

Analysis of Transboundary Movements of Hazardous Wastes and Other Wastes in Asia

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1. Introduction

1.1 Background and objective

At the 1st meeting of Country-led Initiative (CLI), which was launched by Indonesia and Switzerland based on the Decision IX/26 on the President's Statement at the 9th meeting of the Conference of the Parties of the Basel Convention (COP9), the following facts are reported as the current status of transboundary movements (TBM) of hazardous wastes and other wastes in accordance with the Basel Convention:

<Statistics on TBM reported at the 1st CLI meeting>

- The amount of legal transboundary movements for the purpose of final disposal from OECD countries (developed countries) to non-OECD countries (developing countries), and among non-OECD countries is extremely small. TBM among non-OECD countries for the purpose of recycling (roughly 2/3) are much larger than those from OECD countries to non-OECD countries (1/3).
- Among the Parties to the Basel Convention, most of the TBM from non-OECD countries to OECD countries, and among non-OECD countries are made for the purpose of recycling, and the major disposal operations are R4 (recycling/reclamation of metals and metal compounds), R5 (recycling/reclamation of other inorganic materials) and R8 (recovery of components from catalysts).

At the 1st CLI meeting, participants agreed that further analysis is required concerning TBM of hazardous wastes and other wastes made among non-OECD countries for recycling. In response to this need, Ministry of the Environment, Government of Japan (MOEJ) prepared the report in 2009, which aimed to clarify whether the same trends as noted above are to be found in the Asian region and analyzes with a particular focus on understanding the status of TBM of hazardous wastes and other wastes among non-OECD countries in the region. The following issues are analyzed in the report:

<Issues analyzed in the report>

- Background information: economic status of Asian countries/regions
- Development of recycling facilities for hazardous wastes and other wastes in the Asian region
- TBM of hazardous wastes and other wastes in the Asian region
 - ✧ Total amount of TBM of hazardous wastes
 - ✧ TBM of individual type of hazardous waste (used lead-acid batteries (ULAB), waste electronic and electrical equipment (E-waste))
 - ✧ TBM of hazardous wastes by category (hazardous wastes requiring special treatment, metallic hazardous wastes, other recyclable hazardous wastes)
 - ✧ TBM of used electrical and electronic equipment (EEE) (TV sets, air conditioners, refrigerators, washing machines, and PCs)

The countries surveyed were Brunei Darussalam, Cambodia, China (including Hong Kong Special Administrative Region (SAR)), Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam, all of which are non-OECD member countries of the Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes hosted by the MOEJ.

The first report was submitted to the 2nd CLI meeting, which was held in Wildhaus, Switzerland, 12-15 January 2010¹. The update of the status of TBM of hazardous wastes and other wastes in Asian region on a

¹ The first report was downloadable from the website of the Basel Convention (<http://www.basel.int/convention/cli/index.html>)

regular basis is quite important for not only for as input to the CLI, but also for those who involved in the enforcement activities of the Basel Convention in the region including competent authority / focal point of the Convention, as well as Customs department or other relevant international organization branch located in the region. Therefore after the 2nd CLI meeting, the MOEJ collected additional information and statistics and update the information contained in the 1st version of the report.

1.2 Summary of the analysis results

The analysis results of this study are summarized as follows:

- Compared to the situations in 1995 when the Ban Amendment was adopted, some Asian non-OECD countries/regions have reached the similar or even higher economic levels (GDP per capita) as OECD countries (e.g. Japan and Republic of Korea). Even in such countries as Cambodia or Vietnam with relatively low economic levels, rapid economic growth has been observed in recent years (P.4 “Economic status of Asian countries/regions”).
- Non-OECD countries with a higher income level (e.g. Singapore and Malaysia) are establishing facilities capable of recycling and treatment of hazardous wastes and other wastes at a comparatively high technological level. In Thailand and the Philippines as well, facilities are being developed and records of recycling for imported wastes have been confirmed. On the other hand, in countries with relatively low GDP per capita, recycling and treatment facilities for hazardous wastes have not been fully developed, and these countries have not reported the import of hazardous wastes and other wastes for recycling (P5 “Development of recycling facilities for hazardous wastes and other wastes in the Asian region”).
- Regarding the fact reported at the 1st CLI meeting: “TBM of hazardous wastes and other wastes among non-OECD countries surpass those from OECD countries to non-OECD countries,” the same trend can be observed in the Asian region. Most of such TBM are made for the purpose of recycling including recovery and reclamation of metals and inorganic substances (P.8 “Total amount of TBM of hazardous wastes in Asia, and P.18 “TBM of hazardous wastes by category in Asia”).
- Combinations of exporting and importing countries differ according to the type of hazardous wastes. In addition to the development status of recycling technology for individual type of hazardous waste, such combinations are significantly affected by any import regulations stipulated by domestic laws of importing countries. For example, until 2002, Indonesia was the largest importer of ULAB but, with the adoption of import ban, Republic of Korea has become the largest importer of such items (P.13 “TBM of used lead-acid batteries in Asia” and P.16 “TBM of E-waste in Asia”).
- It has been observed that non-OECD countries are actively importing the following wastes: metallic hazardous wastes by the Philippines and Malaysia; and recyclable hazardous wastes by Malaysia, Thailand, and the Philippines. On the other hand, hazardous wastes requiring special treatment such as mercury wastes (e.g. waste fluorescent lamps) and PCB wastes, are exported to Japan and other OECD countries for environmentally sound treatment (P.18 “TBM of hazardous wastes by category in Asia”).
- With growing demand for secondhand products and market expansion in the region, the amount of TBM of used EEE is being active. Both OECD and non-OECD countries are exporters of used EEE (P.25“Estimate of TBM of used EEE in Asia”).

→In the Asian region, countries that import hazardous wastes for recycling are non-OECD countries such as Malaysia and Thailand whose economic level is high, and where recycling facilities for hazardous wastes and other wastes are being developed. TBM by those countries are becoming more and more active, with the progress of economic growth, due to increasing demand for recyclable resources and development of recycling facilities.

1.3 Limitation of data and information used in the report

The analysis in this paper has the following limitation on data and information. Therefore further research will be needed in future.

- The Basel Convention national reporting mainly referred to in this analysis is statistical data on legal TBM in accordance with the Basel Convention; therefore, the data does not give a comprehensive picture of TBM including illegal movements.
- The amount of TBM of hazardous wastes and other wastes reported to the Secretariat is more likely to be the amount which was notified to and obtained consent from importing countries pursuant to the prior notification procedures under the Convention. The amount notified may be in general larger than the amount actually exported and imported.
- The data of TBM of hazardous wastes and other wastes in the national reporting is being compiled by weight. Therefore, when the total amount of TBM – not quantities of individual type of hazardous waste – are analyzed, the trend would be skewed by heavier items; the difference in average weight of individual type of hazardous waste must be taken into account.
- National reporting data is based on each country's reporting system; there is no uniformity in the description of wastes reported, and it is difficult to assess the accurate flow of each type of waste (e.g. it is difficult to identify whether a description of "lead" refers to lead-acid batteries or other type of lead wastes).
- It is not known from the national reporting data which facility received hazardous wastes imported since there is no specific information on the destination facilities; while disposal operation as per Annex VI of the Convention (R or D codes) is reported.
- Due to the significant variations in the amount of TBM according to the year; it is difficult to find any clear time-series trends from the currently available data.
- The list of recycling and disposal facilities for hazardous wastes and other wastes approved by each country's environmental authority is often publicized on his/her website as well as the Secretariat's website of the Basel Convention. However, the information regarding treatment methods, capacity, and environmental management systems in any facility is lacking; therefore, further information gathering is required for making any judgment as to whether such facility operates in an environmentally sound manner.
- TBM of used EEE were analyzed using export statistics only; analysis based on import statistics may be also required for the cross checking purpose.

2. Economic Status of Asian Countries/Regions

This chapter reviews economic status of Asian countries/regions targeted in this study as background information.

<Analysis Results>

- Compared to the situations in 1995, the economic levels of non-OECD countries/regions in Asia has improved; not only Brunei and Singapore, but also Malaysia has been reaching the economic (income) level equivalent to those of Annex VII countries (OECD countries) (Table 1).
- Even in the countries with a relatively low economic level such as Cambodia or Vietnam, rapid economic growth has been observed in recent years (Table 2).

Table 1 GDP per capita (Unit: purchasing power parity with US dollar)

| Non-Annex VII countries/regions (non-OECD) | | | Annex VII countries (OECD) | | |
|--|--------|--------|----------------------------|--------|--------|
| | 1995 | 2008 | | 1995 | 2008 |
| Singapore | 25,422 | 51,226 | Japan | 22,464 | 34,116 |
| Brunei | 42,143 | 50,199 | Republic of Korea | 12,766 | 27,692 |
| Hong Kong SAR | 22,685 | 43,847 | Poland | 7,256 | 17,537 |
| Malaysia | 7,521 | 14,081 | Mexico | 8,090 | 14,534 |
| Thailand | 4,684 | 8,239 | Turkey | 6,700 | 13,139 |
| China | 1,514 | 5,970 | Romania | 5,876 | 12,600 |
| Indonesia | 2,265 | 3,980 | Bulgaria | 5,674 | 12,322 |
| Philippines | 1,981 | 3,515 | | | |
| Vietnam | 1,009 | 2,794 | | | |
| Cambodia | 647 | 2,082 | | | |

* As of 1995, Poland, Romania, and Bulgaria were all non-EU or non-OECD countries.

Source: IMF Data and Statistics (<http://www.imf.org/external/data.htm>)

Table 2 GDP growth rates: Asian countries/regions (Unit: %)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------------|------|------|------|------|------|------|------|
| China | 8.4 | 8.3 | 9.1 | 10.0 | 10.1 | 10.4 | 11.1 |
| Cambodia | 8.8 | 8.1 | 6.6 | 8.5 | 10.3 | 13.3 | 10.8 |
| Vietnam | 6.8 | 6.9 | 7.1 | 7.3 | 7.8 | 8.4 | 8.2 |
| Singapore | 10.1 | -2.4 | 4.2 | 3.1 | 8.8 | 6.6 | 7.9 |
| Hong Kong SAR | 10.0 | 0.6 | 1.8 | 3.2 | 8.6 | 7.5 | 6.9 |
| Malaysia | 8.9 | 0.3 | 4.4 | 5.5 | 7.2 | 5.2 | 5.9 |
| Indonesia | 5.4 | 3.6 | 4.5 | 4.8 | 5.0 | 5.7 | 5.5 |
| Philippines | 6.0 | 1.8 | 4.4 | 4.9 | 6.4 | 4.9 | 5.4 |
| Brunei | 2.9 | 2.7 | 3.9 | 2.9 | 0.5 | 0.4 | 5.1 |
| Thailand | 4.8 | 2.2 | 5.3 | 7.1 | 6.3 | 4.5 | 5.0 |
| Republic of Korea | 8.5 | 3.8 | 7.0 | 3.1 | 4.7 | 4.2 | 5.0 |
| Japan | 2.9 | 0.2 | 0.3 | 1.4 | 2.7 | 1.9 | 2.2 |

Source: IMF Data and Statistics (<http://www.imf.org/external/data.htm>)

3. Development of Recycling Facilities for Hazardous Wastes and Other Wastes in the Asian Region

Based on the Basel Convention national reporting and information from literature surveys, this section analyzes the development status of recycling facilities for hazardous wastes and other wastes in Asian non-OECD countries.

<Analysis Results>

- It is reported that some non-OECD countries have imported hazardous wastes (e.g. ULAB or PVC) for recycling, mainly for R4, R5, and R8 operations in accordance with the Basel Convention (Table 3).
- It can be seen that facilities to recycle or treat hazardous wastes have been established in Asian non-OECD countries (Table 4).
- Some countries, such as Singapore and Malaysia, are developing many facilities capable of treating hazardous wastes using comparatively high standards of technology, while other countries have not yet fully developed such facilities. In the latter countries, health damage and environmental pollution caused by inappropriate treatment of hazardous waste is a particular concern (Table 5, for information on specific facilities, refer to Appendix 1).
- In general, the development status of facilities in each non-OECD country is correlated with the economic level the country achieves (Table 5).

Table 3 Examples of import of hazardous wastes to Asian non-OECD countries

| Year | Country | Type of waste | Disposal operation |
|------|-------------|--|--------------------|
| 1998 | Indonesia | Lead-acid batteries | R4 |
| 1999 | Indonesia | Lead-acid batteries | R4 |
| 2000 | Indonesia | Lead-acid batteries | R4 |
| 2002 | Philippines | Lead-acid batteries, waste oil, PVC | R4, R9 |
| 2003 | Philippines | Lead-acid batteries, waste oil, PVC | R4, R9 |
| | Thailand | Cathode-ray tube | R4 |
| 2004 | Philippines | Lead-acid batteries, waste oil, PVC, solder dross (lead/tin) | R4, R9 |
| 2005 | Philippines | Lead-acid batteries, nickel hydroxide, solder dross (lead/tin) | R4 |
| 2006 | Malaysia | Gypsum | R11 |
| | Singapore | Used solvent | R2 |

Source: Extracted from the document of 1st CLI meeting “Paper 3 - Statistics on waste flows from North to South and from South to South”

Table 4 Recycling facilities reported to the Secretariat of the Basel Convention
by Asian non-OECD countries²

| Country | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------|--------------------|--------------------|------------|--------------------|--------------------|--------------------|-----------------------------|---------------------------------|-----------------------------|
| Indonesia | R4 | R4, R9 | R2, R4, R9 | R2, R4, R9 | R2, R4, R5, R9 | R2, R4, R5, R9 | R2, R4, R5, R6, R7, R9, R13 | R2, R4, R5, R6, R7, R9, R13 | R2, R4, R5, R6, R7, R9, R13 |
| Malaysia | R2, R4, R6, R8, R9 | R2, R4, R6, R8, R9 | - | R2, R4, R5, R6, R9 | R2, R3, R4, R5, R6, R8, R9, R11 | R2, R4, R5, R6, R8, R9, R11 |
| Philippines | - | - | - | - | R4 | R4 | R4 | R4 | - |
| Singapore | - | - | - | R2 | R2 | R2 | R2 | R2 | R2 |
| Thailand | R1, R2, R4 | R1, R2, R4 | R1, R2, R4 | - | R1, R2, R4 | R1, R2, R4 | R1, R2, R4 | R1, R2, R3, R4, R5, R9 | - |

Legend: The - symbol indicates no report was made to the Secretariat of the Convention.

Source: Basel Convention national reporting

Table 5 Development of recycling and treatment facilities for hazardous wastes in Asian countries

| | Development of recycling and treatment facilities | GDP per capita (US dollar, PPP in 2008) |
|-------------------|---|---|
| Singapore | <ul style="list-style-type: none"> ✓ 8 recycling facilities were reported in the national reporting (2006). ✓ As of April 2009, 49 recycling facilities were listed on the website of the National Environment Agency (NEA)³. | 51,226 |
| Japan | <ul style="list-style-type: none"> ✓ A large number of facilities capable of advanced recycling and treatment have been established. ✓ As of April 2006, the number of facilities permitted by the Government reached 19,164 for recycling and treatment and 2,335 for final disposal. | 34,116 |
| Republic of Korea | <ul style="list-style-type: none"> ✓ A large number of facilities capable of advanced recycling and treatment have been established. | 27,692 |
| Malaysia | <ul style="list-style-type: none"> ✓ 104 recycling facilities were reported in the national reporting (2006)⁴. ✓ A list of contractors authorized to recover, transport, storage and treat scheduled wastes onsite or offsite is publicized on the website of the Department of Environment (DOE)⁵. Regarding E-waste, 16 contractors are registered for full recovery and 117 are registered for partial recovery⁶. | 14,081 |
| Thailand | <ul style="list-style-type: none"> ✓ As of February 2009, 1,356 waste treatment and recycling facilities were registered with the Department of Industrial Works (DIW) of the Ministry of Industry. Details are: facilities for landfill or incineration: 139; separation: 962; recycling: 255. | 8,239 |

² In reference to the development status of treatment facilities in national reporting, not all signatories to the Convention have made reports, and the definitions of type of wastes differ according to each country; these points need to be noted.

