

## Summary report on the 9<sup>th</sup> 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2023) online

3RINCs2023 steering committee  
(JSMCWM)

13 – 18 March 2023

### I. Introduction

Japan Society of Material Cycles and Waste Management (JSMCWM) has been hosting a successful world congress of the “3R International Scientific Conference on Material Cycles and Waste Management” (3RINCs), since 2014 held in Kyoto, followed annually in Daejeon, Hanoi, New Delhi and Bangkok, respectively. In the 3RINCs, researchers, experts and concerned parties from all over the world are participating to discuss the latest scientific findings and outcomes on waste management from the aspects of the 3Rs, resource circulation and circular economy as well as the latest information and trends in policy development, private sector technology development, and NGO activities. In particular, in recent years, efforts to deal with global issues such as climate change and plastic pollution have become more active, and unique research, activities and trials have been introduced. Moreover, JSMCWM are keen to strengthen knowledge sharing and network building with related parties around the world through the platform of 3RINCs.

The 9<sup>th</sup> 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2023) was held both online (mainly from 13 and 14 March 2023) and onsite in Kyoto University, Kyoto, Japan (15 – 18 March 2023), co-organized by JSMCWM, Korean Society of Waste Management (KSWM), Society for Solid Waste, Solid Waste Management Association Thailand (SWAT), National Institute for Environmental Studies (NIES) and IconSWM-CE & IPLA Global Forum. Ministry of the Environment Japan (MOEJ), Japan International Cooperation Agency (JICA), United Nations Centre for Regional Development (UNCRD), Institute for Global Environmental Strategies (IGES) and International Solid Waste Association (ISWA) and 33 companies and organizations also cooperated and sponsored, with support from the City of Kyoto and the Kyoto Convention & Visitors Bureau, and with special cooperation from the Kyoto Cho-SDGs Consortium and Aqua Clara Inc.

The five-day conference consisted of three sessions; Plenary session, Special session, and General session with highlighting a variety of topics on 3Rs and waste management in driving scientific knowledge and technologies, advancing policy and behavioural changes, and increasing outreach and awareness to accelerate the sustainable society to achieve the SDGs. The expansion of its scope to critical issues such as climate change and plastic pollution, and also a new trend of the Digital Transformation (DX) was also showcased.

In result, more than 430 participants including academia, experts, national authorities, international agencies, private sector, and civil society from 24 countries/regions joined the 3RINCs2023.

More information is shown in the following links.

- Homepage: <https://www.3rincs.org/>
- Programme: <https://www.3rincs.org/about-3rincs/program/program/>

### II. Opening and Plenary lectures

In the plenary lectures on the first day, Prof. Toshiaki Yoshioka, Graduate School of Environmental Studies, Tohoku University, gave a keynote lecture on “Plastic Sustainability and Carbon Neutrality” followed by Ms. Burçin Temel McKenna, Head of Carbon Capture Competency Center, Ramboll, Denmark, titled “Carbon Capture and Storage activities in the Energy from Waste Industry within Europe”. Prof. Yoshioka highlighted on the global environmental pollution caused by plastic waste discharged into the oceans, and the world-wide efforts to reduce, reuse, collection, recycle, and proper treatment of plastic waste, as well as the early establishment of a plastic resource circulation system to promote the introduction of renewable resources as “+ Renewable”. Ms. McKenna (Ramboll, Denmark) introduced the latest trends in CCUS in Europe. The CCUS technologies are expected to be deployed on a large scale in Europe, and she explained the CO<sub>2</sub> capture projects planned by 2030, mainly in the countries along the North Sea, such as Denmark, UK, Sweden, Netherlands, and Norway. In addition, on the fourth day of the meeting (16 March), Mr. Daisaku Kadokawa, Kyoto City Mayor gave a lecture on Kyoto City’s efforts toward the SDGs, including waste management.

### **III. Special Session**

In the 3RINCS2023, eight (8) special sessions were held during the conference from 13 to 17 March. The topics of special sessions covered i) Plastic flow and its management, ii) Mercury Waste Management after the entry into force of Minamata Convention, iii) Burn or not Burn – Ultimate Choice of Open Dumping and Burning in Low Income Communities, iv) Challenges of waste decarbonization towards zero emission in developing countries, v) Plastic Management Policy and International Cooperation Towards a Circular Economy, vi) Disaster waste: Towards resilient waste management, vii) Sanitary Landfill Stabilization and End of Aftercare, viii) Outcome of the 11<sup>th</sup> Regional 3R and Circular Economy Forum in Asia and the Pacific, Siem Reap, Kingdom of Cambodia. All sessions, including presentations, panel discussions, and Q&A with audiences were successfully conveyed with the latest information sharing and insightful discussion from wide perspectives.

