Advisory Group on Waste Management Facilities
Visit to Japan and Korea on
Municipal Solid Waste Management and
Treatment Technologies

Abstract

In 2002, the Government launched an Expression of Interest Exercise to invite companies and organizations for the submission of proposals on municipal solid waste treatment technologies for Hong Kong. An Advisory Group and five Sub-groups were formed to oversee the evaluation of the submissions. This Report covers the author’s visit to Japan and Korea in November 2004 together with a delegation comprising 11 members of the Advisory Group and Sub-groups. The objective of the visit was to acquire more information and understanding of overseas experience and technologies on municipal solid waste management and treatment. During the trip, two waste incineration plants, two gasification plants, one ash recycling plant and two waste biological treatment plants were visited. Discussion meetings with the Japanese Environmental Consultants Ltd and the Japanese Ministry of Environment were also held. Useful knowledge and understanding on various municipal solid waste treatment technologies and their related management issues in Japan and Korea were acquired.

Environmental Protection Department
November 2004
Visit to Japan and Korea on Municipal Solid Waste Management and Treatment Technologies (November 2004)

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1. INTRODUCTION

The Expression of Interest Exercise for the Development of Waste Management Facilities

1.1 Hong Kong is facing a significant waste problem because of the huge amount of waste requiring disposal and limited disposal capacity. In 2003, about 6.5 million tonnes of waste (of which 53% was municipal solid waste) were disposed of in three landfills at Tseung Kwan O, Nim Wan and Ta Kwu Ling. These three landfills were planned in the 1980’s at which time they were expected to serve Hong Kong well into the 2020’s. However owing to a faster increase in waste quantity from Hong Kong’s growing population and economic activities, the three landfills are being filled up much faster than expected. It is projected that the existing landfill would only last 7-11 years if waste continues to grow at the current trend.

1.2 To tackle the waste problem, the Hong Kong Government recognizes that waste avoidance, reduction, reuse and recycling are the priority measures. A number of initiatives in these areas have been implemented in the recent years. The overall waste recycling rate has increased from 33% in 1998 to 41% in 2003. Notwithstanding that continual effort is being made, the current estimate and also other countries experience indicate that there would still be a huge amount of unrecyclable municipal solid waste (MSW) left that require handling in the future years.

1.3 In view of the scarcity of land in Hong Kong, reliance on dumping the huge amount of unrecyclable MSW direct to landfill is considered not sustainable. Moreover, many developed countries such as those in the EU are phasing out disposal of biodegradable MSW from landfills to reduce the long term environmental liabilities and to reserve valuable landfill space for inert waste or waste that cannot be treated by other means. These all indicate the need to develop facilities to handle the huge amount of MSW in Hong Kong in a more efficient and sustainable manner.

1.4 There exist many different technologies that might be adopted for the development of waste treatment facilities. In order that Hong Kong could consider all such technologies as far as possible, particularly some new and innovative ones that have emerged in recent years, an Expression of Interest exercise (EOI) was launched in late April 2002. In this exercise, the technology suppliers and companies in Hong Kong and elsewhere in the world were invited to submit proposals on waste treatment technologies that are suitable for Hong Kong.
1.5 An Advisory Group (AG) comprising mainly of non-government members was formed to oversee the evaluation process of the EOI exercise and to recommend the choice of preferred technologies. Five Sub-groups (SG) focusing on the five key aspects of technology, environment, social, economics and consumer respectively were also formed to assist the Advisory Group. A total of 59 proposals were received in the EOI exercise by the closing date of the submission in late July 2002. Evaluation of the proposals was carried out in the ensuing months.

Visit to Overseas Waste Management Facilities

1.6 In the 4th AG meeting held on 7 Nov 2003, the suggestion of AG and SG members visiting overseas waste management facilities was raised, and the subject was further discussed in the 5th AG meeting held on 27 July 2004. The 5th AG meeting agreed that a trip to Japan and Korea would be organized in September/ October 2004 such that the AG/SG members could acquire more information and understanding of overseas experience and technologies.

