

Malaysia
The state of Penang

Malaysia

Collaboration Program with the Private Sector for Disseminating Japanese Technology for Mercury Contained Waste Processing in Malaysia Final Report

October 2017

Japan International Cooperation Agency (JICA)

Nomura Kohsan Co., Ltd.

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Contents

| | |
|---|----|
| Map | i |
| Abbreviation | ii |
| Chapter 1 Summary of the report..... | 1 |
| 1.1 Summary | 1 |
| 1.1.1 Background of the project (including development goals of the recipient country) .. | 1 |
| 1.1.2 Technology to be promoted and applied by the project | 1 |
| 1.1.3 Goals and objectives of the project..... | 1 |
| 1.1.4 Contents of the project | 1 |
| 1.1.5 Expected results and output of the project..... | 1 |
| 1.1.6 Future prospects on business development at the current stage (decision to launch, under consideration, unenforceable)..... | 2 |
| 1.1.7 Justification of business profitability | 2 |
| 1.1.8 Remaining challenges for business development and foreseeable measures | 2 |
| 1.1.9 Possibility of cooperation with Japan’s ODA program..... | 2 |
| 1.2 Program outline | 3 |
| Chapter 2 Background of the project..... | 3 |
| 2.1 Local development issues | 3 |
| 2.2 Technology to be promoted and applied to address local issues of development | 4 |
| 2.2.1 Details on technology to be promoted | 4 |
| 2.2.2 Applicability to addressing local issues of development..... | 5 |
| Chapter 3 Outline of the project | 5 |
| 3.1 Goals and objectives of the project | 5 |
| 3.1.1 Objectives and basic direction of project implementation..... | 5 |
| 3.1.2 Goals of the project (contribution to addressing local issues of development in the recipient cities, region and country) | 5 |
| 3.1.3 Goals of the project (concerning business development) | 6 |
| 3.2 Contents of the project | 6 |
| 3.2.1 Project schedule..... | 6 |
| 3.2.2 Schedule..... | 7 |
| Chapter 4 Field work (Omitted)..... | 7 |
| Chapter 5 Project summary (results of implementation and review)..... | 7 |
| 5.1 Project outcomes (contribution to recipient cities, region and country) | 7 |
| 5.2 Project outcomes (business development), remaining challenges and direction to solve issues | 8 |
| 5.2.1 Project outcomes on business | 8 |
| 5.2.2 Challenges and direction of solution..... | 9 |

| | |
|---|----|
| Chapter 6 Further business development after the project..... | 10 |
| 6.1 Goals and objectives of the business | 10 |
| 6.1.1 Expected outcomes of business development (contribution to recipient cities, region and country on social/economic development) | 10 |
| 6.1.2 Expected outcome of business (business development) | 11 |
| 6.2 Business plan | 11 |
| 6.2.1 Outline of the business..... | 11 |
| 6.2.2 Target of the business | 12 |
| 6.2.3 Business formation..... | 12 |
| 6.2.4 Business implementation schedule..... | 13 |
| 6.2.5 Investment and finance..... | 13 |
| 6.2.6 Competitors | 13 |
| 6.2.7 Challenges of the business and direction to solve challenges | 14 |
| 6.2.8 Foreseeable risks and countermeasures | 14 |
| 6.3 Possibility of cooperation with Japan’s ODA program | 15 |
| 6.3.1 Justification of cooperation with ODA..... | 15 |
| 6.3.2 Expected cooperation scheme..... | 15 |
| 6.3.3 Specific issues of cooperation | 15 |

Map



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Abbreviation

| Abbreviation | Description |
|--------------|--|
| DOE | Department of Environment |
| GEC | Global Environment Center Foundation |
| GEF | Global Environment Facility |
| JACTIM | The Japanese Chamber of Trade & Industry, Malaysia |
| JETRO | Japan External Trade Organization |
| JICA | Japan International Cooperation Agency |
| MIA | Minamata Initial Assessment |
| MOE | Ministry of the Environment |
| NRE | Ministry of Natural Resources and Environment |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |

Chapter 1 Summary of the report

1.1 Summary

1.1.1 Background of the project (including development goals of the recipient country)

The state of Penang in Malaysia has proactively promoted material recycling and environmental conservation through various activities, in which citizens have actively taken part. Some local enterprises have also launched e-waste recycling businesses. During a meeting with private sector companies at the Penang Green Carnival in 2014, Mr. Phee Boon Poh, the State Minister of the Environment, expressed his idea to support not only the private sector, including Shan Poornam Metals who are working with mercury contained in FL lamps and batteries, but to also mediate communication with the central government, since the issue is a priority for the state of Penang.

1.1.2 Technology to be promoted and applied by the project

Initially, the project aimed to introduce a series of mercury processing technologies to locally recycle collected glass and metal materials after the removal of mercury from used FL lamps, used batteries, sphygmomanometers and thermometers, which would be discharged as industrial waste or general waste from households.

1.1.3 Goals and objectives of the project

1.1.3.1 To obtain consent from local stakeholders regarding the capacity and specifications of an intermediary processing plant to be installed in Penang

1.1.3.2 To improve the capacity of the state government in order to smoothly implement the intermediary processing of used FL lamps and used batteries

1.1.3.3 To introduce outcomes of the project to the international community through UNEP/GEF projects in order to formulate regional networks for chemical substances and to introduce a referable case through the network

1.1.4 Contents of the project

1.1.4.1 Study tour to Japan, objectives and tour outline

A study tour to Japan was planned as a training program for local bureaucrats on 1) system development concerning inspection and approval, and 2) environmental monitoring and data processing methods, which also include intermediary plant operators as recipients.

1.1.4.2 Field work, objectives and work outline

Field work by Nomura Kohsan staff was planned to 1) conduct a field survey on mercury waste, 2) promote the Minamata Convention on Mercury, 3) raise awareness on the intermediary processing plant, and 4) facilitate coordination between the project and multilateral cooperation schemes of the Global Environment Facility (GEF).

1.1.5 Expected results and output of the project

1.1.5.1 Study tour to Japan

Local bureaucrats from the state of Penang and federal government of Malaysia can enhance their understanding of hazardous waste that contains mercury and accelerate the local

legislation process. Local stakeholders can deepen their knowledge and understanding on the intermediary processing plant. Accordingly, local capacity on environment impact assessments, inspections and maintenance will increase.

1.1.5.2 Field work

Field surveys on the construction of the intermediary plant can be conducted smoothly and a joint venture between Nomura Kohsan and Shan Poornam Metals can be successfully formulated. Subsequent projects funded by GEF can be developed and the acquired knowledge and experience can be replicated for the benefit of neighboring countries in the ASEAN region.

1.1.6 Future prospects on business development at the current stage (decision to launch, under consideration, unenforceable)

<Status: Under review> Since the financial feasibility study shows a promising conclusion, the development of the business is seriously being reviewed. Meanwhile, due to the delay of GEF funding to develop a subsequent project no earlier than 2018, the proposed project will only cover the area of Penang to start.

1.1.7 Justification of business profitability

Based on financial data which was confirmed / verified through field work, it was determined that the baseline scenario's internal rate of return reaches as high as 38.21%, with a payback period of approximately 3.5 years. A pessimistic scenario for the IRR is 17.48% with a payback period of 5.2 years. These figures justify the profitability of investment. Please note that these figures were acquired through repeated field surveys since very little market data on mercury waste was readily available. This made it difficult to simulate a substantial business with a high level of material recycling equivalent to the case of Japan.

1.1.8 Remaining challenges for business development and foreseeable measures

As of October 2017, the project identifies five remaining challenges: 1) appropriation of land, 2) decision to introduce electric furnaces, 3) sales force of Shan Poornam to collect used FL lamps, 4) disposal of used batteries including lithium-ion batteries and 5) legislation of a disposal fee for FL lamps in the general waste from local households. These factors are blocking the formation of a project for Nomura Kohsan to start business in Penang and/or Malaysia due to uncertainties in concrete sales activities.

1.1.9 Possibility of cooperation with Japan's ODA program

While the government of Malaysia is already a signatory to the Minamata Convention on Mercury, it may take some time for the country to ratify the convention. Taking this interval as an opportunity, Japan's ODA program may consider fielding a long-term expert to the government of Malaysia to facilitate the ratification process. This can enhance the effectiveness of the ODA program in working together with the private sector companies of Japan.

1.2 Program outline

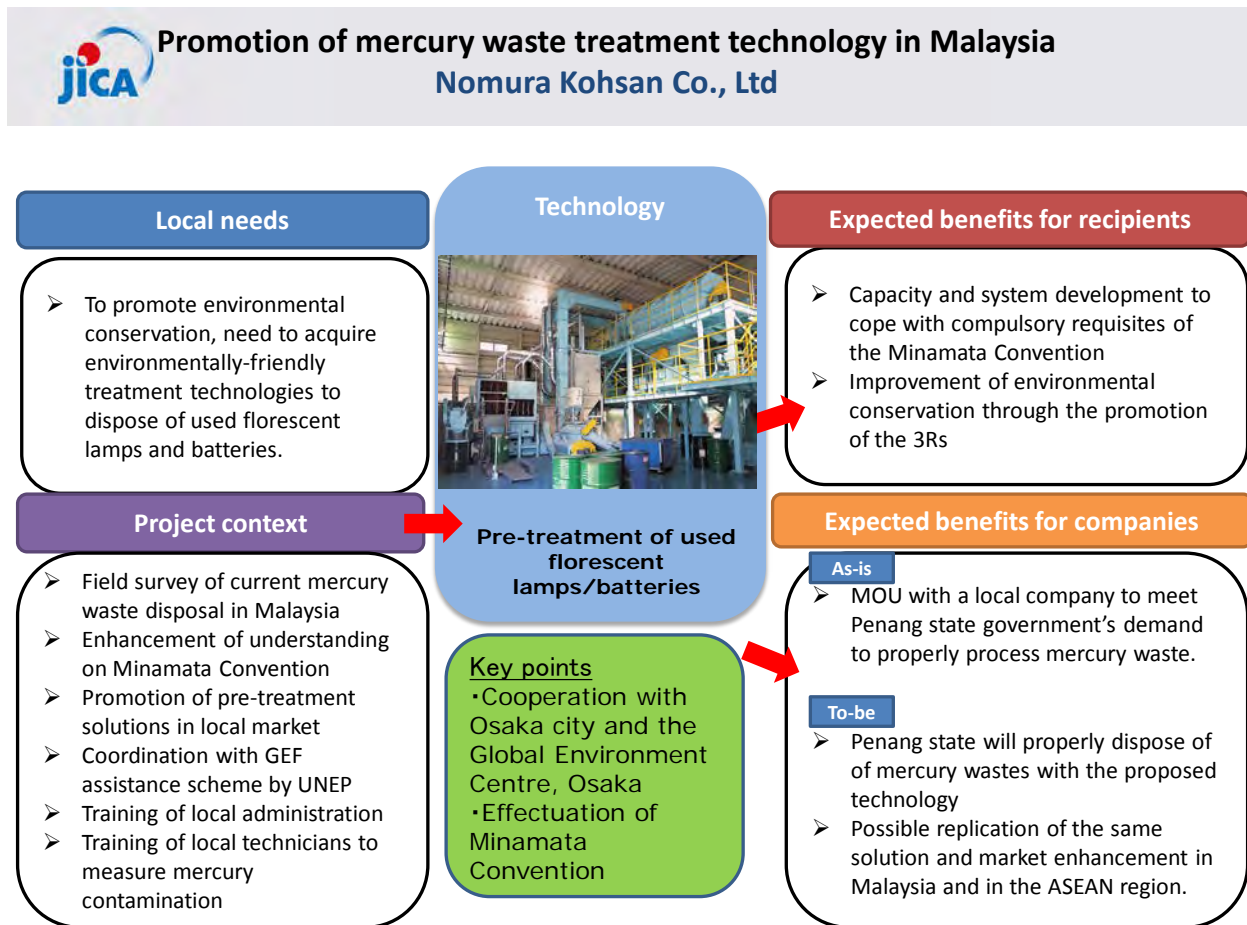


Figure1.2 Program outline

Chapter 2 Background of the project

2.1 Local development issues

In June 2016 the state of Penang put a household garbage separation act into effect and organized awareness-raising campaigns for the citizens to enhance the understanding of local residents. Yet, it is said that the garbage separation practice has been faulty.

The residents of Penang are extremely keen to prevent health hazards and protect the environment. The government takes the initiative to organize public/private cooperation opportunities, while the citizens have committed themselves to volunteering. The government launched a pilot project to start up an e-waste collection system in the past, and overall, the state of Penang's commitment to waste management leads other states in Malaysia. Also, the introduction of the expanded responsibility of manufacturers has been on the table for discussion, and consequently, the state has led the other states in Malaysia with regard to the appropriate disposal of hazardous materials. Despite this, it has been noted that critical challenges remain, such as imbalances between economic development and environment measures or a lack of appropriate technologies to treat hazardous wastes and a qualified workforce to actually handle

hazardous waste management. The state of Penang has proactively promoted material recycling and other measures for environmental protection. It has been observed that a good number of citizens and local community representatives have participated in promotional activities and local enterprises have launched material recycling businesses, including the recycling of e-waste. The Penang Environment Working Group (PEWOG), which was established as an advisory institute to the state government, also proactively promotes material recycling. PEWOG has published a guidebook with a list of material recycling companies in Penang, which helps local communities enhancing group collection services. PEWOG also promotes e-waste collection programs in cooperation with e-waste recycling companies. They have launched a joint collection scheme for FL lamps and batteries with local supermarkets, while final disposal of hazardous content has become a challenge for their activities.

2.2 Technology to be promoted and applied to address local issues of development

2.2.1 Details on technology to be promoted

The technology profile has been downscaled from its initial plan to replicate a full-sized intermediary treatment plant similar to Japan's, to a very simple combination of a small mobile lamp crusher and a rotary trammel machine which conducts dry washing of crushed cullet.



Picture 2.2.1 Mobile crusher

2.2.2 Applicability to addressing local issues of development

Hazardous waste, which includes mercury, may be mixed in e-waste recycling that is being promoted by the state of Penang. Consequently, it becomes a barrier to promoting recycling businesses due to environmental requirements. If the project can introduce optimum disposal technologies for mercury waste, this would facilitate material recycling through separate collection and the appropriate disposal of the mercury waste. Other than this technology, medical waste which contains mercury, such as sphygmomanometers and thermometers with mercury, can also be appropriately treated through the introduction of suitable technology. Further, the project may help addressing Penang's complex challenges, including separate collection of garbage, reduction of garbage volume, promotion of recycling businesses and prevention of health problems caused by hazardous waste.

Chapter 3 Outline of the project

3.1 Goals and objectives of the project

3.1.1 Objectives and basic direction of project implementation

The objectives of the project are to verify that the introduction of mercury waste processing technology to the state of Penang is commercially feasible and to formulate consensus with stakeholders on the results of the feasibility study, as well as to introduce the case to neighboring countries. In order for the objectives to be achieved, the project deploys basic directions to 1) enhance close communication with local counterparts, 2) retrieve the most updated market data and business costs, and 3) establish close cooperation with relevant institutions, including select international organizations.

3.1.2 Goals of the project (contribution to addressing local issues of development in the recipient cities, region and country)

- The project will seek consensus amongst local stakeholders with respect to the policy of the Penang state government on the specifications and capacity of the intermediate processing plant. In practice, the project will refer to the results of the financial feasibility study as described in detail in chapter 6 to reach consensus.
- The project will aim at basic capacity development of local bureaucrats on the smooth implementation of the disposal of used FL lamps and used batteries. In practice, the project will organize a study tour to Japan to be followed-up by field work for the benefit of the cities of Penang Island and Seberang Perai to help local staff enhance their capacity and be a value-adder, rather than a barrier, for the disposal business.
- The project will introduce its outcomes through relevant international organizations to enhance governmental networks on chemical substances within the region. In practice, the project will introduce the case through the United Nations Environment Programme's (UNEP) global mercury partnership where Nomura Kohsan has been a

member. Through preparation for the COP1 of the Minamata Convention on Mercury, the case will also be shared with concerned stakeholders, including UNEP.

3.1.3 Goals of the project (concerning business development)

The goals of the project for business development include: 1) a financial feasibility study on the construction of the intermediary processing plant, 2) agreement with Shan Poornam Metals, the local partner company involved in the disposal of mercury waste, and 3) information sharing with the partner company's shareholders, as well as the federal government of Malaysia.

3.2 Contents of the project

3.2.1 Project schedule

The project was implemented in three stages: 1) basic research on business feasibility study (field work #1 to #4), study tour to Japan, preparation for follow-up (field work #5 and #6, together with the study tour), and 3) revision of the business model to secure business viability (field work #7 to #10).

Table3.2.1 project schedule

| # | Tasks Schedule d tasks of JICA project | Field works | | | | | | | | | | | Content | Object | |
|---|--|----------------|----------------|----------------|----------------|----------------|---------------|----------------|----------------|----------------|-----------------|-----------------|---------|---|---|
| | | #1 (Penang) | #2 (Penang) | #3 (Penang) | #4 (Penang) | #5 (Penang) | #6 (Japan) | #7 (Penang) | #8 (Penang) | #9 (Penang) | #10 (Penang) | #11 (Penang) | | | |
| 1 | Local market viability | | | | | | | | | | | | | <ul style="list-style-type: none"> Hearing from local partner and government Ditto but from local prospects | <ul style="list-style-type: none"> To confirm market viability by numerical data |
| 2 | Knowledge enhancement on industrial waste management | | | | | | | | | | | | | <ul style="list-style-type: none"> Study tour and communication through field works | <ul style="list-style-type: none"> To let local partner and Penang government understand industrial waste management |
| 3 | Consensus with the local partner on alliance | | | | | | | | | | | | | <ul style="list-style-type: none"> Hearing from local partner and government of Penang | <ul style="list-style-type: none"> Commitment on alliance |
| 4 | Scope of service | | | | | | | | | | | | | <ul style="list-style-type: none"> Hearing from local partner and government of Penang | <ul style="list-style-type: none"> To fix business line-ups |
| 5 | Supply chain | | | | | | | | | | | | | <ul style="list-style-type: none"> Hearing from local partner and government Ditto but from local prospects | <ul style="list-style-type: none"> To secure prospects with reasonable target of sales |
| 6 | Financial feasibility | | | | | | | | | | | | | <ul style="list-style-type: none"> Collecting financial data and conducting calculation | <ul style="list-style-type: none"> To develop a financial model |
| 7 | Joint venture company | | | | | | | | | | | | | <ul style="list-style-type: none"> Negotiation with local partner and Penang government | <ul style="list-style-type: none"> To fix the schedule of joint venture company registration |

3.2.2 Schedule

The schedule of project funded activities are shown on the following table

Table3.2.2 Schedule

| # | Date | Activities |
|----|------------------|--|
| 1 | 2015.9.11~9.14 | Pre kickoff meeting |
| 2 | 2015.10.12~10.17 | Kickoff meeting |
| 3 | 2016.1.24~1.28 | Basic research on business feasibility study |
| 4 | 2016.2.22~2.25 | Discussion about nationwide business development |
| 5 | 2016.4.25~4.30 | Preparation of Japan study tour to Japan |
| 6 | 2016.10.26~11.2 | Follow-up of study tour to Japan |
| 7 | 2017.1.9~1.13 | Revision of the business model to secure business viability |
| 8 | 2017.2.20~2.24 | Study on local plant manufacturers |
| 9 | 2017.4.10~4.15 | Negotiating joint venture |
| 10 | 2017.7.19~22 | Negotiating joint venture (On going) |

| | | |
|------------------|----------------|-------------------|
| Japan Study Tour | 2016.7.10~7.16 | Capacity building |
|------------------|----------------|-------------------|

Chapter 4 Field work (Omitted)

Field work details are omitted due to redundancy. A total of 11 field visits were conducted by Nomura Kohsan, which facilitated smooth and productive communication with local counterparts.

Chapter 5 Project summary (results of implementation and review)

5.1 Project outcomes (contribution to recipient cities, region and country)

Through the various activities outlined above, the project successfully indicated a direction for development, including the establishment of a business model for the business of disposing mercury waste and the simulation of a profitable business model based on sales volume and unit price to secure sustainability. The state government of Penang and local stakeholders confirmed their consensus to support the mercury disposal business, which was one of the goals of the project. Further, the project rendered a total of five days of study opportunities (lecture and workshop) in Japan for 14 selected bureaucrats, which were presented through the tour and subsequent field work to fulfill the planned objectives. However, the formulation of the project with UNEP for GEF has been affected by the delay of the ratification of the Minamata Convention by the Malaysian government (not yet ratified as of October 2017) and more time may be needed to start the process with their endorsement.

Note: As stated in 1.1.3, the project has repeatedly discussed the issue with UNEP's officer in charge of GEF project formulation. Their intention is to formulate a project on awareness raising

with regard to the appropriate disposal of mercury waste, in combination with a regional program to introduce the project outcomes so that visibility within the ASEAN region can be enhanced. However, because of the abovementioned delay in ratifying the convention by the government together with the timing for the GEF to close its budgetary phase (GEF6) for the next phase (GEF7), project formulation may be delayed until July 2018 at the earliest.

5.2 Project outcomes (business development), remaining challenges and direction to solve issues

5.2.1 Project outcomes on business

In April 2017, the cities of Penang Island and Seberang Perai started to collect used FL lamps as a demonstration, which can be recognized as a tangible result of the project for capacity building of local governments. They autonomously organized meetings to follow up on the activities of the study tour to Japan. As detailed on chapter 6, a financial model was consolidated on possible investment for the intermediary processing of mercury waste, including pre-treatment of used FL lamps, and shared with a local partner company, particularly with regard to the level of income required to make the business sustainable.