³ Website of the NEA of Singapore (<http://www.nea.gov.sg/cms/rcd/Local%20Recycling%20Plants.pdf>)

⁴ Website of the Basel Convention (<http://www.basel.int/natreporting/2006/compI/t3.pdf>)

⁵ Website of the DOE of Malaysia (<http://www.doe.gov.my/en/content/list-scheduled-waste-contractors-malaysia>)

⁶ For others, the following results are reported: waste oil, mineral sludge, and waste coolants: 34 companies; waste solvent: 22; storage batteries: 7; dross, ash, slag, and waste catalyst: 39; used containers, ink, dye, and paint: 31; heavy metal sludge, and rubber: 28; waste acid, and waste alkali: 29; production of materials for cement: 9; waste gypsum: 4; waste film: 4; phenol, adhesive, and resin: 9.

| | Development of recycling and treatment facilities | GDP per capita (US dollar, PPP in 2008) |
|-------------|--|---|
| China | <ul style="list-style-type: none"> ✓ As of the end of 2006, 6 recycling facilities with permit issued by Ministry of Environmental Protection (MEP) are reported in national reporting. Additionally, provincial environmental protection bureaus issued permits for 741 hazardous waste recovery facilities⁷. ✓ Treatment of imported waste requires permission from the Government, particularly the import and processing of mixed metal (Type 7 waste) is strictly controlled. Every year a list of permitted importers of Type 7 waste is released⁸, and in 2009, 589 companies were listed in China. | 5,970 |
| Indonesia | <ul style="list-style-type: none"> ✓ 25 recycling facilities were reported in the national reporting (2006). ✓ In 2004, the Ministry of Environment (KLH) issued 225 permits for B3 waste management, including 6 permits for treatment and disposal of B3 wastes. As of 2004, 30 permits were issued for effective use of hazardous wastes. | 3,980 |
| Philippines | <ul style="list-style-type: none"> ✓ A list of registered treatment/storage/disposal (TSD) facilities is publicized on the website of the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR)⁹. ✓ As of October 31, 2009, 114 TSD facilities were registered with the EMB. | 3,515 |
| Vietnam | <ul style="list-style-type: none"> ✓ Urban Environment Company (URENCO) is the leading company in waste treatment, while the number of other companies capable of recycling and treatment of hazardous wastes is limited. ✓ Most of hazardous wastes are considered to be treated in informal sectors or disposed at landfill sites with other solid wastes. | 2,794 |
| Cambodia | <ul style="list-style-type: none"> ✓ There is only one landfill site for special industrial wastes within the country; the site is normally used for waste generated from clothing factories. ✓ In general, there are very few facilities for intermediate treatment and recycling of hazardous wastes. | 2,082 |

* Brunei is not included in the table since insufficient data is available to assess the development status of recycling and treatment facilities of hazardous wastes.

Other references:

Institute of Developing Economies Japan External Trade Organization: "Fiscal Year 2005 Report of Information Provision Projects Concerning Industrial Wastes and Recycling Policies in Asian Countries" (2007)

EX Corporation: "Fiscal Year 2007 Report of the Project on the Examination of Policies for Promoting Appropriate Treatment of Wastes in Asian Countries" (2007)

Recycle One, Inc.: "Fiscal Year 2008 Report of an Examination Concerning the Validity Evaluation of the Basel Convention Including 1995 Amendment and Review of the Strategic Plan" (2008)

EX Corporation: "Fiscal Year 2008 Report of a Strategic Examination Concerning Policies for Promoting Resource Recycling in Asia" (2008)

⁷ National Reporting China (<http://www.basel.int/natreporting/2006/cfs/china.doc>)

⁸ Publication of companies permitted to process and use mixed metal (http://www.sepa.gov.cn/info/bgw/bgg/200908/t20090807_157226.htm)

⁹ Website of the EMB of the Philippines (<http://www.emb.gov.ph/hazardous/Treater.PDF>)

4. Transboundary Movement of Hazardous Wastes and Other Wastes in the Asian Region

4.1 Total amount of transboundary movements of hazardous wastes in Asia

Based on the Basel Convention national reporting, this section analyzes the total amount of TBM of hazardous wastes subject to the Convention in the Asian region.

<Analysis Results>

[Overall trend of TBM of hazardous wastes subject to the Basel Convention]

- Both the amount of import and export varies greatly according to the year, and no clear time-series trend can be observed (Fig. 1).
- In most of the years, the total amount of import of hazardous wastes is much larger than that of export in the region (Fig. 1).
- According to the data reported by importing countries in 2006, the huge amount of waste was imported into OECD countries (Republic of Korea and Japan). Non-OECD countries (Malaysia and Singapore) also imported wastes in 2006 (Fig 2).
- According to the data reported by exporting countries in 2006, the amount exported from OECD countries (Japan and Republic of Korea) were small; the amount exported from non-OECD to OECD countries and among non-OECD countries accounted for the majority (Fig. 3).
- In the region, most of the countries importing hazardous wastes have reached relatively high economic levels and have developed recycling and treatment facilities within the countries (Table 6).

[Analysis of import and export by country] (Refer to Appendix 2)

■ Import

- The Asian largest importer of hazardous wastes by weight is Malaysia, due to the import of large amount of blast furnace slag.
- Indonesia used to be a big importer, but, since the total import ban of ULAB in September 2002, this has been reduced to zero.
- Among other non-OECD countries, the Philippines imports hazardous wastes every year (although national reporting data in 2006 is lacking). However, variations by year are considerably high.
- Thailand has also reported import of hazardous wastes since 2003; while the amount by weight is small.
- Brunei, Cambodia and Vietnam have not reported the import of hazardous wastes.

■ Export

- The amount exported from Republic of Korea in 1998 was extremely large due to the export of a massive amount of steel scale wastes to Taiwan and Japan.

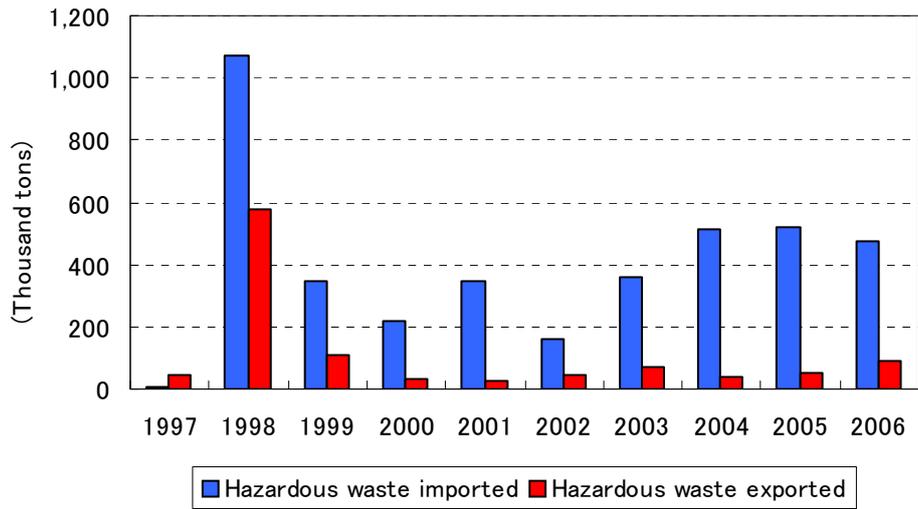


Fig. 1 Import and export of hazardous wastes in Asian countries (1997-2006)

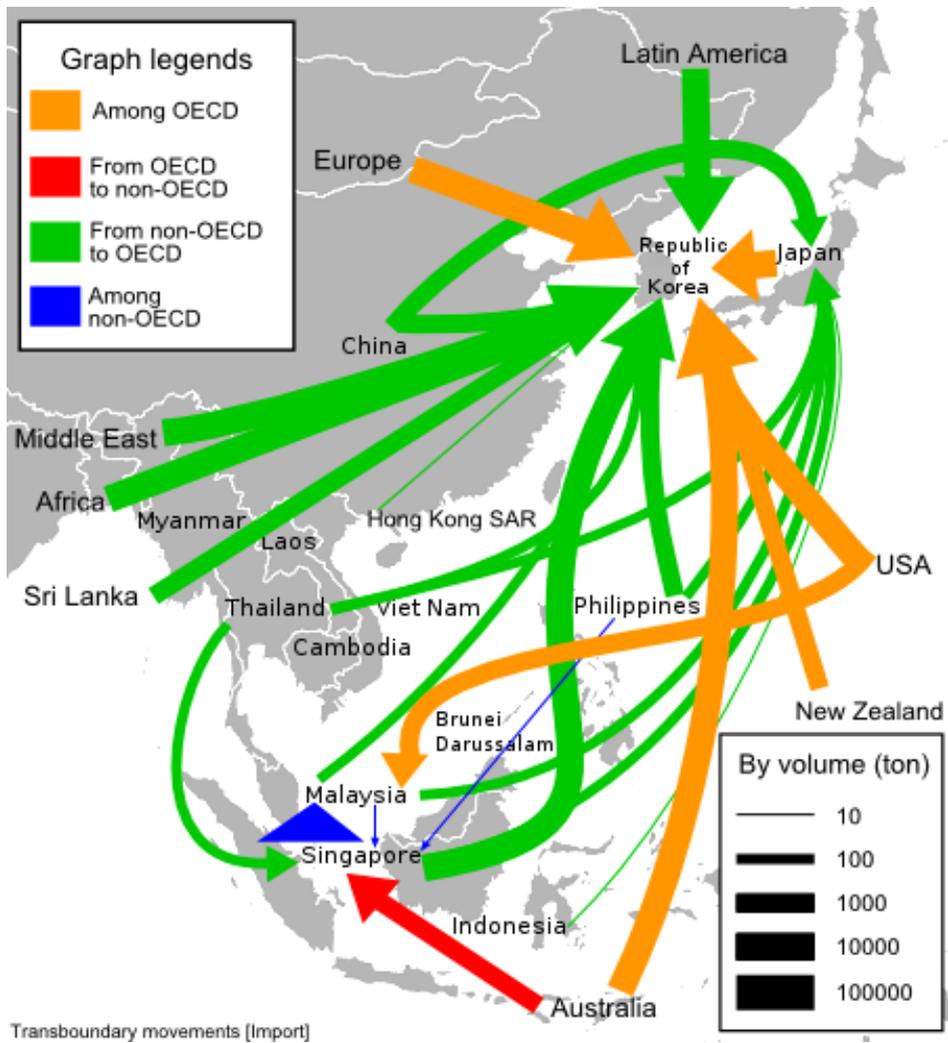


Fig. 2 TBM of hazardous wastes in Asia (Import statistics: 2006)

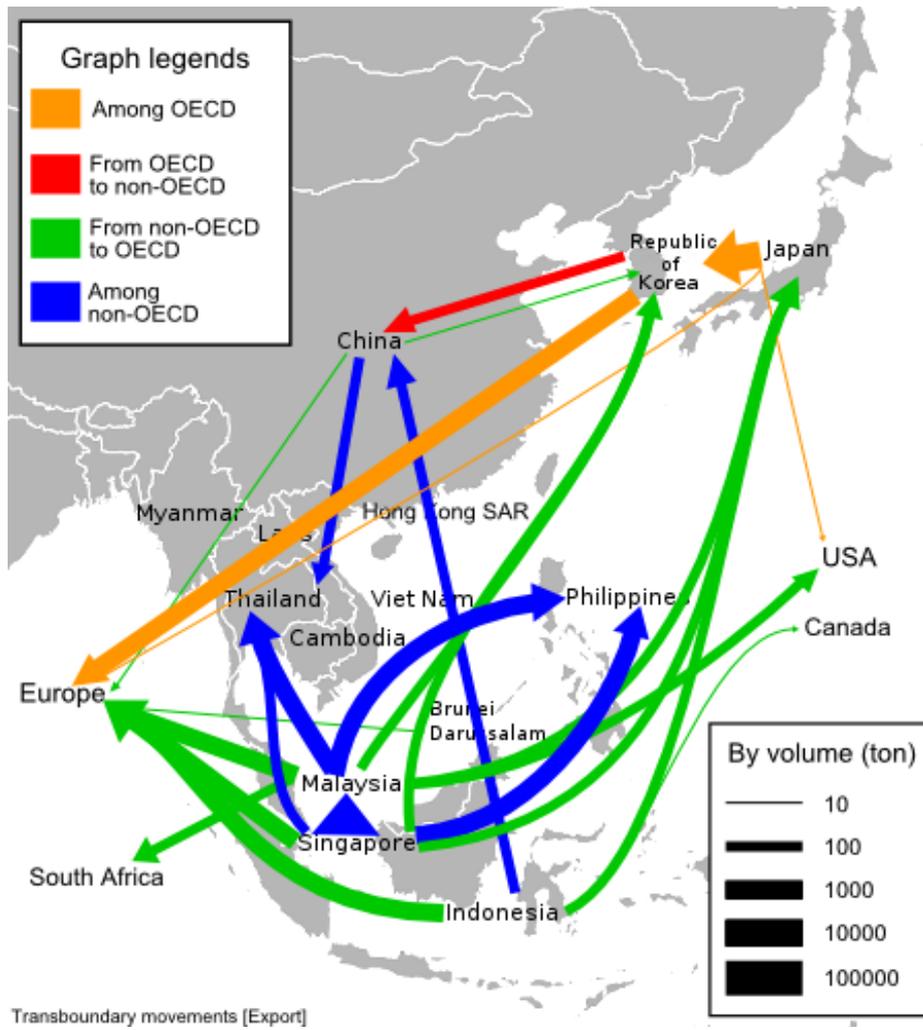


Fig. 3 TBM of hazardous wastes in Asia (Export statistics: 2006)

