NEWSLETTER

No.85 *This Newsletter is a quarterly e-publication.* **October 2013**

JAPAN SOCIETY OF MATERIAL CYCLES AND WASTE MANAGEMENT

Contents

Celebrating the 30th Anniversary of KSWM

Looking back at the relationship between KSWM and JSMCWM, I believe that tighter and closer collaboration has been achieved since the contract for mutual cooperation between our two societies was signed in 1996. When the Korean Society of Waste Management, KSWM, was started 30 years ago, most waste management systems in South Korea were following Japanese policies and strategies as a bench mark, starting with the adoption of a waste classification system of dividing general and industrial wastes. However, over the last 30 years and with drastic changes in waste management in South Korea, I should mention that there has been enormous collaboration and assistance by the Japanese society, JSMCWM. Therefore I would like to share this joyful moment of celebrating our society's 30th anniversary with the members of JSMCWM.

In South Korea the waste management law as a basic framework to manage the national waste was declared in 1986 and leading up to this significant effort was made by KSWM, which was established three years previous in 1983. At that time we classified waste into general and industrial wastes, based on the Japanese system and many management structures followed Japanese practices, I guess. Also the setting of national targets in the 1990s for future waste management, such as achieving an incineration rate of 20% and increasing the waste recycling rate, was also influenced by Japanese policy. After amending the law several times in the 1990s, we have since been setting our own style of waste management such as classifying waste into general and specific (hazardous) wastes and adopting some unique collecting systems like a volume based disposal fee method first implemented in 1995. Moreover, many waste incinerators were installed in the 1990s to achieve the established targets, and as a result South Korea has become an advanced country with very effective and balanced waste management.

This history can be said to have greatly contributed to the statistic that 80% of renewable energy in South Korea was produced from waste energy in 2010. At present, in the case of municipal solid waste (MSW), around 60% is recycled and 20% is converted to energy by combustion, while less than 20% of MSW is dumped into landfills. In step with these achievements in waste management in South Korea, I am sure KSWM's efforts of the last 30 years, and not least the continued cooperation of JSMCWM, have aided this progress, since both societies formally declared their intent to cooperate exactly in the middle of this period, in the year 1996.

As for detailed collaboration, both societies have hosted presentations by Korean and Japanese speakers during the annual meetings of each society since 1995. An international symposium on timely issues has also been held, and this dialogue has helped in resolving such problems faced not only by the East Asia region but also the world. The collaborative publication of this journal by both societies since 2009 has also greatly enhanced the level of research of the professionals and academic members, helping the JSMCWM journal to become one of the most popular and leading international publications, with a flood of manuscript submissions in recent years.

On behalf of the members of KSWM, I would like to

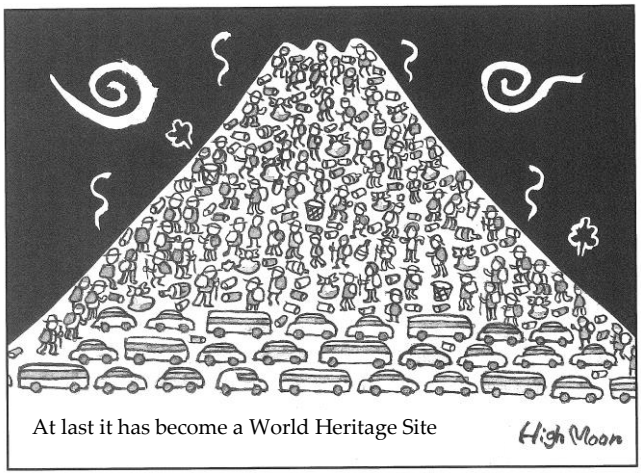
express my sincere thanks to all JSMCWM members for the abovementioned collaboration that has helped South Korean waste management reach its current advanced status, and I am very proud to invite you all to celebrate our 30th anniversary together with us. In celebration we are holding a special annual meeting at Jeju International Convention Center on November 14-16, 2013. Please join us in celebrating this occasion on the beautiful island of Jeju, or by sending a message by e-mail. I would prefer it if you could make a short (10-15 second) video message on your smart phone. Your message can be in English, Japanese, Korean or any other language. Please e-mail your message to kswm@daum.net or seoyc@yonsei.ac.kr. We will show these video messages during our celebratory party.

