Co-combustion Pilot Plant

Presentation to
Legislative Council Panel on Environmental Affairs
May 23, 2005

Outline

- The Co-combustion Project
- Dioxins
- Other Emissions
- Environmental Impacts
- Monitoring and Control Measures

The Co-combustion Pilot Project

Hong Kong's Waste – 2004

- Total waste 65,000 tpd
- Sources:
  - C&D material 54,000 tpd
  - MSW 9,500 tpd
  - Special Waste 1,500 tpd
- Disposal:
  - Public Fill 47,000 tpd
  - Land Fill 18,000 tpd

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MSW Management Options

- Six technologies under Government review:
  - Anaerobic Digestion
  - Composting
  - Mechanical and Biological Treatment
  - Gasification
  - Incineration
  - Co-combustion

Waste Management Strategy

- Waste avoidance and minimisation
- Recovery,recycling and reuse
- Bulk reduction and disposal of unrecyclable waste

(Ref: ETWB Legco panel briefing paper February 28, 2005)

Note: The Co-combustion Pilot Plant aims at dealing with the last two of these three legs!

The Co-combustion Project

- Integrated thermal treatment of waste with a Materials Recovery and Recycling Facility (“MRRF”)
- Co-combustion is a proprietary patented technology integrating thermal treatment of municipal solid waste with cement manufacture

Aims of the Pilot Project

- Integrate the waste-to-energy facility with material recovering and recycling
- Achieve a high waste reduction volume
- Reduce dioxin and other air pollutant emissions well below current regulatory levels
- Convert waste to energy to reduce demand for fossil fuel
- Use residue in cement production

The Co-combustion Pilot Plant

Materials Recovery & Recycling Facility

Co-combustion Facility

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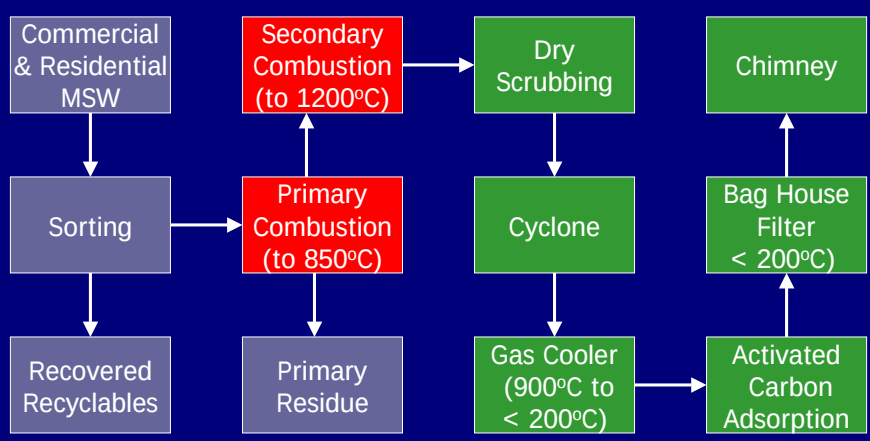
The Co-combustion Process



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Waste Reception

Materials Recovery & Recycling

- Sorting
  - Metal
  - Plastics
  - Batteries
- Disposal of recyclables to dealers
- Three protocols to verify the feasibility of different levels of recycling

Products of the Process

- Recyclables
- Energy
- Residue (5% by volume of the MSW)
- Minimal air emissions

Strengths of the Process

- Dry scrubbing at high temperature gives highly effective removal of dioxin precursors
- Avoids *de-novo synthesis* by upstream removal of chlorides and control of the critical temperature range
- Residue used in the cement process

The Cement Plant

- Located at Tap Shek Kok since1982
- Manufacturing capacity of 2,000,000 tonnes/annum
- Cement sales to Hong Kong only
- Benefits of Co-combustion to the cement plant:
  - Energy
  - Residue used as a raw material for cement

Benefits To Community

- Emissions well below world's best practice
- Substantial reduction in landfill needs thus extending the life of the existing landfills
- Sustainable use of land
- An effective MSW recovery and recycling facility
- A competitive cost for the disposal of MSW

Project Programme

- Load commissioning completed in late April 2005
- Operation Production to start in late May/early June 2005 (subject to EPD approval).
- The cumulative operating period is 16 weeks
- Production will cease in late September 2005
- Final reports on emission available at year-end