Table 6 Summary table of import of hazardous wastes compared with the country's economic status and development of recycling and treatment facilities

| | Import of hazardous wastes | | GDP per capita (US dollar, PPP in 2008) | Development of recycling and treatment facilities |
|-------------------|--|---|---|---|
| | Average amount of annual import (2001 to 2006) | Main types of wastes imported | | |
| Malaysia | 213,215 | Blast furnace slag, copper slag, waste catalysts | 14,081 | <ul style="list-style-type: none"> ✓ 104 recycling facilities were reported in the national reporting (2006). ✓ A list of contractors authorized to recover, transport, storage and treat scheduled wastes onsite or offsite is publicized on the website of the Department of Environment (DOE). Regarding E-waste, 16 contractors are registered for full recovery and 117 are registered for partial recovery. |
| Republic of Korea | 107,953 | ULAB and other wastes containing lead, waste nickel-cadmium rechargeable batteries | 27,692 | <ul style="list-style-type: none"> ✓ A large number of facilities capable of advanced recycling and treatment have been established. |
| Indonesia | 47,759 | ULAB (<i>Since the total import ban of used lead-acid batteries in 2002, there have been no import</i>) | 3,980 | <ul style="list-style-type: none"> ✓ 25 recycling facilities were reported in the national reporting (2006). ✓ In 2004, the Ministry of Environment (KLH) issued 225 permits for B3 waste management, including 6 permits for treatment and disposal of B3 wastes. As of 2004, 30 permits were issued for effective use of hazardous wastes. |
| Philippines | 21,468 | ULAB and other wastes containing lead, waste oil, other metallic hazardous wastes | 3,515 | <ul style="list-style-type: none"> ✓ A list of registered treatment/storage/disposal (TSD) facilities is publicized on the website of the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR). ✓ As of October 31, 2009, 114 TSD facilities were registered with the EMB. |
| Japan | 4,225 | CRT glass, E-waste, precious metals, rare metals (e.g. silver sludge), difficult-to-treat wastes (e.g. waste fluorescent lamps) | 34,116 | <ul style="list-style-type: none"> ✓ A large number of facilities capable of advanced recycling and treatment have been established. ✓ As of April 2006, the number of facilities permitted by the Government reached 19,164 for recycling and treatment and 2,335 for final disposal. |
| Thailand | 327 | CRT glass, waste OA equipment | 8,239 | <ul style="list-style-type: none"> ✓ As of February 2009, 1,356 waste treatment and recycling facilities were registered with the Department of Industrial Works (DIW) of the Ministry of Industry. Details are: facilities for landfill or incineration: 139; separation: 962; recycling: 255. |

| | Import of hazardous wastes | | GDP per capita (US dollar, PPP in 2008) | Development of recycling and treatment facilities |
|-----------|--|----------------------------------|---|--|
| | Average amount of annual import (2001 to 2006) | Main types of wastes imported | | |
| Singapore | 62 | E-waste, etc. | 51,226 | <ul style="list-style-type: none"> ✓ 8 recycling facilities were reported in the national reporting (2006). ✓ As of April 2009, 49 recycling facilities were listed on the website of the National Environment Agency (NEA). |
| China | 0 | No record of any import | 5,970 | <ul style="list-style-type: none"> ✓ As of the end of 2006, 6 recycling facilities with permit issued by Ministry of Environmental Protection (MEP) are reported in the national reporting (2006). In addition, provincial environmental protection bureaus issued permits for 741 hazardous waste recovery facilities. ✓ Treatment of imported waste requires permission from the Government, particularly the import and processing of mixed metal (Type 7 waste) is strictly controlled. Every year a list of permitted importers of Type 7 waste is released, and in 2009, 589 companies were listed in China. |
| Vietnam | 0 | No record of any import | 2,794 | <ul style="list-style-type: none"> ✓ Urban Environment Company (URENCO) is the leading company in waste treatment, while the number of other companies capable of recycling and treatment of hazardous wastes is limited. ✓ Most of hazardous wastes are considered to be treated in informal sectors or disposed at landfill sites with other solid wastes. |
| Cambodia | 0 | No record of any import | 2,082 | <ul style="list-style-type: none"> ✓ There is only one landfill site for special industrial waste within the country; the site is normally used for waste generated from clothing factories. ✓ In general, there are very few facilities for intermediate treatment and recycling of hazardous wastes. |

* In the table, surveyed countries are arranged in the order of their average amount of annual import of hazardous wastes (six years from 2001 to 2006). Brunei is not included in the table since insufficient data is available to assess the development status of recycling and treatment facilities of hazardous wastes.

4.2 TBM of individual type of hazardous waste in Asia

This section analyzes TBM of individual type of hazardous waste (ULAB and E-waste), based on the Basel Convention national reporting.

Overview of transboundary movements by individual type of hazardous waste in Asia

Overview of TBM by individual type of hazardous waste are as follows (refer to Appendix 3)

<Analysis Results>

- The most imported and exported hazardous wastes by weight in Asia are as follows: blast furnace slag, ULAB, copper slag, CRT glass, lead (except for lead-acid batteries and CRT glass), waste catalysts, and waste oil.
- Malaysia is the largest importer of blast furnace slag (46.5% of the total nine-year import in the region). Malaysia treated blast furnace slag as designated waste (hazardous waste) and it was subject to import controls. However, following the amendment of the regulations for designated waste in 2005, blast furnace slag was excluded from the list of designated waste; no TBM were reported in 2006.
- The large amount of iron exported from Republic of Korea in 1998 was accounted for by the export of a massive amount of steel scale wastes to Taiwan and Japan.

Transboundary movements of used lead-acid batteries in Asia

The analysis results of TBM of ULAB in Asia are summarized as follows.

<Analysis Results>

- From 1998 to 2002, Indonesia was the major importer of ULAB. After import ban in 2002¹⁰, the amount of import to Republic of Korea increased from 2004 onward¹¹ (Fig. 4).
- The constant amount of import to the Philippines is observed, presumably for deliveries to registered recycling facilities (Fig. 4).
- Republic of Korea imports and recycles ULAB from all over the world. This would imply the fact that facilities capable of recycling waste lead-acid batteries in an environmentally sound manner have been established in the country. (Figs. 5 and 6).

¹⁰ In 1997 Indonesia incorporated provisions that banned the import of hazardous wastes in Article 21 of the Law Concerning Environmental Management; however only lead-acid batteries were given a grace period until total ban of import came into effect from September 2002.

¹¹ The major exporters of ULAB to Indonesia before 2002 were Singapore and Middle East countries such as Jordan, United Arab Emirates, and Yemen. On the other hand, the largest ULAB exporters to Republic of Korea in 2006 is Japan (accounts for roughly 31% of total import), followed by the United States, Australia, Kuwaiti, and United Kingdom.

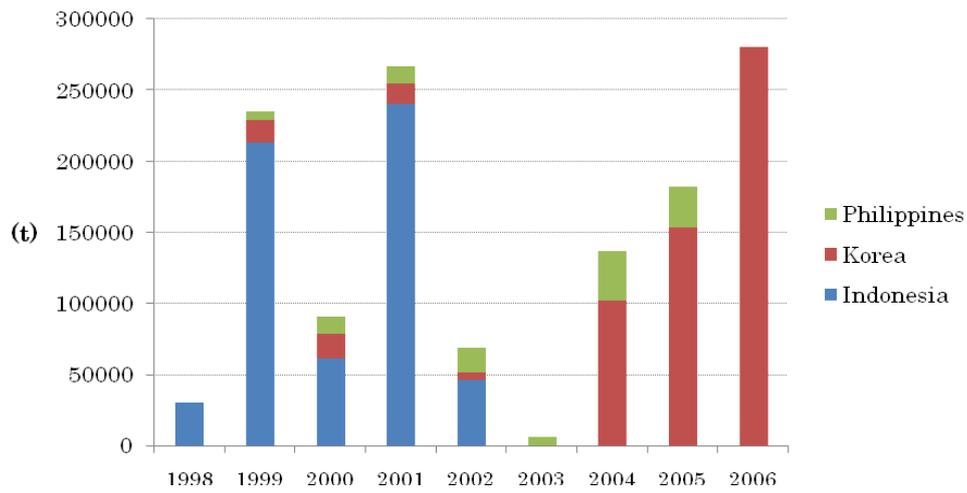


Fig. 4 Import of ULAB by Asian countries (1998 to 2006)

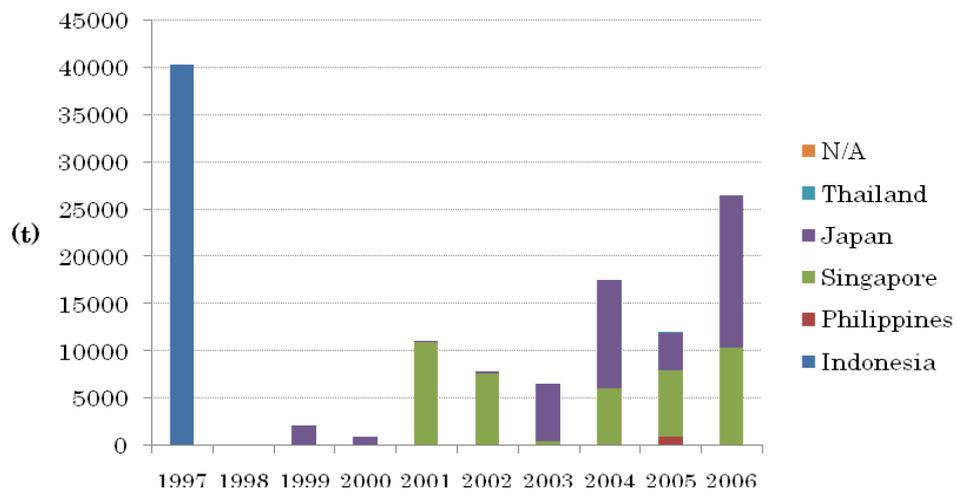


Fig. 5 Export of ULAB from Asian countries (1997 to 2006)

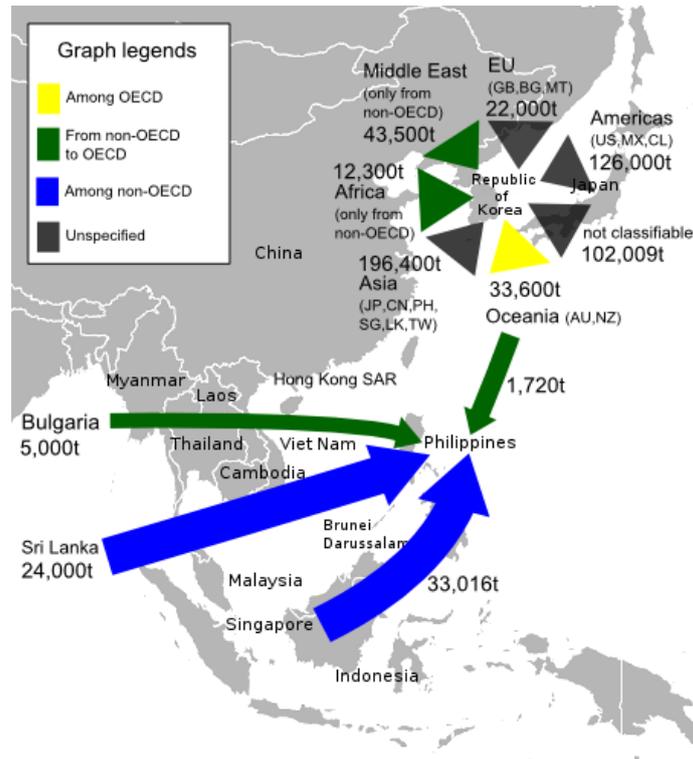


Fig. 6 TBM of ULAB in Asia (Import statistics: 2004 to 2006)¹²

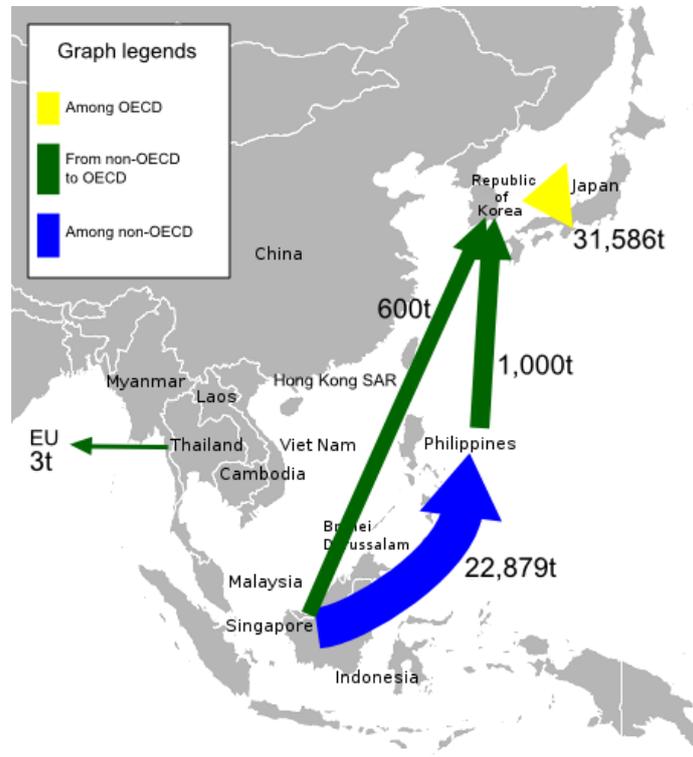


Fig. 7 TBM of ULAB in Asia (Export statistics: 2004 to 2006)

¹² More than two importing or exporting countries/regions are sometime covered in one notification. For example, Republic of Korea imported roughly 90,000 tons of waste lead-acid batteries in 2004 from Japan, Philippines, Kuwait, Hong Kong SAR, Bulgaria, and United States. In this case it is difficult to find out the ratio each country accounts for. Thus this case was categorized into “not classifiable”.

Transboundary movements of E-waste in Asia

The analysis results of TBM of E-waste in Asia are summarized as follows.

<Analysis Results>

- The major importer of E-waste is Japan. Japan has imported waste printed-circuit boards from the Philippines and electronic scrap from Thailand, Singapore, and the Philippines (Figs. 8, 10, and 11).
- The major exporters of E-waste are the Philippines and Thailand. The Philippines mainly exports waste printed-circuit boards to Japan. Thailand also exports E-waste mainly to Japan (Figs. 9, 10, and 11).
- In 2006 Malaysia and Singapore exported E-waste and the main importer was Thailand (Figs. 9 and 11).