Finally, it is my wish that our two societies can collaborate on an even deeper level for long into the future, and that this strong dialogue will lead the waste management sectors not only in the Asia and Pacific region but on the global stage.

Thank you and best regards,

Yong-Chil Seo

President, Korean Society of Waste Management



Now it seems like it will leave another type of "heritage" (waste)

Report of KSWM, Spring 2013

The 17th Korea-Japan Joint International Session "Korea-Japan International Symposium" hosted by KSWM was held on May 9, 2013. The venue was Danyang Daemyung Resort in Danyang which is famous for its abundant nature and historical heritage.

The Joint International Session was conducted by hybrid method of oral presentations and poster sessions. There were 38 presentations, of them 23 from Japan and 15 from South Korea. By theme, 22 presentations (60%) were about final disposal and recycling, and the remainders were about incineration, solid waste management and composting. A special symposium, "Status and Future of ELVs (end-of-life vehicles) and E- Waste (electronic waste) Recycling" was also held.

Chairpersons were Dr. Akiko Kida, the director of JSMCWM who is also a visiting professor of Ehime University and Dr. Jae-Hyuk Hyun, sub-director of KSWM and a professor of Chungnan National University.

Lecture 1 was "Recycling Policy of WEEE and ELV in Korea". This gave an overview of waste metal resource recycling and recycling policy of waste electrical and electronic equipment (WEEE) and ELV in Korea.

Resources are scarce in Korea and the international supply is unstable and costly, while use of metals is increasing year by year and there are environmental problems of contamination by heavy metals. Waste metal resources collectively refer to the metal resources contained in WEEE and ELV, and waste from business sites.

Only 5g of gold can be collected out of 1 ton of ore, while 400g can be collected from the same amount of cell phones. In Korea, many of the main metals are imported from China, Canada, Congo and Australia. There is a limited supply and they are costly.

Currently there is a nationwide effort underway to recover and recycle vehicles in South Korea. From 2009 to 2014, Korea must achieve a recycling target for ELV to reach 85%.

To promote an ELV recycling system, strengthening the responsibility of car manufacturing companies, promoting recycling businesses and re-use of car parts are needed in the near future.

As for metal recycling, higher collection rate among developed countries, reduction of greenhouse gases and promotion of recycling businesses are essential. For this, the target of WEEE was set as 4kg/capita/year, which is the same as in EU, and more than 95% of recycling rate/car for ELV.

Lecture 2 was “Status and Future Perspectives of ELV Recycling” by Dr. Shinichi Sakai of Kyoto University. He lectured about worldwide dissemination of cars, necessity of ELV recycling, car recycling law in Japan, recent developments in appropriate technologies for recycling and dealing with Automotive Shredder Residue (ASR) and future policy trends.

Global vehicle ownership surpassed the 1 billion mark in 2010.The EU and USA occupied 50% of this total. Meanwhile, global automobile ownership is expected to reach 2.4 billion in 2050.

Estimated number of ELVs in 2010 was 40 million in the world. The number of ELVs in the EU alone is estimated to be 16.6 million in 2020. In Japan this number is expected to be 2.9 million in 2020. The number of ELVs in China is expected to reach 10 million in 2020. ELV issues have now become a global concern.

Legislation to manage the recycling of end-of-life vehicles has already been enacted and adopted in some countries and regions: EU, Japan, Korea, and China. The EU directive set the recycling target including thermal recycling as 85% by 2006 and 95% by 2015.

One of the issues of ELV recycling promotion is technology for the appropriate treatment of automobile shredder residue (ASR). Most of ASR is made up of sand and plastics; however it also contains hazardous substances like mercury, PCBs and BFRs.

Gasification and melting technology which is a major thermal recycling technology in Japan was presented as a technology for the appropriate treatment of ASR. To increase the ASR recycling rate, not only thermal-recycling technology with power generation but also effective utilization of melting slag as well as metal reuse through returning fly ash into the non-ferrous metal industry are important. As a result of experiments, it was reported that ASR melting by using a shaft-type melting furnace is effective in the decomposition of brominated dioxins and BFRs.

Ten years has passed since the start of ELV recycling. Minimizing environmental burden and the limited supply of natural resources in the world are important considerations when promoting ELV recycling. Especially, eco-friendly vehicle design and manufacturing processes and advanced collection methods of rare and precious metals are also required. Moreover, as more substances such as PBDE are added to the list of POPs (Persistent Organic Pollutants) it is recommended to implement more trial experiments of technologies for the appropriate treatment of ASRs and a monitoring system to facilitate such initiatives.

