concrete crusher (HCC) in demolition works is one of the potential solutions to minimize construction noise impact. The working principle is to crushing the element by hydraulic closing actions of the jaws. Noise sources from the crusher are mainly from the excavator on which the crusher is mounted.

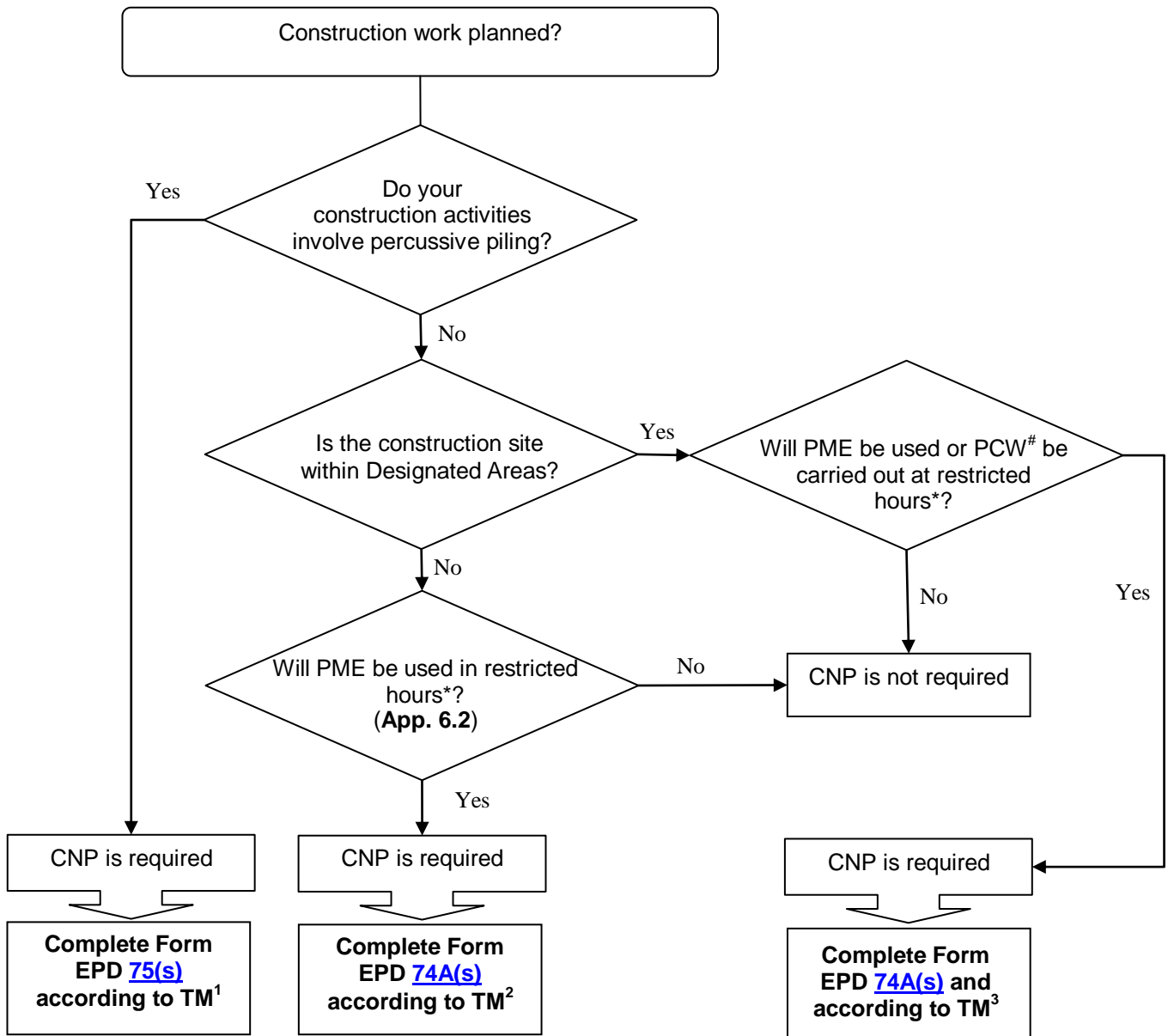


Hydraulic concrete crusher for demolition works

Case 3: Use of Wire Saw for Concrete Cutting

Modern wire saws for concrete cutting achieve a 16dB(A) reduction when compared to an excavator mounted breaker.

Appendix 6.1: Flowchart to Determine the Need of a CNP for Percussive Piling or the use of PME/PCW



For details refer to Section 6.6.3

TM¹ – Technical Memorandum on Noise from Percussive Piling

TM² – Technical Memorandum on Noise from Construction Work Other Than Percussive Piling

TM³ – Technical Memorandum on Noise from Construction Work in Designated Areas

*Restricted hours: The time between 1900 and 0700 hours on normal weekdays and any time on a general holiday including Sunday

PCW: Erecting or dismantling of formwork or scaffolding; Loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding materials; and Hammering

Appendix 6.2: Sound Power Levels for Items of Powered Mechanical Equipment (PME)

Identification Code	Description	Sound Power Level (dB(A))
CNP 001	Air compressor, air flow $\leq 10\text{m}^3/\text{min}$	100
CNP 002	Air compressor, air flow $> 10\text{m}^3/\text{min}$ and $\leq 30\text{m}^3/\text{min}$	102
CNP 003	Air compressor, air flow $> 30\text{m}^3/\text{min}$	104
CNP 004	Asphalt paver	109
CNP 021	Bar bender and cutter (electric)	90
CNP 022	Batching plant	108
CNP 023	Breaker, hand-held, mass $\leq 10\text{kg}$ *	108
CNP 024	Breaker, hand-held, mass $> 10\text{kg}$ and $< 20\text{kg}$ *	108
CNP 025	Breaker, hand-held, mass $\geq 20\text{kg}$ and $\leq 35\text{kg}$ *	111
CNP 026	Breaker, hand-held, mass $> 35\text{kg}$ *	114
CNP 027	Breaker, excavator mounted (pneumatic)	122
CNP 028	Breaker, excavator mounted (hydraulic)	122
CNP 029	Ballast tamper, hand-held (electric)	105
CNP 030	Bulldozer *	115
CNP 041	Conveyor belt	90
CNP 042	Concrete corer	117
CNP 043	Chipper, hand-held (pneumatic)	112
CNP 044	Concrete lorry mixer *	109
CNP 045	Concrete mixer (electric)	96
CNP 046	Concrete mixer (petrol)	96
CNP 047	Concrete pump, stationary/lorry mounted	109
CNP 048	Crane, mobile/barge mounted (diesel)	112
CNP 049	Crane, tower (electric)	95
CNP 050	Compactor, vibratory	105
CNP 061	Derrick barge	104
CNP 062	Dredger, chain bucket	118
CNP 063	Dredger, grab	112
CNP 064	Drill, percussive, hand-held (electric)	103
CNP 065	Drill/grinder, hand-held (electric)	98
CNP 066	Dumper	106
CNP 067	Dump truck *	117
CNP 081	Excavator/loader, wheeled/tracked	112
CNP 101	Generator, standard	108
CNP 102	Generator, silenced, 75 dB(A) at 7 m	100
CNP 103	Generator, super silenced, 70 dB(A) at 7 m	95
CNP 104	Grader	113
CNP 121	Hoist, passenger/material (pneumatic)	108
CNP 122	Hoist, passenger/material (electric)	95
CNP 123	Hoist, passenger/material (petrol)	104

Identification Code	Description	Sound Power Level (dB(A))
CNP 141	Lorry	112
CNP 161	Paint line marker	90
CNP 162	Piling, diaphragm wall, bentonite filtering plant	105
CNP 163	Piling, diaphragm wall, hydraulic extractor	90
CNP 164	Piling, large diameter bored, grab and chisel	115
CNP 165	Piling, large diameter bored, oscillator	115
CNP 166	Piling, large diameter bored, reverse circulation drill	100
CNP 167	Piling, earth auger, auger	114
CNP 168	Power pack for hand-held items of PME	100
CNP 169	Power rammer (petrol)	108
CNP 170	Poker, vibratory, hand-held *	113
CNP 171	Planer, wood, hand-held (electric)	117
CNP 181	Rock drill, crawler mounted (pneumatic)	128
CNP 182	Rock drill, crawler mounted (hydraulic)	123
CNP 183	Rock drill, hand-held (pneumatic)	116
CNP 184	Road planer or miller	111
CNP 185	Road roller	108
CNP 186	Roller, vibratory	108
CNP 201	Saw, circular, wood	108
CNP 202	Saw, chain, hand-held	114
CNP 203	Saw/groover, concrete (petrol)	115
CNP 204	Scraper	119
CNP 221	Tug boat	110
CNP 222	Tractor	118
CNP 241	Ventilation fan	108
CNP 261	Winch (pneumatic)	110
CNP 262	Winch (electric)	95
CNP 263	Winch (petrol)	102
CNP 281	Water pump (electric)	88
CNP 282	Water pump (petrol)	103
CNP 283	Water pump, submersible (electric)	85

* Classified as Specified Powered Mechanical Equipment (SPME). A more stringent Basic Noise Level is applied to the different Area Sensitivity Rating for the use of SPME at the construction site in Designated Areas.

Sound Power Level for Other Commonly Used PME

Identification Code	Description	Sound Power Level (dB(A))
CNP 005	Agitator (electric)	90
CNP 006	Air blower (electric)	95
CNP 031	Breaker, mini-robot mounted	115
CNP 051	Concrete burster	90
CNP 052	Concrete crusher, mini-robot mounted	94
CNP 053	Concrete crusher, hand held	97
CNP 054	Concrete pump (electric)	109
CNP 055	Concrete crusher, excavator mounted	103
CNP 056	Cutter, circular, steel (electric)	112
CNP 070	Dredger, suction	103
CNP 071	Drill, hand held (battery)	89
CNP072	Drill rig, rotary type (diesel)	110
CNP 082	Excavator, mini-robot mounted	94
CNP 105	Grout mixer	90
CNP 106	Grout pump	105
CNP 107	Generator, portable	100
CNP 131	Jig-saw, hand held, wood (electric)	99
CNP 172	Piling, vibrating hammer	115
CNP 173	Poker, vibratory, hand held (electric)	102
CNP 174	Power pack (diesel)	100
CNP 175	Power swivel	100
CNP 176	Paint line marker (low pressure)	87
CNP 177	Paint line remover	104
CNP 187	Road grinder (petrol)	108
CNP 188	Road sweeper	107
CNP 189	Road ripper, mini-robot mounted	97
CNP 190	Road ripper, excavator mounted	105
CNP 205	Saw, wire	101
CNP 206	Soil pump	103
CNP 284	Water jetting unit (diesel), silenced	94
CNP 285	Water jetting unit (diesel), standard	107
CNP 141	Lorry, gross vehicle weight > 38 tonne	112
CNP 142	Lorry, 5.5 tonne < gross vehicle weight ≤ 38 tonne	105
CNP 143	Light goods vehicle, gross vehicle weight ≤ 5.5 tonne	101
CNP 144	Lorry, with crane/grab, gross vehicle weight > 38 tonne	112
CNP 145	Lorry, with crane/grab, 5.5 tonne < gross vehicle weight ≤ 38 tonne	105
CNP 067	Dump truck, gross vehicle > 38 tonne	117
CNP 068	Dump truck, 5.5 tonne < gross vehicle weight ≤ 38 tonne	105
CNP 069	Dump truck, with grab, 5.5 tonne < gross vehicle weight ≤ 38 tonne	105

Appendix 6.3: Summation of Noise Levels

Difference in dB(A) between two noise levels being summed	Amount in dB(A) to add to the higher noise level
0 – 0.5	3.0
1.0 – 1.5	2.5
2.0 – 3.0	2.0
3.5 – 4.5	1.5
5.0 – 7.0	1.0
7.5 – 12.0	0.5
> 12.0	0

Table A6.3.2 Correction Factors to Obtain the PNL from Sound Power Level at Given Distances

Distance (m)	Correction (dB(A))	Distance (m)	Correction (dB(A))
0	8	30 – 33	38
1	8	34 – 37	39
2	14	38 – 41	40
3	18	42 – 47	41
4	20	48 – 52	42
5	22	53 – 59	43
6	24	60 – 66	44
7	25	67 – 74	45
8	26	75 – 83	46
9	27	84 – 93	47
10	28	94 – 105	48
11	29	106 – 118	49
12	30	119 – 132	50
13	30	133 – 148	51
14	31	149 – 166	52
15 – 16	32	167 – 187	53
17 – 18	33	188 – 210	54
19 – 21	34	211 – 235	55
22 – 23	35	236 – 264	56
24 – 26	36	265 – 300	57
27 – 29	37		

This table is valid for distances of up to 300m. For distances greater than 300m, the EPD shall calculate appropriate correction factors having regard to standard acoustical principles and practices.

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7 Water Pollution Control

7.1 Terminology

Any discharge or deposit (including waste, wastewater and effluent), except the discharge of unpolluted water into communal stormwater drain and discharge of domestic sewage into communal foul sewer system, is subject to the control under the Water Pollution Control Ordinance.

Wastewater

It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources.

For a construction site, it includes the contaminated surface runoff and wastewater generated from dewatering, cleaning activities and sewage.

Effluent

Effluent is an outflowing of water from a natural body of water, or from a man-made structure.

Effluent in the man-made sense is generally considered to be polluted, such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. An effluent sump pump, for instance, pumps waste from toilets installed below a main sewage line.

Under the Water Pollution Control Ordinance (WPCO), effluent means any discharge or deposit subject to control. These include effluents from all types of industrial, manufacturing, commercial, institutional and construction activities.

Sewage/Foul Water

It is the subset of wastewater that is contaminated with feces or urine, but is often used to mean any waste water. "Sewage" includes domestic, municipal, or industrial liquid waste products disposed of, usually via a pipe or sewer or similar structure.

Suspended Solids

Suspended solids (SS) is an indicator on how many unsettled particulates are in the water, which also affects the transparency of water. The major source of SS on a construction site is silt. The

discharge of suspended solids in water body will increase the turbidity and affect aquatic organisms.

Oil and Grease

Oil and grease (O&G) is a parameter to measure how much oily matter is in the water. Construction activities seldom introduce O&G in water. The main sources of O&G are spillage of oil and fuel from storage and plant maintenance and food waste from canteens.

Chemical Oxygen Demand

Chemical Oxygen Demand (COD) is a measure of organic matter in water. Such matter on a construction site may include diesel and other chemicals. Contamination of water with sewage may also increase COD in water.

5-Day Biochemical Oxygen Demand

5-Day Biochemical Oxygen Demand (BOD₅) is also a measure of organic matter in water but biodegradable part only. BOD₅ in construction site mainly come from food waste and sewage.

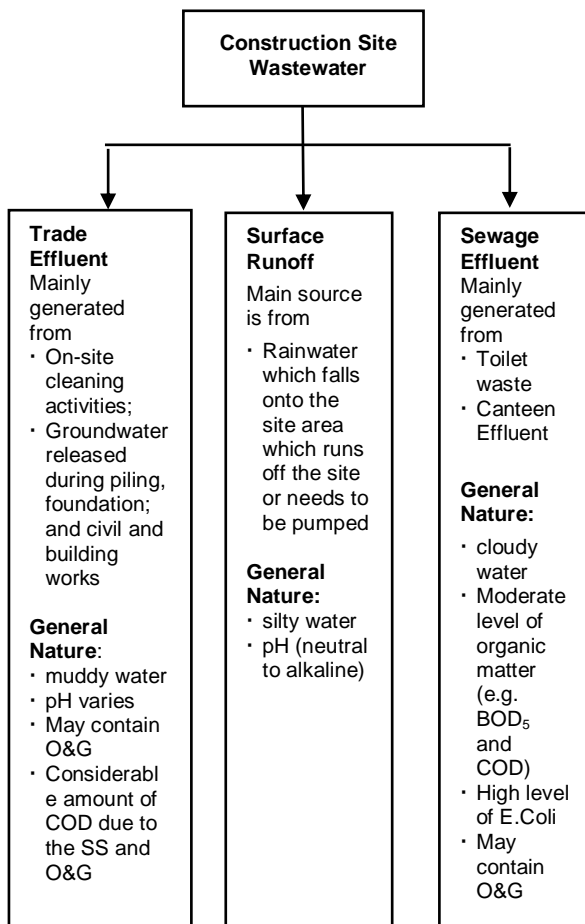
pH

pH is a measure of acidity. A low pH value is associated with acidity while high pH value with alkalinity. The pH value for neutral solution such as drinking water is about 7.

7.2 Main Source of Site Discharges

Construction site wastewater can be divided into trade effluent, sewage effluent and contaminated surface runoff. The major sources of these wastewaters and their general nature are shown in Figure 7.1.

Figure 7.1 – Composition and Nature of Construction Site Wastewater



Notes:
SS – Suspended Solids
O&G – Oil & Grease
COD – Chemical Oxygen Demand
BOD₅ – 5-Day Biochemical Oxygen Demand

7.3 Wastewater Management

As a basic requirement, a Site Drainage Management Plan, covering the collection, treatment and disposal of effluent, should be incorporated as part of the Environmental Management Plan of the construction project concerned. It should be prepared, regularly reviewed and implemented under the close supervision of qualified environmental site staff.

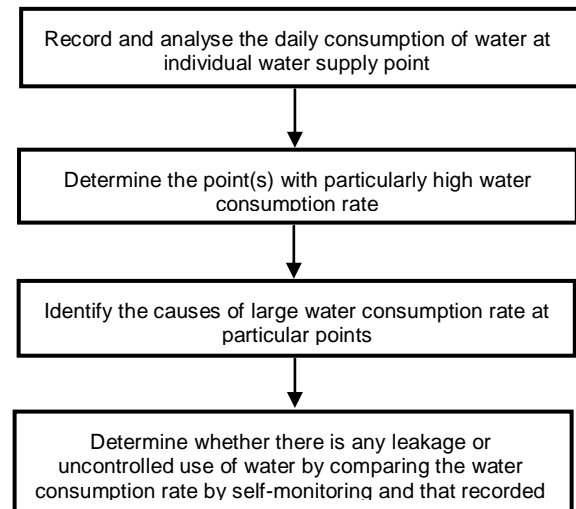
7.3.1 Minimisation of Generation of Wastewater

Water consumption on site should be monitored to minimise wastewater generation. This can be achieved by installing water meters to monitor and control usage.

To identify opportunities to minimize water consumption, the following flowchart can be used.

A beneficial outcome of reducing wastewater generation includes:

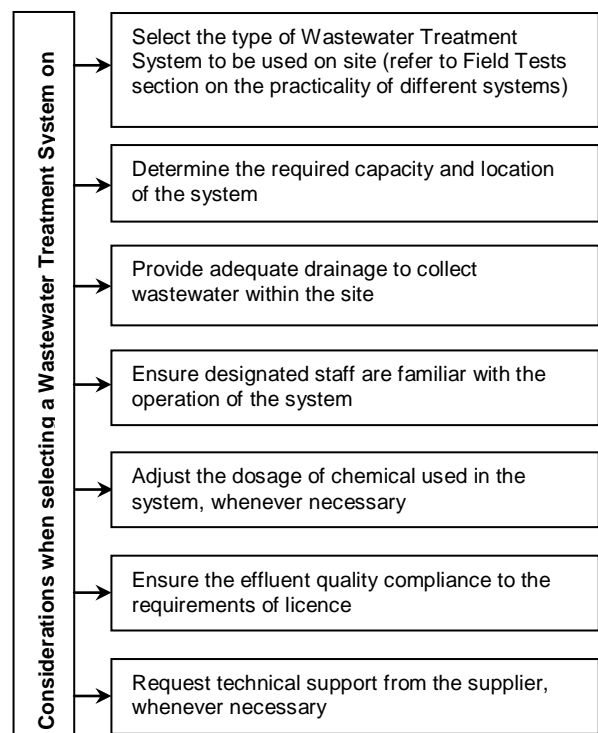
- Minimising the cost of installation and operation of treatment plant; and
- Conserving water resources.



7.3.2 Installation of Wastewater Treatment System

A number of factors should be considered when determining what type of wastewater treatment system is required in order to make sure that discharge standards are met.

Those considerations are shown in the figure below.



7.3.3 Reuse of Treated Wastewater

Treated effluent from the wastewater treatment facilities can not only be used for water testing of pipelines and non-portable water tanks, it can also be reused for some construction operations, such as wheel-washing and dust suppression. In doing so, it is necessary to:

- (a) Treat the wastewater properly before reuse;
- (b) Provide temporary storage tank(s) for the treated effluent, (beware of mosquito breeding in the tank(s) and place mosquito warning sign on the tank(s)); and
- (c) Provide adequate drainage to discharge excess treated effluent to avoid flooding.

Benefit

- Water conservation
- Minimise water bill and effluent surcharge

7.3.4 Management of Rainwater

Rainwater is, one of the major sources of wastewater generated by a construction site, if not properly managed. Rainwater can be a valuable resource that when properly harvested on site reducing the water bill. However, contaminated rainwater will generate a large amount of wastewater to be treated before it can be discharged offsite.

The contractor is encouraged to make frequent reference to the weather forecasting and rainstorm warning features by the Hong Kong Observatory to vigorously prepare for any forthcoming adverse rain fall conditions. The Site Drainage Management Plan should be adjusted and proactive preventive measures should be implemented to cater for the possible huge influx of contaminated runoffs.

Rainwater Harvesting

For civil engineering construction sites, rainwater harvesting system can be deployed at strategic locations such as a cascaded channel or temporary site office roof to collect uncontaminated rainwater.

The rainwater harvesting system consists of piping, water tanks and pumping systems to collect rainwater and deliver it for use on site.



Rain Water Harvesting System

Rainwater Discharge

The temporary site drainage system including perimeter channels, catchpits and pumping system should be provided on site to divert contaminated rainwater to wastewater treatment facilities for treatment prior to discharge.



If heavy rainfall results in large quantities of wastewater being produced at a construction site, would the contaminated water need to be treated before discharge?

Yes, all contaminated runoff is required to be treated before discharge to meet the statutory requirements. The Contractor should take all necessary preventive measures, to avoid the contamination of surface runoff e.g. covering stockpiles of materials with sheeting.

7.4 Wastewater Treatment Technology

Construction site wastewater is mainly contaminated by interaction with soil and resulting in high level of suspended solids and alkalinity. Wastewater treatment systems deployed on site are often required to remove suspended solids and to neutralize alkaline water.

7.4.1 General Design of a Wastewater Treatment System for Construction Sites

The typical flow of the construction wastewater treatment process is shown in Figure 7.2.

All wastewater on site will first be collected to a reception tank or catchpits via the site drainage system such as perimeter channels.

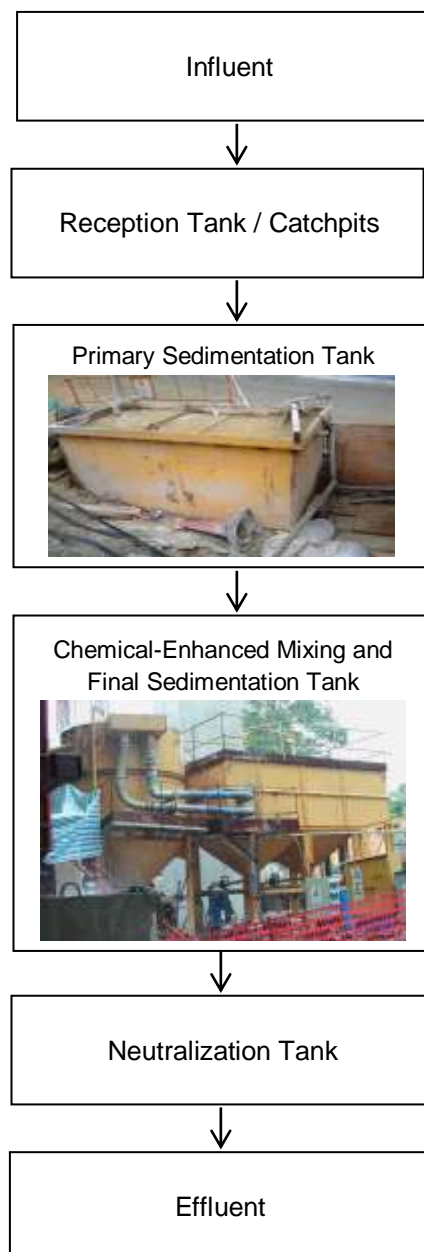
The collected wastewater is then pumped to a primary sedimentation tank for preliminary sedimentation. Part of the suspended solids will be removed in catchpits and primary sedimentation tank. Primary tanks also enable the flow to be

balanced to prevent irregular water flow to the main treatment tanks.

Wastewater is then pumped to chemical-enhanced sedimentation tanks for further treatment. Coagulant such as polyaluminium chloride and polyacrylamide is added to wastewater for further removal of suspended solids.

After removal of suspended solids, the wastewater will be diverted through a neutralization tank to reduce the alkalinity (pH) by adding acid such as sulphuric acid or citric acid.

Figure 7.2 – Typical Flow of Construction Wastewater Treatment Process



7.4.2 Reception Tank

A reception tank in the form of an underground tank or catchpit is primarily used to collect wastewater from the site.

The size and numbers of tank should be sufficient to hold the site wastewater and rainwater for diversion to the primary sedimentation tank without it overflowing out of the site.



An Underground Tank Used as a Reception Tank

7.4.3 Primary Sedimentation Tank

A primary sedimentation tank is used to remove large particle size settleable solids. Although the sedimentation efficiency is not high, those tanks are inexpensive and easy to relocate to different locations when required.

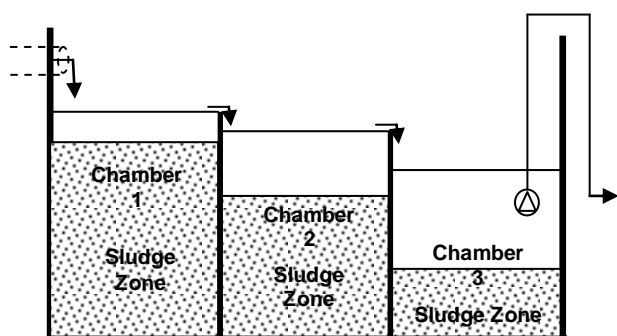
The longer the hydraulic retention time (HRT), the higher the settling efficiency, but the space requirement of the treatment plant will increase. From field tests carried out at local construction sites, primary sedimentation tank designed for 30 to 50 minutes HRT can achieve satisfactory sedimentation performance.