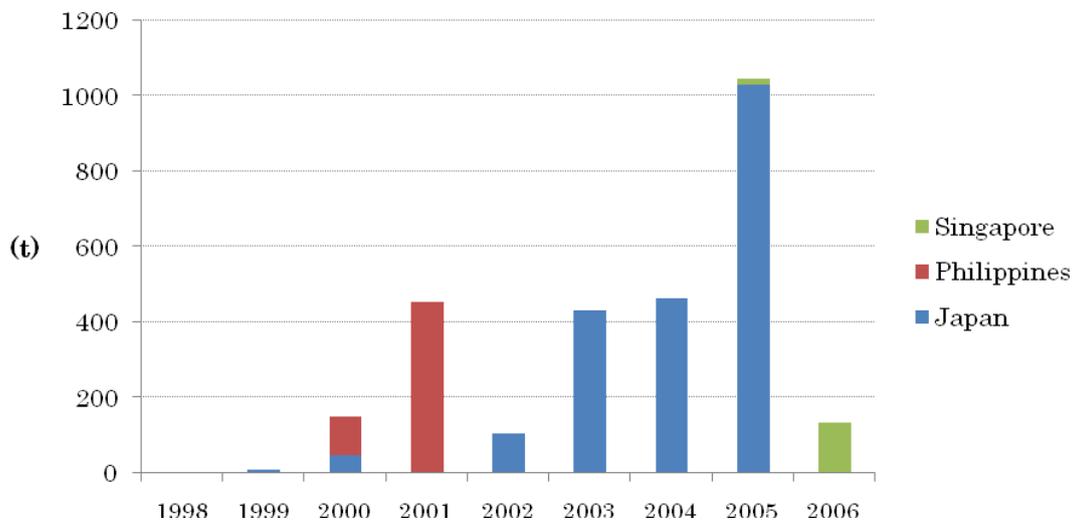


Fig. 8 Import of E-waste by Asian countries (1998 to 2006)

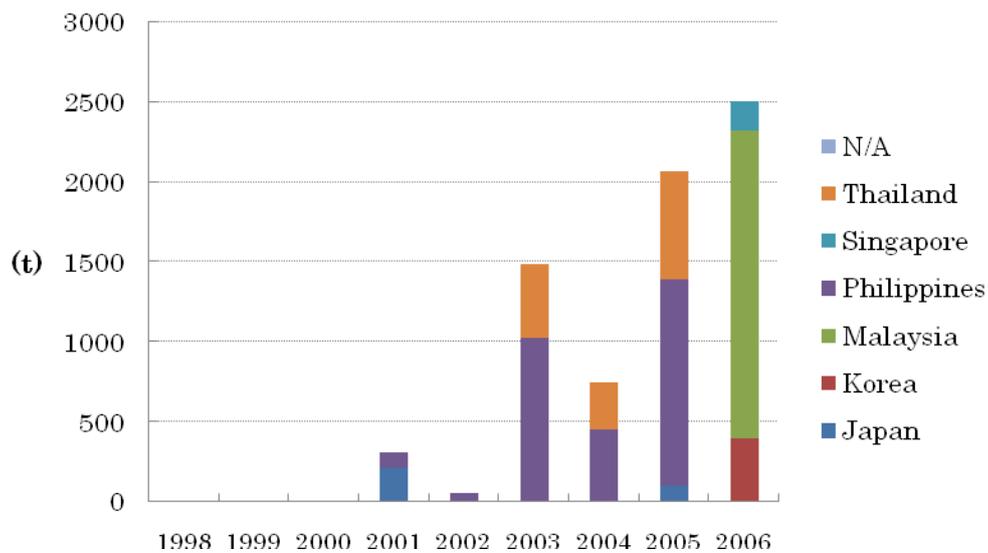


Fig. 9 Export of E-waste from Asian countries (1998 to 2006)

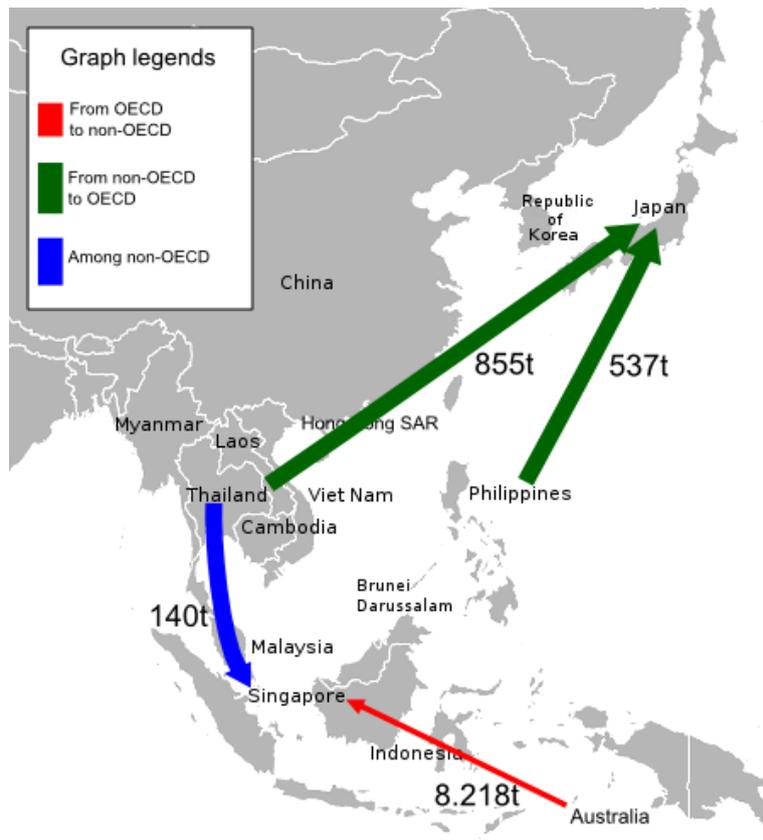


Fig. 10 TBM of E-waste in Asia (Import statistics: 2004 to 2006)

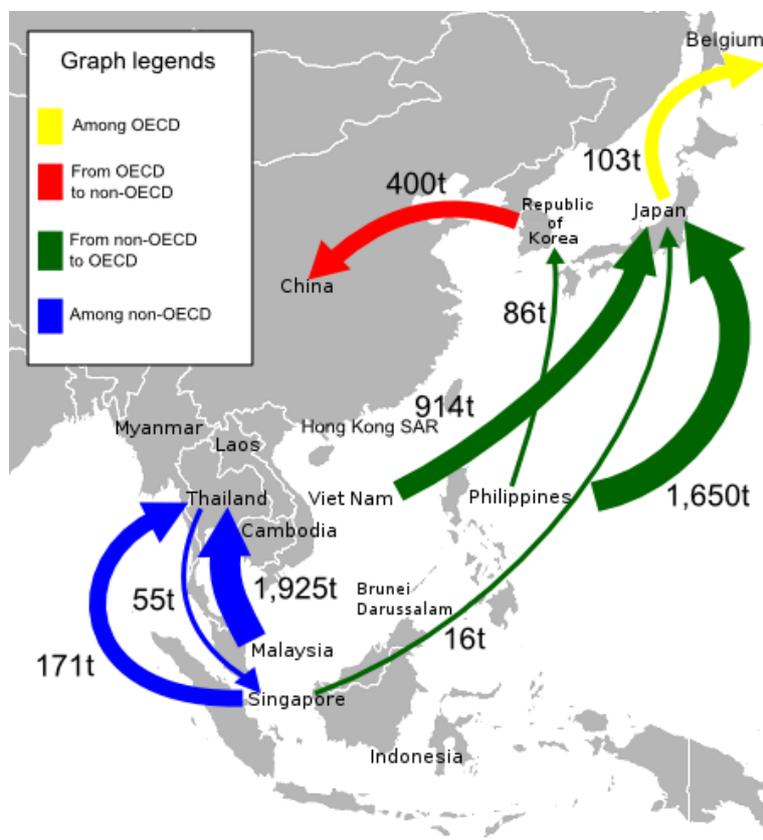


Fig. 11 TBM of E-waste in Asia (Export statistics: 2004 to 2006)

4.3 Transboundary movements of hazardous wastes by category in Asia

Based on the Basel Convention national reporting, this section analyzes TBM of hazardous wastes according to the category of hazardous wastes as shown below (for classification by category, refer to Appendix 4).

- ✧ Wastes that contain mercury or PCB and require special treatment (difficult-to-treat wastes)
- ✧ Metallic hazardous wastes mainly consisting of ferrous or nonferrous metals
- ✧ Other recyclable hazardous wastes to be used as raw material

Overview of transboundary movements of hazardous wastes by category in Asia

Overview of the transboundary movements of hazardous wastes by category is as follows.

<Analysis Results>

- The majority of import to the Asian countries is metallic hazardous wastes and other recycling wastes (Fig. 12).
- Metallic hazardous waste for recycling/reclamation of metals and metal compounds (R4) accounts for the major reason of export (Fig. 13).

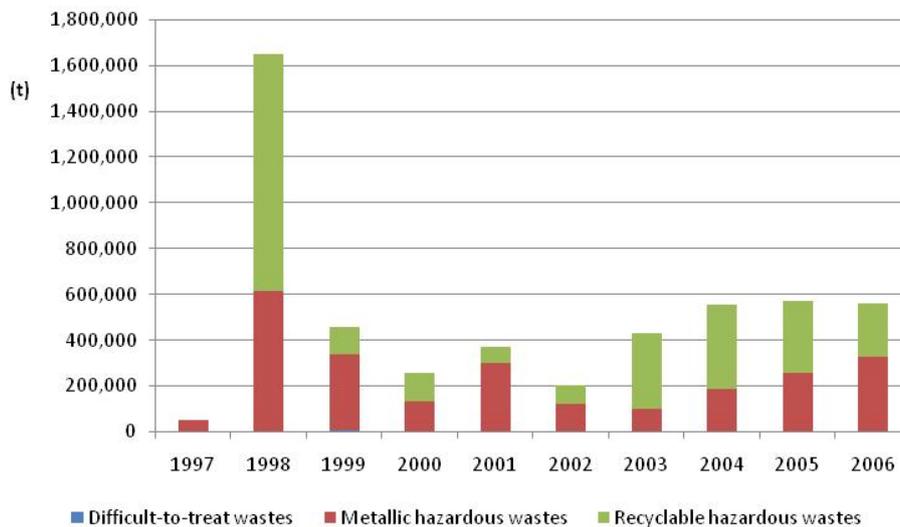


Fig. 12 Import of hazardous wastes by category by Asian countries (1997 to 2006)

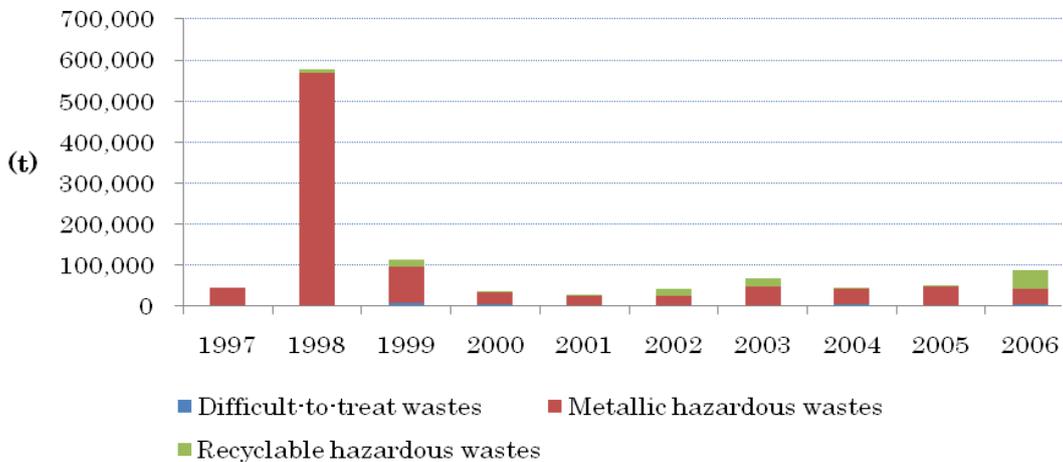


Fig. 13 Export of hazardous wastes by category from Asian countries (1997 to 2006)

Transboundary movements of difficult-to-treat wastes in Asia

The analysis results of TBM of difficult-to-treat wastes in Asia are summarized as follows.

<Analysis Results>

- In general, TBM of hazardous wastes requiring special treatment (e.g. wastes containing mercury or PCB) tended to decrease (Figs. 14 and 15). (In 1997 Republic of Korea imported more than 100 tons of waste fluorescent lamps from Germany).
- In recent years, the only importer of difficult-to-treat wastes within the region is Japan; the main imported waste is waste fluorescent lamps from the Philippines and other countries (Figs. 14 and 16).
- The major exporter of difficult-to-treat wastes from 1998 to 2001 was China; the country exported mercury wastes and PCB wastes to France and Finland for incineration (D10). In recent years the Philippines exported waste transformers and waste fluorescent lamps to EU countries for incineration (D10). Republic of Korea also exported PCB waste to Netherlands and France in 2005 and 2006 respectively (Figs. 15 and 17).

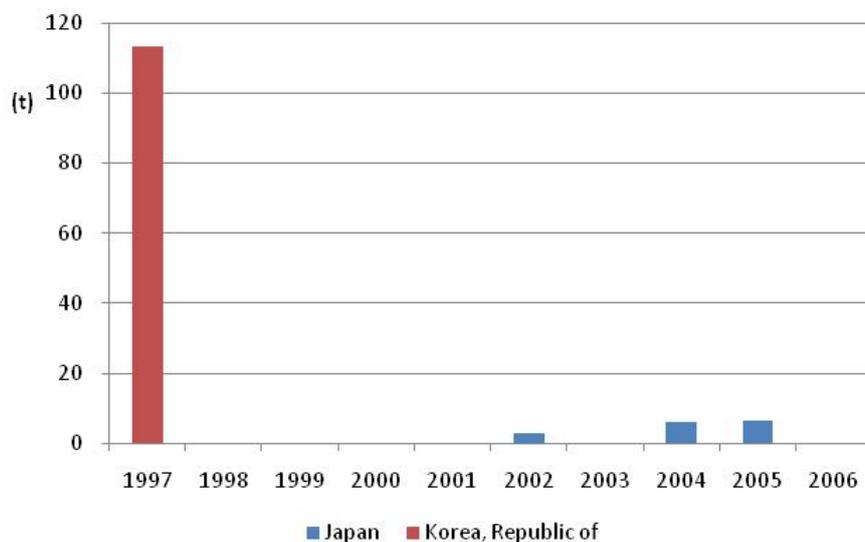


Fig. 14 Import of difficult-to-treat wastes by Asian countries (1997 to 2006)

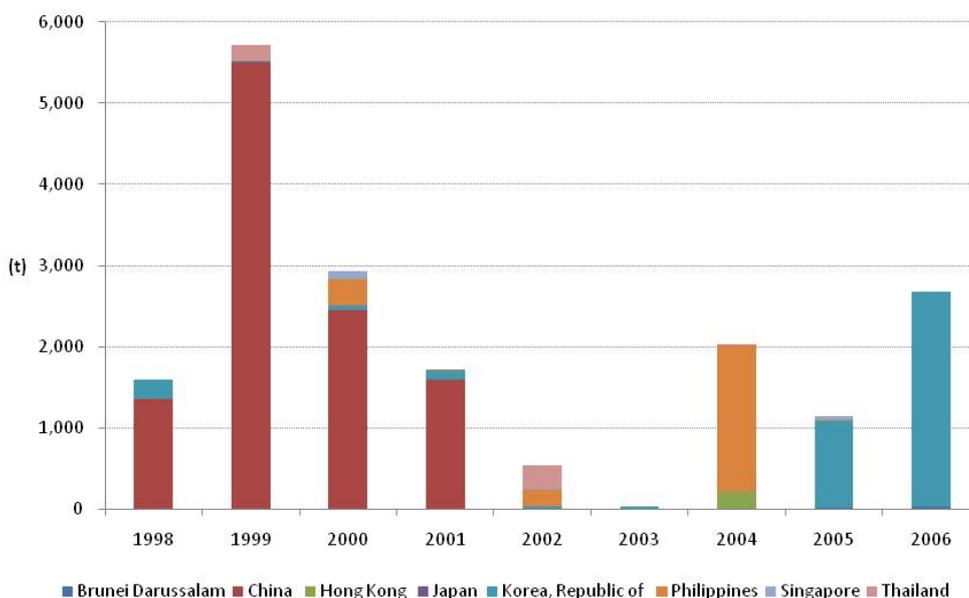


Fig. 15 Export of difficult-to-treat wastes from Asian countries (1997 to 2006)



Fig. 16 TBM of difficult-to-treat wastes in Asia (Import statistics: 2004 to 2006)

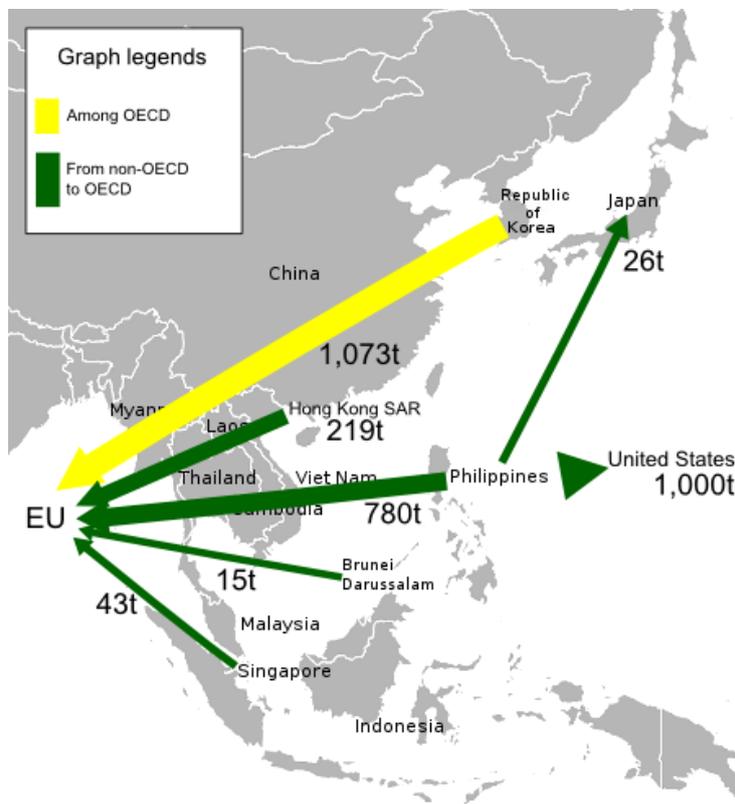


Fig. 17 TBM of difficult-to-treat wastes in Asia (Export statistics: 2004 to 2006)

Transboundary movements of metallic hazardous wastes in Asia

The analysis results of TBM of metallic hazardous wastes in Asia are summarized as follows.