Lecture 3 was “Proposed roadmap and current status of E-Waste management towards sustainable material recycle society in South Korea” by Professor Yong-Chul Jang of Chungnam National University, South Korea, in which he mentioned the definition of E-Waste, the necessity of recycling and current recycling situation.

The target items of E-Waste in South Korea are electrical and electronic equipment such as home appliances: refrigerators, washing machines, air-conditioners; IT equipment: PCs, mobile phones; and lighting equipment. E-Waste contains toxic materials such as heavy metals and PBDE. On the other hand, E-Waste also contains valuable metals such as copper, aluminum, gold, and palladium. Thus, it is crucial to promote recycling.

The consumption of electrical items is increasing every year in South Korea. In 2011, mobile phones made up the greatest proportion of E-Waste, at more than 50 million units, followed by TV sets, refrigerators and washing machines. There are seven E-waste recycling centers owned by major electronics manufactures in South Korea that mainly recycle refrigerators, washing machines and air-conditioners. TV sets, PCs and mobile phones are recycled at E-Waste recycling facilities sponsored by private enterprises or electronics manufacturers. The recycling amount is increasing every year, with the total reaching 0.128 million tons in 2010 which is equivalent to 2.68kg/year per capita. Currently, recycling rate targets have been set for ten E-Waste items including TV sets, refrigerators, washing machines, air-conditioners and mobile phones. The recycling rates of major appliances such as TV sets and refrigerators are significantly higher than the targets. The target of E-Waste recycling rate in South Korea is 4.0kg/capita/year in 2015.

Currently the development of an effective collection system is of utmost importance to improve the South Korean recycling system. The Environment Ministry of South Korea points out the necessity of expanding E-waste scope under the notion of Extended Producer

Responsibility (EPR). In closing, Professor Jang pointed out, the necessity of formulating a roadmap up until 2019 to develop recycling technology to dismantle, crush and sort waste as a way of improving E-Waste recycling.

Lecture 4 was a report on "Home Appliances Recycling Law in Japan" by Mr. Katsumi Fujisaki from Mitsubishi Electric Company. In the lecture an overview and performance of the Law were introduced. In 2011 the collection volume of home appliances (four items: TV sets, air-conditioners, washing machines, refrigerators/freezers) was 16.88 million items in Japan. The average rate of recycling reached 82% and each items' recycling rate exceeded the legal requirements. Japanese manufacturers have been developing material recycling technologies since the home appliances recycling law came into force.

Furthermore, horizontal self-recycling (product to product recycling by manufacturers themselves) cases were introduced; for example, highly pure plastic such as PP, PS, and ABS collected from shredded plastic mixture of used home appliances to use as materials to manufacture new products. Another example was a technology to collect rare earth elements from cross-flow fans of used air-conditioners. Finally, future issues to be solved such as reducing recycling costs and increasing recycling rates were stressed.

On the day following the international session, May 10th, there was a tour of recycling facilities and tourist attractions for the Japanese academic society members, 17 people in total, including Professor Kida, President of the Japan Society of Material Cycles and Waste Management. They visited recycling facilities and cement factories in Danyang County; providing the members with an ideal opportunity to gain an understanding of the current situation of waste management in South Korea. They visited:

- Global Resource Material: a recycling company to collect metals from semiconductors or ASR in the melting furnace;
- Korea Institute of Limestone & Advanced Materials: a manufacturer of PCC (Precipitated Calcium Carbonate) from limestone rocks;
- Hanil Cement: a cement manufacturer.

(Mamoru Inoue)