Primary Sedimentation Tank

The following figure shows a three-chamber primary sedimentation tank. In this setting, part of suspended solids will be removed when wastewater is passing through from Chamber 1, 2 and then 3.

Primary sedimentation tanks can reduce the suspended solids entering the later components of the treatment system, in particular the more sophisticated final sedimentation tank. The sedimentation efficiency of this type of tank is higher but may require more frequent removal of sludge.



Three-chamber Primary Sedimentation Tank

7.4.4 Chemical-enhanced Sedimentation

The efficiency of suspended solids removal by the primary sedimentation tank itself is usually very low, especially with very small particles and the discharge limit cannot be met.

To enhance suspended solids removal, chemicals can be added as an aid to the physical sedimentation process.

Coagulation and flocculation may be achieved by adding coagulant and flocculent chemicals respectively to the wastewater treatment system.

Coagulation refers to feeding of chemical coagulants into wastewater to form microfloc particle. Flocculation refers to the process of gently mixing the smaller particles to contact with each other to form larger particles called flocs. Large flocs are then settled in a sedimentation tank.

To achieve better mixing performance, the chemical should be added at the inlet of the mixing tank.



Chemical Enhanced Mixing Tank

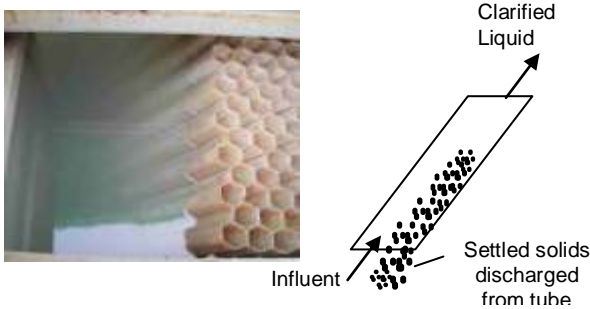
Key design parameters:

- **Chemicals:** The common coagulant is Polyaluminium Chloride (or PAC, alum) and flocculant is Polyacrylamide (or PAM, polymer).
- **Coagulant Dosage:** Normally at 5% to 10% concentration is available market. Dosage is normally at 40 ppm to design the dosing pump.
- **Flocculant Dosage:** Normally at 0.2% to 2% concentration is available market. Dosage is normally at 2 ppm to design the dosing pump.
- **Mixing:** Static mixers include baffled piping, baffled channel or hydraulic jumps; mechanical mixers include paddle, turbine or propeller. The mixers may be installed either in-line or in a separate small basin.

7.4.5 Final Sedimentation

After mixing the wastewater with chemicals, sufficient hydraulic retention time should be allowed in the final sedimentation tank for the enhanced sedimentation process.

A tube / plate settler is one common configuration used in the final sedimentation process. The settlers are shallow settling devices consisting of stacked off-set trays or bundles of small plastic tubes. They are used to enhance the settling characteristics of the sedimentation tank. The settlers are inclined in order to promote self-cleaning. Wastewater passes upward through the tube/plate modules and exits from the tank above the modules. The solids that settle out within the tubes or plates move downward by means of gravity and out of the tube modules to the tank bottom.



Tube Settler for Final Sedimentation

Key design parameters:

- Common tube size: Ranges from 30 mm to 50 mm with a hexagonal cross-section.
- Angle of inclination: The angle is usually set between 45° and 60° above horizontal. Sludge will tend to accumulate within the plates or tubes if the angle is less than 45°. The sludge removal efficiency will decrease if the angle is above 60°.



The discharge standard to a storm drain of 30 mg/L for Suspended Solids appears to be very stringent. What is the rationale behind this?

The permissible discharge standards are determined for each discharger by making reference to the Technical Memorandum issued under the WPCO. It takes into consideration the location of the site and the maximum flow rate of the effluent discharge as well as the water quality objectives that need to be achieved in the receiving water body.

7.4.6 Neutralization

The permitted range of effluent pH value (usually from 6 to 9) is stipulated in the Discharge Licence. On a construction site, wastewater is usually alkaline due to contamination with cement from concrete and grout. Therefore neutralization with an acid is required using a pH neutralization tank.



pH Neutralization Tank

Key design parameters:

- HRT: 10 – 15 min. with mixer speed of 200 rpm.
- Acid Dosing: Either Sulphuric acid (H_2SO_4) at 10% to 20% concentration or citric acid at 50% concentration should be adopted. The weaker Citric action is preferable from a safety and toxicity perspective. Dosage is normally set at 400 ppm for design of the dosing pump.
- pH sensor: A pH sensor is used to measure the pH value. It should have a submersible fitting and sufficient length of cable.



Choice of Acids for Neutralization

- Although sulphuric acid is inexpensive and very effective in neutralizing alkaline construction site waste water, it is a strong acid that is corrosive and toxic. Sulphuric acid should be handled very carefully to avoid potential safety hazard.
- Citric acid is a better alternative as it is a relatively weak acid with less toxic characteristics.

7.4.7 Maintenance of Wastewater Treatment Facilities

Trained personnel should be engaged to properly operate and maintain all wastewater treatment facilities. Such operational and maintenance works include:

- Removal of sand and silt deposited on water channels and catchpits.
- Repairing and replacement of damaged water hose.
- Removing sludge from wastewater treatment plants.
- Replenishment of coagulant and neutralisation agent.
- Calibration of pH sensor of neutralization tank.
- Monitoring and testing of effluent.

Standby equipment should be available on site or alternative arrangements should be planned to guard against failure of major treatment equipment.



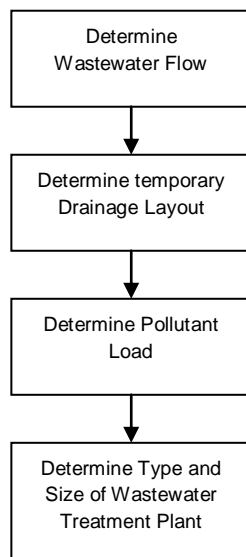
The Licencee should notify and explain to EPD within 24 hours upon the occurrence of an accidental discharge, any emergency bypass, an overflow of untreated wastewater or an operation failure which places the discharge in a temporary state of non-compliance with the discharge licence.

The Licencee should also within 7 days following the incident, submit to EPD a detailed report in writing on the cause and duration of the non-compliance and steps taken or to be taken to reduce, eliminate, or prevent recurrence of such non-compliance.

7.5 Design of Wastewater Treatment Facilities

Wastewater treatment facilities include temporary site drainage and wastewater treatment plants. A number of parameters should be considered during the design of wastewater treatment facilities as shown in Figure 7.3.

Figure 7.3 – Design Parameters of Wastewater Treatment Facilities



7.5.1 Wastewater Flow

In determining the wastewater flow, the following aspects should be considered:

Rainfall

Rainfall is one of the significant sources of wastewater if it is contaminated by soil on site. In estimating the amount of rainfall, the catchment area of the construction site should be measured and the statistical figure on average rainfall obtained from the Hong Kong Observatory for determination of rainwater to be received on site.

To reduce the amount of rainwater that may run on to the site, the rainwater channels entering the site should be diverted at the beginning of the construction work and the hoarding sealed at its base.

Groundwater

Groundwater is another source of wastewater, especially for civil engineering and foundation construction works. The amount of groundwater depends on the geological characteristics of the site. Contamination of groundwater can be prevented by in-situ pumping out of the water so as to avoid disturbing the water thus reducing the pollutant load.

Wastewater from construction activities

The flow of wastewater from different types of construction works vary. In general, the wastewater flows for civil and foundation works are much higher than building construction works.

Wastewater will be generated from different activities such as wheelwashing, cleaning and concreting curing. Construction wastewater should be reused or recycled as far as practicable to reduce flow.

7.5.2 Temporary Drainage Layout

In designing the temporary drainage layout, the following items should be considered:

Site logistics

The temporary site drainage should be arranged through the entire site area such that all the wastewater can be collected and delivered to treatment facilities.

Temporary water channels and catchpits should be constructed on site to effectively divert site wastewater to wastewater treatment facilities. In general, construction of perimeter U-channels surrounding the site area is recommended so as to avoid site wastewater running off to outside site area.

Catchpits should be constructed at low points of the site with water pumps deployed as necessary to convey collected site wastewater to wastewater treatment facilities.

Site topography and existing drainage

The advantage of site topography and existing drainage should be taken such that the wastewater

can flow by gravity or via existing drainage thereby reducing the construction of new temporary drainage and the need to use pumping systems.

Manholes of communal storm drains and foul drains within the site boundary should be identified and protected by bunding or temporary sealing to avoid site wastewater from accidentally entering the manholes.

Location of discharge points

Discharge points should be identified within the site area. Wastewater treatment plant should be located near the discharge points such that treated water can be discharge offsite immediately without recontamination.

Manholes of communal storm drain near wastewater treatment facilities should be designated as Discharge Point for discharge of treated wastewater. In case there is no manholes of communal storm drain inside site area, the nearest gullies of communal storm drain on public road may be designated as Discharge Point for the purpose of Licence application.

The discharge point should have the facility to be able to take water samples to assess legal compliance.

7.5.3 Pollutant Load

The amount of pollutants present in the wastewater depends on a number of factors including the type of construction works, construction programme and supporting activities at the site:

Table 7.1 below shows the general properties of wastewater from different types of construction works.

Table 7.1 Pollutant Load of Wastewater from Different Types of Construction Works

	Civil	Foundation	Building
SS content	Silty	Muddy	Silty
pH	Neutral to Alkaline	Alkaline	Alkaline

The construction programme should be reviewed to determine the types of activities running concurrently to give an indication of the maximum likely pollutant load and type.

Pollutants from other sources of wastewater such as on-site plant maintenance and municipal wastewater should be considered. Wastewater from toilets and canteens should be collected separately and discharge to a foul sewer upon obtaining consent from Drainage Services Department so as to reduce pollutant load for treatment. Connection to existing communal foul sewer is not always available. In many cases, use of chemical toilets and tankering away of sewage is more practical. Use of on-site sewage treatment and disposal facilities could also be considered if situation and resources permit.

Note that sewage can also be treated through proprietary sewage treatment plants and discharged to a communal drain under a Water Discharge Licence.

7.5.4 Type and Size of Wastewater Treatment Plant

The type and size of wastewater treatment plant should be determined based on the wastewater flow rate and type of pollutant.

For silty wastewater and low flow ($<10\text{m}^3/\text{h}$), traditional sedimentation tank may be sufficient.

For muddy wastewater and higher flow rate ($>10\text{m}^3/\text{h}$), chemically enhanced sedimentation tank should be used. Coagulant and flocculant chemical is added to increase the degree of removal of suspended solid by enhancing the sedimentation process.

For wastewater with pH value exceeding 6-9, additional pH adjustment tank should be coupled with sedimentation tank for treatment.

There is a specific capital expenditure deduction under the Revenue Ordinance on environment-friendly machinery and equipment in the year of purchase. For details, please refer to Revenue Ordinance 2008.



! Washing slurry from concrete lorry mixer is one of the major sources of construction site wastewater. Such washing slurry is normally high in alkalinity and suspended solids. As a best practice, the Contractor should prepare containers of sufficient size, such as lined sump pit on ground for large civil site or metal bins for small building site, at designated concrete lorry mixer washing area to receive the washing slurry. After settling of the slurry, the residual water should be diverted to wastewater treatment plant for treatment while the hardened concrete should be broken down and disposed of as inert C&D materials.

? Who should apply for WPCO Licence?

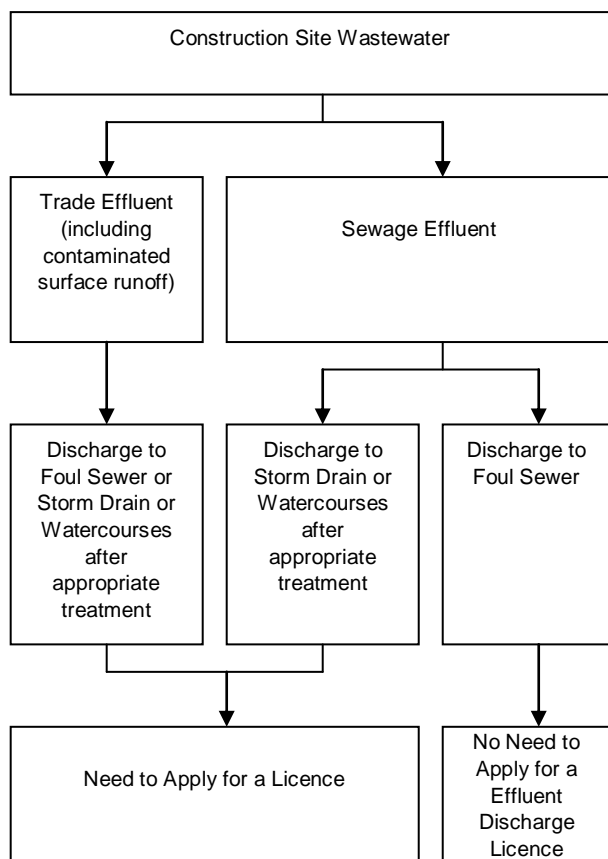
Both the Main Contractor and the Sub-contractor can apply for a discharge licence. According to S.19 of the WPCO, either the person who makes or authorizes the discharge; or the owner or occupier of the premises from which the discharge is made, can apply for the licence. It should be noted however that even if the Sub-contractor is the licensee, the Main Contractor cannot evade their legal liability for causing an illegal discharge, if any, as they have overall control over the site.

As a best practice, Main Contractor should apply for WPCO licence for all the works and areas under his control.

7.6 Application for Licence

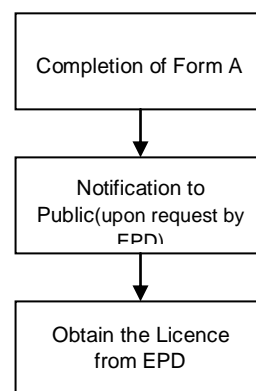
This is a statutory requirement under the WPCO that an effluent discharge licence should be applied for and obtained from EPD before a new discharge can start. Figure 7.4 shows the determination of the necessity to apply for a licence.

Figure 7.4 – Determination of Necessity to Apply for a Licence



The application procedure for obtaining a licence is shown in the figure below.

Figure 7.5 – Application Procedures for Obtaining a Water Discharge Licence



7.6.1 Completion of Form A

Application for a licence should be made by completing Form A and submitting it to EPD. The same form is used for renewing or varying the licence.

Form A can be obtained from the EPD's website.



The form should be duly completed and provide information like the volume of effluent discharge, intended discharge points as specified in the drainage layout plan and the details of the on-site wastewater treatment & disposal facilities.

The completed form should be submitted with the following documents:

- Copies of Business Registration Certificate or Certificate of Incorporation
- Estimation of water flow (Refer to Section 7.5.1)

- Drainage Layout Plan (Refer to Section 7.5.2)

7.6.2 Notification to Public

Public notification is required for making a discharge directly into the waters of Hong Kong such as to any river or Victoria Harbour. Notification means a notice published in English and Chinese newspapers at the Contractor's own expense; the objection period for the public is 30 days from the date of notification.

7.6.3 Obtain the Licence from EPD

For new applications, a Licence will be issued not earlier than 40 days after the notification if no objection is received. For applications that do not require public notification, the licence will be granted in about one month.

EPD would make reference to the Technical Memorandum in fixing the conditions of effluent discharge in the licence. EPD would not normally impose conditions that are more stringent than those in the memorandum.

Three important parameters will be described in the licence:

Maximum Daily Discharge Amount

The licence will consider the information provided by the applicant to grant the maximum daily amount of effluent to be discharged.

Effluent Discharge Limit

EPD will consider the construction work to determine the potential determine and(s) (e.g. pH, suspended solids and COD) and specify the discharge limit for the relevant parameters. Normally, the limit will refer to the Technical Memorandum.

Monitoring Programme

The licence will specify the required monitoring work, e.g. collect effluent sample every month, carry out laboratory analysis of suspended solids and submit the result to EPD.

The effluent discharge licence granted under the WPCO is site specific. On the other hand, an effluent discharge licence may cover multiple sources of effluents with different discharge points. The contractor should provide the relevant effluent discharge information in the licence application form. If there is any change in discharge condition,

the contractor should approach EPD for variation of licence where necessary.

More information concerning the control of wastewater discharges and basic guidelines for handling and disposal of construction site discharge can be referred to the following documents published by EPD:

- A Guide to the Water Pollution Control Ordinance



- Technical Memorandum on Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters



- Practice Note for Professional Person ProPECC PN1/94 on Construction Site Drainage



7.6.4 Variation of the Licence Conditions

If there is any change in the effluent discharge, such as change of flow rate, effluent quality and discharge point(s), an application for variation of the licence should be made to EPD.

To avoid variation of licence conditions, flexibility of discharge details such as numbers and locations of discharge point should be stated in the original application, for example the discharge point may be any communal stormwater drain adjacent to the site.

In applying for a variation, Section D of Form A should be completed and submitted to EPD. It takes about 30 days for the application to be processed.

7.6.5 Renewal of the Licence

The Licence usually has 5 years validity so renewal is rarely required. If the construction extends beyond the expiry date of the Licence, make an application to EPD for renewal of the licence at least 2 months and not more than 4 months before the expiry date of the licence. The same application procedures set out in Figure 7.5 should be followed.

7.6.6 Licence Withdrawal

It is recommended that the Contractor advises EPD at the end of the defects liability period that the licence is no longer required.



Would a less stringent standard be applied to a construction site when the effluent is discharged into a foul sewer?

Generally, yes. The standard is stipulated in the Technical Memorandum issued under the WPCO. Nonetheless, the Contractor should always collect the wastewater generated and may still need to provide proper treatment before discharging into the sewer. More importantly, approval from the Drainage Services Department (DSD) should be sought for any discharge to a foul sewer. It can be done by sending a letter to DSD requesting for a consent. The Contractor should minimize the quantity of wastewater to be discharged to avoid overloading the sewerage system.



Important Reminders

- **Apply for a discharge licence before making a discharge**
- **Strictly adhere to the conditions of the licence to avoid prosecutions.**
- **Understand the wastewater characteristics (e.g. pH, suspended solids, COD etc.)**
- **Plan ahead and install site drainage including channels, catchpits and wastewater treatment plant**
- **Minimize wastewater generation**
- **Use suitable wastewater treatment technology**
- **Operate, regularly maintain and repair the wastewater treatment facilities using trained and experienced staff**
- **Conduct regular sampling based on licence requirement as a minimum**

7.7.2 Routine Water Quality Visual Checking

As good practice, a daily visual check of the discharge effluent quality should be carried out.

The turbidity of the discharge effluent should be visually checked against a standard solution made with the licence-permitted discharge concentration of suspended solids. If the discharge effluent sample looks more turbid than the standard solution, it is a good indication that the suspended solids concentration of the discharge effluent exceeds the licence requirement.

To obtain representative turbidity for visual comparison, the standard solution should be prepared using silt or grit to simulate the source of SS in construction site. This standard solution may be purchased from commercial laboratory at a cost of about HK\$100.

The pH value of the discharge effluent should also be checked using universal indicator paper daily to ensure the pH value of the discharge water does not deviate from the licence requirement.

7.7 Water Quality Monitoring

To ensure the quality of the effluent discharged complies with licence requirements, regular water quality monitoring should be carried out.

7.7.1 Monitoring required by Licence

The Effluent Discharge Licence usually includes conditions on water monitoring requirement. The licensee should take a water sample at the specified sampling point and have the sample tested by a HOKLAS Accredited Laboratory. The analysis report for the required water quality parameters (usually suspended solids, pH and chemical oxygen demand) should be kept in the project records and may need to be submitted to EPD in accordance with the licence condition.

7.8 Site Examples

Good Practices

Temporary Drainage



Drainage is kept clean and tidy



Drainage is blocked by rubbish



Sandbag barrier is erected to protect temporary drainage channel



Temporary drainage channel is not constructed, leading to discharge of untreated wastewater

Site Exit



Wheel-wash facility with washing bay and trough to retain washed sand/dust



Washing bay and trough are not provided for wheel-wash. Wastewater may enter into storm drains directly causing blockages

Good Practices

Bad Practices

Construction Site Runoff



Provide bunding to prevent runoff of wastewater from sites



Insufficient runoff control lead to seepage of wastewater to public road

Wastewater Treatment Plant



Wastewater treatment plant with regular maintenance



Wastewater treatment plant without proper maintenance

7.9 Propriety Wastewater Treatment Packages

There are many types of packaged wastewater treatment systems available from the market to treat construction site wastewater. The use of commercial wastewater treatment plants is recommended for their higher treatment efficiency and relatively compact size. Their treatment principles and relevant characteristics are shown in Figure 7.6 and summarized in Table 7.2 respectively.

Figure 7.6 – Commercial Wastewater Treatment Plant

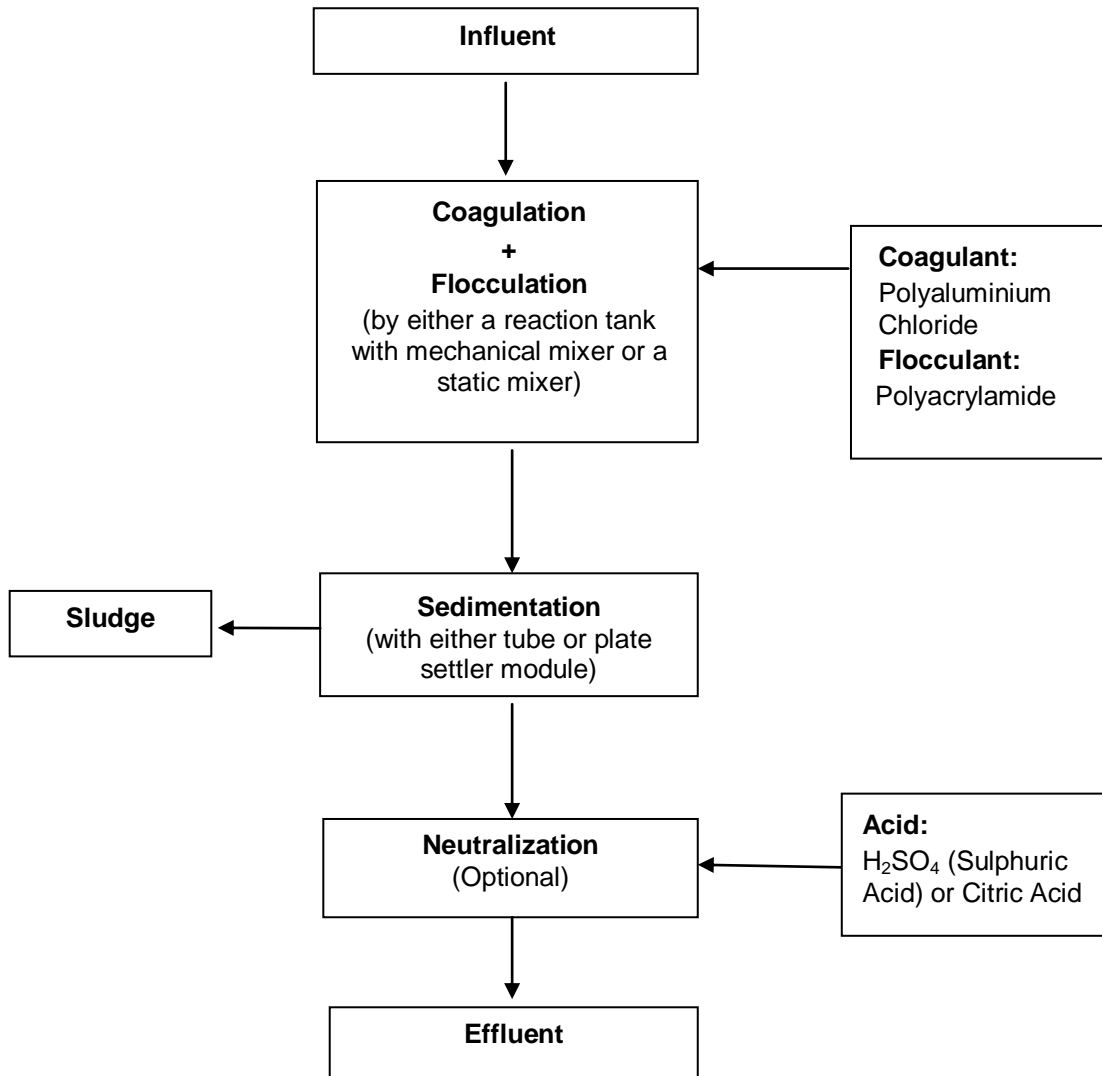


Table 7.2 Commercial Wastewater Treatment System Characteristics

Treatment [m ³ /hr]	Capacity	Typical Space Requirements [m] (Length * Width * Height)	Maximum Suspended [mg/L]	Influent Solids	Treatment Cost per m ³ of Wastewater [HK\$]
10		2.7 * 2.5 * 3.0	< 20,000	< 1	
20		3.3-3.5 * 2.3-2.5 * 3.0-3.6			
40		5.0-5.4 * 2.3-2.5 * 3.0-3.6			
80		7.9-8.4 * 2.3-2.5 * 3.4-3.9			
120		9.5 * 2.5 * 3.9			

7.9.1 Field Tests

Three building construction sites, four civil engineering sites and one bored piling site were chosen for the field tests to examine the wastewater treatment setup and performance. Wastewater treatment facilities were installed in these sites to treat wastewater generated from construction activities. Grab samples collected

from influent, effluent and sedimentation tank (where possible) were sent to a HOKLAS Accredited Laboratory for analysis of suspended solids. Table 7.3 summarises the site conditions, wastewater treatment systems, sample results and conclusion.