<Analysis Results>

- Indonesia used to be the largest importer of metallic hazardous wastes, but in recent years Republic of Korea and the Philippines have increased the amount of import (Fig. 18).
- Waste lead-acid batteries account for a large proportion of metallic hazardous waste; over the nine years from 1997 to 2006 they accounted for 87% of the whole metallic hazardous wastes import.
- The amount of export in 1998 was extremely large due to the export of a massive amount of steel scale wastes from Republic of Korea to Taiwan and Japan (Fig. 19).
- Asia plays a role as an importer of metallic hazardous wastes in the world. When comparing the total figures for the years from 1997 to 2006 (excluding 1998), the amount of import is 3.4 times larger than that of export (Figs. 18 and 19).
- TBM of hazardous wastes for recycling of metal are quite active and many non-OECD countries functions as both importers and exporters (Fig. 20).

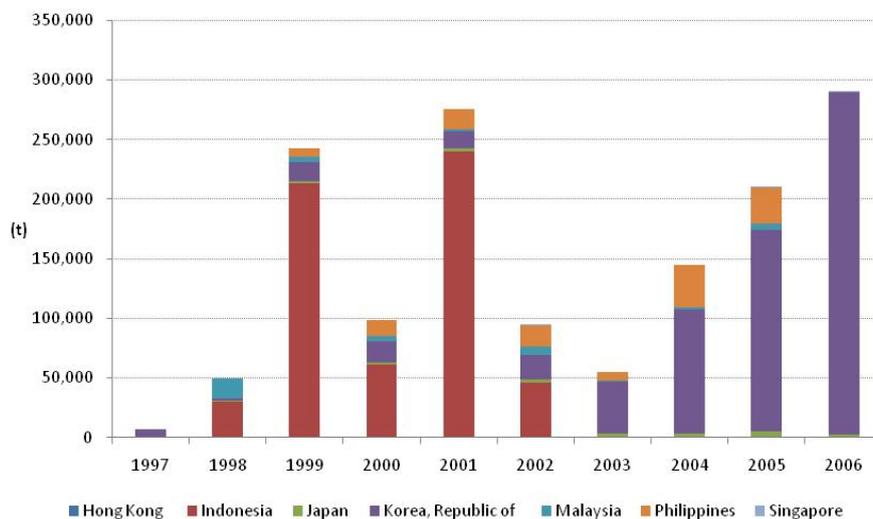


Fig. 18 Import of metallic hazardous waste by Asian countries (1997 to 2006)

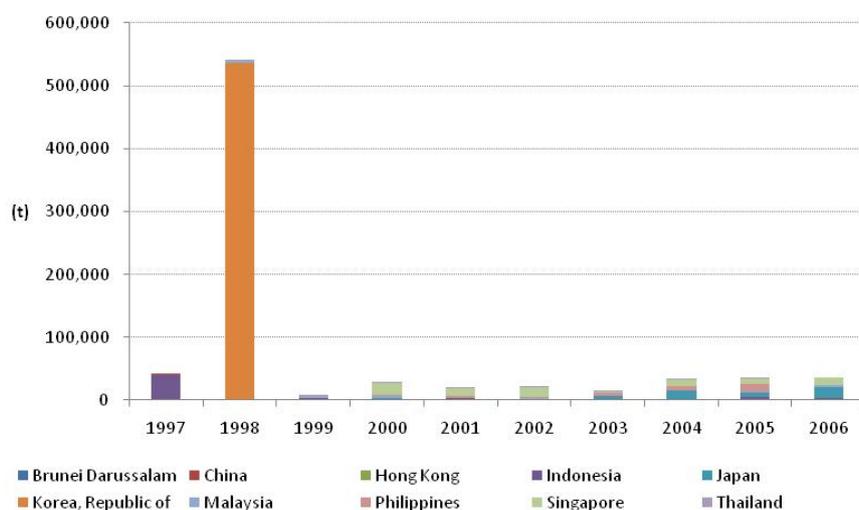


Fig. 19 Export of metallic hazardous waste from Asian countries (1997 to 2006)

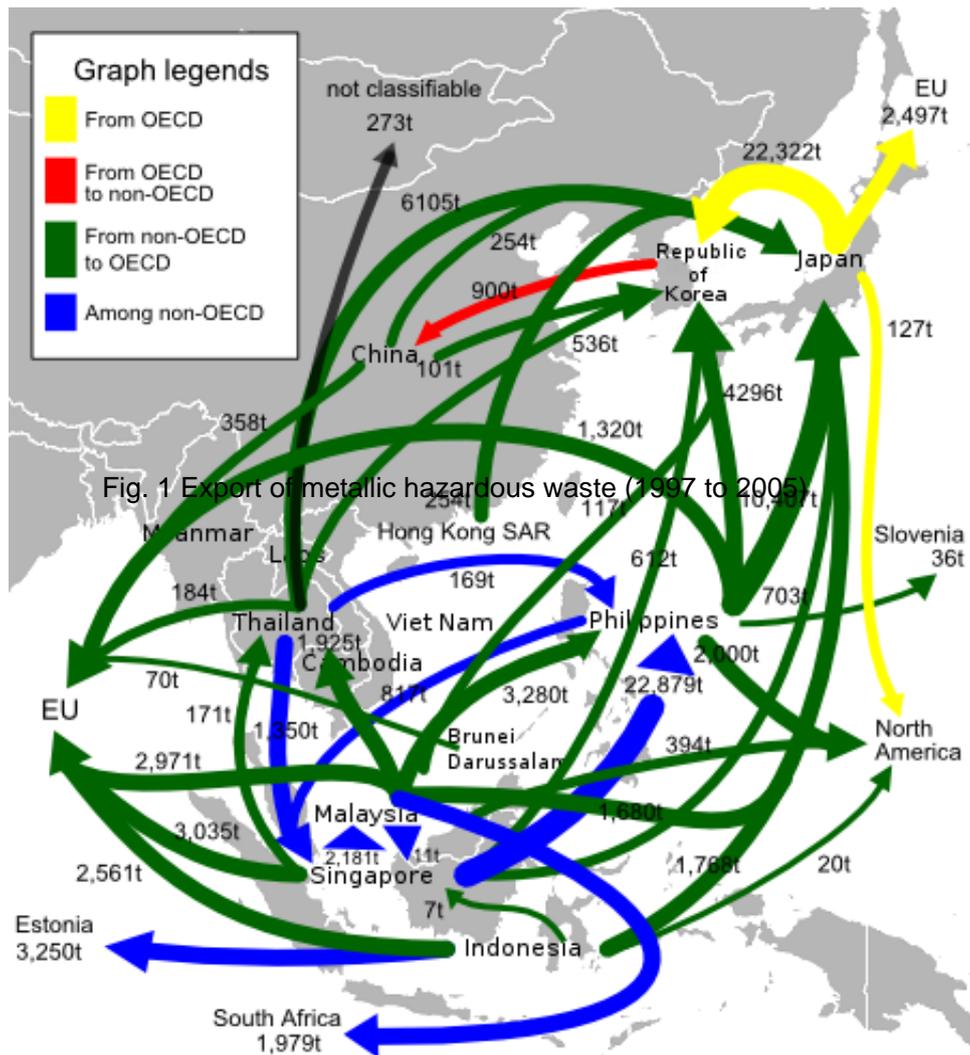


Fig. 20 TBM of metallic hazardous wastes in Asia (Export statistics: 2004 to 2006)

Transboundary movements of other recyclable hazardous wastes in Asia

The analysis results of TBM of other recyclable hazardous wastes in Asia are summarized as follows.

<Analysis Results>

- Import of blast furnace slag account for almost all of the total import of other recyclable hazardous wastes by weight (98.5% of the total import over the eight years from 1998 to 2005). All of them were imported from Japan, China, and Singapore to Malaysia (Fig. 21).
- The amount of export varies greatly according to the year and it is difficult to find any clear trends; China has exported such wastes in very large amount, e.g. blast furnace slag to Malaysia; and the Philippines has continuously exported them, e.g. waste OA equipment to Thailand and the US, and waste oil to EU countries (Figs. 22 and 24).
- In addition to OECD countries, imports to Thailand and the Philippines can be observed to be used as raw material (Figs. 23 and 24).

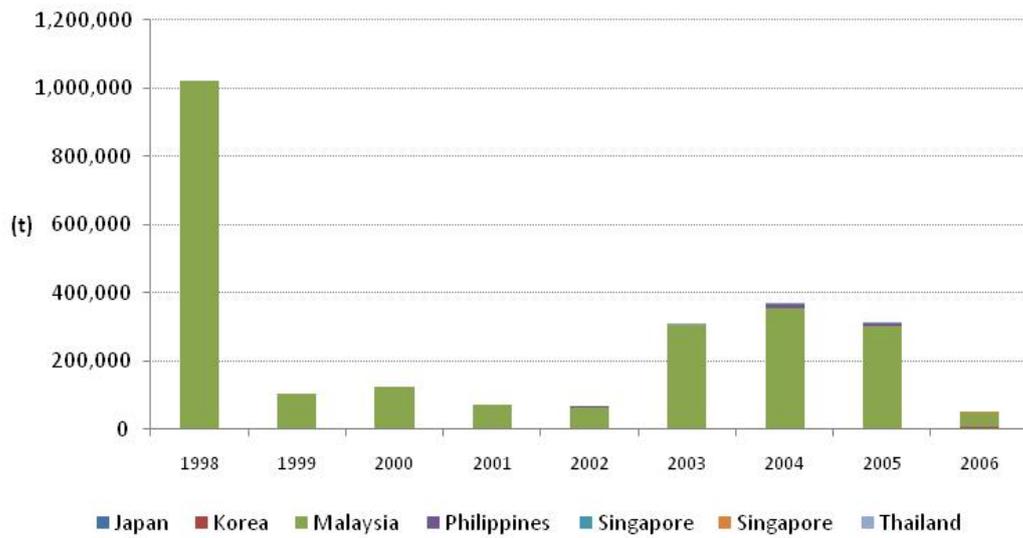


Fig. 21 Import of recyclable hazardous wastes by Asian countries (1998 to 2006)

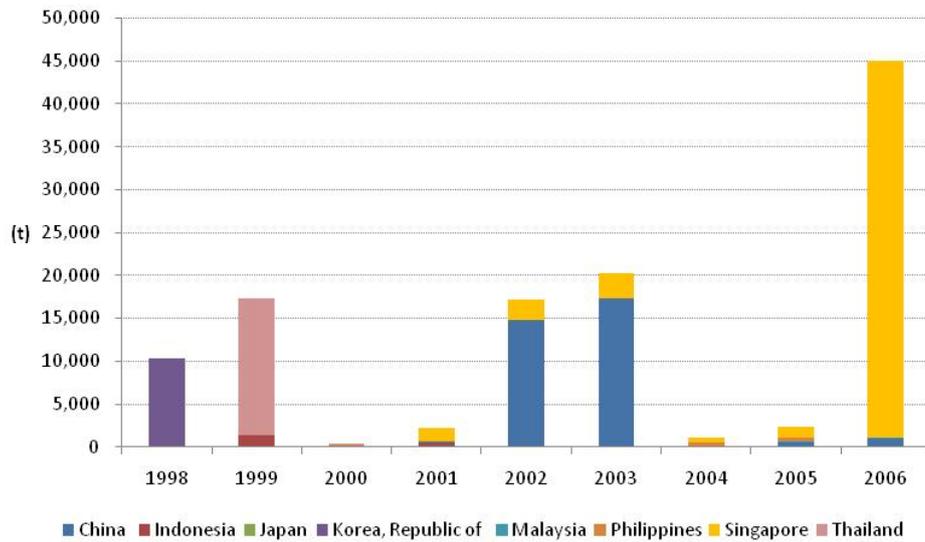


Fig. 22 Export of recyclable hazardous wastes from Asian countries (1998 to 2006)

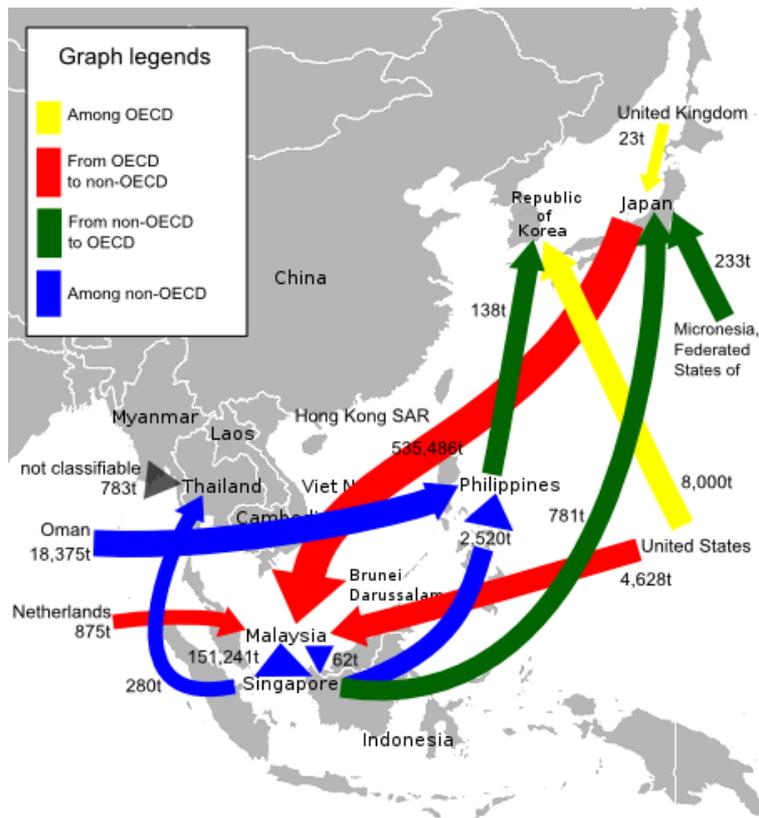


Fig. 23 TBM of recyclable hazardous wastes in Asia (Import statistics: 2004 to 2006)