Table5.2.1 Project outcomes on business

| # | Task Schedule d tasks of JICA project | Field works | | | | | | | | | | | Achievement and evaluation A: complete B: almost complete C: remaining challenge | Remaining challenges and direction | |
|---|--|----------------|----------------|----------------|----------------|----------------|---------------|----------------|----------------|----------------|-----------------|-----------------|--|--|--|
| | | #1 (Penang) | #2 (Penang) | #3 (Penang) | #4 (Penang) | #5 (Penang) | #6 (Japan) | #7 (Penang) | #8 (Penang) | #9 (Penang) | #10 (Penang) | #11 (Penang) | | | |
| 1 | Local market viability | | | | | | | | | | | | B | Obtained reliable information on competitors and market of mercury disposal management. | • Keep reminding local partners about volume estimation of local market. - Oct 2017 |
| 2 | Knowledge enhancement on industrial waste management | | | | | | | | | | | | A | • Knowledge sufficiently acquired by local counterpart through study tour/field works. | |
| 3 | Consensus with the local partner on alliance | | | | | | | | | | | | B | • Time elapsed to change business model from recycle to disposal, basic consensus was confirmed on alliance. | • Confirmation in writing not yet done. - Oct 2017. |
| 4 | Scope of service | | | | | | | | | | | | C | Partner company demanded additional land space. State government supports. | • Waiting for official answer from the state government, Nov 2017- |
| 5 | Supply chain | | | | | | | | | | | | C | • Local partner showed interest on catalyst and lithium-ion batteries. | • Need to discuss about additional investment with local partners, Nov 2017- |
| 6 | Financial feasibility | | | | | | | | | | | | C | Local partner showed interest but no commitment on price and volume. | • Need to confirm numerical figures on volume and price. Nov 2017- |
| 7 | Joint venture company | | | | | | | | | | | | A | A financial model was established based on market research. | |
| 8 | Settlement of schedule for joint venture | | | | | | | | | | | | C | Schedule was not fixed yet due to 4, 5 and 6 of above. | • Negotiation to be continued to sort out the remaining challenges and proceed to joint venture establishment. Nov 2017- |

5.2.2 Challenges and direction of solution

At the conclusion, the project recognizes the following challenges and direction of solutions as follows:

1) Land premises

The project was notified by the local partner company (Shan Poornam Metals) that their own premises cannot accommodate the intermediary processing plant and they want to make use of a vacant space next to their factory, which is currently owned by the state

government. While the state government is supportive, space requirements for the joint venture business must be specified to reach consensus on the deadline to convert the use of the vacant space with official permission from the government.

2) Scope of service

The partner company (Shan Poornam Metals) showed interest in undertaking the saturated catalyst of oil and gas industries to capture mercury content, together with lithium-ion batteries, which are collected with other e-waste. Since the project was not originally planned to cover either one of these items, Nomura Kohsan may offer the introduction of an electric furnace on a commercial basis for catalysts and may trade batteries through a joint venture if the price is attractive enough. The electric furnace may process sludge with mercury (mostly phosphor), which will be generated by the intermediary processing plant, and Nomura Kohsan may extend assistance to suggest the most optimum mode of introduction for the electric furnace through technical R&D process in Japan.

3) Supply chain

The project has helped Nomura Kohsan negotiate with the local partner, although it is still early for them to verify a detailed list of prospects, volume of FL lamps and the price of disposal. While they acknowledged that they can meet the requirements of the financial feasibility study, Nomura Kohsan prefers to confirm the commitment in writing before stepping forward with the formulation of a joint venture.

4) Establishment of joint venture company and schedule

Nomura Kohsan thinks that the abovementioned items 1) to 3) are a critical prerequisite for the formulation of a joint venture company and expects to solve these issues first, so that the establishment of the joint venture company can be secured, together with the schedule of fixed investment, as well as the start of service in Penang.

Chapter 6 Further business development after the project

6.1 Goals and objectives of the business

6.1.1 Expected outcomes of business development (contribution to recipient cities, region and country on social/economic development)

It will be a meaningful development for the state of Penang and for the entire country of Malaysia to start processing mercury waste locally with appropriate technology in order to comply with the requirements of the Minamata Convention, which came into effect on 16 August 2017. Until now, Malaysia has disposed of crushed FL lamps after encapsulation into local landfills without removing mercury, which is a very rudimentary method.

The removal of mercury will increase the value of valuable wastes, such as used catalysts or e-waste, and it is expected that the yield ratio of recycled materials to total volume of crude waste will improve.

6.1.2 Expected outcome of business (business development)

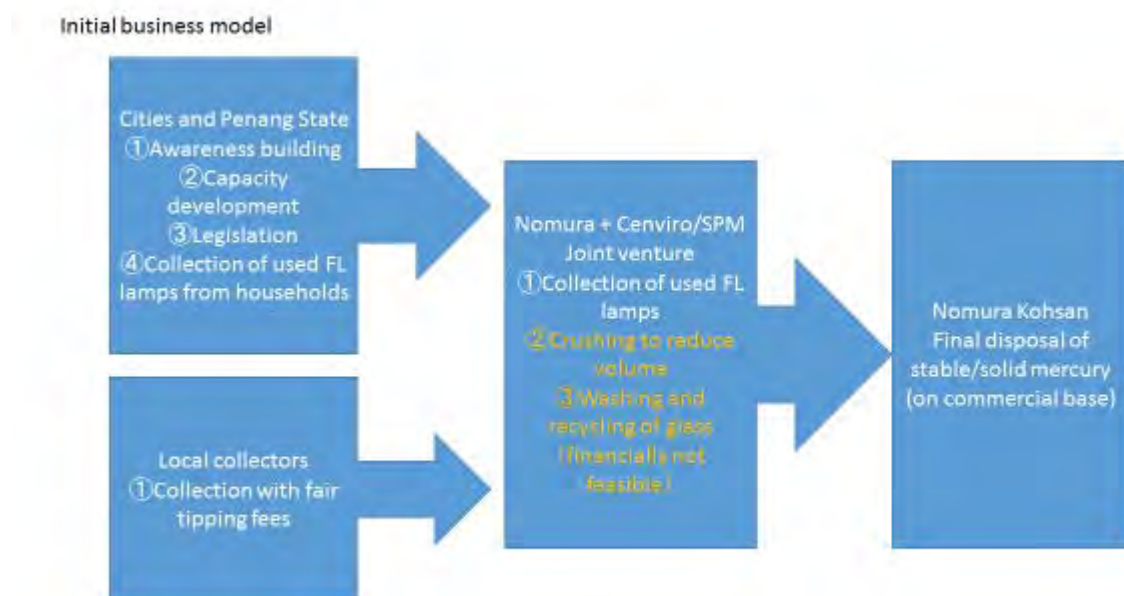
At this time, the business model is focused on the intermediary treatment of used FL lamps on site in small quantities, either at the current market price or lower, which means that it will not be very profitable. Yet it is expected that the initial investment of the business model of approximately JPY 10 million will be paid-off in three to five years after investment and will secure an IRR exceeding 30% after 10 years of operation, and therefore, the proportional return is quite sufficient, although the volume of investment is small.

Further, from a mid- to long-term perspective, a probable scenario to replicate the business model of Penang throughout the entire country may promise even higher returns due to regulations to comply with the Minamata Convention. Nomura Kohsan will keep checking the validity of business proactively.

6.2 Business plan

6.2.1 Outline of the business

The business plan includes the installation of a lamp crusher together with a rotary trammel unit to separate phosphor with mercury from glass/aluminum which can be locally landfilled, and transport the separated phosphor with mercury together with used filters and other mercury wastes to the Itomuka plant of Nomura Kohsan in Hokkaido, Japan for final disposal after stabilization and solidification. There are two additional proposals: 1) removal of mercury from used catalysts to recycle valuable metals and 2) export of used lithium-ion batteries to Japan for recycling. So far, neither one of these proposals have been financially verified due to the lack of required market data. In addition to these proposals, Malaysia recently showed interest in Nomura's technology to dispose of medical wastes containing mercury.



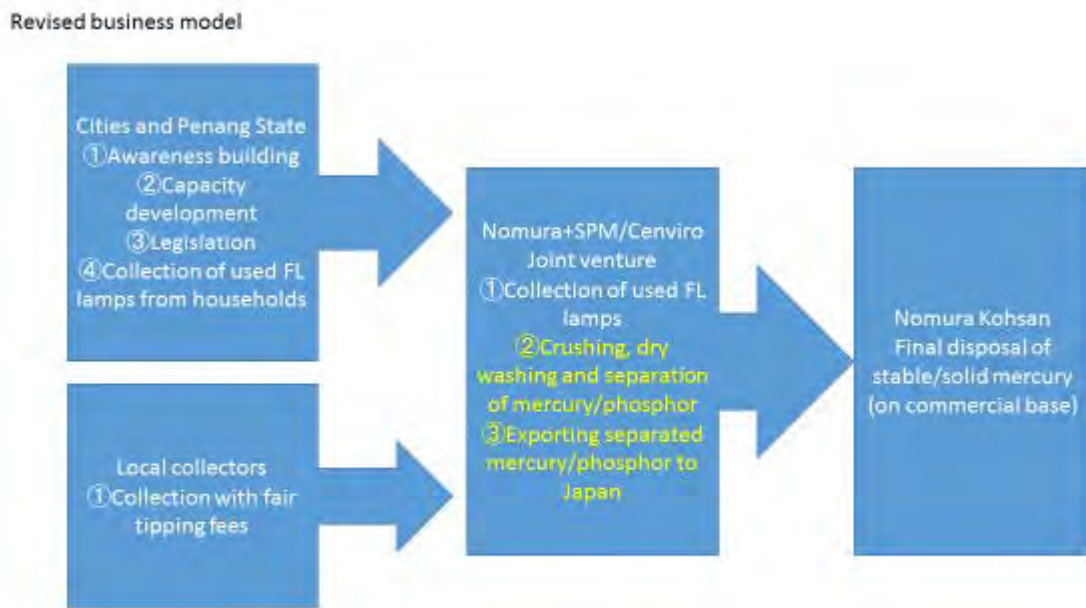


Figure 6.2.1 Initial business model and Revised business model

6.2.2 Target of the business

The most promising subsector that may discharge a certain volume of used FL lamps will be industrial businesses, including foreign manufacturers located at export processing zones, since they are mandated to cover the cost of proper disposal as “industrial scheduled waste (SW109)”. If the business can consistently secure a minimum of 100 tons of lamps per year, the initial investment will be paid off in 2.5 years. Otherwise, it is expected that 1) used batteries will be exported to Japan to be recycled and 2) used catalysts from oil and gas industries will be pre-treated to remove mercury with newly introduced electric furnaces, which will then be handed over to the local partner who may extract valuable metals through their own refinery process.

Malaysia has legislated that the responsibility for the proper disposal of industrial waste containing mercury lies with waste generators, and the country has also signed the Minamta Convention on Mercury.

6.2.3 Business formation

- Cooperation with local partners (public/private) and organizations

It has been discussed with local stakeholders that 1) Nomura Kohsan and Shan Poornam Metals (SPM) will formulate a joint venture company to start the intermediary treatment of mercury waste (used FL lamps) within the premises of SPM, 2) Nomura Kohsan will support the engineering work of the intermediary treatment plant, 3) a lamp crusher will be exported from Japan, while a rotary trammel machine will be newly manufactured by a local assembly

plant, and 4) SPM will collect the lamps to secure sufficient volume at a profitable price. Recently, the issue of land space was placed on the table of discussion which affected the formulation of the joint venture. The project is currently waiting on a response from Penang state.

- Value chain and division of responsibility

The basic framework counts on: 1) sales activity by the local partner and 2) technical support by Nomura Kohsan, which shall remain applicable to accept used batteries, used catalysts and medical equipment. Details on business procedures shall duly be fixed as the project moves forward.

6.2.4 Business implementation schedule

At this time, it is not clear how quickly the issue of land space will be resolved. The following plan is based on the assumption that the stalemate will be resolved by the end of the 2017 calendar year. After the decision, another six months will be needed for approval of the construction of new buildings, which means that business operations can concretely start by mid-2018 at the earliest.

- 1) The joint venture company between Nomura Kohsan and Shan Poornam Metals will be established by mid-2018.
- 2) The mobile crusher and manufacturing rotary trammel will be exported upon the establishment of the joint venture company. It will take three months to have both machines delivered to the site, which means that engineering work should start as soon as the construction of the new building begins.
- 3) Including commissioning and test-running, the plant will be ready for operation approximately seven months after the establishment of the joint venture company. At this time, the project assumes that the plant will be ready to start operations in February 2019.
- 4) However, sales can start as soon as the joint venture company is established. Collection and storage of used FL lamps can begin as soon as the new building is completed. Therefore, December 2018 will be the target date for the project to start storing lamps from customers at the new building.

6.2.5 Investment and finance

The total investment from Nomura Kohsan will be approximately JPY 16 million.

Initial investment for fixed assets will be JPY 11 million. Since the investment amount is small enough, 100% of capital will be internally procured and no long-term loans will be borrowed. Depending on the sales performance, it will take between three to five years for the joint venture company to recover the initial investment for fixed assets.

6.2.6 Competitors

Attachment 4 contains a list of the registered disposers of waste that contains mercury. All of the listed companies either do not actively collect waste containing mercury or just

encapsulate mercury waste without separating mercury. Since the Minamata Convention on Mercury prohibits the controllable release and emission of mercury by anthropogenic activities, Nomura Kohsan will have a strong advantage due to its technology to separate mercury from waste, if the government of Malaysia ratifies the convention.

6.2.7 Challenges of the business and direction to solve challenges

As stated above in section 5.2.2., the remaining challenges are as follows;

- 1) To secure land space for the new business
- 2) To confirm service lineups
- 3) To verify the supply chain
- 4) To establish a joint-venture company

Nomura Kohsan has been in continuous dialogue with the local counterpart to address items 1) to 4) above.

6.2.8 Foreseeable risks and countermeasures

- 1) Business risks and deployable countermeasures

There are two perceived business risks: 1) increase of initial investment and 2) leaving sales performance under the responsibility of the local partner. The initial investment assumes only the introduction of an intermediary treatment facility for used FL lamps. However, the project may anticipate the diversification of mercury waste for which the initial investment may not be sufficient. As a countermeasure for this, Nomura Kohsan must continue to pay attention to the scope of work and review the initial investment cost as necessary. Nomura Kohsan will negotiate with the local partner to prepare a list of prospects with sales targets by which the joint venture company can tangibly grasp the target volume for lamp treatment. As existing competitors may also become another business risk, the joint venture company must continue to pay attention, and if possible, position competitors as secondary customers.

- 2) Environmental risks and deployable counter measures

There are two environmental risks: 1) the regulations of the Minamata Convention may be strengthened and 2) the Basel Convention on Hazardous Waste may restrict the export of mercury waste to Japan. Close communication with the Malaysian government (DOE) on the Minamata Convention will be the key to identifying the regulations that need to be strengthened in practice. Under the Basel Convention, permission must be obtained from authorities of transit countries when exporting mercury to another country. Nomura Kohsan has had experience in the Philippines where it took excessive time to obtain permission from the Korean government to export mercury waste, which became an obstacle to the smooth export of mercury waste to Japan. Based on this experience, Nomura Kohsan is ready to deploy authorization agents in Korea in order to reduce the risk.

- 3) Social risks and deployable countermeasures.

There is a risk that the project will be criticized by local society as it prioritizes commercial profitability rather than addressing the mercury waste issue of the local community, including remote areas and poorer segments of the population. In order to avoid this risk, Nomura Kohsan is cooperating with the state government of Penang to try to formulate another technical cooperation project with UNEP in which a broader range of civil society can take part. Nomura Kohsan will further seek opportunities to enhance social benefits to be widely distributed throughout society, which will mitigate risks.

6.3 Possibility of cooperation with Japan's ODA program

6.3.1 Justification of cooperation with ODA

The business to appropriately dispose mercury waste has a wider concern on public interest as stipulated on the Minamata Convention on Mercury, though profitability will remain lower than e-wastes, due to lower market value. Because of this characteristic, it is meaningful to cooperate with Japan's ODA, which has a mission to prioritize public interest. Specifically, the following themes can be taken up by Japan's ODA to seek for synergy with Nomura Kohsan's business: 1) accelerated ratification of the Minamata Convention to smooth other international assistance to Malaysia, 2) introduction of internal regulations to promote appropriate disposal and prohibit illegal dumping, 3) capacity development of relevant authorities, including local governments, and 4) disclosure of the case to neighboring countries.

6.3.2 Expected cooperation scheme

One possibility for cooperation is to field a long-term expert to the government of Malaysia. The Ministry of Natural Resources and Environment (NRE), the focal point of the Minamata Convention, has already launched the Minamata Initial Assessment (MIA) to investigate the baseline of mercury management in Malaysia, which is expected to take another two years until completion at the end of 2019. Further, NRE and the Department of Environment (DOE) are in a comparatively weak position compared to other central government agencies and it is not guaranteed that the Malaysian government will automatically ratify the convention. On the other hand, Malaysia has comparatively advanced chemical industries within ASEAN countries and the needs to properly dispose industrial waste is duly higher than the neighboring countries. In order to smoothly complete the MIA and promote early ratification, allocation of the long-term expert should be effectively.

6.3.3 Specific issues of cooperation

It is preferable if the long-term expert is allocated to the Prime Minister's office, which controls the NRE. The term of assignment would be until completion of MIA by the end of 2019 and the expert will be assigned to advise local authorities about the smooth ratification of the convention. For this purpose, the expert may have a variety of duties, including contact with the Ministry of Justice, custom authorities and other relevant authorities in order to

explain the background and coordinate with them on related processes, as well as to organize seminars for capacity development.

The candidate is envisioned as a practitioner with knowledge on the Minamata Convention in the Ministry of Environment of Japan (MOEJ) or subsidiary institutions, or a scholar working for universities or research institutions. In order to address coordination with international frameworks, candidates who have experience in working for an international organization may also be considered.

Attachments

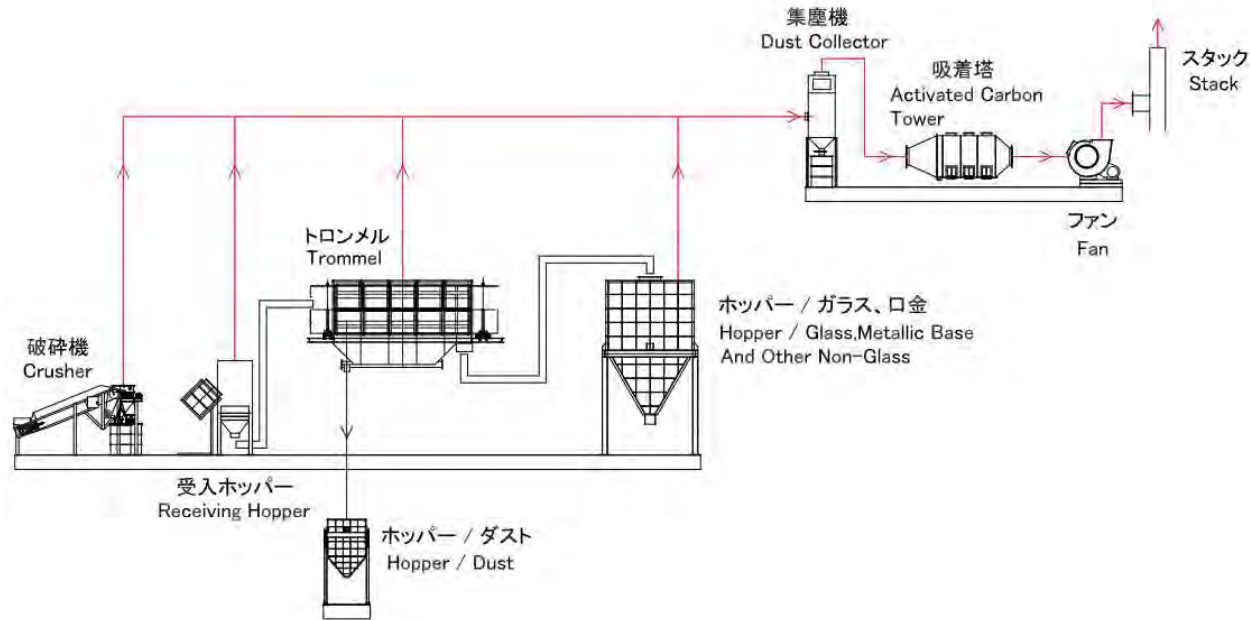
1. Specifications of lamp crusher
2. Conceptual process flow, used fluorescent lamp treatment in Malaysia
3. Financial data
4. SW109 Recovery facility licensed by DOE
5. Action Plan
6. Overview of the study tour in Japan
7. Pictures of Activities