Table 7.3 Summary of Field Tests

Construction Activities	Wastewater Treatment Processes	Suspended Solids Concentration	Conclusion*
Building (Site B1)	One reception tank and a primary sedimentation tank followed by a wastewater treatment system HRT by the primary sedimentation = 31 min HRT by the tube settler = 16 min	Influent: 1284mg/L, Effluent: 10 mg/L	Effluent quality complies with the discharge standard.
Building (Site B2)	One reception tank followed by a wastewater treatment system HRT by the reception tank = 19 min HRT by the tube settler = 16 min	Influent: 182 mg/L, Effluent: 40 mg/L	Effluent quality does not comply with the discharge standard. It is recommended to adjust the chemical dosing rate and ensure regular maintenance of the system.
Building (Site B3)	A reception tank and two primary sedimentation tanks followed by a wastewater treatment system HRT by the reception tank and primary sedimentation = 42 min HRT by the tube settler = 16 min	Influent: 5520 mg/L, Effluent: 5 mg/L	Effluent quality complies with the discharge standard.
Civil Engineering (Site C1)	One reception tank followed by a wastewater treatment system HRT by the reception tank = 45 min HRT by the tube settler = 16 min	Influent: 12590 mg/L, Effluent: 4 mg/L	Effluent quality complies with the discharge standard.

* The discharge standard for the suspended solids of the sites was 30 mg/L.

Table 7.3 Summary of Field Tests (Continued)

Construction Activities	Wastewater Treatment Processes	Suspended Solids Concentration	Conclusion*
Civil Engineering (Site C2)	One reception tank with addition of coagulant and followed by a wastewater treatment system HRT by the reception tank = 49 min HRT by the tube settler = 12 min Coagulant dosing \approx 7.5L/min (proprietary chemical so the dosage and concentration did not know)	Influent: 2271 mg/L, Effluent: 9 mg/L	Effluent quality complies with the discharge standard.
Civil Engineering (Site C3)	Two primary sedimentation tanks with addition of coagulant in the first primary tank followed by a wastewater treatment system HRT by the primary sedimentation = 18 min HRT by the tube settler = 23 min Coagulant dosing \approx 5L/min with dosage of 40 ppm	Influent: 1240 mg/L, Effluent: 17 mg/L	Effluent quality complies with the discharge standard.
Civil Engineering (Site C4)	The Contractor adopts a self-developed wastewater treatment system. The system is composed of three sedimentation tanks. Coagulant is added into 1st sedimentation tank and flocculant is added into first chamber of 2nd sedimentation tank. HRT by the sedimentation = 10 min Coagulant dosing \approx 7.5L/min with dosage of 40 ppm Flocculant dosing \approx 5L/min with dosage of 2 ppm	Influent: 3491 mg/L, Effluent: 16 mg/L	Effluent quality complies with the discharge standard.
Bored Piling (Site P1)	The wastewater treatment system is composed of five circular tanks. Due to the site constraint, the influent and effluent samples were not collected. HRT by the primary sedimentation = 30 min	After 2nd tank: 219mg/L, After 3rd tank: 207mg/L, After 4th tank: 149mg/L	From our observation, there is a short circuit of wastewater in each tank. Wastewater enters at the inlet and leaves at the outlet directly. It is recommended to install a baffle between inlet and outlet of a tank.

* The discharge standard for the suspended solids of the sites was 30 mg/L.

Appendix 7.1 Site Inspection Checklist-Wastewater

		Implemented?		Remark
Construction Site Runoff		Yes	No	
1	Exposed soil areas are minimised	<input type="checkbox"/>	<input type="checkbox"/>	
2	All exposed earth are stabilised after completion of earthworks, or within 14 days of the cessation of earthworks	<input type="checkbox"/>	<input type="checkbox"/>	
3	Dykes are provided at boundary of any critical or low-level areas of earthworks for flood protection	<input type="checkbox"/>	<input type="checkbox"/>	
4	Sufficient temporary ditches, drainage pipes and/or culverts for collection of site runoff are provided	<input type="checkbox"/>	<input type="checkbox"/>	
5	Sedimentation tanks are provided for treatment of effluent prior to the discharge	<input type="checkbox"/>	<input type="checkbox"/>	
6	Sedimentation tanks are of sufficient capacity	<input type="checkbox"/>	<input type="checkbox"/>	
7	Sedimentation tanks are effectively maintained according to planned schedules with clear records	<input type="checkbox"/>	<input type="checkbox"/>	
8	Reinstate any temporarily diverted drainage to its original condition when works are completed	<input type="checkbox"/>	<input type="checkbox"/>	
9	Sediment traps are installed upstream and downstream of modified culvert systems	<input type="checkbox"/>	<input type="checkbox"/>	
10	All the sedimentation facilities are inspected, maintained and cleaned on a regular basis or as necessary	<input type="checkbox"/>	<input type="checkbox"/>	
11	Oil interceptors are provided in the drainage system where necessary and are cleaned on a regular basis or as necessary	<input type="checkbox"/>	<input type="checkbox"/>	
12	Oil interceptors serving open area have a peak storm bypass (No bypass for oil interceptors serving covered area.)	<input type="checkbox"/>	<input type="checkbox"/>	
13	Temporarily exposed slopes are covered by tarpaulin or similar fabric during rainy seasons	<input type="checkbox"/>	<input type="checkbox"/>	
14	Temporary access road is protected by crushed stone or gravel during surface excavation works	<input type="checkbox"/>	<input type="checkbox"/>	
15	Any open stockpiles of construction materials of more than 50m ³ are covered with tarpaulin or similar fabric during rainstorms	<input type="checkbox"/>	<input type="checkbox"/>	
16	Intercepting channels are provided near the drainage system to prevent washing away of construction material, soil, silt or debris	<input type="checkbox"/>	<input type="checkbox"/>	
17	Manholes under construction are covered and temporarily sealed	<input type="checkbox"/>	<input type="checkbox"/>	
18	Wheel washing facility is provided at every site exit and maintained	<input type="checkbox"/>	<input type="checkbox"/>	
19	Sand and silt in the wheel washing bay are removed regularly	<input type="checkbox"/>	<input type="checkbox"/>	
20	Subsequent permanent work or surface protection is carried out immediately after the final surfaces are formed	<input type="checkbox"/>	<input type="checkbox"/>	

		Implemented?		
	Construction Site Runoff	Yes	No	Remark
21	Trenches are dug and backfilled in short sections if excavation of trenches in wet seasons is necessary	<input type="checkbox"/>	<input type="checkbox"/>	
22	Ingress of rainwater into trenches is minimised	<input type="checkbox"/>	<input type="checkbox"/>	
23	Rainwater pumped out from trenches or foundation excavations is discharged into storm drains via silt removal facilities	<input type="checkbox"/>	<input type="checkbox"/>	
24	Discharge of surface runoff into foul sewers is prevented	<input type="checkbox"/>	<input type="checkbox"/>	
25	Spent bentonite slurries used in diaphragm wall construction are reconditioned and reused, wherever practicable	<input type="checkbox"/>	<input type="checkbox"/>	
26	Rubbish is cleared from drains and wastewater system	<input type="checkbox"/>	<input type="checkbox"/>	
27	Chemical toilets are provided in the case that connection to the existing foul sewer main is not possible	<input type="checkbox"/>	<input type="checkbox"/>	
28	Grease traps are provided to treat wastewater from kitchens or canteens	<input type="checkbox"/>	<input type="checkbox"/>	
29	Vehicles are cleaned before leaving the construction site	<input type="checkbox"/>	<input type="checkbox"/>	
30	Treated wash water is reused for non potable use, where possible, like dust emission control and vehicle washing.	<input type="checkbox"/>	<input type="checkbox"/>	
31	Sand and silt in wash-water is settled out or removed before discharging into storm drains	<input type="checkbox"/>	<input type="checkbox"/>	
32	Sewage from toilets and similar facilities is discharged into a foul sewer if connection to foul sewer can be made	<input type="checkbox"/>	<input type="checkbox"/>	
33	If foul sewer cannot be made, on site sewage treatment and disposal facilities or tinkering away of sewage are provided	<input type="checkbox"/>	<input type="checkbox"/>	
34	Drainage serving an open oil filling point is connected to storm drains via a petrol interceptor with peak storm bypass	<input type="checkbox"/>	<input type="checkbox"/>	
35	Vehicle and plant servicing areas and lubrication areas are located within roofed area as far as possible	<input type="checkbox"/>	<input type="checkbox"/>	
36	Drainage in the roofed/covered areas for Item 33 is connected to foul sewers via a oil trap	<input type="checkbox"/>	<input type="checkbox"/>	
37	Prior agreement from Drainage Services Department is obtained before sewage discharge to foul sewer.	<input type="checkbox"/>	<input type="checkbox"/>	
38	Oil leakage or spillage is contained and cleaned up immediately	<input type="checkbox"/>	<input type="checkbox"/>	
39	Drainage facilities, erosion and sediment control structures are well maintained and inspected regularly	<input type="checkbox"/>	<input type="checkbox"/>	
40	Site drainage plan being prepared, reviewed and implemented by qualified environmental site staff	<input type="checkbox"/>	<input type="checkbox"/>	
41	Effluent discharge licence is obtained from EPD before any discharge is made	<input type="checkbox"/>	<input type="checkbox"/>	
42	Copy of the effluent discharge licence, together with effluent monitoring report and maintenance record of the on-site wastewater treatment and disposal facilities, is placed at site office for checking by EPD	<input type="checkbox"/>	<input type="checkbox"/>	
43	Sampling of effluent is being conducted regularly to ensure compliance with the effluent discharge limits stipulated in the discharge licence	<input type="checkbox"/>	<input type="checkbox"/>	

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8 Waste Management

8.1 Terminology

Construction & Demolition (C&D) Material

C&D Material means any substance, matter or thing which generated as a result of construction work and abandoned whether or not it has been processed or stockpiled before being abandoned.

It is a mixture of surplus materials arising from:

- Site Clearance;
- Excavation;
- Construction;
- Refurbishment;
- Renovation;
- Demolition; and
- Road Works.



Construction and Demolition Material

C&D material can be further classified into inert and non-inert substances. The former is commonly known as “Inert C&D Material” while the latter is called “C&D Waste”.

C&D Waste

C&D waste which means any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. And it is those materials not suitable for reclamation. Subject to recovery of reusable or recyclable items, C&D waste is disposed of at landfills. The following substances are example of C&D waste:

- Bamboo;
- Timber;

- Vegetation;
- Packaging Waste; and
- Other Organic Materials.



C&D Waste containing vegetation, timber and plastics

Inert C&D Material

Over 80% of C&D materials are inert materials. They are suitable for land reclamation and site formation. The following substances are example of inert C&D material/public fill:

- Rubble;
- Boulder;
- Concrete;
- Bricks;
- Asphalt;
- Tile;
- Masonry;
- Earth/Soil/Sand;
- Rock; and
- Used bentonite.



Generally inert C&D material from demolition works

Landfills

Landfills refer to the strategic landfill sites managed by EPD. At present, three strategic landfills are in operation:

- West New Territories (WENT) Landfill;
- South East New Territories (SENT) Landfill; and
- North East New Territories (NENT) Landfill.

C&D waste disposed of at landfills should contain not more than 50% by weight of inert C&D materials.



In accordance to Waste Disposal (Designated Waste Disposal Facility) Regulation (Chapter 354L), the following Criteria should be adopted.

For a load of construction waste not consisting entirely of bamboo, plywood or timber delivered by a vehicle:-

Inert Waste Content \leq 50%.

For goods vehicles with demountable skips:

Weight Ratio \leq 0.25

The depth of the waste loaded >1 meter

For other types of vehicles:

Weight Ratio \leq 0.20

The depth of the waste loaded >1.5 meter

For a load of construction waste consisting entirely of bamboo, timber or plywood delivered by a vehicle, there is no restriction on the depth of the waste and the weight of the waste loaded on the goods vehicle divided by the permitted gross vehicle weight of the vehicle.

Public Fill Reception Facilities

Public fill reception facilities are managed by the Civil Engineering and Development Department (CEDD) to accept public fill. The facilities includes:

- **Public Filling Areas**
A designated part of a development project accepting public fill for reclamation.
- **Public Filling Barging Points**
A strategically located public fill reception facility utilizing barge transportation to transfer public fill from road vehicles to marine based public filling areas.
- **Public Fill Stockpiling Areas**
A newly reclaimed land where public fill is stockpile as surcharging material to accelerate settlement.
- **Fill Banks**

An area allocated for temporary stockpile of public fill for later use.

- **C&D Material Recycling Facility**

The facility process hard inert materials into recycled aggregates and granular materials for use in construction activities.



Under the Charging Regulation, existing Public Fill Reception Facilities available to the public are:

- Tseung Kwan O Area 137 Fill Bank
- Tuen Mun Area 38 Fill Bank
- Chai Wan Public Filling Barging Point
- Mui Wo Temporary Public Filling Barging Point

C&D material disposed of at public fill reception facilities should consist entirely inert materials while that disposed of at sorting facilities should contain more than 50% by weight of inert materials.

Construction Waste Sorting Facilities

There are two operating sorting facilities, one at Tseung Kwan O Area 137 and the other at Tuen Mun Area 38 for sorting the inert portion of construction waste from mixed waste. C&D material disposed of at sorting facilities should contain more than 50% by weight of inert materials.



In accordance to Waste Disposal (Designated Waste Disposal Facility) Regulation (Chapter 354L), the following Criteria should be adopted.

For a load of construction waste not consisting entirely of bamboo, plywood or timber delivered by a vehicle:-

Inert Waste Content \geq 50%.

For goods vehicles with demountable skips:

Weight Ratio \geq 0.25

The depth of the waste loaded <1 meter

For other types of vehicles:

Weight Ratio \geq 0.20

The depth of the waste loaded <1.5 meter

For a load of construction waste consisting entirely of bamboo, plywood or timber delivered by a vehicle, the load is regarded as construction waste containing not more than 50% by weight of inert construction waste.

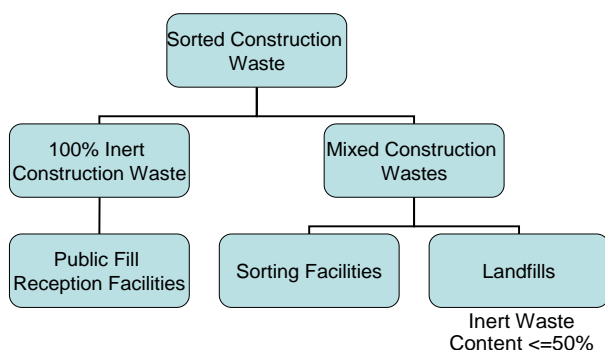
For easier understanding on the current acceptance criteria and practice, a table shown below has been provided to the industry:

Vehicle Type	Waste Depth	Weight Ratio	Waste Disposal Facilities
Vehicles with demountable skips	>1.0 metre	Any Ratio	Landfills
	≤1.0 metre	≤ 0.25	Landfills
		> 0.25	Sorting Facilities
Other types of vehicles	>1.5 metres	Any Ratio	Landfills
	≤1.5 metres	≤ 0.20	Landfills
		> 0.20	Sorting Facilities

Outlying Islands Transfer Facilities

Outlying Islands Transfer Facilities refer to the waste transfer facilities located at Mui Wo, Peng Chau, Hei Ling Chau, Cheung Chau, Yung Shue Wan, Sok Kwu Wan and Ma Wan. There is no restriction on the percentage of inert materials for C&D material disposed of at Outlying Islands Transfer Facilities.

Specific requirements on the size and moisture content of the materials may also be stipulated in individual works contract.



A Guide for Determination of 50% Waste Materials Content

Weight Ratio =

$$\frac{\text{Weight of in-weighbridge} - \text{Tare weight of vehicle}}{\text{Permitted Gross Vehicle Weight (PGVW)}}$$

8.2 Statutory and Non-Statutory Requirements

Refer to Chapter 2 of the Guide for requirements under the Waste Disposal Ordinance, subsidiary regulations and non-statutory requirements.

8.3 Construction Waste Disposal Charging Scheme

C&D waste producers need to open a billing account with EPD and pay for the construction waste disposal charge prior to using government waste disposal facilities.

8.3.1 Open a Billing Account

Step 1: Submit application with the required documents

Case 1: Construction work with value of \$1 million or above

- Open a billing account solely for the contract
- Application shall be made by main contractor within 21 days after the contract awarded (failing this will be an offence under the law).

Application form with guidance notes and conditions



Sample of completed application form



Supporting documents required



Case 2: Construction work with value less than \$1 million

- Any person such as the premises owner or his/her contractor can open a billing account;
- The account can also be used for contracts each with value less than \$1 million; and
- Premises owner concerned may also engage a contractor with a valid billing account to make arrangement for disposal of the C&D waste.

Application form with guidance notes and conditions



Sample of completed application form



Required Documents and Information

	Photocopy of HKID or BR Certificate	Photocopy of Proof of company address	Photocopy of construction work contract
Case 1	√	√	√
Case 2	√	√	X

Step 2: Pay the deposit stated on Demand Note

Case 1: Construction Work with Value of \$1 million or above

- Minimum \$15,000 for issuance of up to 200 “Chits” for each account
- Obtain additional “Chits” at HK\$75 each

Case 2: Construction work with value less than \$1 million

- HK\$300 per “Chit”
- HK\$75 per “Chit” (for Outlying Islands Transfer Facilities users)

Step 3: Bring collection note to designated office to collect “Chits” or obtain “Chits” by post (for 20 Chits or less)

8.3.2 Use of “Chit”

The procedures for using the “Chit” are:

- Account-holder makes arrangement for disposal of construction waste
- Account-holder fills in and issues the “Chit” to the waste hauler and retains Part A of the “Chit”
- Waste hauler presents Parts B and C of the “Chit” to the operator of designated waste disposal facility
- Operator after stamping returns Part B to the waste hauler
- A transaction record slip can be obtained upon completion of the disposal

The image shows three parts of a 'Chit' form. Part A is the top section, retained by the account holder. It includes fields for 'Account No.' (00000585), 'Date of Issue' (24/01/2011), and 'Name of Account Holder' (ABC Construction Company). Part B is the middle section, retained by the waste hauler. It includes fields for 'Account No.' (00000585), 'Date of Issue' (24/01/2011), and 'Name of Account Holder' (ABC Construction Company). Part C is the bottom section, retained by the government. It includes fields for 'Account No.' (00000585), 'Date of Issue' (24/01/2011), and 'Name of Account Holder' (ABC Construction Company). The forms are labeled 'Part A: retained by account holder', 'Part B: retained by Waste Hauler', and 'Part C: retained by Government' at the bottom.

Application for Issuance of Chits for Existing Account, Download Form



As a general construction waste disposal requirement, the Gross Vehicle Weight of a vehicle using the waste disposal service of the prescribed facilities shall not exceed the Permitted Gross Vehicle Weight" against overloading of vehicle, similar to the one under Section 8.4.1.

8.3.3 Payment

- EPD will issue a monthly demand note and waste transaction information to the account-holder
- The account-holder pays charges within 45 days from the date of demand note. The charges may be paid by post, in person, through phone payment service (PPS) or internet



If the charges are not paid by due date, the account-holder shall pay a surcharge of 5% of the unpaid amount.

If the unpaid charges and the surcharge are not paid with 14 days from the date on which the surcharge becomes payable, the Director of Environmental Protection (DEP) may suspend the account and serve a final notice to the account-holder.

Where the outstanding charges and the surcharge are not paid within 14 days from the date of final notice, the DEP may revoke the account.



To avoid delay of construction progress due to insufficient stock of CHIT for C&D material disposal, the following strategy on CHIT application should be observed:

- Prepare C&D materials disposal schedule for the whole construction period.
- Update the disposal schedule at least half-yearly.
- Keep CHIT stock for sufficient use for the coming 2 months.
- Replenish CHIT as and when required.

8.3.4 Change/Closure/Reinstatement of an Account

- Prescribed Form 5 should be used for notification of changes in Account information.
- Prescribed Form 6 should be used for application for closure or reinstatement of an Account.



8.4 Dumping Licence and Trip-Ticket System

8.4.1 Dumping Licence

A Dumping Licence is required for disposal of public fill to the public filling facility. The Fill Management Division (FMD) of CEDD is responsible for issuing Dumping Licence.

- The Dumping Licence together with a windscreen Dumping Label are issued free of charge.
- Application for a Dumping Licence can be made all the year round.



As stipulated in the Dumping Licence conditions, the licensee or his authorized dump truck driver should not overload his dump truck beyond the gross vehicle weight.

Non-compliance with that condition may lead to receipt of warning letter or even cancellation of the Dumping Licence for repeated non-compliance. The main contractor can also be penalised through the Contractor's Performance Record.

8.4.2 Trip-Ticket System

The trip-ticket system (TTS) is a recording system for orderly disposal of construction waste. The system has been in operation for many years, prior to the introduction of the Construction Waste Disposal Charging Scheme.

Sample of the Disposal Delivery Form used on government contracts

DDF for TTS continues to apply to existing contracts and contracts for which tenders were invited before 1 November 2010, ETWB TC(W) 31/2004.

Sample of the CHIT used on government contracts

CHIT for TTS is applicable to all public works contracts for which tenders are invited on or after 1 November 2010, DEVB TCW No.6/2010.

For government contracts, the Contractor is required to complete a standard trip-ticket form outlining:

- Date of Disposal
- Vehicles License Plate Number
- Contents of the vehicle (type and approximate volume of waste)
- Designated disposal facility

After being checked, signed, copy and stamped by the Engineer's or Architect's Representative or site supervisory staff, the load of waste will be delivered to the designated facility.

For the waste delivered to the government designated facility, stamped trip ticket will be returned to the vehicle operator. In parallel, the Contractor shall check the information and disposal records at EPD's /CEDD's website for verification of the compliance.

In order to ensure proper disposal of C&D materials, enhancement measures to further improve the TTS recording system, a video recording system shall be installed to monitor the vehicular exit/entrance of the site and disposal records shall be checked against survey records.

For details of the Trip-ticket System, please refer to the government's technical circular DEVB TCW No.6/2010.

For non-government contracts, the Contractor is also encourage to adopt the TTS. With the success of the adoption of the TTS in public works, the arrangement can also be applied to private sector works.

8.5 Government Waste Disposal Facilities for C&D Material

8.5.1 Charge Level

The level of charge for disposal of different types of construction waste at government waste disposal facilities is shown in Table 8.1.

Table 8.1 Charge levels for different waste types

Government waste disposal facilities (Please see location map)	Type of construction waste accepted	Charge per tonne [#]
Public fill reception facilities	Consisting entirely of inert construction waste ⁺⁺	\$27
Sorting facilities	Containing more than 50% by weight of inert construction waste ⁺⁺	\$100
Landfills [@]	Containing not more than 50% by weight of inert construction waste ⁺⁺	\$125
Outlying Islands Transfer Facilities [@]	Containing any percentage of inert construction waste ⁺⁺	\$125

[#] Except for the Outlying Islands Transfer Facilities, the minimum charge load is 1 tonne, i.e. if a load of waste weighs 1 tonne or less, it will be charged as 1 tonne. A load of waste weighing more than 1 tonne will be charged at 0.1 tonne increment. For Outlying Islands Transfer Facilities, the charge is \$12.5 per 0.1 tonne and the minimum charge load is 0.1 tonne.

⁺⁺ Inert construction waste means rock, rubble, boulder, earth, soil, sand, concrete, asphalt, brick, tile, masonry or used bentonite.

[@] If a load of waste contains construction waste and other waste, that load will be regarded as consisting entirely of construction waste for the purpose of calculating the applicable charge.

8.5.2 Timetable of Services for Waste Disposal Facilities

A timetable of services for waste disposal facilities can be found at the EPD's [W](#) /CEDD's [W](#) websites.

8.6 Waste Management

8.6.1 Planning

The options for waste management are listed in preferred order:

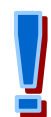
- 1 Avoidance;
- 2 Minimization;
- 3 Recycling;
- 4 Treatment; and
- 5 Disposal.

Proper planning for waste reduction should be carried out before site operations commence. It can be achieved by:

- Preparing a waste management plan as part of the overall Environmental Management Plan
- Setting out waste reduction targets and programmes
- Arranging on-site sorting and proper waste disposal
- Setting up a good housekeeping practice
- Setting up a waste management monitoring and audit programme



On site sorting of construction waste into inert and non-inert streams



For sites with limited available working space, waste materials should at least be separated into inert and non-inert portions by directly depositing into skips.

Preparing a Waste Management Plan

A waste management plan provides an overall framework for waste management and reduction. It identifies major waste types and defines ways for waste reduction. Details of the contents of the plan are given in Section 8.6.4.

Waste Reduction Targets

For each identified waste stream, waste reduction targets such as percentage or quantity reduced or recycling rates should be set.

Waste Reduction Programme

The programme sets out the actions required for waste reduction for each identified waste type in the form of waste reduction programmes, procedures and guidelines.

Arranging On-site Sorting

Identify designated areas for on-site sorting of waste for reuse and recycle and provide suitable containers to temporarily store sorted materials such as metals, concrete, timber, packaging and plastics. Sorting and segregation at the works location (i.e. at source) can achieve higher recovery effectiveness.



Recycling cage for waste sorting

Proper Waste Disposal

Define a proper waste disposal procedure for each waste type and arrange disposal.

Good Housekeeping Practice

Do not order too early or over-order to avoid accumulation of material that can lead to damage and deterioration. Provide good storage and maintenance of raw materials to prevent deterioration. Return any surplus material to a centralized storage area with suitable protection measures.

A proposed storage guide is provided in **Appendix 8.1**.

A Good Housekeeping Checklist is provided in **Appendix 8.2**.

Monitoring and Audit

Set up a team to record the quantity of waste generated, reduced, recycled and disposed and to monitor the effectiveness of the waste management programme. The monitoring team should recommend improvement or corrective measures when necessary.

8.7.2 Waste Reduction Guidelines

Step 1: Lean Construction

For design and build projects, the adoption of “lean construction” techniques can minimize the quantity of raw materials being used and thus reduce the amount of waste, for example:

- Use thinner internal wall and floor slabs
- Reduce foundation size
- Adopt modular building designs and precast or prefabricate building components such as facades, staircases and semi-precast floor slabs

Step 2: Assign a Site Waste Officer

Assign a site waste officer who may be an environmental engineer, site agent or other suitable staff. The officer should be responsible for:

- Drafting a waste management plan;
- Identifying waste management procedures and instructions; and
- Performing a regular site waste audit.

Step 3: Material Utilization

Poor handling of materials and improper operating procedures often causes high raw material wastage.

- Broken items or off-cuts should be considered for sections when small lengths are required;
- Set up management system making use of information technology facilitating senior site staffs or headquarter staffs to check the usage and waste of materials; and
- Measure wastage of different materials to identify improvement opportunities.

