

Overview of Center for Material Cycles and Waste Management Research

Contributing to sustainable use of resources and reducing wastes and environmental loads accompanying usage

Center for Material Cycles and Waste Management Research (CMW) is tasked with surveying and investigating the current state and future prospects regarding the use of materials in society and environmental loads accompanying usage. We also assess materials both as potential resources and for their toxic properties, and conduct studies on the recycling of resources and proper disposal of wastes and waste water, develop technologies for restoring the environment, and investigate the implementation of technologies in the field.

History

- January 1938 National Institute for Public Health established
- March 1974 National Institute for Environmental Studies (NIES) established
- July 1990 Designation of NIES in Japanese changed
- April 1992 Waste Management Engineering Division established in National Institute for Public Health
- January 2001 Ministry of the Environment established as part of administrative reforms of the Japanese government (centralization of waste administration). Waste Management Research Division established in NIES (by transferring and integrating Waste Management Engineering Division from National Institute for Public Health)
- April 2001 NIES established as an incorporated administrative agency. Waste Research Division expanded to Research Center for Material Cycles and Waste Management. First five-year plan* (2001–2005) commenced
- April 2006 Designation of the Center in Japanese changed. Second five-year plan (2006–2010) commenced
- April 2011 Designation of the Center changed to Center for Material Cycles and Waste Management Research (CMW). Third five-year plan (2011–2015) commenced

*Five-year plan: A medium-term plan on which the operation of an independent administrative institution is based. In the case of National Institute for Environmental Studies, such a plan is formulated as a five-year plan to achieve “medium-term objectives” determined by the Minister for the Environment.



Overview of research activities on material cycles and waste management

Overview of the studies

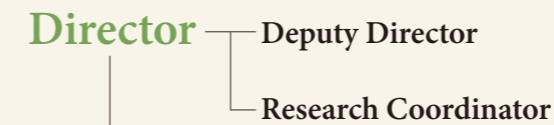
Material-cycle society programs

Research topics	Keywords	Expected results
Project-1: Appropriate management of materials with hazards and resource potential in harmony with international material cycles	Flow of materials and money (Supply chain)	Contribute to safe and environmentally efficient material cycles and waste management in Japan and the world (Asia) and the creation of supportive social systems
Project-2: Establishment of appropriate technological system for municipal waste in Asia	Consumption of resources and environmental impacts	
Project-3: Establishment of material cycle system by utilizing regional characteristics	Systems and rules of society Technical systems	

Necessary waste management researches in response to national policies

Research topics	Keywords	Expected results
Thermal treatment technologies for a low-carbon society	Technology development, Technology innovation, Energy assessment, City planning, Large area, Separation class	Contribute to solving short- to long-term important issues on material cycle and waste management policies
Development of new landfill and control methods	Land reclamation, Environment restoration, Reserve, Accelerated waste stabilization of landfill, Quality control technology	
Low-carbon method of treating liquid wastes in harmony with natural material cycles	Mixing treatment of organic wastes, Smart house dispersed waste treatment (new concept responding to changes in lifestyle)	
Methods for treating and analyzing negative legacies and difficult-to-recycle materials	Asbestos-containing materials, Difficult-to-recycle materials (cathode-ray tube glass, liquid crystal panels, excess mercury), POP wastes, illegal waste dumping, inappropriate disposal sites	
Environmental safety and quality assessment of recycled products	Use of construction materials, Recycled plastic products	

Organization



Sustainable Material Cycle Systems Section is in charge of studies on formulating future visions of a material-cycle society, establishing the goals of policies related to material cycles, and designing technological and social systems for achieving the goals.

International Material Cycles Research Section is in charge of analyzing systems and investigating appropriate management measures for materials in and outside Japan in order to promote an international sound material cycle society.