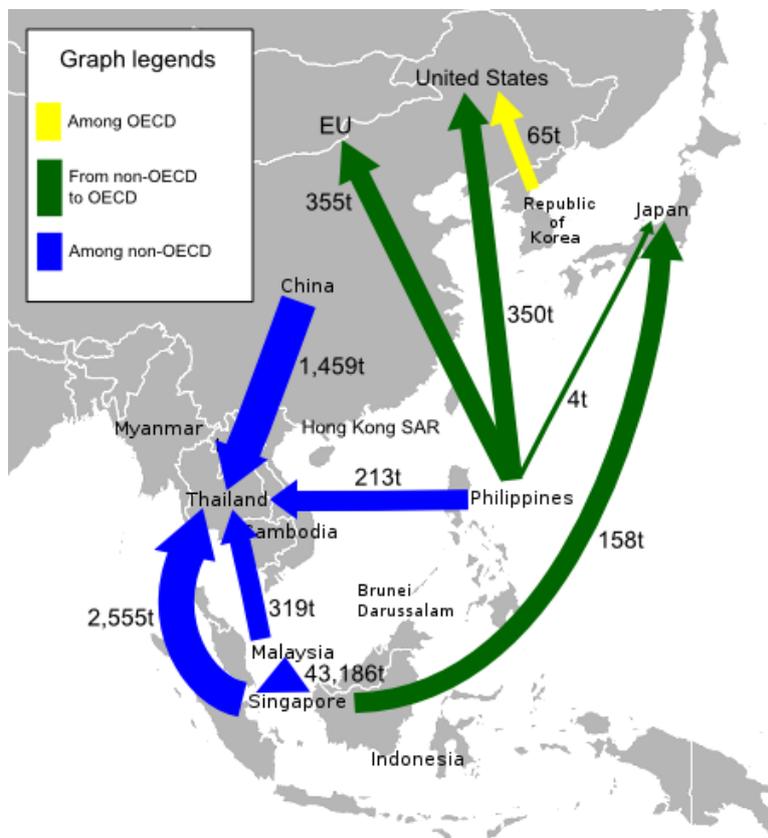


Fig. 24 TBM of recyclable hazardous wastes in Asia (Export statistics: 2004 to 2006)

Estimate of transboundary movements of used electrical and electronic equipment

Based on the World Trade Atlas data, a survey was conducted in 2008 to estimate the amount of TBM of used EEE among Asian countries/regions. This section summarizes the estimated results not by weight but by quantity targeting on the products below:

| Product | HS code |
|------------------|---------|
| Color TV sets | 85.2812 |
| Air conditioners | 84.1510 |
| Refrigerators | 84.1810 |
| Washing machines | 84.5011 |
| Desktop PCs | 84.7141 |
| Laptop PCs | 84.7130 |

The TBM of secondhand products are not distinguished from those of new products in the current trade statistics. For this reason, the following assumption was used to estimate the amount of TBM of used EEE: products were assumed to be used EEE when their average unit price (USD/unit) in export statistics is cheaper than that of the secondhand products of the same kind traded in local markets of the importing country/region.

In their efforts to overcome the uncertainty in estimation and to have better control targeted to used EEE, Japan developed a specific domestic HS code to distinguish used EEE from new products depending on whether or not they are individually packaged for retail sale.

<Analysis Results>

- For all types of used EEE, considerable amount of TBM of used EEE has been observed not only from OECD countries to non-OECD countries, but also among non-OECD countries. At present, non-OECD countries are also exporters of used EEE in the region (Figs. 25 to 30).
- Combinations of exporting and importing countries differ according to the type of products. Some countries are both importers and exporters of the same products.
- Significant amounts of used EEE, e.g. used color TV sets, are exported to countries/regions such as Hong Kong SAR and Singapore; most of them are considered to be re-exported to other countries.

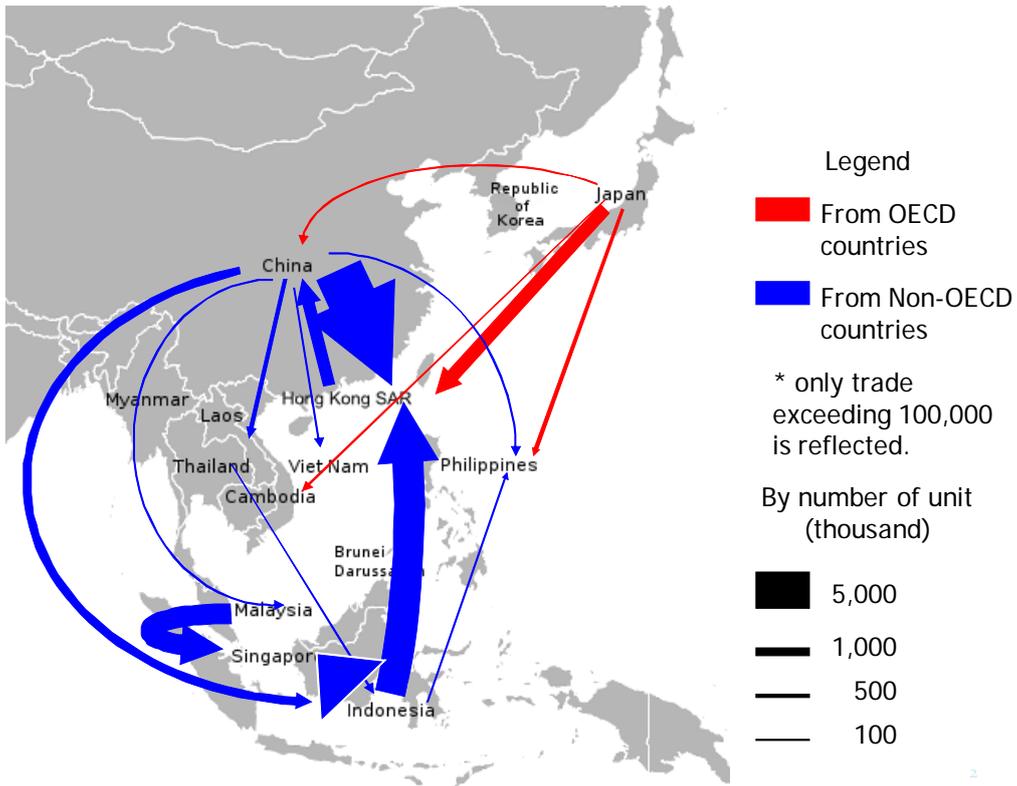


Fig. 25 Estimate of TBM of used color TV sets in Asia (Export statistics: 2006)

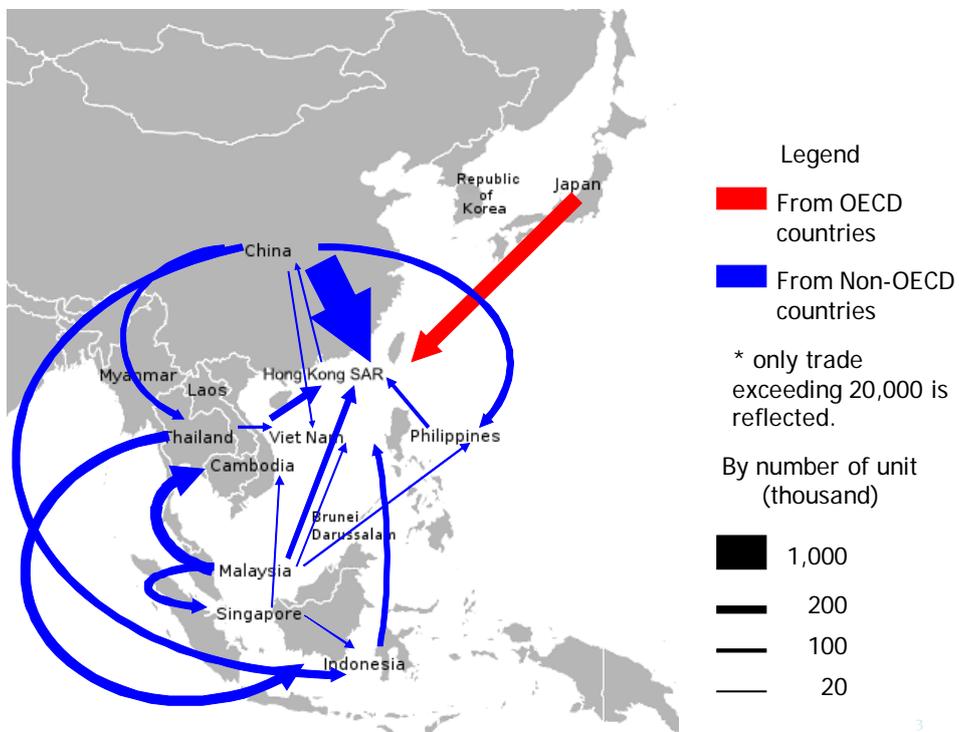


Fig. 26 Estimate of TBM of used air conditioners in Asia (Export statistics: 2006)

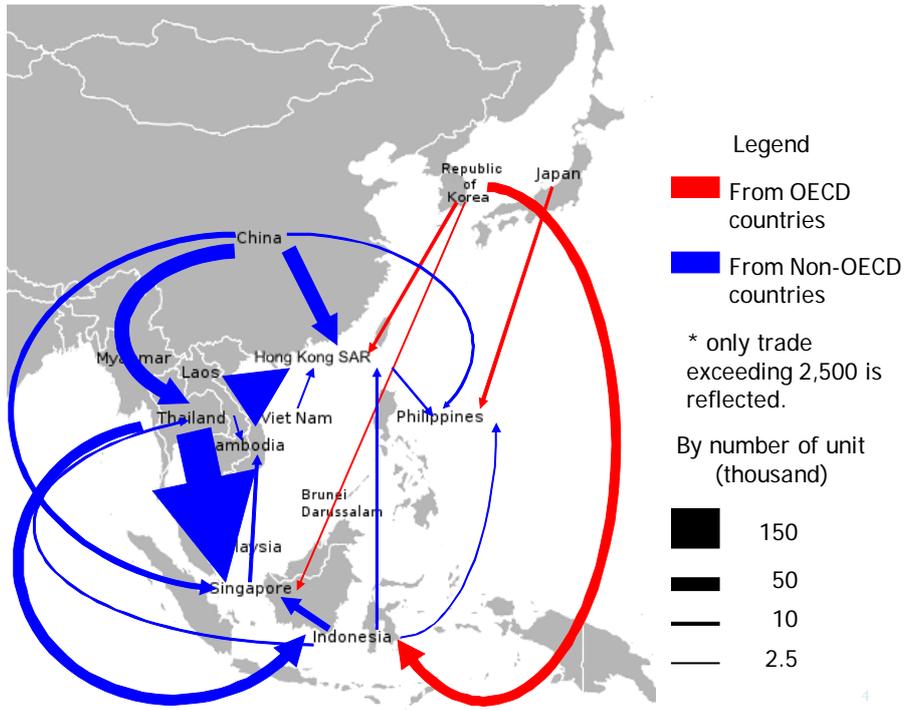


Fig. 27 Estimate of TBM of used refrigerators in Asia (Export statistics: 2006)

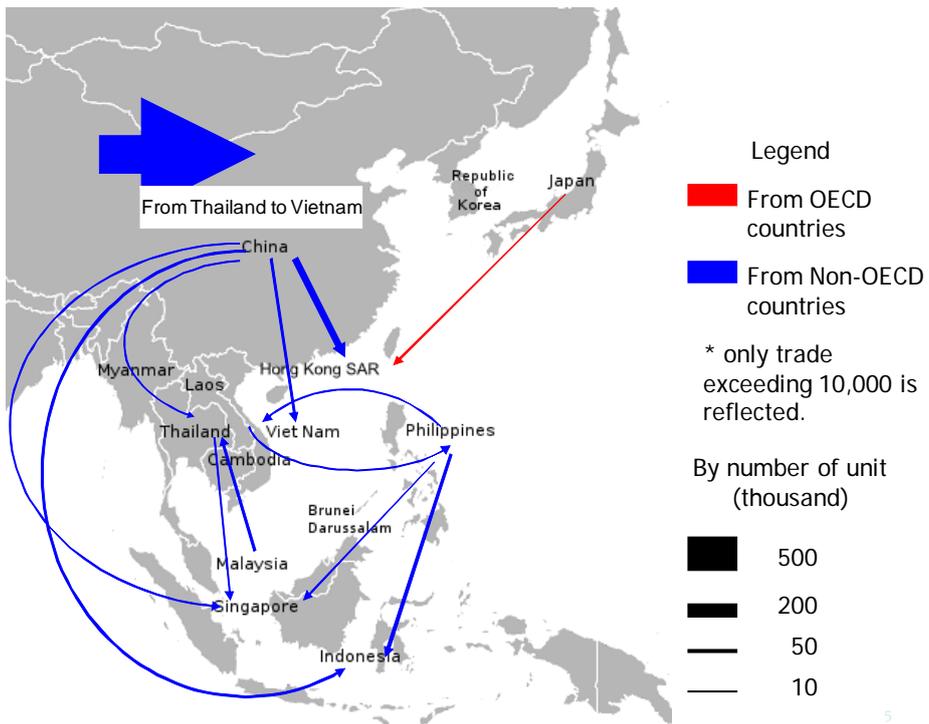


Fig. 28 Estimate of TBM of used washing machines in Asia (Export statistics: 2006)

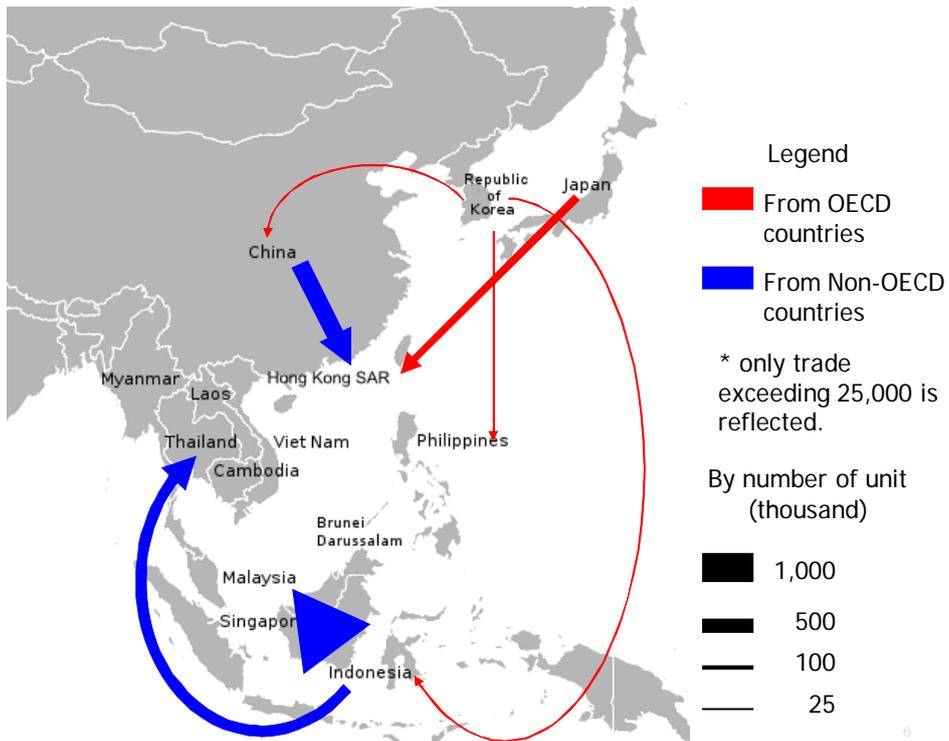


Fig. 29 Estimate of TBM of used desktop PCs in Asia (Export statistics: 2006)