On-site sorting area – proper sorting of raw materials



Properly designed on site storage area

Step 4: Reuse and Recycling

Reuse and recycling is an essential part of waste management, to prevent surplus materials from being disposed, measures include:

- Reuse items such as hoarding, formwork and scaffolding;
- Recycle materials such as metals, concrete and asphalt. A list of reusable and recyclable material is shown in Table 8.2; and
- Consider an on-site crusher for demolition material into aggregates for reuse.

A list of recyclers is available at EPD's website.



On-site sorting area for reusable and recyclable materials



Provide an on-site sorting area for reusable or recyclable materials

Table 8.2 – Reusable and Recyclable Materials

Type of Material	How can it be Reused or Recycled?
Concrete	Recycling for use as aggregate in new concrete. Recycling for use as unbounded aggregate in roads or fill. The specification facilitating the use of recycled aggregates can be found in WBTC 12/2002 and ETWB TCW 24/2004.
Bitumen and Asphalt	Recycling for use in bound layer of road. Recycling for use as bulk fill.
Excavation Spoil	Reuse for landscaping.
Topsoil	Reuse for landscaping.
Timber	Reuse, eg. for formwork or noise barriers. Reuse for chipboard.
Metals	Reuse. Recycle.
Clay, Concrete Pipes, Tiles, Blocks and Bricks	Reuse.
Packaging and Plastics	Reuse or send to recycler



Designs should be flexible to provide opportunities for future adaptation of buildings

- Use of durable materials; and
- Flexible design allowing conversion of building to meet future uses.



Reuse and Recycling should be encouraged.

- Reuse surplus construction materials such as bricks and tiles;
- Use of recycled materials in new construction such as recycled aggregates and asphalt, and
- Use of pulverized fuel ash and durable and recyclable materials such as metals instead of timber.



For foundation and earthworks projects, design for reusing excavated spoil as back-fill material to balance cut and fill.

If cut and fill cannot be balanced on-site, look to other possible sites. Consolidation of material needs across Hong Kong is carried out Fill Management Division of the Civil Engineering and Development Department.

The Hong Kong Construction Association can also assist in publicising material availability and needs of projects to facilitate waste management initiatives within Hong Kong.

Some Good Examples

Case 1: Selective Demolition

To maximise recovery of reusable and recyclable materials, the following measures should be adopted:

- Hand demolition and dismantling should be considered prior to demolition using point breaker, bulldozer, crane ball and chain, and explosives, which are more relevant to recycling than reuse.
- Salvageable materials such as metals, timber, bricks and tiles should be removed from the buildings before demolition.
- Selective sequential demolition should be adopted to remove one type of material at one time to avoid mixing.

Case 2: Designs for Long-Life

Designs should be flexible to provide opportunities for future adaptation of buildings

- Use of durable materials; and
- Flexible design allowing conversion of building to meet future uses.

Case 3: Reuse and Recycling of materials

- Reuse surplus construction materials such as bricks and tiles;
- Use of recycled materials in new construction such as recycled aggregates and asphalt; and
- Use of pulverized fuel ash and durable and recyclable materials such as metals instead of timber.

Case 4: Unitized Precast Construction


When compared with traditional building construction approaches, the use of unitized precast construction eliminates the use of timber formwork and wet trades; reduces water consumption and dust and noise nuisance and

more importantly reduces the disturbances caused by the construction activities and also the overall construction cycle period.




Precast units for facades of housing blocks

Video Shows

Some videos showing low waste construction design and technologies can be viewed at EPD's website. 

8.7.3 Waste Management Implementation


ETWB TCW No. 19/2005 "Environmental Management on Construction Sites"  includes procedures on waste management requiring contractors to reduce the C&D material to be disposed of during the course of construction. Some of the strategies to be adopted include:

- Nominating a person, such as a site manager, to be responsible for good site practices, collection and effective disposal of all wastes generated at the site to an appropriate facility;
- Training of site personnel in proper waste management and chemical waste handling procedures;
- Developing and providing toolbox talks for on-site sorting of C&D materials to enhance worker's awareness in handling, sorting, reuse and recycling of C&D materials;
- Providing sufficient waste disposal points and regular collection of waste;
- Implementing a regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors;
- Sorting C&D waste from demolition of existing facilities to recover recyclable portions such as metals;
- Segregating and sorting different types of waste into different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal;

- Encouraging collection of aluminium cans, plastic bottles and paper by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the work force;
- Recycling unused chemicals;
- Ensuring proper storage and site practices to minimise the potential for damage or contamination of construction materials; and
- Routine inspection and reporting system.



Mixed waste skip needs emptying – make sure there is a monitoring regime for best practice

	Is a Waste Management Plan (WMP) a mandatory requirement?
<p>Under ETWB TCW No. 19/2005, capital works contracts (including Design & Build contracts and E&M contracts, with contract sum \geq \$20M and contract period $>$ 6 months) are required to prepare and implement an Environmental Management Plan (EMP) of which the Waste Management Plan becomes part.</p>	

8.7.4 Prevention against illegal land filling and flytipping activities

A list of Ordinances/Regulations has imposed controls on depositing construction waste on government and private land, which includes:

- ◆ Town Planning Ordinance;
- ◆ Waste Disposal Ordinance;
- ◆ Public Cleansing and Prevention of Nuisances Regulation;
- ◆ Fixed Penalty (Public Cleanliness Offences) Ordinance;
- ◆ Public Health and Municipal Services Ordinance;
- ◆ Building Ordinance; and
- ◆ Relevant pollution control ordinances.

Potential preventative measures are suggested to be implemented by the landowners, developers/contractors and truck drivers in order to prevent illegal land filling and flytipping activities:

For landowners:

- Proper site entry and exit control of dump trucks with construction waste;
- Prompt reporting of any suspected noncompliance case to the authorities;
- Close checking and keeping of disposal record of construction waste;
- Installation of CCTV/ photo taking of each dump truck entering and leaving the site;
- Ensure disposal of construction waste at proper disposal outlets; and
- Ensure land filling is permitted.


For developers/contractors:

- Implementation of waste management plan;
- Proper control and management of chits issued to dump truck operators;
- Close checking and keeping of disposal record of construction waste;
- Photo taking and on-site loading measurement of each dump truck leaving the site;
- Ensure disposal of construction waste at proper disposal outlets;
- Ensure the transporter comply with all legal requirements;
- Prompt reporting of any suspected noncompliance case to the authorities; and
- Employ only reliable driver, vehicle and companies with no previous record of engagement in flytipping activities.

For truck drivers:

- Ensure disposal of construction waste at proper disposal outlets;
- Ensure to comply with environmental and safety requirements;
- Report of any suspected noncompliance case to the authorities;
- Close checking and keeping of disposal record of construction waste; and
- Request the C&D wastes producers to adopt a trip ticket system to track the loads.

More information on guidelines for control of flytipping activities can be referred to the following leaflets published by EPD.

- Be responsible, say "NO" to illegal waste dumping - A Guide for Construction Waste Transporters 

- Know your environmental responsibilities: Managing construction and demolition materials properly - A Guide for Developers, Contractors and Property Managers

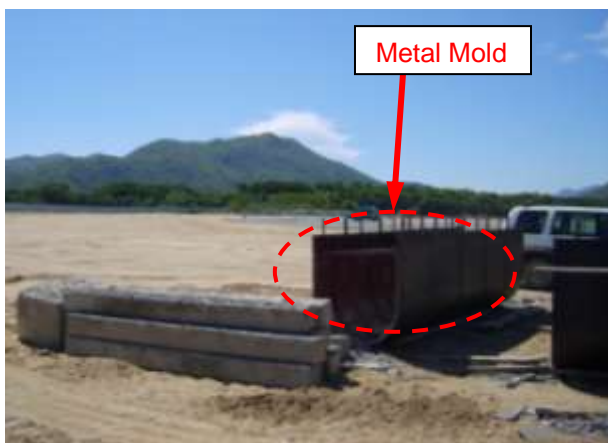


8.8 Case Studies

Case 1: Use of metal moulds for forming concrete channels

Merits:

- 1 Reduce timber required for concrete works; and
- 2 Metal moulds can be recycled after use.



Use of metal moulds for concrete works

Case 2: Reuse of Surplus Concrete

Merits:

- 1 Reuse surplus concrete as counterweight base for hoarding; and
- 2 Reuse surplus broken concrete for paving haul road.



Plan ahead to make sure that surplus concrete can be reused

Case 3: Recycle Backfilling Materials

Merits:

- 1 Temporary stockpile of excavated material for recycling as backfilling material at a later stage.



Stockpiling material – be aware of potential construction dust impacts and mitigate when necessary

Case 4: On-site sorting of construction waste





Sorting of materials for reuse or recycling. Careful demolition can ensure high levels of material recovery

8.9 Marine Sediment Disposal

Given that dredging and excavation works are commonly occurred in Hong Kong, to facilitate the reclamation works or infrastructure development. There is a need to manage the sediment generated from dredging works at sea or land-based excavation works in an environmental friendly, cost effective and efficient manner. In particular, appropriate consideration should be given to waste management options of reuse, recycling or upland treatment and/or disposal prior to marine disposal.

Dredged mud may be dumped at sea subject to permit controls under the Dumping at Sea Ordinance, Cap. 466 (DASO). The permits are issued by the Director of Environmental Protection (DEP) as the Authority under the Ordinance. Applicant should note that the Authority may refuse to issue a permit for dumping any matter if it is determined that appropriate opportunities exist to reuse, recycle or treat the waste. Relevant considerations are set out in the DASO Guidance Note No. 1/2006 "Implementation of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972".

This section explains the procedure for seeking approval to dredge/ excavate sediment and the management framework for marine disposal of such sediment.

More details can be found in Technical Circular (Works) No. 34/2002 Management of Dredged/ Excavated Sediment adopted by Environment, Transport and Work Bureau.



8.9.1 Terminology

The Marine Fill Committee (MFC)

The MFC is responsible to identify and manage the supply and demand of marine fill resources as well as to provide and manage the disposal capacity of the dredged/excavated sediment. Applications for approval of dredging/ excavation proposals and allocation of marine disposal space shall be made to the Secretary of MFC.

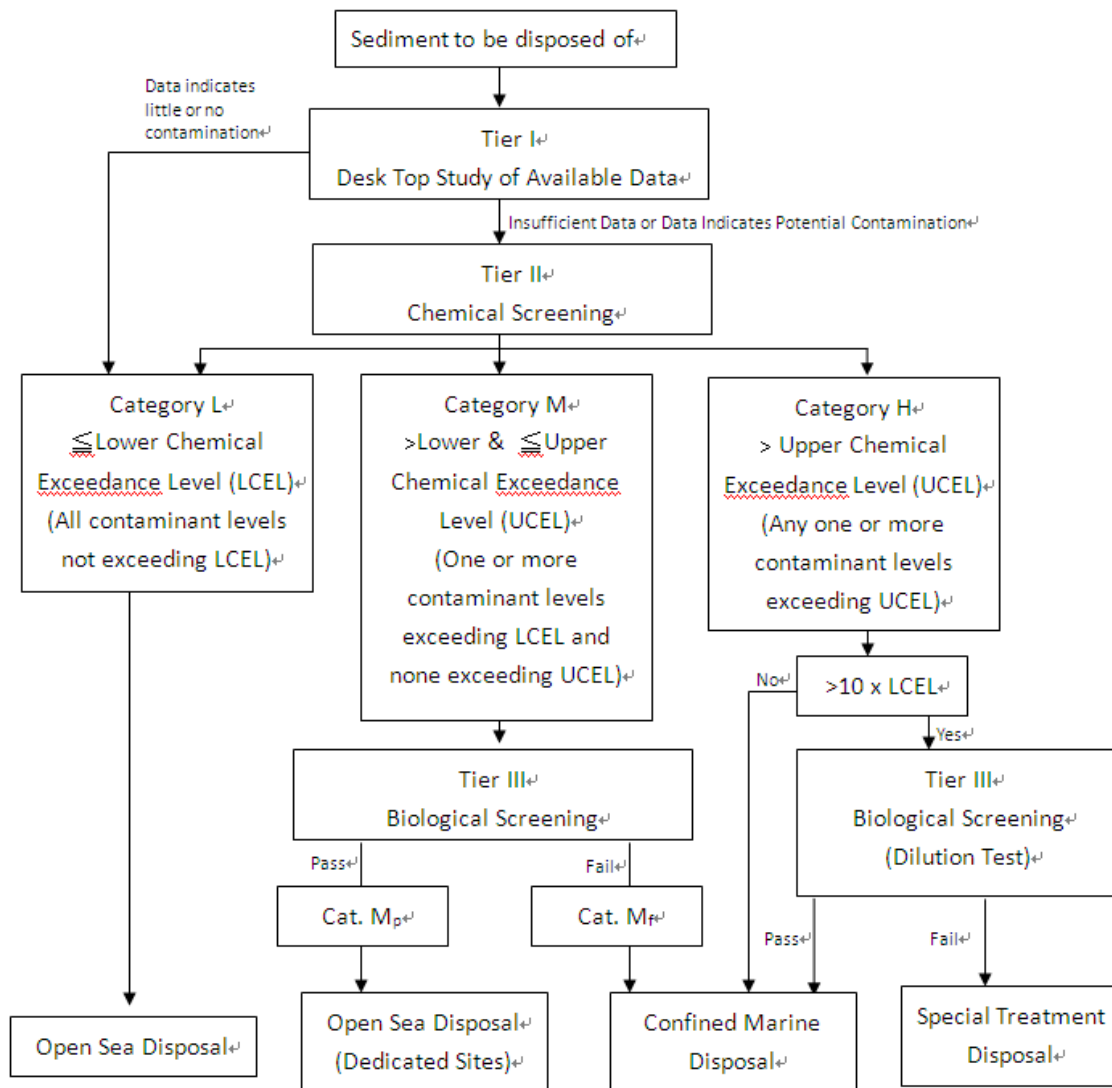
Permits for marine disposal (DASO Permit)

The Director of Environmental Protection (DEP) is responsible for the issue of permits for marine disposal under the provisions of the Dumping at Sea Ordinance (Cap.466). The DASO Permit stipulates the quantity of material to be disposed of, the allocated disposal ground and the source of sediment, the validity period of the permit, a list of vessels employed for the disposal of dredged/ excavated sediment as well as the name of the permit holder.

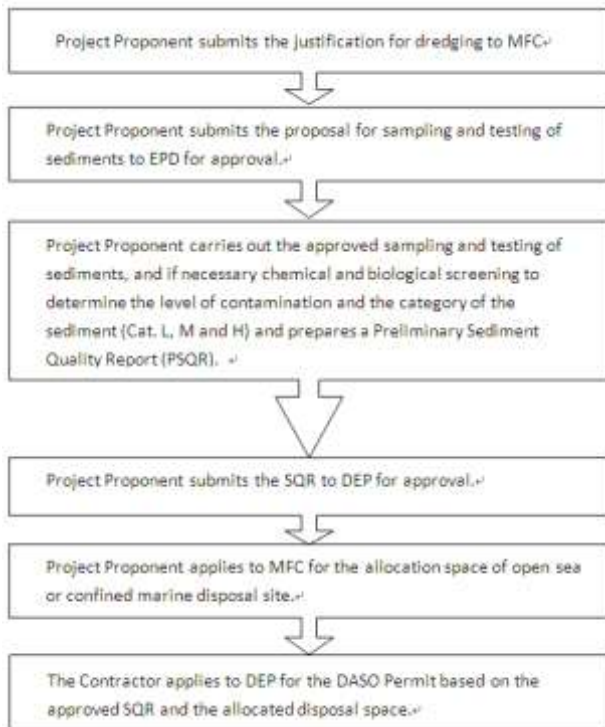
Preliminary Sediment Quality Report (PSQR)/ Sediment Quality Report (SQR)

Upon completion of the sampling and chemical testing, the project proponent shall submit a PSQR to DEP with a copy to the Secretary of MFC. This report shall include the sampling details, the chemical testing results, quality control records, proposed classification and delineation of sediment according to the Technical Circular and the information and/or records as specified by DEP in his approval of sediment sampling and testing plan. Should biological screening be required to determine the subsequent sediment disposal arrangement, the project proponent shall submit a formal SQR to DEP for approval.

8.9.2 Screening Process and Disposal Arrangement for Dredged/ Excavated Sediment



8.9.3 Dredging/Excavation and Disposal Work Flow



8.9.4 Application Procedures

The requirements stipulated in "Environment, Transport and Works Bureau Technical Circular (Works) No. 34/2002" [W](#) as applicable or "Buildings Department Practice Notes for Authorized Persons and Registered Structural Engineers No. 252" (re-issued as ADV-21) [W](#) regarding dredged sediments testing and allocation of dumping capacity should be fulfilled.

Applicant should also note that the requirements stipulated in the technical circulars in respect of the sampling and testing of the dredged sediment and allocation of dumping capacity have already been fulfilled before they submit their applications. This will avoid unnecessary delays to processing the applications.

Application for the permit should be made in a standard application form EPD 114a. [W](#)

Separate applications should be made if a single project involves sediment requiring different types of disposal option.

The application form together with any relevant document can be submitted to any of the Customer Service Counters of EPD.

The applicant may also be required to submit further details such as drawings, method of dumping and confirmation letters to substantiate the application and the provided information.

Document:

- Covering letter
- Completed application form with authorized signature and company chop
- Copy of a valid Business Registration Certificate (BRC) of the permit applicant
- Dredging plan(s) & layout plan(s) with coordinate explicitly showing the dredging/excavation areas and the depth of dredging/excavation
- Sectional drawings showing the interface between sediment layers requiring different "Type" of disposal
- Documents certifying the award of Contract (from the Waste Producer/ Client to the Main Contractor, and from the Main Contractor to the Dumping Operator if applicable)
- Method statement for the dumping operation
- Documents certifying that you are the waste producer
- Sediment quality report on the proposed dredging excavation areas
- Allocation of mud disposal capacity endorsed by Marine Fill Committee (MFC) of the Civil Engineering and Development Department or EPD
- Letter from Resident Engineer stating that will provide Independent Supervision to ensure the dumping is carried out in an environmentally acceptable manner
- Name and License number of vessels to be employed for dumping operation
- Name and BRC copy of Main Contractor/ Dumping Operation
- Crossed cheque made payable to "The Government of the Hong Kong Special Administrative Region" containing the application fee
- Copy of the up-to-date dumping returns of the project.

Appendix 8.1: Material Storage Requirements

Material	Preferred storage				Special Requirements
	Under cover	Secure area	On pallets	Banded	
Sand, gravel, rock, crushed concrete					Store on hard standing base to reduce wastage. Store in bays if large quantities
Plaster, cement	✓		✓		Avoid material getting damp
Concrete pavers				✓	Store material in original packaging until used, and protect from vehicle movements
Bricks and blocks			✓	✓	Store material in original packaging until used, and protect from vehicle movements
Clay pipes, concrete pipes			✓	✓	Use stoppers and spacers to prevent rolling, and store in original packaging until used
Wood	✓	✓		✓	Protect all types of wood from rain
Metals	✓	✓			Store in original packaging until used
Any internal fittings	✓	✓			Store in original packing until used
Cladding	✓	✓			Wrap in polythene to prevent scratches
Sheet glass, glazing units		✓	✓		Protect glass from breakage due to bad handling or vehicle movements
Paints		✓			Store in original packing until used
Bituminous felts	✓	✓			Usually store in rolls and protect with polythene
Insulating material	✓	✓			Store under polythene
Ceramic tiles	✓	✓		✓	Store in original packaging until required
Glass fibre	✓			✓	
Ironmongery	✓	✓			
Oils		✓			Store in bowsters, tanks or cans according to quantity – protect container from damage to reduce likelihood of spillage – use a bund
Kerbstones				✓	Protect from vehicle movements & tar spraying to reduce damage
Clay & slate tiles		✓	✓	✓	Keep in original packaging until use
Topsoil, subsoil					Store on hard-standing base to reduce wastage and keep segregated from potential contaminants
Precast concrete units					Store in original packaging, away from vehicular movements
Reinforcement				✓	Store material in original packaging until used
Steelwork					Store in original packaging until used

Note: The manufacturer's instructions/recommendations for handling and storage of materials should be followed in conjunction with the above recommendations.

Appendix 8.2: Good Housekeeping Checklist

Good Housekeeping Checklist for Waste Management				
Items		Implemented?		Remarks
		Yes	No	
1	General (Non Construction) All work areas are cleaned regularly to remove general litter and refuse	<input type="checkbox"/>	<input type="checkbox"/>	
2	General refuse and litter are stored in enclosed bins or compaction units separate from construction or chemical waste	<input type="checkbox"/>	<input type="checkbox"/>	
3	Collect general waste and litter from site for disposal	<input type="checkbox"/>	<input type="checkbox"/>	
4	No burning of refuse at any construction area	<input type="checkbox"/>	<input type="checkbox"/>	
5	Separately labelled bins are provided to allow segregation of recyclable material	<input type="checkbox"/>	<input type="checkbox"/>	
6	Save paper and recycle waste paper	<input type="checkbox"/>	<input type="checkbox"/>	
7	All vehicles carrying waste are properly fitted with side and tail boards, and with tarpaulin covered	<input type="checkbox"/>	<input type="checkbox"/>	
8	Training is provided to workers on waste management procedures	<input type="checkbox"/>	<input type="checkbox"/>	
	General (Construction)			
9	Different types of construction waste generated from the site is segregated, stored, transported and disposed of separately	<input type="checkbox"/>	<input type="checkbox"/>	
10	Sorting of waste is conducted on-site	<input type="checkbox"/>	<input type="checkbox"/>	
11	All waste materials are segregated into categories covering:			
	Inert portion of construction & demolition (C&D) material for reuse on-site	<input type="checkbox"/>	<input type="checkbox"/>	
	Inert portion of C&D material to be used as public fill	<input type="checkbox"/>	<input type="checkbox"/>	
	Remaining waste for landfill	<input type="checkbox"/>	<input type="checkbox"/>	
	Chemical waste	<input type="checkbox"/>	<input type="checkbox"/>	
	Packaging waste	<input type="checkbox"/>	<input type="checkbox"/>	
	General waste	<input type="checkbox"/>	<input type="checkbox"/>	
12	Separate compartments for inert (e.g. soil, rubble, sand, stone, etc.) and non-inert (e.g. wood, glass, plastics, steel and metals, organics, etc.) wastes are provided	<input type="checkbox"/>	<input type="checkbox"/>	
13	Inert waste is used on site before disposed of at public fill reception facilities	<input type="checkbox"/>	<input type="checkbox"/>	
14	Non-inert waste is sorted for re-use or recycling where possible before disposal at strategic landfills	<input type="checkbox"/>	<input type="checkbox"/>	
15	Site fencing, scaffolding and timber for building work are reused wherever possible	<input type="checkbox"/>	<input type="checkbox"/>	
16	Regular maintenance and cleaning of waste storage area	<input type="checkbox"/>	<input type="checkbox"/>	
17	Excavated materials are properly treated (re-used/disposed of) according to specified procedures	<input type="checkbox"/>	<input type="checkbox"/>	
18	General refuse stored in specified enclosed bins/compaction units, or reused if possible	<input type="checkbox"/>	<input type="checkbox"/>	
19	Does the waste collector have any records of dumping?	<input type="checkbox"/>	<input type="checkbox"/>	

Good Housekeeping Checklist for Waste Management				
Items		Implemented?		Remarks
		Yes	No	
	General (Construction)			
20	A barge loading point is provided to facilitate transfer of suitable material to public dumps	<input type="checkbox"/>	<input type="checkbox"/>	
21	Records of reuse/recycling/disposal of construction waste are properly kept	<input type="checkbox"/>	<input type="checkbox"/>	

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9 Chemical Waste Management

9.1 Terminology

Chemical Waste

Any substance or thing being scrap material, effluent or an unwanted substance or by-product which:

- Contains any substance or chemical specified in Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation and
- Causes pollution or constitute a danger to health or risk of pollution to the environment

9.2 Rationale to Deal with Chemical Waste

Chemical wastes arising during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner. The potential hazards include:

- Toxic effect to workers;
- Adverse effect on soil and water quality from spills and improper disposal; and

- Fire hazard.

Chemical Waste Producer

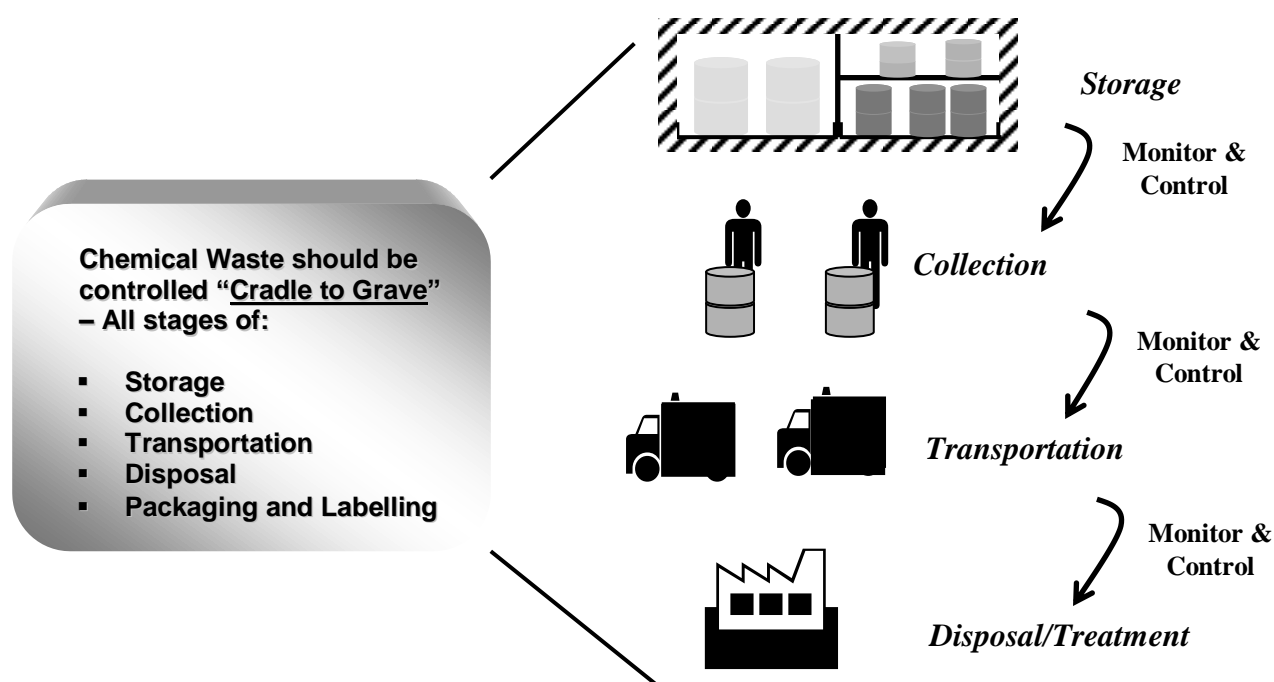
Under the Waste Disposal (Chemical Waste) (General) Regulation, any person who produces chemical waste or causes it to be produced will be defined as a “Chemical Waste Producer”.

