

6. WASTE

6.1 Introduction

This section identifies the waste arising from the construction and operation of the MOS Extension and assesses the potential environmental impacts associated with the handling and disposal of the waste. Opportunities for waste minimisation, recycling, storage, collection, transport and disposal have been examined and measures for controlling the environmental impacts due to handling and disposal of wastes are recommended.

6.2 Legislation and Guidelines

6.2.1 Introduction

The criteria and guidelines for evaluating potential waste management implications are laid out in *Annexes 7* and *Annex 15* of the *Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)* under the *EIAO* (Cap 499).

The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in the Hong Kong Special Administrative Region (SAR), and will also be considered in the assessment.

- Waste Disposal Ordinance (Cap 354);
- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
- Land (Miscellaneous Provisions) Ordinance (Cap 28); and
- Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws.

6.2.2 Waste Disposal Ordinance

The *Waste Disposal Ordinance* (WDO) prohibits the unauthorised disposal of wastes, with waste defined as any substance or article which is abandoned. Construction and demolition (C&D) waste is not directly defined in the *WDO* but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any waste building, or civil engineering materials, but does not include animal waste.

Under the *WDO*, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The *WDO* also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of C&D waste or trade waste.

6.2.3 Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)

Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*, if such a substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable, upon conviction for a first offence, to a fine of up to HK\$200,000 and to imprisonment for up to 6 months.

Producers of chemical wastes must treat their wastes, utilising on-site plant licensed by the EPD or have a licensed collector take the wastes to a licensed facility. For each consignment of wastes, the waste producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. The system is designed to allow the transfer of wastes to be traced from cradle to grave.

The *Regulation* prescribes the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees with training in such procedures.

6.2.4 Land (Miscellaneous Provisions) Ordinance (Cap 28)

Construction and demolition materials¹ which are wholly inert may be taken to public filling areas. Public filling areas usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED). The *Land (Miscellaneous Provisions) Ordinance* requires that public filling licences are obtained by individuals or companies who deliver inert C&D material (or public fill) to the public filling areas. The licences are issued by the CED under delegated authority from the Director of Lands.

Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions public filling areas will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the public filling supervisor.

¹ "C&D material" contains a mixture of inert and non-inert material. The inert portion is the "public fill" and the non-inert portion is the "C&D waste"

6.2.5 Public Cleansing and Prevention of Nuisances by-Laws

These by-laws provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK\$ 10,000 and imprisonment for up to 6 months.

6.2.6 Additional Guidelines

Other 'guideline' documents which detail how the contractor should comply with the regulations are as follows:

- *Waste Disposal Plan for Hong Kong* (December 1989), Planning, Environment and Lands Branch Government Secretariat;
- *Environmental Guidelines for Planning In Hong Kong* (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government;
- *New Disposal Arrangements for Construction Waste* (1992), Environmental Protection Department & Civil Engineering Department;
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* (1992), Environmental Protection Department.
- *Works Branch Technical Circular No. 6/92, Fill Management*; Works Branch, Hong Kong Government;
- *Works Branch Technical Circular No. 2/93, Public Dumps*. Works Branch, Hong Kong Government;
- *Works Branch Technical Circular No. 16/96, Wet Soil in Public Dumps*; Works Branch, Hong Kong Government; and
- *Works Bureau Technical Circular No. 4/98, Use of Public Fill in Reclamation and Earth Filling Projects*; Works Bureau, Hong Kong SAR Government.

6.3 Construction Impacts

6.3.1 Construction Activities

The construction of the MOS Extension which consists of two at grade sections and two viaduct sections, will involve the following construction works:

- site preparation;
- foundation works for viaduct, stations and depot;
- construction of approximately 8.24 km of viaducts;
- construction of approximately 3.42 km of railway track at grade;
- construction of nine passenger stations including Tai Wai (TAW), Shatin Tau (STT), Shau Kok Street (SKS), City One (CIO), Shek Mun (SHM), Chevalier Garden (CHG), Heng On (HEO), Ma On Shan (MOS) and Lee On (LEO):

- construction of the Tai Wai Depot; and
- installation and erection of electrical and mechanical equipment.

There will be two main Work Areas, one at Shek Mun on the proposed station/development site and the other at Lee On on the development site. There will also be a number of workfaces along the alignment.