#### **Session 1: Plastic flow and its management**

Four Japanese research group from Hokkaido University, Kyushu University, Kyoto University and the University of Tokyo presented the latest research results on plastic flows and its management from the S-19 project under the Environment Research and Technology Development Fund moving towards sustainable resource management of plastics and reducing ocean plastic leakage: 1. a field experiment measuring the effects of interventions, 2. behavior and inventory of microplastics via wastewater from various municipal solid waste incinerator in Japan, 3. microplastics in a solid waste landfill in Japan, 4. quantity- and quality-oriented scenario optimizations for the material recycling of plastic packaging in Japan. In the following panel discussion, a panelist from Plastic@Sea which is a French business developer joined in and exchanged opinions on the value and possibilities of the results, and future challenges. Discussions were held on how to fuse both macro and micro plastic research in the future, and whether there were points that could be fed back to developing countries.

#### **Session 2: Mercury Waste Management after the entry into force of Minamata Convention**

In this session, the overall picture of mercury waste management in Japan was introduced by the Ministry of the Environment, followed by the presentations by invited experts from China, Korea, EU, Indonesia about regional conditions of mercury issues, mercury waste management. Then the researchers in SII-6 project under the Environment Research and Technology Development program reported LCA research on treatment and disposal of waste containing mercury, and research on treatment and disposal of waste consisting mercury. The session discussed about the issue of how to make Minamata convention socio-environmentally effective, separation methods for mercury-added

products from waste streams to reduce mercury concentration in the waste contaminated with mercury and mercury compounds (c-waste), international discussion for the thresholds to categorize c-waste.

### **Session 3: Burn or not Burn – Ultimate Choice of Open Dumping and Burning in Low Income Communities**

This special session was organized by UNEP Asia and the Pacific Office. Open dumping and burning are regarded as inappropriate solid waste management practices, but most of the low-income communities, not many options are available and affordable. To tackle with this issue, four presentations including plastic waste, agricultural residue, hazardous substances, and unintentional POPs generation were given by the invited experts from BMA Thailand, Live & Learn Vietnam, UNEP ROAP and UNIDO. To exchange views on the action for the low-income communities towards a long and winding journey to sustainable consumption and waste management, following topics were discussed: integrated system for MSW management, support for local government policy makers, importance of barrier system, local community society, technology selection, co-benefit, technologies/profit for citizens and municipalities, leader/mayor's decision, capacity building for officer/inter-sectional collaborations.

### **Session 4: Challenges of waste decarbonization towards zero emission in developing countries**

The session was organized by the collaborative research laboratory by National Institute of Environmental Study- JAPAN, Kasetsart University, and King Mongkut's University of Technology Thonburi-Thailand, Ochanomizu University, Institute for Global Environmental Strategies (IGES). 3 presentations were given by the researchers from Thailand, Vietnam and Japan. The advantages and disadvantages of waste-to-energy such as energy recovery with incineration, RDF production, and anaerobic digestion operated in Thailand and Vietnam were introduced. Then the lessons learnt from European countries and Japan emphasized necessity of integrated system of waste management to achieve the decarbonization. In the panel discussion on the success factors for zero emission approach, following discussions were held: avoidance and minimizing landfilling, roadmap of implementation of WtE in developing countries, requirements for RDF/SRF utilization in developing countries, multiple benefits and beneficiaries of the project, support of policy makers in local government, capacity building and inter-sectional collaboration.

### **Session 5: Plastic Management Policy and International Cooperation Towards a Circular Economy**

The session was organized and chaired by the Korea Society of Waste Management (KSWM). Plastic waste management is a critical and serious issue around the world, especially in Asian countries. UN international community gathered in March 2022 and agreed to prepare international treaty on plastic by the end of 2024 to find solutions of plastic problems. The aim of this special session is to promote the academic knowledge exchange in the field of plastic circulation policy and circular economy. 3 presentations were made by researchers from Korea Ministry of Environment, Korea, Tokai University, Japan and Holy Angel University, Philippines. The session discussed about plastic waste policy and strategies to strengthen circular economy in Korea and global treaty efforts, high concern for Japanese corporate governance and awareness of plastic issues as a corporate risk, necessity of international cooperation and capacity building in the Philippines for solving heavy plastic pollution.