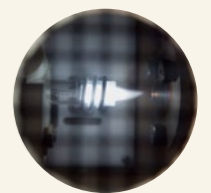
Material Lifecycle and Substance Management Section is in charge of studies on promoting the recycling of resources by investigating both the positive (resources) and negative (toxicity) aspects of wastes and appropriately controlling the entire life cycle of products.

Fundamental Recycling Technology Section is in charge of developing basic technologies for chemical analysis, material testing methods and physicochemical property measurements of recycled resources and wastes to make the best use of resources contained in wastes and to reduce environmental loads.

Appropriate Waste Disposal Engineering Section is in charge of developing and verifying waste treatment technologies that are proper for environmental protection, highly efficient and reliable in terms of energy and cost and investigating their implementation in and outside Japan by considering regional characteristics.

Environmental Restoration and Conservation Technology Section is in charge of developing, verifying and assessing advanced technologies for low-carbon and material cycle systems suitable for restoring and regenerating the water environment in polluted areas in and outside Japan.

R & D Promotion and Partnership Office is the core of research and development of material cycles and waste management and is in charge of promoting cooperation with other institutes in and outside Japan on technology development and implementation in society.



PROJECT-1

Appropriate management of materials with hazards and resource potential in harmony with international material cycles

Material-cycle society program

Subtheme 1

Understanding international material flows and system analysis

We are investigating the flows of resources, materials, and products that are internationally transferred, and conducting system analysis on those material cycles.

Subtheme 2

Field study on product and material cycles for managing resources and toxicity

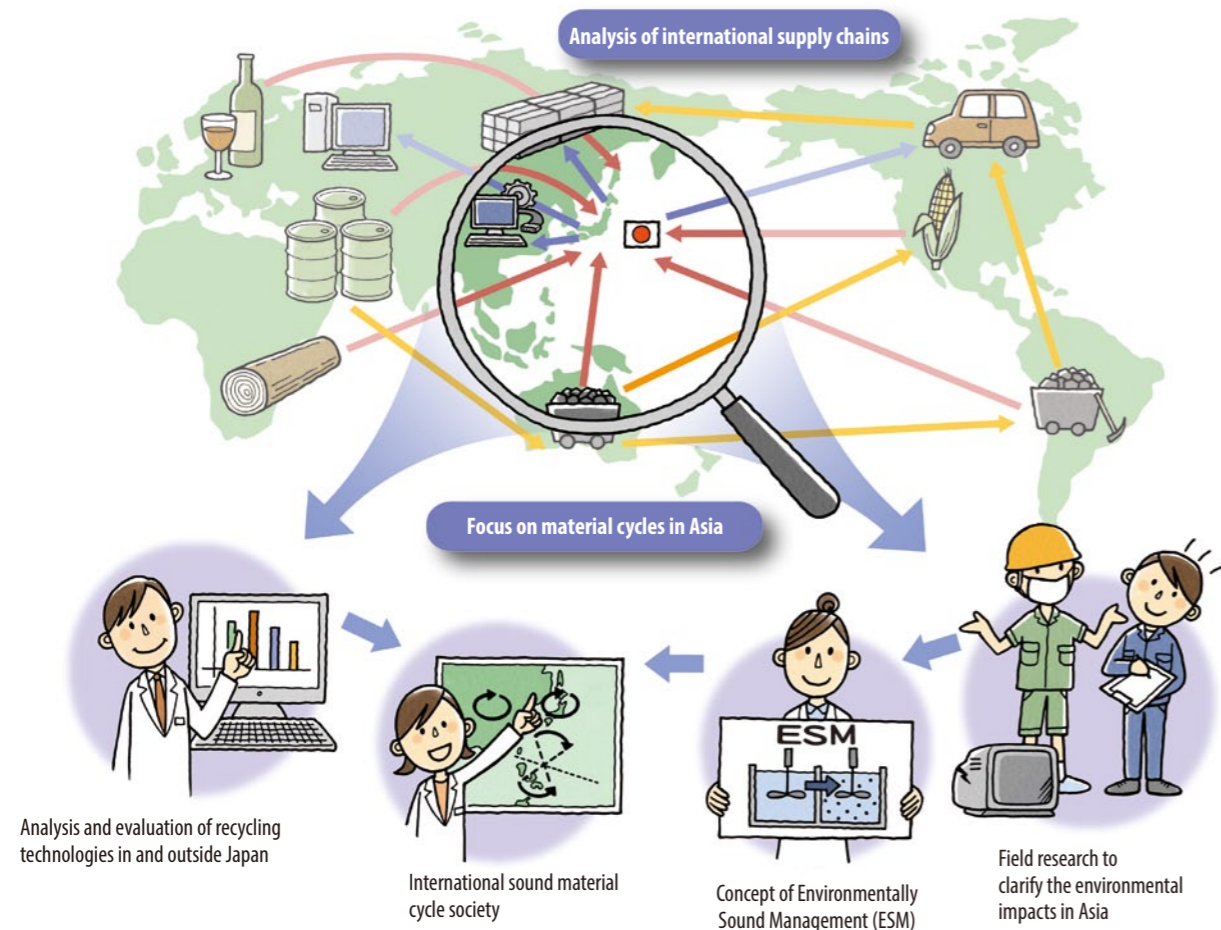
We are analyzing resource recovery and the environmental emission and impacts of hazardous substances in recycling and disposal processes via field studies to develop more effective measures.