6.3.2 Potential Sources of Impact

Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their composition, as follows:

- excavated material;
- construction and demolition waste;
- chemical waste; and
- general refuse.

The nature and quantity of each of these waste types arising from the construction of the MOS Extension are identified below.

Excavated Material

Excavated material is defined as inert virgin or reclamation fill material removed from the ground and sub-surface. As the MOS Extension will be constructed on viaducts or at grade, the excavation work will be limited to construction of pier foundations and minor earthworks. Viaduct units with a span of 35 m and 40 m will be supported by piers which sit on four bored piles of 1.2 m or 1.5 m diameter, respectively and socketed 0.5 m to 1.5 m into rock. The lengths of the majority of the bored piles vary from 20 m to 30 m below ground level. Between HEO station and MOS station, the rock head level was not identified in the limited site investigation even at depths of more than 70 m below ground. Steel H-piles are therefore proposed for this section. No or minimal excavation will be required for the construction of H-piles. Excavated materials will also be generated from foundation construction for the stations and depot. It is estimated that the quantity of excavated material arising from all the foundation works will be in the order of 500,000 m³. The excavated materials will be generated within a 36 month period between mid 2000 and mid 2003 and will comprise rock, sand, concrete (in particular, in the area near Tai Shue Hang where public fill has been used as fill material for the reclamation), clay and mud.

Construction and Demolition Waste

The principal superstructures to be constructed will include:

- piers and viaducts;
- nine passenger stations; and

- Tai Wai Depot.

The viaduct piers will be concreted *in situ* on the pile caps. The typical viaduct structure proposed is a 2.5 m deep pre-stressed concrete box girder to be constructed using the pre-casting method. Standard 35 m span single track viaducts and 40 m span double track viaducts will be used for the majority of the alignment. The viaduct segments will be pre-casted at the Shek Mun and Lee On Work Areas and delivered to the workfaces using temporary rail track and special rolling stock mounted with cranes. Standard formworks will be used for the pre-casting works.

C&D material will be generated from the construction of new structures. These materials comprise unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements, and materials used and discarded. The C&D material will arise from a number of the construction activities and typically may include:

- wood from formwork and falsework;
- equipment and vehicle maintenance parts;
- materials and equipment wrappings;
- unusable/surplus concrete/grout;
- bentonite slurry; and
- damaged/contaminated construction materials.

The quantity of C&D material generated from the construction of piers and viaducts cannot be estimated at this stage. As standard reusable wood or steel formworks will be used, it is expected that the amount of C&D material to be produced will be small.

Based on a generation rate of 0.1 m³ per 1 m² of gross floor area (GFA) constructed¹, the quantity of C&D material to be produced from the construction of stations and depot is presented in *Table 6.3a*.

Table 6.3a C&D Material Arising From Construction of Stations and Depot

Structure	Gross Floor Area (m ²) ^(a)	C&D Material Arisings
Tai Wai Depot	N/A	N/A
Tai Wai Station	4,000	400
Shatin Tau Station	1,800	180
Sha Kok Street Station	1,520	152
City One Station	1,420	142
Shek Mun Station	2,000	200

¹Reduction of Construction Waste Final Report (March 1993). Hong Kong Polytechnics

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Structure	Gross Floor Area (m ²) (a)	C&D Material Arisings
Chevalier Gardens Station	1,300	130
Heng On Station	1,340	134
Ma On Shan Station	1,800	180
Lee On Station	3,230	323
Total	14,780	1,478

Notes: (a) Excluding commercial, GIC and domestic GFA

The total amount of C&D material to be generated from the construction of stations and depot will be in the order of 1,500 m³.

C&D material will also be generated as a result of the clearance of sites which are currently occupied by man-made structures. Part of the following properties will need to be cleared prior to the construction work.

- Government kennel and Shatin plant quarantine area;
- Hin Tin Playground;
- Tai Wai Bus Terminus;
- Hong Kong School of Motoring;
- Che Kung Miu Road Sports ground;
- Tai Wai cycle recreation ground;
- Happy Dragon Amusement Park;
- Tsang Tai Uk Recreation Ground;
- Plant nursery of RSD at Chap Wai Kon Street; and
- part of Siu Lek Yuen Road Playground.