### **Session 6: Disaster waste : Towards resilient waste management**

This session was organized by Disaster Waste Management Group of the Japan Society of Material Cycles and Waste Management. Ensuring resilience in waste management is related to capacity to

reduce disaster wastes, to deal with generated disaster wastes, to ensure continuity of waste management services after disasters, to seek for transformation of waste management systems after disasters. This session invited academic professionals from disaster prone countries to share knowledge and discuss future directions on making waste management systems more resilient in Asia-Pacific. First, presentation about resilience in Japanese waste management system was given followed by the panel discussion with panelists and chairpersons from Rabdan Academy, University of Philippines Diliman, JGSEE-KMUTT, Fukuoka University, National Institute for Environmental Studies and NTT Data institute of management consulting. In the panel discussion, 2 topics were discussed: (1)Is resilience important for waste management systems? , (2)Can we mainstream “resilience” in waste management systems? As a wrap up of the discussion, following were proposed : necessity of the views of resilient waste management, formation of the tangible network and coordination with various stakeholders from other subthemes of waste management by providing papers, data, information, evidence.

#### **Session 7: Sanitary Landfill Stabilization and End of Aftercare**

This session was organized by the members of Landfill Research Group of the Japan Society of Material Cycles and Waste Management from Muroran Institute of Technology, National Institute of Technology, Hokkaido University, and invited speakers from Kasetsart University and King's Mongkut University of Technology Thonburi, Thailand. The topic in this session was the assessment of landfill stabilization for the end of aftercare. This session focused several issues related to landfill stabilization for the end of aftercare of sanitary landfills in Thailand and Japan. 4 presentations were given about Introduction of Sanitary Landfill Stabilization and End of Aftercare, Genotoxicity Assessment of Landfill Emissions Using Comet Assay in Golden Pothos (*Epipremnum aureum*), Determination of landfill stabilization using geotechnical analysis, Gas monitoring at landfill sites approaching the end of aftercare: Case studies in Japan. Finally, discussion and wrap up on “Sanitary Landfill Stabilization and End of Aftercare” were made by considering the several indicators for assessments of the landfill stabilization and the end of aftercare.

#### **Session 8: Outcome of 11th Regional 3R and Circular Economy Forum in Asia and the Pacific, Siem Reap, Kingdom of Cambodia**

The session was organized by United Nations Centre for Regional Development (UNCRD), Ministry of Environment, Kingdom of Cambodia and Ministry of the Environment, Government of Japan to discuss the outcome of the 11th Regional 3R and Circular Economy Forum in Asia and the Pacific organized from 8-10 February in Siem Ream Cambodia. The Forum comprehensively discussed on various topics including: (i) linkage between circular economy, SDGs, and climate change; (ii) circular economy towards sustainable tourism; (iii) circular economy towards sustainable Tonle-Sap ecosystem; (iv) circular economy for small and medium enterprises (SMEs); (v) 3R infrastructure gap towards circular and zero waste societies; and (vi) eco-friendly alternatives to single-use plastics, among others. The Forum is planning to adopt new 3R Hanoi Declaration with 15 goals in the 12th Regional 3R and CE Forum in 2024. Future Plans of 3R and WM policy of the host country Cambodia was presented as well. The session also discussed the business practices on circular economy by SMEs. It also discussed how to keep the Forum relevant under the situation where CE have been mainstreamed both at AP level and global level.