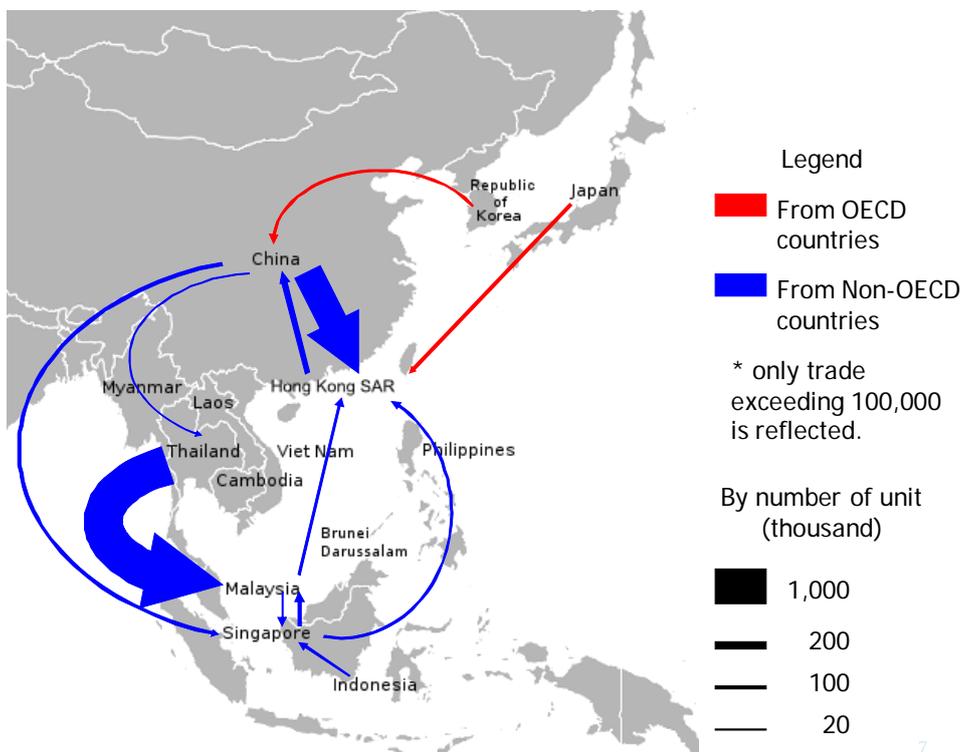


Fig. 30 Estimate of TBM of used laptop PCs in Asia (Export statistics: 2006)

Appendix 1

Examples of Facilities That Recycle and Treat Hazardous Wastes and Other Wastes in Asian Non-OECD Countries

Exclusion Clause

Information described in this appendix was based on interviews with recyclers, exporters, government officials, etc., and due attention was paid to the accuracy of the information. However, it may contain outdated or inaccurate information to some extent.

Appendix 1-1 Indonesia: examples of recycling and treatment facilities of hazardous wastes

| Name of facility | Region | Treatment method and treated amount |
|----------------------------------|-----------------------------------|---|
| PT.PPLI | Cileungsi,Bogor | Treatment and disposal of hazardous wastes by stabilizing, solidifying, incinerating, and landfilling Disposal amount in 2004: 4.8 tons |
| PTJawaPower | DesaCilangkap, Curug-Prwakarta | Disposal facility that landfills fly ash Disposal amount in 2004: 108,800 tons |
| PT.PaitonEnergy | | Disposal of ash and WWTP sludge Disposal amount in 2004: 66,600 tons |
| Tanjung Enim Lestari | Muar a Enim, South Sulawesi | Landfill of ash, sand, dreg/grits, serene reject, and sludge generated by the company Disposal amount in 2004: 39,000 tons |
| Lontar PapyrusPulp and Paper | TanjungJabung, Jambi | Landfill of ash, grit/dreg, and serene rejects generated by the company |
| IndoBharatRayon | Jakarta | Landfill of sludge generated by the company Disposal amount in 2004: 18,500 tons |
| WGI | Cibitung Bakagitel | Waste oil refining |
| Teknotama LingkunganInternusa | LippoKarawachi, Tnagerang | Recovery of acid solution |
| AgipLubrindo | Jakarta | Waste oil refining |
| MultimadyaNiaga Pratama | East Jakarta | Recovery of waste solvent |
| HanwaKimia Indonesia | LippoCikarang, Bekasi | Recovery of copper chloride, zinc ash, and Zn blowing |
| Wastec International | Cilegon, Banten | The facility started operation in 2004. It incinerates sludge from effluent treatment facilities and paint sludge and other wastes from the paint industry. |

Sources:

Homepage of the Secretariat of the Basel Convention “Country Fact Sheet”

Institute of Developing Economies, Japan External Trade Organization: “Fiscal Year 2005 Report of Information Provision Projects Concerning Industrial Wastes and Recycling Policies in Asian Countries” (2007)

EX Corporation: “Fiscal Year 2007 Report of the Project on the Examination of Policies for Promoting Appropriate Treatment of Wastes in Asian Countries” (2007)

Appendix 1-2 Malaysia: examples of waste treatment facilities approved by
Department of Environment (DOE), Ministry of Natural Resources and Environment

| Facility name and address | Treatment method and process | D Code |
|--|--|--------|
| Trienekens (Sarawak) Sdn. Bhd., Sarawak | Solidification | - |
| | Incineration | D10 |
| | Landfill site for domestic wastes and Industrial wastes | D5 |
| | Off-site storage | D15 |
| Tensidchem Sdn. Bhd., Pelabuhan Klang, Selangor | Waste oil | R9 |
| | Waste solvent | |
| | Recycling of waste containers that contain unprocessed raw materials | |
| Techno Indah Sdn. Bhd., Pasir Gudang, Johor | Off-site recycling of oil mud and contaminated oil from tankers | R9 |
| Syarikat Perniagaan Liang Seng, Klang, Selangor | Off-site recycling of nonorganic halogen waste solvent, wastes or materials specified for off-site treatment, ink, coloring agent, and paint | R2, R5 |
| Southern Cement Industries Sdn. Bhd., Pasir Gudang, Johor | Off-site recycling of calcium sulfate mud | R5 |
| Sinohydro Corporation (M) Sdn. Bhd., Belaga, Sarawak | Off-site recycling of materials that use fly ash | R4 |
| Positive Chemical Sdn. Bhd., Pasir Gudang, Johor | Waste solvent | R2, R6 |
| | Waste copper chloride | |
| | Waste alkali | |
| | Waste acid | |
| | Recycling of off-site waste ferric chloride | |
| Metal Reclamation (Industries) Sdn. Bhd., Klang, Selangor | Waste ammoniac chloride solution | R4 |
| | Oxide generated in the process of metal dissolution, slag, ash, dust, or dust generation-controlling systems | |
| | Oxidized dross | |
| | Recycling of undetermined wastes or batteries and metallic hydroxide mud discharged from battery plants | |
| Boral Plasterboard (M) Sdn. Bhd., Parit Buntar, Perak | Off-site recycling of waste plaster discharged from power plants | R11 |
| Kualiti Alam Sdn. Bhd., Port Dickson, N. Sembilan | Physical and chemical treatment site | D9 |
| | Solidification | - |
| | Incineration | D10 |
| | Landfill site for domestic wastes and Industrial wastes | D5 |
| | Off-site storage | D15 |
| Associated Pan Malaysia Cement Sdn. Bhd., Kanthan Works, Perak | Off-site recycling of iron hydroxide and calcium sulfate mud | R5 |
| | Siliceous mud | R5 |
| | Phenol resin paper | R5 |
| | Off-site recycling of aluminum hydroxide mud | R5 |
| | Fiber mud | R5 |
| | Copper slag | R5 |
| | Aluminum hydroxide powder | R5 |
| Alumina filter solid mud | R5 | |

Source: Recycle One, Inc.: "Fiscal Year 2008 Report of an Examination Concerning the Validity Evaluation of the Basel Convention Including 1995 Amendment and Review of the Strategic Plan" (2008)

Appendix 1-3 Malaysia: examples of full recovery facilities for e-waste treatment approved by Department of Environment (DOE)¹³, Ministry of Natural Resources and Environment

| Facility name | Treatment method | Item to be treated |
|---|--|---|
| Victory Recovery Sdn. Bhd. | Crushing, recycling | Waste electronic appliances |
| | Recycling | Solder paste/solder dross |
| | | Waste container, packing material, waste office equipment |
| | Recovery of resources | Metallic hydroxide sludge |
| | | Silver paste |
| Waste alkali solution (containing cyanogen) | | |
| Incineration | Wastes related to photographic development | |
| TES-AMM (Malaysia) Sdn. Bhd. | Recycling, recovery of resources | Fiber waste, wastepaper |
| | | Waste electronic appliances |
| | Recovery of resources | Waste electronic appliances containing PCB |
| | | Cinders, slag, soot and dust (containing precious metals) |
| | | Waste alkali solution (containing precious metals) |
| | | Waste chromic acid solution (containing precious metals) |
| | | Wastes related to photographic development |
| Solder dross | | |

Source: EX Corporation: "Fiscal Year 2007 Report of the Project on the Examination of Policies for Promoting Appropriate Treatment of Wastes in Asian Countries" (2007)

¹³ Malaysia's DOE approves facilities that only disassemble, separate, and crush e-wastes as partial recovery facilities, and facilities that also recover precious metals in addition to the aforementioned treatment as full recovery facilities. As of October 2009, the DOE approved 16 companies in addition to the two mentioned in the table above as full recovery facilities.

(<http://www.doe.gov.my/files/bahanberbahaya28/pdf/contractors/B1.pdf>)

Appendix 1-4 The Philippines: examples of recycling and treatment facilities
of hazardous wastes

| Facility name | Item to be treated | Treatment method |
|---|--|---|
| INCHEM Environmental, Inc. | Waste acid, waste alkali, inorganic chemical wastes, cyanogen-containing wastes, waste oil, waste organic solvent, ink, paint, etc. | The company has no facilities for disposing of stabilized residues, and monitors hazard levels by using TCLP tests, before disposal at general landfill sites. |
| Cleanway Technology Corporation | Waste acid, waste alkali, medical wastes, inorganic and organic chemical wastes, waste organic solvent, paint, plate-processed effluent, sludge such as resin and adhesive, cyanogen-containing wastes | The company treats wastes physically and chemically, solidifies them, and then disposes of any treated waste residues. It is now developing a waste-receiving system. |
| D.H. Lijauco Enterprises | Dehydrated fuel oil | Recycling |
| Geosphere Industrial Services 3RTC Facility | Waste alkali, wastes containing organic and inorganic substances, waste oil, contaminated containers | Incineration heat treatment, recycling |
| HARESHIAN PLASTIC INDUSTRIES CORPORATION | Processed plastic wastes | Recycling |
| HAZCHEM, Inc. | Contaminated water generated through metal production, sludge, waste substrates | Treatment, recycling |
| HI-PROVITE INDUSTRY, INC. | Waste oil, sludge | Incineration heat treatment, storage, disposal, recycling |
| Maritrans Recycler, Inc. - LAGUNA | Waste solvent | Recycling |
| | Waste oil | Recycling |
| Maritrans Recycler, Inc. - CEBU | Waste organic solvent | Recycling |
| MR. OILY TRADING | Waste oil | Recycling |
| O.M. Manufacturing Philippines, Inc. | Solder dross | Recycling |
| Orin Chem Industrial Corporation | Copper chloride, zinc ash, zinc, dust | Recycling |
| Petromine (M) SDN. BHD. | Waste oil | Recycling |
| | Sludge | Recycling |
| Philippine Recyclers, Inc. | Storage batteries | Recycling |
| Philippine Sinter Corporation | Waste oil | Recycling |
| Sacred Heart Scrap Trading | Waste oil | Wastes are recycled as fuel. |
| | Waste oil | Wastes are recycled as fuel. |

Source: Recycle One, Inc. "Fiscal Year 2008 Report of an Examination Concerning the Validity Evaluation of the Basel Convention Including 1995 Amendment and Review of the Strategic Plan" (2008)

Appendix 1-5 Thailand: number of recycling and treatment facilities of industrial wastes approved by the Department of Industrial Works, Ministry of Industry

| | |
|---|-------------|
| Treatment facility (101) | 139 |
| Wastewater treatment facilities | 110 |
| Incinerator | 29 |
| Common incinerators | 9 |
| Incinerators for non-industrial/infectious/non-hazardous wastes | 18 |
| Incinerators for hazardous wastes | 2 |
| Segregation/Disposal facility (105) | 962 |
| Segregation facilities | 940 |
| Landfill sites for non-hazardous wastes | 18 |
| Landfill sites for hazardous wastes | 4 |
| Recycling facility (106) | 255 |
| Total number of facility (101, 105, 106) | 1356 |

Note: The data is as of February 2009.

Source: Recycle One Inc.: "Fiscal Year 2008 Report of an Examination Concerning the Validity Evaluation of the Basel Convention Including 1995 Amendment and Review of the Strategic Plan" (2008)

Appendix 1-6 Thailand: examples of waste treatment facilities

| Facility Name | Treatment method | Item to be treated |
|--|---|---|
| Siam City Cement Public Co., Ltd. (Geocycle) | Cement raw material | Various items |
| | Cement fuel | Fly ash, dust |
| | Cement fuel (in paste form) | Various items |
| | Mixing, cement fuel | Various items |
| | Crushing, cement fuel | Various items |
| Umicore Precious Metals (Thailand) Ltd. | Recycling (electrolysis) | Waste jewelry (silver) |
| | | Waste jewelry (gold) |
| Recycle Engineering Co., Ltd. | Recycling (distillation, quality improvement) | Wastes generated from the cleaning process and by-products from petrochemical processes |
| Professional Waste Technology (1999) Co., Ltd. | Solidification | Wastes containing eluting materials |
| | | Processed residues |
| | Mixed fuel | Waste lubricant |

Source: EX Corporation: "Fiscal Year 2007 Report of the Project on the Examination of Policies for Promoting Appropriate Treatment of Wastes in Asian Countries" (2007)

Appendix 1-7 Vietnam: examples of waste treatment facilities

| Facility name | Treatment method | Item to be treated |
|---|-------------------------------------|---------------------------------|
| Hanoi Urban Environment Co. (URENCO) | Incineration | Oil mud |
| | | Paint sludge |
| | | Waste rags |
| | Physical and chemical treatment | Waste oil |
| | | Copper chloride (II) solution |
| | | Waste sulfuric acid |
| | Landfill | Inorganic sludge |
| Solidification, landfill | Sludge | |
| Development Resources & Environmental Technology Joint Stock Co. (DRET) | Cement raw material | Incineration ash, slag |
| | Cement fuel | Waste oil, waste solvent |
| | Incineration | Sludge |
| | | Sludge |
| | | Sludge after effluent treatment |
| Thanh Cong Construction Material Manufacturing Co.Ltd. | Cement raw material and cement fuel | Bottom ash |
| | | Sludge |
| | | Paint residue |
| | | Emery sand for polishing |
| | | Petroleum waste |

Source: EX Corporation: "Fiscal Year 2007 Report of the Project on the Examination of Policies for Promoting Appropriate Treatment of Wastes in Asian Countries" (2007)

Appendix 2

Import and Export of Hazardous Wastes by Asian Countries/Regions (1997 to 2006)