Attachment ① Specifications of lamp crusher

| | | |
|---|--|-------------------------|
| 1. Model | GZ21-10 | |
| 2. Allowable types fluorescent lamps for crushing | Linear fluorescent lamps: up to 1,200mm(40W) in length Circular fluorescent lamps: up to Φ 380mm (40W) in diameter (With additional options, possible up to 2,400mm (110W) lamps) | |
| 3. Storage container for crushed lamps | JIS Z1600 Type I (Open drum container, nominal capacity 200) Diameter: Φ 600mm, height: 900mm (second-hand containers are also accepted) | |
| 4. Storing capacity of storage container | Open drum container Linear fluorescent lamps [1,200mm(40W)]: approx. 500 lamps | |
| 5. Simultaneous loading capacity of fluorescent lamps | Linear fluorescent lamps: up to 3 (three) Circular fluorescent lamps: 1 (one) | |
| 6. Crushing capacity (Net operating time) | Linear fluorescent lamps [1,200mm(40W)]: max. 1,500 lamps/h Circular fluorescent lamps [Φ 380mm(40W)]: max. 1,000 lamps/h | |
| 7. Processing of dust and exhaust gas | Treatment processes using cartridge element (equipped with a pulse jet ‘knocking-off’ mechanism) and specialized adsorbent (activated carbon-based) | |
| 8. External dimensions | Approx. 765W \times 2,800L \times 1,830H mm | |
| 9. Weight of lamp crusher | Approx. 750kg (excluding storage container) | |
| 10. Motors | Conveyor | Three-phase 200V 0.75kW |
| | Blower (dust collector) | Three-phase 200V 1.0kW |
| | Compressor | Three-phase 200V 0.2kW |
| | Blower (adsorbent) | Three-phase 200V 1.0kW |
| 11. Power cord | Approx. 10m | |

Attachment②

Conceptual process flow, used fluorescent lamp treatment in Malaysia



| Equipment | Specifications |
|-----------------------|--|
| Receiving hopper | Material:SS Dimension:W2,000×L1,000×H800 Volume:5.0m ³ Input with power 1.5kW Output with power 0.75kW |
| Trommel | Material:SS, Cylinder: φ1,200×L4,000 Screen:3mm, Capacity:1.5t/h Drive motor:2.2kW Power for output :0.75kW |
| Hopper/dust | Material:SS Dimension:W1,000×L1,000×H1,820 Volume:1.2m ³ |
| Hoper, Glass + others | Material:SS Dimension:W1,520×L1,520×H1,820 Volume:4.0m ³ |
| Dust collector | Dimension:W900×L900×H1,200 Wind volume:36m ³ /min Fan capacity :3.7kw |
| Activated carbon unit | Material:FRP/PVC, Dimension:W1,200×L3,080×H1,200, Volume of absorber1.8m ³ Wind volume:36m ³ /min Pressure loss:less than 100mmAq |
| Fan | Material:FRP, Wind volume:100N/min, Static pressure at activated carbon tower 500mmAq, Speed:2,450rpm, Motor 30Kw |
| Stack | Material:FRP/PVC, Diameter:φ350mm Height:12m |

Attachment ③ financial data

| | Pessimistic scenario | | Baseline scenario | | Optimistic scenario | |
|---------------------------------|----------------------|---------|-------------------|---------|---------------------|---------|
| Scenario | 3500MYR/kg, 60tpa | | 3500MYR/kg, 80tpa | | 3500MYR/kg, 100tpa | |
| Currency | JPY | MYR | JPY | MYR | JPY | MYR |
| Fixed investment on machinery | 10,000,000 | 395,257 | 10,000,000 | 395,257 | 10,000,000 | 395,257 |
| Total initial investment | 10,441,802 | 412,719 | 10,499,811 | 415,012 | 10,557,820 | 417,305 |
| Net Present Value (NPV) on 7.6% | 3,777,239 | 149,298 | 11,721,893 | 463,316 | 19,666,547 | 777,334 |
| Internal Rate of Return, % | 17.48 | | 38.21 | | 62.24 | |
| Pay Back Period (Normal), years | 5.15 | | 3.43 | | 2.57 | |

SW109 RECOVERY FACILITY LICENSED BY DEPARTMENT OF ENVIRONMENT MALAYSIA

| | | |
|--|----------|---|
| ESTALCO SDN. BHD. | JOHOR | PLO 595, JALAN MIEL 1 OFF JALAN KELULI 9 KAWASAN PERINDUSTRIAN MIEL IV 81700 PASIR GUDANG, JOHOR , PASIR GUDANG , JOHOR |
| SYP RECOVERY & RECYCLING SDN. BHD. | MELAKA | LOT 2833-2834, KAWASAN PERINDUSTRIAN BUKIT RAMBAI, MUKIM TANJUNG MINYAK, MELAKA , MELAKA , MELAKA |
| MERIAHTEK (M) SDN. BHD. | MELAKA | NO 1, JALAN TTC 30, LOT 4827, 4828, 4831 & 4832, TAMAN TEKNOLOGI CHENG,MUKIM CHENG , MELAKA , MELAKA |
| KRUBONG RECOVERY SDN. BHD. | MELAKA | (2625 & 2630) PT.1671 & PT 1676,KAWASAN PERINDUSTRIAN KRUBONG , MELAKA , MELAKA |
| VICTORY RECOVERY SDN. BHD. | MELAKA | LOT 2211, 2212, 2213 & 2214, 2215,2216 JALAN PK 11 KAWASAN PERINDUSTRIAN KRUBONG , KERUBONG , MELAKA |
| TEX CYCLE SDN BHD (NO. 10, PUCHONG) | SELANGOR | NO.10 JALAN TPK 2/4, TAMAN PERINDUSTRIAN KINRARA , PUCHONG , SELANGOR |
| TEX CYCLE SDN BHD | SELANGOR | LOT 8942 DAN LOT 8960, KAWASAN PERINDUSTRIAN TELOK GONG, KLANG , KLANG , SELANGOR |

MODEL DEVELOPMENT FOR: MERCURY WASTE COLLECTION, SEGREGATION AND TRANSPORTATION

A. CONSTRAINTS

1. A proper treatment mechanism for mercury waste in terms of collection, segregation and transportation must be established by exploring all options in consideration with public environmental awareness as well as sustainable recycling programs. Primarily, considerations on constraints have to be taken into account involving matters on:-
 - (i) Wastes with mercury content collection stream are sometimes defined by rigid laws/regulations and usually does not accept any innovative ideas for modification within its system.
 - (ii) Proposed mercury waste management system must be designed with flexibility so that it can be improved by all stakeholders' innovative ideas.
 - (iii) Collection targets based on an **appropriate price or incentive models** may allow enough function to explore various options to meet the collection target.
 - (iv) Collection system itself must be evolutionary by any innovative ideas in order to achieve the collection target.
 - (v) Stakeholders' behavior is majorly affected by the economic incentives for any recycling programmes.
 - (vi) People are affected by the price or incentive signal.
 - (vii) People response sensitively to any price or incentive mechanism

- (viii) Local businesses will not perform at their best unless they are motivated by themselves. Once it is initiated by the motivation, a reliable system can be realized.
- (x) Logistic difficulties need to be addressed:-
 - (a) Difficulty in securing storage spaces at collection point including set up at public or private facilities.
 - (b) Difficulty in the management and operation of the mercury waste collection system.

B. ACTION PLAN

1. Regulation and Compliance:

1.1 Performance of any mercury waste management system strongly depends on the regulatory force and the compliance of each stakeholder through Extended Producer Responsibility (EPR) policy. Generally, recycling guidelines are only able to monitor on voluntary recycling method in terms of:-

- (i) Deterministic system
- (ii) Voluntary system by consumer/producer
- (iii) Interactive system between Public and Private Sector
- (iv) Within the framework of Waste Electrical and Electronic Equipment (WEEE) Directive
- (v) Limited legal binding for punitive action

- 1.2 Participation of stakeholders is crucial for proper establishment of sound mercury waste management consisting residents, business and institutional stakeholders.
- 1.3 The focal point will be on how to formularize the negotiation method with relevant industries and commercial sector.

2. Proposed Concept of the System/ Design the Mercury Waste Flow

- 2.1 In the consideration of the system options, either government led or producer led or Full Recovery Facility (FRF) led model must be used in order to collect discarded waste to achieve the collection target.
- 2.2 Appropriate mercury waste disposal points needs to be provided for consumer in any proposed led system. These points must be made available with consideration of efficiency and convenience for all stakeholders' involves within the mercury waste flow system.

(i) FOR HOUSEHOLD:

- (a) The system designed by the government usually will not be flexible enough. However, the experience of mercury waste collection can work effectively coupled with strong political commitment is required.

(ii) FOR BUSINESS INSTITUTION:

- (a) Producers are business sensitive and can act flexibly. The producers will be able to develop the collection routes through the retailer. But the producer may raise objection for their limited participation in system design. Based on the proposed by law, the collection

mechanism by the private sector is licensed by the local authorities.

Diagram 1:
Proposed Concept of the System/Design the Waste Flow

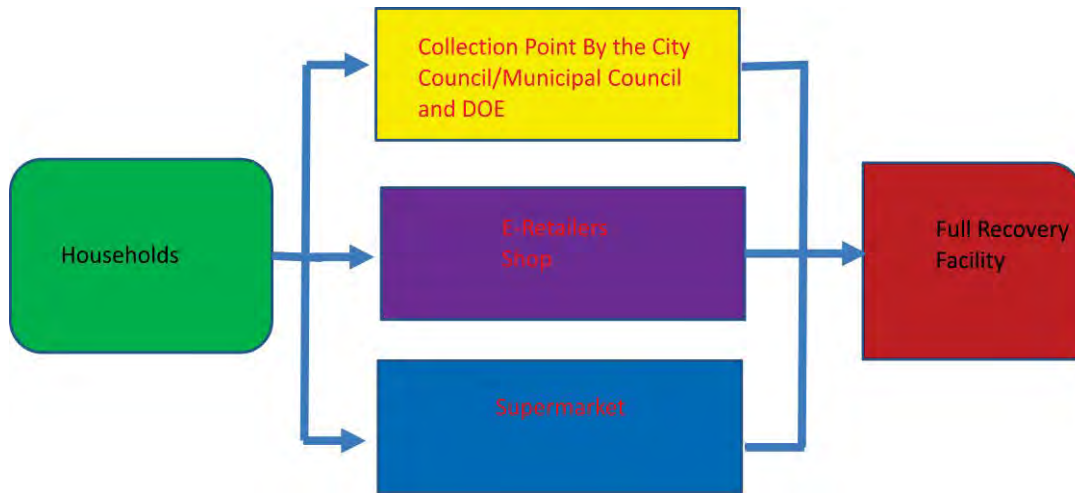
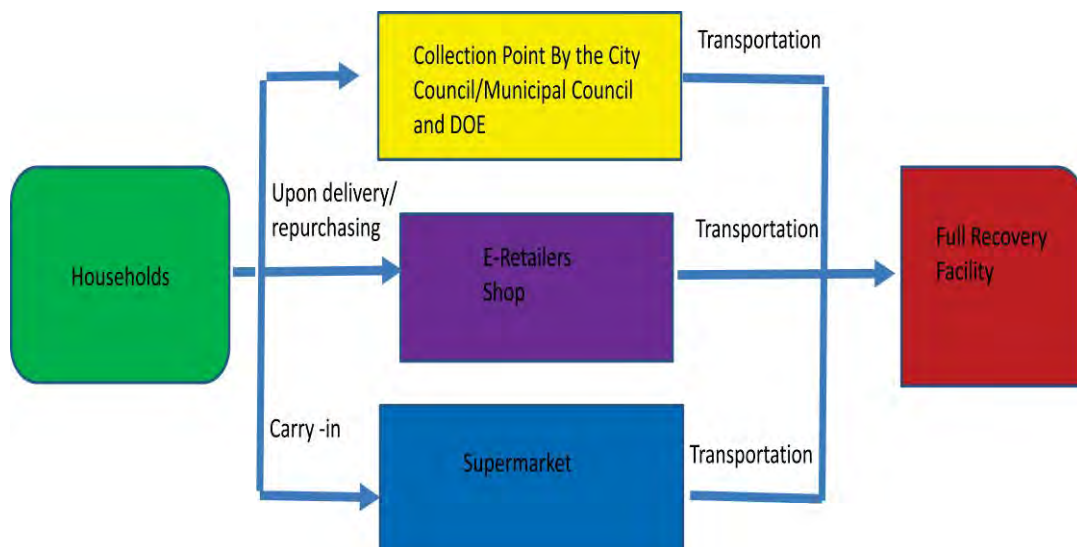


Diagram 2:
Material Flow



3. Stakeholder Involvement/Public Awareness

3.1 Steps must be taken to establish a material sound society and change the human (household) behavior. The human behavior needs to be

induced to follow a set of systems that takes into consideration which:-

- (i) The proposed system should include economic, health or environmental values as an attraction to change the discarders' behavior.
- (ii) Households must be able to send their mercury waste such as fluorescent lamp and others to the nearest collection point. People can save their labour and time (labour and time saving) to bring the material to the nearest point if the waste are collected by someone.
- (iii) Business and Institutional outlet such as home e-product shop and supermarkets must be able to receive/take back discarded waste and carry out their Corporate Environment Responsibilities (CER).

4. Financial Implication

4.1 **Who pays** for the cost to collect transport and dispose the mercury waste from each the Collection Point/Product Shops/ Supermarkets? Is it the City Council/Municipal Council/Producer/FRF? A depth analysis need to be address on the financial implication in order to assure that costs of disposal are allocated accordingly to the entity that should pay for the mercury waste treatment.

(i) FOR HOUSEHOLD :

- (a) The amount of expenditure for waste handling needs to be allocated yearly base on the quantity and type of discarded waste. It can lead to the excessive burden on

the council and it is difficult to make the tax payers or consumer understand that the cost are social costs. Some cost would be partially absorbed by corporate bodies.

(ii) FOR BUSINESS/INSTITUTION:

- (a) Based on polluters pay mechanism/ cross subsidies for social obligation.

4.2 The primary question that needs to be answer is **WHO PAYS FOR THE TREATMENT FEES?**

5. Design Assessment

5.1 An evaluation indexes must be developed in terms of these aspects:-

(i) Effectiveness

- (a) Change of discarded behavior (Participation Rate):
Amount of waste collected for recycling compared to amount of product purchased by the customer.

- (b) Collection rate:
Amount of waste collected for recycling compared to the amount of product sold in the past years.

- (c) Policy effects (Traceability):
Amount of waste going to the full recovery facility compare to the amount of discarded waste.

- (ii) Efficiency
 - (a) Required cost for setting up the collection center and storage container.
 - (b) Required cost for collection and transportation.
- (iii) Sustainability
 - (a) Budget for the project implementation.
- (iv) Applicability
 - (a) Planning and implementation in wide areas.

C. SUMMARY

A proper mercury waste management system must be established to ensure that mercury wastes are treated in a sustainable manner. The mercury waste management system must take into consideration of all stakeholders' constraint and opinion in order to develop a sound mercury waste management system with minimal impact to the environment. Proper planning must also include financial implication to the public as well as social behavior in response towards the mercury waste management system. The system must be evaluated periodically to measure its effectiveness and amendment should be made accordingly for enhancement.

Group Members:

- | | |
|--------------------------------|-----------------------------------|
| 1. Honorable Mr. Phee Boon Poh | 4. Mr. Tan Chong Hee |
| 2. Mr. Mubarak Bin Junus | 5. Mr. Shahril Zamani Bin Md Zain |
| 3. Mr. Mohd Puad Bin Hamid | 6. Ms. Josephine Tan Mei Leng |

SOURCES OF E-WASTE

Industrial sectors :

from electrical and electronic equipment assemblies

Household, commercial areas and institutions:

used **end of life** electrical and electronic goods

Generation of industrial e-waste in 2013 was about 138,036 metric tonnes; and forecasted to be 1.11 million metric tonnes in 2020

PILOT PROJECT IN PENANG SEPTEMBER 2011-MAC 2013



Penang E-waste Project

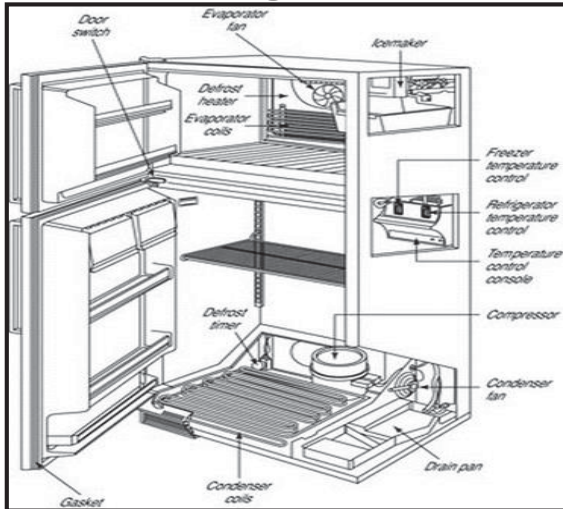
A project for e-waste recycling in Penang Island funded by JICA

***'E-WASTE, COLLECTION,
SEGREGATION AND
TRANSPORTATION FROM
HOUSEHOLDS FOR
RECYCLING'***



Household E-Waste Targeted Item By DOE & JICA

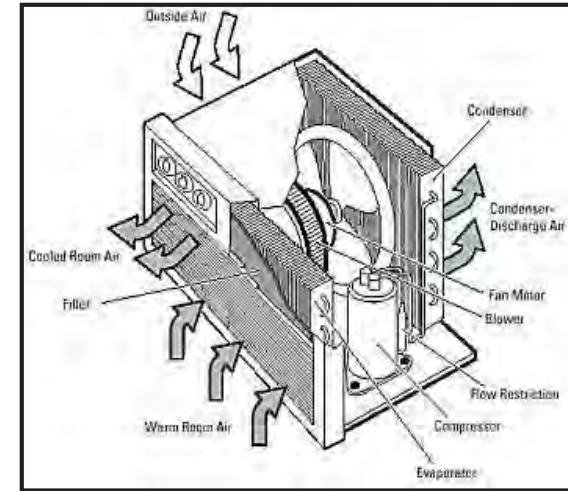
Refrigerator



Washing Machine



Air Conditioning



CPU



Television



Mobile

SPM TECHNOLOGY IS READY

We care ...



Household E-Waste Next Phase



SPM TECHNOLOGY IS READY

We care ...

Household E-Waste Non Targeted Item By DOE & JICA – SPM



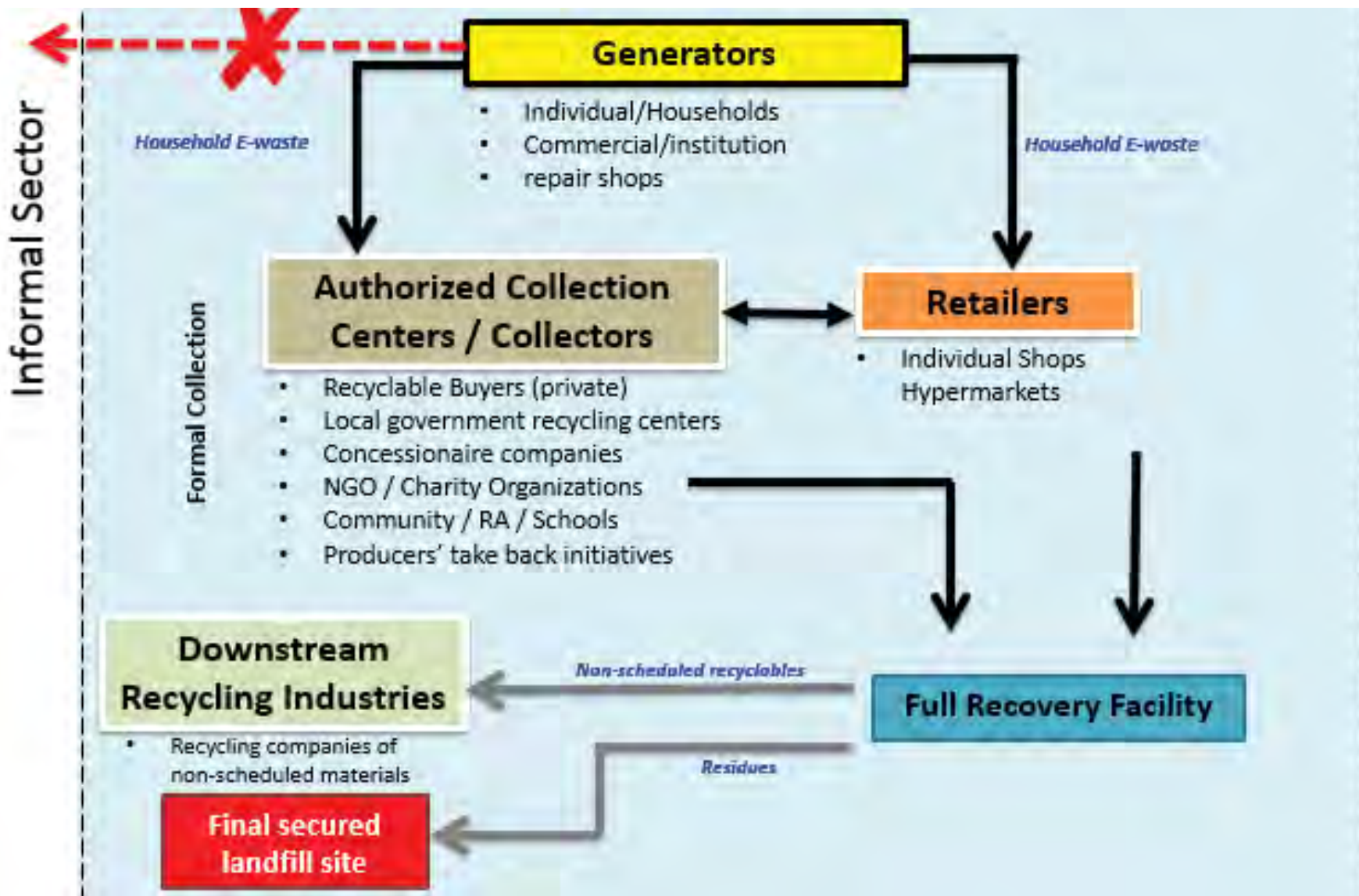
Battery



Flourescent lightings

FUTURE SPM TECHNOLOGY

Household E-Waste Flow



Methodology And Financial Support

- **Awareness Program**
 - ✓ **Flyer – Government**
 - ✓ **Social Media(Facebook), TV, display board – Government**
 - ✓ **Road Show & Training – Government and Household E-Waste Full Recovery facility.**