Subtheme 3

Proposing management measures toward international sound material cycle society

We are discussing the current management measures and future perspectives toward the international sound material cycle society.

To analyze and propose appropriate management of materials in Japan and overseas



Many products on domestic and international markets, such as electric and electronic equipment, contain valuable resources such as precious and rare metals as well as toxic substances such as heavy metals and flame retardants. Japan needs methods for managing resources including base and rare metals taking into account international material cycles, while the international community, particularly Asian nations, should recover and recycle materials to control environmental pollution.

In this study project, we are integrating system analysis and field studies on the international cycle of materials circulating in

and around Japan. We are also discussing the recycling of resources and regulatory measures for hazardous substances both in Japan and internationally. We are also discussing recycling of resources and regulatory measures for hazardous substances both in domestic and international scale.

Based on the investigation and analysis of material flows and surveys on the life cycle behaviors of products, we will propose appropriate management of products that contain both resources and toxic substances for promoting 3R overseas as well as in Japan.

PROJECT-2

Establishment of appropriate technological systems for municipal waste in Asia

Material-cycle society program

Subtheme 1

Development of a method for designing Semi-Aerobic landfill technologies appropriate for Asian districts

We are assessing the effects of Semi-Aerobic landfill technologies in mitigating global warming and reducing pollution by leachate, and will propose its specification appropriate for the climate and wastes in Southeast Asia.