The C&D material generated from the clearance work may include:

- brick, concrete, reinforcing bars, pipework and other rubble;
- derelict equipment and plant; and
- wood, furniture, fittings and fixtures and general refuse.

With respect to the landuses of the affected properties, it is not expected that the structures or lands are contaminated. As detailed structural plans for these properties are not available, it is not possible to determine the quantity of C&D material to be generated from the demolition work. However, it is expected that the quantity will likely be least than 10,000 m³.

Chemical Waste

Chemical Waste, as defined under the *Waste Disposal (Chemical Waste) (General) Regulation*, includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of substances is provided under the *Regulation*, however substances likely to be included in the above category generated as a result of construction activities will primarily arise from the maintenance of plant and equipment. These may typically include the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oil;
- hydraulic fluids;
- used air, oil and fuel filters from machinery;
- spent mineral oils/cleaning fluids from machinery; and
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities.

Chemical waste will arise primarily from vehicle and plant maintenance at the two main Work Areas. Chemical wastes may pose serious environmental, and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. These hazards may include:

- toxic effects to workers;
- adverse effect on air, water and land from spills;
- fire hazards; and
- disruption to sewage treatment works due to damage to the sewage biological treatment systems if waste is allowed to enter the sewerage system.

It is difficult to quantify the amount of chemical waste which will arise from the construction activities as it will be highly dependent on the contractor's on-site maintenance practices and the numbers of plant and vehicles utilised. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, will be small and in the order of a few hundred litres per month.

General Refuse

The presence of a construction site with large numbers of workers, site offices and canteens will result in the generation of general refuse requiring disposal. General refuse will mainly consist of food wastes, aluminium cans and waste paper.

The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently, windblown litter.

water quality impacts if waste enters water bodies, and visual impact. The sites may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes at sites other than the approved landfills can also lead to adverse impacts at those sites.

Construction of the MOS Extension is expected to require a maximum of approximately 1,600 full time workers. Based on a waste generation rate of 0.65 kg per worker per day, the amount of general refuse requiring disposal would be approximately 1,040 kg d⁻¹ or 1 tonne per day. Using an assumed density of 100 to 200 kg m⁻³, the expected daily volume of general refuse will be about 5 to 10 m³ d⁻¹.

6.3.3 Evaluation of Impacts

With reference to the criteria and guideline for evaluating potential waste management implications presented in *Annexes 7 and 15* of the *EIAO-TM*, the assessment of potential environmental impacts associated with management of waste from the construction of the MOS Extension is based on the following factors:

- the types of waste generated;
- the quantities of the principal waste types generated; and
- the proposed recycling, storage, transport, treatment and disposal methods, and the impacts of these methods.

Excavated Material

Excavated material will be reused, wherever possible, on site for construction of abutments and other miscellaneous works such as landscaping while the excess material should be taken to other reclamation sites or public filling areas. Given the inert nature of this material, reuse of the material on-site or in other reclamation works is unlikely to cause any adverse environmental impacts. As the amount of excavated material requiring off-site disposal will be small (about 500,000 m³ or 560 m³ per day), it is not expected that it will have significant impacts on the demand of public filling areas.

It is not anticipated that there will be any potential hazard associated with handling and disposal of excavated material if general construction safety procedures are properly implemented.

The excavated material will be generated from various work sites along the alignment and the daily quantity of material generated at each work site will be small. The traffic associated with off-site disposal of excavated material will therefore be minimal and it is not anticipated to cause any adverse traffic impacts.

Construction and Demolition Waste

If not properly managed, the storage, handling, transport and disposal of C&D material have the potential to create visual, water, dust, noise and traffic impacts.

With respect to the nature of the construction and demolition activities, the C&D material will consist of a mixture of inert (ie concrete, tiles, bricks, etc) and putrescible (paper, plastic, wood, etc) materials. It is recommended that C&D material should be sorted on-site, in particular at the main Work Areas. Inert and non-inert materials should be segregated and stored in different transit skips. The inert C&D material (or public fill) should be used, as far as practicable, for the abutment construction and landscaping works. If on-site use is not practicable, the inert C&D material should be delivered to other reclamation sites or public filling areas. The disposal of inert C&D material at public filling areas or other reclamation sites is unlikely to raise any long term concerns because of its inert nature.

