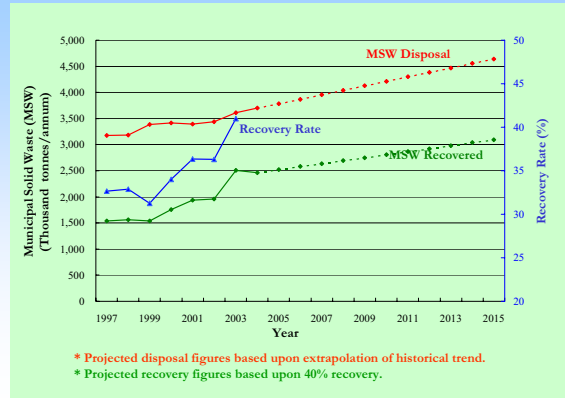


Environmental Considerations in Choosing Solid Waste Management Options

C. S. POON

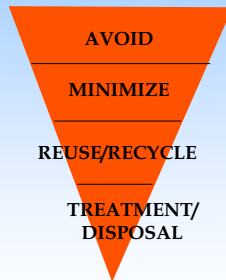
Waste Generation Statistics



Source : EPD

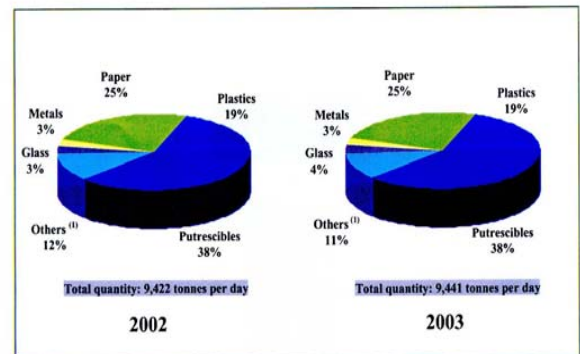
WASTE MANAGEMENT HIERARCHY

1. Avoid waste generation
2. Minimize waste generation
3. Reuse/Recycle the material
4. Waste treatment
5. Landfill disposal



Types of Waste Requiring Disposal after Source Recovery

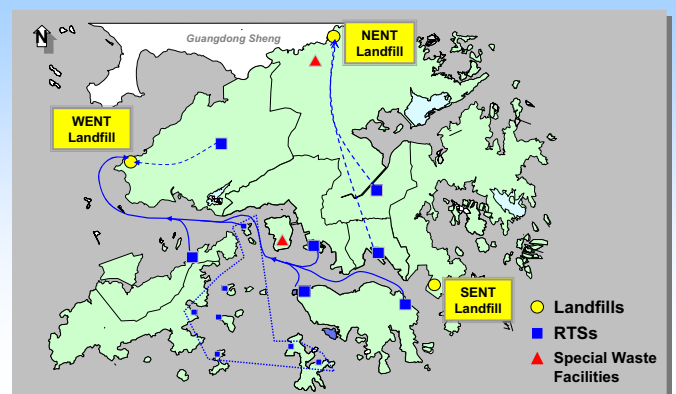
Plate 2.10 Municipal solid waste by waste type in 2002 & 2003