1.7 Subsequently a schedule to visit waste management facilities in Japan and Korea in November 2004 was drawn up. The delegation for the visit comprised 11 AG and SG members and also the author as EPD’s representative. The list of Delegation is given in Appendix I and the itinerary of the visit is at Appendix II. The list of reference materials on waste management and treatment acquired during the visit is given in Appendix III, while the reference materials themselves are bound in a separate volume that is kept in the library of the Waste Facilities Division of EPD.
2. VISIT PROGRAMME IN JAPAN

Briefing by the Japan Environmental Consultants Ltd.

2.1. The Japan Environmental Consultants Ltd had helped to organize and guide the visit programme in Japan. Upon arrival in Tokyo, the delegation was received by Mr. Takada (President & CEO), Mr. Kawada (Senior Advisor), Mr. Murano (Chairman) and Mr. Kishioka (Manager, Consulting Division) of the Japan Environmental Consultants Ltd. This was followed by a briefing on Japan's experience in MSW treatment and disposal by Mr. Kishioka.

2.2. Mr. Kishioka said that Japan regarded dumping of untreated solid waste a potential environmental hazard to the future generation because the resulting source of pollution would exist for several decades. Moreover the dumped waste would emit substantial amount of Green House Gas (e.g. 6 million tonnes of Carbon Dioxide equivalent per year for dumping of 9000 tonnes per day of MSW). Therefore Japan has been promoting treatment of solid waste prior to landfill dumping. At present Japan mainly relies on thermal treatment for MSW that was not recycled. In 2001, there were a total of 1680 thermal treatment facilities in Japan, catering for more than 77% of MSW. The main technologies included the conventional stoker type furnace, fluidized bed furnace and gasification. Mr. Kishioka remarked that the gasification technology was first developed in Europe and introduced to Japan later. Japan is successful in achieving stable and continuous commercial operation.

2.3. Mr. Kishioka also introduced the situation in Tokyo. Tokyo has an area of 610 square kilometres and a population of 8.4 million. About 100,000 tonnes per day (tpd) MSW was generated and treated in 18 incineration facilities located in the city. There is only one landfill in Tokyo, hence Japan's policy is to reserve the landfill capacity as far as possible. To this end, Tokyo government is vigorously promoting further recycling and melting of incinerator ash. Mr. Kishioka pointed out that in addition to volume reduction, ash melting could stabilise the toxic and hazardous material in the ash so that the slag produced could be reused safely as construction material. There are two approaches to melt ash, either by an ash melter separate from the incinerator or in an integrated gasification and ash melting system. Of these two approaches, the gasification system is advantageous in terms of capital, operation/maintenance and energy usage.

2.4. Mr. Kishioka mentioned that gaining public acceptance of incineration facilities is very important. The approach used in Tokyo included adoption of the best and safe technologies; having pleasing aesthetic design that is harmonious to the vicinity area; and providing return
and benefits to the residents (e.g. community spa, swimming pool facilities).

**Visit to the Ariake Incineration Plant**

2.5. The Ariake Incineration Plant is located at the water front area in southern Tokyo. The delegation was received by Mr. Nagauasu who introduced the general situation of MSW treatment and disposal in Tokyo followed by information about the Ariake Plant.

2.6. The Tokyo Metropolis prefecture comprises the inner Tokyo area and 39 cities, towns and villages. The inner Tokyo area comprises 23 ku (i.e. special wards). Since 1985 the amount of waste generated in the 23 ku has increased each year. However after the collapse of the bubble economy in 1989, the amount decreased partly due to the introduction of a full-scale resource collection system. Now the 23 ku generate some 9000 tpd of MSW. In general MSW in Tokyo is classified and separately collected in 4 categories, namely large-size waste (e.g. furniture), combustible waste (e.g. paper, kitchen waste), incombustible waste (e.g. leather) and recyclables (e.g. aluminum can). The combustible waste is incinerated, while the incombustible waste is pulverized at incombustible waste processing centres or put into landfills.