Disposal of non-inert C&D material (ie C&D waste) to licensed landfill will not cause unacceptable environmental impacts. However, given the very limited landfill space which is available, it is important to minimise, wherever possible, the wastes being delivered to landfill. Government policy is not to accept C&D waste with more than 20% (by weight) inert material at landfill sites. Wherever, practical, the production of C&D waste should be minimised by the careful control of ordering procedures and the segregation of materials. It will also assist in minimising costs should landfill charges be introduced.

With respect to the small quantity of C&D material to be produced from the construction and demolition works, it is not anticipated that the off-site disposal of the C&D material will cause any adverse noise and traffic impacts. With the implementation of good construction site practices such as those stated in the Air Pollution Control (Construction Dust) Regulation, the handling and disposal of C&D material will not cause adverse dust impacts.

Similar to the management of excavated material, it is not anticipated that there will be any potential hazard associated with handling and disposal of C&D material if general construction safety procedures are properly implemented.

Chemical Waste

The chemical waste to be generated from the construction activities will be readily accepted at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.

Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Provided that this occurs, the potential environmental impacts arising from the handling, storage and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

General Refuse

The amount of general refuse to be generated at each work sites is small (in the order of 100 to 200 kg d-1, and a total of 1 tonnes per day for all work sites). Provided that the mitigation measures recommended in Section 6.5 are adopted, the potential environmental

impacts caused by storage, handling and disposal of general refuse are expected to be minimal.

6.4 Operational Impacts

6.4.1 Identification of Waste Generation Activities

The operation of the MOS Extension will involve the following waste generating activities:

- operations of the railway;
- maintenance works;
- commercial retailers within the new stations; and
- office activities.

6.4.2 Potential Sources of Impact

The above activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their composition, as follows:

- industrial waste;
- chemical waste; and
- general refuse.

The nature and quantity of each of these waste types are discussed below.

Industrial Waste

Industrial waste will be generated from the maintenance activities in the Tai Wai Depot and the maintenance and upkeep of the building services of the nine passenger stations.

The Depot will carry out all the maintenance activities for the MOS Extension and its facilities include two running maintenance berths, with one berth having a carriage lifting facility and a small heavy repair workshop. However, the Depot will mainly be used for stabling and running maintenance due to the small train fleet size. The generation of waste materials will therefore be significantly lower than that generated at existing East Rail depots.

Based on information of previous studies, it is anticipated that the depot will generate less than 75 tonnes of ferrous and non-ferrous scrap metal per month.

Industrial wastes have the potential to create similar environmental impacts to general refuse as described above.

Chemical Waste

Chemical wastes will be generated from the maintenance of the depot, buildings and railway track. These may include, but need not be limited to the following types of waste:

- waste lubricants, oils, paints;
- pesticides;
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities; and
- waste batteries.

As discussed for the construction phase, these chemical wastes may pose significant environmental, health and safety hazards if they are not properly managed.

It is estimated that approximately 1 to 2 hundred litres of waste oil will be removed from train gearboxes and disposed of each month. The quantities of other types of chemical waste cannot be determined at this stage. However, it is expected to be small and they can be readily disposed of at the CWTC.

General Refuse

General refuse will be generated by the public and commercial retailers and by the station offices and canteens within each of the stations. Based on similar operations, general refuse is likely to be composed of food waste, wood, plastic containers/bottles, office wastes, paper, aluminium cans, old tins/containers, cleaning materials and miscellaneous other wastes produced during daily activities. It is expected that the majority of the general refuse will be waste paper which can be recycled. It has been estimated from experience that each of the new stations may generate up to $5 \text{ m}^3 \text{ d}^{-1}$ of such waste although it is difficult to estimate at this stage the precise contribution from the commercial element until more details of their operations can be confirmed.

Approximately 170 staff comprising train operators, operator supervisors, cleaners and maintenance staff will be based at the depot. It is therefore expected that the depot will generate less than 5 m^3 of general refuse per day, primarily consisting of litter from trains, cotton waste from workshops, paper towels, rags, empty containers and packaging materials.

The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently, windblown litter, water quality impacts if waste enters water bodies, and visual impact. The sites may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes at sites other than approved landfills can also lead to adverse impacts at those sites.