CURRENT SITUATION IN HK

- Total reliance on landfills for non-recycled waste

HK has an efficient waste transfer and disposal system



3 Strategic Landfills



Nim Wan
稔灣

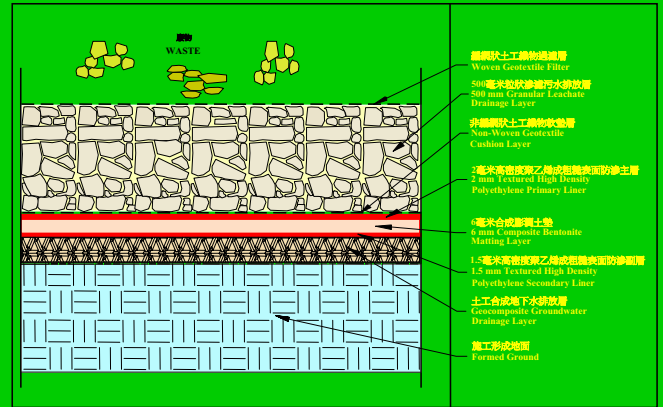


Ta Kwu Ling
打鼓嶺



Tseung Kwan O
將軍澳

防滲瀘墊層詳細圖



防滲透墊層的鋪設



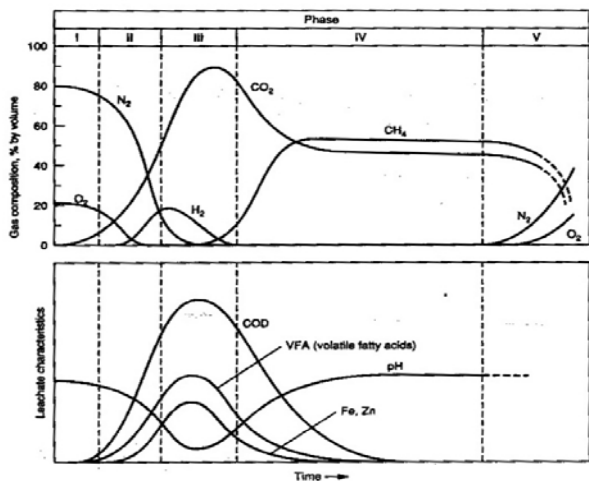
Problem with Landfills

- Require much land (HK landfill capacity will be exhausted in 6-10 years time)
- Long-term liability (leachate and landfill gas)
- VOC and green-house gases



The Hong Kong
POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF CIVIL & STRUCTURAL ENGINEERING



Leachate Treatment system at NENT



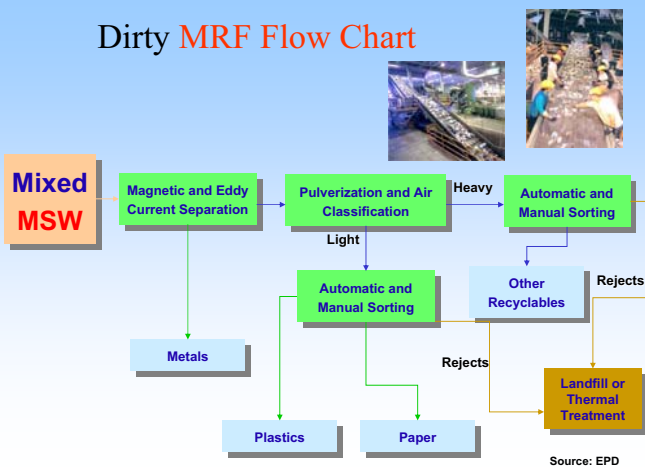
Gas extraction and flare systems at a closed landfill



Summary

- Landfill gas and leachate are long term liability issues related with landfilling.
- The problem may last for a least a few decades.

Dirty MRF Flow Chart



Environmental Considerations of MRF

- Odour and hygiene problems
- Other environmental impacts e.g. wastewater
- Marketability of products (depends on level of contamination)
 - » Recyclables
 - » Compost
- Management of residuals
 - Landfills
 - Thermal treatment

Composting

Organic Waste + O₂ + Bacteria



Compost + CO₂ + H₂O + heat

Sha Ling Livestock Waste Composting Plant



Composting of MSW



Old Chai Wan Composting Plant

- Commissioned in 1979 : designed to treat principally organic refuse
- Max. Throughput : 360 tonnes of waste/ day

Problem :

- Compost quality is poor, consisting considerable amount of granular particles of glass, plastics, etc. and
- Poor demand : heavy metal content rendered the compost product unsuitable for use
- Plant ceased operation in 1987

Composting

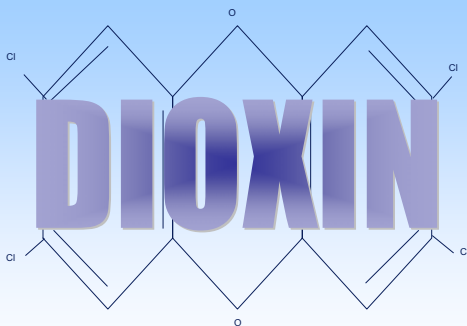
1. Types of source materials significantly influence the quality of compost produced
2. Outlets of compost need to be secured before implementation
3. In Hong Kong, suitable for source separated food waste, especially from commercial sources