- **Collection Centre Setup**
 - ✓ **Location – Government, Retailer and NGO**
 - ✓ **Recycle Bin – Government**
 - ✓ **Overhead – Government, NGO & Retailer**

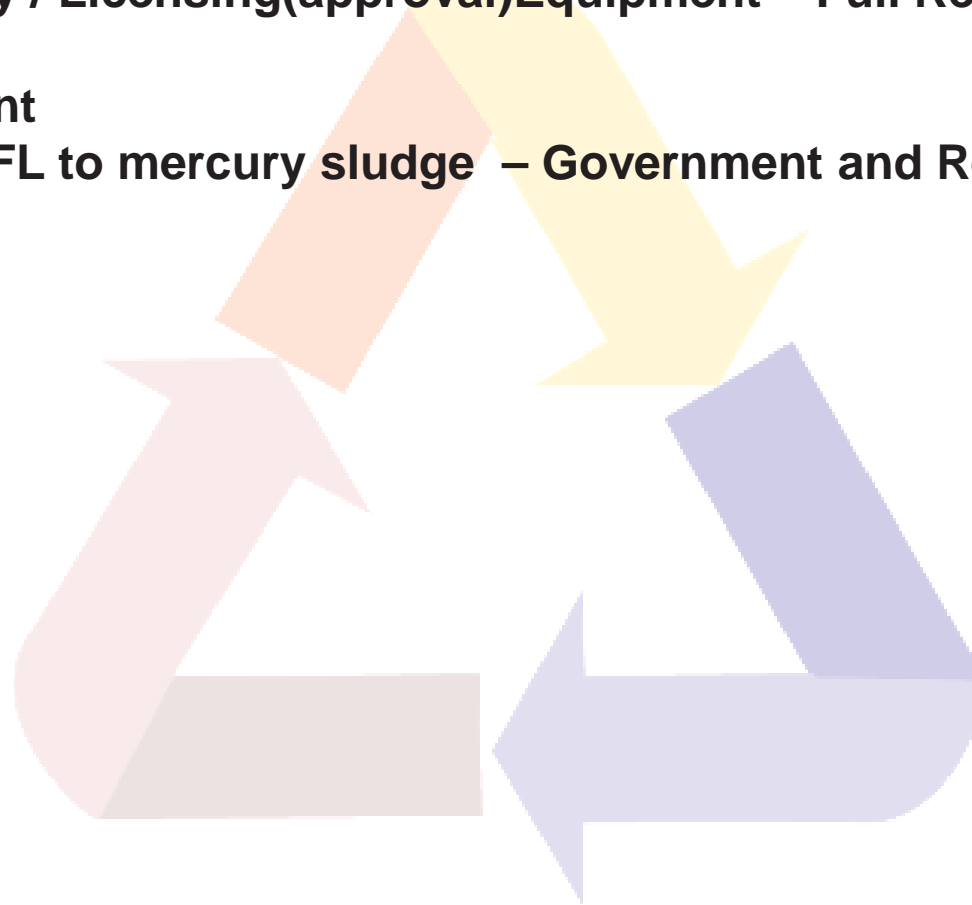
- **Transportation**
 - ✓ **Generator to collection center – Generator**
 - ✓ **Collection Centre to Full Recovery – Full Recovery Facility**

- **Treatment & Disposal**
 - ✓ **Full Recovery – Government**
 - ✓ **Secured Landfill - Government**

Methodology And Financial Support

➤ Technology Consideration/Equipment

- ✓ Suitability / Licensing(approval)Equipment – Full Recovery and DOE
- ✓ Equipment
Turning FL to mercury sludge – Government and Recycler



Attachment 6

Overview of the Program Conducted in Japan

1. Name

Promotion of Adequate Treatment Technology of Mercury Contained Waste

2. Period & Schedule

10-16 July 2016 Osaka, Japan

| Date | Training content | | Venue |
|--------|---|---|---|
| | 1. Institution-building training (inspection, licensing, etc.) | 2. Environment measurement and processing method training for all trainees (including intermediate processing facility staff) | |
| 10-Jul | Arrival (Kansai airport) | | |
| 11-Jul | Orientation | | GEC |
| | Activities to promote public awareness of treating mercury containing/contaminated waste by NPO | | GEC |
| | Waste Management-Challenges and Opportunities and IETC Activities on Waste Management | | GEC |
| 12-Jul | Fluorescent lamp collection process by Kyoto City and site visit | | Kyoto City |
| | Fluorescent lamp recycling facility | | Kansai Factory |
| 13-Jul | Municipal waste processing plan by Osaka City | environmental measurement, data processing methods | 1. Osaka City 2. Kansai Factory |
| | Dissemination to the public and collaborative activities (introduction) | Facility and operation management methods | 1. Osaka City 2. Kansai Factory |
| | Waste reduction measures by Osaka City (waste segregation/ collaborative activities) | Crisis management methods | 1. Osaka City 2. Kansai Factory |
| 14-Jul | Fluorescent lamp collection process by Osaka City | | Osaka City |
| | Land fill site | | Osaka Bay Regional Environmental Improvement Center |
| 15-Jul | Home Appliance Recycling Facility | | GEC |
| | Group Discussion | | |
| 16-Jul | Departure | | |

3. Participant list

| No. | |
|-----|--|
| 1 | Mr. Shahril Zamani Md Zain – Assistant Director, Penang State Economic Planning unit |
| 2 | Mr. Mubarak Junus – MBPP Head of Urban Services Department |
| 3 | Mr. Mohd Husaini Bin Saad, he is our assistant director of State Economic Planning Unit. |
| 4 | Mr. Tan Chong Hee – MPSP City Councillor |
| 5 | Mr. Tan Chee Teong – MPSP City Councillor |
| 6 | Mr. Mohd Puad bin Hamid – MPSP Head of Urban Services Department |
| 7 | Mr. Mohd Nazri bin Ramli – Assistant Director of Department of Environment (DOE) |
| 8 | Ms. Koay Gaik Kee – Special Officer to Hon. Mr. Phee Boon Poh |
| 9 | Ms. Josephine Mei Ling Tan – Special Officer to Hon. Mr. Phee Boon Poh |
| 10 | Mr. EW Tan, Marketing Manager – Shan Poornam Metals Sdn. Bhd |
| 11 | Mr. Teoh Yik Then, EHS Manager –Shan Poornam Metals Sdn. Bhd |
| 12 | Mr. Khor Hung Teik, Senior consultant for YB Phee |
| 13 | YB Phee Boon Poh – Penang State Minister of Welfare, Caring Society and Environment |
| 14 | YB Yeoh Soon Hin – Penang State Assemblyman of Paya Terubong |

4. Attachment (Handout)

- ① Consumers Kyoto
- ② UNEP
- ③ Kyoto city
- ④ Nomura Kohsan Kansai Factory
- ⑤ Osaka City (Municipal Solid Waste Management Plan)
- ⑥ Osaka City (Action Plan for Reduction of waste)
- ⑦ Osaka City (Waste Sorting)
- ⑧ Osaka City (Overview of Information Dissemination and Enlightenment among Citizens)
- ⑨ Osaka City (Collection and Treatment of Used Fluorescent Lamps and Other Wastes in Osaka City)

Towards the Proper Processing of Fluorescent Lamps

July 11th, 2016

Tsuyoshi Hara



Consumers Kyoto (non-profit organization)

- July 1972 The Kyoto Liaison Committee of Consumer's Organization was formed.
- April 2003 Decision to incorporate the Kyoto Liaison Committee of Consumer's Organization as a non-profit organization (NPO) during the 31st General Meeting.
- June 2003 Formation of "Consumers Kyoto" (Kyoto Liaison Committee of Consumer's Organization).
- October 1st, 2003 Certification by Kyoto Prefecture Governor. Began activities in the areas of "consumer protection" and "environmental protection" as an NPO.

What do we do?!
With burdensome household waste



Towards the Proper Treatment of Fluorescent Lamps
Through the combined efforts of citizens, municipalities and industries



Waste Management Law and Fluorescent Lamps

Municipal waste

Responsibility to treat and dispose of waste is on the municipality.
⇒ Fluorescent lamps generated by households

Industrial (commercial) waste

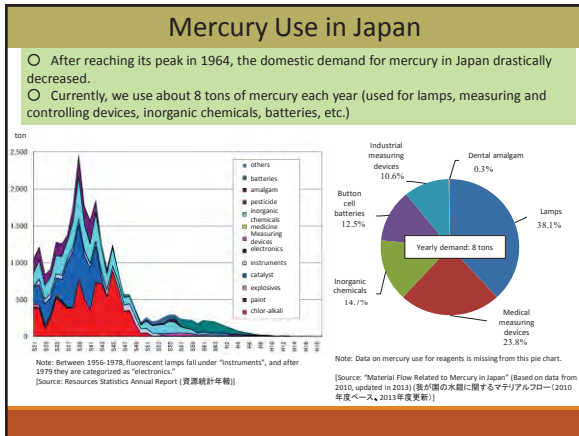
Responsibility to treat and dispose of waste is on the waste generator.
Must form a contract with a waste treatment company.
Must manage the Waste Manifest.
⇒ Fluorescent lamps generated by offices

Adoption of the "Minamata Convention on Mercury" (October 2013)

Japan, now a Party to the Convention, is currently in the process of preparing domestic measures (including the implementation of a model project)

The Main Articles of the Convention

| | |
|---------------------------------------|--|
| Preamble | |
| Preface | Objective, Definitions |
| Supply and trade | Mercury supply sources and trade |
| Products and manufacturing processes | Mercury-added products (batteries, measuring devices (including thermometers, sphygmomanometers), lamps, switches and relays, dental amalgam, etc.), manufacturing processes in which mercury is used, exceptions for mercury used for allowable uses permitted by the Parties |
| Artisanal and small-scale gold mining | Artisanal and small-scale gold mining (ASGM) |
| Emissions and releases | Emissions into the atmosphere, releases into land and water |
| Storage, waste, etc. | Environmentally sound storage, mercury waste, contaminated sites |
| Financial and technical assistance | Financial resources and mechanism, technical assistance, committee |
| Awareness and research | Information exchange, public information, awareness and education, research, development and monitoring, health aspects, implementation plans, reporting, effectiveness evaluation |



- ### Key Points on Domestic Measures on Mercury in Response to the Minamata Convention
- ❖ Discontinuation of mercury use in industrial processes
 - ❖ Proper collection and treatment of mercury-containing products
 - ❖ Expanding the scope of efforts from fluorescent lamps to mercury thermometers and mercury blood pressure measuring devices

Brochure produced by Consumers Kyoto.
 Has been received favorably by readers; very convenient and easy to read.

An angel mascot, "Akari-chan", for fluorescent lamp recycling

水銀条約採択!!
国内対策「次の一手」は?!

環境のリサイクルヘルムールちゃん

特定非営利活動法人
 コンシューマーズ情報(株)京都府支部

2014.12

Proper Treatment of Household Fluorescent Lamps Case Study: Kyoto City

- ### Fluorescent Lamps from Households (case study: Kyoto City)
- ❖ Collection route
 - 1 Household electronic stores as collection points
 - 2 Public facilities as collection points
 - 3 Localized voluntary collection by citizens

+

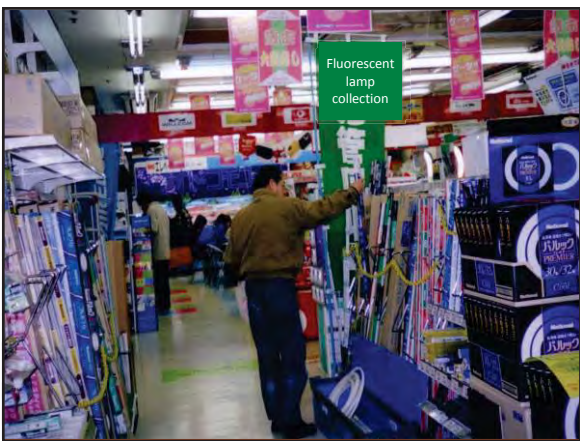
 - 4 Portable recycling collection points

- ### Collection of Fluorescent Lamps Using Household Electronics Stores
- ❖ Stemming from the case studies of Kitakyushu City and Sapporo City, a collection demonstration was carried out in December 2005.
 - ❖ Based on the result of this demonstration, a proposal was submitted to Kyoto City.
 - ❖ Since October 2006, a lamp collection system has been put in place, using electronic stores as collection points.
 - ❖ Additionally, municipal facilities are used as collection points.



“Social experiment”: Working in collaboration with electronics retailers for the proper disposal of fluorescent lamps (December 2005)

ventured in this experiment as a MOEJ eco-community project
(Collaboration with TANIYAMAMUSEN)



京都市では2006年10月1日から蛍光管の回収を実施しています
使用済み蛍光管はお近くの回収協力店か区役所・まち美化事務所等の回収拠点へ

京都市では家電販売店の協力を得て、使用済み蛍光管を買い替える際に回収協力店で引取ってもらえる制度を作りました。買い替えられる場合、使用済み蛍光管は「蛍光管回収協力店」のあるお店にお持ち込みください。

あらかじめ蛍光管の買置きをしていた場合、蛍光管の買い替えではないため使用済み蛍光管を回収協力店で引取ってもらうことはできません。この場合の使用済み蛍光管については、各まち美化事務所か区役所・支所に設置している回収ボックスに入れてください。

このステッカーが目印です
このステッカーが目印です
このステッカーが目印です
お買い替えの際に、お引き取りします

対象
家庭から排出される直管・直管・電球型の蛍光管が対象です(自然電球は回収していません)。

出し方
蛍光管は割れないように、できるだけ買った時のケースなどに入れて、お近くの回収協力店か回収拠点へお持ちください。
※割れた蛍光管は厚紙等に包んで裏面ごととしてお持ちください。

事業所から出る蛍光管は?
京都市では事業系の蛍光管を引き取ることはできません。事業者が排出する蛍光管は、産業廃棄物として処理業者に依頼して適正に処理してもらう必要があります。

お問い合わせは
京都市環境政策局まち美化推進課
☎075-213-4960





Fluorescent lamp collection

Fluorescent lamp collection boxes

Portable Recycling Collection Points

including hazardous and dangerous wastes as collection targets



Collection



Reception



Collection boxes for recyclables



Cleaning agents



Hazardous and danger materials



Unopened oil



Unopened wax

Proper Treatment of Fluorescent Lamps from Offices

❖ Pilot experiment: joint collection of fluorescent lamps from office buildings

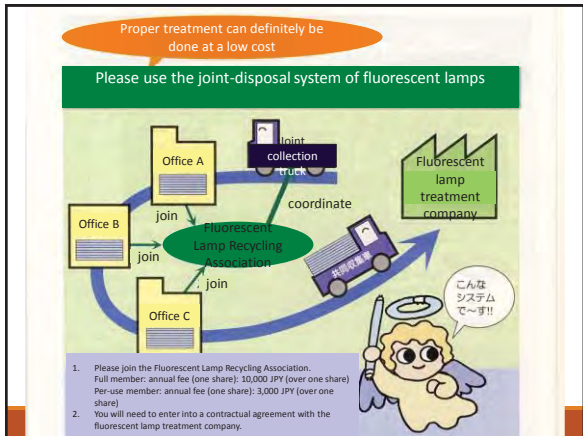
❖ Based on this result, the “Fluorescent Lamp Recycling Association” was established in October 2010

Pilot Collection of Fluorescent Lamps from Office Buildings



Fluorescent Lamp Recycling Association

1. Organizes awareness raising activities for the proper treatment of fluorescent lamps;
2. Conducts surveys and studies for the proper treatment of fluorescent lamps;
3. Coordinates joint disposal of fluorescent lamps from office buildings;
4. Coordinates community-level collection of fluorescent lamps.



Starting the Collection of Mercury-Containing Thermometers and Sphygmomanometers

回収実験を実施します!!

家庭で眠っている
水銀体温計 & 水銀血圧計

●11月30日(日)
10時～16時30分
●みやこめっせ
左京区船岡山公園 1
Tel:075-752-2335

●12月13日(土)
14日(日)
10時～16時
●パルスプラザ
伏見区船岡山 5
Tel:075-752-10011

京都コンシューマーフェスティバル 2014



京都市ごみ減量推進会議助成事業

回収実験を実施します!!

家庭で眠っている
水銀体温計 & 水銀血圧計

●6月6日(土)
午前10時～午後2時30分
●船岡山公園
船岡山公園 1
Tel:075-752-2335

北区民ふれあいまつり 2015

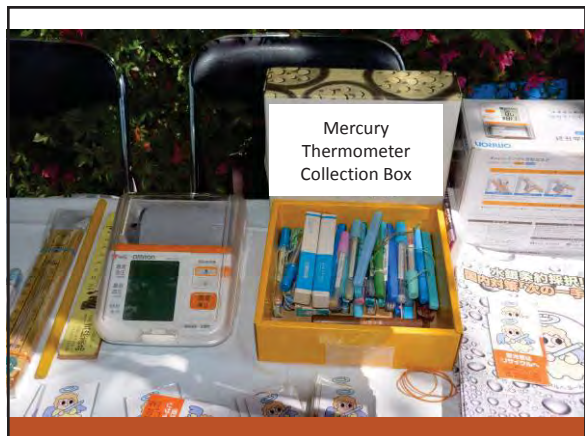
京都コンシューマーフェスティバル 2014

【回収対象品について】
1. 水銀体温計、水銀血圧計
2. 水銀体温計、水銀血圧計の部品
3. 水銀体温計、水銀血圧計の包装紙
4. 水銀体温計、水銀血圧計の取扱説明書
5. 水銀体温計、水銀血圧計の保証書
6. 水銀体温計、水銀血圧計の修理記録
7. 水銀体温計、水銀血圧計の廃棄記録
8. 水銀体温計、水銀血圧計の回収票
9. 水銀体温計、水銀血圧計の回収票の控え
10. 水銀体温計、水銀血圧計の回収票の控えの控え

【回収場所について】
1. 船岡山公園 1
2. 船岡山公園 2
3. 船岡山公園 3
4. 船岡山公園 4
5. 船岡山公園 5
6. 船岡山公園 6
7. 船岡山公園 7
8. 船岡山公園 8
9. 船岡山公園 9
10. 船岡山公園 10

【回収期間について】
1. 6月6日(土) 午前10時～午後2時30分
2. 6月7日(日) 午前10時～午後2時30分

【お問い合わせ先】
京都市環境局 資源管理課 資源回収係
〒600-8501 京都市中京区船岡山 1
Tel:075-752-2335



Treatment fee of fluorescent lamps: who will bear the burden? How will it be paid?

the concept of “extended producer responsibility” (EPR) is one possible answer...

Future activities

In response to the Minamata Convention on Mercury:

- ❖ Provide consumers and citizens with accurate information on mercury;
- ❖ Participate in the creation of a system for proper collection and treatment of mercury-containing waste;
- ❖ Strengthen relations with waste administrations of local governments;
- ❖ Cooperate with business organizations;
- ❖ Strengthen the activities conducted through the “Fluorescent Lamp Recycling Association.”