Registration as a “Chemical Waste Producer” is required if a construction site generates chemical waste.

The site is required to register with the Environmental Protection Department (EPD). For registration procedures refer to Section 9.4.

The “Cradle to Grave” approach used to control chemical waste under the Regulation is shown in Figure 9.1.

Figure 9.1 – “Cradle to Grave” Control of Chemical Waste



9.3 Classification of Chemical Waste

Chemical wastes are classified according to their chemical nature and hazards.


Symbols to describe the chemical nature and its hazard are summarised in the following figure.

Classification 危險分類	Symbol 符號	Classification 危險分類	Symbol 符號
Explosive 爆炸性		Toxic 有毒	
Flammable 易燃		Harmful 有害	
Oxidizing 助燃		Corrosive 腐蝕性	
Irritant 刺激性		Asbestos 石棉	

Chemical Classification Symbols

9.4 Chemical Waste Identification


Figure 9.3 can assist in determining whether a contractor is a chemical waste producer and is therefore subject to the registration requirement.




Mixing of different types of chemical wastes may result in a chemical reaction leading to hazards, e.g. mixture of flammable and explosive wastes can cause explosion and fire. Therefore, chemical wastes with different nature should not be mixed / stored in the same container.



9.5 Application of Licence / Registration

Registration as a Chemical Waste Producer is required for construction sites generating chemical wastes including:


- Surplus adhesives with solvent content
 - Spent lubricating oils and mineral oils
 - Unwanted paint, paint thinners and paint removers
 - Spent acid and alkaline solutions
 - Spent solvent
 - Waste containers
 - Asbestos sheets/waterpipes
 - Demolition wastes containing dioxins, asbestos, PCB
 - Unwanted DG Cat 2-10
- (Refer to EPD “A Guide to the Registration of Chemical Waste Producers”) 

Special handling and storing procedures are required for chemical wastes. Please refer to EPD “Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste”  for details.

9.5.1 Registration Procedure

Registering as a chemical waste producer (CWP) can be made by submitting a completed form (EPD 129)  or by On-line Application. 

Particulars including location of waste generating establishments, nature of the business and waste types shall be recorded on the registration form and be provided to EPD for processing.

The fees required for the registration can be found at the EPD’s webpage. 

Upon completion of the registration, EPD will issue a registration certificate (EPD130) which designates a unique waste producer number.

Registration is a one-off requirement and not subject to renewal. However, each registered chemical waste producer has the obligation to notify EPD of any change in the particulars of the registration. For example, changes in:

- Contact person
- Telephone number or fax number
- Correspondence address
- Company name
- Waste location
- Business Registration Certificate

Such notifications should be made in writing within two weeks of the change.

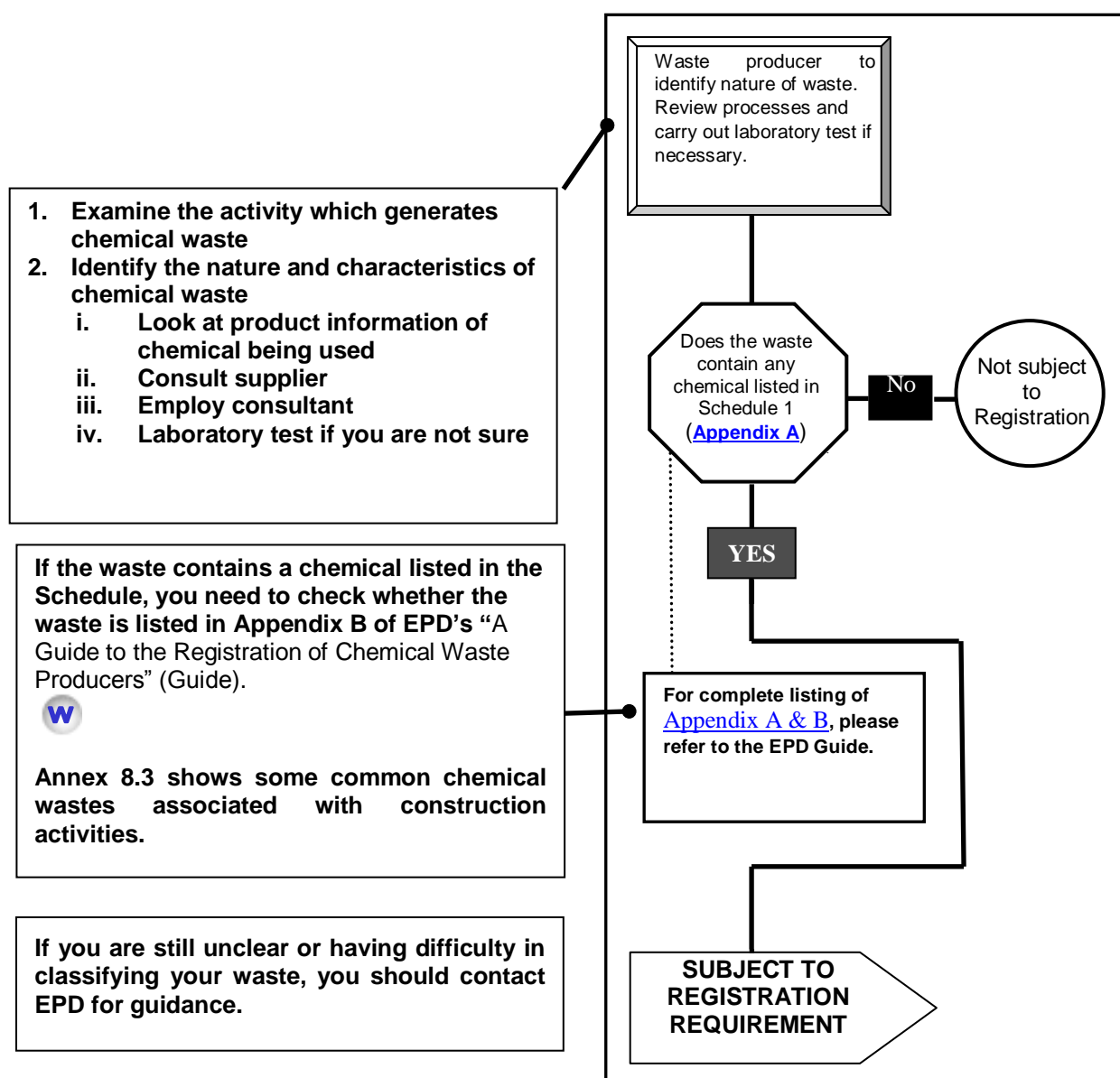
! No matter how small the waste quantity is, as long as chemical waste is produced, the producer is required to register.


A registered producer should properly keep his chemical waste in designated storage area until it is collected by a licensed collector.

In-house storage must comply with the requirements prescribed under the Waste Disposal (Chemical Waste)(General) Regulation.


Please also refer to EPD "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes" for details

Figure 9.2 – Flow Chart for Determination of Chemical Waste Producer



 Upon registration, EPD may issue a notice requesting you to furnish more information on the wastes you produce.

According to section 23B of the Waste Disposal Ordinance, you will be required to furnish the information within the period specified in the notice. Any person who fails to comply with the requirement or provides inaccurate/false information or omits information commits an offence and is liable to a fine of \$100,000.

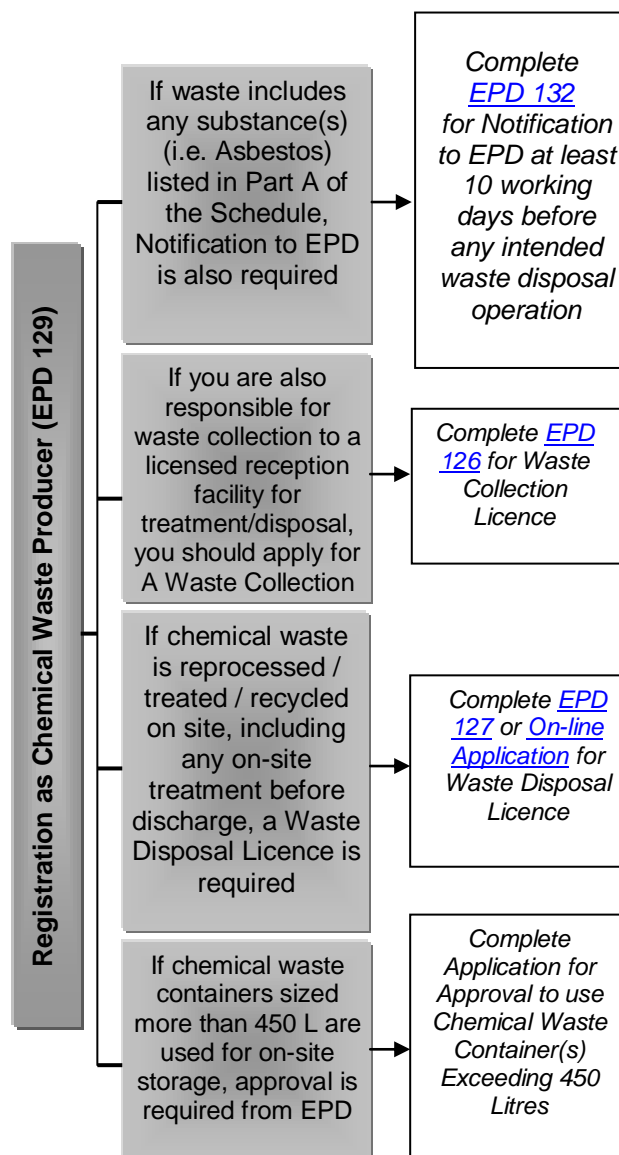
 Are there any other chemical waste related licences I have to obtain for construction activities?

For construction activities, “registration as a chemical waste producer” is required for the generation of chemical waste (such as spent lubricating oil). However, other licence(s) may also be required depending on how you manage the chemical waste, i.e. are you also responsible for collection or disposal of chemical waste? Figure below shows the licences required for different steps in chemical waste management.


9.5.2 Chemical Waste Licences Application & Requirements


License application to EPD is required for various handling processes of chemical waste. Figure 9.3 shows the different chemical waste license requirement.

Figure 9.3 – Chemical Waste Licenses Requirement



9.6 Chemical Waste Management

 Under the Waste Disposal (Chemical Waste) (General) Regulation, waste producers are required to arrange proper packaging, labelling and storage of chemical waste before they are transported off-site to disposal facilities.

 The new ETWB TCW No. 19/2005 “Environmental Management on Construction Sites” includes the requirement for environmental measures requiring contractors to follow during the course of construction.

9.6.1 Good Planning and Housekeeping

Good planning can:

- Estimate the amount of chemicals needed before the actual work; avoid excess ordering and delivery of chemicals
- Use chemicals efficiently; avoid overdosing
- Minimise the possibility of expiry of chemicals by tracking usage
- Minimise the space necessary for excess storage
- Train and educate how to use chemicals efficiently and minimise waste generated

Good housekeeping can:

- Avoid prosecution
- Avoid damage to health and environment, as well as hazards
- Lead to better image
- Avoid wastage

Measures that can be taken include:

- Minimise waste production as far as possible
- Train staff for good practice in handling, storage and disposal of chemical waste
- Monitor the site environment, check waste skips regularly for unauthorized disposal of chemicals
- Monitor water quality to ensure no chemical waste is disposed of improperly. For example:
 - Observe for any oil present in water discharge
 - Use universal indicator paper to test the pH
 - Check for any odour from discharge water

9.6.2 Minimising the Generation of Chemical Waste

Quantities of chemical waste produced can be reduced by careful site management.

You can use up leftover chemicals within the site or from other sites according to their originally intended purposes as far as possible. Good practice can avoid contamination of chemicals with other substances; thus enhancing the possibility to minimising any surplus of the original chemicals; thus avoiding wastage.

9.6.3 Treatment / Recycling / Disposal of Chemical Wastes

The chemical waste producer is responsible for arranging a Licensed Waste Collector(s) to collect and dispose of (includes recycling or treatment) chemical wastes.



The chemical waste producer is also required to provide records to demonstrate that arrangements have been made for proper disposal of the chemical waste. Chemical waste producer is required to keep a copy of trip ticket of each waste consignment for 12 months.



For construction sites in Hong Kong, off-site treatment of chemical waste at licensed reception facilities through licensed collectors is required.

9.6.4 Licensing of a Chemical Waste Collector

If a contractor wishes to carry out the collection or removal of chemical waste, they should apply for a Waste Collection Licence from EPD. This requirement applies also to a waste producer if he wishes to collect and transport his own waste.

An application should be made in a specified form which can be obtained from the EPD. Each application should be accompanied by the appropriate licence fee set out in the Waste Disposal (Permits, Authorisations and Licences) (Fees) Regulation. The current fee levels for the application can be found in EPD's webpage.



The following information is needed for a Waste Collection Licence application:

- Particulars of the applicant, including details of key management staff;
- The types and quantities of waste to be collected;
- The collection vehicles/vessels and equipment to be used (including relevant drawings, plans and specifications); and
- An Operational Plan which covers a detailed description of the collection operation as specified in the Concise Guide in Writing an Operational Plan for Chemical Waste Collector.



Empty chemical containers, when drained of all chemicals, are not classified as chemical wastes and such containers may be disposed of in landfill sites. There are also waste collectors which collect empty containers for reuse and refill.

9.6.5 Trip Ticket System

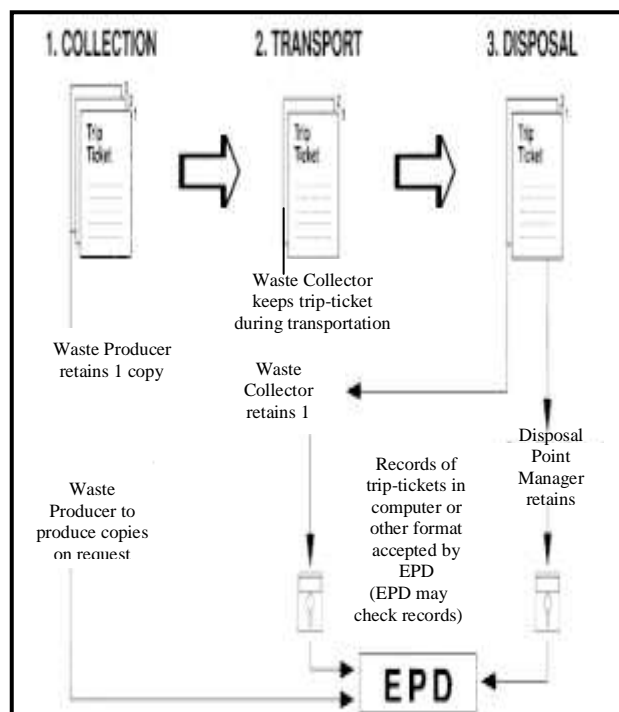
Waste producers should only engage "licensed waste collectors" to arrange for the collection and removal of chemical waste.

Waste collectors are persons licensed by EPD to provide such services.

Monitor chemical waste movements

The chemical waste producer and licensed collector shall each complete his part on the trip ticket when the waste is collected for disposal. The Trip Ticket System Procedures are shown in Figure 9.4.

Figure 9.4 – Trip Ticket System Procedures



Trip Ticket System Checklists for Waste Producer

A trip ticket system checklist for the chemical waste producer is shown in Figure 9.5.

9.6.6 Packaging

Chemical waste should be packed and held in containers of suitable design and construction so as to:

- Prevent leakage
- Prevent spillage or escape of contents under normal conditions of handling, storage and transport

The recommended types of containers are listed as below:

- The use of any container with a capacity exceeding 450 litres is subject to the approval of the EPD.

- Drums and jerricans are preferred as they are commonly available and suitable for a wide range of waste.
- Consideration should be given to the quantity and frequency of chemical waste produced when determining the size of containers to be used. This should be carried out in the planning stage.
- Space and access within the premises should also be considered if large size containers have to be moved between the production and storage areas.
- For construction sites, chemical waste normally will not be produced in very large quantities, therefore smaller containers are recommended. You can also use the original chemical container for storing the same type of chemical waste, to save cost and minimise waste.
- Plastic and steel are the most common types of materials of containers.
- For wastes in solid and bulky form, e.g., asbestos waterpipes or PCB contaminated equipment, heavy duty and leak proof plastic sheets should be used.

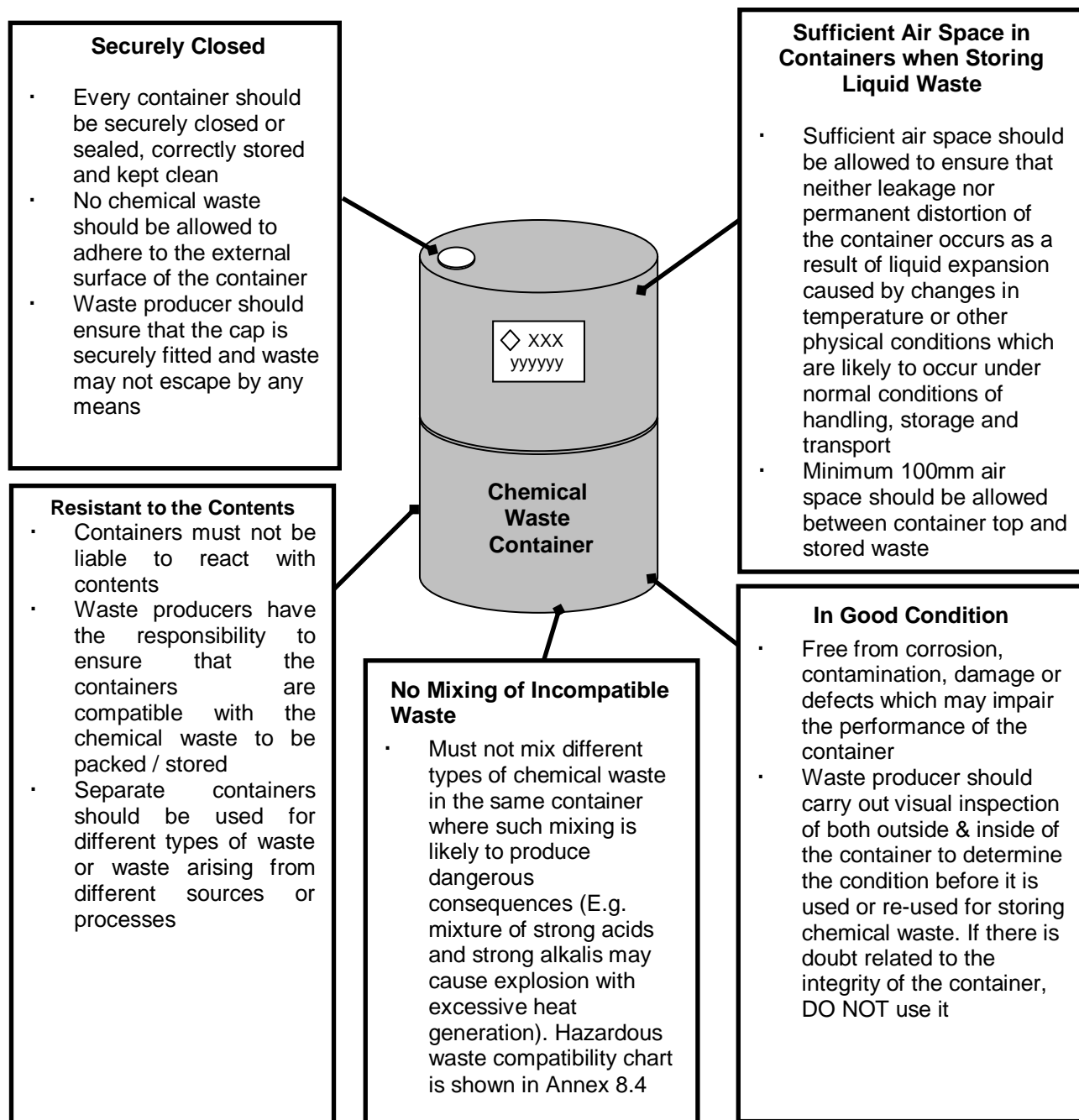
Figure 9.6 shows the important issues about the use of chemical waste containers.

Please refer to EPD “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes” [W](#), “Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste” [W](#) and “Code of Practice on the Handling, Transportation and Disposal of Polychlorinated Biphenyl (PCB) Waste” [W](#) for details.

Figure 9.5 – Trip Ticket System Checklist for Waste Producer

Trip Ticket	
Checklist:	
<input type="checkbox"/>	Have you completed all the necessary particulars and information on the Ticket?
<input type="checkbox"/>	Have you checked that all copies of the Ticket are clearly filled in?
<input type="checkbox"/>	Have you checked that the waste to be delivered is correctly classified, described, quantified and labelled?
<input type="checkbox"/>	Have you checked and certified the Ticket?
<input type="checkbox"/>	Have you kept a copy of the Ticket for your record?
<input type="checkbox"/>	Have you given the original and one further copy to the waste collector?
	<input type="checkbox"/> Waste collector should keep a copy
	<input type="checkbox"/> Reception point manager of the disposal facility will keep the original
Note:	
•	Retain your copy of the trip ticket for at least 12 months following the consignment of the waste
•	Waste collector should deliver the collected waste to a reception point within 48 hours of collection and should not unload the collected wastes from collection vehicles for any off-site storage.
•	Any subsequent transfer of waste from a reception point would also need to follow the same Trip Ticket requirements
•	Waste producers, waste collectors and reception point managers are obliged to provide EPD with any extra information

Figure 9.6 – Important Issues in Using a Chemical Waste Container



9.6.7 Labelling

- Every container of chemical waste should be labelled clearly, in both Chinese and English
- The waste producer should ensure that the information contained on the label is accurate and sufficient so as to enable proper and safe handling, storage and transport of the chemical waste
- The label should be securely attached to a suitable part of the container (to the sides of

drum and not on the top), which allows the information on the label to be easily read

- Remove old labels from the containers if you decide to reuse or recondition containers

The label should contain all the particulars as shown in Figure 9.7.

Figure 9.7 – Information to be included in Chemical Waste Label

CHEMICAL WASTE 化學廢物	
符號 Symbol	Chemical name/Common name 化學名稱或普通名稱
	Waste type and Code 廢物種類及代號
Name, address and Telephone No. of Waste Producer 廢物產生者姓名 地址及電話	Particular Risks 危險情況
	Safety Precautions 安全措施

Title of Label

Not be less than 1/20th of the area of the label. For small-size labels, the minimal size of the characters should be around 5mm high.

Symbol

Not be less than 1/10th of the label area
No case shall be less than 500mm²

Minimum dimension should be 25mm × 25mm

Classification 危險分類	Symbol 符號	Classification 危險分類	Symbol 符號
Explosive 爆炸性		Toxic 有毒	
Flammable 易燃		Harmful 有害	
Oxidizing 助燃		Corrosive 腐蝕性	
Irritant 刺激性		Asbestos 石棉	

Chemical Classification Symbols

Chemical Name

Waste types and codes for different chemical wastes can be found in EPD's "A Guide to the Registration of Chemical Waste Producers". Waste

code consists of 'Process code' and 'Waste sub-code'.

Particular Risk and Safety Precaution

A full list of recommended risk phrases and safety precautions should be addressed.

A typical chemical waste label is shown below.



A Typical Chemical Waste Label

Sizes of Chemical Waste Labels

The dimension of the labels should be as follows:

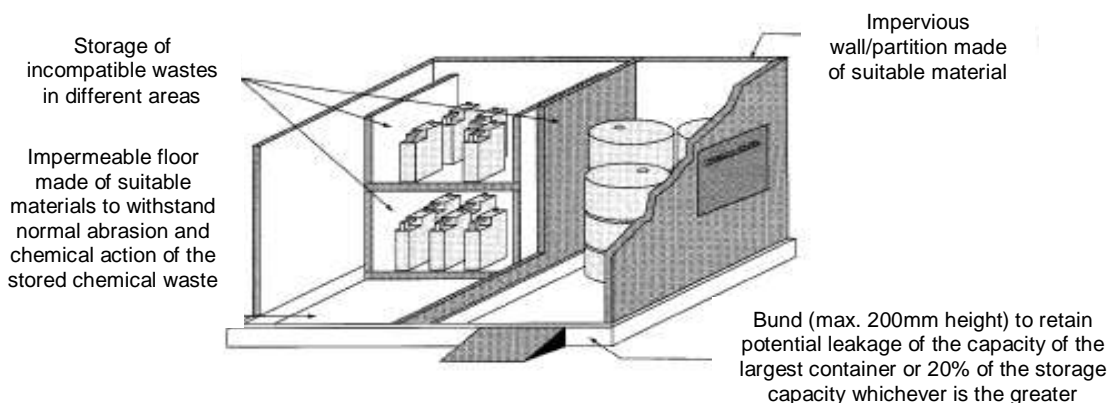
Capacity of Container	Dimension of label to be not less than:
< 50 litres	90mm × 100mm
50 – 450 litres	120mm × 150mm
> 450 litres	180mm × 200mm

9.6.8 Storage

- The chemical waste producer should provide a suitable area for temporary storage of chemical waste. The illustrations are shown in Figure 9.8.
- The storage area should be used for chemical waste storage only. It is strictly forbidden to store chemical waste with either chemicals or dangerous good substances in the same storage facility.
- The storage area should be located close to the source of waste generation.
- The storage area should be enclosed on at least three sides by a wall, partition or fence with a height of not less than two metres or at least the total height of containers in the stack.
- Suitable materials for enclosures:
 - Concrete
 - Brick
 - Steel with protective coating or treatment
- Enclosures should be rigidly erected and fixed to the area.
- Adequate space should be allowed within the storage area for container handling by workers

- Containers of incompatible chemical waste must not be stored together where potentially dangerous consequence may result in the event of contact between the wastes.
- A warning sign that indicates the English words and Chinese characters “**CHEMICAL WASTE**” “**化學廢物**” clearly and boldly in red on a white background with a letter/character size of not less than 60mm high should be displayed at or near the entrance or opening of the storage area for chemical waste other than asbestos and PCB wastes.
- For more details on the requirements of storage area and warning panel for asbestos and PCB wastes, please refer to Section 7 of the Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste or Section 7 of the Code of Practice on the Handling, Transportation and Disposal of Polychlorinated Biphenyl (PCB) waste.