Municipal Solid Waste Management in Cambodia

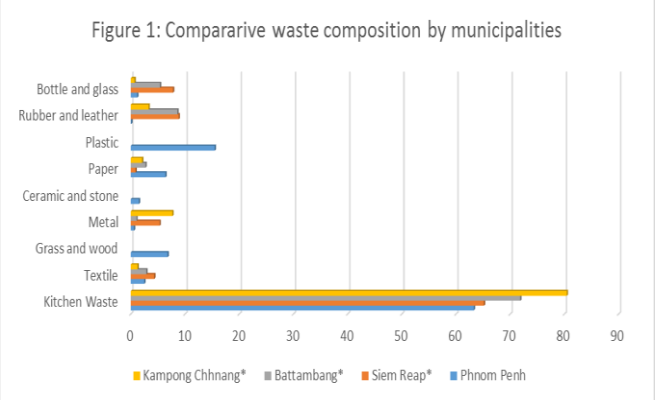
Introduction

Solid waste has become an increasing concern in developing countries, particularly in urban poor areas. Cambodia is no exception to this, as a less developed country with a rapidly increasing and urbanized population. Population growth and increasing per capita consumption is leading to higher levels of waste generation, making the solid waste management system more complex. Most Cambodian waste collection, transportation and disposal in major cities and towns is provided by private companies. This leads to the primary concern being benefits to the private company rather than environmental and human health improvements. However, some provincial towns in Cambodia still do not have solid waste management services. Each household manages its own waste, through burning, or through illegal disposal onto vacant land or into water bodies. Generally, significant quantities of solid waste are found in public areas, on vacant land, low lying land and in wetland areas.

This study aims to identify and understand the existing municipal solid waste management situation in Cambodia. The study employs a combination of exploring existing documentation, qualitative data analyses and reconnaissance studies.

Waste generation and composition

Cambodia's capital city, 23 provinces including 26 towns under provincial supervision (Census, 2008), are all quickly developing their infrastructure and becoming more urbanized. Many towns within the provinces are extending their waste collection coverage, to include the increasing population. The Cambodian population is approximately 14 million people (Census, 2008), generating around 6,818,000 tons/year of waste. This is based on the country's only available per capita waste figure of approximately 0.487 kg per capita per day for Phnom Penh (JICA, 2005). Based on JICA (2005) and MoE (2011), comparative waste composition in three towns and the capital city shows that organic waste is between 60 to 89 % while metal, paper and glass are less than 10 % each (Figure 1).

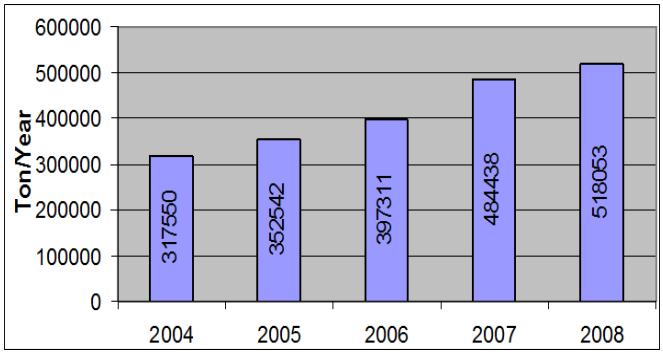


Waste collection and transportation

Not all towns in Cambodia have an official waste collection system. Solid waste collection, transportation and disposal are officially undertaken only in Phnom Penh, Preah Sihanouk, Siem Reap and Battambang towns, which are the major population centers. In some towns waste is only collected from markets. Therefore, it is not possible to collect exact data on the solid waste generation in all the urban areas. However, based on MoE's report (2011) shows that the proportion of waste collection and disposal in a provincial dumpsite is very variable. More tourist oriented cities, e.g. Siem Reap have good waste management service coverage, but more remote provinces e.g. Preah Vihear, have a very low percentage of MSW collected.

Based on an annual report made by Department of Environmental Pollution Control (DoEPC) in 2011, the amount of waste collected and transported to landfills in Cambodia's urban areas was 317,550 tons in 2004, increasing to 518,053 tons in 2008 (Figure 2). This increase is presumed to be a result of increasing waste collection coverage areas and also urbanization.

Figure 2: Amount of waste collected and disposed into landfills in urban areas.



Source: DoEPC, 2011

Landfill and disposal

Waste treatment is limited in Cambodia. Apart from small amounts of recyclable materials sorted out by waste pickers and a few local NGOs, wastes are dumped at open dumpsites without any treatment. There is only one sanitary landfill (located in Phnom Penh) and no incinerators or other treatment facilities for industrial or municipal wastes.

Dump site at Kampong Chhnang municipality

Dump site at Pursat Municipality (Photo in 2013 by Sethy)

Conclusion and recommendation

It is concluded that municipal solid waste management in Cambodia has improved, when compared to the last 10 years or so, with at least one engineered landfill and slowly increasing waste collection service coverage. The Government is showing it understands the need for improved waste management; however, it is still very limited in suburban and rural areas, with plenty of room for improvement.