Waste Management-Challenges and Opportunities and IETC Activities on Waste management

Shunichi Honda, PhD
 International Environmental Technology Centre
 Chemicals and Waste Branch
 Division of Technology, Industry and Economics
United Nations Environment Programme
IICA project on "Promotion of Adequate Treatment Technology of mercury Contained Waste", 11 July 2016

UNEP



United Nations
Environment Programme




UNEP HQ (Nairobi)

| | |
|--|--------------------|
| Division of Technology, Industry and Economics (Paris) | 5 Divisions |
| International Environmental Technology Centre (Osaka) | 6 Regional Offices |
| Waste management | 7 Sub-programmes |
| | 6 MEAs |



UNEP DTIE IETC

| | | |
|------------------|---|--|
| Established | October 1992 | |
| Staff | 10 (5 Professional staff, 5 Programme assistants) | |
| Activities | Global/Regional Waste Management Outlook | <ul style="list-style-type: none"> • Integrated solid waste management • Holistic waste management • E-waste • Mercury waste • Disaster waste • Biomass agriculture • Waste and climate change, etc |
| | Global Partnership on Waste Management | |
| Waste management | Development and deployment of waste management techniques guidance Delivering integrated waste solutions at the national and local level | |



Programme

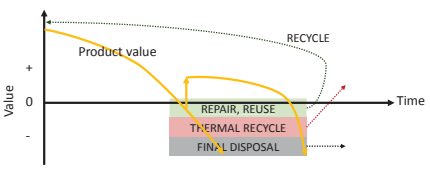
- 1 Introduction
- 2 Sound Management of Waste
- 3 UNEP's Work for Mercury
- 4 Mercury Waste

2 Sound Management of Waste



What is a Waste?

| | |
|------------------|---|
| General | Waste is any substance which is discarded. |
| Basel Convention | "Wastes" are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. |



Sound Management of Waste

Basel Convention

"Environmentally sound management" of hazardous waste means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes

Holistic Waste Management

Holistic waste management

A comprehensive waste management programme interlinking all types of wastes and their factors

Holistic Waste Management

| Waste Type | Waste management | Impact | Interlinkages | |
|---------------|------------------|-------------------------|-----------------------|--------------------|
| Solid Waste | Handling | GHG emission | Air pollution | |
| | Separation | Chemicals releases | | |
| | Collection | Residues | Water pollution | |
| | Packaging | Leachate | | |
| | Liquid Waste | Labeling | Resource recovery | Land contamination |
| | | Transportation | Socioeconomic benefit | |
| Storage | | Sustainable development | | |
| Gaseous Waste | Recovery | | | |
| | Disposal | | | |
| | | | | |

3 UNEP's Work for Mercury

History of Mercury

Mercury poisoning in Minamata – Minamata disease

- 1940-1960's: 1st May 1956: First patients were discovered officially.
- 1990's: Environmental rehabilitation was completed
- AFTER more than a half century...
- October 2013: The Minamata Convention on Mercury was adopted.
- 2017?: The Minamata Convention may entry into force.
- 201?: Mandate of mercury waste management

Many liver cases
> 3,000 confirmed patients
200 billion USD for compensation
Social issues (discrimination etc)
In Japan

UNEP's Work for Mercury

Global mercury events timeline

Emission

Regional mercury emissions in 2010

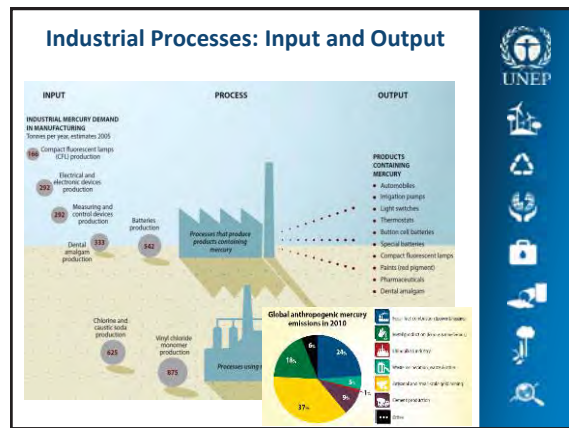
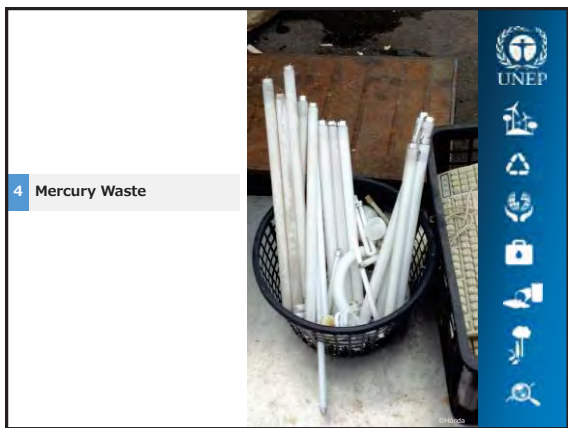
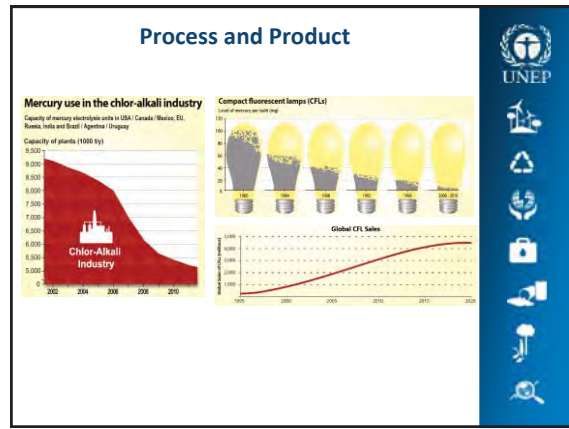
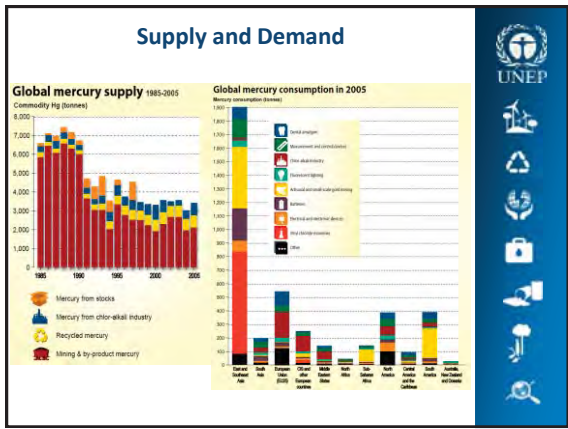
| Region | Percentage |
|---------------|------------|
| China | 39.7% |
| United States | 16.1% |
| Other regions | 44.2% |

Emissions to air

| Year | Approximate Emissions (tonnes) |
|------|--------------------------------|
| 1990 | 2000 |
| 1995 | 1800 |
| 2000 | 1600 |
| 2005 | 1400 |

Global anthropogenic mercury emissions in 2010

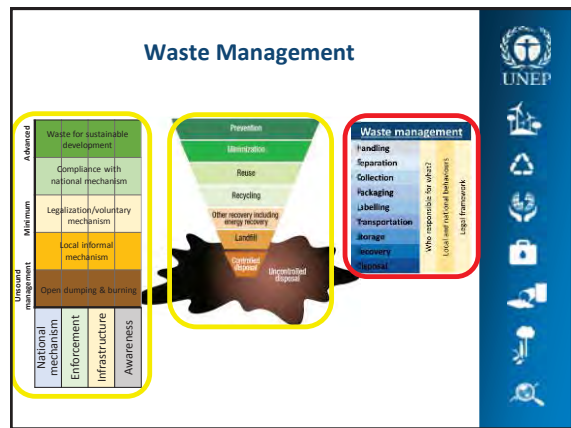
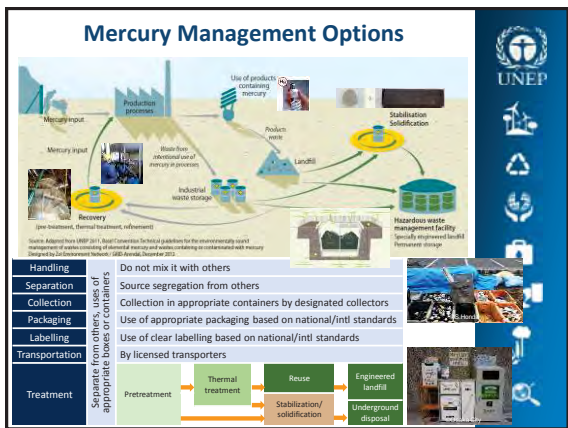
| Category | Percentage |
|---------------------------|------------|
| Intentional use sectors | 37% |
| Unintentional use sectors | 63% |



Trace quantities of mercury in various wastes

| Source of Hg wastes | Examples of Hg wastes |
|---|--|
| 1 Extraction and use of fuels/energy sources | Flue gas cleaning residues |
| 2 Primary (virgin) metal production | Residue, tailings |
| 3 Production processes with mercury impurities | Residues, sludge |
| 4 Intentional use of mercury in industrial production | Solid wastes contaminated with Hg, residues |
| 5 Products and applications with intentional use of mercury | Used/obsolete/broken products, residues |
| 6 Secondary metal production | Flue gas cleaning residues, process residues |
| 7 Waste incineration | Flue gas cleaning residues, process residues |
| 8 Waste deposition/landfilling and wastewater treatment | Wastewater, treatment residues |
| 9 Crematoria and cemeteries | Flue gas cleaning residues |

- ### Provisions for Mercury Wastes in the Minamata Convention
- The Minamata Convention (Art 11: Mercury wastes)**
- 1 Relevant definitions of the Basel Convention shall apply to waste covered by this Convention.
 - 2 Mercury wastes means substances or objects:
 - (a) Consisting of Hg or Hg compounds;
 - (b) Containing Hg or Hg compounds; or
 - (c) Contaminated with Hg or Hg compounds.
 Above **thresholds**, to be defined by COP
 - 3 ESM for mercury wastes with the Basel Hg guidelines, TBM under the Basel Convention, with **requirements** to be adapted by COP
- www.mercuryconvention.org
-





















References

References

- Mercury Acting Now
- Mercury Time to Act
- Global Mercury Assessment 2013
- Practical Sourcebook on Mercury Waste Storage and Disposal
- Basel Convention Technical Guidelines of Mercury Wastes
- UNEP Hg Toolkit Level I
- UNEP Hg Toolkit Level II

Collection at city-designated facilities (18 items)

| | | | | | |
|--|---|---|---|--|---|
| ① Newspaper, cardboard  | ② Miscellaneous paper waste (paper boxes, wrapping paper, etc.)  | ③ Cartons  | ④ Waste cooking oil for tempura  | ⑤ Used clothing (used clothes, cloth, etc.)  | ⑥ Dry batteries  |
| ⑦ Button batteries  | ⑧ Rechargeable batteries (small secondary batteries)  | ⑨ Fluorescent lights  | ⑩ Mercury thermometers, mercury sphygmomanometers  | ⑪ Small home appliances (smaller than H:30cm x W:40cm x D:40cm)  | ⑫ Memory media (CDs, videotapes, etc.)  |
| ⑬ Ink cartridges  | ⑭ Reusable bottles (Issho-bin or sake bottles of 1.8 liters, and beer bottles)  | ⑮ Edged tools (knives, scissors, etc.)  | ⑯ Disposable lighters  | ⑰ Ceramics  | ⑱ Trimmed tree branches  |

* ⑪ does not include four types of home appliances (televisions, air conditioners, refrigerators/freezers, and clothes washers/dryers) and personal computers **P17**, and oil/kerosene heaters.

These recyclables are collected at the sites below.

● **Recyclables collection facilities** (Collect ① - ⑯ above. *Some items cannot be collected, depending on collection facilities.)

Recyclables are collected at Counters for Ecological Activities in Ward Offices and Ward Branch Offices, Ward Beautification Offices, Kamigyo Recycle Station, and cooperating stores in Kyoto City. Collection items and dates differ, depending on collection facilities. Ask a Counter for Ecological Activities in a Ward Office or Ward Branch Office or refer to the recyclables collection map in advance. [recyclables collection map](#) [Search](#)

Kamigyo Recycle Station

Address: 100 Kainokami-cho, Aburanokoji-Higashiiru, Nakadachiuri-dori, Kamigyo-ku, Kyoto City

Business hours: 9:00 a.m.-5:00 p.m. on weekdays

9:00 a.m.-5:00 p.m. on weekends and national holidays

*Closed for year-end and New Year holidays



● **Mobile collection services** (Collect ①~⑱ above and “harmful or hazardous wastes (*)”)

We go to accessible places such as schools and parks, and collect recyclables every year and harmful or hazardous wastes such as petroleum every other year based on previous school districts. For collection dates and locations, please see fliers circulated in your area. You can find this information in the Citizen's Newspaper (Ward version) or on Internet, depending on the scale.

[mobile collection services](#) [Search](#)

(*) “Harmful or hazardous wastes” are the following four items:

- ① Petroleum, ② Medical and pharmaceutical products, agrochemicals ③ Chemicals, coating materials, wax, paint, ④ Detergent

Should you have any questions, please contact a Counter for Ecological Activities in a Ward Office or Ward Branch Office.



Cans, bottles, PET bottles/Plastic containers and packages
03

Small metal objects and spray cans/Combustible garbage
05

Recyclable paper
07

Other ways that recyclables are collected
09

For residents of apartments from which private contractors collect garbage
11

Where recyclables go
13

How to dispose of excess garbage/Carrying in garbage to incineration plants
15

What is NOT collected in Kyoto City
17

Other efforts
19

Practice of Recycle that doesn't create garbage
21



Safety Measures for Treatment of Used Fluorescent Lamps

Kansai Factory
Nomura Kohsan Co., Ltd.

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Physical Characteristics of Mercury- 1

The only metallic element liquid at room temperature


Color: Silver-white with a metallic luster

Specific gravity: 13.6 (0°C)

Melting point: -38.84°C (freezing point)

Boiling point: 356.58°C

Solubility: 0.02 mg/l (20°C, water)
⇒ very difficult to dissolve in water.


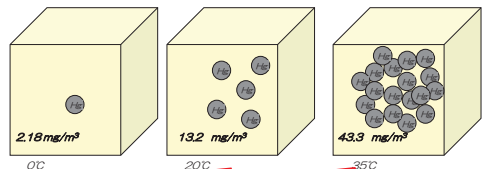


Easily amalgamates with other metals such as gold, silver, copper, zinc, lead, sodium and potassium

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Physical Characteristics of Mercury- 2

- ◆ **Vaporizes easily** even at room temperature (20°C)
- ◆ Saturation concentration in air (the max. value of Hg that evaporates at that temperature)






The more the temperature increases, the more easily mercury vaporizes
Hotter the weather, the more likely to be exposed to a greater amount of mercury gas

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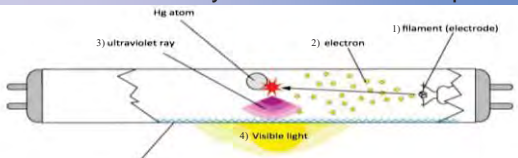
Handling and Storage of Mercury

| Handling | Storage |
|---|--|
| <ol style="list-style-type: none"> 1) Be sure to install exhaust equipment in every work area where mercury is being handled. 2) Wear protective goggles, gloves, clothing and mercury gas-proof masks when handling mercury. 3) No drinking, eating or smoking in work areas. | <ol style="list-style-type: none"> 1) Storage containers should be sealable and be made of iron, glass or plastic. They should be stored in a locked, dark and cool place; specifically dedicated to mercury. 2) DO NOT STORE with azide, acetylene, or ammonia; chemicals will react and produce explosive compounds. |

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The Role of Mercury in Fluorescent Lamps



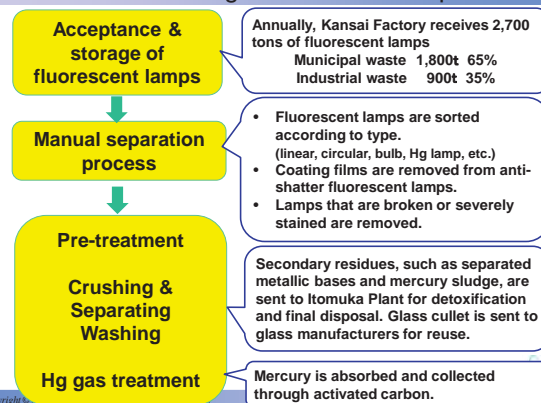
Principle of emission

- 1) Electric current is provided to the filament (electrode).
- 2) Thermal electrons are emitted.
- 3) Electrons collide with the **mercury** in the tube, producing ultraviolet (UV) rays.
- 4) UV rays cause the fluorescent powder to produce visible light.

| Composition of a 40W fluorescent lamp (250g/piece) | |
|--|---|
| Glass | 92.2% |
| Al/ brass | 2.4% |
| Iron/Nickel | 3% |
| Fluorescent powder | 2.4% |
| Mercury | 4 × 10⁻³% (approx. 7mg) |

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Process for Treating Fluorescent Lamps



Annually, Kansai Factory receives 2,700 tons of fluorescent lamps

- Municipal waste 1,800t 65%
- Industrial waste 900t 35%

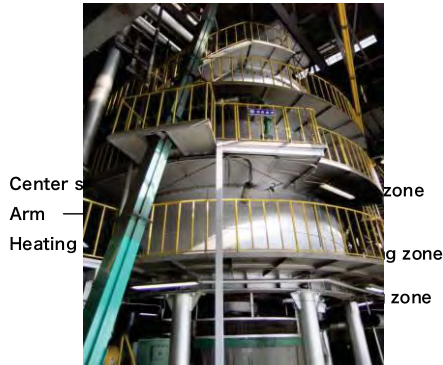
- Fluorescent lamps are sorted according to type. (linear, circular, bulb, Hg lamp, etc.)
- Coating films are removed from anti-shatter fluorescent lamps.
- Lamps that are broken or severely stained are removed.

Secondary residues, such as separated metallic bases and mercury sludge, are sent to Itomuka Plant for detoxification and final disposal. Glass cullet is sent to glass manufacturers for reuse.

Mercury is absorbed and collected through activated carbon.

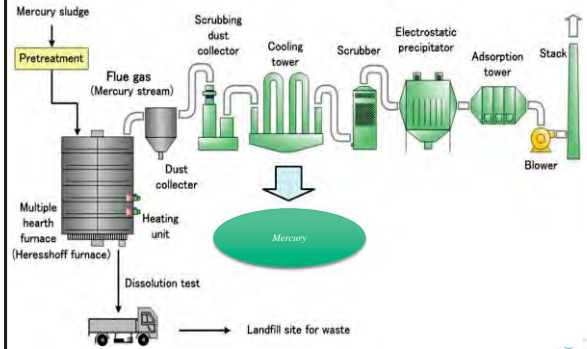
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Treatment of the mercury waste at Itomuka Plant



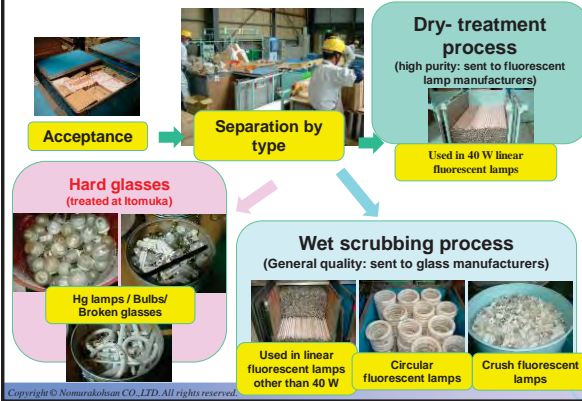
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Treatment of the mercury waste at Itomuka Plant



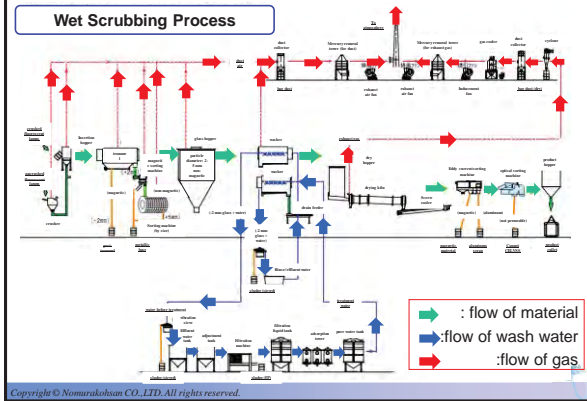
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Storage and Separation



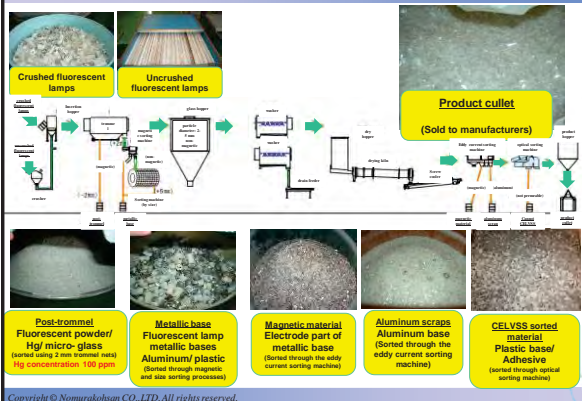
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Flow of Fluorescent Lamp Treatment



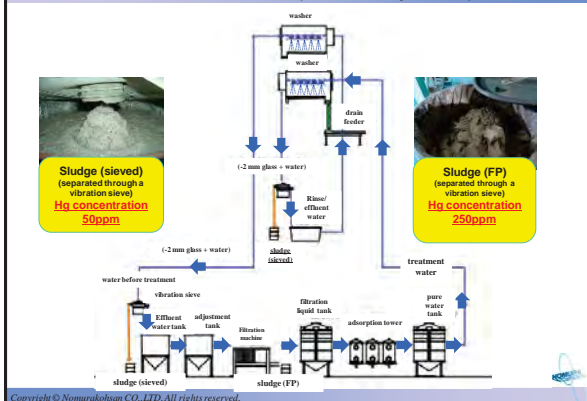
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Fluorescent Lamp Treatment (From Crushing/ Sorting to Product Cullet)