2.7. Each of the 23 ku of the inner Tokyo area is responsible for their own MSW collection, but the intermediate processing (e.g. incineration) is handled by the "Clean Association of Tokyo 23" established by the 23 ku. Final landfill disposal (e.g. incinerator ash) is managed by the Tokyo Metropolitan Government.

2.8. The Ariake Plant has two lines of Mitsubishi-Martin stoker incineration unit, the total plant capacity is 400 tpd. Heat generated from the incinerator is recovered for district heating and cooling at various community facilities such as the Koto city Ariake sport centre. The heat is also used to generate electricity power (5600 KW). A special feature associated with the Plant is a vacuum pipeline system used to convey waste from nearby developments to the Ariake Plant, thereby reducing the amount of road traffic for refuse transportation. The vacuum pipeline system comprised refuse discharge and store units, pneumatic pipelines, substation with refuse separator and weighting machine and secondary transport pipelines.

2.9. The Ariake Plant building was designed to achieve harmony with the nearby landscape. The Plant's stack is in a sharp-edged triangular shape instead of the conventional circular shape, and it was intended to be the landmark of the Tokyo waterfront area. Manned by 76 staff, the Plant has been operating for about 10 years now. It was highlighted that the Plant's
emissions have been very good. Dioxin emission from the stack was monitored twice per year, and the levels measured were considerably lower than the Japanese national standard requirement which is 0.1 ng-TEQ/cum.

Fig. 1  The Ariake incineration plant building with a triangular shape stack

Fig. 2  Control room for waste grabbing from the bunker to the combustion hopper.
Visit to the Shin Koto Incineration Plant

2.10. The Shin Koto Incineration Plant was commissioned in 1998. With a capacity of 1800 tpd (3x600 tpd), it is the largest incineration plant in Tokyo. The Plant is based on the conventional stoker furnace technology. Heat from the incinerator is recovered to generate electricity via a 50 MW stream turbine. Part of the heat is supplied to the adjacent public facilities including the Tatsumi swimming pools, the Yumenoshima House of Tropical Plants Tokyo and the Yumenoshima Rest House. The Plant was equipped with the state-of-the art air pollution preventive equipments resulting in pollution emission levels far lower than the Japanese national standards.

2.11. The Plant has a total of 97 staff, 40 of whom are operation staff for the incinerator units. The capital cost of the Plant was about 88 billion yen (HK$6.4 billion) while the annual operation cost (including staff cost) is about 2.3 billion yen (HK$168 million). Revenue generated from selling electricity to the grid is about 1 billion yen (HK$73 million) each year.

2.12. The architectural design of the Plant had incorporated an image of a yacht for compatibility with the nearby marine environment. Inside the Plant building, there are spacious community educational provisions such as video and exhibition facilities. It was reported that there has been little public complaint nor major incidents.
Fig. 4  A view of the Shin Koto incineration plant building

Fig. 5  The Yumenoshima House of tropical plants and marina adjacent to the Shin Koto incinerator

Fig. 6  Central control room of the Shin Koto incineration plant
Meeting with the Ministry of Environment, Japan

2.13. In the afternoon of 15 Nov, Ms Koike, the Minister of Environment Japan together the Director General of Department of Waste Management and Recycling met with the delegation. In the meeting, Mr. Keith Kwok introduced the delegation and the purposes of the visit to Japan. Ms Koike welcomed the delegation for visiting waste technologies and facilities in Japan. She remarked that waste was a great problem in Japan because of the dense population and developments. Related to this, there was a peculiar situation this year due to the flooding that caused a large amount of waste being collected. Ms Koike also highlighted that one should shift the paradigm about waste, as it could be turned into useful resource.