Applications of Thermal Treatment for MSW

Japan (2003)	Taiwan (2001)	Singapore (2001)
78%	48%	90%

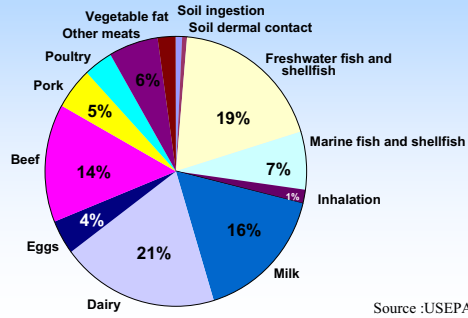
Sources and Pathways of Human Exposures

- Sources:
 - ➔ Combustion
 - ➔ Metal Smelting, Refining, Processing
 - ➔ Chemical Manufacturing
 - ➔ Biological and Photochemical Processes
 - ➔ Reservoir Sources
- Pathways:
 - ➔ Inhalation of Vapors and Particulates
 - ➔ Dermal Contact with Soil
 - ➔ Ingestion of Soil, Meats, Dairy Products, Fish



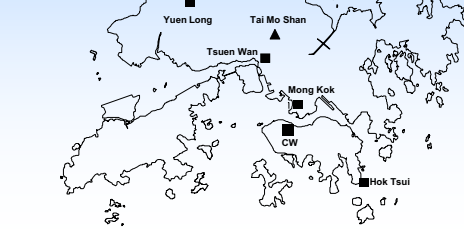
US Adult Average Daily Intake of CDDs/CDFs/dioxin-like PCBs