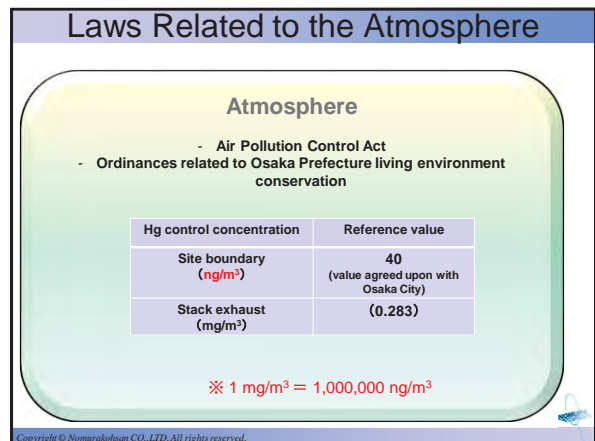
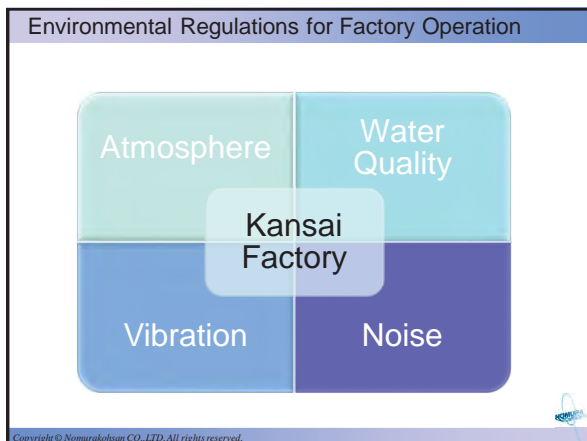
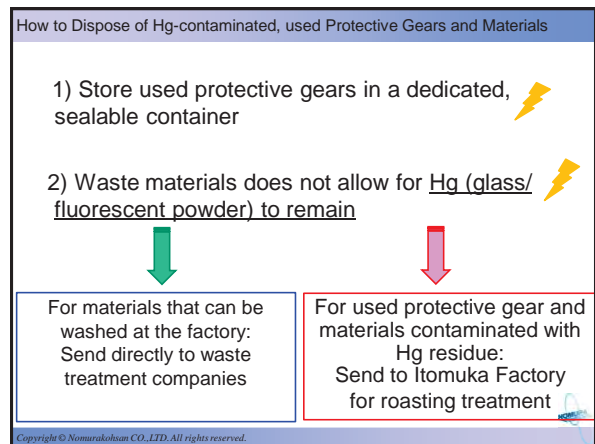
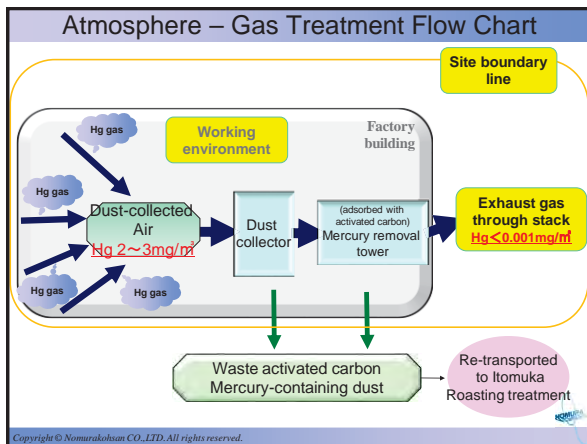
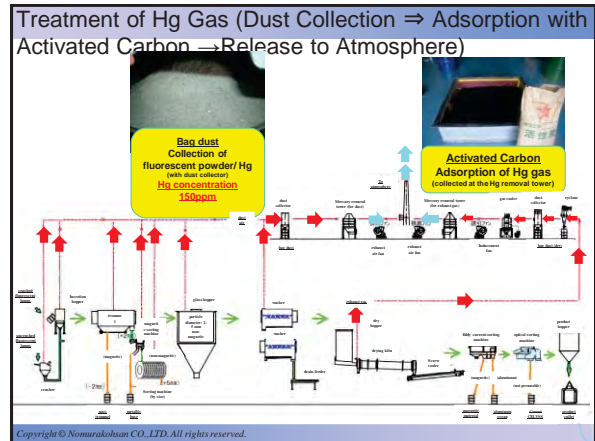
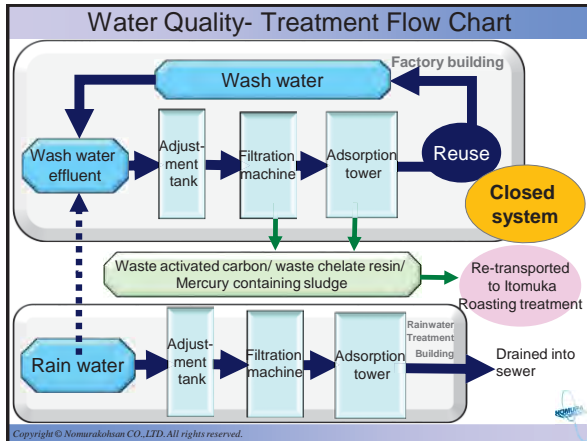


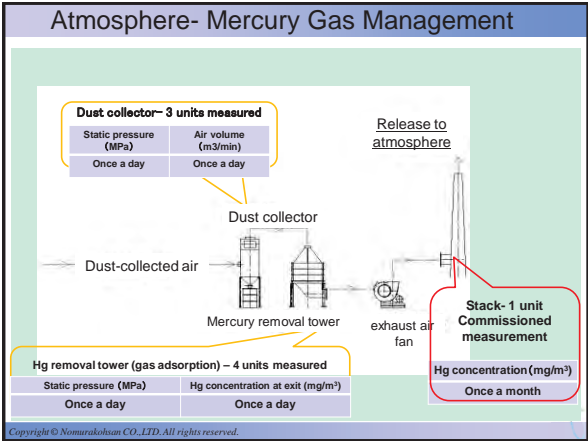
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Reuse of wash water (closed system)



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Agreement with Osaka City Government Environment Bureau (Management of Hg concentration at site boundary line)

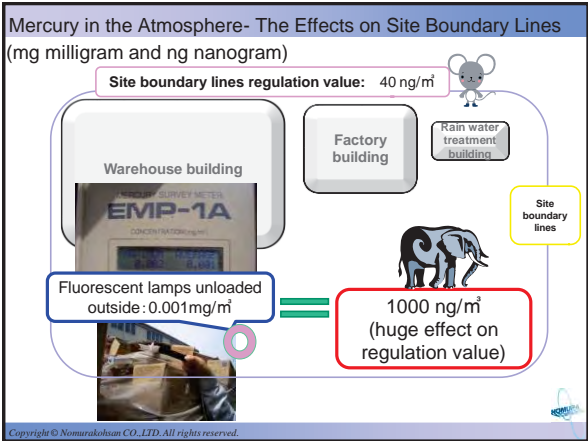
Results from site boundary line measurements (2015 Unit: ng/m³)

| Location No.1 | Location No.2 | Location No.3 | Location No.4 | Annual average value | Agreed value with Osaka City |
|---------------|---------------|---------------|---------------|----------------------|------------------------------|
| 9.0 | 10.6 | 13.2 | 13.1 | 11.4 | 40 |

↓

- To be attentive to outdoor situations
Not to leave the materials received, such as fluorescent lamps (including broken pieces of glass on the floor), for a long period of time.
- To monitor and improve factors that have a big impact on Hg releases such as factory interior (working environment).

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Atmosphere – Mercury Gas Measurement

Measurement of site boundary line ~Manual for hazardous substances and air pollutant measurement~
(Measuring Hg-gas in the outdoor atmosphere)

Measurement frequency (At 4 locations on the site boundary line)
Once a month

Measurement of work environment ~Work environment evaluation standards based on Industrial Safety and Health Act (Art 65.2.2)-
(Measuring Hg-gas inside the factory)

| | | |
|---|---|--------------------------------------|
| Requests for Environmental Analysis Yamato Environment Center | Simple measurements done at our factory | |
| Frequency of measurements designated by law | Self-management | |
| Once, within every 6 months | Once a day | Once a month |
| (at 18 locations within the factory) | (at 13 locations within the factory) | (at 30 locations within the factory) |

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Water Quality/ Noise/ Vibration

Water quality measurement ~Water Pollution Control Act (Osaka City water sewer ordinance)~

| Measurement frequency | Water from treated rain water | |
|-----------------------|-------------------------------|----------------------|
| | Reference value (Hg elution) | Reference value (pH) |
| Once every month | 0.005 mg/L | 5~9 |

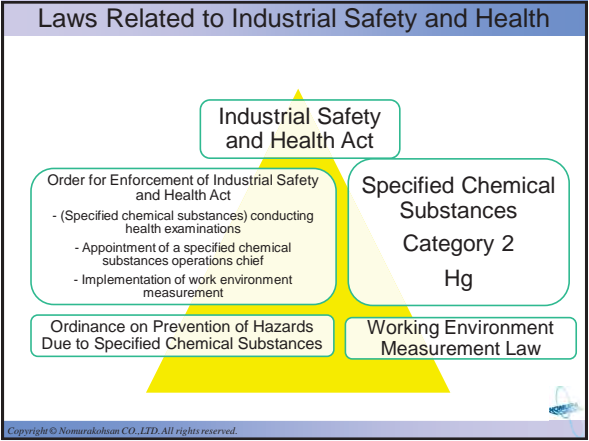
Noise measurement ~Noise Regulation Act (Osaka Prefectural ordinance)~

| Measurement frequency | 4 points on the site boundary lines (8 AM- 6 PM) | |
|-----------------------|--|-------------------------------|
| | Reference value (dB) | Voluntary standard value (dB) |
| Once every 6 months | 70 | 68 |

Vibration measurement ~Vibration Regulation Act (Osaka Prefectural ordinance)~

| Measurement frequency | 4 points on the site boundary lines (6 AM- 9 PM) | |
|-----------------------|--|-------------------------------|
| | Reference value (dB) | Voluntary standard value (dB) |
| Once every 6 months | 70 | 68 |


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Understanding the Workplace Environment: Conducting Work Environment Measurements

Industrial Safety and Health Act (Art. 21)
(Hazardous operations that require work environment measurements)

7. Indoor workplaces that handle specified chemical substances (Hg) listed in Schedule 3




↓

Pre-treatment facility for fluorescent lamps falls into this category
Work environment measurements are conducted once, within 6 month intervals

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* Toxicity of Mercury

Inside fluorescent lamps: inorganic (metallic) mercury



◇About metallic mercury:

- Poisoning occurs through large inhalation of gas, vapor and mist.

Levels of Hg concentration in atmosphere that causes mercury poisoning

| Severe poisoning | Moderate poisoning | Mild poisoning | Reference) Standard value for working environment |
|--|---------------------------|------------------------|---|
| Several to several dozen mg/m ³ | 0.3~0.5 mg/m ³ | <0.2 mg/m ³ | 0.025 mg/m ³ |

Symptoms: Can often cause headaches, general fatigue, stomatitis, anorexia, bronchitis, pneumonia, hematuria, albuminuria or diarrhea.

*Even if metallic mercury is ingested orally, it will rarely be absorbed into the body through the digestive organs.

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Safety Management: Managing the Health of Workers

Industrial Safety and Health Act (Art. 22)
(Hazardous operations that require a health examination)

3. Work that requires the handling of specified chemical substances (Hg) listed in Schedule 3

↓

Crushing fluorescent lamps falls into this category



Health examination by a doctor once, within 6 month intervals

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Content of Special Health Examination

Content:

- 1) Survey of work history
During the check up
- 2) Check for subjective symptoms such as headaches
During urinalysis
- 3) Check for occult blood and protein in urine
Examination results

* Data stored for 5 years.

At present, not only those who currently produce or handle specified chemical substances, but also employees who have been exposed to these jobs in the past are subjected to the examination

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Working Environment Measurement Results at our Factory (2015) (average value per site)




Working environment reference Hg value: 0.025 mg/m³

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Measuring Hg Gas at Every Step of the Operation

Measurement results from each workplace **clears the reference value on average**, but



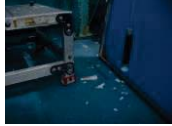
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when you look closely at the daily performances, during certain operations, **the Hg value is temporarily detected at high levels.**

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Example: At the Factory

1) Crushing/ Sorting: Glass scattered on the factory floor during operations (indoor workplace)



Hg value:
0.027mg/m³

Hg gas vaporizes
from the glass.

2) Crushing/ Sorting: Drum container filled with crushed fluorescent lamps when opened (indoor workplace)



Hg value: 1.40mg/m³

High Hg
concentration.
Drums must be closed

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Examples: When Unloading Waste or When Stored Improperly

1) Receiving & unloading waste: measuring immediately after unloading



Hg value: 0.001mg/m³

Hg gas spreads out into
the outside atmosphere

2) Storage area (inside warehouse): measuring broken fluorescent lamps



Hg value: 0.021mg/m³

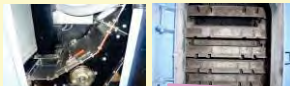
Hg gas accumulates in
enclosed space
(i.e. closed warehouses)

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Other Circumstances

1) Lamp crusher

When the cover is opened for maintenance/ collection or other emergencies



Hg gas will leak from opened ports.

2) Inspection of exhaust gas treatment equipment

- When replacing dust-collection element
- When replacing activated carbon



Collected Hg gas will leak.

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Protection Against Hg Gas and Dust

-Use of gas masks



SHIGEMATSU GM77

Check the expiration dates of the activated carbon and the breakthrough time for masks when using in work areas with high mercury concentration levels.

-Collection of Hg dust



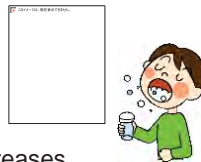
Sinto Amano
Vacuum Cleaner

The exhaust port can be safely used since it is mounted with activated carbon for Hg collection.

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First Aid Measures for Hg Inhalation

- Remove to fresh air.
- Blow nose.
- Rinse throat.
- If body temperature decreases, provide insulation by wrapping in blanket.
- If not breathing, provide artificial respiration.



In any case, get medical attention immediately.

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First Aid Measures for Other Exposures to Hg

1) Eye contact:

Use gauze or absorbent cotton to wipe, and **immediately flush eye with plenty of pure water.**



2) Skin contact:

If clothing is contaminated, remove carefully, and use gauze or absorbent cotton to wipe off excess mercury. Immediately flush skin with plenty of pure water.

3) Ingestion: **Induce vomiting** by ingesting milk and egg whites.

In any case, **get medical attention immediately.**

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Emergency Situations (Fire / Hg leakage)

In case of fire

First aid measures:

Although mercury does not burn, it will evaporate when heated, so all Hg-containers must be removed to a safe place immediately.

If removal is not possible, spray the containers and their surroundings with water to keep cool.

Fire extinguishing method:
Spray from a windward location while wearing a protective mask.

To extinguish fire, use foam, carbon dioxide gas or dry chemicals.



In case of leakage

1. Use a pipet **to absorb** liquid.
2. Use the sticky side of **duct tape** to pick up small pieces.
3. Spray with calcium polysulfide; sweep and collection.
4. Collected and/or contaminated materials should be placed in a **sealable container**. Mercury must be disposed of properly.



*Avoid using industrial vacuum cleaners for clean up, since the inside of the vacuum cleaner will be contaminated with mercury. Afterwards, the vacuum cleaner will constantly emit Hg vapor.



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Summary

In order to carry out the treatment of fluorescent lamps as safely as possible:

It is important for all facility personnel to have a thorough understanding of mercury and to have heightened level of awareness.

Furthermore, each equipment must be properly managed, and the workers should pay close attention to every step of their work phase.



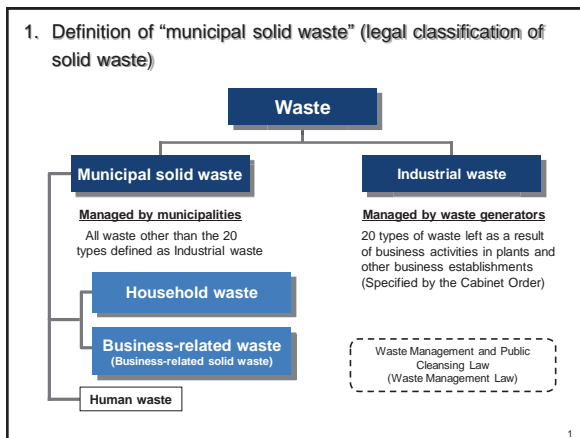
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Osaka City Municipal Solid Waste Management Plan

Planning Department, General Affairs Division
Environment Bureau, City of Osaka

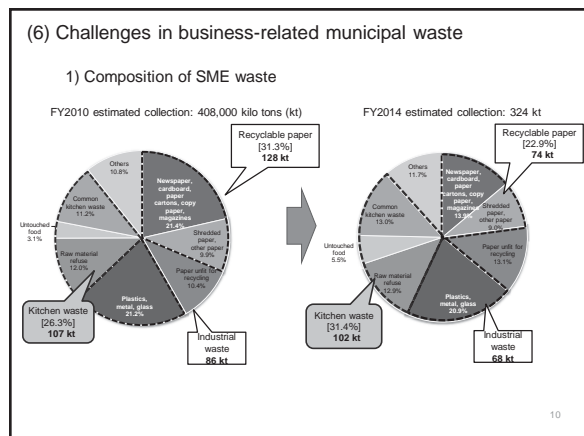
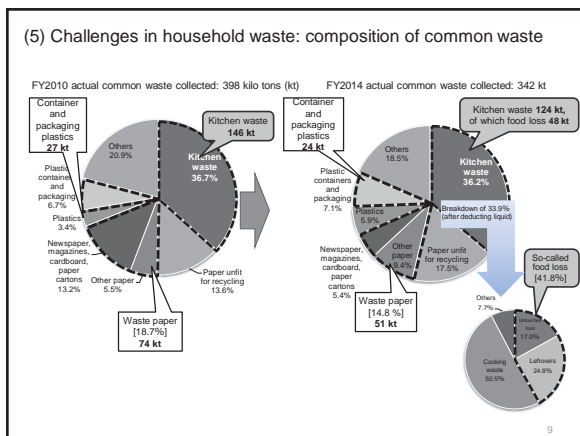
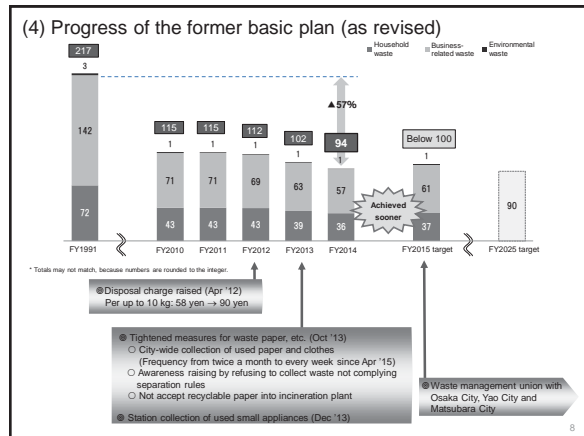
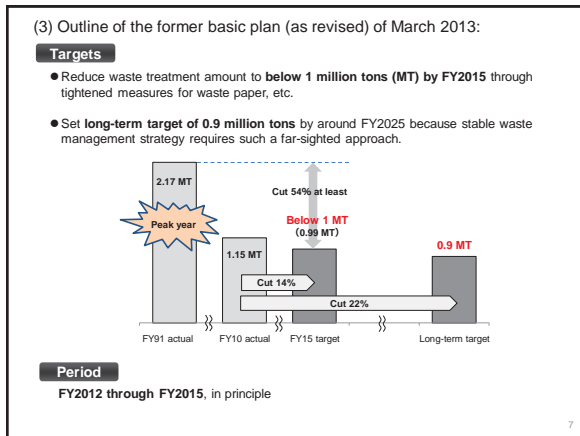
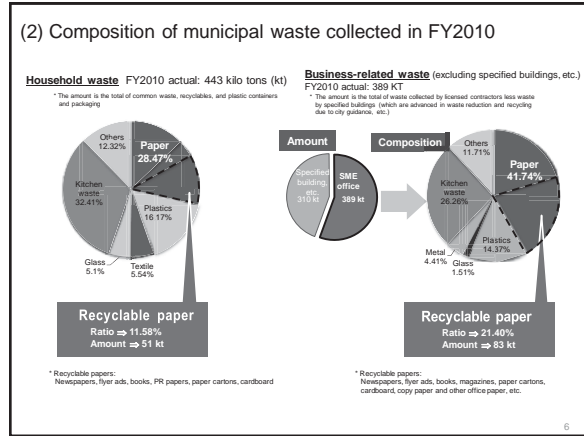
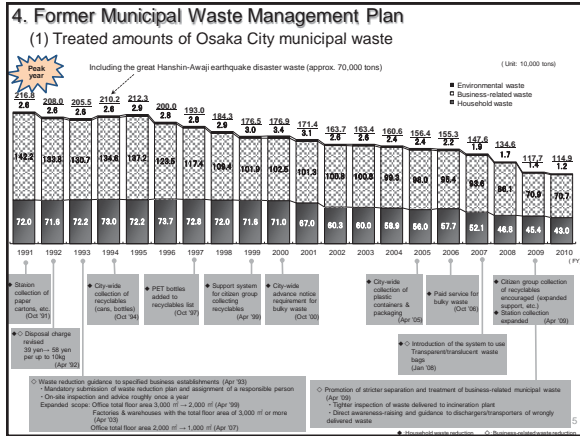
Contents

1. Definition of “municipal solid waste” (legal classification of solid waste)
2. A legal requirement of municipal waste management plan
3. Outline of Osaka City
4. Former Osaka City Municipal Waste Management Plan (as revised)
5. Current Osaka City Municipal Waste Management Plan

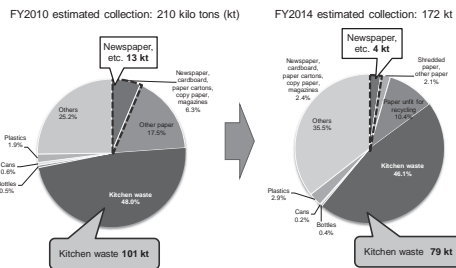


(2) Osaka City in figures

| | Osaka City | Japan total |
|---|------------------|--------------------|
| ■ Area (km ²) | 225.21 (2015) | 377,955 (2015) |
| ■ No. of households | 1,354,202 (2015) | 53,403,000 (2015) |
| ■ Estimated population | 2,691,742 (2015) | 127,110,000 (2015) |
| Male | 1,302,569 (2015) | 61,829,000 (2015) |
| Female | 1,389,173 (2015) | 65,281,000 (2015) |
| ■ Registered foreigners | 122,147 (2015) | 2,232,189 (2015) |
| ■ Population density (per km ²) | 11,952 (2015) | 340.8 (2015) |
| ■ No. of business establishments | 208,835 (2014) | 5,926,804 (2014) |



2) Composition of large establishments waste



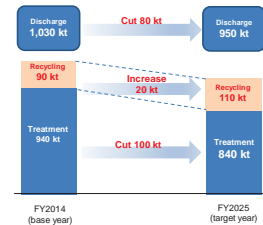
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5. Current Osaka City Municipal Waste Management Plan

(1) Outline of current Basic Plan of March 2016

Targets

- Reduce treatment amount to: **840 kilo tons (kt) by FY2025** through prioritization of 2R's (Reduce: reducing waste generation, and Reuse: reusing goods) and promotion of separation at source and recycling
[Breakdown]
 - Cut discharge by 80 kt
 - Increase recycling 20 kt
 - Cut treatment by 100 kt
- Raise efficiency while ensuring safe and appropriate waste management, including emergency responses to natural disasters



Period

10 years from FY2016 through FY2025

12

(2) Basic policy and major measures

Basic policy 1: Priority on 2R's

The 3R's (reduce, reuse, recycle) are important for creation of a sustainable, sound material-cycle society, particularly the 2R's of reducing waste generation reusing goods. Waste reduction requires voluntary participation of citizen and business operators, and so the City will prepare an environment to facilitate the initiative of these players. Priority is given to the 2R's because they are achievable with minimal extra input of energy or costs. The City will encourage shifts to new life and business styles which place the highest priority on waste generation reduction.