References:

Census, 2008: General Population Census of Kingdom of Cambodia 2008; National Institute of Statistics, Ministry of Planning.

DoEPC, 2008: Report on solid waste management status, December 2008; Department of Pollution Control, Ministry of Environment, Cambodia.

DoEPC, 2011: Report on solid waste management status, 2011; Department of Pollution Control, Ministry of Environment, Cambodia

JICA, 2004: The study on solid waste management in the Municipality of Phnom Penh. Kokosai Kogyo Co., LTD.

JICA, 2005: The study on solid waste management in the Municipality of Phnom Penh: Final Report; Kokusai Kogyo Co., LTD.

(Sour Sethy, Takeshi Fujiwara and Rachel Wildblood)

A step towards safe treatment of radioactively contaminated waste
Behavior of cesium (Cs) in bottom ash from incinerated municipal solid waste

The Fukushima nuclear power plant disaster caused by the Great Tohoku Earthquake (magnitude 9.0) and subsequent tsunami of 11 March 2011 released massive amounts of radioactive materials (radioactive noble gases I131, Cs134, Cs137, Sr90) into the atmosphere and ocean, contaminating not only Fukushima Prefecture but vast areas of nature and communities throughout the Tohoku Region in northeast Japan and the Kanto Region around Tokyo. Incineration of contaminated waste such as sludge from wastewater treatment facilities and plant matter included in municipal solid waste reportedly dramatically increases the level of radioactivity, up to between several tens- to several hundred-thousand Becquerel/kilogram, of incineration residues (bottom ash, fly ash).

Of utmost urgency in order to come up with safe methods of final disposal of the massive amounts of radioactively contaminated incineration residues that are building up daily is determining the behavior of the radioactive materials contained in the incineration residues, particularly cesium 137 which has a long half-life of approximately 30 years. The contamination level of cesium chloride (CsCl), the main type of cesium found in fly ash, is considered able to be reduced by washing. On the other hand, the leaching rate of cesium in incineration ash is low, with approximately 80% remaining in the ash. Reasons for this are thought to be due to the formation of pollucite, a cesium aluminosilicate ($CsAlSi_2O_6$), as a result of incineration, and because it attaches to layer silicates, the main clay minerals found in waste. However, existence form and long term behavior of cesium in incineration bottom ash have not been clarified.

With this background, the author decided to begin investigating safe methods of long term disposal of radioactively contaminated incineration bottom ash, which is highly likely to be landfilled, by endeavoring to gain an understanding of the existence form and the characteristics of leaching of cesium contained in the bottom ash. Firstly, to make it measurable with general analysis equipment (XRD, XRF), controlled-incineration bottom ash with a cesium content of an order of several percent was made, by firstly combining refuse-derived fuel with a stable cesium compound (CsCl or $CsCO_3$) and then incinerating under actual waste incineration conditions (excess air ration, combustion temperature) using a small incinerator (3 t/day).

The analysis results of the controlled-incineration bottom ash revealed cesium compounds in low to high concentrations in amorphous silicates; pollucite (aluminosilicate minerals) and metallic cesium were also identified. One of the obtained scanning electron microscope (SEM) images from the controlled-incineration ash is shown in Figure 1. Amorphous (non-crystalline) and various crystalline minerals can be observed. As can be seen in Table 1, no cesium was detected in crystalline minerals, but it was detected in high concentrations in amorphous minerals. As the cesium in the incineration bottom ash thought to be encased in amorphous minerals, it will not be able to be easily leached out. The fact that cesium has large particle size compared to other alkali metals is thought to be a factor in why it does not easily crystallize.

The behavior of cesium is slowly becoming clearer using controlled-incineration bottom ash with a cesium content of an order of several percent; however, further investigations are necessary to find if this accurately depicts phenomenon of actual incineration bottom ash that only contains cesium of an order of several tens of ppm. Moreover, while the leachate experiments revealed the cesium contained in landfilled incineration ash should remain in the landfill, there is an urgent need to research the behavior of cesium in incineration bottom ash after long-term (i.e. twenty to thirty years) storage in landfills and many years of weathering.

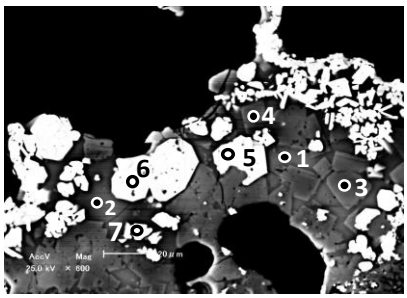


Figure 1: SEM image of the bottom ash matrix

Table 1: Chemical composition of the points in Fig 1 (Wt%).