#### **IV. General Session**

A total of 25 general sessions, consisting of 7 online sessions and 18 hybrid sessions, were successfully held from March 14th through March 17th, 2023. The conference featured 119 academic presentations, as well as 10 presentations and movies from sponsors. The number of presentations

was nearly double that of the previous 8th 3RINCs conference in 2022. Over 400 participants from 24 countries attended the conference, including Austria, Bangladesh, Cambodia, Cameroon, Canada, China, the Czech Republic, Denmark, Ecuador, Germany, India, Indonesia, Italy, Japan, Korea, Malaysia, Mozambique, Palestine, Papua New Guinea, the Philippines, Taiwan, Thailand, Turkey, and Vietnam. Active discussions were conducted during the conference. All presentations reported cutting-edge research and activities and were future-oriented with high motivation for building a sustainable society. Each session was successfully managed by the internationally distinguished chairs (41 chairs). Similar to the previous conference, students and young researchers actively participated in discussions and tried to expand their network through the conference. It was a great achievement since the new generation will take responsibility for our society and pioneer a new era of sustainability. Excellent presentations and outstanding works were recommended for submission as full papers to the Special Issue of the Journal of Material Cycles and Waste Management (JMCWM) on the 9th 3RINCs in 2023.

## V. Technical Tour

In the 3RINCs 2023, three technical tours were provided. There were 12, 18, and 12 participants for tour 1, 2, and 3, respectively. This program is supported by a subsidy from Kyoto City and the Kyoto Convention & Visitors Bureau.

### **Tour 1. SATOYAMA SDGs two days “Let’s discover and enjoy another Kyoto!” (17 and 18 March 2023)**

In Tour 1, participants gathered at 17:00 on 17 March, and enjoyed local IZAKAYA experience as dinner. After that, participants moved and stayed to Kyoto SATOYAMA “Keihoku” area. On 18 March, participants toured Keihoku area in the morning. After that, participants made the inspection of “KOTOS” which is SDGs base using the closed school. In addition, participants experienced the biogasification of food waste and resource separation/recycling during lunch time. Tour also included the visitation of Miyama Kayabuki no Sato (Nantan city), and participants enjoyed the buildings with Japanese traditional techniques.



Photo. Participants Enjoyed history and nature in Keihoku, SATOYAMA north of Kyoto City



Photo. Kimono upcycling at "KOTOS," a Kyoto Satoyama SDGs lab using an abandoned school, was a big hit.

### **Tour 2. SATOYAMA SDGs (18 March 2023)**

In Tour 2, participants made the inspection of "KOTOS" which is SDGs base using the closed school. In addition, participants experienced the biogasification of food waste and resource separation/recycling during lunch time. Tour also included the visitation of Miyama Kayabuki no Sato (Nantan city), and participants enjoyed the buildings with Japanese traditional techniques.



Photo. The soon-to-be-completed biogasification plant for food waste attracted many questions.

### **Tour 3. Waste management and Environmental Education Tour (18 March 2023)**

In tour 3, participants visited Kyoto City south clean center and SUSTAINA KYOTO (environmental learning facility of Kyoto City south clean center). The tour 3 included a plant tour in the south clean center and an explanatory lecture on the facility's exhibits. Participants actively asked questions, engaged in discussions, and exchanged information.





Photo. Participants experienced an environmental education exhibit in SUSTAINA KYOTO and actively discussed.

#### **VI. Public relation, outreach and networking**

The 3RINCs 2023 announcement including the event schedule, call for papers, and registrations were widely distributed to all stakeholders such as members of the JSMCWMM, partners, supporters, sponsors, past participants of the 3RINCs, and international societies all over the world. All communication and outreach materials such as a flyer and a brochure were delivered through e-mail and uploaded to the 3RINCs webpage (<https://www.3rincs.org/>). This year, part of the webpage has been redesigned to make it easier to find information about the conference, and meeting information is now available from the top page of the web site.

The website is also linked up with other SNS like Facebook. Information on plenary lectures and special sessions were uploaded to the website and SNS as soon as it became available, aiming to attract participants' interest. The presentation documents were shared with registered participants prior to the sessions. Introduction of sponsors was also incorporated into e-proceedings.

The analysis on access of the 3RINCs website was conducted by a member of the steering committee and the following results were introduced.

- The number of accesses to the 3RINCs home page has increased from last year, and since the official announcement through the home page was made earlier this year in October, the number of accesses in November and December is higher. (ref. figure below)
- The top four countries accessing the website in March were Japan, South Korea, Thailand, and the U.S., in that order.