Subtheme 2

Development of on-site wastewater treatment technologies for developing nations

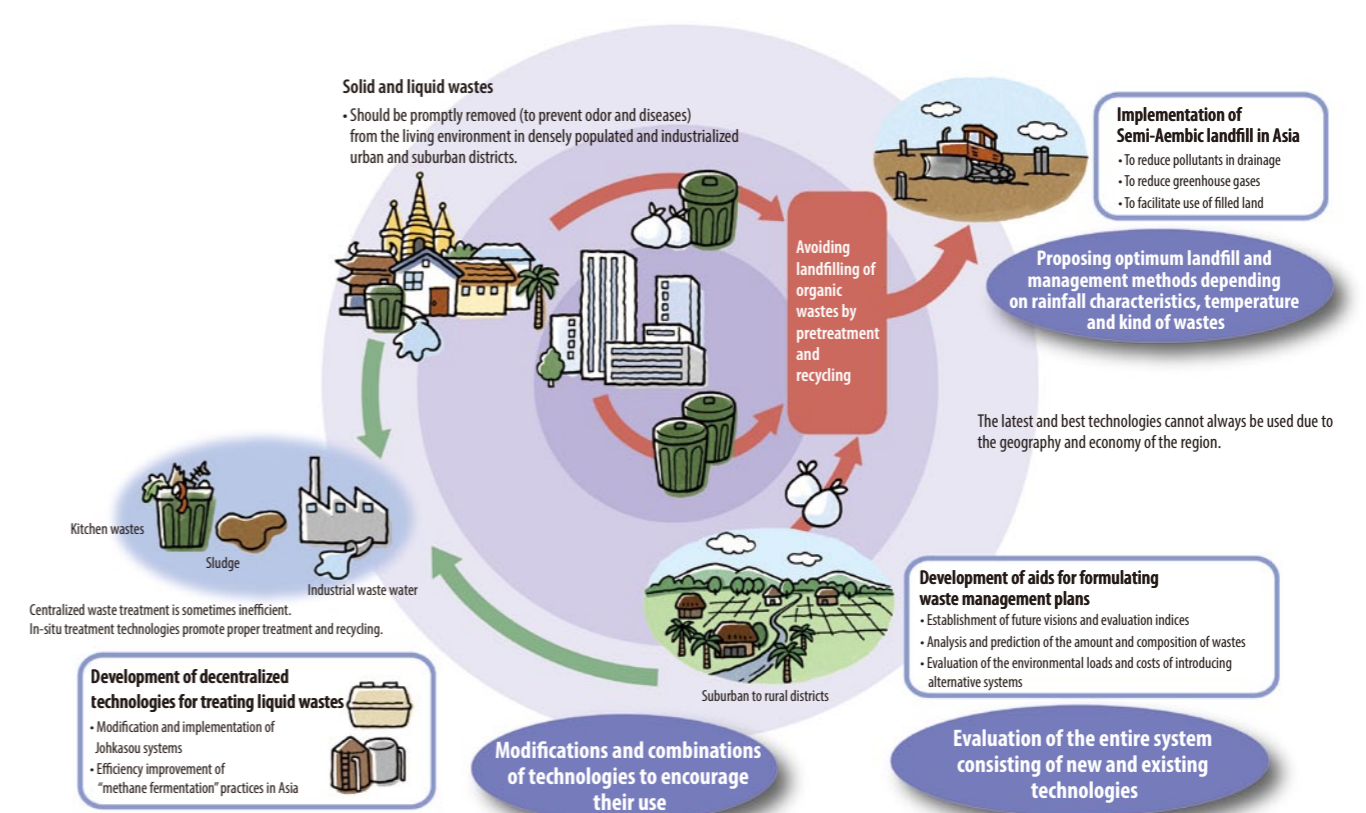
Proper technologies are being developed for treating and recycling liquid wastes, such as sewage, kitchen wastes and sludge. We will modify them to suit the local conditions and propose low-carbon and efficient systems.

Subtheme 3

Development of tools to assist the planning of waste management systems

We are developing models for estimation of future waste generation, and design of technical, social and economic systems, and will propose improvements of waste management.

To establish appropriate waste management systems for urban districts in Asia



Many Asian nations are facing rapid population influxes to cities accompanying economic growth, and as a result, need to treat vast amounts of wastes in urban districts. Such cities in Asia need waste management systems that emit few greenhouse gases, impose little load on the environment, and are feasible both economically and technically to improve the hygiene conditions and scenery.

As an advanced nation, Japan has the ability and duty to assist Asian nations to build frameworks for waste management. In this project, we are conducting field surveys to clarify the present

states of waste management in urban districts in Asia, and are modifying the highly efficient decentralized wastewater treatment and Semi-Aerobic landfill technologies of Japan to suit the conditions in Asia. The modified technologies will be introduced into Asian cities combined with existing techniques. We are also developing tools to assist the planning of waste management systems in Asian cities to promote proper waste treatment and recycling. Based on the results, a waste management system will be developed and tested in an actual city or urban district to verify the effects, which is the goal of this project.