Major measures

1- (1) Easy-to-see information dissemination, and environmental education / awareness raising

- Provide data-based, easy-to-see information on the need for and progress in waste reduction
- Use diverse PR media, such as separation-at-source apps, website, brochures
- Hold community workshops for diverse age groups
- Awareness raising for senior citizens, cooperating with "Zero Waste" leaders and communities.
- Promote awareness raising activities by waste management centers (including help desks at ward offices)
- Recommend sector-specific reduction measures for Business-related municipal waste, etc.

13

1- (2) Kitchen waste reduction

Reduce kitchen waste from households

- Encourage reduction of food loss such as untouched food and leftovers, and promote "3 Off's" campaign to reduce weight of kitchen waste through dewatering at home
 - Kitchen waste 3 Off's
 - Use off all food materials, eat off all foods served, dry off kitchen waste before putting out for collection

Reduce kitchen waste from business establishments

- Individual awareness-raising and guidance to business establishments discharging large amount of food waste
- Study measures for promotion of minimizing leftovers in restaurants
- Promote reduction and recycling of kitchen waste generated at city schools, other public facilities, etc.

1- (3) Collaboration among citizens, business, and government

- Consider promoting campaigns for "My Bag" and "My Bottle" in collaboration with citizens and business operators
- Hold garage sales together with Zero Waste leaders, promote reuse-oriented behavior of citizens by collecting, displaying, and offering maternity wear, baby clothes, toddler clothes, etc.
- Promote 3R's in our own government offices through awareness raising, action programs, etc.

14

Basic policy 2: Promote separation at source and recycling

The city government has long worked with the citizens and business operators to promote separation at the source and recycling of various types of waste, achieving considerable waste reduction. The fact remains, however, that the waste we incinerate contains used paper, plastic containers and packaging, and other items designated for separation at the source as well as industrial waste and other wrongly discharged items. We will continue to address these challenges through close collaboration and communication with citizens and business operators in order to promote further appropriate separation and sound waste management.

Major measures

2- (1) Household waste

- Promote recycling by reactivating group collection and community collection
- Promote station collection of dry cells, fluorescent lamps, mercury thermometers, ink cartridges, and used small appliances
- Awareness raising by refusing to collect waste not complying separation rules
- Study measures to control illegal picking of recyclable waste, etc.

2- (2) Business-related waste

- Give guidance to owners/managers of specified establishments on waste reduction and commend good performers
- Encourage appropriate separation of business-related waste and provide guidance to correct streams of industrial waste (recommendations/warnings based on unpacking inspections at incineration plants and on-site surveys)
- Ban delivery of recyclable paper to incineration plants, redirect to recycling routes, etc.

15

Basic policy 3: Promote sound and efficient waste management with attention to the environment

Waste that is left behind even after genuine efforts in the 3R's needs to be treated and disposed of appropriately. The City will work to reduce environmental load in every step of waste management and in the most efficient way. We will cooperate closely with the Union of Waste Incineration Facilities to ensure safe and stable municipal waste management, including emergency response to natural disasters.

We will also conduct various investigations and studies on the 3R's and sound waste management

Major measures

3- (1) Promote environment-conscious waste management

- Contribute to GHG emissions reduction through reduction of waste incineration, use of eco-vehicles for collection, etc.

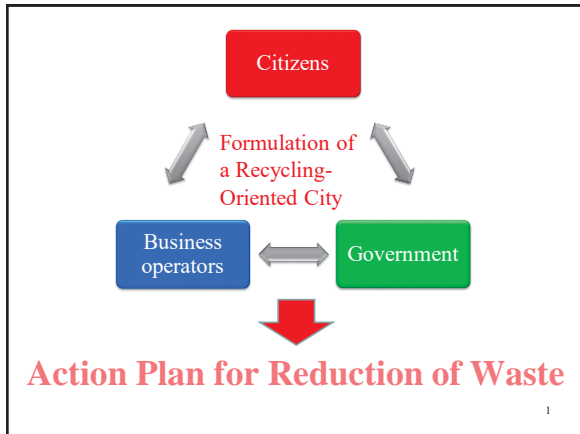
3- (2) Improve efficiency further and establish safe and stable system

- Expand contracting of household waste collection/transportation to private service providers
- Build waste management systems capable of transporting and disposing of disaster waste appropriately and speedily in heavy disaster situations

3- (3) Study on 3R's and sound waste management

- Study possible program for designating recycling operators to promote reduction and recycling of business-related waste
- Evaluate effectiveness of policy measures and study possible waste reduction measures based on economic approaches, etc.

16



Reduction of Waste and Efficient Use of Resources

- Priority for waste disposal under the Basic Law for Establishing a recycling-oriented Society

3R

| | |
|----------------------------------|---|
| Reduce (Reduction of generation) | • Reduce waste generation from the stages of production, distribution, and consumption. |
| Reuse (Reuse) | • Reuse things that can be repeatedly used many times. |
| Recycle (Recycle) | • Utilize unnecessary things as raw materials. |

2

Action Plan for Reduction of Waste

⇒ Action menu in practicing the 3R
-Citizens, business operators, Osaka City-

Three scenes in life

1. When shopping
2. In daily life
3. In order to utilize things that are no longer necessary

3

[Three Scenes in Life]

1. When shopping

- Bring your grocery bags when going shopping.
- Refuse excessive packaging.
- Choose refillable products and compact products.
- Choose products that are sold loosely and by measure.
- Choose products that are in reusable containers.
- Choose recycled goods.

4

[Three Scenes in Life]

1. When shopping

- Refrain from using disposable products.
- Use rental products and used items.

5

[Three Scenes in Life]

1. When shopping

- Be an environment-friendly consumer.

6

[Three Scenes in Life]
2. In daily life

- Try not to waste food.
- Try to use products as long as possible by fixing them when broken.



7

[Three Scenes in Life]
2. In daily life

- Frequently check food quality and the expiration date.



8

[Three Scenes in Life]
2. In daily life

- Get involved in waste reduction activities in the community, school, etc.
- Try to reduce raw waste.



9

[Three Scenes in Life]
3. In order to utilize things that are no longer necessary

- Give away things that can still be used to a person who needs them.
- Put out empty cans, bottles, and plastic bottles for collection of recyclable waste.
- Put out plastic containers and packaging for collection of plastic containers and packaging.
- Put out used paper and clothes for sorted collection of used paper and clothes.



Osaka City's Promoter of
Waste Reduction, etc.

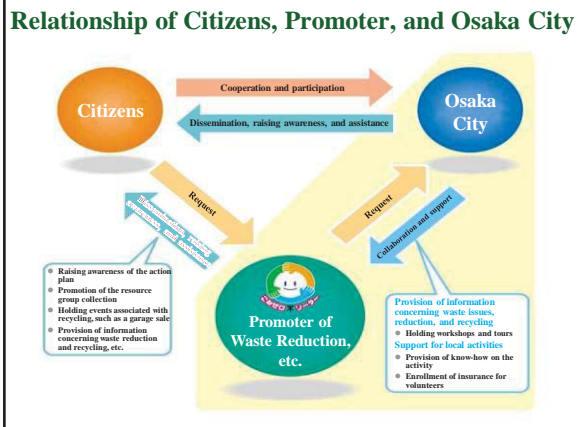


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○ Who is Promoter of Waste Reduction, etc. ?

12

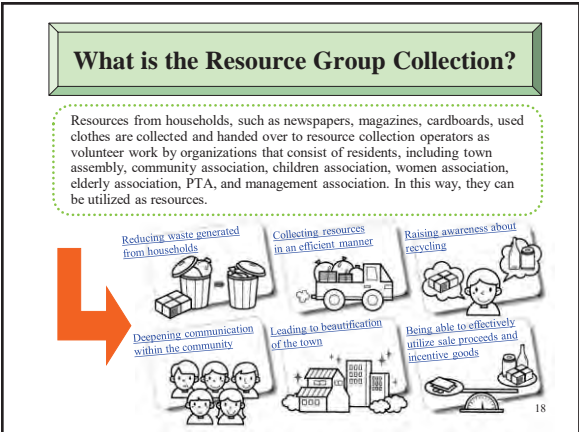
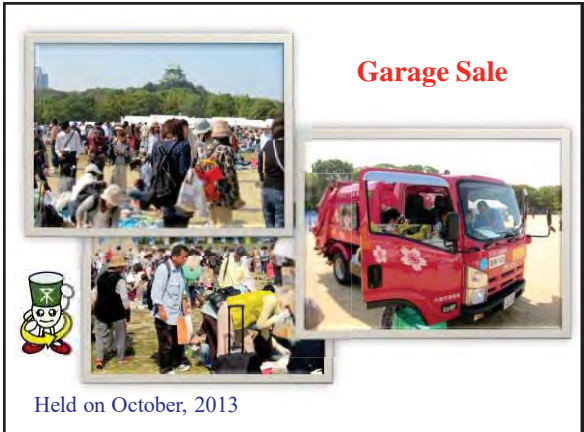



○ Fundamental Activities

14

- (1) Dissemination and raising awareness regarding reduction of waste
(Utilization of the action plan for reduction of waste)
 - (2) Promotion of reuse and recycling activities
(Resource group collection, etc.)
 - (3) Promotion of waste that are put out for sorted collection
 - (4) Provision of information, etc. concerning waste reduction and recycling, and other matters
 - (5) Promotion of efforts for beautification activities
- 
- 

- Promoting the “Action Plan for Reduction of Waste”
 - Holding briefing sessions
 - Utilization of meetings and gatherings in the community
 - Utilization of community notices
- 
- 16



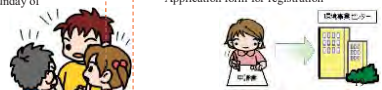
To Begin the Group Collection

1. Discuss and make decisions

- ◆ Determine the divisions of roles (examples) a persons in charge of accounting, public relations, and others
- ◆ Determine items to collect (examples) old newspapers, old magazines, used clothes, cardboard, etc.
- ◆ Determine collection operators
- ◆ Determine the collection date (examples) "Every ___ Sunday of each month"

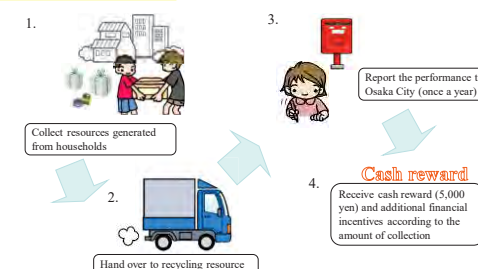
2. Register your organization

- ◆ Organizations that are eligible to registration as a group collection. (examples) non-profitable organizations operating within Osaka City, which consist of 10 households or greater
- ◆ Reception desk
Environmental Business Center in charge of the region
- ◆ Things required for registration
 - Application form for registration



Flow of the Group Collection

1. Collect resources generated from households
2. Hand over to recycling resource collection operators
3. Report the performance to Osaka City (once a year)
4. **Cash reward**
Receive cash reward (5,000 yen) and additional financial incentives, according to the amount of collection

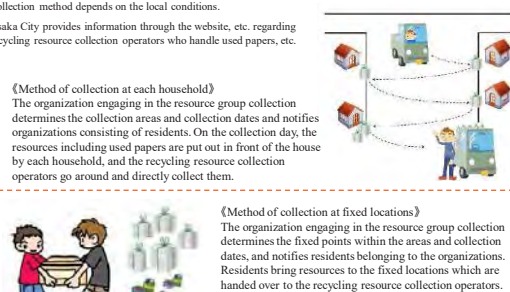


Collection Method

Collection method depends on the local conditions. Osaka City provides information through the website, etc. regarding recycling resource collection operators who handle used papers, etc.

{Method of collection at each household}
The organization engaging in the resource group collection determines the collection areas and collection dates and notifies organizations consisting of residents. On the collection day, the resources including used papers are put out in front of the house by each household, and the recycling resource collection operators go around and directly collect them.

{Method of collection at fixed locations}
The organization engaging in the resource group collection determines the fixed points within the areas and collection dates, and notifies residents belonging to the organizations. Residents bring resources to the fixed locations which are handed over to the recycling resource collection operators.




Performance Report of Group Collection

4. Receive cash reward, incentive goods, etc.

- Every year in March, the Environmental Business Center sends out documents relating to the group collection, which are required for receiving incentives.
- The performance of collection conducted during a period of one year starting in every April is reported.

◆ Incentive program
[Cash reward] 5,000 yen a year

[Amount of incentive]
Up to 15 tons: 1.5 yen/kg
Up to 30 tons exceeding 15 tons: 2 yen/kg
Exceeding 30 tons: 3 yen/kg
* Maximum payment for products from recycled papers and incentive is 7 hundred thousand yen.



Collection at Fixed Locations

Collection box (ward offices, ward branch offices, city office (the head office), and some supermarkets)
Collection reception [Environmental Business Center]

| | |
|--|---|
| Dry-cell battery Dry-cell battery is made of manganese dioxide, zinc, iron, carbon rod, etc. Collected dry-cell batteries are recycled into iron materials for common use. Not accepted: Rechargeable battery, Button battery, Not accepted: Rechargeable battery. Please contact the battery device regarding the disposition of these items. (See page 3.) | Fluorescent lighting tube, mercury thermometer Most part of a fluorescent lighting tube is made of glass. Collected fluorescent lighting tubes are recycled into glass wool (heat-insulation material) or recycled. Not accepted: Mercury thermometer, Not accepted: Light bulb, Not accepted: Energy light bulb. Please put it out as ordinary trash. |
| Ink cartridge Ink cartridge being used as a recycled cartridge, an ink cartridge can be recycled for various purposes such as materials for ballpoint pen. Not accepted: Ink cartridge for a home-use ink jet printer. | List of items Mobile phone terminal, PC (including tablet terminal), Telephone/Fax machine, Radio, Digital camera, Video camera, Video equipment (including portable DVD player), Portable audio player, Baby equipment (such as stroller, baby carriage, baby walker, etc.), Plastic, Flatlight, E-book reader, Electronic dictionary, Calculator, Electronic thermometer, Electronic thermometer, Hair dryer, Baby's equipment (such as stroller, baby carriage, baby walker, etc.), Plastic, Flatlight, Clock/watch, Video game console, Handheld game console, Car navigation device, Outdoor equipment (such as a car-mounted GPS), etc. (see separate sheet), etc. (see separate sheet), etc. (see separate sheet). |

Collection box (ward offices, ward branch offices, city office (the head office), and Environmental Business Center)

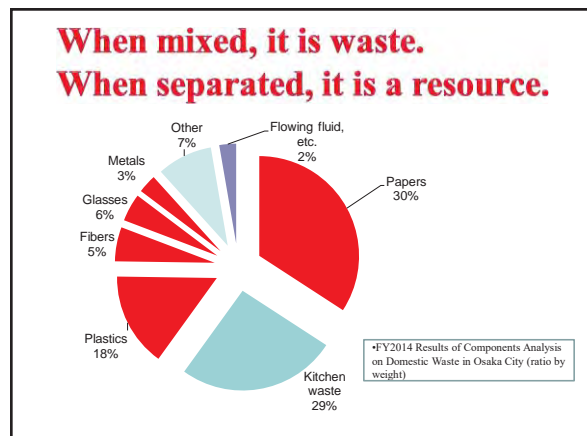
Use small home appliances
Use small electricity battery-driven appliances which can be thrown into the mouth of a collection box (15 cm x 30 cm). This collection aims to recycle valuable resources including rare metals, which are contained in used small home appliances such as mobile phones and digital cameras. Recycling these items facilitates waste reduction and recycling of resources.

Collection reception [Environmental Business Center] and collection by application over the phone

Maternity wares, baby clothes, and children's clothes

◆ Clothes relevant to maternity wares in reusable condition will be accepted, even if small in quantity.
◆ Please wash them before putting out for recycling.
◆ Please put it out as ordinary trash.

Use of maternity wares, baby clothes, and children's clothes
Maternity wares and the like provided by the citizens are exhibited/offered (free of charge) at Environmental Business Center (please see page 8) and the like.
◆ Date: Every third Sunday
◆ Hours of exhibition/offering: 10:00-12:00 AM, 1:30-4:00 PM
◆ Number of items offered: Free (donation price per one item per day)



Waste Sorting in Osaka city



Osaka City Environment Bureau

Types of waste

Ordinary waste



Recyclable waste



Plastic containers and packaging



- 2 -

Bulky waste



※Collection will begin October 1st, 2013

Used Paper and Clothing



- 3 -

Ordinary waste

Major ordinary waste items

Besides kitchen waste, ordinary waste includes the following items, which should not exceed 30 cm in size. For detailed information, please contact the Environmental Management Center in charge of your area.

| | |
|---|---|
| Glass products #Cups #Dishes #Cosmetic bottles #Sheet glass | Plastic products (other than plastic containers, glass, medicine and paint) #Ballpoint pens #Toothbrushes #Video tapes |
| Electric appliances #Electric pots #Radio cassette players #Electric stoves #Electric foot warmers #Lighting devices (including light bulbs) #Hair dryers #Video cameras #Juicers and mixers #Telephones #Ventilating fans | Daily commodities #Pottery and chinaware #Vases #Vacuum bottles #Baskets #Trays #Plastic buckets #Hangers #Umbrellas #Bags #Shoes and boots #Clocks and watches #Toys (including stuffed dolls) #Scales |
| Furniture, bedclothes, etc. #Mats and sheets #Curtains #Curtain rails (shorter than one meter) #Pillows #Cushions | Sporting goods #Helmets #Balls #Gloves #Fishing rods #Rackets |

Items Collected as Recyclable Waste

Items collected as recyclable waste in the past

| | |
|---|---|
| Empty cans # Empty metal cans for drinking water, food products, and other daily commodities (including cans, exceed 1.5 liters (one sho) in size, spray cans, and gas cylinders) | Empty bottles # Empty glass bottles for drinking water, food products, and other daily commodities, which do not exceed 1.5 liters (one sho) in size |
| Housewares made of metal # Metal housewares such as pots, sautery, aluminum foil, which should not exceed 30 cm in size | Plastic bottles # Plastic bottles for soy sauce, drinking water, and liquor # Items with the mark * Plastic bottles are collected at some supermarkets as well |

Rules about the size of metal products other than empty cans



Products whose longest sides or diameters do not exceed 30 cm; products in the shape of poles should not exceed 1 m in length

- 5 -

Points to Be Noted When Disposing of Recyclable Waste

- Empty out the contents of cans and bottles (including plastic bottles) completely and rinse them with water.
- Make sure to remove caps from bottles (including plastic bottles) and dispose of plastic caps as plastic waste (plastic containers and packaging) and metal caps as recyclable waste.
- Dispose of plastic bottle labels as part of plastic waste (plastic containers and packaging).
- Crush empty cans and plastic bottles to make them as small as possible.
- Empty out the contents of spray cans and portable fuel cylinders completely and puncture them in well-ventilated places before disposing of them as ordinary waste.
- Earthenware products cannot be recycled, so dispose of them as ordinary waste.
- Glass products (such as glass cups, cosmetic bottles, sheet glass, and light bulbs) and pointed objects (such as knives) cannot be recycled, and they also hinder waste collection operations. So please wrap them in thick paper, write "Dangerous waste" on the waste bag, and dispose of them as ordinary waste.
- Please contact stores and manufacturers about how to dispose of cans and bottles that contain hazardous chemicals or paint.