2.14. After the meeting, the delegation was briefed about the waste policy in Japan by Mr. Ryutaro Yatsu, Director of the Planning Division on Waste Management and Recycling Department, Ministry of the Environment. Mr. Yatsu highlighted that Japan is moving towards a sound material-cycle society to minimize natural resources consumption and waste disposal. This would be achieved by following the hierarchy of reduction, reuse, material recycling, thermal recycling and lastly landfill disposal. A legislative framework comprising fundamental environmental law and a number of regulations for specific categories of items is being developed. A programme of “Fundamental Plan for Establishing a Sound Material-Cycle Society” was also established in March 2003. The programme established the following quantitative targets to be achieved by 2010:

(a) reduce 20% of garbage discharged from households per person per day compared with year 2000
(b) double the size or material-cycle related business and the number of jobs compared with year 1997
(c) improve resource productivity by 40% compared with year 2000 (resource productivity is defined as the ratio of GDP to Direct Material Input)
(d) improve cyclical use rate by 14% compared with year 2000
(e) reduce final disposal amount by 50% compared with year 2000

2.15. Mr. Yatsu also briefed the Delegation about the overall amount of waste recycling, thermal treatment and final disposal in Japan during the recent years. It was noted that in the year of 2001, there was in a total of 1680 waste thermal treatment plants, 15 of which was gasification plants and 13 ash melters whilst the rest were incineration plants.
Visit to the Asahi Clean Centre

2.16. The Asahi Clean Centre is located in the Kawaguchi City in the proximity of Tokyo. It occupies some 3.1 hectares and comprises a recycling plaza, a MSW gasification plant of 420 tpd capacity (3x140 tpd) and also a number of education and community facilities (e.g. bathrooms, swimming pool, exhibition hall, video library, lecture room). All these facilities and provisions are housed inside a nice building. Apart from MSW, the Centre also received 37 tpd of ash (from other stoker type MSW incinerators) for ash melting treatment. Whereas the
recycling plaza receives recyclables such as bottles, cardboard and cans for processing and packaging, the processed material are sent to other dedicated plants for resource recycling.

2.17. Gasification technology with ash melting is used in the Centre because of the need to minimize final landfill dumping and dioxin emission. The imposed dioxin emission standard is 0.05 ng-TEQ /cum, which is more stringent than the Japanese national standard of 0.1 ng-TEQ/ cum. The delegation was told that the actual dioxin level in the emission is far below the 0.05 ng-TEQ/ cum standard. Another feature of the gasification technology is that it requires a relatively smaller footprint due to the lower air intake ratio as compared with a conventional stoker incinerator.

2.18. The capital cost of the gasification plant was reported to be 3 billion yen (HK$220 million) and that of the recycling plaza was 6.6 billion yen (HK$480 million). The operating cost was 14,000 yen (HK$1022) per tonne of waste. The revenue from sale of electricity was about 140 million yen (HK$10 million) since operation commencement. The melted ash, in the form of slag was sold at 200 yen (HK$15) per tonne. There was also revenue arising from the sale of recovered metals.

2.19. It was observed that the Centre is located close to residential/ commercial houses. During the visit, no waste odour was noted outside the Centre but slight odour was detected inside. Apart from community facility provisions mentioned in paragraph 2.16 above, solar light and wind power generations and roof rain water utilization in the Centre were noted. While the delegation was at the Centre, a group of students was visiting the Centre. It seems that the Centre has been able to integrate well with the nearby community and provide lively environmental education to the students.
Fig. 9  A view of the Asahi Clean Centre

Fig. 10  Residential houses near the Asahi Clean Centre.
Fig. 11  Local students visiting the Asahi Clean Centre

Fig. 12  Exhibition hall inside the Asahi Clean Centre building.
Fig. 13 Environmental exhibits inside the Asahi Clean Centre building.

Fig. 14 Sorting of glass waste inside the recycling plaza of the Asahi Clean Centre
Visit to the JFE Gasification Plant

2.20. The JFE waste gasification plant is located near the Kawasaki Steel Plant in Chiba. The delegation’s visit to the plant was received by Mr. Nobuyuki Imagawa (Group Manager) and Mr. Matsuto Shimizu (Project Manager) of the JFE Ltd. At the time of visit, the gasification plant was under regular maintenance hence no waste treatment operation was observed.