PROJECT-3

Establishment of material cycle system by utilizing regional characteristics

Material-cycle society program

Subtheme 1

Designing a framework for constructing regionally-appropriate material cycle systems

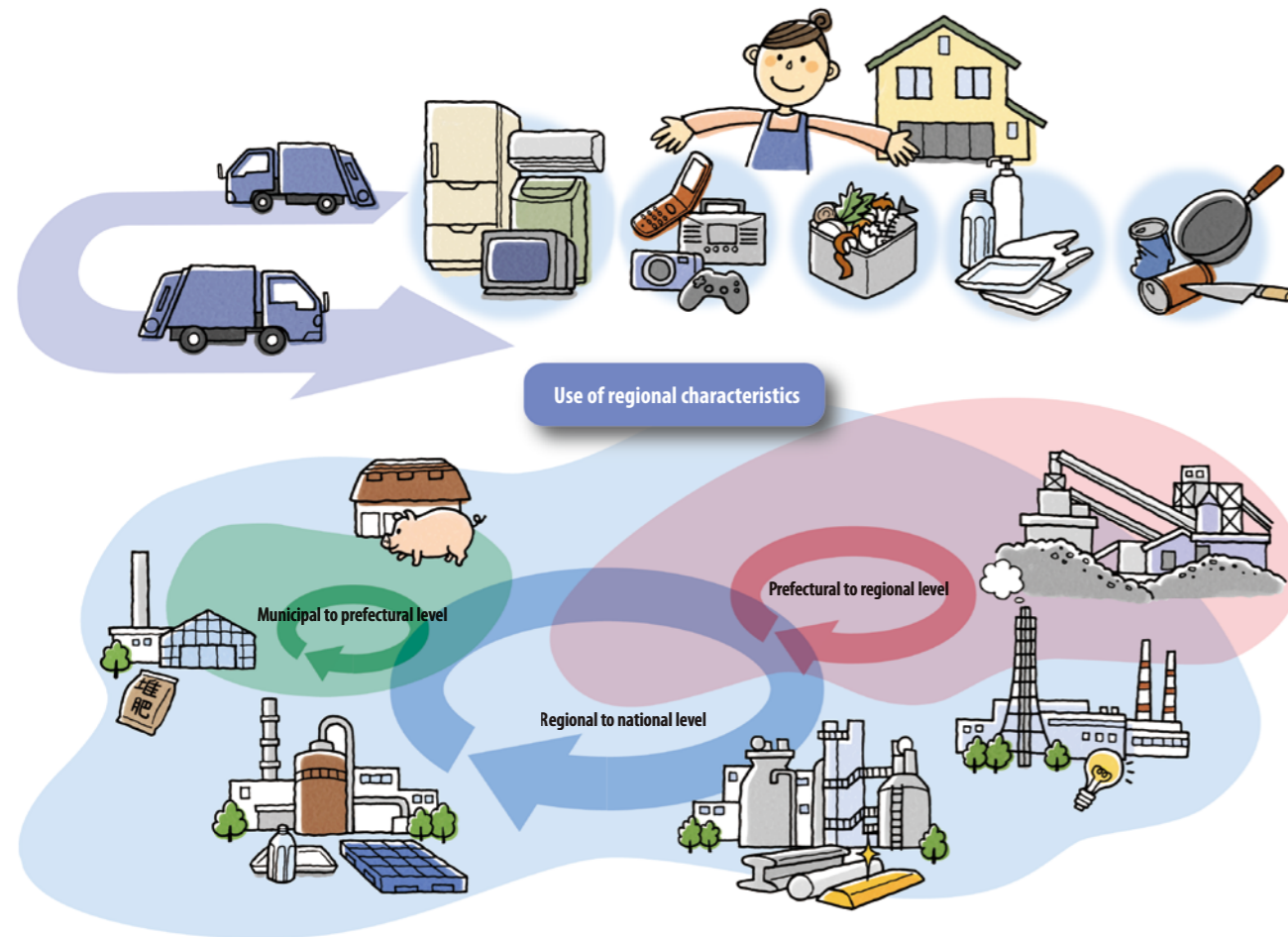
We will identify problems to be solved for constructing systems and investigate the appropriate geographical scale of material cycles.