6.4.3 Evaluation of Impacts

Industrial Waste

Metals and discarded electronic equipment have high scrap value and may be sold for recycling. Provided that the scrap materials are collected regularly, it is not expected that the storage, handling, transport and disposal of these materials will cause adverse environmental impacts. Other general industrial waste such as plastic, cloth and paper can be collected together with general refuse and disposed of at a licensed waste transfer station or landfill.

Chemical Waste

Chemical waste should be stored, handled, transported and disposed of in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on Packaging, Labelling and Storage of Chemical Wastes*. They should be collected and transported to the CWTC or other licensed facility by a licensed waste haulier. Provided that appropriate handling, storage and disposal procedures are followed, no unacceptable impacts associated with the management of chemical waste during the operational phase of the MOS Extension are anticipated.

General Refuse

General refuse should be collected at each station on a daily basis and delivered to local refuse collection points. It is recommended that recycling bins/containers should be placed at convenient locations of each stations in order to encourage the recycling of waste paper and aluminium cans, and reduce the quantity of waste to be disposed of at landfills. Provided that the mitigation measures recommended in Section 6.5 are adopted, the environmental impacts caused by storage, handling, transport and disposal of general refuse are expected to be minimal.

6.5 Mitigation Measures

6.5.1 Introduction

This section sets out recycling, storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with the handling and disposal of waste arising from the construction and operation of the MOS Extension. Upon appointment of the contractor for each of the MOS Extension contracts, the contractor should prepare a comprehensive on-site waste management plan for the construction works which should take into account the recommended mitigation measures in the EIA report. Such a management plan should incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials.

For the operational phase, KCRC should develop a waste management plan for the operation of the MOS Extension which should incorporate the recommended mitigation measures of the EIA report.

6.5.2 Waste Management Hierarchy

The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be preferable have the least impacts and are more sustainable in the long term, hence, the hierarchy is as follows:

- avoidance and minimisation;
- reuse of materials;
- recovery and recycling; and
- treatment and disposal, as the last option to be considered.

The contractors should consult the Waste Disposal Authority, which is the Environmental Protection Department, for the final disposal of wastes.

The above hierarchy should be used to evaluate and select waste management options. The aim should be to minimise the amount of waste to be generated and hence reduce the waste handling and disposal costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing materials and in disposing of wastes.

Excavated Material

Excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas or reclamation sites and avoiding the need for disposal at landfill. The priority for off-site disposal of surplus excavated material should be as follows:

- transport to other reclamation sites at Shatin and MOS areas; and
- transport to public filling areas.

The locations of construction sites in the Shatin and MOS areas that are likely to require fill material between 2000-2003 are shown in *Figure 6.5a*.

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Careful planning and good site management can minimise over ordering and waste of materials such as ready mixed concrete and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. More durable alternatives such as steel formwork or plastic facing should be considered in order to increase the potential for reuse.

The requirements for the handling and disposal of bentonite slurries should follow the Practice Note For Professional Persons, Construction Site Drainage Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94).

The contractors should recycle as much as possible of the C&D material on-site. Proper segregation of wastes and materials into different transit skips/containers on-site will increase the feasibility of recycling certain components of the waste stream by recycling contractors. Concrete and masonry, for example, can be crushed and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas of the worksites can be designated for segregation and storage of the various materials.

Wherever possible, the inert C&D material should be reused or recycled with the remaining inert materials before being delivered to other reclamation sites or public filling areas. Waste containing putrescible materials should be disposed of at landfills. At present, Government is developing a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to encourage proper segregation to allow free disposal of inert C&D material to public filling areas.

In order to minimise the potential dust and water quality impacts of demolition works, C&D material should be cleared as quickly as possible after demolition. The demolition and clearance works should therefore be undertaken simultaneously.

Chemical Waste

For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes. Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 l unless the specifications have been approved by EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in *Schedule 2 of the Regulations*.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;



FIGURE 6.5a

LOCATIONS OF CONSTRUCTION SITES IN MOS AND SHATIN AREAS WHICH REQUIRE FILL MATERIAL BETWEEN 2000 AND 2003

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Management



- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed of as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.