Phases	Glass		Crystalline				
Points	1	2	3	4	5	6	7
Cs	1.75	1.51	0.00	0.00	0.00	0.00	0.00
Al	6.16	7.12	4.13	3.71	0.90	0.91	1.14
Si	28.73	28.68	24.53	23.99	16.77	16.92	4.07
Ca	5.30	4.38	20.94	19.38	23.72	23.47	2.01
Fe	15.65	10.70	8.22	9.03	20.96	20.42	60.93
K	2.95	2.76	0.24	0.29	0.18	0.17	0.28

(Takayuki Shimaoka)

Upcoming events

24th Annual Conference of JSMCWM
Date : 2-4 November, 2013
Venue : Building of Faculty of Engineering, Hokkaido University

The annual meeting to celebrate the 30th anniversary of KSWM
Date: 14-16 November, 2013
Venue: Jeju International Convention Center

"3R International Scientific Conference on Material Cycles and Waste Management (3RI)" and "13th Expert Meeting on Solid Waste Management in Asia and Pacific Island (SWAPI)
Date: 10-12 March, 2014
Venue: Kyoto University (Clock Tower Centennial Hall)
For further information go to http://3ri-2014.org.

Material Cycles and Waste Management Research Vol.24, No.4 (July, 2013)

The Working of the Managers in the Kansai Regional Chapter

Journal of the Japan Society of Material Cycles and Waste Management Vol. 24, No.4 (July, 2013)

Paper

Fundamental Study on the Application of Glycerin-containing Byproducts Obtained from BDF Production for Liquid Fuel
Masataka Ogasawara, Yuuki Mabuchi, Masayuki Nomura, Sumio Kato and Shinichi Nakata

Material Cycles and Waste Management Research Vol.24, No.5 (September, 2013)

Preface

Is 'Material Circulating Society' out of date?

Eiji Hosoda

Special issues:

Recycling Technologies for Carbon Fiber Reinforced Plastic (CFRP) Carbon Fiber and CFRP

Koji Yamaguchi

Present and Future Status of CFRP Materials for Automobiles: Expectations for CFRP Recycling
Yuji Kageyama

CFRP Recycling Technology using Depolymerization of Epoxy Resin under Ordinary Pressure
Katsuji Shibata

CFRP Recycling using Subcritical and Supercritical Fluids
Idzumi Okajima and Takeshi Sako

Recycling of Carbon Fiber using Two-stage Thermal Treatment System
Hidehito Itazu, Hajime Kanki and Hiroshi Moritomi

Complete Recovery of Reinforcing Fibers from FRP and Their Recycling with Thermally Activated Oxide Semiconductors
Jin Mizuguchi, Yuichiro Tsukada and Hiroo Takahashi

Recovery of Carbon Fibers from CFRP and Surface Modification using Superheated Steam
Masashi Wada, Makoto Tanaka, Kazuhiko Kawai, Satoshi Kitaoka, Hirohito Hira and Tomoyuki Suzuki

Activity Report from the Regional Chapter

Report on the Third Seminar of the Kanto Regional Chapter: The Facility Tour on the Industrial Waste Disposal Facilities in Chiba

Journal of the Japan Society of Material Cycles and Waste Management Vol. 24, No.5 (September, 2013)

Paper

Ag Compound Recovery from Used X-ray Film Using Supercritical Water
Yuta Matsumoto and Yoshito Oshima

Study on the Leachate Generating Mechanism of Semi-aerobic Landfill that is Comprised Primarily of MSW
Hiroshi Matsugu, Osamu Hirata, Ayako Tanaka and Yasushi Matsufuji

Measuring Wrack Floats Originating from East Asia's Marine Products Industry
Tamon Okano and Ikumi Kato

Medical and Sanitary Wastes on Tottori Beaches and the Dumping Ratio of Wastes in Japan
Tamon Okano and Motoki Yasumoto

Current Members of JSMCWM as of September 30, 2013	
Regular Members	2,327
Fellow	37
Senior	22
Honorary member	4
Students	244
Public Institutions	87
Supporting companies	118
NPOs	5
Individual	14
Total	2,858

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