2000 Draft Estimate: ~ 65 pg TEQ_{DFF-WHO}/day



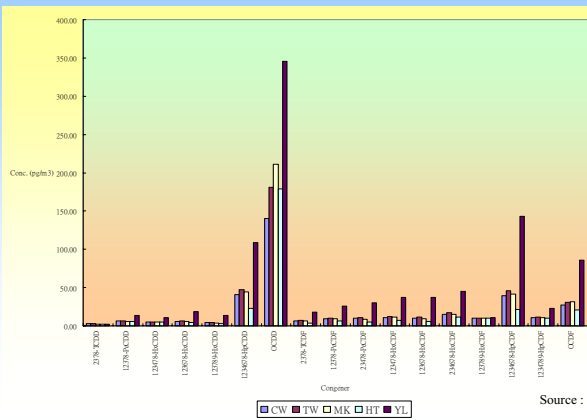
Source : USEPA

Toxic Air Monitoring Network in HK



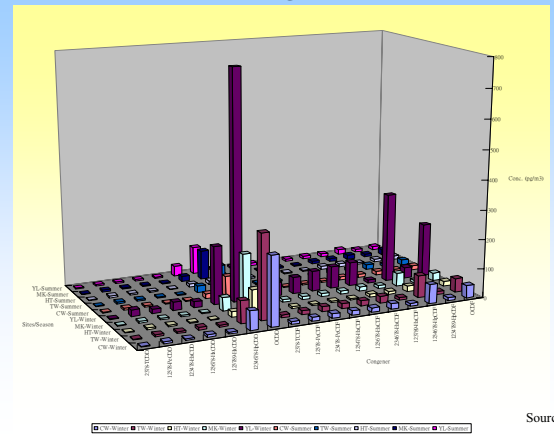
Source : EPD

Congener profile at different locations



Source : EPD

Seasonal Congener Profiles

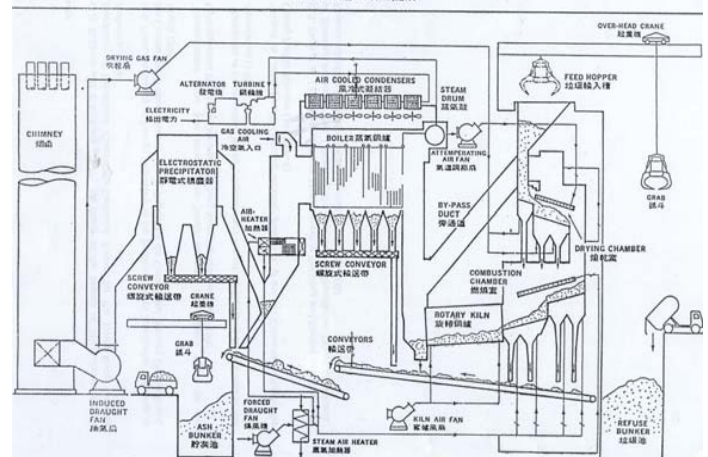


Source : EPD

Closed Kwai Chung Incinerator



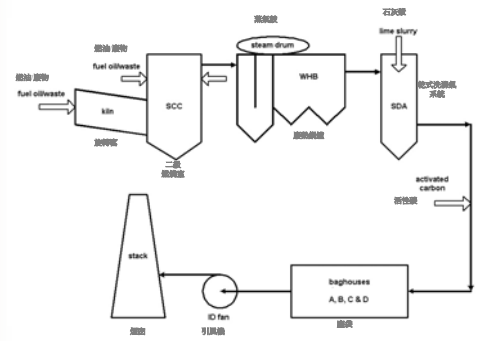
DIAGRAMMATIC LAYOUT OF KWAI CHUNG INCINERATION PLANT



CWTC – Tsing Yi



焚化系統流程圖

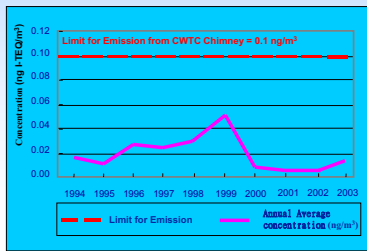


Measures taken to address dioxin issue

- the CWTC developed in the late 1980's adopted Dioxin emission standard of 0.1 ng/cum



Source : EPD



Independent Assessment on Dioxin Emission During the Last Incineration of Dioxin Containing Thermal Desorption Residues from To Kau Wan

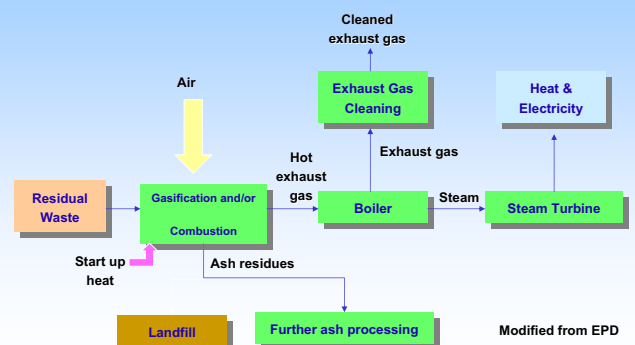
Source: CEDD

Table 4. Comparison of the concentrations of dioxins in the stack emission samples.

	Concentration of Dioxins (ng TEQ/m ³)
Trial incineration exercise (26 Nov 04)	0.005
First incineration exercise (5-9 Jan 05)	
6 Jan 2005 sampling	0.0002
8 Jan 2005 sampling	0.0006
Mean ± SD	0.0004 ± 0.00028
Second incineration exercise (24-28 Feb 05)	
25 Feb 2005 sampling	0.0006
27 Feb 2005 sampling	0.0007
Mean ± SD	0.00065 ± 0.00007
Last incineration exercise (26-30 Mar 05)	
27 Mar 2005 sampling	0.00006
29 Mar 2005 sampling	0.00002
Mean ± SD	0.00004 ± 0.00003
Emission limit (CWTC Criteria)	0.1
Alert level (Independent Assessment)	0.08

Source: CEDD

Typical Thermal Treatment Flow Chart



Modified from EPD

Advantages of Thermal Treatment over landfills

- Reduce 85-95% of MSW by volume
- Require much less land
- Recover energy for power generation
- Reduce long-term liability (leachate and landfill gas)
- Reduce VOC and green-house gases