Subtheme 2

Design, assessment and implementation of regionally-appropriate material cycle systems

Appropriate systems for recycling waste plastics, waste biomasses and used electric appliances, etc. and construction methods will be investigated.

To determine which wastes to recycle, how to recycle them, and what recycling system to establish



Proper material cycle systems of various geographical scales should be established to build a sound material-cycle society. In this project, we are investigating the framework for establishing material cycle systems appropriate for regional characteristics such as the state of waste generation, industries and relations among various entities. We will also design proper material cycle systems for several recyclable resources (including waste plastics, biomass wastes, used products containing critical metals, etc.) at the municipal, prefectural, regional, and national levels. The

systems will be designed to minimize the load on the environment and costs and also to revitalize and promote regional economies by actively using and cultivating regional industries and other entities. The project aims to contribute to regional communities by designing actual systems and to the science of material cycles by establishing methodologies for estimating the appropriate geographical scale of material cycles and formulating concepts for the local use of material cycles.

Necessary waste management researches in response to national policies

Other major researches and studies



1. Evaluation of waste incineration system and development of energy recovery technology

To promote the appropriate treatment and recycling of wastes and build a low-carbon society, we are developing tools for municipal governments and private operators to assess the amount of carbon emitted in the production and operation of their incineration plants. We will also establish low-temperature gasification technologies, which are expected to contribute to a low-carbon society and propose a prototype of a plant system.



2. Development of quality control engineering system for wastes towards an advanced sound material-cycle society

To present waste management strategies needed for the advanced recycling society in future, we will classify wastes by resource value, environmental load and treatment costs, and will develop new technologies and systems for controlling the quality of wastes which are to be recycled or treated, and for final disposal, etc., by managing material flows and setting new types of final disposal.



3. Establishment of appropriate countermeasures for domestic liquid-waste and greenhouse gas emissions

We are investigating greenhouse gases generated from packaged plants "Johkasou" for treating domestic wastewater and the effects of disposers and water-saving devices, etc. on sewage and waste treatment. We will also develop systems for properly treating domestic wastewater that minimize residues, environmental loads, greenhouse gas emissions, etc. appropriate for regional characteristics.



4. Development and evaluation of treatment technologies and analytical methods for the countermeasures toward legacy wastes and materials with recycling difficulties

Proper treatment technologies are being researched and developed for asbestos, persistent organic compounds (POPs), and other "negative legacies". We are also developing technologies for recycling materials that are difficult to recycle, and methods for evaluating new treatment and recycling technologies, and measuring the progress of treatment. Remedial systems for illegal dumping sites and improper disposal sites are also being investigated.



5. Development, standardization and application of testing methods for the evaluation of recycled products on the environmentally sound quality of chemicals

Measures will be developed and proposed for facilitating the recycling of construction wastes and byproducts including testing methods and standards for ensuring environmental safety. We are also researching the flow of toxic substances, such as additives, in the production and use of recycled plastics to investigate the environmental safety.



International Activities

Center for Material Cycles and Waste Management Research (CMW) at NIES has been actively widening its reach of research partnerships with overseas institutes and universities since its establishment in 2001.

CMW has concluded Memorandum of Understanding (MOU) with 7 overseas institutes and universities. Through conclusion of MOU with various institutes, CMW has expanded the area and region of research and it is continuously growing the researcher's network through implementation of different programs such as joint researches and training workshops.