Appendix 2-1 Import of hazardous wastes by Asian countries/regions: 1997 to 2006

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 10 Year Total |
|-------------------|-------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| Brunei | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Cambodia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| China | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Hong Kong SAR | 0 | 0 | 16 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 61 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Indonesia | 15 | 30,385 | 212,810 | 61,069 | 240,220 | 46,332 | 0 | 0 | 0 | 0 | 590,831 |
| | 0.2% | 2.8% | 61.3% | 27.6% | 69.6% | 29.1% | 0.0% | 0.0% | 0.0% | 0.0% | 14.7% |
| Japan | 0 | 786 | 1,939 | 3,924 | 4,326 | 2,505 | 4,815 | 3,971 | 5,419 | 4,314 | 31,999 |
| | 0.0% | 0.1% | 0.6% | 1.8% | 1.3% | 1.6% | 1.3% | 0.8% | 1.0% | 0.9% | 0.8% |
| Republic of Korea | 6,787 | 5,581 | 16,264 | 17,380 | 14,338 | 20,453 | 44,190 | 104,688 | 168,430 | 295,618 | 693,730 |
| | 99.8% | 0.5% | 4.7% | 7.9% | 4.2% | 12.8% | 12.2% | 20.5% | 32.4% | 62.6% | 17.3% |
| Malaysia | 0 | 1,034,000 | 108,957 | 125,875 | 69,942 | 70,763 | 305,398 | 354,390 | 306,646 | 172,151 | 2,548,122 |
| | 0.0% | 96.6% | 31.4% | 56.9% | 20.3% | 44.4% | 84.4% | 69.3% | 59.0% | 36.5% | 63.4% |
| Philippines | 0 | 0 | 7,274 | 12,973 | 16,470 | 19,338 | 6,481 | 48,006 | 38,515 | 0 | 149,056 |
| | 0.0% | 0.0% | 2.1% | 5.9% | 4.8% | 12.1% | 1.8% | 9.4% | 7.4% | 0.0% | 3.7% |
| Singapore | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 162 | 205 | 372 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Thailand | 0 | 0 | 0 | 0 | 0 | 0 | 894 | 420 | 645 | 0 | 1,959 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.1% | 0.1% | 0.0% | 0.0% |
| Vietnam | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total | 6,802 | 1,070,752 | 347,260 | 221,221 | 345,341 | 159,396 | 361,778 | 511,475 | 519,817 | 472,288 | 4,016,129 |

Upper row figures refer to import amount (t/year), and percentages on the lower refer to import by the country against total import of surveyed countries in each year (%)

Appendix 2-2 Export of hazardous wastes by Asian countries/regions: 1997 to 2006

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 10 Year Total |
|-------------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|
| Brunei | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 30,225 44.4% | 70 0.2% | 15 0.0% | 30 0.0% | 30,340 2.8% |
| Cambodia | 0 0.0% | 0 0.0% | 61 0.1% | 0 0.0% | 61 0.0% |
| China | 0 0.0% | 1,351 0.2% | 6,800 6.1% | 2,970 8.6% | 2,841 10.7% | 14,770 34.8% | 17,559 25.8% | 322 0.8% | 776 1.6% | 1,074 1.2% | 48,463 4.5% |
| Hong Kong SAR | 0 0.0% | 0 0.0% | 451 0.4% | 376 1.1% | 0 0.0% | 0 0.0% | 0 0.0% | 219 0.5% | 254 0.5% | 0 0.0% | 1,300 0.1% |
| Indonesia | 40,339 88.7% | 235 0.0% | 3,603 3.2% | 1,977 5.7% | 2,100 7.9% | 550 1.3% | 269 0.4% | 760 1.8% | 4,218 8.6% | 2,883 3.3% | 56,936 5.3% |
| Japan | 1,262 2.8% | 1,544 0.3% | 2,926 2.6% | 1,539 4.5% | 1,515 5.7% | 824 1.9% | 6,511 9.6% | 14,057 33.9% | 6,766 13.8% | 17,357 19.9% | 54,300 5.0% |
| Republic of Korea | 3,862 8.5% | 566,316 98.0% | 44 0.0% | 60 0.2% | 114 0.4% | 32 0.1% | 27 0.0% | 0 0.0% | 1,638 3.3% | 3,050 3.5% | 575,144 53.0% |
| Malaysia | 0 0.0% | 8,626 1.5% | 5,186 4.7% | 4,947 14.4% | 2,675 10.0% | 3,110 7.3% | 2,362 3.5% | 3,354 8.1% | 5,224 10.6% | 5,806 6.7% | 41,290 3.8% |
| Philippines | 0 0.0% | 0 0.0% | 176 0.2% | 2,773 8.1% | 2,918 10.9% | 4,335 10.2% | 6,028 8.9% | 9,655 23.3% | 14,016 28.5% | 0 0.0% | 39,900 3.7% |
| Singapore | 0 0.0% | 0 0.0% | 23 0.0% | 19,549 56.9% | 14,354 53.8% | 18,095 42.6% | 4,195 6.2% | 10,942 26.4% | 9,699 19.7% | 57,071 65.4% | 133,928 12.3% |
| Thailand | 0 0.0% | 76 0.0% | 92,164 82.7% | 193 0.6% | 142 0.5% | 713 1.7% | 915 1.3% | 2,089 5.0% | 6,532 13.3% | 0 0.0% | 102,824 9.5% |
| Vietnam | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% |
| Total | 45,463 | 578,148 | 111,434 | 34,384 | 26,660 | 42,428 | 68,092 | 41,468 | 49,138 | 87,272 | 1,084,487 |

Upper row figures refer to export amount (t/year), and percentages on the lower refer to export by the country against total export of surveyed countries in each year (%)

Appendix 3

Import and Export of Individual Type of Hazardous Wastes by Asian Countries/Regions

Appendix 3-1 Import of individual type of hazardous wastes by Asian countries/regions (Unit: t/year)

| Waste type | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Total | Percentage (%) |
|---------------------------------|-------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|----------------|
| Blast furnace slag | | 600,000 | 104,917 | 93,673 | 31,765 | 29,940 | 252,007 | 293,684 | 241,872 | | 1,647,859 | 41.0% |
| Waste lead-acid batteries | | 30,385 | 235,008 | 90,836 | 266,966 | 68,431 | 6,000 | 137,025 | 182,320 | 280,200 | 1,297,170 | 32.3% |
| Copper slag | | 417,000 | | 27,254 | 36,611 | 33,945 | 52,283 | 58,723 | 58,774 | 33,674 | 718,264 | 17.9% |
| Lead | 800 | 261 | 19 | 240 | 950 | 15,798 | 43,772 | 1,021 | 13,370 | 3,898 | 80,129 | 2.0% |
| Waste catalysts | 5,889 | 17,224 | 4,423 | 4,999 | 1,565 | 6,878 | 1,108 | 1,108 | 6,000 | | 49,194 | 1.2% |
| Waste oil | | | | | | 1,434 | | 12,203 | 8,925 | | 22,562 | 0.6% |
| CRT glass | | | | 2,005 | 1,739 | 98 | 2,828 | 903 | 182 | 12,766 | 20,521 | 0.5% |
| Other metals | | 28 | 1,199 | 47 | 3,385 | 1,249 | 885 | 2,846 | 2,157 | 480 | 12,276 | 0.3% |
| Copper | | 39 | 8 | 1,113 | 1,301 | 935 | 1,474 | 1,476 | 1,382 | 2,260 | 9,988 | 0.2% |
| Waste NiCad batteries | | 1,139 | 66 | 200 | 66 | | 196 | 300 | 1,926 | 1,990 | 5,883 | 0.1% |
| Precious and rare metals | | 277 | 808 | 148 | 111 | 355 | 691 | 699 | 494 | 150 | 3,733 | 0.1% |
| E-waste | | 3 | 10 | 149 | 455 | 104 | 433 | 465 | 1,046 | 133 | 2,799 | 0.1% |
| Other recycling | | 2,649 | 8 | 19 | 21 | | | | 27 | 36 | 2,760 | 0.1% |
| Waste plastics | | 1,543 | | | | | | 875 | | | 2,418 | 0.1% |
| Zinc | | | | | | | | | 691 | 759 | 1,450 | 0.0% |
| Waste catalysts (copper) | | | 468 | 317 | | | | | | | 785 | 0.0% |
| Waste OA equipment, ink, toners | | | | | | | | 140 | 645 | | 785 | 0.0% |
| Waste photographic film | | 204 | 215 | 143 | 113 | 106 | | | | | 781 | 0.0% |
| Waste transformers | | | | 33 | 245 | 116 | 91 | | | | 484 | 0.0% |
| Waste fluorescent lights | 113 | | | | | 3 | | 6 | 6 | | 129 | 0.0% |
| Other treatment/Unknown | | | 48 | | 47 | | | | | 135,941 | 136,036 | 3.4% |
| Waste solvent | | | 20 | 39 | | | | | | | 59 | 0.0% |
| Iron | | | 43 | | | | | | | | 43 | 0.0% |
| Waste ion exchange resin | | 0 | | 6 | | 4 | 9 | | | | 19 | 0.0% |
| Fly ash | | | | | | | | 2 | 0 | 0 | 2 | 0.0% |
| Total | 6,802 | 1,070,752 | 347,260 | 221,221 | 345,341 | 159,396 | 361,778 | 511,475 | 519,817 | 472,288 | 4,016,129 | 100.0% |

Appendix 3-2 Export of individual type of hazardous wastes by Asian countries/regions (Unit: t/year)

| Waste type | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Total | Percentage (%) |
|---------------------------------|--------|---------|---------|--------|--------|--------|--------|--------|--------|--------|-----------|----------------|
| Iron | | 526,100 | | | 20 | | | | | | 526,120 | 48.5% |
| Other metals | 2,479 | 24,467 | 81,298 | 2,479 | 3,343 | 2,412 | 32,167 | 2,936 | 9,328 | 2,016 | 163,228 | 15.0% |
| Waste lead-acid batteries | 40,339 | | | | 11,033 | 7,698 | 520 | 6,100 | 8,016 | 10,367 | 84,073 | 7.8% |
| Lead | 1,849 | | 342 | 19,765 | 460 | 1,016 | 6,919 | 14,342 | 6,608 | 17,303 | 68,604 | 6.3% |
| Waste catalysts | | 12,672 | 3,909 | 3,371 | 1,692 | 8,193 | 918 | 5,032 | 5,635 | 3,358 | 44,779 | 4.1% |
| Copper slag | | | | | | | | | | 43,186 | 43,186 | 4.0% |
| Blast furnace slag | | | | | | 14,770 | 17,363 | | | | 32,133 | 3.0% |
| Waste plastics | | 10,252 | 13,536 | 26 | | | | | 65 | | 23,879 | 2.2% |
| Copper | 779 | 1,600 | 651 | 2,498 | 1,839 | 1,598 | 1,374 | 5,077 | 3,717 | 169 | 19,302 | 1.8% |
| Precious and rare metals | | 125 | 147 | 159 | 907 | 1,302 | 1,789 | 2,087 | 6,094 | 64 | 12,675 | 1.2% |
| Waste containing PCB | | 1,350 | 687 | 2,929 | 1,614 | 256 | 27 | 600 | 1,073 | 2,650 | 11,186 | 1.0% |
| Other treatment/Unknown | | | 1,560 | 1,040 | 764 | 1,520 | 1,783 | 985 | 1,167 | 1,253 | 10,072 | 0.9% |
| CRT glass | | | | 170 | 1,703 | 2,461 | 2,935 | 635 | 854 | 634 | 9,392 | 0.9% |
| E-waste | | | | | 307 | 54 | 1,486 | 745 | 2,065 | 2,509 | 7,167 | 0.7% |
| Waste containing mercury | | | 5,000 | | 100 | 282 | | 1,399 | 58 | 30 | 6,869 | 0.6% |
| Waste catalysts (copper) | | 1,062 | | 1,191 | 867 | 690 | 323 | 744 | | 965 | 5,842 | 0.5% |
| Waste NiCad batteries | | 184 | 536 | 555 | 1,383 | 157 | 468 | 224 | 634 | 270 | 4,411 | 0.4% |
| Zinc | 17 | | | | 60 | | | 39 | 2,348 | 1,136 | 3,600 | 0.3% |
| Waste OA equipment, ink, toners | | | | | | | | 504 | 1,109 | 1,230 | 2,843 | 0.3% |
| Other recycling | | 96 | 2,343 | 200 | 120 | | 18 | | | | 2,778 | 0.3% |
| Waste oil | | | 1,400 | | | | | | 355 | | 1,755 | 0.2% |
| Waste solvent | | | 0 | 2 | 444 | 13 | | | | | 458 | 0.0% |
| Waste fluorescent lights | | 240 | 23 | | 3 | 3 | 2 | 15 | 11 | | 297 | 0.0% |
| Waste ion exchange resin | | | | | | 4 | | | | | 4 | 0.0% |
| Fly ash | | | | | | | | 4 | | | 4 | 0.0% |
| Total | 45,463 | 578,148 | 111,434 | 34,384 | 26,660 | 42,428 | 68,092 | 41,468 | 49,138 | 87,139 | 1,084,656 | 100.0% |

Appendix 4

Classification of Hazardous Wastes by Category

Appendix 4-1 Classification of hazardous wastes by category

| Large category | Middle category | Waste type | Disposal operation |
|--|---------------------------------|--------------------------------------|--|
| Hazardous wastes requiring special treatment | Waste containing mercury | Waste containing mercury | R4 (metal recovery) |
| | | Waste fluorescent lights | R4 (metal recovery) |
| | Waste containing PCB | Waste containing PCB | D10 (incineration) |
| Metallic hazardous wastes | Iron | Iron | R4 (metal recovery) |
| | | Copper | R4 (metal recovery) |
| | Copper | Waste transformers | R4 (metal recovery) |
| | | Waste catalysts (copper) | R8 (recovery from catalysts) |
| | Lead | Lead | R4 (metal recovery) |
| | | Waste lead-acid batteries | R4 (metal recovery) |
| | Zinc | Zinc | R4 (metal recovery) |
| | Precious and rare metals | Precious and rare metals | R4 (metal recovery) |
| | | Waste electric/electronic appliances | R4 (metal recovery) |
| | | Waste photographic film | R4 (metal recovery) |
| | | Waste ion-exchange resin | R4 (metal recovery) |
| | Other metals | Waste catalysts | R8 (recovery from catalysts) |
| Other metals | | R4 (metal recovery) | |
| Other recyclable hazardous wastes | Waste plastics | Waste plastics | R5 (recovery of other inorganic materials) |
| | | CRT glass | R5 (recovery of other inorganic materials) |
| | Fly ash | Fly ash | R4 (metal recovery) |
| | Waste oil | Waste oil | R9 (oil refining) |
| | Waste solvent | Waste solvent | R2 (solvent recovery) |
| | Slag | Blast furnace slag | R5 (recovery of other inorganic materials) |
| | | Copper slag | R5 (recovery of other inorganic materials) |
| | Waste OA equipment, ink, toners | Waste OA equipment, ink, toners | R13 (recycling of multiple materials) |
| Other recycle | Other recycle | Other recycle | |
| Others/unknown ¹⁴ | — | — | — |

Note: The classification is based on the classifications made in Recycle One Inc.: “Fiscal Year 2008 Report of an Examination Concerning the Validity Evaluation of the Basel Convention Including 1995 Amendment and Review of the Strategic Plan” (2008)

¹⁴ Wastes for which there are no specific description for their treatment methods (Y-code) or disposal operations (R-code) were classified as “Others/unknown.”