Figure 9.8 – Chemical Waste Storage Facilities – Enclosure



Chemical Waste Store

Requirements for Chemical Waste Storage:

- Ensure adequate ventilation (leave some space between top of enclosure walls and ceiling; or provide louvers on the sides of enclosure walls).
- Should be no connection to any surface water drains or foul sewers.
- Should not obstruct any means of escape.
- Roof or cover should be used if enclosure is located outside building, to prevent rain and reduce heat from sunlight.

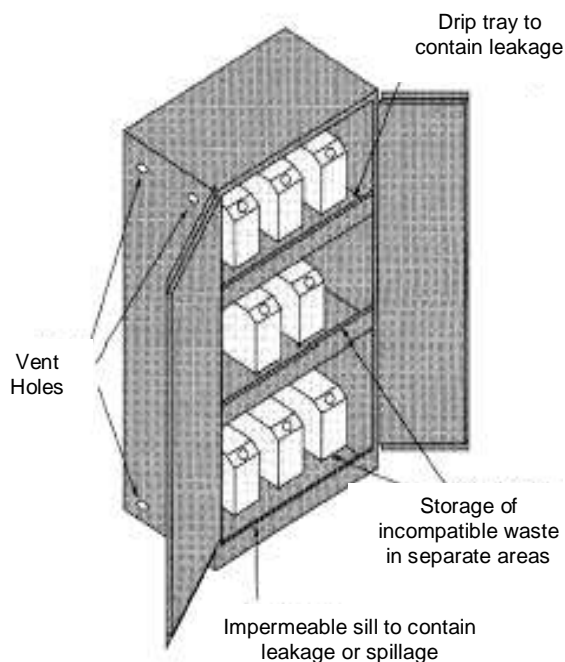
- Raise floor area if flooding is likely.
- Additional drip trays are encouraged for extra prevention measures.
- Storage area should be kept secured with an appropriate door/gate and locked at all time.
- Storage area should be kept clean and dry.
- Size of enclosure can be predicted by the amount of chemical waste produced and chemical containers used. Allow additional space for unpredicted waste.
- Stacks of containers should be secured and easily accessible without risk when handling the chemical waste containers.
- The maximum height of a stack should not be more than 2.5 metres.

Please refer to MSDS (Material Safety Data Sheet) for the potential hazard of different chemical wastes. Do not mix incompatible wastes into the same container.



For a proactive compliance check on construction site, EPD staff would check whether all chemical wastes are properly packaged, labelled and stored; and that the wastes have not been improperly disposed of. The storage area should be enclosed on three sides and should be kept secured with door/gate locked at all times except for necessary access. The Contractor has to retain the trip tickets for inspection by EPD staff.

For small chemical waste producers (those requiring less than 300 litres of storage capacity in total), Chemical Waste Storage Cupboards as shown below can be used instead of Enclosures.



Chemical Waste Store - Cupboard

- Storage shelves should be fitted with a leak-proof tray or spill catcher trays in its base to retain the capacity of the largest container or 20% of the total storage capacity in that shelf, whichever is greater, so that chemical waste can be retained within the trays if spillage occurs, without overflowing to other shelves or outside the shelves.
- Storage shelves should be strong enough to carry the full weight of the filled containers being stored.
- Ventilation holes of at least 30mm diameter located at the top and bottom of the side panels of the cupboard.

- Materials for tray and cupboard should be able to withstand the chemical action of the chemical waste stored in the containers. E.g. steel with protective coating.
- A proper warning sign should be displayed at or near the door of the cupboard (refer to Section 9.6.7 for details).

9.7 Practice to Reduce the Risk of Spillage

- Reduce the amount of chemical waste generated during activities by careful planning and usage.
- Reduce the amount of chemical waste stored on site, regular collection of chemical waste by licensed Waste Collector.
- Chemical waste should be stored within designated enclosure, away from direct sunlight or heat generating / propagating activities. Always close the door of enclosure.
- Ensure ventilation is adequate within enclosure, prevent the building up of gaseous substances.
- Separate incompatible chemical waste from each other.
- Use a pump instead of simple pouring to transfer liquid waste.
- Ensure caps and lids are tightly fitted to seal containers.
- Ensure drip trays are placed under each chemical waste container, so that any spillage can be retained.
- Check conditions of containers regularly.
- Avoid the use of large size containers, as they are hard to handle and transport.
- Clearly label all the chemical waste.
- Use suitable carriers to transfer containers between locations.
- Provide training to staff on chemical waste handling.
- Ensure the shelves are secure, and easily accessible to collect or handle chemical waste containers.
- Use absorbent materials to absorb spillage of chemicals or chemical wastes. (Note: Used absorbent materials should be handled as chemical wastes). The following figures show the spill control kit and the handling of chemical spill.
- Regular drills on handling of chemical spills should be conducted.



Chemical Drums on Drip Tray



Handling of Chemical Spill



Chemical Spill Control Kit

Appendix 9.1: Good Housekeeping Checklist for Chemical Waste Management

Good Housekeeping Checklist for Chemical Waste Management				
Items		Implemented		Remarks
		Yes	No	
1	Chemical waste is packaged and labelled properly as soon as they are produced	<input type="checkbox"/>	<input type="checkbox"/>	
	A proper chemical waste container/packaging is used	<input type="checkbox"/>	<input type="checkbox"/>	
	Container/packaging has markings that conform to EPD Specifications	<input type="checkbox"/>	<input type="checkbox"/>	
	Container/packaging is made of compatible materials	<input type="checkbox"/>	<input type="checkbox"/>	
	Seek approval from EPD if container/packaging exceeds 450 L	<input type="checkbox"/>	<input type="checkbox"/>	
2	The labels on the container/packaging are clear, intact and adhere firmly to the container/packaging	<input type="checkbox"/>	<input type="checkbox"/>	
3	The labels contained all required information:	<input type="checkbox"/>	<input type="checkbox"/>	
	English Word “ Chemical Waste”	<input type="checkbox"/>	<input type="checkbox"/>	
	Chinese Characters “化學廢物”	<input type="checkbox"/>	<input type="checkbox"/>	
	Appropriate symbol	<input type="checkbox"/>	<input type="checkbox"/>	
	Name, address & contact phone number of the chemical waste producer	<input type="checkbox"/>	<input type="checkbox"/>	
	Chemical name and common name of the substance	<input type="checkbox"/>	<input type="checkbox"/>	
	Waste Type and Code Labelled	<input type="checkbox"/>	<input type="checkbox"/>	
	Hazard Classification Symbol	<input type="checkbox"/>	<input type="checkbox"/>	
	Indication of Particular Risks	<input type="checkbox"/>	<input type="checkbox"/>	
	Indication of Safety Precautions	<input type="checkbox"/>	<input type="checkbox"/>	
4	The waste container is in good condition (no corrosion, damage, contamination) and the caps are kept tightly closed	<input type="checkbox"/>	<input type="checkbox"/>	
5	The storage area is kept dry and clean and is used for storage of chemical waste only	<input type="checkbox"/>	<input type="checkbox"/>	
6	Different types/sources of chemical wastes are stored in different containers	<input type="checkbox"/>	<input type="checkbox"/>	
7	For liquid waste, about 100mm air space is allowed between top of container and level of liquid contents	<input type="checkbox"/>	<input type="checkbox"/>	
8	The storage area is enclosed by at least a 3-sided structure	<input type="checkbox"/>	<input type="checkbox"/>	
9	A proper warning panel is displayed at or near the entrance or opening of the storage area	<input type="checkbox"/>	<input type="checkbox"/>	
10	The storage area is provided with a roof or similar covering	<input type="checkbox"/>	<input type="checkbox"/>	
11	The enclosed storage structure has vent holes or ventilation facilities	<input type="checkbox"/>	<input type="checkbox"/>	
12	The storage area is constructed of concrete, brick or steel (can be a cupboard or cabinet for waste quantities <300L)	<input type="checkbox"/>	<input type="checkbox"/>	

Good Housekeeping Checklist for Chemical Waste Management				
Items		Implemented		Remarks
		Yes	No	
13	The location for waste storage is labelled clearly and away from any potential hazard e.g. heat generating activities	<input type="checkbox"/>	<input type="checkbox"/>	
14	The chemical waste container is put inside a drip tray or a spill retention structure is available to contain spillage	<input type="checkbox"/>	<input type="checkbox"/>	
15	The drip tray or cabinet is free of other substances (e.g. rubbish/spillage) except those contained in the waste container(s)	<input type="checkbox"/>	<input type="checkbox"/>	
16	Incompatible wastes are prevented from mixing in case of a spill	<input type="checkbox"/>	<input type="checkbox"/>	
17	The storage structure has no connection to the sewer or surface water drain	<input type="checkbox"/>	<input type="checkbox"/>	
18	The storage structure for liquid chemical wastes has a retention capacity for 20% of the total waste stored or the volume of the biggest container, whichever is the greater	<input type="checkbox"/>	<input type="checkbox"/>	
19	Emergency procedure for spillage or leakage of chemical waste is posted for workers' reference	<input type="checkbox"/>	<input type="checkbox"/>	
20	Disposal records i.e. trip tickets for chemical waste are retained	<input type="checkbox"/>	<input type="checkbox"/>	
21	No stacking of containers of chemical waste exceeding 2.5 meters	<input type="checkbox"/>	<input type="checkbox"/>	
22	Stacks of containers are made secure to prevent their falling down	<input type="checkbox"/>	<input type="checkbox"/>	
23	Conduct regular drills on handling of chemical spills. Chemical spillage handling kit is provided at site	<input type="checkbox"/>	<input type="checkbox"/>	
24	Emergency contact telephone numbers are displayed for quick reference in handling chemical spills	<input type="checkbox"/>	<input type="checkbox"/>	

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10 Land Contamination

10.1 General

Contaminated land is caused by spillage, leakage or disposal of toxic chemicals to the ground. Soil at or below the ground surface and sometimes groundwater may be contaminated depending on the subsurface conditions. Before a contaminated site is re-developed, it is necessary to assess the level of contamination.

If contamination is above an acceptable level, defined by a set of standards or remediation goals, remediation is required to render the site safe for future use.

Historically, Hong Kong had no locally-derived contaminated land standards. The Dutch B levels of the Netherlands referenced in the Practice Note for Professional Persons for Contaminated Land Assessment and Remediation, ProPECC PN 3/94 issued by EPD in 1994, have been used up to 14 November 2007. Since 15 August 2007, with a transitional period of 3 months, a set of locally-derived contaminated land standards, the RBRGs, has been adopted which is in line with the latest international practice.

More details can be found in the Guidance Note for Contaminated Land Assessment and Remediation which supersedes the ProPECC PN 3/94.



This section explains the contamination assessment process adopted in Hong Kong and describes commonly available contamination treatment technology.

10.2 Terminology

Contaminated Land

Contaminated land refers to land which has been polluted by hazardous substances as a result of industrial or commercial operations carried out on and around the site over a number of years. Very often, these contaminants pose hazardous risks or may cause detrimental effects to the land users or the nearby environment.

Risk-Based Remediation Goals (RBRGs)

The Risk-Based Remediation Goals (RBRGs) have been designed to protect the health of people who could potentially be exposed to land impacted by

chemicals. The RBRGs are developed for four broad post-restoration land use categories, namely urban residential, rural residential, industrial, and public parks.

They are intended to be used as site assessment criteria that will be appropriate on a stand-alone basis for the majority of sites in Hong Kong, where human health is the only significant receptor that needs to be protected.

The philosophy of the RBRGs is that, in being risk-based, they tailor the extent of remediation required to the level of risk under certain land uses. For example as residential land use is more sensitive than industrial land use that land would need to be remediated to a greater extent.

10.3 Land Contamination Caused by Construction Activities

There are several construction activities that may lead to land contamination. These include:

- Plant maintenance;
- Refuelling;
- Accidental spillage from storage of fuel, chemical and chemical waste; and
- Accidental leakage of fuel, hydraulic oil and lubrication oil from construction plant and vehicles.

The scale of the land contamination arising from these construction activities is usually very small. The Contractor may adopt the emergency procedure for chemical spillage as detailed in Chapter 3 of this Guide for cleaning up any contamination.

10.4 Land Uses with Potential to Have Land Contamination

A number of industries in Hong Kong have been identified as having potential for causing land contamination. These include:

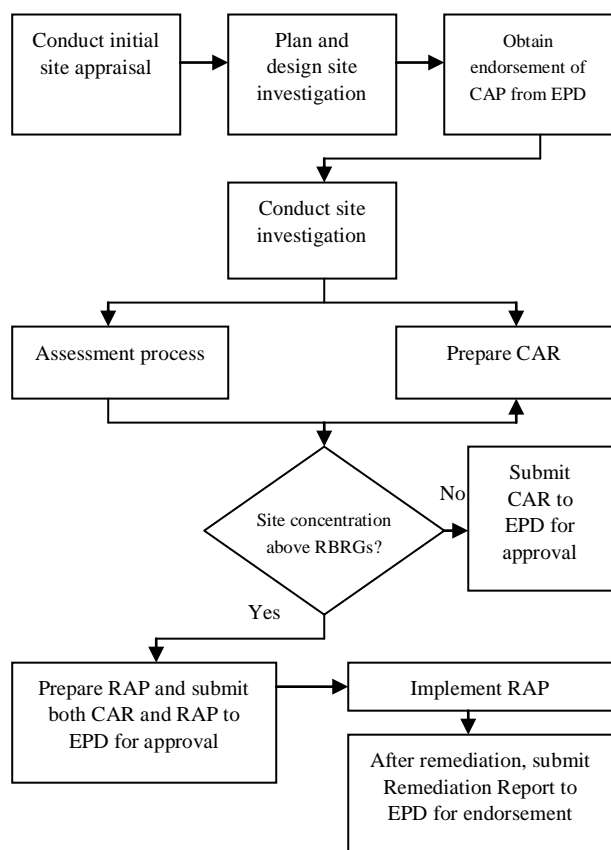
- boatyards;
- scrap yards;
- power plants;
- gas works;
- petrol filling stations;
- vehicle repair/maintenance or dismantling workshops;
- Seabed soil in reclaimed land;
- metal or mechanical workshops; and
- oil installations (e.g. oil depots).

10.5 Contamination Assessment Process

The primary responsibility for this process usually rests with project proponent during the EIA process. The Contractor may have a role to play in the process depending on the contractual requirements. Usually only the remediation process in accordance with the Remediation Action Plan (see Section 10.5.3) may involve the Contractor.

The contamination assessment process in Hong Kong is illustrated in Figure 10.1. RBRGs should be used to determine the need for future action and remediation at a contaminated site.

Figure 10.1
The Contamination Assessment Process in Hong Kong



Implementation of the RBRGs and an assessment of the RBRGs to chemical concentrations detected on a site should be undertaken by a competent specialist consultant.

Prior to the commencement of the land contamination site investigation work, the project proponent has to prepare and submit a Contamination Assessment Plan (CAP) to EPD for endorsement.

Based on the endorsed CAP, the project proponent should conduct a contamination assessment and compile a Contamination Assessment Report (CAR) to document the findings for approval by the EPD. If the findings confirm that the site is contaminated, a Remediation Action Plan (RAP) should be drawn up.

The RAP and CAR may be submitted as a combined report for EPD's approval referencing the corresponding CAP prior to the commencement of clean up work on site.

More detail can be found in the Guidance Manual for Use of Risk-Based Remediation Goals for

Contaminated Land Management and Practice Guide for Investigation and Remediation of Contaminated Land.

10.5.1 Contamination Assessment Plan (CAP)

The CAP should be submitted to EPD after initial site appraisal, prior to commencement of land contamination investigation.

The content of the CAP should include:

- Site description
- Past and present site activities
- Inventory of chemicals/hazardous substances and their handling/storage
- Design of land contamination investigation

10.5.2 Contamination Assessment Report (CAR)

The CAR should be submitted to EPD after land contamination investigation is completed.

The content of the CAR should include:

- Procedure of land contamination investigation
- Field results
- Laboratory results
- Interpretation of results
- Plans showing contaminant distribution

10.5.3 Remediation Action Plan (RAP)

If the CAR shows that contamination is above an acceptable level as defined in RBRGs, a RAP should be devised. The RAP should be submitted to EPD after site investigation is completed, but prior to commencement of site remediation. It is to be submitted together with the CAR if remediation is required.

The content of the RAP should include:

- Background information from CAR

- Objectives of remediation action
- Evaluation of remediation alternatives
- Design and operation of remediation
- Implementation programme.



The whole contamination assessment process for a typical site takes approximately 6 months to complete and any follow-up remediation, if necessary, may take another 6 months or more. Therefore, it is advised to conduct the required assessment as soon as the site is available or accessible to avoid any delay to the subsequent construction programme.

10.6 Soil Contamination Treatment Technology

The selection of an appropriate treatment method for remediation a site would depend on a number of factors:

- Nature of the contamination;
- Level of the contamination;
- Future use of the site;
- Soil characteristics;
- Time allowable;
- Treatment cost;
- Availability of local expertise and facilities for undertaking the treatment; and
- Disposal of the contaminated wastes.

A number of options for remediation are described in this section. The method used should follow that described in the RAP.

10.6.1 Biopiling

Biopiling is an *ex-situ* bioremediation method that makes use of the biodegrading ability of naturally occurring or specifically added bacteria to break down the contaminants in the soil or to convert them into harmless substances (such as carbon dioxide and water).

Application and Environmental Benefits

- Effective to Total Petroleum Hydrocarbons (TPH) and a wide range of organic contaminants with some successful local case studies, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay and reclamation works at North Tsing Yi Shipyard site.
- Most cost-effective for large volumes of contaminated soil.
- All materials and equipment are commercially available.

- Can be designed to be a closed system; vapour emissions can be controlled.

Limitations and Environmental Dis-benefits

- Labour-intensive; require considerable maintenance.
- Time-consuming (~1 year required) and not cost-effective for treating small volume of soil.
- Space required for biopile construction.

10.6.2 Soil Venting

Soil venting is a technology that uses air to extract volatile contaminants from contaminated soils. The technology is also known as soil vapor extraction, in situ volatilization, in situ vapor extraction, in situ air stripping, enhanced volatilization, in situ soil ventilation, and vacuum extraction.

This is done by applying a vacuum through wells and extracting the air in the contaminated zone.

Application and Environmental Benefits

- Commonly used for the removal of volatile to semi-volatile organics from a site.
- Suitable for remediation in built up areas because wells can be placed between or below buildings.
- Applicable to large sites with widespread contamination.
- Uses readily available equipment; easy to install.
- Vapour emissions can be controlled but not to the extent of biopiling due to underground soil in-situ properties.

Limitations and Environmental Dis-benefits

- Effectiveness is limited by underground soil features e.g. soil moisture content and permeability.
- May induce possible air emission to the sensitive receivers.
- Require large space for the system development.

10.6.3 Landfarming

Landfarming is an *ex-situ* bioremediation method usually involves spreading excavated contaminated soils in a thin layer on the ground surface and stimulating aerobic microbial activity within the soils through aeration and/or the addition of minerals, nutrients and moisture.

Application and Environmental Benefits

- Very effective in treating TPH
- Simple to design and implement

Limitations and Environmental Dis-benefits

- May induce possible dust and vapour emission to sensitive receivers (surrounding factories and buildings) and is relatively difficult to control.
- Requires a large flat space for the system development.
- Slow bioremediation rate and require long operation period (as long as 2 years) which may affect future development schedule.

10.6.4 Solidification/Stabilization

Solidification/Stabilization is an *in-situ* or *ex-situ* immobilization technique that treats contaminated soil by mixing soil with binding agents, e.g. cement so that the contaminants become to chemically and physically bound within a stable mass.

Solidification/stabilization has been used on certain contaminated sites in Hong Kong and is demonstrated as a successful treatment method for inorganic contaminated soil, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site and a few isolated sites identified in the Deep Bay Link project.

In-situ Method

Application and Environmental Benefits

- Applicable to clean-up inorganic contaminants (including radionuclides).
- Timeframe is short to medium-term.

Limitations and Environmental Downsides

- Depth of contaminants may limit some types of application processes.
- Future usage of may 'weather' the materials and affect ability to maintain immobilization of contaminants.
- No/Limited effectiveness against VOCs, SVOCs and pesticides depends on type of methods employed.
- Increase in volume of material following treatment.
- Certain wastes are incompatible with variations of the processes.
- Treatability studies are generally required.
- Reagent delivery, effective mixing and confirmatory sampling are more difficult than *ex-situ* application.
- Solidified material may hinder future site use.

- Processing of contamination below the water table may require dewatering.

Ex-situ Method

Application and Environmental Benefits

- Applicable to clean-up inorganic contaminants such as heavy metals.

Limitations and Environmental Downsides

- The effectiveness reduces with the presence of organic contaminants.
- Large boulders may hinder the mixing process. Soil sorting is necessary before the treatment taken place.
- Increase in volume of material following treatment.

10.6.5 Soil Washing

Soil Washing is an *ex-situ* soil separation processes mostly based on mineral processing techniques. It is a water-based process for scrubbing soils *ex-situ* to remove contaminants.

Application and Environmental Benefits

- Applicable to clean inorganic contaminants such as heavy metals from coarse-grained soils.

Limitations and Environmental Dis-benefits

- The effectiveness of the treatment depends on soil particle size. Fine soil particles may require the addition of a polymer to remove them from the washing fluid.
- Complex waste mixtures make formulating washing fluid difficult.
- Requires further treatment and disposal for residuals.

10.6.6 Excavation and Landfill Disposal

Excavation and landfill disposal is an *ex-situ* method whereby contaminants are removed by excavation of the contaminated soil and direct disposal to landfill.

Application and Environmental Benefits

- Most simple and quickest way to dispose of contaminated soil.
- Wide experience in Hong Kong.
- Applicable to all waste or mixture that meet landfill disposal criteria.

Limitations and Environmental Dis-benefits

- Generally not allowed and approval only granted when there is no other feasible methods.
- Only small disposal quantity is allowed.
- Pre-treatment may be required for contaminated soil to meet landfill disposal criteria.
- Landfill space limited and valuable.
- Indirect costs to the landfill management on monitoring and maintenance.
- Potential long-term liabilities to landfill.
- Need large volume of clean backfill materials.
- No access to the working site until completion of backfilling.
- Least desirable management option.
- Landfill disposal should be considered as the last resort and should be employed only when all other remediation measures as well as reuse option are proved to be inappropriate or infeasible, when there is very localized contamination of the site, and when the quantity of excavated material requiring landfilling is small.
- The disposal of contaminated soils at landfills is not allowed unless other in-situ or ex-situ remediation measures as well as reuse of soil either on-site or off-site are proved to be inappropriate or infeasible. To ensure landfill stability and safety, landfill disposal can be adopted only for localized contamination and where the extent of contamination is small.

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11 Protection of Ecological Resources

11.1 Terminology

Tree Survey Report

A Tree Survey Report is a report usually prepared by a landscape architect during the planning stage of a proposed development. The report usually contains an inventory of existing trees affected by the proposed development; tree survey plans showing location and condition of trees; photographic records of the affected trees; and a proposal for tree retention, transplantation, felling and compensatory planting.

Tree Protection Zone

A Tree Protection Zone is the area the perimeter of which is defined by the dripline of the tree. "Dripline" of a tree means the imaginary vertical plumb line that extends downward from the tips of the outer most tree branches and intersects the ground.

11.2 Tree Management

11.2.1 Definition of Tree

According to ETWB TCW 3/2006, a plant is considered as a "tree" if its trunk diameter measures 95 mm or more at a height of 1.3m above the ground level.

11.2.2 Hierarchy for Tree Management Consideration

No tree should be unnecessarily felled or pruned. The following order of priority should be adopted for tree management considerations:

- (a) Retain the trees at their existing locations with protection;
- (b) If (a) is not possible, transplant the affected trees to other permanent locations within the site, so as to increase the tree's survival rate after transplantation and minimize the loss of greenery on the local environs. This should be considered as far as possible unless the trees affected are of low conservation and amenity value, or have a low chance of surviving or recovering to its normal form after transplanting;
- (c) If both (a) and (b) are not possible, transplant the trees to a permanent location off site. Location of receptor site should preferably be within the same area for retention of amenity

value in the vicinity. To strike a balance between cost and benefit, only trees with high conservation value or high amenity value including rare and precious species and "transplantable" trees (i.e. trees that have a very good chance of recovering to its normal form) should be considered for transplanting; and

- (d) Felling of trees will only be considered as a last resort.

11.2.3 Management of Trees at Construction Site

Trees at the construction site should be managed in accordance with the recommendations in the Tree Survey Report and the EIA Report. In general, the following good practices shall be adopted:

- Erect, secure and maintain in good condition temporary protective fencing to protect the preserved trees before commencement of any works within the site. The temporary protective fencing should be erected along or beyond the perimeter of the tree protection zone of each individual tree.



Temporary Protective Fencing
(Photo extracted from the EPD's website)

- No nails or other fixings shall be driven into the trees.
- No fencing, services, or signs other than the identification labels or markings shall be attached to any part of the trees.
- No trees shall be used as anchorages for ropes or chains used in guying or pulling or for equipment used for removing stumps, roots or other trees, or for any other purposes.

- No soil, materials, equipment or machinery shall be stockpiled or stored within the tree protection zones.
- No site offices, workshops, canteens, containers or similar structures shall be installed within the tree protection zones.
- Excessive water shall be drained away from the tree protection zones to prevent damage to tree roots by asphyxiation.
- No chemical / chemical waste store shall be set up within the tree protection zone to avoid accidental chemical spillage that may cause damage to the tree.
- Wheel washing bay / concrete lorry mixer washing area (if any) shall be located away from tree protection zone to prevent the alkaline washout from damaging the roots of trees.
- No passage or parking of vehicles and no operation of equipment or machinery shall take place within the tree protection zones unless otherwise agreed by the Engineer.
- No stripping of surface vegetation or top layer of soil shall be carried out within the tree protection zones unless otherwise agreed by the Engineer.