Problems of Traditional Thermal Treatment Technologies

- Flue gas emission
- Ash residues are toxic (heavy metals and dioxin)
- Residues still account for 10-15% of waste input volume

Advances in Thermal Waste Treatment Technologies

- Effective flue gas cleaning
- High temperature to decompose dioxin
- Effective ash reduction and treatment

Flue Gas Cleaning System

- Combustion controls
- *bag house* to clean the flue gas of soot, smoke and metals
- *wet scrubber* sprays lime to neutralize acid gases
- *Selective non-catalytic reduction (SNCR)* or *selective catalytic reactor (SCR)* to convert nitrogen oxides to nitrogen
- *Activated carbon injection* to absorb pollutants

Ash Melting

Use of high temperature (1200-1400 C) to

- (i) destroy dioxin
- (ii) turn ash into glassy slag*
- (iii) entrap heavy metals in glass matrix.

* The slag can be used as a construction material





Gasification and Ash Melting Plant

リフレッシュ 露天風呂やジャグジーで
心も体もリフレッシュ

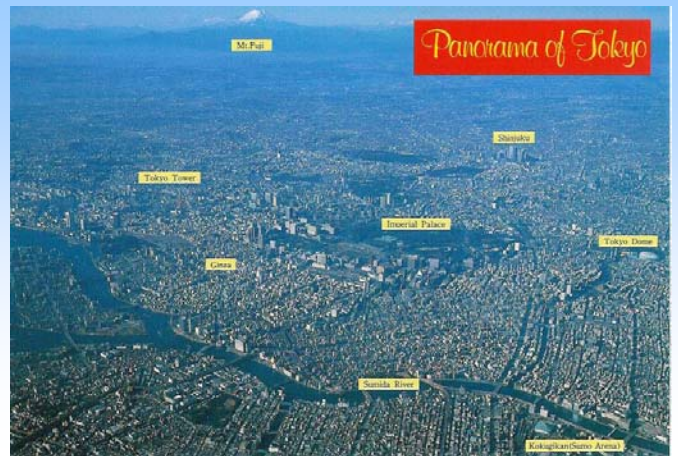
女子浴室 男子浴室 露天風呂 ミストサウナ
キョコシャワー 運動広場 ジャグジー
幼児プール 湯 温泉 温泉
プールエリア全図

※プールエリア内は、水泳帽・水着着用です。

Recycle

サンアル朝日のお湯は、隣接する朝日環境センターでごみを燃焼する余熱を利用したものです。また、サンアル朝日があるリサイクルプラザには、資源物を再利用するために処理する資源化施設と、環境ライブラリーなどの環境啓発施設があります。

Where and how have Tokyo built their facilities?

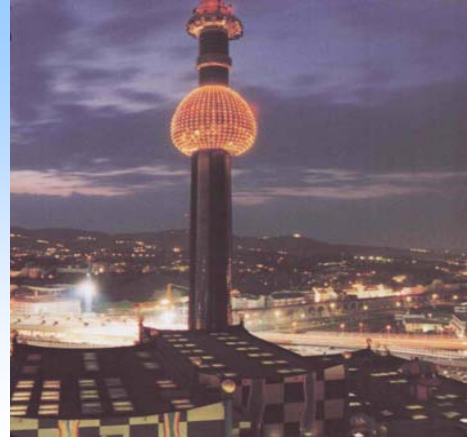


Over twenty thermal waste treatment facilities built in Inner Tokyo



Major Considerations

- Design : Harmonize with the surrounding environment
- Technology : Use of best and safe technology
- Public relationship: Benefit to residents



Reality of Hong Kong

Hong Kong cannot afford to build new landfills to manage our non-recoverable solid waste

Major Issues

1. What is the maximum waste recycling rate ?
2. What is the minimum waste quantity requiring disposal ?
3. Zero waste or zero landfill ?
4. Use of bulk waste reduction (thermal) technology ?
5. Which type(s) of technology(ies)



Thank you

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