2.21. The gasification plant is of 300 tpd (2x150 tpd) capacity and it commenced operation in 1999 for MSW initially. In March 2000, the plant started to receive industrial waste from the nearby areas. Currently quite a lot of the industrial wastes treated are plastics from packaging. The plant is based on the Thermoselect gasification technology developed in Germany and is the second commercial plant of such technology. Five other plants (2 for MSW and 3 for industrial waste) based on similar technology are under construction in Japan at the moment.

2.22. Some reported features of the plant are that there is nearly no dioxin emission, no fly ash nor flue gas. By products of the plant included purified synthesis gas, water, slag, salt, metal, metal hydroxide and sulphur. As all these products could be sold, dumping of residue to landfill is not necessary. Presently the synthesis gas is sold to the nearby Kawasaki Steel Plant where it is mixed with fuel gas for power generation.

2.23. For operation, it was understood that waste pre-treatment is not needed but oxygen
supply is required. The capital cost of the plant was about 10 billion yen (HK$730 million), and the operation cost was reported to be higher than conventional waste incinerators. JFE indicated that while similar Thermoselect gasification technology is licensed to the Daewoo Ltd in Korea, JFE gets the exclusive license right for the SE Asia market.

Fig. 16  The JFE waste gasification plant in Chiba  
Fig. 17  High temperature gasifier of the JFE plant

Visit to the Taiheiyo Eco-cement Plant

2.24. The delegation was received by Mr. Hiroshia Uno (Managing Director), Mr. Hirotaka Semba (Deputy Manager), Mr. Hiroshi Obana (Deputy General Manager) in the visit of the Taiheiyo Eco-cement Plant at the Chiba prefecture. The idea of turning incinerator ash to cement started in early 1990’s as it was found that the incinerated ash ingredients were similar to those in cement, apart from the relatively high chlorine and heavy metal contents in the incinerator ash. It was felt that by extracting heavy metal chlorides, incinerator ash could be turned to a cement product. Researches on this idea had been successfully carried out in the mid 1990’s.

2.25. Construction of the Eco-cement plant in Chiba started in 1999 while the operation
commenced in 2001. The plant is designed to turn incinerator ash and also sludge into cement. The production capacity is 110,000 tonnes of eco-cement each year. The plant processes include drying the ash/sludge in a rotary dryer, followed by screening and metal removal, grinding, mixing with natural material (e.g. limestone), and combustion at >1300 degrees Celsius in a rotary kiln to produce clinkers. Finally the clinkers are mixed with gypsum to produce eco-cement product. Touring of the facilities revealed that it is very much a chemical plant in outlook, unlike typical Japanese MSW incinerator which is usually housed inside a nice-looking building.

2.26. Combustion in the rotary kiln of the plant would produce flue gas. As the combustion temperature is very high and the Eco-cement plant is equipped with advanced air pollution control equipments, pollutant contents (e.g. dioxin) in the flue gas emission were reported to be far below the required standard levels.

2.27. Currently about half of the incinerator ash received is bottom ash while the remaining is fly ash. The properties of the eco-cement (e.g. compressive strength) were reported to be comparable to Ordinary Portland cement. The cost of treating one tonne of incinerator ash to produce about half tonne of eco-cement is about US$240-300, while the market price of Ordinary Portland cement is about 8000 yen (HK$580) per tonne. It was learned that another Eco-cement plant is now under construction in the Tama area in Tokyo.
Fig. 19  Rotary kiln of the Taiheiyo Eco-cement plant

Fig. 20  Flue gas cleansing facilities followed by the stack

Fig. 21  Eco-cement products of the Taiheiyo plant
3. VISIT PROGRAMME IN KOREA

Visit to the Food Waste Treatment Facility in the Ansung City

3.1. In the morning of 18 Nov 04, the delegation visited the food waste treatment facility of Kyung-Gi Special Equipment Co. Ltd in the Ansung City, Korea. The delegation first visited a workshop where collection vehicles for food waste were manufactured. It was noted that the vehicles were equipped with automatic lifting system for transferring of waste from bins into the concealed rotary tank of the vehicles.