11.2.4 Control Procedures for Tree Felling or Transplanting

Public Works

The control procedures for tree felling or transplanting for public works are detailed in ETWB TCW 3/2006 and are extracted below:

- The project office shall submit an application to the relevant District Lands Officer (DLO) for formal approval of the felling/transplanting proposal, with copies to Agriculture, Fisheries and Conservation Department (AFCD) or Leisure and Cultural Services Department (LCSD), or the relevant tree maintenance departments as appropriate.
- LandsD will scrutinise the application and reply to the applicant within 10 weeks from the date of receipt of an application with all the requisite information, or within 4 weeks upon receipt of all comments from relevant departments, whichever is the earlier.
- Longer processing time may be required should the proposal involve felling or transplanting of a tree included in the Register of Old and Valuable Trees.
- Where the project office disagrees with DLO's decision on the tree felling/transplanting application, either party may bring the dispute

to the District Lands Conference (DLC) under LandsD for a decision.

- For removal of Old and Valuable Trees, the project office should seek recommendation from Development Bureau before an appeal is made to DLC for decision.

Private Projects

The control procedures for tree felling or transplanting for private projects are detailed in Lands Department Practice Note 7/2007 and extracted as below:

- The lot owners or their Authorized Person (AP) shall submit an application to DLO under the tree preservation clause of the lease.
- The application should contain a conceptual proposal comprising the tree survey submission, the tree removal proposal together with justifications for tree felling, transplanting, tree preservation/protection measures and a conceptual compensatory planting proposal and a detailed compensatory planting proposal.
- To ensure compliance with the tree preservation clause, the pre-sale consent will not be given unless and until approval to all aspects of the tree removal including any required compensatory planting proposal of the application has been obtained.

11.2.5 Penalty for Illegal Tree Felling

Illegal tree felling is liable for prosecution and fine. For trees on unleased Government land, they are protected under the Forests and Countryside Ordinance. Under the Ordinance, any person who fells any trees on unleased Government land is punishable by a fine up to \$25,000 and imprisonment up to one year.

For trees on leased Government land, felling of trees not in accordance with the tree preservation clause of the lease is punishable by a fine. The amount of fine may be as high as few ten thousands dollars per tree.

11.3 Ecological Sensitive Receivers

Ecological Sensitive Receivers are areas of ecological importance that should be conserved as far as possible. Such receivers include wildlife habitat, protected species and endangered species.

11.3.1 Wildlife Habitat

A wildlife habitat is an environmental area that is inhabited by a particular species. It is the natural environment in which an organism lives, or the

physical environment that surrounds (influences and is utilized by) a species population.

Common important habitat types include:

- mature native woodland larger than one hectare
- undisturbed natural coastal area larger than one hectare or longer than 500 metres in linear measurement
- intertidal mudflats larger than one hectare
- established mangrove stands of any size
- brackish or freshwater marshes larger than one hectare
- established seagrass bed of any size
- natural stream courses and rivers longer than 500 metres
- established coral communities of any size
- other habitats found to have special conservation importance by documented scientific studies such as country parks; marine reserves; marine parks and Ramsar Site

11.3.2 Endangered Species

Endangered species is a population of an organism which is at risk of becoming extinct because it is either few in number, or threatened by changing environmental or predation parameters. Such species are listed in the Protection of Endangered Species of Animals and Plants Ordinance.

Common endangered species include:

- Chinese White Dolphin
- Tiger
- Elephant
- Sulphur crested cockatoo (小葵花鳳頭鸚鵡)
- Slipper orchids (拖鞋蘭)

11.3.3 Protected Species

Protected species are animals and plants defined in Wild Animals Protection Ordinance and Forests and Countryside Ordinance respectively.

Common protected animal species include:

- All wild birds
- Squirrels
- Monkey
- Water Monitor
- Romer's Tree Frog (盧文氏蛙)
- Birdwing Butterfly (黃扇蝶)

Common protected plant species include:

- Orchids (蘭花)

- Azaleas (杜鵑)
- Chinese New Year Flower (吊鐘)
- Pitcher-plants (豬籠草)

11.4 Ecological Mitigation Measures

11.4.1 Hierarchy for Ecological Mitigation Consideration

The general policy for mitigating ecological impacts on important habitats and wildlife, in the order of priority, are:

Avoidance

Potential impacts shall be avoided to the maximum extent practicable such as adopting suitable alternatives (e.g. change of site, design, construction method, alignment, layout, programme, etc.).

Minimizing

Unavoidable impacts shall be minimized by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations.

Compensation

The loss of important species and habitats may be provided elsewhere (on-site or off-site) as a compensation. Enhancement and other conservation measures should always be considered whenever possible.

11.4.2 Ecological Mitigation Measures at Construction Site

Ecological impacts should have been fully considered during the project planning and EIA stages such that the impacts have been mitigated through project design to acceptable level. Residual ecological impacts during construction period on site should be managed in accordance with the recommendations in the EIA Report and the Particular Specifications of the construction contract. In general, the following measures may be adopted at construction site:

- Re-provision or enhancement of habitats such as fish pond, marsh and reedbed as compensation for ecological impact. A detailed method statement should be prepared for the landscape architect and ecologist's review.
- Installation of piezometer for monitoring of groundwater level and recharge to restore the local groundwater to the acceptable envelope when necessary.

- Carry out baseline and periodic measurement of ecological attributes throughout the construction period. Such attributes may include:
 - Survival, growth and reproduction of key species (especially sown, planted or translocated species).
 - Health of planted species e.g. pest or fungal attack.
 - Plant species richness and diversity.
 - Presence or abundance of selected ecological indicator species.
- Restrict construction activities to work areas that should be clearly demarcated. The work areas should be reinstated after completion of the works.
- Minimize the use of reflective materials to avoid collision by birds.
- Place equipment or stockpiles in designated works areas and select access routes on existing disturbed land to minimise disturbance to natural habitats.
- Animals shall not be fed and no food shall be left for any animals and no pets of any type shall be allowed on the site.

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12 Resources Management

12.1 Rationales for Resources Management

Resource use on construction sites mainly includes construction materials (concrete, steel and timber), water, energy and paper.

To promote resources management, the 3-R principles 'Reduce, Re-use and Recycle' should be adopted in the day-to-day operation of construction sites and in site offices.

By taking measures to better manage resources the following benefits can be achieved:

- Over the long term, the cost of purchasing resources can be reduced when waste avoidance and recycling measures are adopted. Generally, if existing materials are used more efficiently, less money will be spent.
- Efforts will increase environmental awareness among staff and the workforce.
- By minimizing the amount of resources used, finite resources will be protected and pollution levels will decrease.

12.2 Measures for Resources Management

This section introduces practical measures that can be taken in construction site and site office for better management of resources. It is suggested that contractors should set up performance targets on resource management for a construction site at the project planning stage. The use of different resources in subsequent construction activities should then be closely monitored and checked against the established performance targets.

Where appropriate, incentive schemes for front line site staffs on resources saving should be considered to enhance their involvement in the exercise.

12.2.1 Construction Materials and Equipment

Avoid over-ordering of materials. Prolonged stockpiling of materials may lead to deterioration and wastage.

Allocate designated and preferably sheltered locations for stockpiling of materials. Proper labelling should be affixed on materials.

Devise a preventive maintenance programme for construction equipment to ensure they are operating efficiently.

Adopt modular and standardized design as far as possible to reduce on site casting of concrete to reduce generation of construction wastes.

Sort and segregate reusable and recyclable materials on-site from bulk wastes.

Reuse excavated materials as fill materials.

Reuse materials for hoarding, formwork, scaffolding and trench supports.

Reduce the use of embedded infrastructure for power, data and MVAC systems. The repair or replacement of these embedded infrastructures requires demolishing of the surface wall that generate C&D wastes and also require subsequent refurbishment of the structure.

Selective demolition should be adopted whenever practicable to maximize the collection of recyclable materials.

Regular maintenance of plant and equipment to prolong their lifespan as well as maintaining their working efficiency.

12.2.2 Energy

Use compact fluorescent lights and lamps instead of incandescent light bulbs for indoor lighting.

Use non-tungsten floodlight instead of traditional tungsten floodlight for outdoor lighting (e.g. craneage, security).

Turn off a portion of your office lights during lunch breaks, during overtime work and after normal office hours.

Ensure lights and air conditioning in conference rooms/meeting rooms are turned off after use. This can be achieved by posting signs near the room exits.

Encourage the use of natural lighting and ventilation where at all possible.

When purchasing new appliances check with suppliers to determine the energy efficiency of the products and choose those products (with energy labels) that will save the most energy possible.

Require the last person to leave his/her office to ensure that all office equipment, lights and air-conditioners are switched off.

Plants and equipments that may be in intermittent use shall be shut down between works periods or throttled down to a minimum to minimize fuel consumption as well as air pollution.

The Environment Bureau has also published the Guidelines on Industry Best Practices for External Lighting Installations to minimize the impact of external lightning on the environment.



12.2.3 Water

Use rainwater harvesting systems to capture freshwater for site use. More detail can be found in Section 7.4.4 of this Guide.

Install flow restrictors and automatic shut-off systems and other water flow devices to faucets. This will ensure that water use is reduced at all times.

Encourage staff to always completely turn off all faucets and report any possible leaks. Post reminder signs to tell people to turn off faucets and indicate the number to call to report leaky faucets.

Establish a monitoring and repair programme to ensure that pipes are in good working order and that leaks and other problems are repaired as soon as they are detected.

Reuse treated wastewater whenever practicable (e.g. for dust suppression).

12.2.4 Paper

Use double-sided photocopying and printing.

Encourage the use of E-mail for both internal and external communication, or if this is not possible circulate material rather than making copies for individuals.

Avoid photocopying faxed documents unless required.

Place boxes and trays beside photocopiers as containers to collect used papers for recycling use.

Develop electronic document management system for distribution of document in electronic manner.

Reference could be made to the Waste Paper Recycling Programme described in “Tips to Save the Earth” for details on implementation of waste paper recycling programme in the site office.



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13 Environmental Impact Assessment Ordinance

13.1 Environmental Impact Assessment Process

Environmental impact assessments (EIAs) are intended to identify the potential impacts of a project in the early planning stages, as well as any alternatives or mitigation measures. The EIA Ordinance enacted in 1997 makes EIAs statutory for designated projects in both the private and public sectors. 

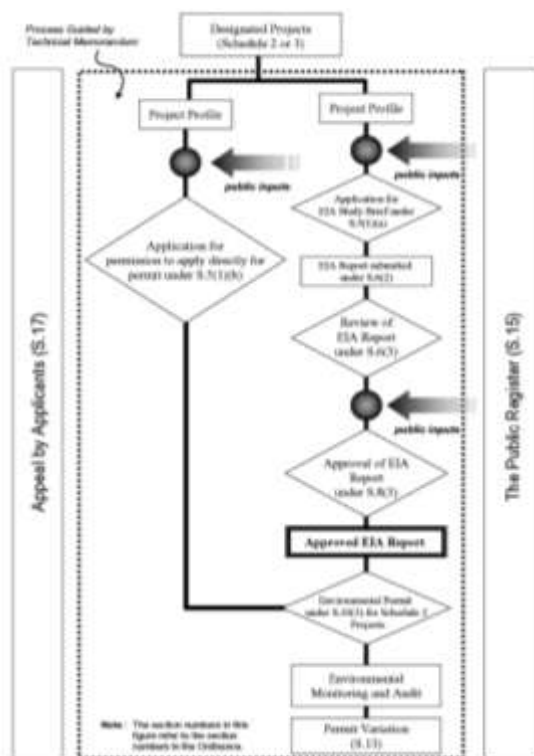
Before an environmental permit for a Schedule 2 designated project can be obtained, a person planning the designated project is required to:

- apply for an EIA study brief, proceed with the EIA study, and then seek approval of the EIA report under the Ordinance; or
- seek a permission to apply directly for an environmental permit.

A Schedule 3 designated project requires an EIA report to be approved under the Ordinance. Once approved, the EIA report will be placed on the Register established under the Ordinance.

The statutory environmental impact assessment process is shown in Figure 13.1.

Figure 13.1 The Statutory EIA Process



13.1.1 Purpose and Principles of EIA Process

The purpose of the EIA process is to protect the environment through prevention. The basic principles of the process are:

- Proactive Planning and Decision Tool.
- Avoidance, Pre-emption and Prevention of Adverse Environmental Consequences.
- Making Positive Influence on Decision Making at the Earliest Possible Opportunity and Thinking Proactively about Options and Alternatives.
- Living Process throughout the Project Cycle.
- Making EIA Recommendations Enforceable.
- Flexibility amidst Robustness and Transparency, with Public Participation and with the Ability to Adapt to Changes.
- Seeking Practical Environmental Outcomes for the Environment and Community.
- Avoidance of any Late Focus.
- Efficiency amidst Effectiveness.
- Transparent Agreement among Relevant Parties, Clear Expectations of what need to be done and what the Performance will be, and Explicit Resolution of any Conflicts.

13.1.2 Designated Projects under the EIA Ordinance

Designated projects are projects or proposals that may have an adverse impact on the environment. They are projects covered by Schedules 2 and 3 in the EIA Ordinance.

Schedule 2 consists of two parts: Part I for projects that require environmental permits to construct and operate of the following categories of works:

- A Roads, Railways and Depots
- B Airports and Port Facilities
- C Reclamation, Hydraulic and Marine Facilities, Dredging and Dumping
- D Energy Supply
- E Water Extraction and Water Supply
- F Sewage Collection, Treatment, Disposal and Reuse
- G Waste Storage, Transfer and Disposal Facilities
- H Utility Pipelines, Transmission Pipelines and Substations
- I Waterways and Drainage Works
- J Mineral Extraction
- K Industrial Activities
- L Storage, Transfer and Trans-shipment of Fuels
- M Agriculture and Fisheries Activities

- N Community Facilities
- O Tourist and Recreational Developments
- P Residential and Other Developments
- Q Miscellaneous

Part II is for projects that require environmental permits to decommission.

Schedule 3 designated projects require Environmental Impact Assessment Report to construct and operate of the following works:

1. Engineering feasibility study of urban development projects with a study area covering more than 20 ha or involving a total population of more than 100,000.
2. Engineering feasibility study of redevelopment projects with a study area covering more than 100,000 existing or new population.

13.1.3 Environmental Monitoring and Audit Requirements

After obtaining the Environmental Permit, the execution of the designated project can be commenced and the Environmental Monitoring and Audit (EM&A) process will be triggered. An EM&A Manual will be developed which outlines the monitoring and audit programme for the designated project. It aims to provide systematic procedures for monitoring, auditing and minimising environmental impacts associated with Project activities. The purpose of the EM&A process is to:

- ensure the execution of the designated project comply with the EIA study recommendations and the Environmental Permit conditions;
- assess the effectiveness of the recommended mitigation measures; and
- identify any further need for additional mitigation measures or remedial action.

13.1.4 Role & Responsibility of Contractors in EM&A Process

The EM&A process involve the Contractor, Engineer, Environmental Team (ET) and Independent Environmental Checker (IEC). The Contractor is the party responsible for the execution of the designated project. Its duties and responsibilities with respect to EM&A include:

- providing assistance to ET in carrying out monitoring;
- submit proposals on mitigation measures in case of exceedance of Action and Limit Levels in accordance with the Event and Action Plans;

- implement measures to reduce impact where Action and Limit Levels are exceeded;
- implement the corrective actions instructed by the Engineer;
- participate in joint site inspection undertaken by the ET; and
- adhere to the procedures for carrying out complaint investigation.

13.1.5 Responsibility of Contractors in Environmental Complaint Investigation

When an environmental complaint is received, it should be referred to ET for coordination. The validity of the complaint should be investigated by ET in consultation with IEC. If the complaint is justified to be due to the execution of the construction work, the Contractor is responsible to propose and implement mitigation measures to alleviate the situation. The performance of the mitigation measures will be reviewed by ET and additional mitigation measures may be required by ET if necessary.

13.2 Implication to Contractor

13.2.1 Environmental Permit (EP) and Further Environmental Permit (FEP)

Under the EIA Ordinance, a Project Proponent such as a private developer or a works department of the Government, who wants to construct a Designated Project, needs to apply for and obtain an EP before the construction work can commence.

The Project Proponent, i.e. the EP holder, will instruct his contractor to conduct all necessary actions to fulfil the permit conditions during the construction work. There are two common approaches:

Option 1

The Project Proponent holds the EP by himself. The Project Proponent is still fully responsible for legal liability. The Project Proponent needs to monitor the Contractor's performance to ensure compliance with the EP conditions.

In case of breaches of the EP condition, both the Project Proponent and contractor might be subject to prosecution under the relevant ordinances. For example, the Project Proponent did not carry out the environmental monitoring works as specified in the permit; the Project Proponent/contractor might be prosecuted by EPD under EIAO. Whilst the discharged wastewater could not comply with the

relevant discharge requirements, EPD might make a prosecution under the WPCO.

Option 2

The project proponent requires the Contractor to apply for a FEP for the whole or part of the project. The Contractor, i.e. the FEP holder, will become legally responsible to fulfil the FEP conditions.

The Project Proponent can then surrender the whole or part of the EP after ceasing to be responsible, by submitting an application to the EPD.

13.2.2 Content of Environmental Permit

In general, the EP will include 3 parts, namely:

- Part A (Main Permit);
- Part B (Description(s) of Designated Project), and
- Part C (Permit Conditions)

Part A (Main Permit)

Part A contains the EP application number and document in the register which includes the reference number of the letter of approval of the EIA Report or the reference number of the letter of permission to apply directly for an EP.

The permit would state that the EP for the particular project is issued to “name of permit holder” with the designated project name. If the conditions of the EP have been changed from previous one(s), the approved EP would indicate it is an amended permit.

Note that the Environmental Permit refers to EIA report approved and permission to apply directly for permit granted under the Ordinance.

Part B (Descriptions of Designated Project)

The descriptions of the designated project may include the title, nature, location, physical scale and scope of the project.

Part C (Permit Conditions)

In general, Part C of the EP shall include the following sections:

- General Conditions:
This section will generally list the legal requirements for the permit holder. The Permit Holder shall display a copy of the EP on the construction site(s) at all vehicular site entrances/exits or at a convenient location for public information at all times, and all

documents listed in Part A of the EP shall be readily available in all sites/offices covered by the EP.

The Permit Holder shall also ensure that the project is designed and implemented in accordance with the information and recommendations described in the EIA report and relevant environmental legislation.


The Permit Holder shall notify the EPD in writing of the commencement date no later than one month before the commencement of the Project.

- Special Conditions/Measures and Submissions for Commencement of the Project:

There may be some specified conditions, as “special conditions”, listed in the EP that the holder needs to follow. Different designated projects may have different special conditions. Particular matters, which are related to construction work, are listed as follows:

- Design, alignment, plan, layout or visual appearance of a designated project
- Limits on the strength, severity or level of the environmental impact of a designated project
- Pollution control, environmental protection or other mitigation measures to be carried out outside the site of a designated project
- Compensation or restoration measures for the conservation, preservation or protection of flora, fauna, ecological habitat or other ecological resources, including replanting, relocation, re-establishment or rehabilitation measures, to mitigate an adverse environmental impact of a designated project
- The mitigation of the environmental impact of a designated project, and the timing, phasing or order of mitigation measures


13.2.3 Application for a Further Environmental Permit (FEP)

Prescribed Form 6  should be completed for application for the FEP.

Normally, application of a FEP will take 30 days from receipt of the application. The FEP should be obtained before he/she assumes the responsibility. The applicant should pay the prescribed fee. The prescribed application fee can be found in EPD’s webpage.




In submitting the application, the details of the part of designated project including location, scope and the reference in EIA Report to be covered by FEP should be described.





Approval of the FEP application is subjected to:

- **There has been no material change to the designated project since the previous environmental permit was issued; and**
- **The information and findings of the EIA report, if any, are still relevant and adequate.**

13.2.4 Application for Variation of an EP or FEP

When the need for variation of conditions of an environmental permit arises, the permit holder could apply for a variation of an EP or FEP using the prescribed Form 5. 


The permit holder should pay the prescribed fee. The prescribed application fee can be found in EPD's webpage.  The application will be processed within 30 days.



In order to facilitate the application process, it is advisable to take a proactive role and start an early dialogue with EPD to identify potential environmental issues and resolutions before submitting the formal application.

A variation of the environmental permit would be issued without the need for an environmental impact assessment report if the Director of Environmental Protection is satisfied that there is no material change to the environmental impact of the designated project with mitigation measures in place and the designated project complies with the requirements in the Technical Memorandum on Environmental Impact Assessment Process. If an environmental impact assessment report is required, the procedures described in sections 5, 6, 7 and 8 of the EIA Ordinance should be followed.

The definition of “material change” in the Ordinance shall be used for a material change to a designated project. The material change shall refer to significant changes only. As a matter of principle, an environmental impact is considered to be

adverse if any factor listed in Annex 3 of the Technical Memorandum on Environmental Impact Assessment Process applies and the criteria in Annexes 4 to 10 of the Technical Memorandum on Environmental Impact Assessment Process  may be violated. As a general rule, changes under the following circumstances are regarded as material changes to a designated project:

- a change to physical alignment, layout or design of the project causing an environmental impact likely to affect existing or planned community, ecologically important areas or sites of cultural heritage;
- a physical change resulting in an increase in the extent of reclamation or dredging affecting water flow or quality likely to affect ecologically important areas, or disrupting sites of cultural heritage;
- an increase in pollution emissions or discharges or waste generation likely to violate guidelines or criteria in this technical memorandum without mitigation measures in place;
- an increase in throughput or scale of the project leading to physical additions or alterations that are likely to violate the guidelines or criteria in this technical memorandum without mitigation measures in place; or
- a change resulting in physical works that are likely to affect a rare, endangered or protected species, or an important ecological habitat, or a site of cultural heritage.

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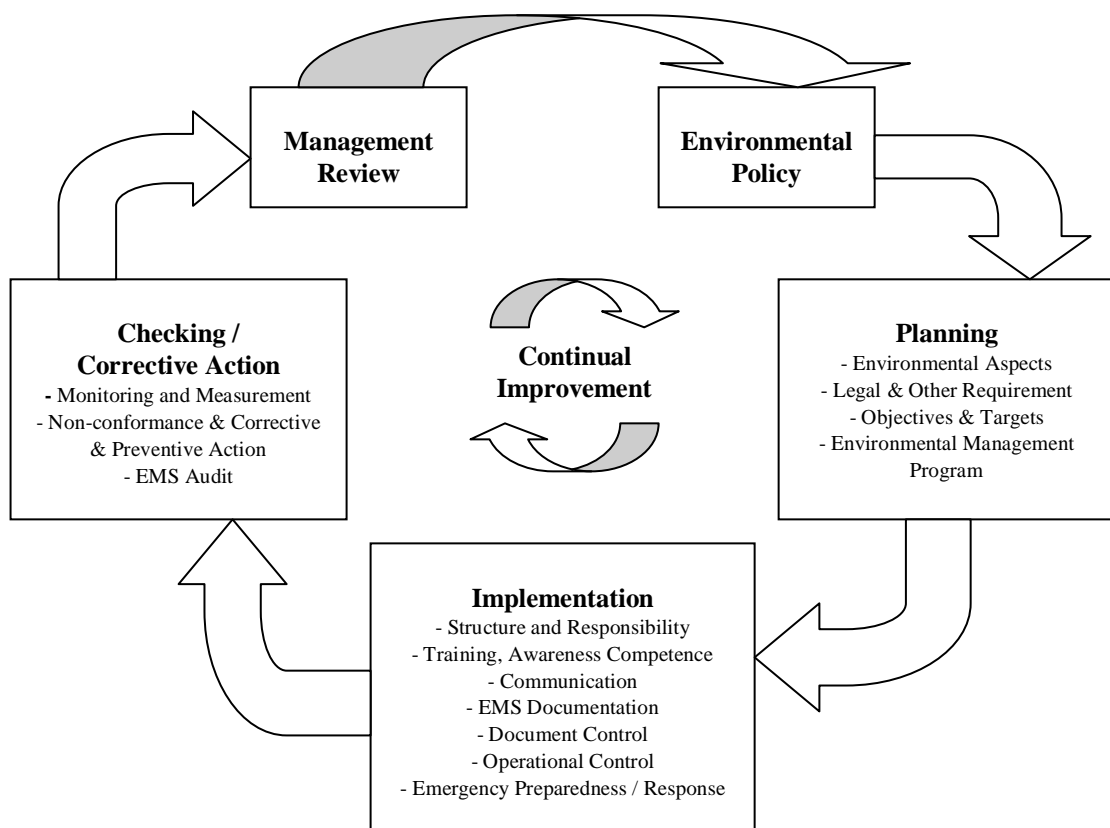
14 Implementation of Environmental Management System

14.1 Environmental Management System

An Environmental Management System (EMS) is a continual business cycle of planning; implementing, reviewing and improving the processes and actions that the company undertakes to meet its environmental obligations and continually improve its environmental performance. The ISO 14001 EMS model is illustrated in Figure 14.1.

ISO 14001 is the international specification for an EMS. It was first published in 1996 and technically revised in 2004 and specifies the actual requirements for an EMS. The overall idea is to establish an organized approach to systematically reduce the impact of the environmental aspects which an organization can control.

Figure 14.1 – Key Elements of EMS



14.2 Environmental Policy

An environmental policy is top management's declaration of its commitment to protecting the environment and it provides a unifying vision of environmental concern by the entire organization. The policy establishes the principles of action for an organization. It sets the level of environmental responsibility and performance required of the organization, against which all subsequent actions will be measured.

The policy should be appropriate to the significant environmental aspects of the organization, e.g. generation of construction wastes, and should guide the setting of objectives and targets.

The responsibility for setting environmental policy rests with an organization's top management. The organization's management is responsible for implementing the policy and for providing input to the formulation and modification of the policy. The policy should be communicated to all persons working for or on behalf of the organization. In

addition, the policy should be made available to the public.