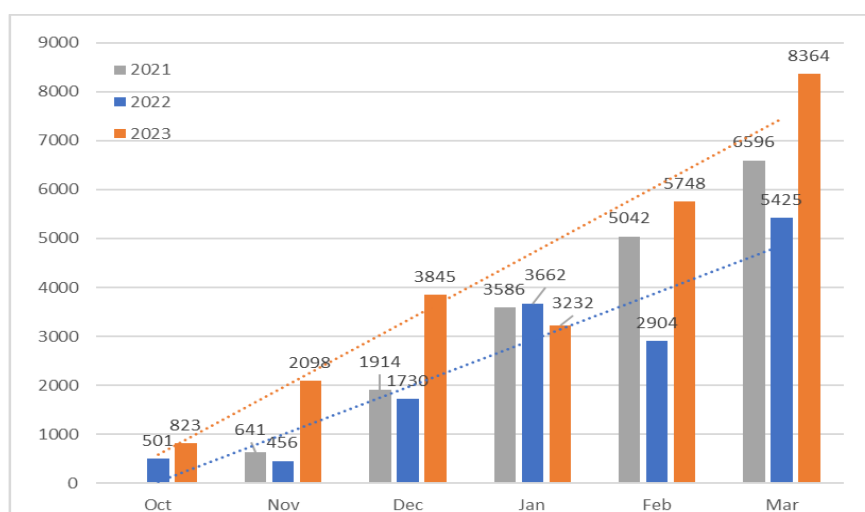


Figure. The number of 3RINCs webpage access in 2021- 2023

In addition, the steering committee of the 3RINCs updated the list of stakeholders such as international, national and regional organizations and groups who are engaged in 3Rs and waste management in the world, and invited some representatives from the list to strengthen the collaboration and networking with them for further enhancement of the 3RINCs platform.

#### VII. Acknowledgement

The steering committee thanks especially for the following stakeholders who vitally organized and supported the 3RINCs2023. Their continuous supports enable 3RINCs to play a role of a knowledge platform to share latest findings and experiences, and to enhance networking among stakeholder all over the world to overcome challenges, difficulties, and constraints of the global, regional and local crises on waste management.

##### Organizer

- Japan Society of Material Cycles and Waste Management
- Korean Society of Waste Management
- Solid Waste Management Association Thailand (SWAT)
- National Institute for Environmental Studies (NIES)
- IconSWM-CE & IPLA Global Forum
- 

##### Supporter

- Ministry of the Environment Japan (MOEJ)
- Japan International Cooperation Agency (JICA)
- United Nations Centre for Regional Development (UNCRD)
- Institute for Global Environmental Strategies (IGES)
- International Solid Waste Association (ISWA)

##### Sponsor (A)

- DOWA HOLDINGS CO., LTD.
- Hitachi Zosen Corporation
- JFE Engineering Corporation
- NIPPON STEEL ENGINEERING CO., LTD.



- TOWA Technology Corporation

Sponsor (B)

- Daiei Kankyo Co., Ltd.
- EX Research Institute Ltd.
- IDEA Consultants, Inc.
- Kawasaki Heavy Industries, Ltd.
- Kobelco Eco-Solutions Co.,Ltd.
- Mitsubishi Heavy Industries Environmental & Chemical Engineering Co.,Ltd.
- Rematec Corporation
- TAKUMA CO., LTD.

Special Sponsor

- Japan Industrial Waste Information Center
- JAPAN INDUSTRIAL WASTE MANAGEMENT FOUNDATION
- Japan Waste Research Foundation

Sponsor (Advertising sponsorship)

- Ebara Environmental Plant Co., Ltd.
- ecommit Co.,Ltd.
- Eight-Japan Engineering Consultants Inc.
- JAPAN NUS CO., LTD
- KAJIMA CORPORATION
- Kajima Environmental Engineering
- Konoike Construction Co., Ltd.
- KUBOTA ENVIRONMENTAL SERVICE CO.,LTD.
- KUNINAKA ENVIRONMENTAL GROUP
- Kyoto Environmental Preservation Public Corporation
- METAWATER Co., Ltd.
- NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.
- Panasonic Corporation
- Plantec Inc.
- ShinMaywa Industries, Ltd.
- TAIHEIYO CEMENT CORPORATION
- Yachiyo Engineering Co., Ltd.

Special Partner (Subsidiary body)

- Kyoto Prefecture
- City of Kyoto
- Kyoto Convention & Visitors Bureau

Special Partner (Supporter and collaborator)

- Aqua Clara Inc. (water server installation)
- Kyoto Cho-SDGs Consortium (SDGs operation)
- G.T.CENTER