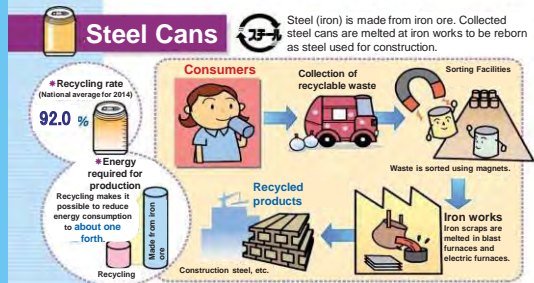
- 6 -

How Recyclable Waste Is Processed



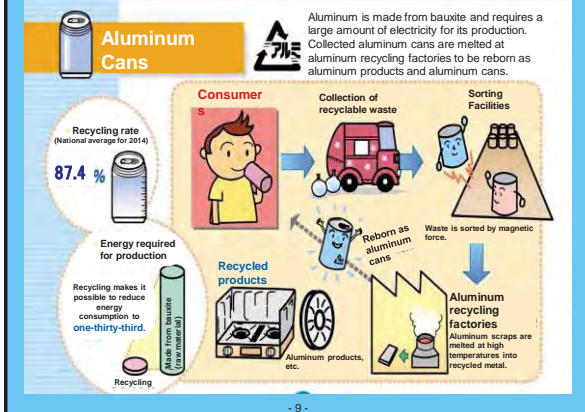
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Flow of Recycling



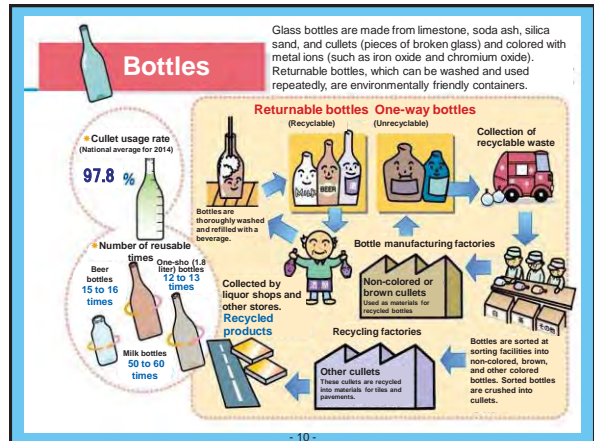
- 8 -

Aluminum Cans



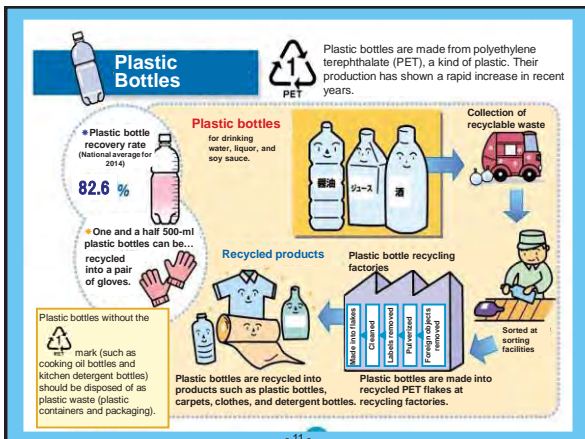
- 9 -

Bottles



- 10 -

Plastic Bottles



- 11 -

Plastic Containers and Packaging



- 12 -

Examples of Plastic Containers and Packaging

Plastic bottles

- Containers for cooking oil, sauce, broth, dressing, and basic soft drinks
- Containers for detergent, shampoo, hair conditioner, and cosmetics
- Containers for medicines such as mouthwash and eye wash
- Plastic bottles for soy sauce, beverage, and liquor

Plastic cups and packages

- Cups for soups, instant pudding, and jelly
- Packages for eggs, fruits, and ham
- Disposable cups and lids
- Plastic trays for soups, instant pudding, and jelly
- Tray containers for soups, instant pudding, and jelly
- Tray containers for soups, instant pudding, and jelly

Plastic trays (tray containers)

- Food trays
- Trays for soups, instant pudding, and jelly
- Tray containers for soups, instant pudding, and jelly

Plastic bags and wrappings

- Bags for bread, snacks, and vegetables, and candy wrappings
- Bags for instant foods and frozen foods
- Wrappings for perishable food and frozen food at convenience stores, and shipping items for products like car rollers

Plastic tubes

- Tubes for detergents, toothpaste, and grated wash radish
- Supermarket bags, bags for coffee, instant milk, and other commodities, and detergent bags

Other products

- Plastic caps and seals for plastic bottles, spray cans, and glass bottles
- Net bags for oranges and onions
- Form-polymer production and items for products such as bulbs and electric appliances

Items That Are Not Included as Plastic Containers and Packaging

Please don't dispose of these items together with plastic containers and packaging.

Products that are not made of plastic

- Wrapping paper and paper bags
- Milk packages
- Empty glass bottles and metal cans

Dispose of them as ordinary waste.

Deliver them to waste collection points such as ward offices and environmental project centers.

Dispose of them as recyclable waste.

Attachments to products

- Straws attached to beverage packages
- Lunch spoons
- Measuring spoons for detergents

Please dispose of them as ordinary waste.

Products

- Toys
- Videotapes and compact discs
- Dishes
- Stationery such as ballpoint pens and rulers
- Toothbrushes
- Washbowls and buckets
- Vinyl sandals
- Hangers
- Disposable lighters
- Disposable products, such as antismoking pipes and draining bags

Please dispose of them as ordinary waste.

Items shaped as containers that are themselves sold as products, like food preservation containers, soap cases and cosmetic pouches, are not included as plastic containers.

How to Dispose of Plastic Containers and Packaging

Empty out the contents of containers completely before disposing of them.

- Empty out the contents of food containers and bags completely before disposing of them. Unwashed containers and bags may be disposed of as they are.

Don't dispose of items other than plastic waste together with plastic containers and packaging.

- Items, such as retort pouches for instant foods, that are combined with materials other than plastics, should be disposed of as plastic waste (plastic containers and packaging).
- Remove paper labels and seals (self-by date seals or price labels) that are easily removable, however small they may be. Labels and seals that cannot be easily removed may be left as they are.

Dispose of polystyrene trays to waste collection counters at supermarkets and other stores as much as possible.

Wash containers and wrappings clean before disposing of them.

Rinse out food remains using residual water from dish washing. Containers and packages stained inside that need to be decomposed to be washed clean should be disposed of as ordinary waste.

How Plastic Containers and Packaging Is Processed

Plastic containers and packaging that are separately collected are recycled as materials for chemical and plastic industries.

Collection of plastic waste

Once every week

Plastic recycling factories

Recycled into plastic containers, wrappings, toys, hangers, car stoppers, and flower pots

Used as materials for the chemical industry and fuels for steel production

Recycled as plastic material

Turned into oil

Heat-decomposed to extract oil and used as fuels or materials for the chemical industry

Gasified

Heat-decomposed to extract several kinds of gases and used as materials for the chemical industry and fuels

Used as reducing agents for blast furnaces

Used as reducing agents for producing iron ore at blast furnaces

Turned into chemical materials by coke furnaces

Heat-decomposed by coke furnaces and used as reducing agents for iron ore or materials and fuels for the chemical industry

Waste discharge designation system by use of "contents-visible waste bag (transparent or semi-transparent)"

For discharge of all wastes including ordinary waste, recyclable waste, plastic containers and packaging, transparent or semi-transparent waste bags through which contents are visible need to be used. Do not use opaque bags or cardboard boxes through which you cannot see the contents inside. Wastes discharged in those opaque containers will not be collected.

What Is Bulky Waste?

Items collected as bulky waste

Domestic waste materials discharged from everyday lives, whose largest sides or diameters exceed 30 cm, or which are in the shape of poles and exceed 1 m in length.

Note also that

Fees will be charged for the collection of waste disposed of in large quantities at one time when moving or for housecleaning.

Bulky Waste Collection Application Center
Telephone: 0120-79-0053



Overview of Information Dissemination and Enlightenment among Citizens

Osaka City Environment Bureau

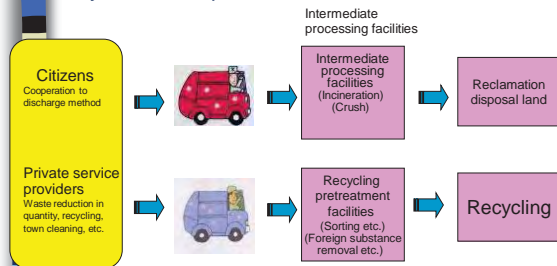
1

Contents of Information Dissemination and Enlightenment Required from Authorities

1. Acquisition of cooperation from citizens on service implementation
 - Improvement in discharge manners
 - Proper discharge of waste according to the collection system of the administration
2. Acquisition of citizens' understanding to administrative service
 - About the installation of facilities and service management
3. Implementation of collaborative work with citizens and service providers
4. Environmental education

2

City Waste Disposal



3

Contents of Information Dissemination and Enlightenment Required from Authorities 1 "Acquisition of cooperation from citizens on service implementation"

- ◆ Keeping citizens informed of the waste discharge rules.
- ◆ Implementation of trusted service
 - Waste is always collected on time.
 - Waste uncollectible or not meeting the discharge rules is not collected.

4

Contents of Information Dissemination and Enlightenment Required from Authorities 2 "Acquisition of citizens' understanding of administrative service"

- ◆ Maintenance of facilities with no aggravation of the circumference environment.
- Implementation of environment-friendly service management with no pollution.
- Explanation of necessity for the service and the installation of facilities.
- Public presentation of the contents of the facilities and service.
- Implementation and public presentation of environmental assessment.



5

Contents of Information Dissemination and Enlightenment Required from Authorities 3 "Implementation of collaborative work with"

1. Town beautification
 - Cleaning in front of each family's house, and town cleaning activities of local communities
2. Waste reduction in quantity
 - Waste quantity reduction before discharge and waste recycling
3. Planning and presentation of a menu that can be implemented by citizens with ease Maintenance of social systems
4. Fostering of a network to promote collaboration work

6

Contents of Information Dissemination and Enlightenment Required from Authorities 4 “Environmental education and waste problem education”

1. Home education
2. School education
3. Social education
4. Enlightenment through local communities and NPOs

Heightening the social evaluation of citizens and enterprises.
EcoMark, Green Mark, R Mark, etc.
ISO14001 arrangements.

School education

Osaka City prepares “Osaka Environment Class,” a side reader to be used in classes of elementary schools and junior high schools for sufficient environmental education which covers global warming, biodiversity, waste reduction and urban environment conservation. Through the education, Osaka City aims at creating sustainable society.



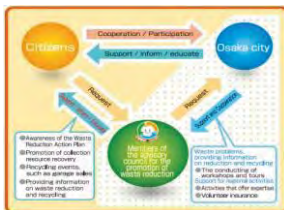
For 3rd and 4th graders of elementary school For 5th and 6th graders of elementary school For Junior high school students

Enlightenment through local communities

“Waste Reduction Leader”(Zero Waste Leader)

Zero Waste Leaders is an initiative which promotes the recycling of waste in the Osaka area.

Zero Waste Leader members, in cooperation with Osaka citizens work together on a mandate to carry out a Waste Reduction Action Plan and the Civic Action Menu.



Guidance for citizens and enterprises' consciousness

1. Guidance with merits provided
Subsidy and commendation systems
2. Guidance with demerits imposed
Regulation instruction measures: Regulations, instructions, penalties, and charges
3. Promotion of volunteer activities and philanthropy activities

Promotion of volunteer activities and philanthropy activities

Support Cleaning Activities

To promote volunteerism and support a clean city, individuals and organizations that perform clean-up activities in the area will be given cleaning utensils, and after years of volunteering will be awarded for their efforts.



Introduction of examples of measures taken by authorities

1. Magazine of the city
2. Mass communications
3. Website, brochure, bulletin board, image, sound and other media
4. Events

1. Magazine of the "Osaka City Government"



2. Mass communications



5.1.2013 Nihonkeizai Shinbun

3. Website, brochure, bulletin board



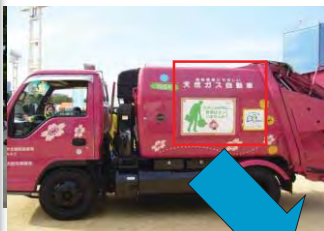
Homepage

English-language edition
<http://www.city.osaka.lg.jp/contents/wdu020/kankyo/english/>



Brochures

Using boards of collection vehicle for promotion



4. Events



Eco-tour for family

Eco-cooking class
(In the morning)



Eco-tour for family



Tour to Incineration plant
(In the evening)



Eco Festival
Garage Sale
in Osaka Town



19



20

Environment Education by Environmental management centers



21

Incineration Plant Open Day Tours



Thank you

22

Osaka City

Collection and Treatment of Used Fluorescent Lamps and Other Wastes in Osaka City

July 14th, 2016
Osaka City Government
Environment Bureau

Osaka City

Contents

1. Overview of Osaka City
2. Current practices for waste segregation and treatment
3. Collection and recycling methods for used fluorescent lamps and other wastes
4. Budget
5. Future efforts

Osaka City

Overview of Osaka City

| | |
|------------|--------------------------------|
| Area | 225.21km ² (2014) |
| Population | 2,686,246 people (2014) |
| Households | 1,364,161 households (2014) |
| GDP | approx. 19 trillion yen (2013) |

Osaka City

Legislative Framework to Establish a Sound Material-Cycle Society

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graph TD
    A[Fundamental Environmental Law 1994. 8] --> B[Fundamental Law for Establishing a Sound Material-Cycle Society 2001. 1]
    B --> C["(Establishment of General Systems)"]
    C --> D[Waste Management and Public Cleansing Law]
    C --> E[Law for Promotion of Effective Utilization of Resources]
    D --> F["(Regulations according to the Characteristics of Respective Items)"]
    E --> F
    F --> G1[Container and Packaging Recycling Law 2000. 4]
    F --> G2[Home Appliances Recycling Law 2001. 4]
    F --> G3[Construction Materials Recycling Law 2002. 5]
    F --> G4[Food Wastes Recycling Law 2001. 5]
    F --> G5[End-of-life Vehicles Recycling Law 2005. 1]
    F --> G6[Small Home Appliance Recycling Law 20012. 8]
    G1 --> H[Law on Promoting Green Purchasing]
    G2 --> H
    G3 --> H
    G4 --> H
    G5 --> H
    G6 --> H
  
```

Osaka City

Basic Principles for Waste Treatment

- In Japan, waste must be treated and recycled according to the "Waste Disposal Law" and various other recycling laws.
- Japanese law separates waste into two types: waste generated from households are classified as "municipal waste" and waste from businesses and industrial sources are considered as "industrial waste."
- The processing of "municipal waste" is the responsibility of the municipality, while the processing of "industrial waste" is the responsibility of each business operator that is generated the waste.
- Even the same two fluorescent lamps may end up being processed differently, depending on whether they were discarded by households or by industrial sources.
- In conformity with the laws, Osaka City collects and treats "municipal waste", such as used fluorescent lamps, which are discarded from households.
- Also, to encourage segregation of household waste and the 3Rs, we implement public awareness-raising activities.

Osaka City

Waste Segregation in Osaka City

- Ordinary waste (collected 2x a week)**: Includes items like bicycles, cardboard boxes, and household trash.
- Plastic packaging and containers (collected 1x a week)**: Includes plastic bottles, containers, and packaging.
- Recyclable waste (collected 1x a week)**: Includes glass bottles, paper, and other recyclables.
- Used paper/ clothing (collected 1x a week)**: Includes newspapers, magazines, and clothing.
- Bulky waste (fee required)**: Includes large items like refrigerators, air conditioners, and furniture. A note specifies: "If the diameter, or any of the sides of the waste is larger than 30 cm, or is a cylindrical rod over 1 m long, then it is considered as 'bulky waste'".

Waste Collection Centers

In order to reduce the amount of waste disposed and to encourage recycling, we have placed collection boxes at ward offices and environment management centers, which act as waste collection centers.

【Targeted Waste Types】

Fluorescent lamp tubes, mercury thermometers, dry-cell batteries, ink cartridges, used small home appliances, maternity clothing, baby clothing and children's clothing

【Number and location of collection boxes】 (as of April 1, 2016)

| Location | Number |
|------------------------------------|--------|
| Private facilities | 158 |
| Ward offices and public facilities | 66 |

Amount of Waste Collected at Collection Centers


(Unit: tons)

| | 2013 | 2014 | 2015 |
|--|------|------|------|
| Fluorescent lamps/ Hg thermometers | 18 | 18 | 18 |
| Dry-cell batteries | 64 | 69 | 73 |
| Ink cartridges | 4 | 4 | 2.3 |
| Used small, home appliances | 6.5 | 12.3 | 13.5 |
| Maternity, baby and children's clothes | 23 | 21 | 25 |


How to Discard Used Fluorescent Lamps, Hg Thermometers and Dry-Cell Batteries

Collection centers were established in October 2001, to promote the proper recovery, treatment and recycling of mercury and metals contained in fluorescent lamps, mercury thermometers and dry-cell batteries.

Discarding fluorescent lamp tubes
To prevent breakage, lamp tubes should be packed in cardboard boxes or tubes, or be wrapped in newspaper before being brought to the collection centers



NOT accepted at collection centers
Bulbs, glow lamps, LED lights, electronic thermometers, button cell batteries, rechargeable batteries



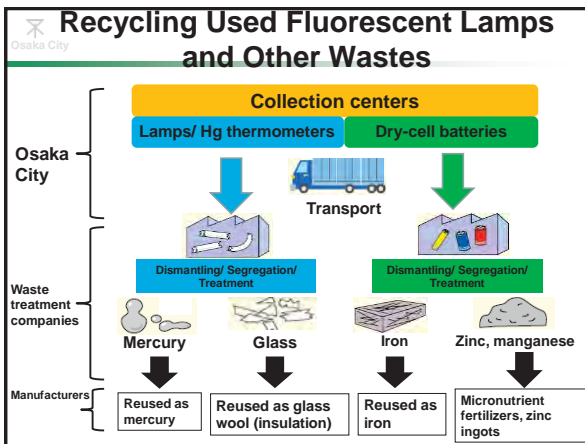
Collection Boxes for Used Fluorescent Lamps and Other Wastes



- Collection boxes are placed in public facilities, ward offices and some supermarkets
- Waste can be brought in any time during opening hours of the establishment

Supermarkets installed with collection boxes are marked with stickers that say "Store cooperating in the collection of used dry-cell batteries and used lamps" or "Store cooperating in the collection of used dry-cell batteries"



Osaka City

Budget for 2016

| Activity | Content | Budget (JPY) |
|---|--|--------------|
| Waste collection at collection centers | Purchasing collection containers for fluorescent lamps and other wastes; creating pamphlets, etc. | 5,154,000 |
| Awareness-raising and promotion of waste reduction and 3Rs | Conducting classes and lectures on recycling, etc. | 2,230,000 |
| Engaging in initiatives with the local community that promote waste reduction and recycling | Local awareness raising activities such as waste reduction campaigns during local festivals, garage sales, conducting tours for citizens, and commissioning waste reduction promotion officers | 15,580,000 |
| Educational materials for schools | Developing a supplementary book for elementary and middle schools, titled "Osaka Environment Department" | 5,954,000 |
| Treatment of used fluorescent lamps and other wastes | Paying the treatment fee to waste treatment companies | 7,808,000 |

Osaka City

Future Efforts

We will continue to promote the collection and recycling of used fluorescent lamps by:

- Thoroughly raising awareness on the community level:
Informing citizens on the dangers of mercury and educating them on proper treatment and disposal methods
- Taking advantage of community events to increase collection:
Like in the past, taking various community-level events as opportunities to promote collection of waste
- Promoting recycling of used fluorescent lamps that are emitted from businesses:
As the switchover to LED lighting increases, we will provide guidance on the recycling process for the large amounts of fluorescent lamps that will be discarded
- Preparing for the Minamata Convention on Mercury:
In October 2013, at Kumamoto City and Minamata City, the "Minamata Convention on Mercury" was adopted and signed. Following this, in June 2015, the "Act to Prevent the Mercurial Pollution of the Environment" was enacted in Japan



Attachment⑦ Pictures of Activities

2nd Activity in Malaysia



Kickoff meeting (15th, October, 2015)



Kickoff meeting (15th, October, 2015)

Group Photo



Kickoff meeting (15th, October, 2015)

Interview from media after meeting



Participant conference (15th, October, 2015)

Attachment⑦ Pictures of Activities

5th Activity in Malaysia



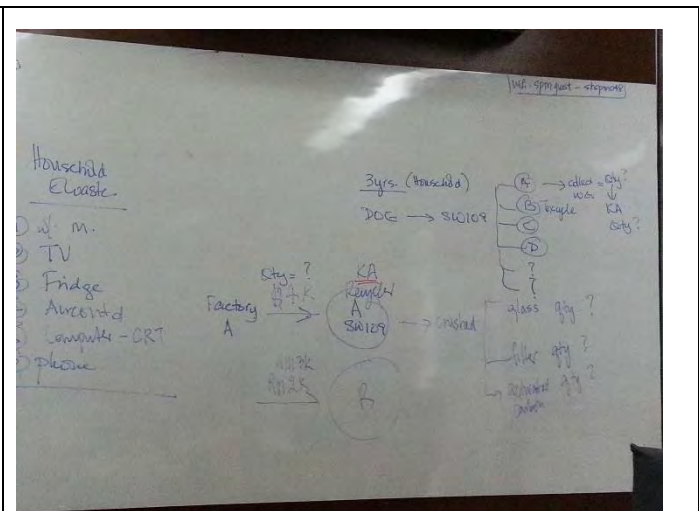
Interview to DOE (29th, April, 2016)
 Exchanging opinion between DOE and Nomura Kohsan with company which are Cenviro and SP.

Same as left box.

6th Activity in Malaysia



Meeting with SP (1st, November, 2016)
 Interview with Mr. Kumar (CEO) of SP.



Meeting with SP (1st, November, 2016)
 Content of discussion

Attachment⑦ Pictures of Activities

9th Activity in Malaysia



Interview with SP and government on Penang
(11th, April, 2017)



Interview with SP and government on Penang
(11th, April, 2017)
Explaining treat fluorescent lamp by using
trommel way.



Interview with DOE and Cenviro (13th, April, 2017)



Interview with DOE and Cenviro (13th, April, 2017)
Explaining treat fluorescent lamp by using
trammel way.