An environmental policy must include:

- compliance with legal requirements and voluntary commitments;
- pollution prevention; and
- continual improvement in environmental performance, including areas not subject to regulation.

! The policy statements usually address a combination of the following:

- Meet all relevant regulatory and legislative requirements.**
- Reduce waste and consumption of resources (materials, fuel and energy), recover and recycle, where feasible.**
- Minimize the production of pollutants to the environment.**
- Adopt technologies and raw materials that will minimize pollution, energy use and waste.**
- Design products in such a way to minimize their environmental effects in production, use and disposal.**
- Minimize the adverse environmental effects of new developments through strategic planning.**
- Provide environmental education and training.**
- Work towards the achievement of sustainable development.**

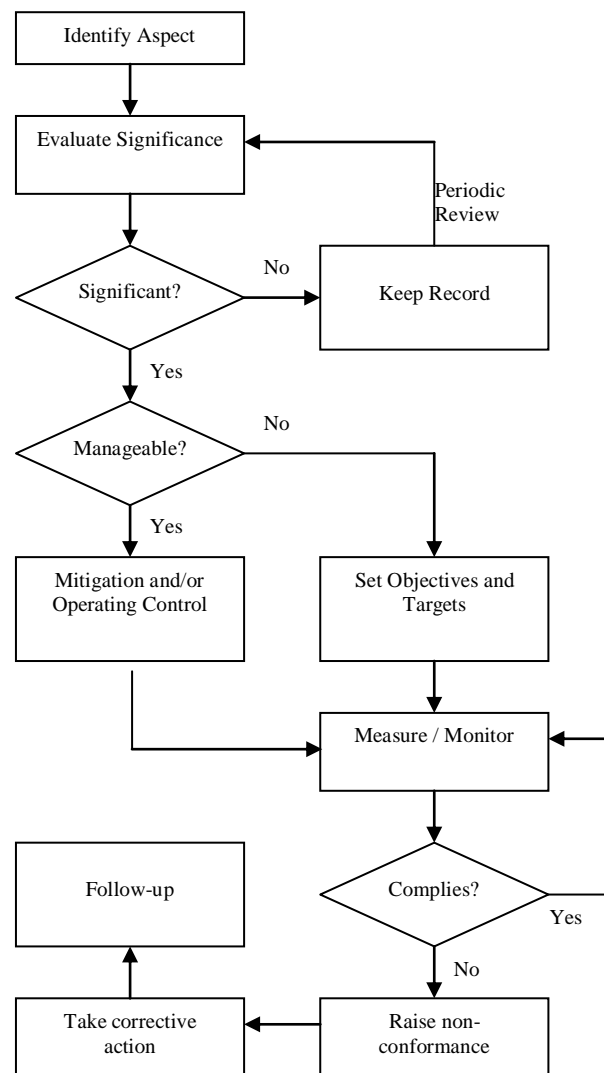
14.3 Planning Stage

Tasks at EMS planning stage include the following items:

- Identification of environmental aspects and their associated impacts
- Identification of legal and other requirements
- Development of objectives and targets
- Development of an environmental management programme

The relationship between the above items is shown graphically in Figure 14.2.

Figure 14.2
Relationship between Environmental Aspect, Impact and Objective and Target



14.3.1 Identification of Environmental Aspects

Environmental aspects are elements of an organization's activities, products and services that can interact with the environment. An organization should identify environmental aspects within the scope of its EMS that are associated with its past, ongoing and planned activities, products and services. In all cases, the organization should consider normal and abnormal operating conditions including start-up and shut-down maintenance and emergency situations and accidents.

In identifying environmental aspects, the following should be considered:

- Operations and activities that interface with the environment in a way that could result (or has resulted) in environmental impacts;

- Materials, energy sources and other resources to be used in the work;
- Emissions to the air, water or land;
- Wastes generated and their handling or disposal processes;
- Characteristics or attributes of the products or services that could result in impact to the environment (e.g. through their intended use or end-of-life management);
- Interaction of the land or infrastructure (e.g., buildings) with the environment; and
- Activities (for example, chemical storage) that might lead to accidental releases.



Environmental Aspects should be identified considering normal and abnormal conditions.

Normal condition means routine daily operation with everything functioning properly.

Abnormal condition means operation out of scheduled program or under abnormal working environment. Abnormal conditions may include operating out of normal working hours or under inclement weather conditions.

14.3.2 Identification of Environmental Impacts

Environmental impacts are changes to the environment, either adverse or beneficial, that result wholly or partially from environmental aspects. Upon identification of the relevant aspects, an organization must be able to correlate the aspect to the respective impacts whereby the significance of the impact is determined for prioritizing the resources to be mobilized.

In evaluating environmental impacts, the following should be considered:

- Are the impacts effect in normal or abnormal condition?
- Are the impacts beneficial or damaging to the environment?
- What is the magnitude or degree of these impacts?
- What is the frequency or likelihood of these impacts?
- What is the duration and geographic area of these impacts?
- Which parts of the environment might be affected (e.g., air, water, land, flora, fauna)?
- Is the impact regulated in some manner?
- Have the interested parties expressed concerns about these impacts?

Examples of environmental aspect and associated impacts are shown in Table 14.1.

Table 14.1 – Examples of Environmental Aspect and Associated Impacts

Environmental Aspects	Environmental Impacts
Activity: Bored piling	
Emission of exhaust from construction plants	Pollution of air Respiratory impacts on local residents Odour nuisance
Discharge of soil to water bodies from foundation works	Pollution of water body
Consumption of fresh water	Use of natural resources
Use of powered mechanical equipment	Construction noise impacts on local residents
Generation of construction wastes	Impacts on land use and use of natural resources

14.3.3 Identification of Legal and Other Requirements

As stated in environmental policy, compliance with legal and other requirements is a commitment of top management. Chapter 2 of this Guide summarises the legal and other requirements relevant to construction industry.

14.3.4 Development of Objectives and Targets

An environmental objective shall mean the overall environmental goal, arising from the environmental policy, that an organization sets itself to achieve, and which is quantified where practicable.

Environmental target is the detailed quantifiable performance requirement that arises from the environmental objectives and that needs to be met in order to achieve that objective. Examples of objectives and targets are shown in Table 14.2.

Table 14.2 – Examples of Objectives and Targets

Objectives	Targets
Reduce energy usage	Reduce electricity use by 10% in 2008. Reduce diesel use by 10% in 2008.
Improve employee awareness of environmental issues	Hold monthly awareness training courses at all sites. Train 95% of employees by end of 2008.



Objectives and Targets should be meaningful and achievable and can bring real satisfaction to staff once achieved, rather than being over-ambitious which may lead to failure and discouragement. The following steps may be taken in development of objectives and targets:

- 1. Gather data on the environmental aspects which are planned to be controlled.**
- 2. Analyse the assembled data to determine the current baseline.**
- 3. Against the current baseline, set the targets which the organization aims to achieve over time.**
- 4. Evaluate the financial, technological and other capabilities that are required to achieve the objectives and targets.**

14.3.5 Development of Environmental Management Programme

Environmental management programme is an action plan that it translates the organization's goals and policy commitments into concrete actions so that environmental objectives and targets are achieved. An individual programme should be developed for each target.

The programme should include the following elements:

- Why – That is the specific target to be achieved in the programme
- What – A list of detailed actions to be done in order to achieve the target
- Who – the responsible person for each specific action
- When – the time frame and schedule for completing each specific action

14.4 Implementation Stage

Tasks at implementation stage include the following elements:

- Structure and Responsibility
- Training
- Communication
- EMS Documentation and Control
- Operation Control
- Emergency Preparedness and Response

14.4.1 Structure and Responsibility

Responsibility should be clearly defined and delegated to different levels of staff for effective implementation of EMS. Employees at all levels should be accountable, within the scope of their responsibilities, for environmental performance in support of the overall environmental management system.

One possible approach for developing environmental responsibilities is indicated in Table 14.2. It should be recognised that as construction companies have different organisational structures, individual contractor would need to understand and define environmental responsibilities based upon their own work processes.

Table 14.3 – Environmental Responsibilities

Sample Environmental Responsibilities	Typical Person(s) Responsible
Establish overall direction	Chairman, Managing Director, Board of Directors
Develop environmental policy	Chairman, Managing Director, Environmental Director/Manager
Develop environmental objectives, targets and programmes	Managers of a project or department
Monitor overall EMS performance	Environmental Director/Manager
Assure regulatory compliance	Senior Project Manager, Project Manager
Ensure continual improvement	All Managers
Develop and maintain accounting procedures	Quantity Surveyor, Finance/Accounting Managers
Comply with defined procedures	All Staff

14.4.2 Training

An analysis of training needs should be undertaken to determine the appropriate training for each grade of staff. The training provided to staff should be relevant to the achievement of environmental policies; objectives and targets; and management programme. Employees should be trained to have knowledge on proper procedures to perform their tasks and understand the environmental consequence if such procedures are deviated.

More information about training can be found in Chapter 15 of this Guide.

14.4.3 Communication

Communication channels should be established to:

- Demonstrate management commitment to implement environmental protection on site.
- Deal with concerns and questions about the environmental aspects of the organisation activities, products or services.
- Raise the environmental awareness of the staff on the organisation's environmental policies, objectives, targets and programmes.
- Inform internal or external interested parties about the organisation's environmental management system and performance as appropriate.

This could be done by:

- Displaying the company's environmental policy, objectives, targets and programme to the public;
- Displaying contact details of nominated correspondents (include name of person, address, telephone number and fax number);
- Regular internal environmental meeting to review environmental performance;
- Meeting with interested parties and stakeholders to seek their environmental concerns; and
- Distribution of company's environmental report addressing the work done with respect to environmental protection.

14.4.4 EMS Documentation and Control

Operational processes and procedures should be defined and appropriately documented and updated as necessary. The organisation should clearly define the various types of documents to establish and specify effective operational procedures and control.

For construction sites, the EMS documentation should, as a minimum include the Company's EMS

Manual and the site specific Environmental Management Plan.

The existence of the EMS manual supports employee's awareness of what is required to achieve organisation's environmental objectives and enables the evaluation of the system and environmental performance. The environmental manager or project manager could discuss the manual through training at site offices.

Other EMS records cover:

- Legislative and regulatory requirements
- Licences and Permits
- Environmental aspects (such as construction noise, wastewater treatment, chemical waste, etc.) and impacts and their associated mitigation measures (such as construction of noise barrier, wastewater recycling plant, drip tray for chemical waste, etc.)
- Environmental training activity for management, operation staff, contractors, etc.
- Inspection, calibration and maintenance activity
- Monitoring data (see Section 14.5.1)
- Details of non-conformance: incidents, complaints and follow-up action
- Environmental audits and management reviews

Effective management of these records is essential towards successful implementation of the EMS. All documentation should be dated (with dates of revision), readily identifiable, organised, and retained for a specified period.

14.4.5 Operational Control

Implementation is accomplished through the establishment, running and maintenance of operational procedures and controls to ensure that the company's environmental policy, objectives and targets can be met. Including communicating applicable procedures and requirements to suppliers and contractors.

14.4.6 Emergency Preparedness and Response

The Contractor should carry out the following tasks:

- Identify the possibilities for accidents and emergency situations.
- Develop emergency preparedness and response procedures.
- Evaluate, revise and test the procedures.

During identification of emergency situation, the nature, location, duration and scale of works should be considered. Both normal and abnormal operating conditions should be taken into account.

Emergency response procedure for each of the identified emergency situation should be established. Emergency Team for execution of the procedure should be setup.

Regular training and drill should be exercised to enhance the awareness.

More information about the planning for emergency situation can be found in Chapter 3 of this Guide.

14.5 Checking Stage

Tasks at EMS Checking stage include the following items:

- Monitoring and Measurement
- Non-conformance, Corrective and Preventive Action
- EMS Audit

14.5.1 Monitoring and Measurement

A construction company should measure, monitor and evaluate its environmental performance, to ensure that the organisation is performing in accordance with the stated environmental management programme.

This should be mainly based on the licence(s) and permit(s) issued from EPD, which requires environmental monitoring. They may include the WPCO Effluent Discharge Licence, Environmental Permit requirements (stating the required monitoring works such as construction dust, noise and water sampling and measurements). Results, if necessary, should be submitted to EPD for their record.

The EPD or general public would appreciate the main contractor undertaking additional/further monitoring works in order to satisfy their own environmental policy, objectives and targets.

14.5.2 Non-conformance, Corrective and Preventive Action

The findings, conclusions, and recommendations reached as a result of measuring, monitoring, audits and other reviews of the EMS should be documented, and necessary corrective and preventive actions identified. Management should ensure that these corrective and preventive actions

are implemented, with systematic follow-up to ensure their effectiveness.

14.5.3 EMS Audit

Internal EMS audits should be conducted at planned intervals to determine and provide information to management on whether the system conforms to planned arrangements and has been properly implemented and maintained. They can also be performed to identify opportunities for improvement in an organization's environmental management system.

Typical audit should include the following procedures:

- Opening meeting
- Document review
- Detail site inspection
- Staff interview
- Close meeting
- Audit report preparation

14.6 Management Review

A review of the EMS should be conducted at appropriate intervals (normally of every 12 months) to ensure its continuous suitability and effectiveness. Company officers and top management should be involved in the review process, to ensure all environmental issues are identified and where applicable improved.

While the site documents such as EMP should be reviewed quarterly to cope with the different stages of construction works, the review of the EMS should include:

- Review of environmental objectives, targets and environmental performance
- Evaluation of the suitability of the environmental policy and the need for changes in the light of
 - Changing legislation
 - Changing expectations and requirements of interested parties such as the client
 - Advances in science and technology
 - Lessons learned from environmental incidents
 - Market preferences
 - Reporting and communication

14.7 ISO 14001 EMS Resource

The Environmental Protection Department (EPD) has provided a free support package on Environmental Management Information and ISO 14001 EMS tailored made for SMEs in the construction sector. It aims to help SMEs in the construction sector understand the local environment pressure from different stakeholders

and stay competitive in the environmentally conscious market. The package includes up-dated environment management information related to supply chain pressure in the construction sector, a set of user-friendly generic ISO 14001 EMS templates and a user manual with sector specific practical examples to facilitate their adoption and implementation of the ISO 14001 EMS. The package is freely accessible via EPD's website.



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15 Training Resources and Materials

Environmental training is an effective way to enhance staff and workers' awareness with respect to environmental protection on construction sites. This chapter introduces different types of environmental training and provides resources on training materials.

15.1 Internal Environmental Training

Internal Environmental Training mainly includes:

- Site-specific Induction Environmental Training
- Environmental Toolbox Talks

15.1.1 Site-specific Induction Environmental Training

Site-specific Induction Environmental Training should be conducted to all site staff and workers. It should be arranged by site Environmental Officer and delivered by Environmental Officer or Environmental Supervisor. The training should be provided within the first week of the staff or worker first report duty of the site and then every half-year. The content of the training should include:

- Environmental Policy
- Environmental Legislations
- Legal requirements
- Organization structure on environmental management
- Environmental duties and responsibilities
- Environmental nuisance abatement measures
- Environmental objectives and targets
- In-house rules and regulations

15.1.2 Environmental Toolbox Talks

Environmental Toolbox Talks are mainly attended by site workers. The purpose is to provide practical and appropriate measures to be implemented on construction sites in order to minimize environmental nuisance and impact during their execution of construction activities.

They should be arranged by the site Environmental Officer and delivered by Environmental Officer or Environmental Supervisor weekly throughout the construction period.

The following matters should be considered during the selection of appropriate training topics:

- Trade of workers
- Recent construction activities
- Recent environmental inspection findings

- Advice / comment from authorities, client and Architect/Engineer

Environmental toolbox talk materials relevant to different construction activities have been prepared by Hong Kong Construction Association (HKCA). The Environmental Toolbox Training Kit published in January 2008 should be referred to during the arrangement of the training. This Training Kit can be purchased from HKCA. Please refer to HKCA's webpage for detail.



15.2 External Environmental Training

Various environmental training courses are available in different institutes, including Construction Industry Council Training Academy (CICTA), Hong Kong Productivity Council (HKPC), Institute of Vocational Education (IVE) and School of Professional Education and Executive Development (SPEED) of The Hong Kong Polytechnic University, and are suitable for different levels of staff. The following lists out some relevant courses.

15.2.1 Environmental Management Course for Construction Managers

Suitable for site management staff including project manager, construction manager and site agent.

Course focuses on:

- contractual requirement on environmental management;
- implementation of environmental management system; and
- nuisance abatement measures on air, noise, water quality and waste management.

15.2.3 Environmental Protection Course for Environmental Supervisors

Suitable for Environmental Supervisor in accordance with ETWB TCW 19/2005.

Course mainly focuses on management of air quality, noise, water quality and waste management and waste reduction techniques.

15.2.4 Environmental Officer Course

Suitable for Environmental Officer in accordance with ETWB TCW 19/2005.

Course focuses on legislation and relevant requirements for management of various

environmental parameters and preparation and implementation of Environmental Management Plan.

15.2.5 Supervision of Tree Works Course




Suitable for any person who want to fulfil the requirement of the Technical Circular No. 3/2006 Tree Preservation as a competent member to oversee and supervise tree works related to horticultural operations and preservation of trees.

Course focus on tree preservation and felling; tree protection; tree surgery; tree planting; tree work safety procedures; and tree maintenance.




15.3 Environmental Training Resources

Environmental training materials are available at the following EPD's webpage.




15.3.1 General Training Material

- Green Construction Pocket Handbook

- Guidance Notes for Green Construction (Part I)

- Guidance Notes for Green Construction (Part II)





15.3.2 Air Pollution Control Training Materials

- Train-the-Trainer Package for Air Pollution

- EPD Guidelines and References on Air Pollution Control

- Green Construction Video on Dust Management


15.3.3 Noise Control Training Materials

- Train-the trainer Package for Construction Noise

- Green Construction Video on Noise Control

- EPD Guidelines and References on Noise Control


15.3.4 Water Pollution Control Training Materials

- Train-the trainer Package for Water and Waste

- Green Construction Video on Water Pollution Control

- EPD Guidelines and References on Water Pollution Control


15.3.5 Waste Management Training Materials




- Train-the Trainer Package for Construction and Demolition Waste

- Green Construction Video on Low Waste Construction

- EPD Guidelines and References on Waste Pollution Control


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16 Innovative Environmental Control

Hong Kong Construction Innovative Environmental Award programme was launched in year 2007. This Section extracts some of the innovative technologies developed by the participants to tackle site environmental pollution problems.

16.1 Innovation on Dust Control

This Section introduces the dust control innovations developed by the participants.

16.1.1 Dust Control for Soil Nail Drilling Work

During drilling operation for installation of soil nail, construction dust emission would be generated especially during drilling against the rock and concrete. The use of “Mist Shield” can effectively suppress the dust migration while the consumption of water is limit.

The “Mist Shield” is constructed with 20mm diameter water pipe formed in closed loop with water inlet port and bores (~2mm diameter) outlet at the inner edges. It is lightweight and portable. Installation of it is easy to handle and could be completed in a very short time. All these features facilitate reuse of it in several soil nail installation projects.



Dust Shield for Soil Nail Rig

16.1.2 Dust Control for Operation of Backhoe

During the use of backhoe for concrete breaking work, construction dust emission will be generated.

The innovation of water spraying funnel fabricated by a traffic cone and a manual water pump is developed. The funnel is mounted on the backhoe and water is delivered to the breaker bit using hand water pump to reduce dust emission during breaking work.



Water Spraying Funnel for backhoe

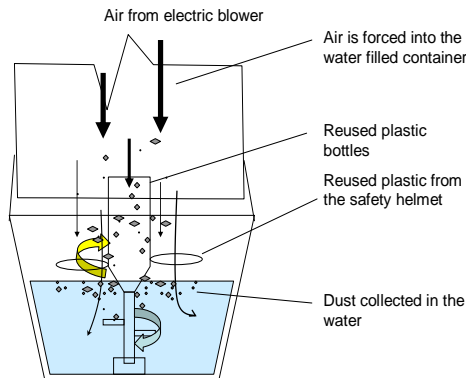


Water Spraying Funnel Mounted on Backhoe

16.1.3 Dust Suppressor for Breaking Work

The aim on the dust suppressor is to remove dust generated during the breaking process. It is achieved by using an air blower to force the dusty air to come into contact with the water. The baffles in the water will be working as a turbine to create turbulence. By the turbulence force, the dust in the air will mix with water and subsequently settle down to the bottom.

Principles



Schematic Design of Dust Suppressor



Dust Suppressor

16.1.4 Mobile Sprinkler

Mobile sprinkler is designed to improve the mobility of sprinkler system.

Four wheels are installed at the base of the unit for easy mobilization on uneven grounds around the site. The unit is light weight and can be manipulated on site by one person. It is suitable for use in open spaces or near public areas. This temporary arrangement is particularly made for places where fixed water spraying is not possible.



Mobile Sprinkler

16.1.5 Electrostatic Dust Filter Box

The filter box consists of multiple layers of corrugated aluminum mesh which is used for dust filtration. The electrostatic charge is enhanced by the friction of airflow generated by air blower over the media surface. When the dusty air is drawn to the filter box by the air blower, the dust is trapped by the corrugated aluminium mesh and the clean air expelled.

The advantage is that the corrugated aluminum mesh is easily washable by water jet that enhances the lifespan of the system.



Electrostatic Dust Filter Box

16.2 Innovation on Green Site Office

This Section introduces the green site office innovations developed by the participants.

16.2.1 Green Cladding

The green cladding was an innovative design with high flexibility, reliability and good appearance. It is a prefabricated product with lightweight feature that just one person can handle it solely and easily.

Thus, it is replaceable and transferable easily and reduces the difficulties during maintenance. The claddings can be fixing horizontally and vertically. For vertical application, it can be mounted in new building surface or existing building surface. For horizontal application, it can be placed on the top of a site office or building as a green roof. This helps to reduce indoor temperature and hence energy consumption. Moreover, it can increase oxygen content of the working space and provide more greenery to mitigate visual impact.



Green Cladding



Green Cladding Mounted on Roof of Site Office

16.2.2 Energy Efficient Site Office

The energy efficiency of different site office design is studied and the following design consideration is proposed.

Container Colour

Painting the container with a coat of white paint give power consumption reduction in air-conditioning demands.

Roof

Constructing a roof to shade the container from direct sunlight and to create an insulation layer of air in the roof void above the office container ceiling.

Door Closer

Installing a door closer to keep the door closed at all times reduces the unnecessary loading on the air conditioner compressor and reduces the power consumption.

Timer Control

Installing a timer to control the site office containers main electrical power supply. As a result, the main power will be switched on/off automatically on a daily basis or as required.

Window Blind

Installing window blind so that direct sunlight cannot enter the office container. It can reduce consumption of energy for air conditioning.

16.3 Innovation on Recycle, Reuse and Reduce

16.3.1 Reuse Sample Rock Material

Reuse of sample rock material from rock socket during pilling for planting purpose.



16.3.2 Recycle, Reuse and Reduce of Fell tree

Recycle the trees felled in construction projects to mulches and compost materials in order to minimize landfill utilization.



Felling

Cutting
and

Composting

Sorting



Reusing for Wood fencing, Mulching and Planting

16.3.3 Organic Farming on Green Roof

In order to diminish poor impression from public about construction site generated kinds of pollutions from construction activities. A Joint Organic Farming Program with public/educational school to be organized to improve impression of construction industry and raise concern of healthy organic food.



Organic Farming in Construction Site

Organic farming in construction site not only increases green area, but also reduces Heat Island Effect and Carbon Emission.

16.3.4 Natural Composting

Reducing waste is one of the essential topics in waste management.

During site clearance, hay and grass clippings by-products can be used to composting into valuable fertilizer to minimizing waste to disposal to landfill.

The composting bin with holes for aeration should be placed in a partially sunny location outdoors at ambient temperature to facilitate composting of vegetation. During site clearance, generated vegetation will be collected, centralized and transferred to the composting bin which will be watered daily and stirred weekly. Soil that contains essential microorganism will be added to facilitate composting.



Composting Bin with Holes



Hay and Glass Mixed with Essential Soil



Watered Daily



Stirred Daily



Final Compost Product



Return to the Nature

The final compost product (composting period is approximately three month depends on the materials and site condition), will be used to nurture nearby vegetation on site.

In addition to reduction of waste disposed of at landfills and reuse of valuable resources, on-site composting also help to control carbon emission of works by reducing the scale of transportations.

16.3.5 Reduce Chemical Waste Generation on Sulphuric Acid Spillage

Base on the use of sulphuric acid is more common in use at construction works area. (e.g. Battery Fluid, pH regulator and concentrated sulphuric acid).

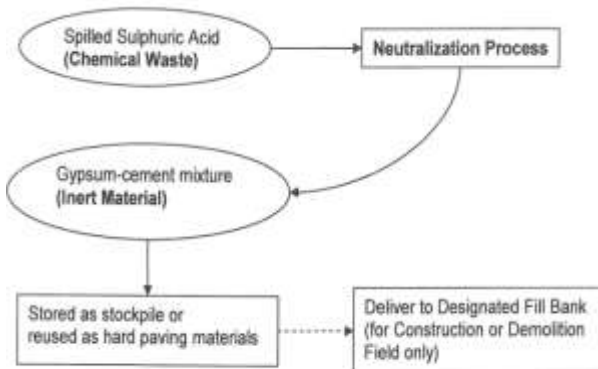
A simple neutralization process can be applied to minimize or zeroing chemical waste generation during chemical spillage occurs.



Treatment on Spillage Acid on Site

An anhydrous cement powder can be used as the neutralization agent and can be found in the Material Safety Data Sheets which provided from suppliers.

Volume of Acid	Neutralization Agent (kg) to be Used (at least)			
	Batteries Fluid (32% of Sulphuric Acid)	Batteries Fluid (44% of Sulphuric Acid)	pH Regulator (66% of Sulphuric Acid)	Conc. Sulphuric Acid
1L	0.301	0.444	0.753	1.354
2L	0.603	0.887	1.505	2.707
3L	0.904	1.331	2.258	4.061
4L	1.205	1.774	3.010	5.415
5L	1.507	2.218	3.763	6.769



— New Procedures for Treatment on Sulphuric Acid

The sorbent with acid waste can be changed into cement powder and reused as hard paving materials.