3.2. After leaving the workshop, the delegation went to the food waste processing facility that is located in a rural area near the Ansung City. The delegation was received by Mr. Jun Hee Tag (Executive Director), Mr. J.W. Chun (Management Adviser) and Mr. Jin Wen Rong. It was introduced that food waste is normally collected separately in Korea. Since 2004, disposal of food waste to landfill had been banned. Hence there is a great demand for facilities to receive and treat food waste.

3.3. The capacity of the Ansung facility is about 50 tpd. In the facility, the collected food waste is shredded, separated and then mixed with bran or assorted feed. The mixture is then sterilized at 80 degree C, cooled and conveyed to silos for fermentation with enzyme and bacteria. The fermented product after sorting is used as feed for the pig farm adjoining the facility, whilst residues are sent to another site for composting.

3.4. There are about 14 similar facilities in Korea. It was understood that the Korean government provides subsidy of about HK$480 per tonne for food waste treatment.
Visit to the Paju City Waste Anaerobic Digestion Plant

3.5. The delegation was received by Mr. Kim Jeong Kyu (Deputy General Manager) and Mr. Heo Nam Hyo of the Halla Energy and Environment Ltd. The waste Anaerobic Digestion Plant is located in a rural area near the Paju City, Korea. The Plant was designed by the Halla Ltd to treat 60 tpd of manure and 20 tpd of food waste from part of the Paju population. It was
understood that there is another anaerobic digestion plant that receives 30 tpd of food waste from the same area.

3.6. Construction of the plant commenced in May 2001 and its operation started in Sep 2004. Inside the plant, the collected food waste first goes through a crushing and separation process to remove inert matters. It is then mixed with the collected manure and water to a total solid content of about 8-12%. The mixture then passes through a gravity separation process to separate out the inert material. This was followed by a 2 stage anaerobic digestion process that produces biogas and sludge residue. The sludge residue is dewatered and treated by an open windrowing process to produce compost for agriculture use. The biogas is used to generate electricity via a 485 KW generator. However all the electricity generated is used within the plant. The anaerobic digestion and sludge dewatering processes produce quite an amount of waste water, therefore the Paju plant also comprises a treatment plant to handle the waste water.

3.7. It was introduced that the anaerobic digestion process of the Paju plant takes about 25 days while that of the aerobic composting process takes another 21 days. The compost produced from the plant was given to the farmers for agricultural use. However there had been occasions that the demand was low such that some of the compost had to be dumped at landfill. Capital cost of the plant was reported to be about 10.4 billion won (HK$73 million), while the running cost was about 16000 won per tonne of waste (HK$110). The number of operating staff in the plant was 17.
4. OBSERVATIONS

4.1 The large number of waste incineration and gasification plants in Japan (1680 nos in 2001) and the high portion of waste handled by such technologies (>77%) indicate that thermal treatment is the most common technology adopted in Japan to process unrecycled MSW prior to landfill disposal. From the visits to the various incineration and gasification plants in or near Tokyo, it is observed that most of these plant buildings are designed with aesthetically pleasing appearances that are able to integrate with the surrounding environmental well. Community facilities such as swimming pool or exhibition hall are commonly provided within or near the plant buildings, and the energy generated from waste combustion is supplied to these community facilities. It seems that the incineration/gasification plant design and operation in Japan are able to integrate well with the nearby community.

4.2 There are 18 waste incinerators within the Tokyo city, some of which are built near residential/commercial or recreational areas. The Asashi Clean Centre in the Kawaguchi City, which comprises a waste gasification plant, is found to be located quite close to a residential area. To gain public’s acceptance of such facility, the Japanese experience suggests that adaptation of the state-of-art technologies, stringent emission standards, good plant building designs and integration of the facility with community services are useful means that should be considered.

4.3 It is noted that Japan has a policy of progressing towards a more material-cycle society so as to reduce natural resource consumption and waste disposal. One significant approach is the diversion of waste away from landfill as far as possible. It is observed that waste incineration plays an important role in achieving this objective by greatly reducing the bulk waste size for final disposal. Indeed Japan now seems to be reducing the final disposal even further by promoting incinerator ash melting and ash recycling. The gasification plant of the Asahi Clean Centre and also the Eco-cement plant are examples of such.