6.5.3 General Refuse

General refuse generated on-site should be stored in enclosed bins or compaction units separate from C&D material and chemical wastes. A reputable waste collector should be employed by the contractors to remove general refuse from the site, separately from C&D material and chemical wastes, on a daily basis to minimise odour, pest and litter impacts. The burning of refuse on-site is prohibited by law.

General refuse is generated largely by food service activities on site, so reusable rather than disposable dish ware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins for their deposit should be provided if feasible.

Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

6.5.4 Summary

This section describes waste management requirements and provides practical recommendations which should be implemented to minimise the potential environmental impacts due to storage, handling, transport and disposal of wastes.

Waste reduction is best achieved at the planning and design stages, as well as by ensuring that processes are developed and operated efficiently. Good management and control can

prevent the generation of significant amounts of waste. For unavoidable wastes, reuse and optimal disposal are recommended as follows:

- use of excavated material (inert) suitable for reclamation or fill;
- disposal of inert C&D material (public fill) for on-site reclamation or reuse at public filling areas;
- disposal of C&D waste at landfills;
- consignment of chemical waste to the CWTC or other approved facilities for treatment and disposal; and
- disposal of general refuse at landfills.

The criteria for sorting solid waste is described in *New Disposal Arrangements for Construction Waste*. Waste containing in excess of 20% by volume of inert material should be segregated from waste with a larger proportion of putrescible material.

Proper storage and site practices will minimise the damage or contamination of construction materials. On-site measures may be implemented which promote the proper disposal of wastes once it is moved off site. For example having separate skips for inert (rubble, sand, stone, etc) and non-inert (wood, organics, etc) wastes would help to ensure that the former are taken to public filling areas, while the latter are properly disposed of at controlled landfills. Since waste brought to public filling areas will not attract a charge, while that taken to landfill may attract some future charge, separating waste may also help to reduce waste disposal costs, should landfill charging be introduced.

Specifically, it is recommended that:

- wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;
- only reputable waste collectors authorised to collect the specific category of waste concerned should be employed;
- procedures, such as a ticketing system, are developed to facilitate the tracking of loads and to ensure that illegal disposal of wastes does not occur;
- removal of C&D material should be arranged to coincide with the demolition work;
- appropriate measures should be employed to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;
- the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance* (Cap 354), *Waste Disposal (Chemical Waste) (General) Regulation* (Cap 354), the *Crown Land Ordinance* (Cap 28) and *Dumping at Sea Ordinance* (1995);

- collection of general refuse should be carried out on a daily basis;
- waste should only be disposed of at licensed sites and site staff and the contractors should develop procedures to ensure that illegal disposal of wastes does not occur;
- waste storage areas should be well maintained and cleaned regularly;
- records should be maintained of the quantities of wastes generated, recycled and disposed (determined by weighing each load or by another method); and
- during demolition, the contractor should adopt selective demolition measures so that reusable material, like wood and metal, can be disposed of at landfills, and inert demolition materials can be reused on site or delivered to public filling areas, public filling points or land formation sites.

Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan.

6.6 EM&A Requirements

It is recommended that auditing of waste management practice should be carried out on a monthly basis by the Independent Environmental Checker to determine if wastes are being managed in accordance with approved procedures and the site waste management plan and to see if waste reduction could be enhanced. The audits should look at all aspects of waste management including waste generation, storage, recycling, transport and disposal.

6.7 Conclusions

It is expected that quantities of excavated materials in the order of 500,000 m³ will arise from the development of the MOS Extension, stations and depot. It is important that the mitigation measures relating to good practice which have been recommended are followed to ensure that adverse impacts are prevented and that the opportunities for waste minimisation and recycling are taken.

The level of general refuse produced by the operation of the MOS Extension is not expected to be unduly high, but all feasible measures should be taken to avoid, minimise and recycle wastes. Industrial and chemical wastes arising from maintenance activities will be low and limited to plant and equipment maintenance.

Mitigation measures relating to good practice have been recommended to ensure that adverse environmental impacts are prevented and that opportunities for waste minimisation and recycling are followed.

If the recommendations of this report are implemented, the potential environmental impacts associated with the storage, handling, collection, transport, and disposal of wastes

arising from the construction and operation of the MOS Extension will meet the criteria specified in the *EIAO-TM* and no unacceptable environmental impacts is anticipated.