Dioxins

Formation of Dioxins

- Dioxins can form when the following are present:
  - Heat
  - Hydrogen
  - Carbon monoxide
  - Chlorine
- Dioxins have existed in nature since man discovered fire

Sources of Dioxins - Natural

- Forest fires
- Biological
- Biochemical

- Volcanic activity
- Biosynthesis of halogenated organics

Sources of Dioxins – Man-made

- Combustion
  - Manufacturing
  - Tobacco smoking
  - Burning ad hoc waste

- Chemical
- Secondary

Man-made Sources

- Chemical source. Precursors are:
  - Chlorine
  - Process temperature above 150^{o} C
  - Presence of alkaline conditions

Note: Usually occurs in the liquid phase

Man-made Sources of Dioxins

- Combustion. Precursors are:
  - Chlorine
  - Process temperature between 250°C and 400°C
  - Pollution abatement equipment maintained between 250°C and 400°C

Note: Usually occurs in the gaseous phase

Man-made Sources of Dioxins

- Secondary
  - Emissions from contaminated sites
  - Atmospheric redistribution of emissions

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Dioxin Inventory – Hong Kong

	1997 (g I-TEQ)	2007 (g I-TEQ)
Power Generation	0.4 - 2.0	0.3 - 1.8
Landfill gas combustion	0.2 - 0.3	0.13 - 0.15
MSW Combustion	21 - 27	0.5
Other industrial sources	0.82 - 3.12	0.64 -1.54
Non-industrial sources	0.11 - 0.66	0.14 - 0.34
Total	23 - 33	2 - 4

- *Assumptions on calculation apply.*
- *Ref. "An Assessment of Dioxin Emission in Hong Kong" ,March 2000, EPD.*

Eliminating Dioxins

- At source
  - Eliminate the precursors

  Note: Difficult without a major shift in consumer attitudes
- In the manufacturing process
  - Breakdown the dioxins
  - Prevent reformation

  Note: Demonstrate through the Co-combustion project

Other Air Pollutant Emissions

Other Air Pollutant Emissions

- Organic Compounds
- Nitrogen Oxides
- Sulphur Dioxide
- Hydrogen Chloride
- Heavy Metals
- Particulates

Eliminating Pollutant Emissions

- Dry scrubbing with calcined lime
- Removal of coarse particles
- Reduction of Nitrogen Dioxide
- Adsorption on activated carbon
- Physical removal of particulates (in a bag house)

Incineration

- Co-combustion and incineration are both thermal treatment methods but the processes and emissions are different
- **The co-combustion process targets a step-change in lowering harmful emissions**

Project's Environmental Impacts

Project Impacts

- Space
  - Minimal impacts - site is already in use
- Landscape
  - Minimal impacts - site is already in use
- Habitat
  - Minimal impacts - site is already in use
- Physical
  - See following abatement measures

Abatement Measures

- Air emissions
  - Installed equipment controls all emission well below regulatory limits
  - Interlocked controls cause automatic shut-down if pre-set limits are exceeded
- Traffic
  - No additional traffic

Abatement Measures

- Water
  - Water is used for cooling and is not contaminated by the process
  - Water is recycled and no water is discharged to the sea
- Noise
  - Noise from the plant is not audible across the boundary
  - Occupational health limits are not exceeded

Abatement Measures

- Waste
  - Uncontaminated residue is used for cement production
  - Contaminated residue(<1% by volume of incoming waste) is stabilised in concrete, tested for leachates and disposed of at landfills
- Odour
  - Odour control measures (scented sprays) in place
  - Reception hall air changed four times per hour

Abatement Measures

- External Health
  - Air emissions well below regulated limits
  - Vehicles entering reception hall are washed with disinfectant
- Occupational Health
  - Medical screening
  - Disposable cover-alls, face masks, face screens, gloves
  - Decontamination facilities

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Monitoring and Control Measures

Monitoring

- On-site
  - Continuous Emission Monitoring (Information is available live to EPD)
  - Periodic (by an independent monitor)
- Off-site
  - Periodic (by an independent monitor)
- Independent Monitor
  - The Hong Kong Productivity Council using Hong Kong Baptist University

Controls

- Controls allow automatic shut-down if preset limits exceeded
- Regulations impose penalties on company (fines) and its directors (fines and/or custodial sentences)
- EPD is monitoring emission and operational data live
- Emission data is published on GII website

Thank You