4.4 Perhaps because of the policy of ash reuse and recycling, it is observed that a number of new waste gasification plant are under planning or construction in Japan although the majority of thermal treatment plants for MSW remains to be the stoker type. The gasification process can combust the waste and melt the ash together whilst a conventional stoker furnace would need separate melter to process the ash for reuse. As such, if ash melting is necessary, the gasification system may be advantageous in terms of capital, operation/maintenance and energy usage.

4.5 The visit to Korea was relatively short and focused mainly on biological treatment
technologies. The two plants visited are located in rural areas with relatively small capacities (<100 tpd). Both plants were designed to treat a specific waste stream (e.g. food waste, manure) but not mixed MSW. It appears that the Korean policy which requires separate collection of food waste and bans disposal of it to landfill would have promoted the development of the plants

4.6 The food waste treatment facility in Ansung processes food waste to produce animal feed and also residue for composting. For the anaerobic digestion plant in Paju, it receives food waste and manure to produce compost. Whilst energy could be produced in this plant in the form of biogas, there was no net energy export as the other process such as waste water treatment uses up most of the biogas energy. These two plants indicate that food waste could be biologically treated to produce animal feed or compost both of which are for agricultural applications.

4.7 From the visits to the two plants in Korea, it is understood that government subsidy for treating food waste to animal feed or compost is provided. Moreover, there could be low demand for the compost product at times, leading to the need to dispose of the compost to landfill. The information suggests that cost-effectiveness and the availability of market outlet for the treatment product (e.g. animal feed or compost) are important considerations for the development of biological treatment facility for such waste in Hong Kong.
5. **CONCLUSION**

5.1 Overall the visit has been very useful. The delegation members are able to gain more information and understanding on waste management and treatment technologies in Japan and Korea, particularly incineration, gasification and biological treatment of food waste.

5.2 From the visit, it is observed that thermal treatment such as incineration or gasification are common technologies used in Japan for MSW treatment. These facilities could be designed and built to very high standards with good emission quality and pleasing visual appearance. The experience in Japan indicates that waste facility could integrate well with the nearby community via provision of social facilities and better communication (e.g. exhibition, visit arrangements).

5.3 The experience of the two plants visited in Korea suggests that biological treatment technologies are suitable for specific organic waste stream such as food waste or manure. Product (e.g. compost) outlet, cost-effectiveness and policy requirements seem to be amongst the main issues that would affect the development of large scale biological plant for waste treatment.

6. **ACKNOWLEDGEMENT**

The author wishes to thank the Japan Environmental Ltd., the Hong Kong Consulate-General of Korea, and the staff of the Economic and Trade Office of the Hong Kong SAR Government in Tokyo and many others for their assistance and the arrangements made for the delegation before and during the visit.
### Appendix I