Lastly, CMW also accepts researchers and visitors from abroad. The number of visitors to CMW exceeds more than 100 people a year. Our researchers welcome you and provide you a research background and insights. Launch of training workshop of "Sustainable landfill management" with funding partners is also a way of technology and research methodology transfer to the younger researchers from developing countries in Southeast Asia.

International Partners with MOU agreement

SWEDEN:

- International Institute for Industrial Environmental Economics, Lund University

CHINA:

- North Research Center for Rural Wastewater Treatment Technology, Ministry of Housing and Urban-rural Development

THAILAND:

- Laem Chabang City
- King Mongkut's Institute of Technology
- Kasetsart University

VIETNAM:

- Institute of Science for Environmental Management (ISEM)
- Institute for Urban Environment and Industry of Vietnam (INEV)

Objectives

Establishment of regional network for standardization and application of system and technology

- 1) Enrichment of waste management tools and data
- 2) Capacity development



Development of Semi-Aerobic landfill technology

In order to examine the possible installation of Semi-Aerobic landfill in the condition of Southeast Asia, we have launched the pilot landfill cell in Leam Chabang, Thailand. For the purpose of technology transfer and knowledge sharing, the investigation is implemented based on the MOU with Kasetsart University, King Mongkut's Institute of Technology and Leamchabang city in Thailand.

Contact: Dr. Masato Yamada



Development of resource recycling and appropriate treatment systems for liquid wastes

To propose an efficient and effective co-benefit technology for the treatment of liquid wastes in developing countries, we are conducting the researches on the functions of small-scale decentralized wastewater treatment systems-including wetlands, johkasou, and aquatic plant and soil treatment systems suitable for rural areas.

Contact: Dr. Kaiqin Xu



Development of tools to assist the planning of waste management systems

In order to plan and evaluate the waste management system established by national/local government, appropriate model of planning and evaluation will be an output of this project. For developing countries, Not only formal sector but informal sector should be taken into consideration in terms of waste management. Main field of research is Hanoi city in Vietnam and other medium-small sized cities in the country.

Contact: Dr. Kosuke Kawai



Appropriate management of international material cycles with hazardous and resource potential

International and domestic material flow of E-waste and other recyclable resources is surveyed in Asia. Environmental effect by E-waste recycling is investigated throughout field survey and experimental analysis. In order to reduce hazardous potential and achieve effective resource recovery, we explore the environmentally-sound management of E-waste (and others) in Asia.

Contact: Dr. Atsushi Terazono



Development of Environmentally Sound Quality Control Method of Recycling Materials in Construction Toward East Asian Standard

Regulatory system and current status of the recycling of by-products and solid wastes in construction are investigated especially from the aspect of environmental safety. Toward East Asian standard, a basic concept and framework for the assurance of environmental safety quality as well as test methods are proposed by NIES and are discussed with Chinese, Korean, and Taiwanese research institutes.

Contact: Dr. Hirofumi Sakanakura



Environmental Product Policy and Extended Producer Responsibility (EPR)

Environmental product policy aims to optimize environmental performances of a product system from production to waste disposal. In collaboration with cooperative researchers, we investigate and evaluate policy instruments such as product standards, environmental labeling, and rewards point systems. As a guiding principle, EPR, especially those built in Japanese recycling laws, has also been studied.

Contact: Dr. Tomohiro Tasaki

Center for Material Cycles and Waste Management Research

(Material Cycles and Waste Management Research Building)



Map of National Institute for Environmental Studies



National Institute for Environmental Studies

Access

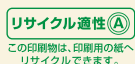
- 6 km from Hitachino Ushiku Station on JR Joban Line, 20 minutes by bus
- 4 km from Tsukuba Station of Tsukuba Express, 15 minutes by bus
- Approximately 100 minutes from Narita Airport to Tsukuba Express Station

National Institute for Environmental Studies

Center for Material Cycles and Waste Management Research

Onogawa 16-2, Tsukuba, Ibaraki 305-8506 Tel. 029-850-2807

<http://www-cycle.nies.go.jp/index-e.html>



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