**List of Delegation for the Visit to Waste Management Facilities in Japan and Korea**

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Title</th>
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<tbody>
<tr>
<td>1.</td>
<td>Mr. Keith KK Kowk (ETWB)</td>
<td>Permanent Secretary for the Environment, Transport and Works Bureau, Hong Kong SAR Government</td>
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<tr>
<td>2.</td>
<td>Mr. PH LUI (EPD)</td>
<td>Principal Environmental Protection Officer, Environmental Protection Department, Hong Kong SAR Government</td>
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<tr>
<td>3.</td>
<td>Prof. Joseph Lee (Advisory Group member)</td>
<td>Pro-Vice-Chancellor, Redmond Chair of Civil Engineering, University of Hong Kong</td>
</tr>
<tr>
<td>4.</td>
<td>Prof. Wong Tze Wai (Advisory Group member)</td>
<td>Professor, Department of Community and Family Medicine, Chinese University of Hong Kong</td>
</tr>
<tr>
<td>5.</td>
<td>Ms. Connie Lau (Advisory Group member)</td>
<td>Deputy Chief Executive, Consumer Council</td>
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<tr>
<td>6.</td>
<td>Dr. Ng Cho-nam (Environment SG member)</td>
<td>Associate Professor, Department of Geography, University of Hong Kong</td>
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<tr>
<td>7.</td>
<td>Dr. Albert Koenig (Technology SG member)</td>
<td>Associate Professor, Department of Civil Engineering, University of Hong Kong</td>
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<tr>
<td>8.</td>
<td>Dr. CK Chan (Technology SG member)</td>
<td>Associate Professor, Department of Chemical Engineering, Hong Kong University of Science &amp; Technology</td>
</tr>
<tr>
<td>9.</td>
<td>Mr. Apo Leung (Social SG member)</td>
<td>Executive Director, Asia Monitor Resource Center</td>
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<tr>
<td>10.</td>
<td>Mrs. Katherine Shum (Consumer SG member)</td>
<td>A former member of Consumer Council</td>
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<tr>
<td>11.</td>
<td>Ms. Jasminia Cheung (Consumer SG member)</td>
<td>Managing Director, Sixrights Ltd</td>
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<tr>
<td>12.</td>
<td>Dr. Lo Wai-kwok (Consumer SG member)</td>
<td>Managing Director, Artesyn Technologies Asia-Pacific Ltd</td>
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## Itinerary for Visit to Waste Management Facilities in Japan and Korea
### 14th-18th November 2004

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>14 Nov 04</td>
<td>09:10 Depart Hong Kong for Tokyo, Japan</td>
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<tr>
<td>Sun</td>
<td>18:00 Introductory presentation and welcome party by Japan Environmental Consultants Ltd.</td>
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<td>15 Nov 04</td>
<td>10:00 Ariake Incineration Plant (MHI) : Stoker furnace</td>
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<td>Mon</td>
<td>P.M. Shin Koto Incineration plant (Takuma) : Stoker furnace</td>
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<td>14:00-16:30 Meeting with Ms Koike, Minister of the Environment, followed by briefing by Waste Management &amp; Recycling Department</td>
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<td>16 Nov 04</td>
<td>10:00 Asahi Clean Center (Ebara) : Fluidized-bed Gasification and ash melting furnace</td>
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<td>Tue</td>
<td>P.M. JFE Chiba Factory (JFE) : Thermoselect type gasification plant</td>
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<td></td>
<td>Dinner 19:30 Dinner hosted by Economic and Trade Office (Tokyo)</td>
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<td>17 Nov 04</td>
<td>10:00 Ichihara Ecocement Plant (Taiheiyo Cement)</td>
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<tr>
<td>Wed</td>
<td>17:30 Depart Tokyo for Seoul, Korea</td>
</tr>
<tr>
<td>18 Nov 04</td>
<td>9:30 Visit Professional-Environmental First-Recycling System, Ansung City</td>
</tr>
<tr>
<td>Thu</td>
<td>14:00 Visit anaerobic digestion plant, Paju City</td>
</tr>
<tr>
<td></td>
<td>19:45 Depart Seoul for Hong Kong</td>
</tr>
</tbody>
</table>
Appendix III

List of Reference Materials Acquired:

1. a folder on Solid Waste Treatment Facilities Visit prepared by Japan Environmental Consultants Ltd
3. Brochure of the Ariake Incineration Plant
4. Brochure of the Tokyo Teleport Town Refuse Collection and Transport System
5. Brochure of the Shin-Koto Incineration Plant
6. Notes Solid Waste in Japan prepared by the Planning Division on Waste Management and Recycling Department
7. Report of Solid Waste Treatment in Japan prepared by Planning Division on Waste Management and Recycling Department
8. Brochure of the Asahi Clean Centre
9. Brochure of JFE Thermoselect System – the Resources Recycling Plant
10. Brochure of Ecocement by Taiheiyo Cement
11. Notes of Ecocement and Construction works of the Plant fro the Tama Area Waste by Taiheiyo Cement
14. Brochure of Kyung-Gi Special Equipment Co. Ltd
15. Brochure of Anaerobic Technologies for Treating Food Waste in Korea by Halla Energy & Environment
16. Brochure on Clean and Pleasant Environment by Halla Energy & Environment